APPENDIX Q HYDROLOGICAL ANALYSIS

1. Calculation for Probability distribution of daily rainfalls

Order	Daily rainfall X_1	Date	E=2i - 1/2N	$X = \log X_1$	$X_2=(\log X_1)^2$
1	283.0	Aug. 9 1975	7.14	2.45179	6.01126
2	163.3	Oct. 3 1974	21.43	2.21299	4.89732
3	132.6	Jul.18 1970	35.71	2.12254	4.50518
4	120.0	Jul.31 1977	50.00	2.07918	4.32299
5	119.1	Aug.13 1971	64.29	2.07591	4.30940
6	110.3	Aug. 6 1978	78.57	2.04258	4.17213
7	100.3	Aug. 5 1973	92.86	2.00130	4.00520
Total				14.98629	32.22348

$$\bar{X} = \frac{\Sigma X}{N} = \frac{14.98629}{7} = 2.14090$$

$$\bar{X}^2 = \frac{\Sigma X^2}{N} = \frac{32.22348}{7} = 4.60335$$

$$= \sqrt{\bar{X}^2 - (\bar{X})^2} = 0.14106$$

$X = 2.14090$ $X = 138.3$

$X + \sigma = 2.28196$ $X = 191.4$

$X - \sigma = 1.99984$ $X = 99.9$

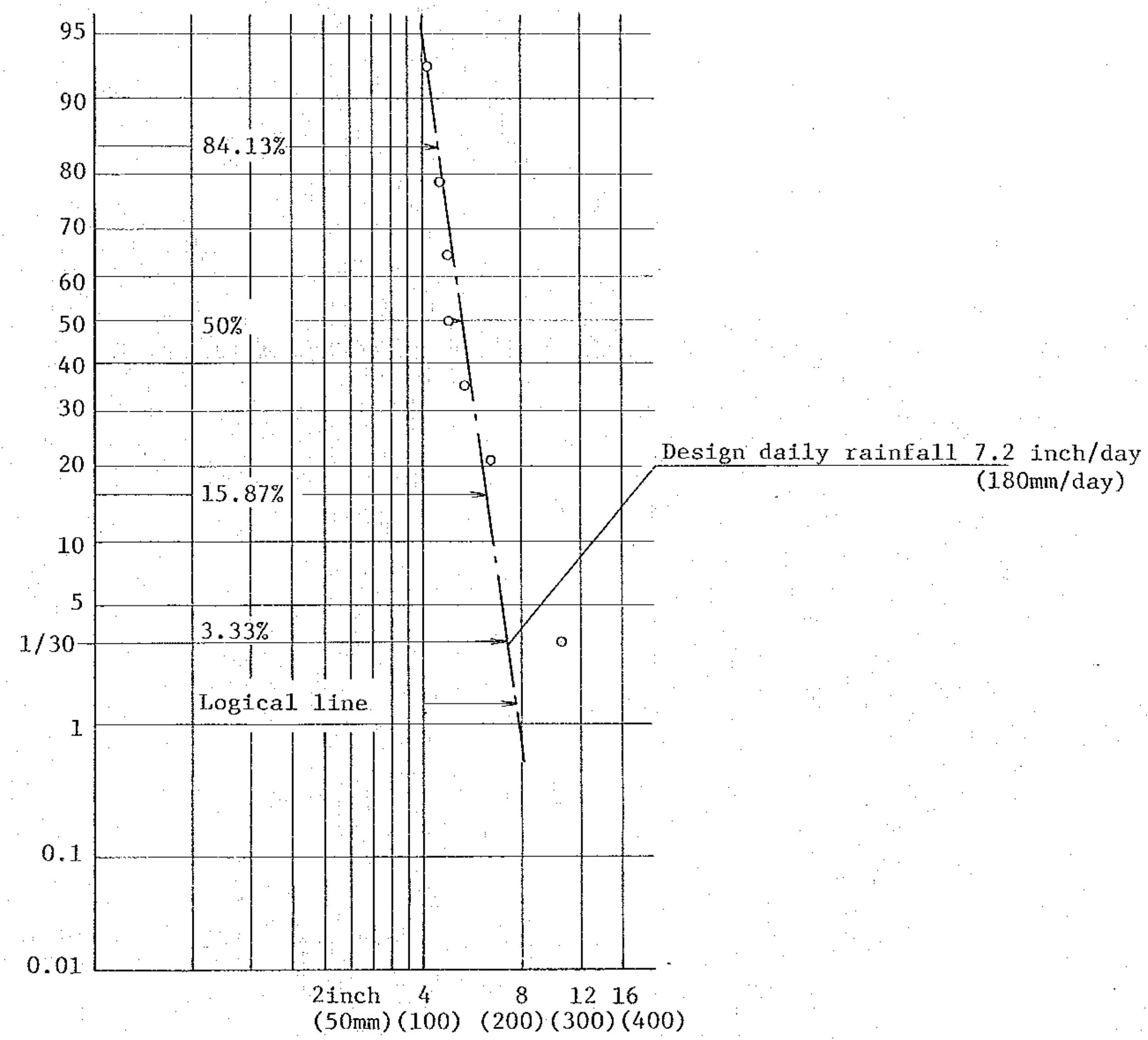


Fig. 1 Calculation of Probability Distribution for Daily Rainfall by Probability Paper at Makeni

2. Calculation for Time of Concentration

$$T = \frac{L}{W} \qquad W = 72 \left(\frac{H}{L} \right) 0.6$$

where

T :	Time of concentration	(hr.)
L :	Horizontal distance	(Km)
H :	Vertical Height	(Km)
W :	Velocity of flood	(Km/hr.)

3. Calculation for Discharge Volume of Flood

$$Q = 0.2778 \text{ f Rt A} \qquad Rt = \frac{R}{24} \left(\frac{24}{T} \right)^{\frac{2}{3}}$$

where

Q :	Assumed pick discharge volume	(m^3/Sec.)
f :	Coefficient factor of discharge	(0.2)
Rt :	Houry rainfall	(mm/h)
R :	Daily rainfall	(mm/h)
A :	Catchment area	(Sq.km)
T :	Time of concentration	(hr.)

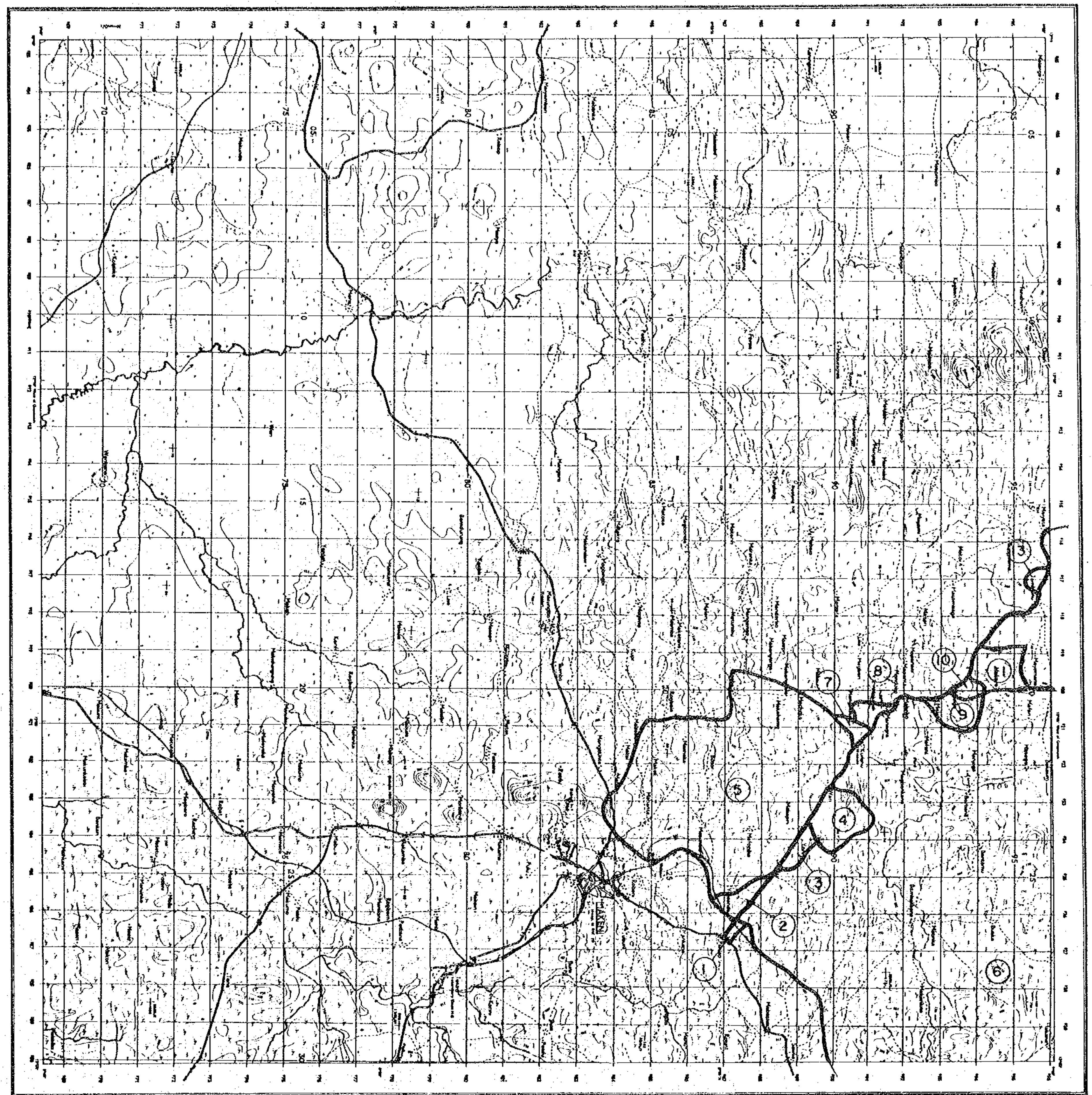
4. Calculation for Assumed Discharge Volume on the basis of Openning Area of Existing Structure

$$Qc = Ac \cdot V \qquad V = \frac{1}{n} \cdot R^{\frac{2}{3}} \cdot I^{\frac{1}{2}}$$

Qc :	Assumed discharge volume	(m^3/sec.)
Ac :	Average velocity at existing structure	(m^2)
n :	Coefficient factor by material of waterway	
R :	Discharge radius	
I :	Average gradient of river	

5. Calculation of Proposed Discharge Volume

Location Catchment Area				H	L	W	T	$(\frac{24}{T})^{2/3}$	R	$\frac{R}{24}$	Rt	A	f	Q	1/n	$R^{2/2}$	I	$I^{1/2}$	V	Ac	Qc	Proposed discharge volume
Km	Mile	No.	Km^2	Km	Km	Km/hr	hr		mm		mm/hr	Km^2		m^3/sec		m	%		m/sec	M^2	m^3/sec	m^3/sec
5+30	3.3	④	18.32	0.010	1.0	4.54	0.22	22.8	180	7.5	171.0	8.00	0.2	76.0	50.	1.02	0.5	0.07	3.57	8.6	30.7	76.0
6+0	3.7	③④⑤	45.17	0.020	4.0	3.00	1.33	6.9	180	7.5	51.8	45.17	0.2	130.0	50.	1.34	0.5	0.07	4.69	28.0	131.3	131.3
8+00	5.0	⑥③④⑤	695.02	0.015	15.0	4.54	3.30	3.8	180	7.5	28.5	750.0	0.2	1801.8	50.	2.00	0.5	0.07	7.00	300.0	2100.0	2100.0
9+40	5.9	⑨	0.96	0.003	0.5	3.34	0.15	29.5	180	7.5	221.3	0.96	0.2	11.8	66.6	0.70	0.5	0.07	3.26	2.80	7.3	11.8
10+90	6.8	⑪	1.90	0.004	0.7	3.25	0.22	22.8	180	7.5	171.0	1.90	0.2	18.1	66.6	1.02	0.5	0.07	4.76	8.84	33.7	33.7
13+20	8.3	⑭	32.60	0.015	3.0	3.00	1.00	8.3	180	7.5	62.3	32.60	0.2	112.8	50.	1.30	0.5	0.07	4.55	19.8	90.1	112.8
16+20	10.1	⑮	3.10	0.005	1.0	3.00	0.33	17.4	180	7.5	130.7	3.10	0.2	22.5	50.	0.96	0.5	0.07	3.36	7.2	24.2	24.2
17+00	10.6	⑯	5.72	0.006	1.2	3.00	0.40	15.3	180	7.5	114.8	5.72	0.2	36.5	50.	1.03	0.5	0.07	3.60	9.0	32.4	36.5
22+20	13.9	⑰⑱⑲	13.48	0.013	2.7	2.93	0.92	8.8	180	7.5	66.0	13.48	0.2	49.4	50.	1.08	0.5	0.07	3.78	13.5	51.0	51.0
23+40	14.5	⑳	1.68	0.005	0.8	3.43	0.23	22.2	180	7.5	166.5	1.68	0.2	15.5	76.9	0.28	1.0	0.1	2.15	0.28	2.4	15.5
26+30	16.4	㉑	21.46	0.006	1.5	2.62	0.57	12.1	180	7.5	90.8	21.46	0.2	108.3	50.	1.34	0.5	0.07	4.69	28.0	131.3	131.3
27+20	17.0	㉒	96.96	0.024	4.0	3.34	1.20	7.4	180	7.5	55.5	96.96	0.2	299.0	50.	1.45	0.5	0.07	5.08	56.0	284.5	299.0
27+70	17.3	㉓	1.82	0.003	0.8	2.52	0.32	17.8	180	7.5	133.5	1.82	0.2	13.5	50.	1.02	0.5	0.07	3.57	8.6	30.7	30.7
30+20	18.9	㉔	2.24	0.005	1.0	3.00	0.33	17.4	180	7.5	130.5	2.24	0.2	16.2	50.	1.04	0.5	0.07	3.64	9.0	32.8	32.8
32+00	20.0	㉕	1.84	0.004	0.8	3.00	0.27	19.9	180	7.5	149.3	1.84	0.2	15.3	50.	0.84	0.5	0.07	2.94	5.5	16.2	16.2
32+60	20.4	㉖㉕	2.50	0.005	1.0	3.00	0.33	17.4	180	7.5	130.5	2.50	0.2	18.1	66.6	0.93	0.5	0.07	4.34	6.6	22.9	22.9
34+00	21.3	㉗㉖㉕	11.70	0.010	2.0	3.00	0.67	10.9	180	7.5	81.8	9.20	0.2	59.9	50.	1.30	0.5	0.07	4.55	18.0	81.9	81.9
35+10	21.9	㉘㉙㉚	23.16	0.013	2.5	3.07	0.82	9.5	180	7.5	71.3	20.95	0.2	100.1	50.	1.28	0.5	0.07	4.48	17.28	77.4	100.1
35+90	22.4	㉙㉚	2.21	0.006	1.2	3.00	0.40	15.3	180	7.5	114.8	1.70	0.2	17.1	66.6	0.90	0.5	0.07	4.20	6.8	22.8	22.8
37+40	23.3	㉚	0.51	0.003	0.5	3.34	0.15	29.5	180	7.5	221.3	0.51	0.2	6.3	66.6	0.75	0.5	0.07	3.50	3.4	9.5	9.5
43+10	26.6	㉛	62.52	0.021	3.5	3.34	1.05	8.1	180	7.5	60.8	62.52	0.2	211.2	50.	1.55	0.5	0.07	5.43	42.5	230.8	230.8
43+90	27.4	㉛'	0.30	0.0015	0.3	3.00	0.10	38.6	180	7.5	289.5	0.30	0.2	4.8	66.6	0.86	0.3	0.05	2.86	6.0	17.2	4.8
44+60	27.9	㉜	1.00	0.002	0.4	3.00	0.13	32.4	180	7.5	243.0	1.00	0.2	13.5	66.6	0.92	0.5	0.07	4.29	7.5	25.7	13.5
45+40	28.4	㉝㉞	11.32	0.007	1.5	2.88	0.52	12.9	180	7.5	96.8	10.86	0.2	65.8	50.	1.41	0.5	0.07	4.93	22.5	110.9	65.8
47+10	29.4	㉞	0.46	0.0015	0.3	3.00	0.10	38.6	180	7.5	289.5	0.46	0.2	7.4	66.6	0.61	0.5	0.07	2.84	1.8	4.1	7.4
49+00	30.6	㉟	0.54	0.001	0.2	3.00	0.10	38.6	180	7.5	289.5	0.54	0.2	8.7	66.6	0.72	0.5	0.07	3.36	3.2	8.6	8.7
49+60	31.0	㊱㉟	3.26	0.016	0.8	6.89	0.12	34.2	180	7.5	256.5	2.72	0.2	47.5	50.	1.00	0.5	0.07	3.50	8.1	28.4	47.5
51+20	32.0	㊲	24.70	0.009	1.6	3.22	0.50	13.2	180	7.5	99.0	24.70	0.2	135.9	50.	1.46	0.5	0.07	5.11	25.8	131.8	135.9
57+00	35.7	㊳	3.72	0.010	1.00	4.54	0.22	22.8	180	7.5	171.0	3.72	0.2	35.3	50.	0.89	0.5	0.07	3.12	6.6	20.6	35.3
58+10	36.1	㊴	3.10	0.005	0.80	3.43	0.23	22.2	180	7.5	166.5	3.10	0.2	28.7	50.	0.95	0.5	0.07	3.33	7.2	24.0	28.7
60+30	37.7	㊵	161.34	0.034	8.50	2.62	3.24	3.8	180	7.5	28.5	161.34	0.2	255.5	50.	1.36	0.5	0.07	4.76	49.5	235.6	255.5
61+50	38.4	㊶	2.08	0.005	1.00	3.00	0.33	17.4	180	7.5	130.5	2.08	0.2	15.1	50.	1.19	0.5	0.07	4.17	5.0	16.7	16.7
64+10	40.0	㊷	2.70	0.006	1.00	3.34	0.30	18.6	180	7.5	139.5	2.70	0.2	20.9	50.	0.81	0.5	0.07	2.84	5.4	15.3	20.9
64+80	40.5	㊸	7.08	0.008	1.60	3.00	0.53	12.7	180	7.5	95.3	7.08	0.2	37.5	50.	1.11	0.5	0.07	3.89	12.06	46.9	46.9
67+00	41.9	㊹	34.32	0.017	3.40	3.00	1.13	7.7	180	7.5	57.8	34.32	0.2	110.2	50.	1.36	0.5	0.07	4.76	30.0	142.8	142.8
67+40	42.1	㊺	5.60	0.006	1.20	3.00	0.40	15.3	180	7.5	114.8	5.60	0.2	35.7	50.	0.87	0.5	0.07	3.05	5.25	16.0	35.7
74+20	46.4	㊻	319.64	0.035	8.80	2.61	3.37	3.7	180	7.5	27.8	319.64	0.2	493.7	50.	1.67	0.5	0.07	5.85	80.0	468.0	493.7
76+30	47.4	㊼	3.22	0.005	1.00	3.00	0.33	17.4	180	7.5	130.5	3.22	0.2	23.3	66.6	0.61	0.5	0.07	2.84	1.92	4.4	23.3
53+30	33.3	㊲	1.00	0.001	0.20	3.00	0.10	38.6	180	7.5	289.5	1.00	0.2	16.1	66.6	0.84	0.5	0.07	3.92	5.28	16.6	16.6
3+40	2.1	③	0.44	0.0015	0.30	3.00	0.10	38.6	180	7.5	289.5	0.44	0.2	7.1	76.9	0.28	1.0	0.1	2.15	0.28	1.4	7.1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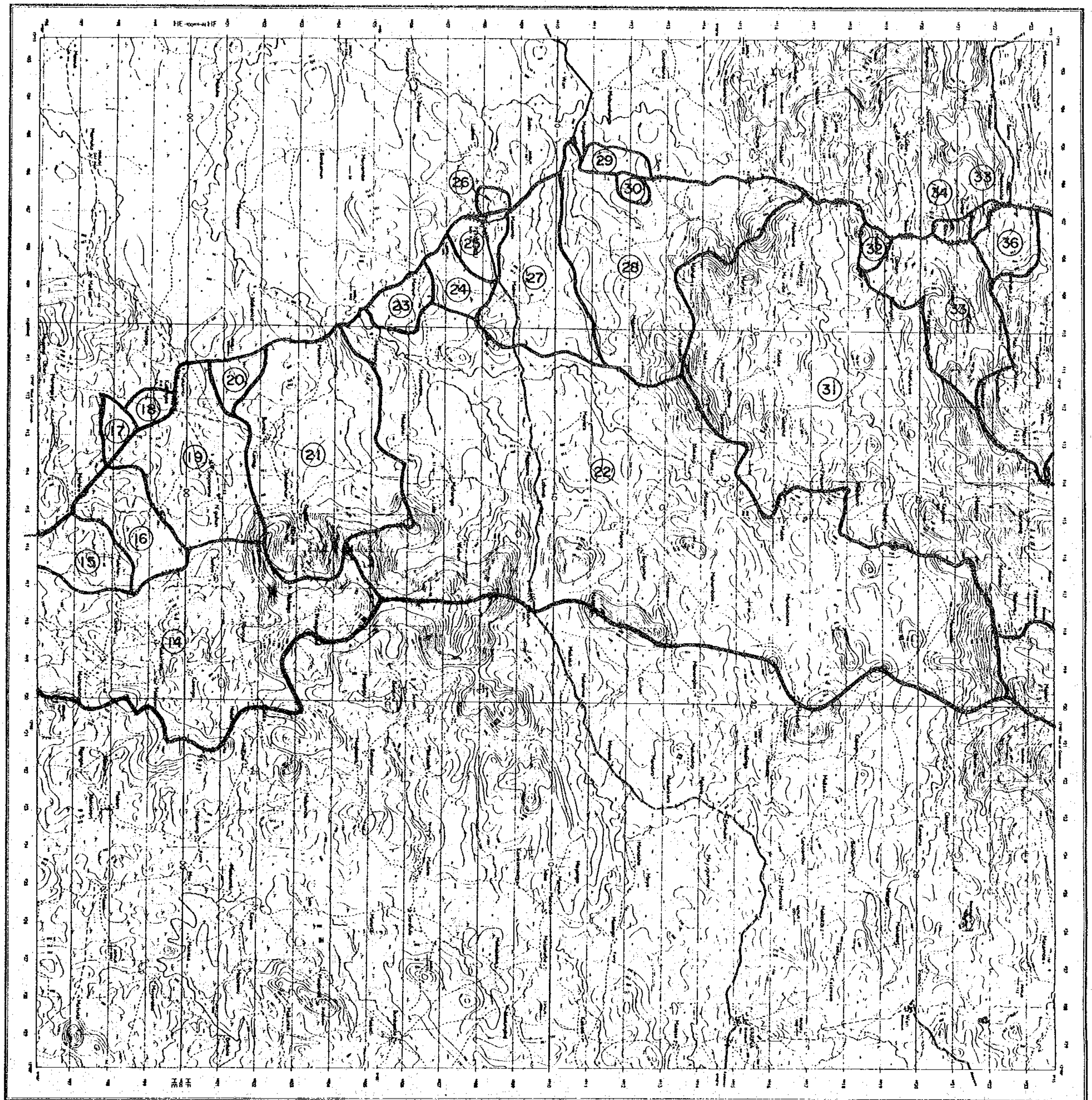
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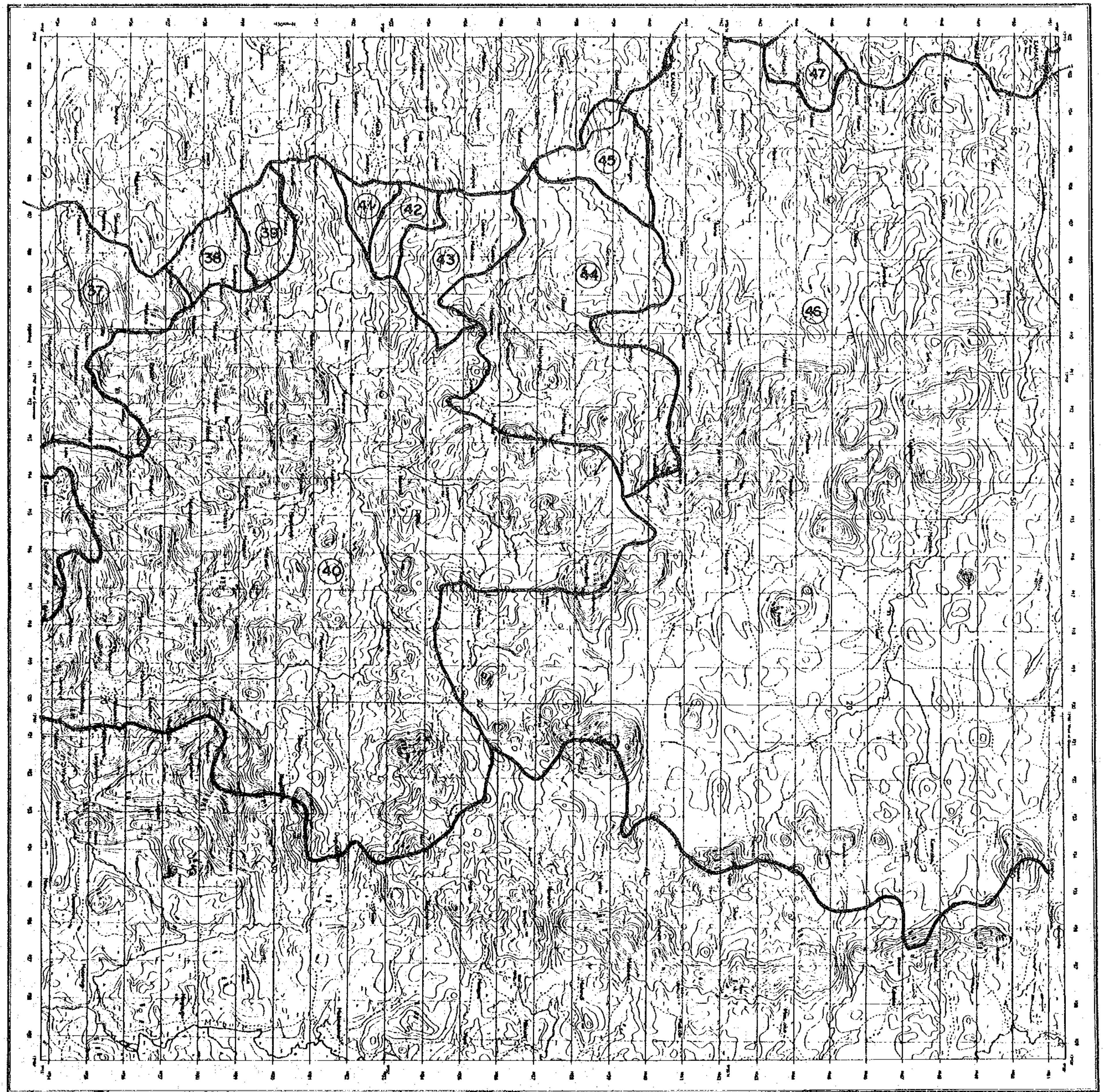
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APPENDIX R CALCULATION OF PAVEMENT THICKESS

1. Future Traffic Volume between Panlap and Mabole

Unit: ADT

	1985		1995		2010	
	Number	rate	Number	rate	Number	rate
Cars	50	1.00	116	2.32	394	7.88
Pick-ups & Vans	99	1.00	164	1.66	326	3.29
Trucks & Buses	68	1.00	113	1.66	223	3.28
Extra heavy vehicles	23	1.00	39	1.70	52	2.26
Total	240	1.00	432	1.80	995	4.15

Source : JICA Mission.

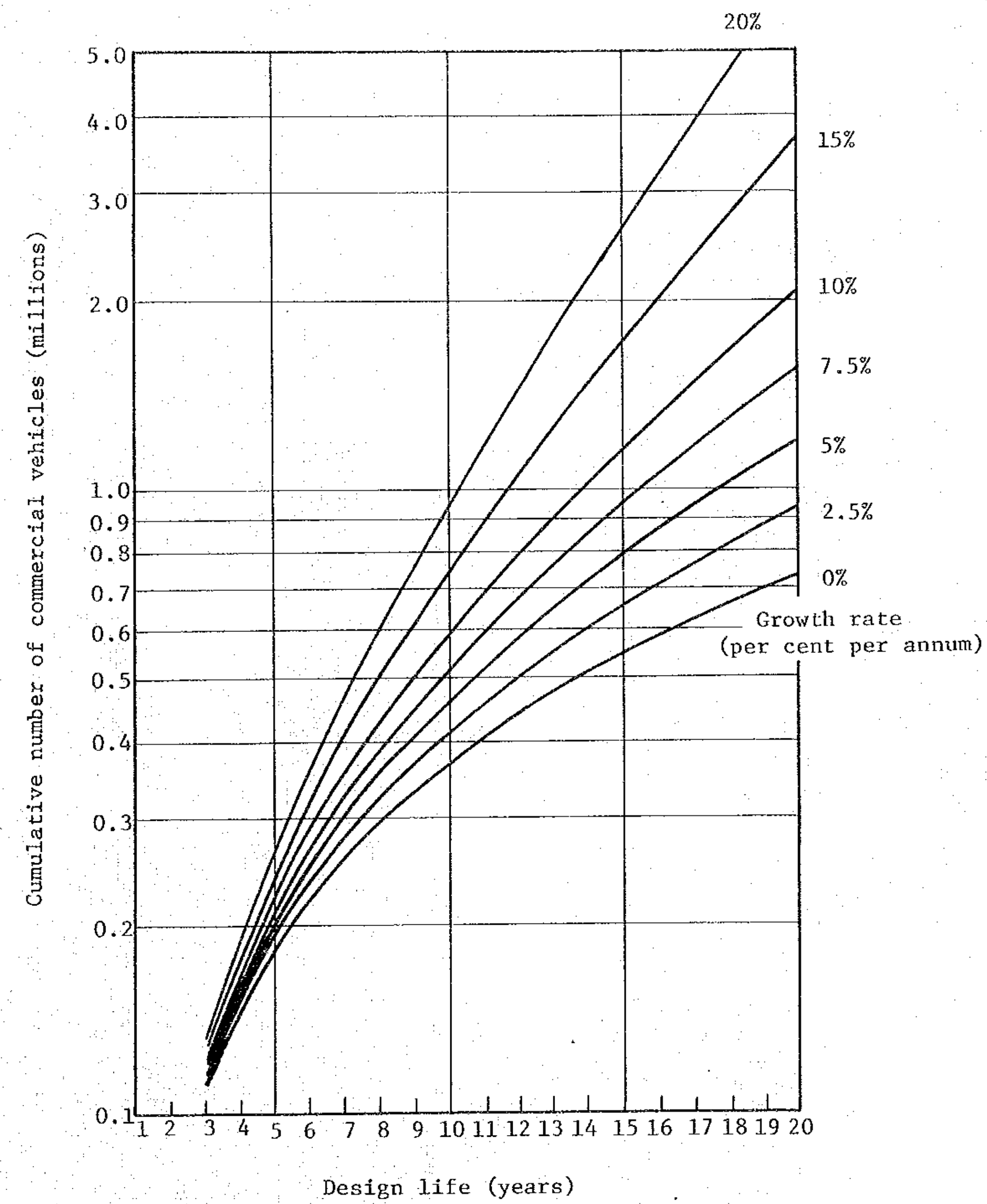
2. Cumulative Axle Loads for ten years

	Traffic Volume		One direction/100	Cumulative Vehicles No./100 L1	Actual Cumulative Vehicles Number	Equivalent Factor L2	Design Cumulative Number
	Both of Direction	One Direction					
	①	②=①x 2/3	③=②/100	④	⑤ =③ x ④	⑥	⑦= ⑤ x ⑥
Cars	50	33	0.33	0.65	0.2145	0.0002	0.00004
Pick-ups & Vans	99	66	0.66	0.49	0.3234	0.0025	0.00081
Trucks & Buses	68	45	0.45	0.48	0.2160	0.08	0.01728
Extra heavy Vehicles	23	15	0.15	0.50	0.0750	1.00	0.0750
Total	240	159	-				0.09313

Note : L1 is calculated by Fig. 1.
L2 is depended on "British Note 31 page 7".

Source : JICA Mission.

Fig. 1



RELATION BETWEEN TOTAL NUMBER OF VEHICLES USING A ROAD DURING THE DESIGN LIFE AND GROWTH RATE FOR AN AVERAGE DAILY TRAFFIC OF 100 COMMERCIAL VEHICLES PER DAY IN THE INITIAL YEAR

Source : British note 31

3. Calculation of design C B R Value

Sample No.	1	2	3	4	5	6	7	8	9	10	Average
C B R Value	43	160	130	98	100	74	87	26	46	50	65.5

Source : JICA Mission

$$\text{Design C B R} = \text{Average C B R} - \frac{\text{Maximum C B R} - \text{Minimum C B R}}{d}$$

$$= 65.5 - \frac{100 - 26}{2.96}$$

$$= 40.5 \quad > \quad 25$$

Note : "d" is a coefficient value on the basis of numbers of C B R Test Values.

5. Pavement Structure

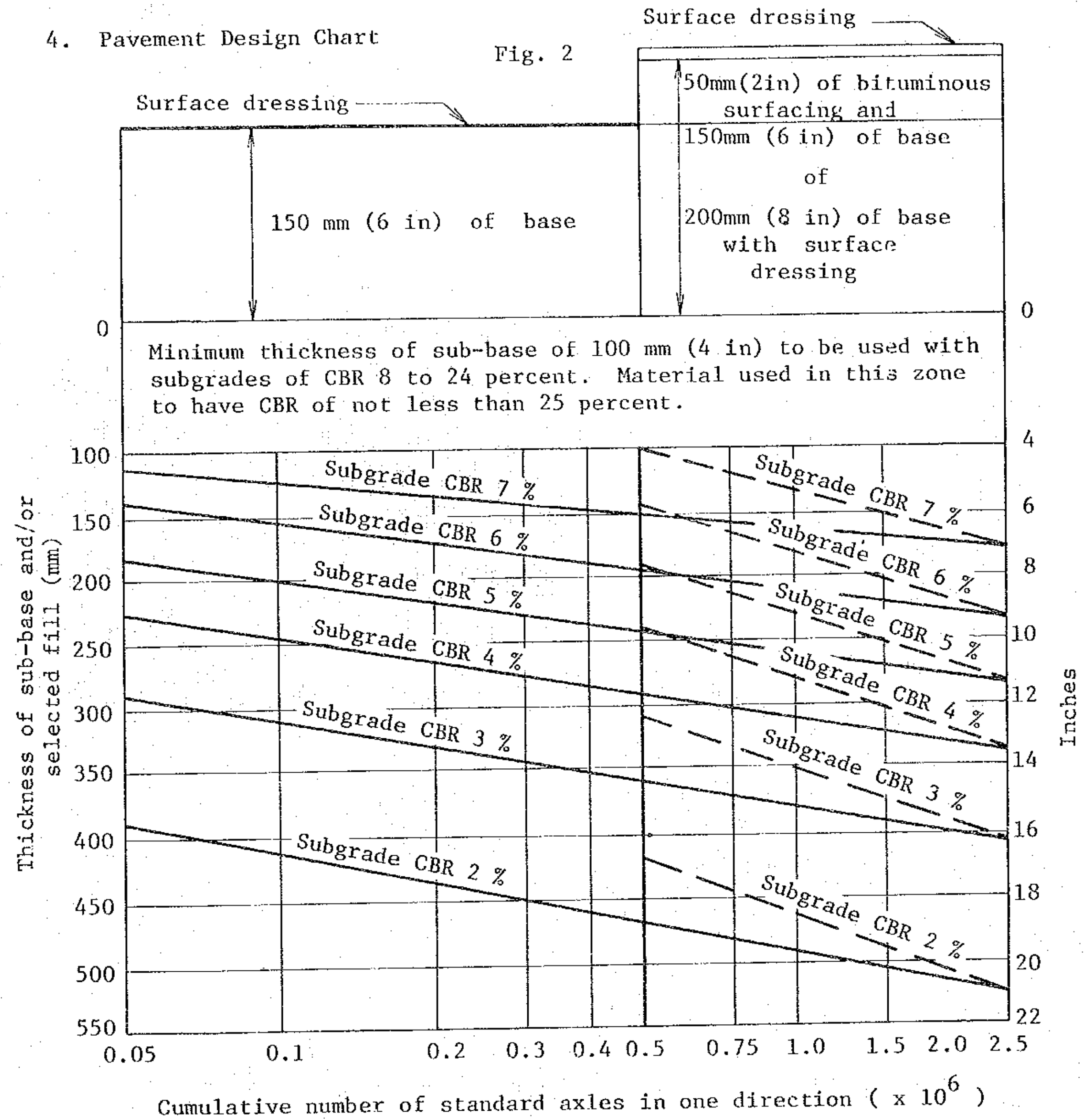
The thickness of each layer is calculated on the basis of Design C B R and Design cumulative number of standard axles from Fig. 2 Pavement Design Chart for flexible pavement.

The thickness of each layer is as follows.

Sub base course	4 inch	
Base course	8 inch	
Surface dressing	2-coat	3/4 inch + 1/2 inch chipping.

4. Pavement Design Chart

Fig. 2



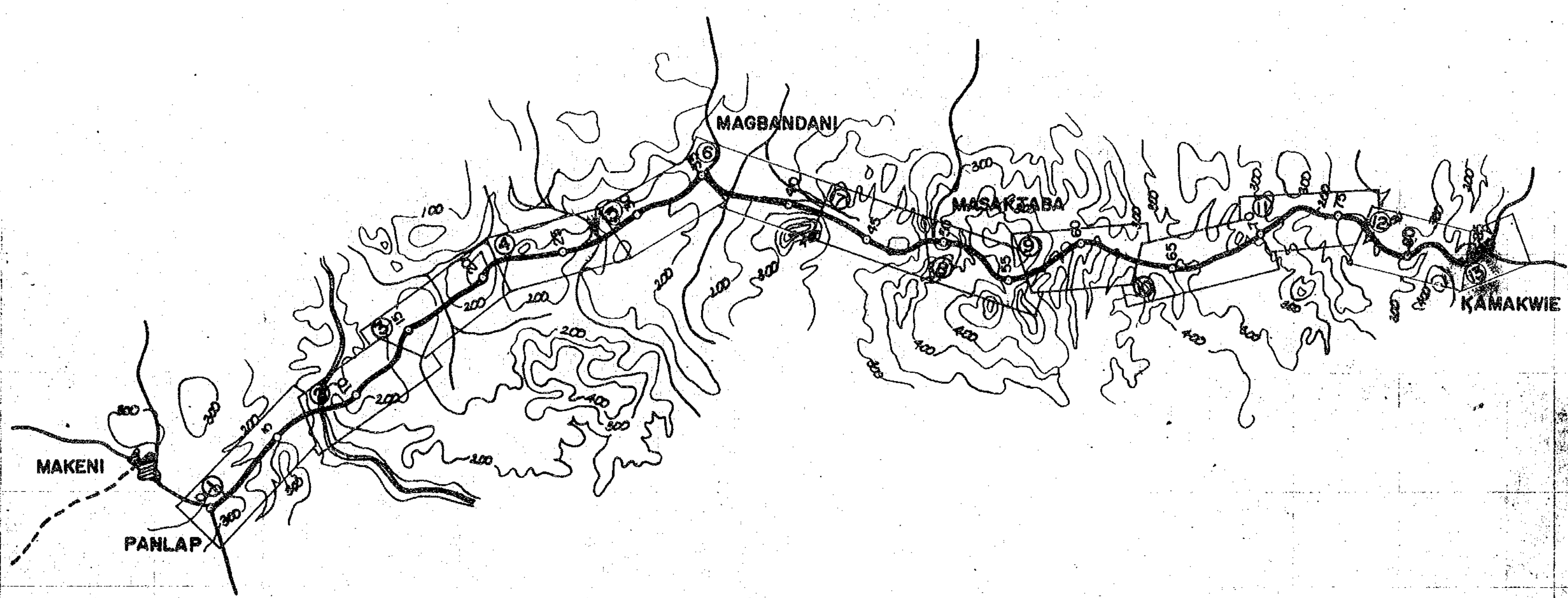
If it is desired to provide at the time of construction a pavement capable of carrying more than 0.5 million standard axles the designer may choose either a 150 mm (6 in) base with a 50 mm (2 in) bituminous surfacing or a 200 mm (8 in) base with a double surface dressing. For both of these alternatives, the recommended sub-base thickness is indicated by the broken line.

Alternatively, a base 150 mm (6 in) thick with double surface dressing may be laid initially and the thickness increased when 0.5 million standard axles have been carried. The extra thickness may consist of 50 mm (2 in) of bituminous surfacing or at least 75 mm (3 in) of crushed stone with double surface dressing. The largest aggregate size in the crushed stone must not exceed 19 mm (3/4 in) and the old surface must be prepared by scarifying to a depth of 50 mm (2 in). For this stage construction procedure, the recommended thickness of sub-base is indicated by the solid line.

Source : British Note 31

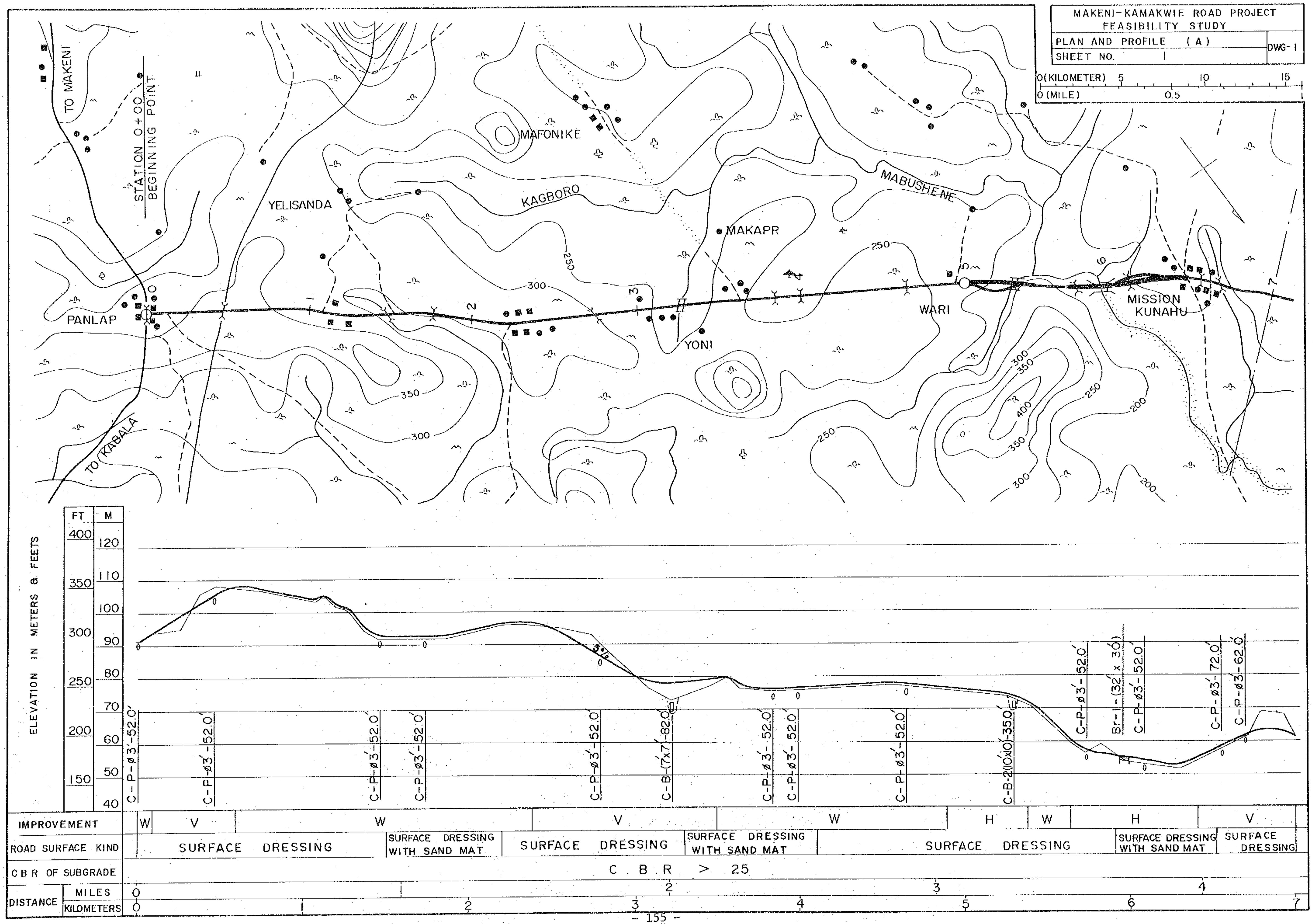
MAKENI - KAMAKWIE ROAD PROJECT FEASIBILITY STUDY	
COVER SHEET (A)	DWG-
SHEET NO.	

APPENDIX S-1 PLAN AND PROFILE OF ALTERNATIVE PLAN A



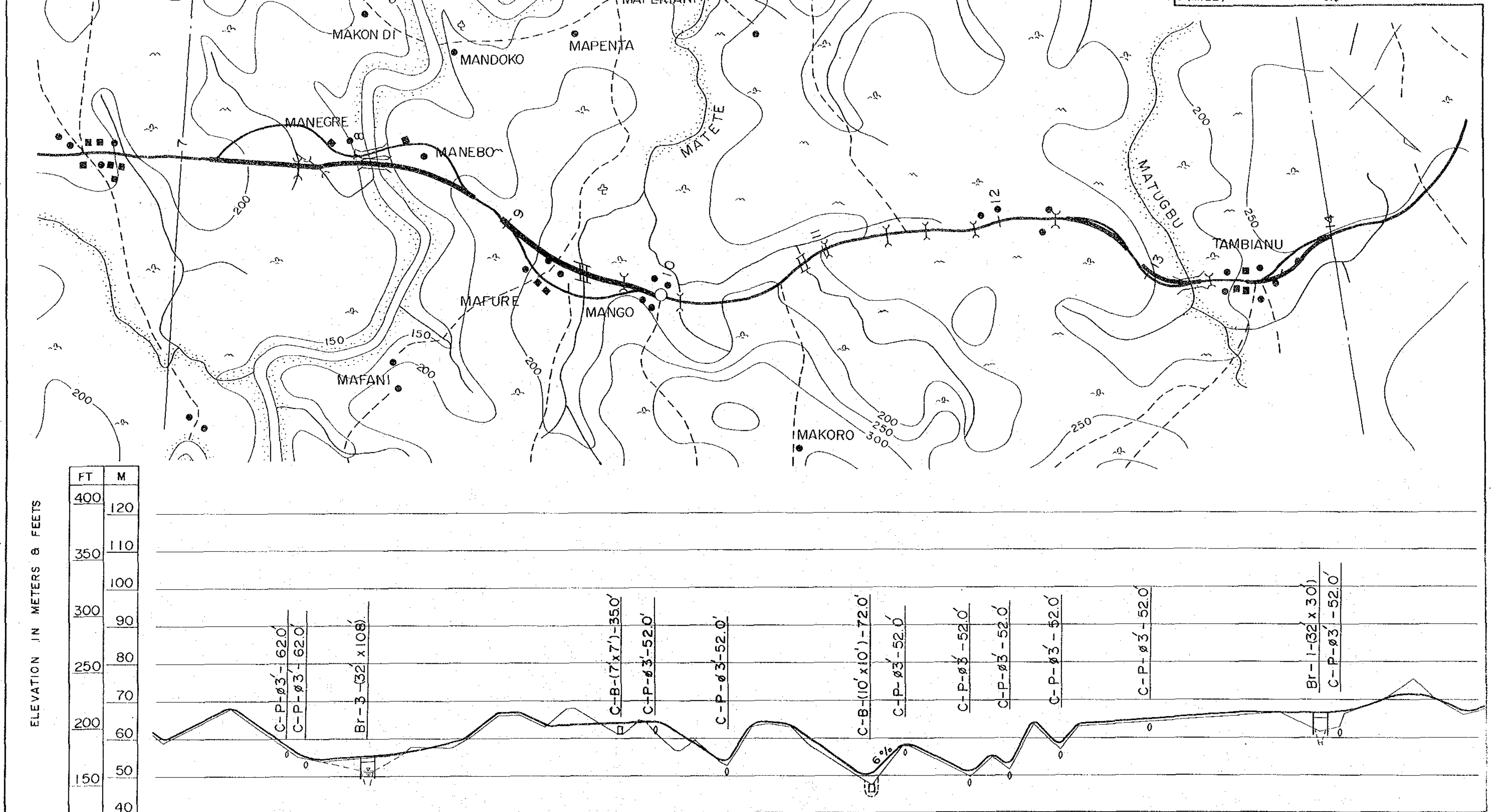
ABBREVIATIONS

H	RE-ALIGNMENT, HORIZONTAL FOR ROAD IMPROVEMENT
V	RE-ALIGNMENT, VERTICAL FOR ROAD IMPROVEMENT
W	WIDENING OF ROAD WIDTH FOR ROAD IMPROVEMENT
C - P - ϕa - ℓ	PROPOSED PIPE CULVERT, ϕa (DIAMETER, FOOT), ℓ (LENGTH, FOOT)
C - B (a x b) - ℓ	PROPOSED BOX CULVERT, a x b (WIDTH x LENGTH ALONG THE ROAD), ℓ (CULVERT LENGTH)
C - B - n(a x b) - ℓ	PROPOSED BOX CULVERT, n (ROW), a x b (WIDTH x LENGTH ALONG THE ROAD), ℓ (CULVERT LENGTH)
Br - n - (a x b)	PROPOSED PRESTRESSED CONCRETE BRIDGE, n (NOS. OF SPAN), a x b (WIDTH x SPAN LENGTH)



MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY
PLAN AND PROFILE (A)
DWG-1
SHEET NO. 1
0(KILOMETER) 5 10 15
0(MILE) 0.5
TO MAKENI
STATION 0+00
BEGINNING POINT
MAFONIKE
YELISANDA
KAGBORO
MABUSHENE
MAKAPR
PANLAP
YONI
WARI
MISSION
KUNAHU
TO KABALA
250
300
350
400
200
ELEVATION IN METERS & FEETS
FT
M
400
350
300
250
200
150
120
110
100
90
80
70
60
50
40
C-P-ø3'-52.0'
C-B-(7x7)-82.0'
C-B-2(10x10)-35.0'
Br-1-(32' x 30')
C-P-ø3'-72.0'
C-P-ø3'-62.0'
IMPROVEMENT
W
V
H
ROAD SURFACE KIND
SURFACE DRESSING
SURFACE DRESSING WITH SAND MAT
CBR OF SUBGRADE
C.B.R > 25
DISTANCE
MILES
KILOMETERS
0
1
2
3
4
5
6
7

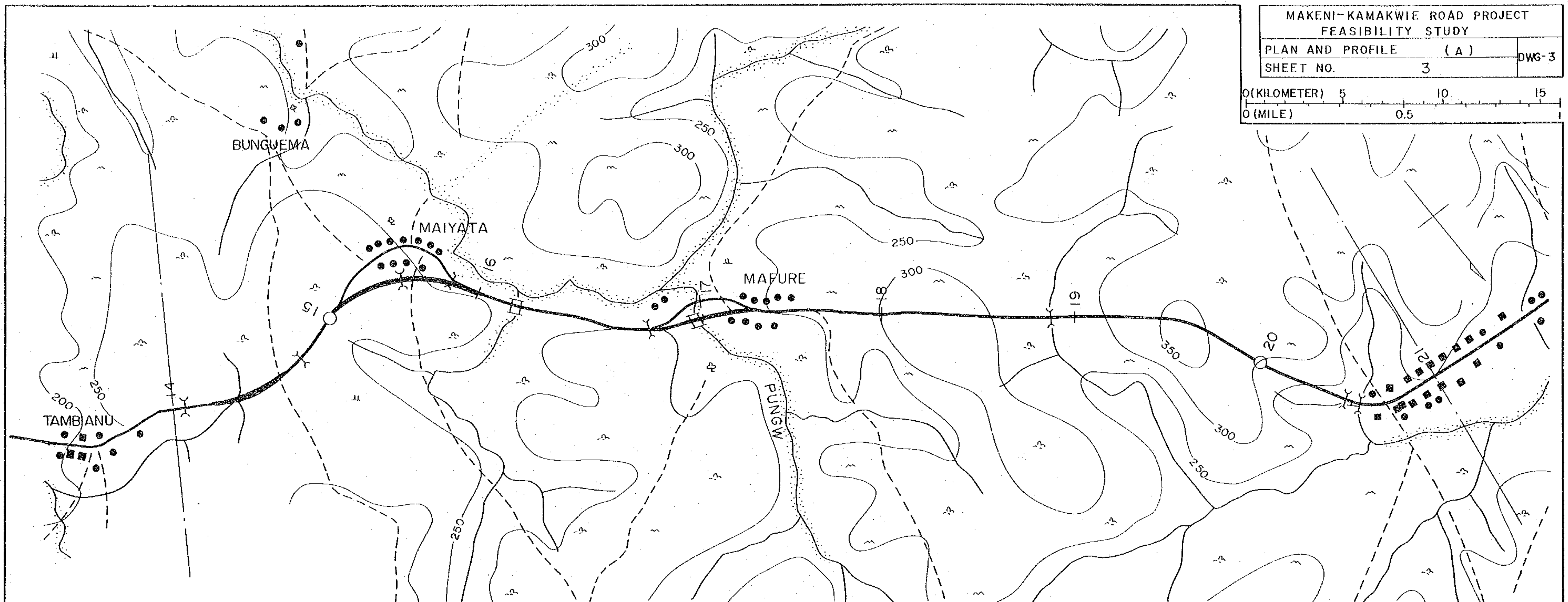
MAKENI-KAMAKWIE ROAD PROJECT FEASIBILITY STUDY	
PLAN AND PROFILE (A)	DWG-2
SHEET NO. 2	

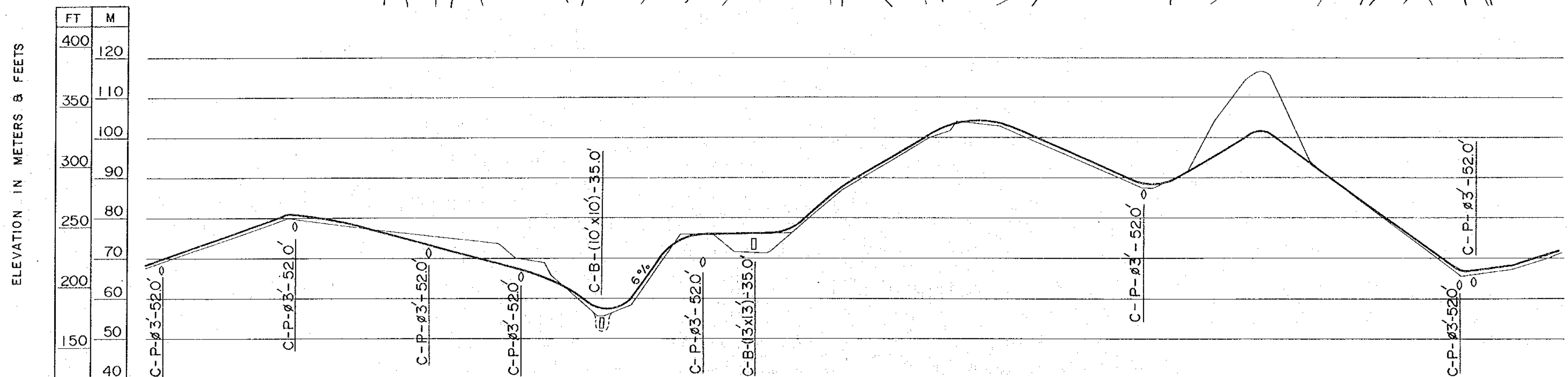


IMPROVEMENT	W, H, W, H, W, V, W, H, W, H, W, H
ROAD SURFACE KIND	SURFACE DRESSING; SURFACE DRESSING WITH SAND MAT; SURFACE DRESSING; SURFACE DRESSING; SURFACE DRESSING WITH SAND MAT; SURFACE DRESSING
C B R OF SUBGRADE	C.B.R > 25
DISTANCE — MILES	5, 6, 7, 8
DISTANCE — KILOMETERS	7, 8, 9, 10, 11, 12, 13, 14

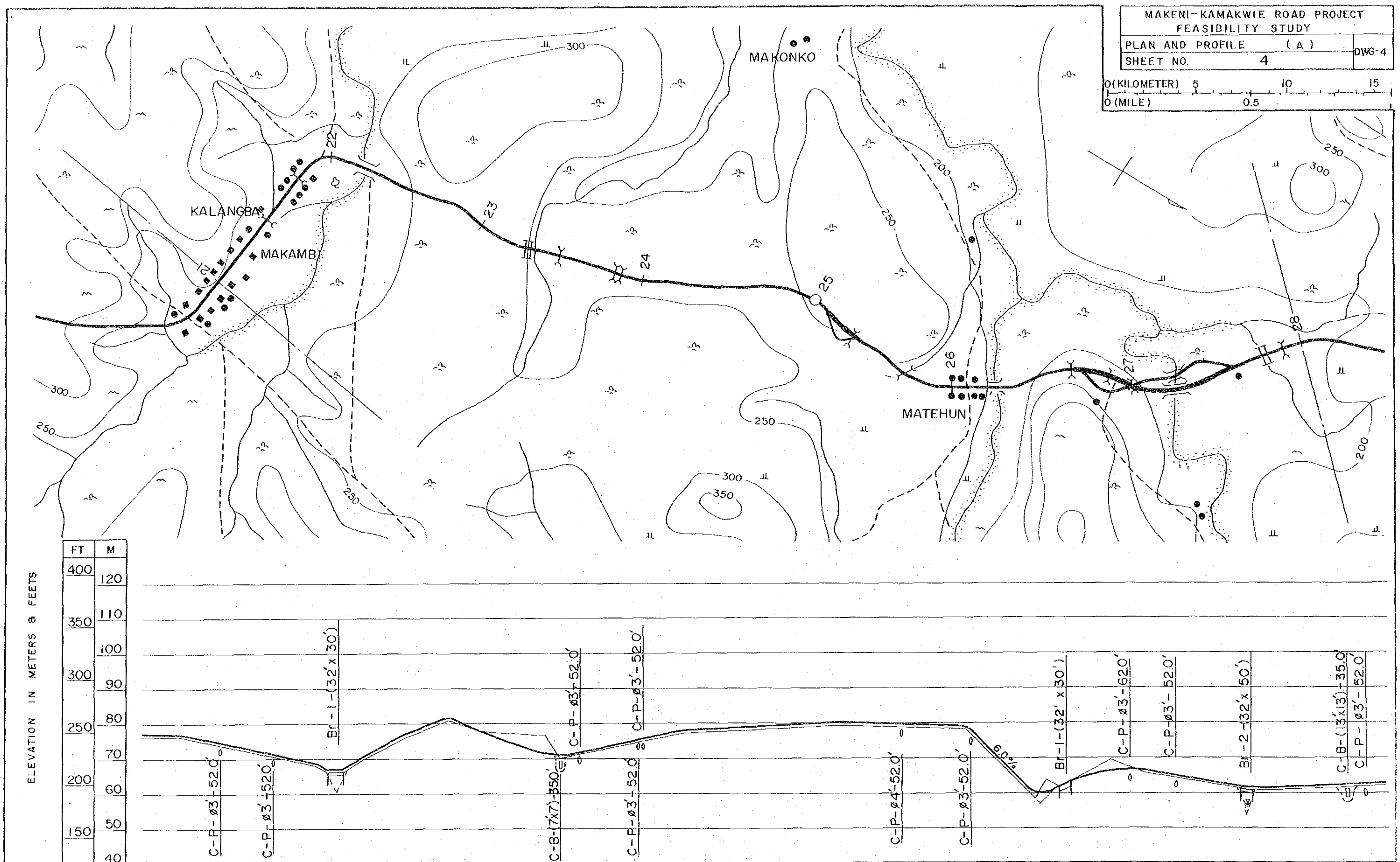
MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE	(A)	DWG-3
SHEET NO.	3	





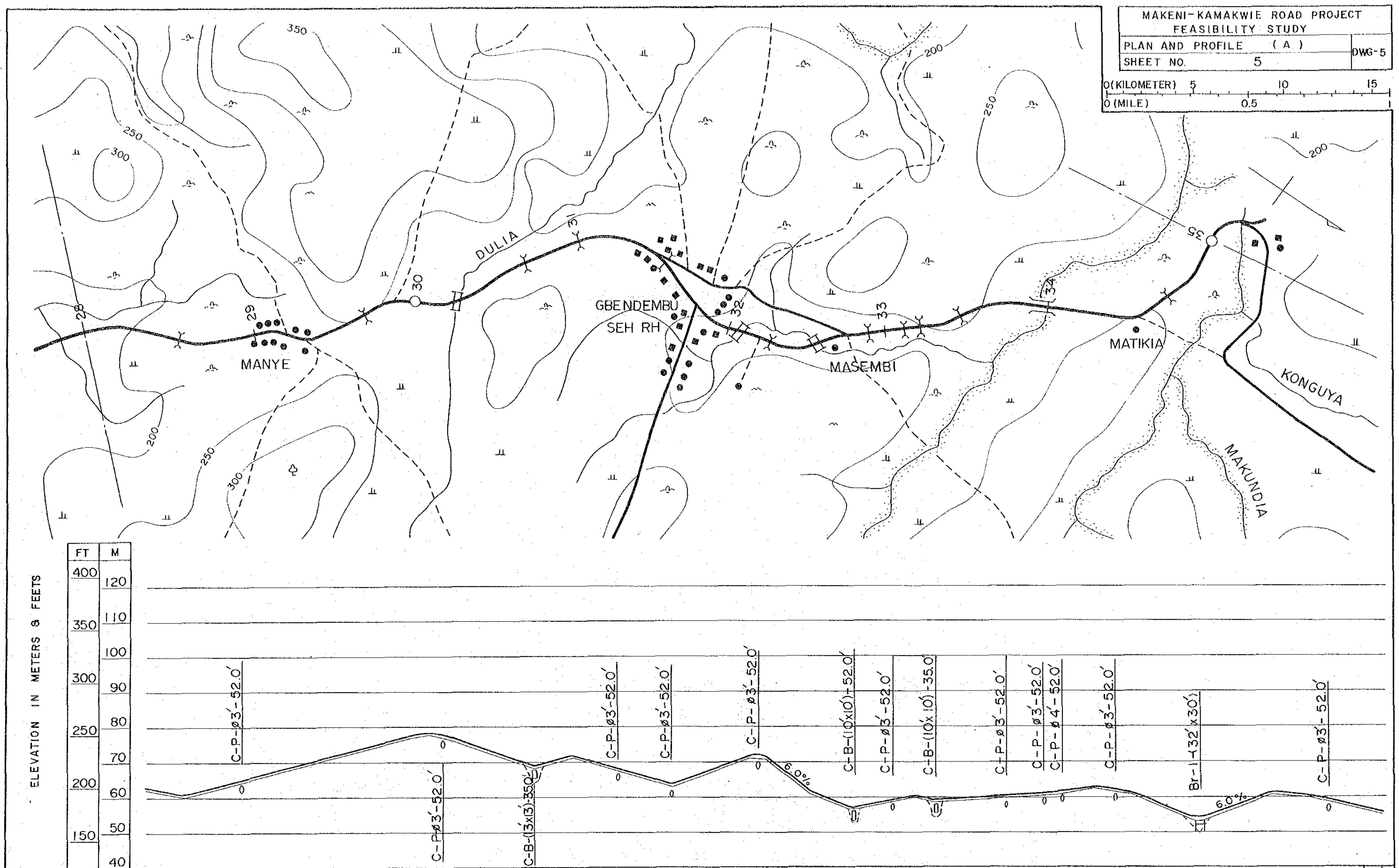
IMPROVEMENT	W, H, W, H, W, H, W, V, W, V, W
ROAD SURFACE KIND	SURFACE DRESSING; SURFACE DRESSING WITH SAND MAT; SURFACE DRESSING; SURFACE DRESSING WITH SAND MAT; SURFACE DRESSING; SURFACE DRESSING WITH SAND MAT; SURFACE DRESSING
C B R OF SUBGRADE	C.B.R > 25
DISTANCE — MILES	9, 10, 11, 12, 13
DISTANCE — KILOMETERS	14, 15, 16, 17, 18, 19, 20, 21



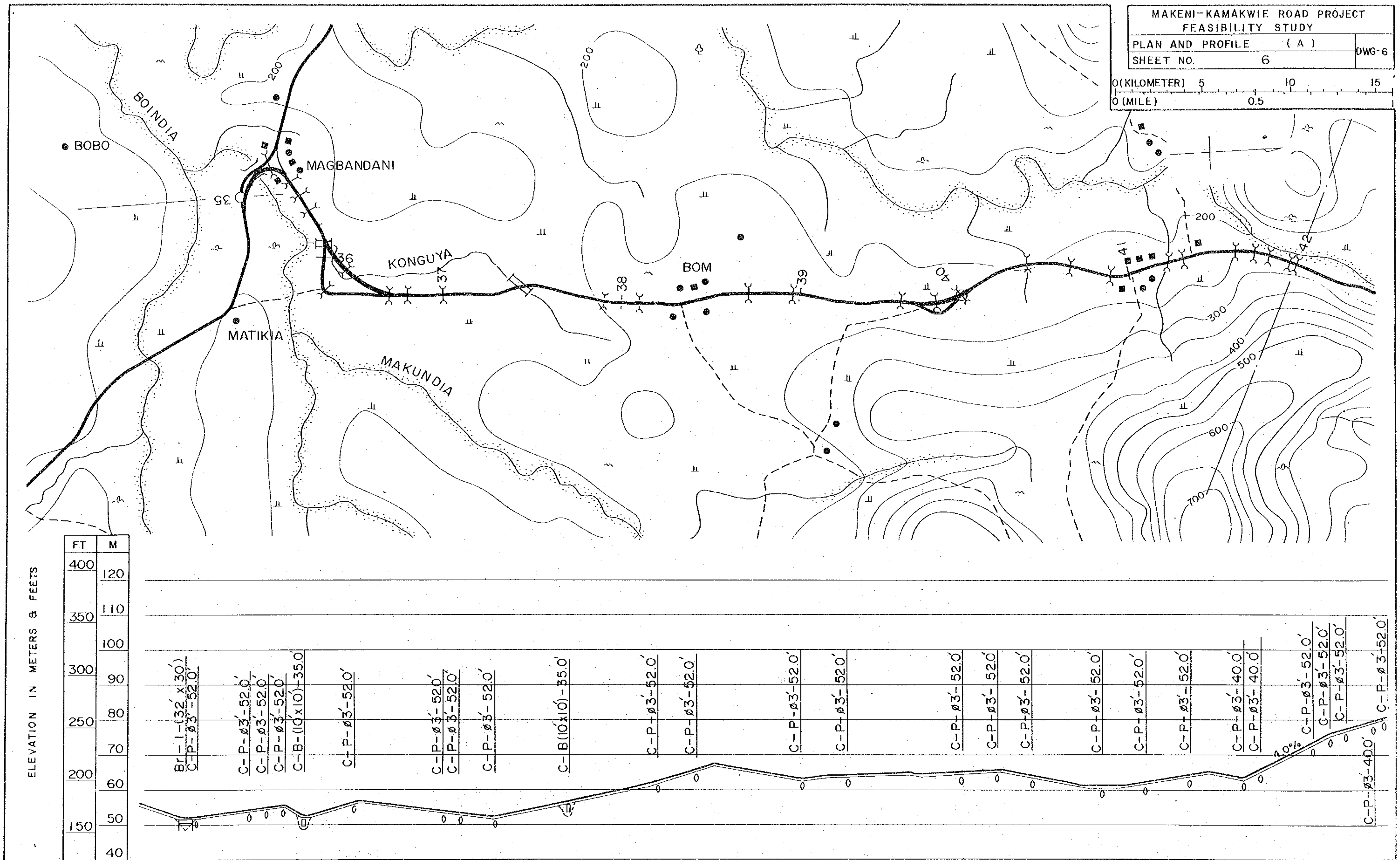
IMPROVEMENT		W	V	W	H	W	V	H	W
ROAD SURFACE KIND		SURFCE DRESSING	SAFACE DRESSING WITH SAND MAT	SURFACE DRESSING		SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING		
C B R OF SUBGRADE		C.B.R > 25							
DISTANCE	MILES	14	15	16	17				
	KILOMETERS	21	22	23	24	25	26	27	28

MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

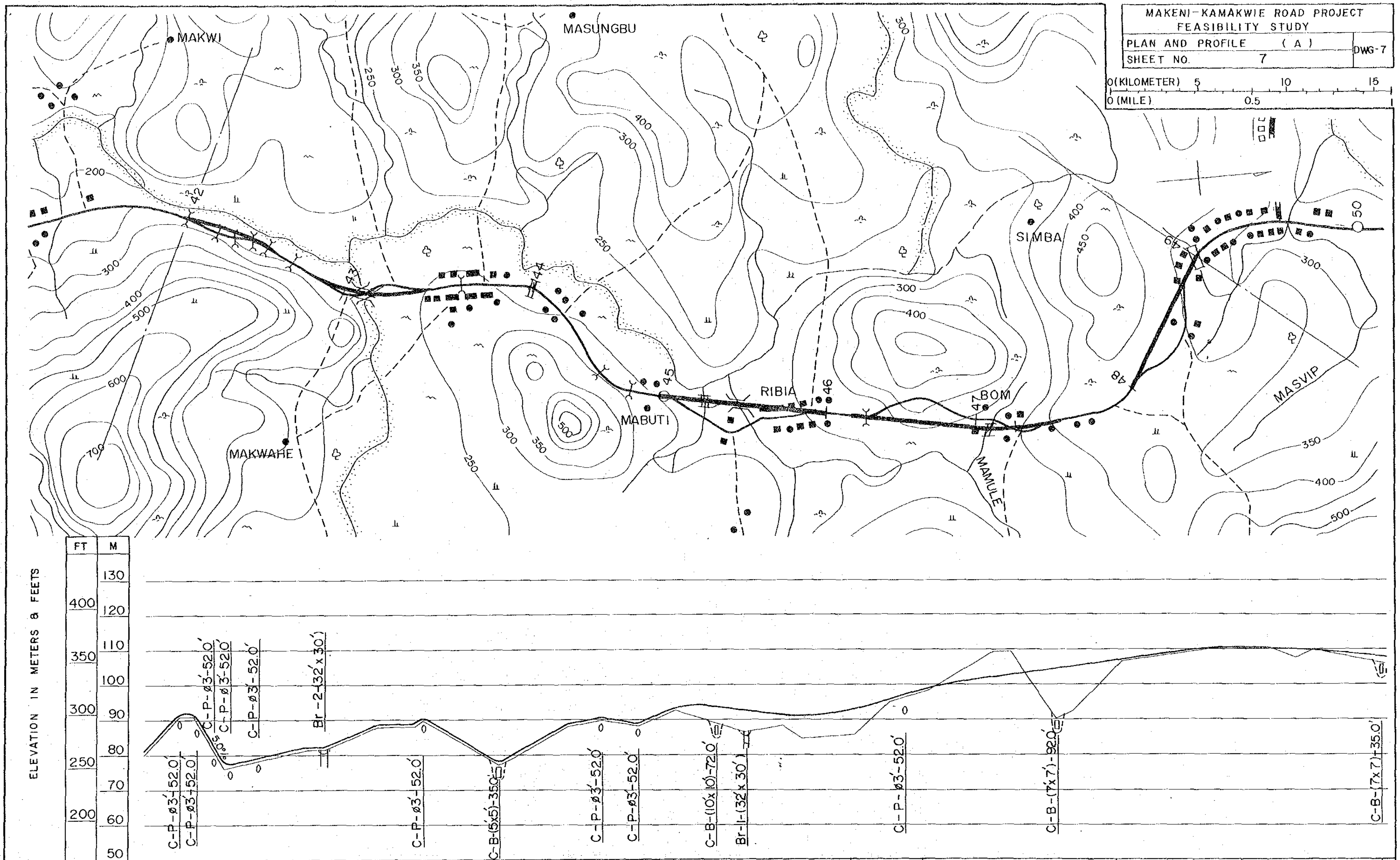
PLAN AND PROFILE	(A)	DWG-5
SHEET NO.	5	



IMPROVEMENT	W						H
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING
C B R OF SUBGRADE	C.B.R > 25						
DISTANCE — MILES	18	19	20	21			
DISTANCE — KILOMETERS	28	29	30	31	32	33	34	35



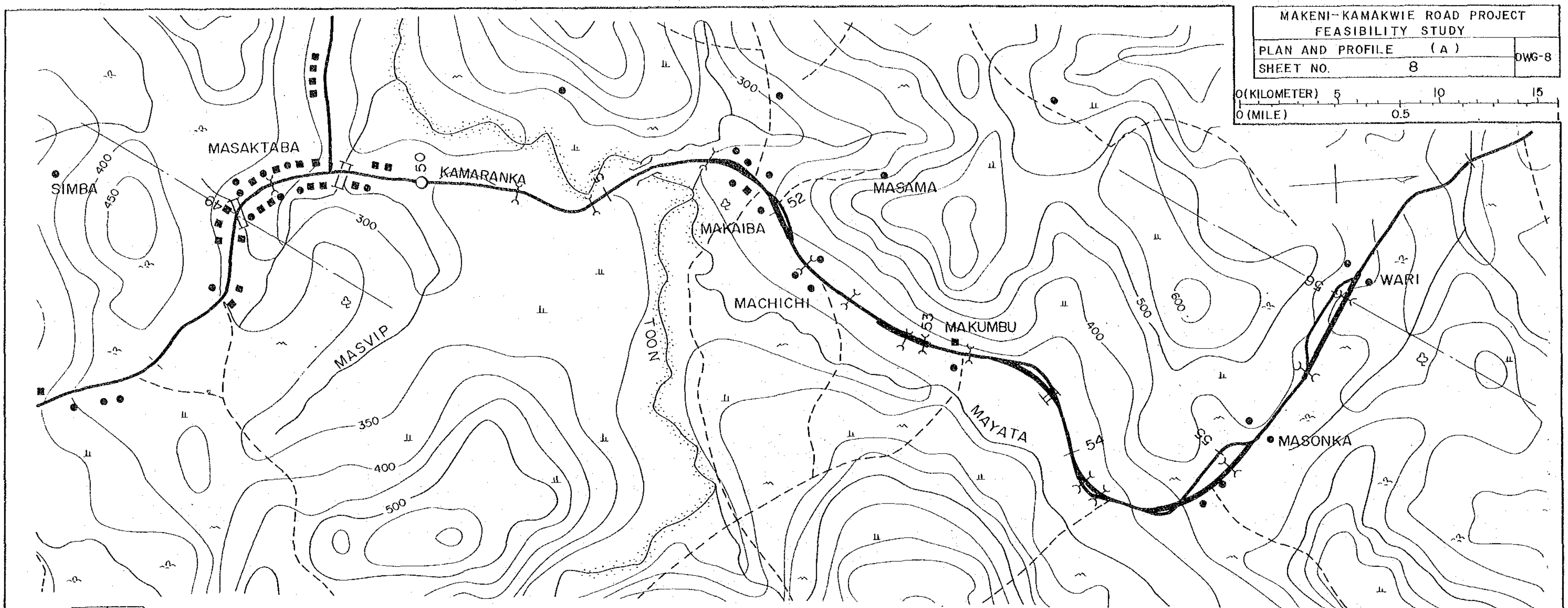
IMPROVEMENT	H	W	H	W		H	W		
ROAD SURFACE KIND	SURFACE DRESSING			SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING		SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	
CBR OF SUBGRADE	C.B.R > 25								
DISTANCE MILES	22	23	24	25	26				
DISTANCE KILOMETERS	35	36	37	38	39	40	41	42	

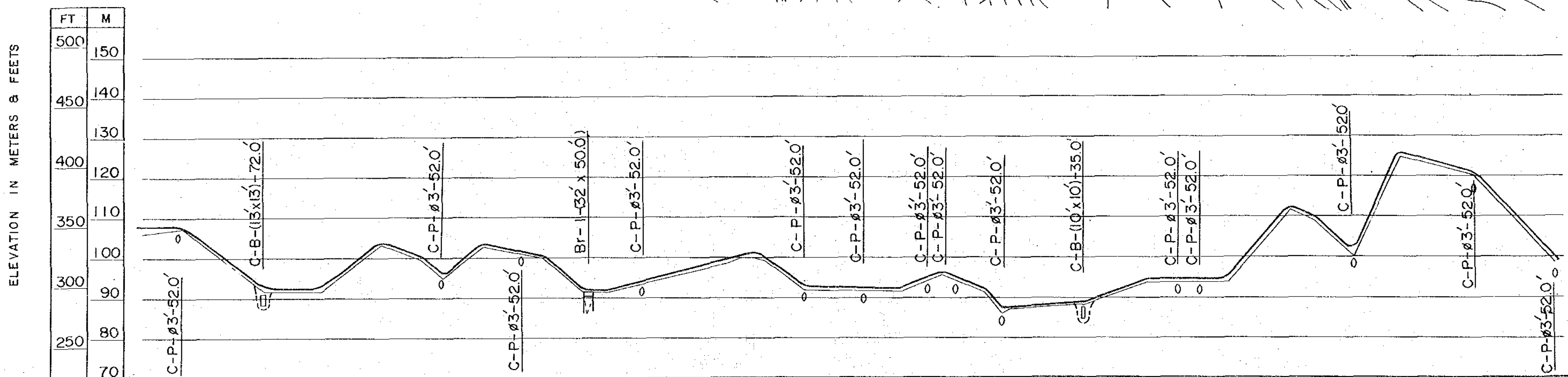


IMPROVEMENT		H	W	H	W	H	W	H	W	H
ROAD SURFACE KIND		SURFACE DRESSING					SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING
C B R OF SUBGRADE	C.B.R > 25									
DISTANCE	MILES	27	28	29	30					
	KILOMETERS	42	43	44	45	46	47	48	49	

MAKENI–KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE	(A)	DWG-8
SHEET NO.	8	





IMPROVEMENT	W	H	W	H	W	H	W	H	W	H	W	H	W	H	W	H

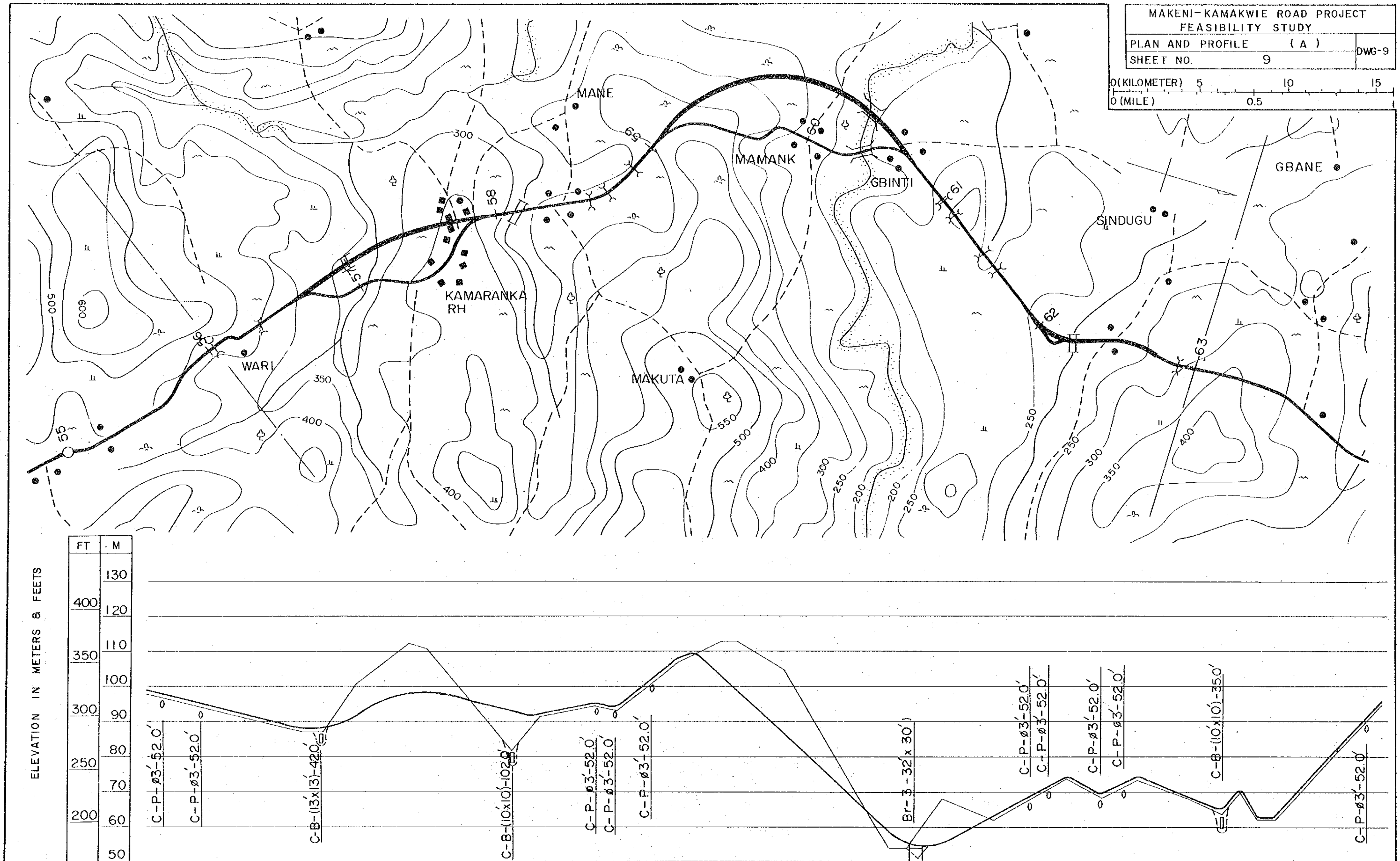
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING

C B R OF SUBGRADE	C.B.R > 25

DISTANCE									
MILES		31		32		33		34	
KILOMETERS	49	50	51		52	53	54	55	56

MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

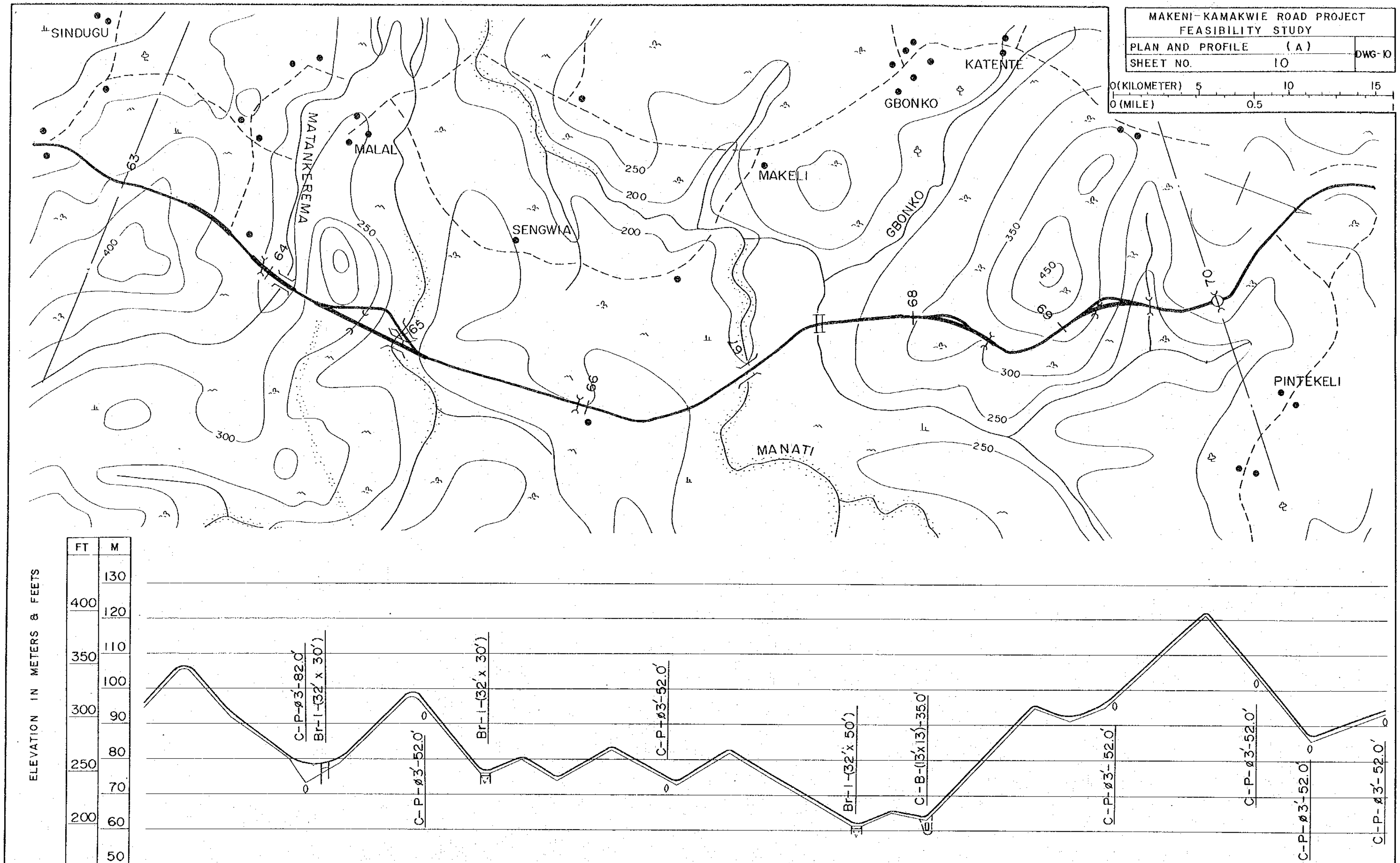
PLAN AND PROFILE	(A)	DWG-9
SHEET NO.	9	



IMPROVEMENT	H	V	H	V	W	H	W	H	W
ROAD SURFACE KIND		SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING		SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	
C B R OF SUBGRADE	C. B. R > 25								
DISTANCE MILES	35	36	37	38	39				
DISTANCE KILOMETERS	56	57	58	59	60	61	62	63	

MAKENI–KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE	(A)	DWG-10
SHEET NO.	10	



IMPROVEMENT	W	H	W	H	W	H	W	H	W	H	W

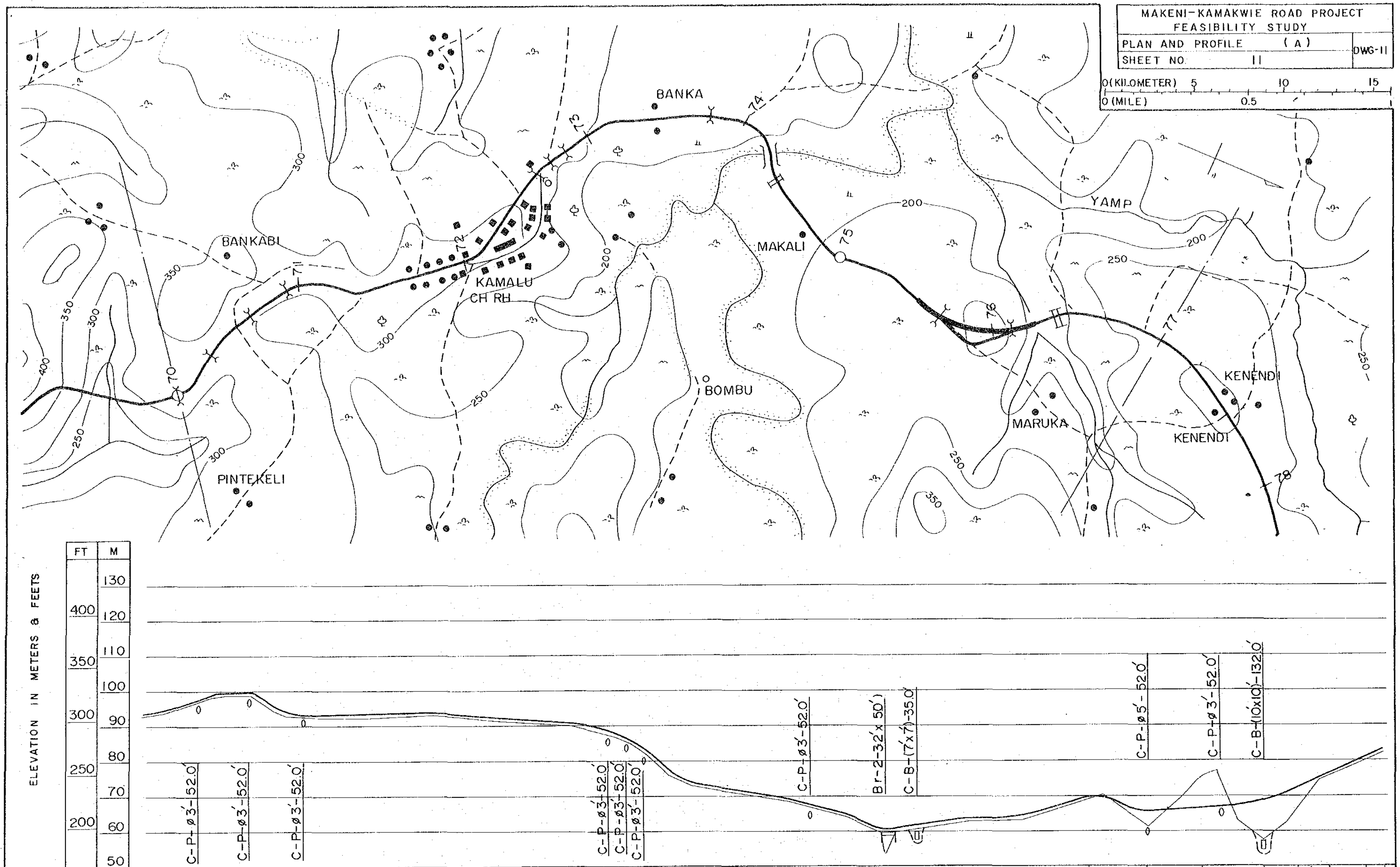
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING

CBR OF SUBGRADE	C.B.R > 25

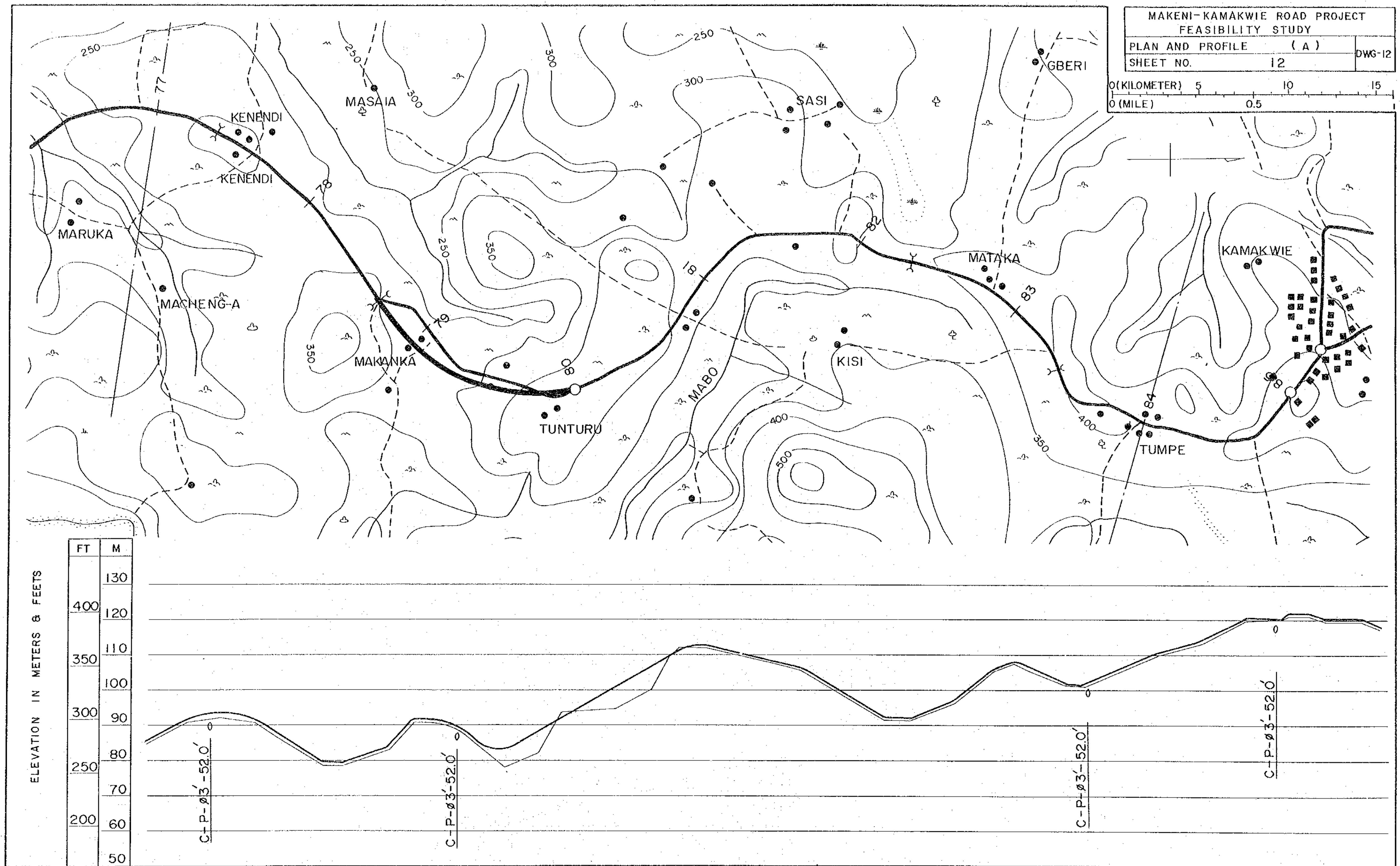
DISTANCE												
MILES			40		41			42			43	
KILOMETERS	63	64		65	66		67		68	69		70

MAKENI–KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE (A)		DWG-11
SHEET NO. 11		



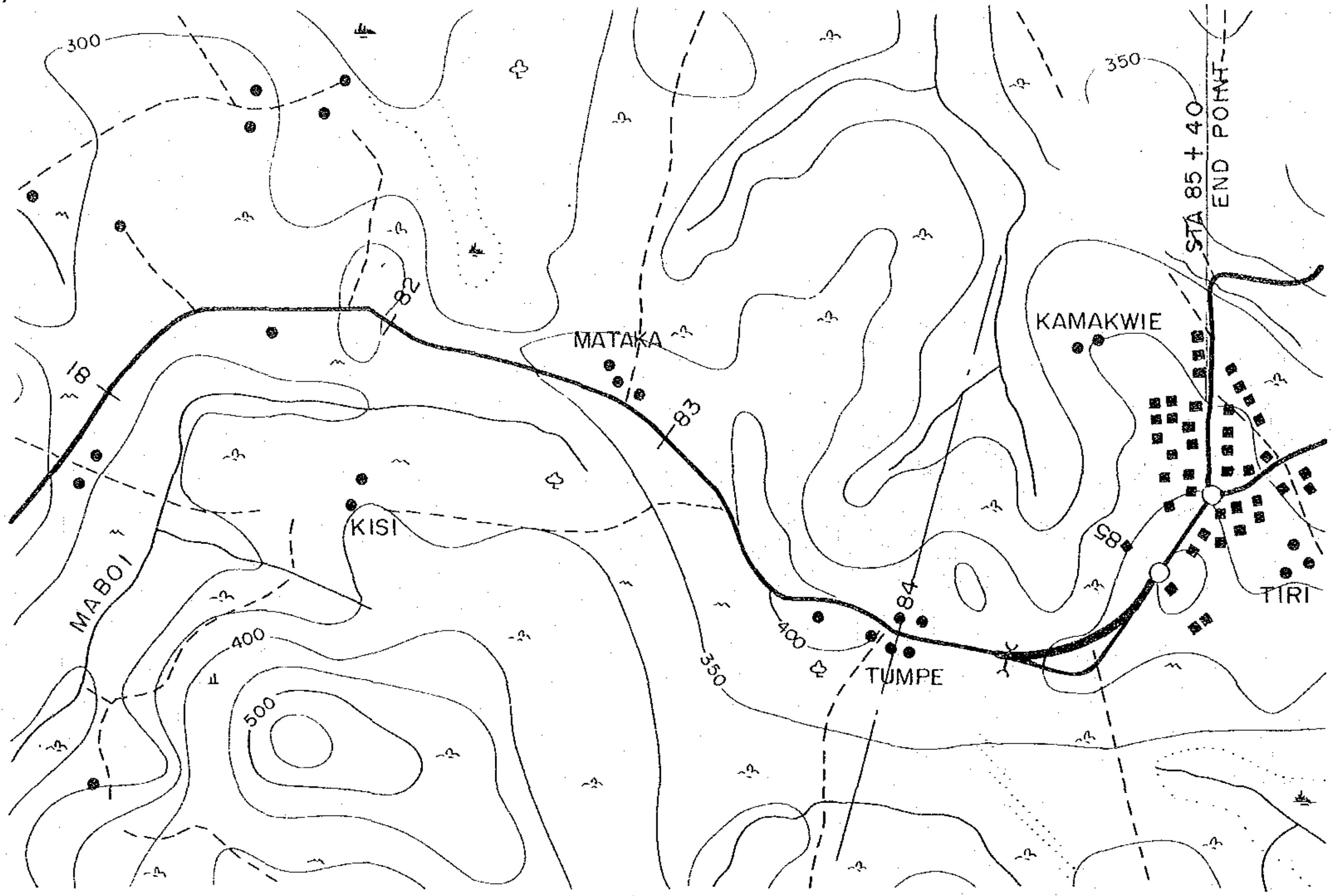
IMPROVEMENT	W	V	H	V	H	V	H	W	
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING						
C B R OF SUBGRADE	C.B.R > 25								
DISTANCE MILES	44	45	46	47					
DISTANCE KILOMETERS	70	71	72	73	74	75	76	77	

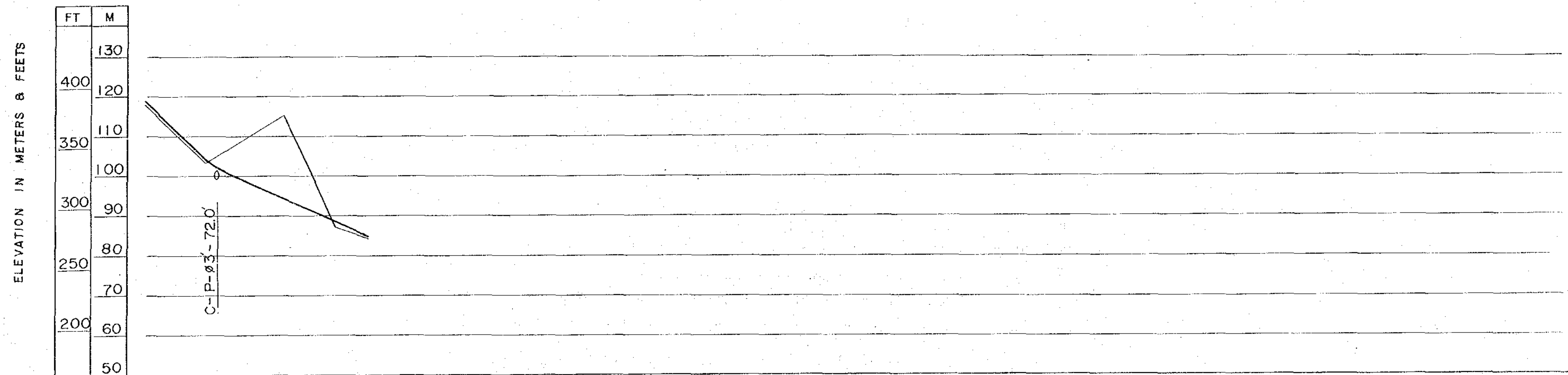


IMPROVEMENT	W	H	W	H	W
ROAD SURFACE KIND	SURFACE DRESSING		SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	
C B R OF SUBGRADE	C.B.R > 25				
DISTANCE MILES	48	49	50	51	52
DISTANCE KILOMETERS	77, 78	79	80, 81	82, 83	84

MAKENI-KAMAKWIE ROAD PROJECT FEASIBILITY STUDY	
PLAN AND PROFILE (A)	DWG-13
SHEET NO. 13	

0(KILOMETER) 5 10 15
0 (MILE) 0.5

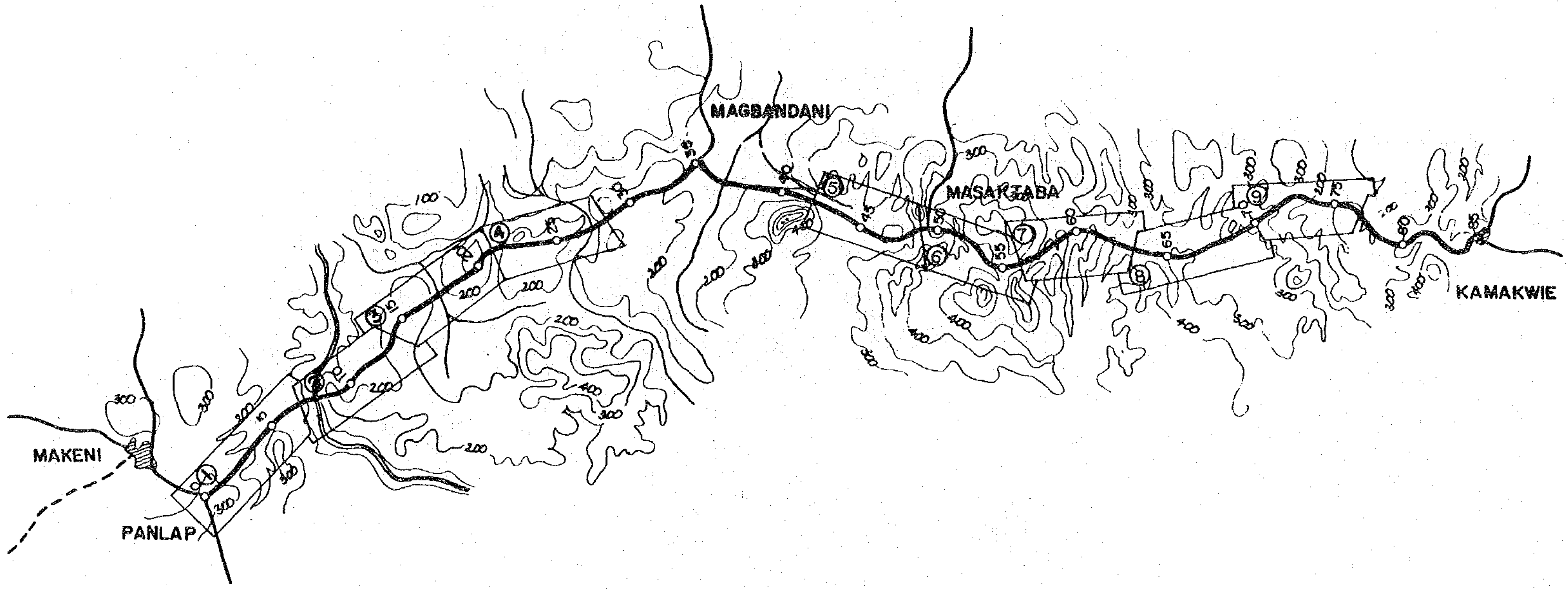




IMPROVEMENT	W	H	W
ROAD SURFACE KIND	SURFACE DRESSING		
C B R OF SUBGRADE	C.B.R > 25		
DISTANCE MILES / KILOMETERS	84	85	

MAKENI - KAMAKWIE ROAD PROJECT FEASIBILITY STUDY	
COVER SHEET (B)	DWG-
SHEET NO.	

APPENDIX S-2 PLAN AND PROFILE OF ALTERNATIVE PLAN B

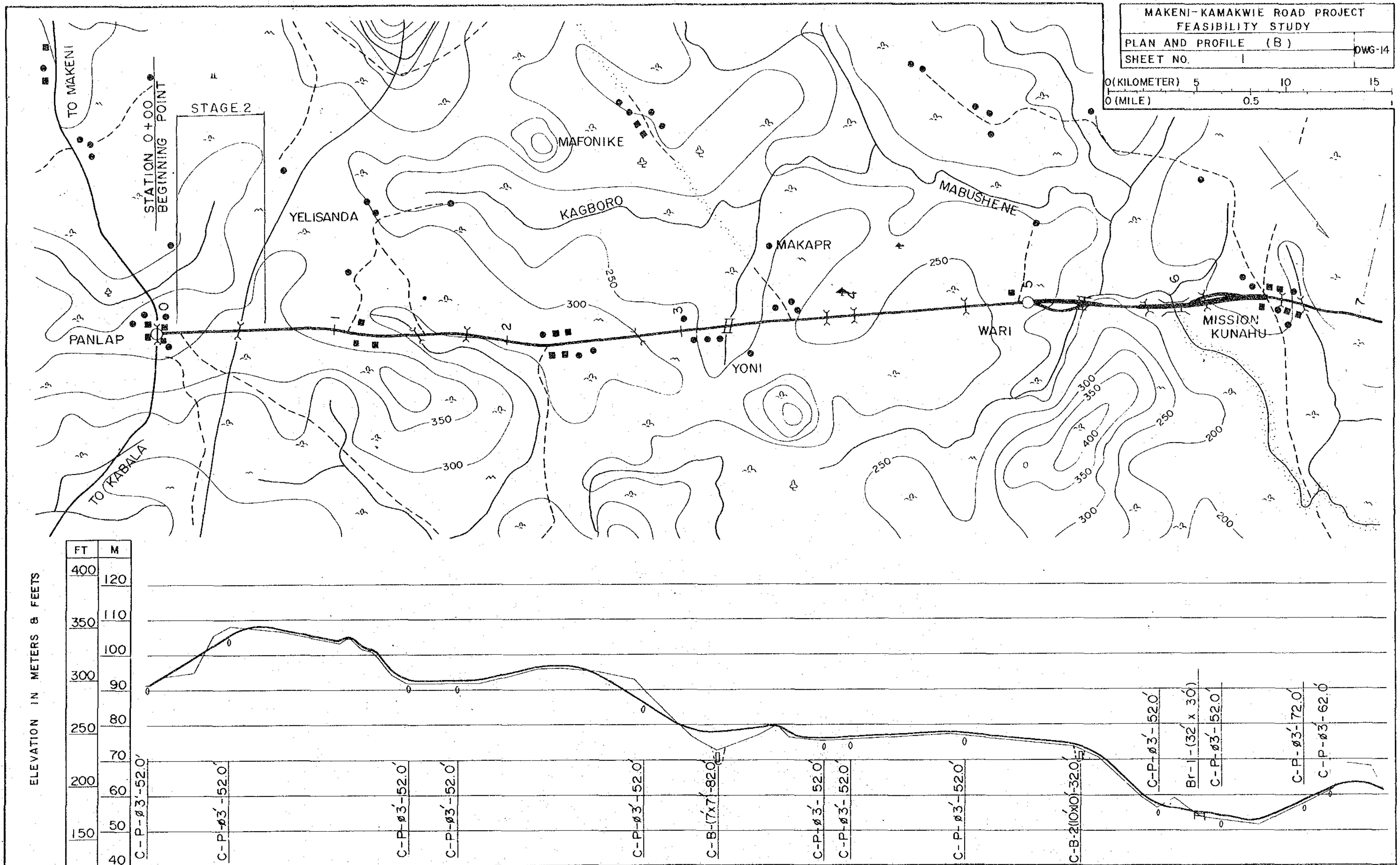


ABBREVIATIONS

H	RE-ALIGNMENT, HORIZONTAL FOR ROAD IMPROVEMENT
V	RE-ALIGNMENT, VERTICAL FOR ROAD IMPROVEMENT
W	WIDENING OF ROAD WIDTH FOR ROAD IMPROVEMENT
C - P - ϕa - ℓ	PROPOSED PIPE CULVERT, ϕa (DIAMETER, FOOT), ℓ (LENGTH,FOOT)
C - B (a x b) - ℓ	PROPOSED BOX CULVERT, a x b (WIDTH x LENGTH ALONG THE ROAD), ℓ (CULVERT LENGTH)
C - B - n(a x b) - ℓ	PROPOSED BOX CULVERT, n (ROW), a x b (WIDTH x LENGTH ALONG THE ROAD), ℓ (CULVERT LENGTH)
Br - n - (a x b)	PROPOSED PRESTRESSED CONCRETE BRIDGE, n (NOS. OF SPAN), a x b (WIDTH x SPAN LENGTH)

MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE (B)	DWG-14
SHEET NO. 1	



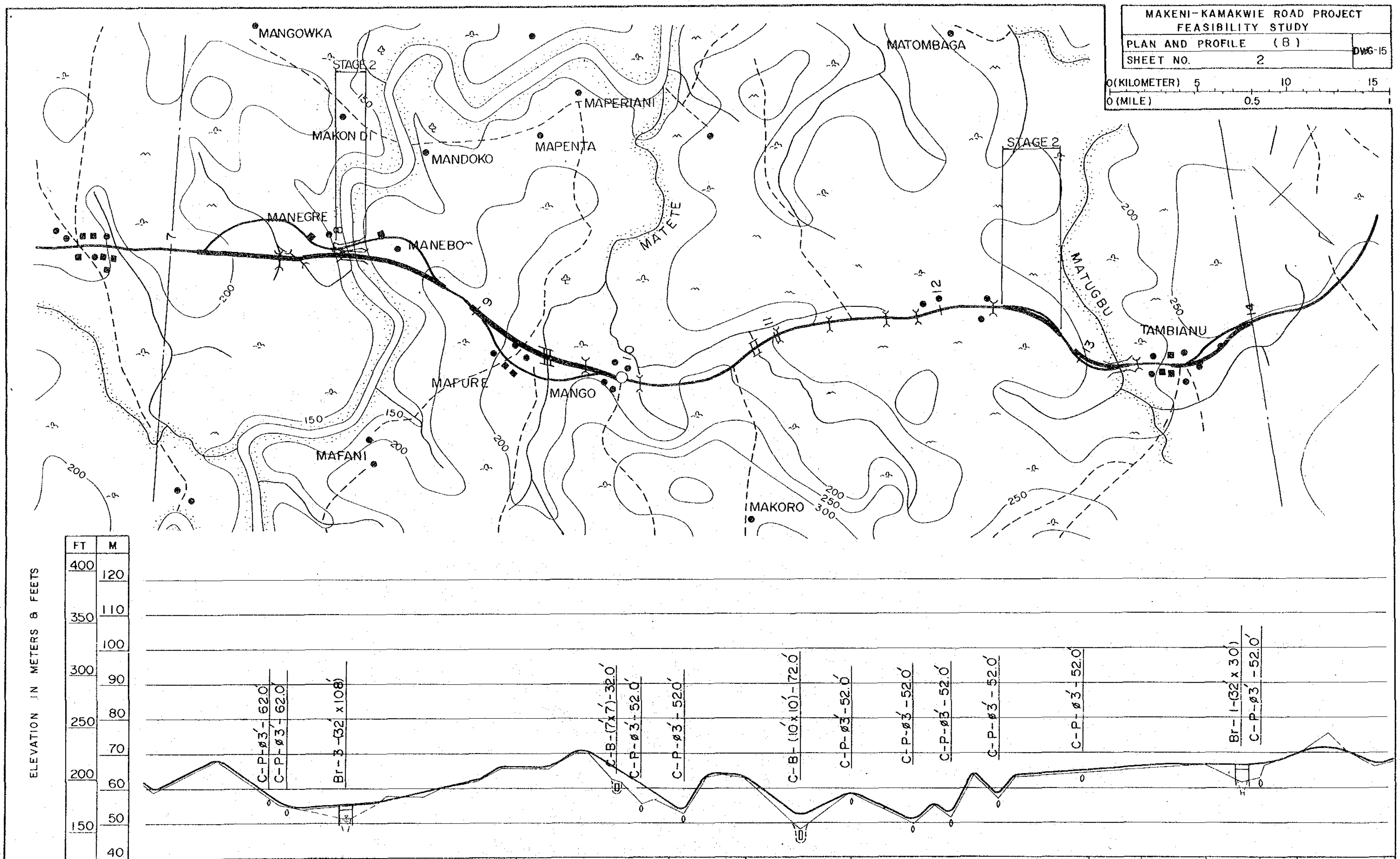
IMPROVEMENT	W	V	W	V	W	H	W	H	V

ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING

C B R OF SUBGRADE	C. B. R > 25
DISTANCE MILES	0, 1, 2, 3, 4
DISTANCE KILOMETERS	0, 1, 2, 3, 4, 5, 6, 7

MAKENI–KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE (8)		DWG-15
SHEET NO.	2	



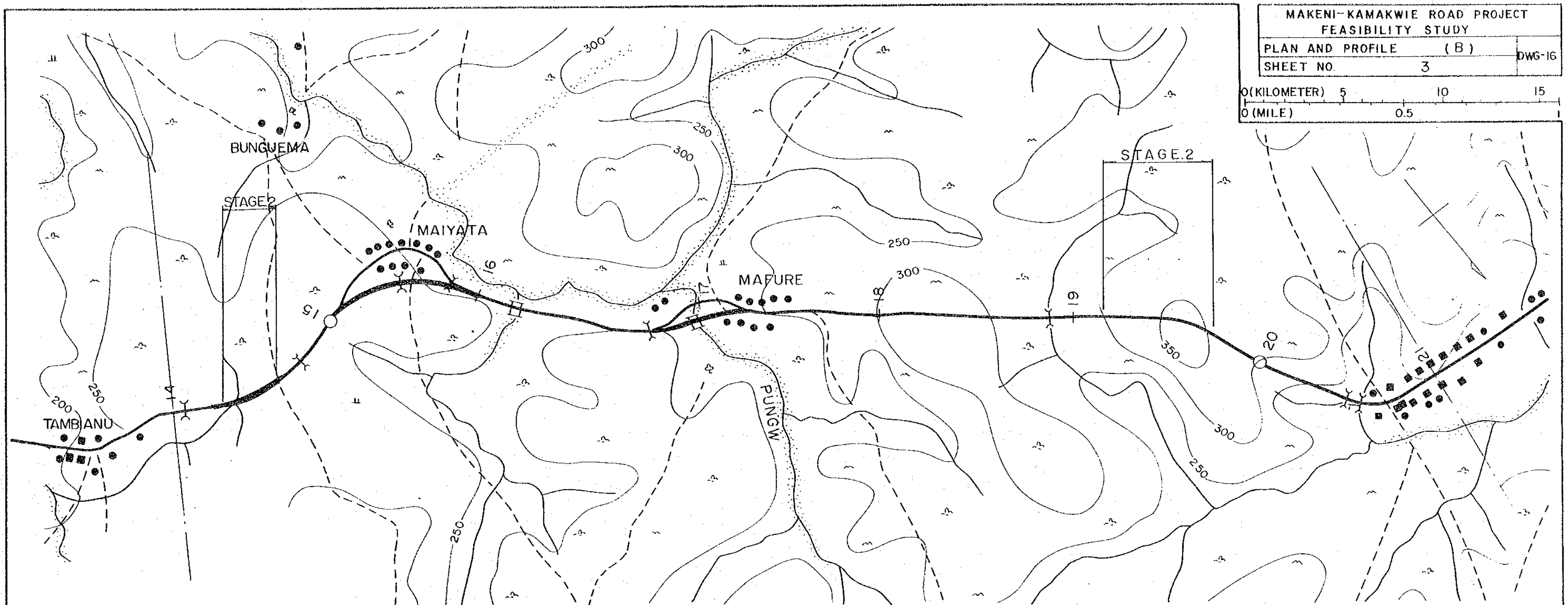
IMPROVEMENT	W	H	W	H	W	V	W	H	W	H	W	H

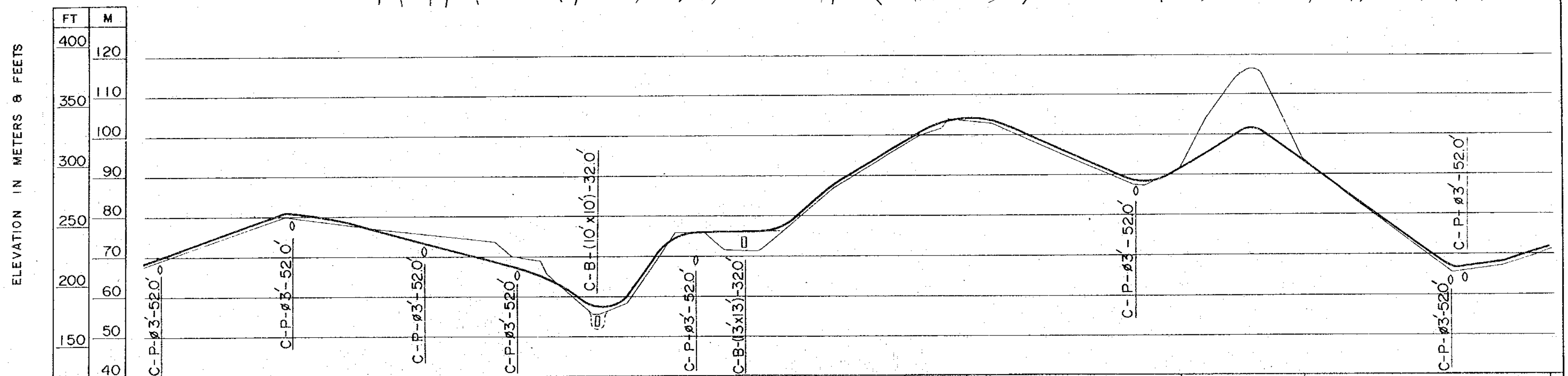
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING
C B R OF SUBGRADE	C.B.R > 25					

DISTANCE									
MILES		5		6		7		8	
KILOMETERS	7	8	9	10	11	12	13	14	

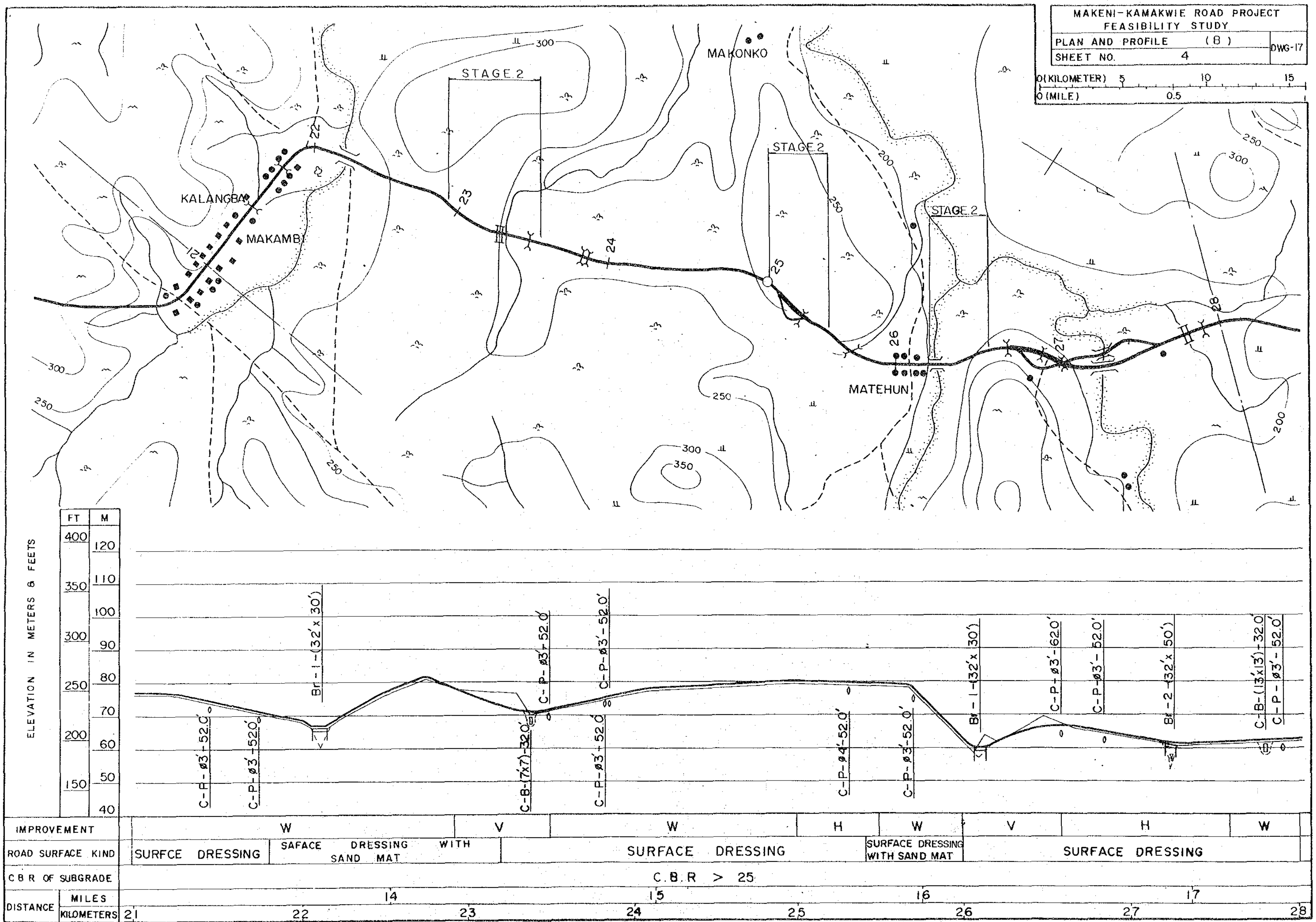
MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

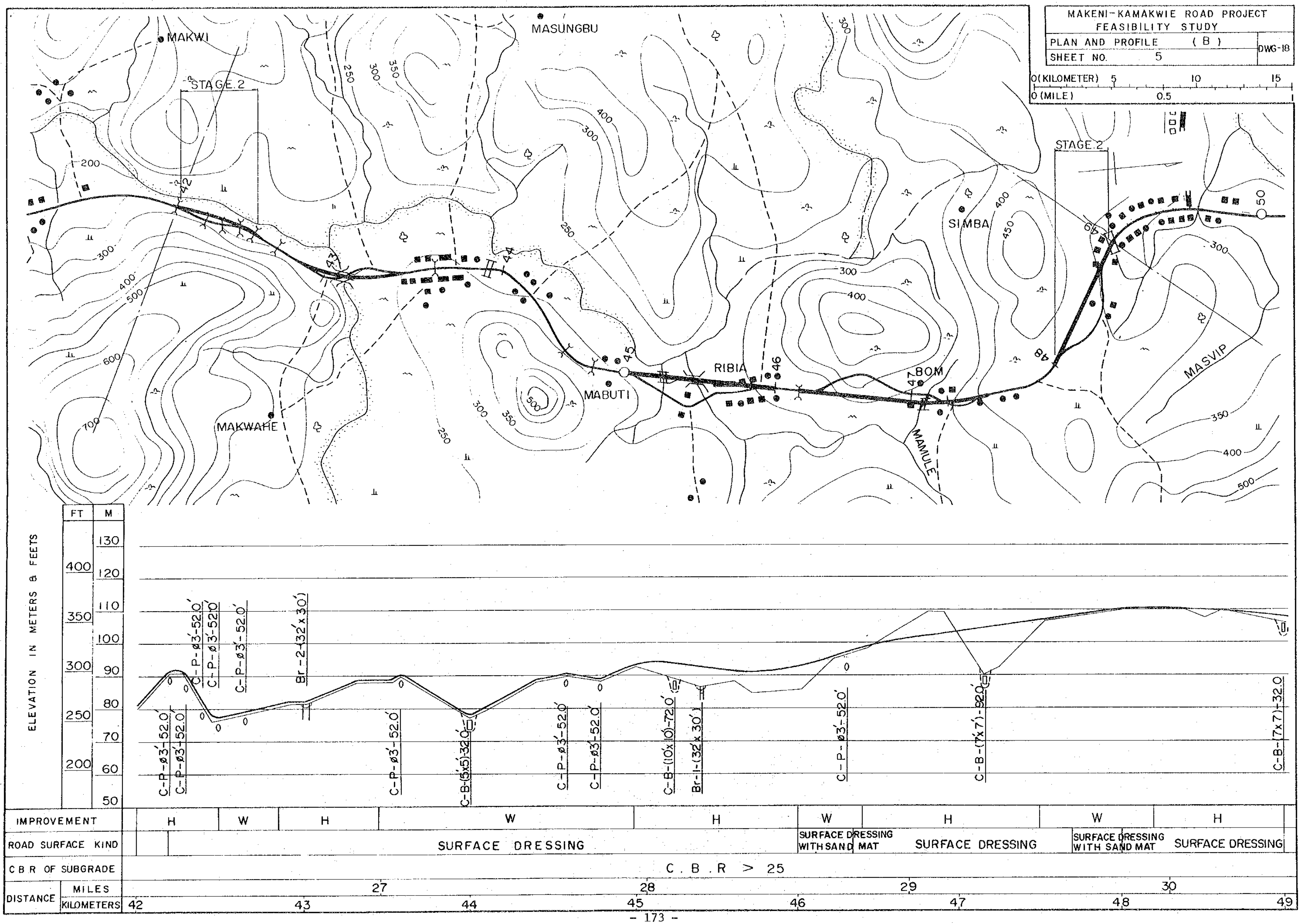
PLAN AND PROFILE	(B)	DWG-16
SHEET NO.	3	



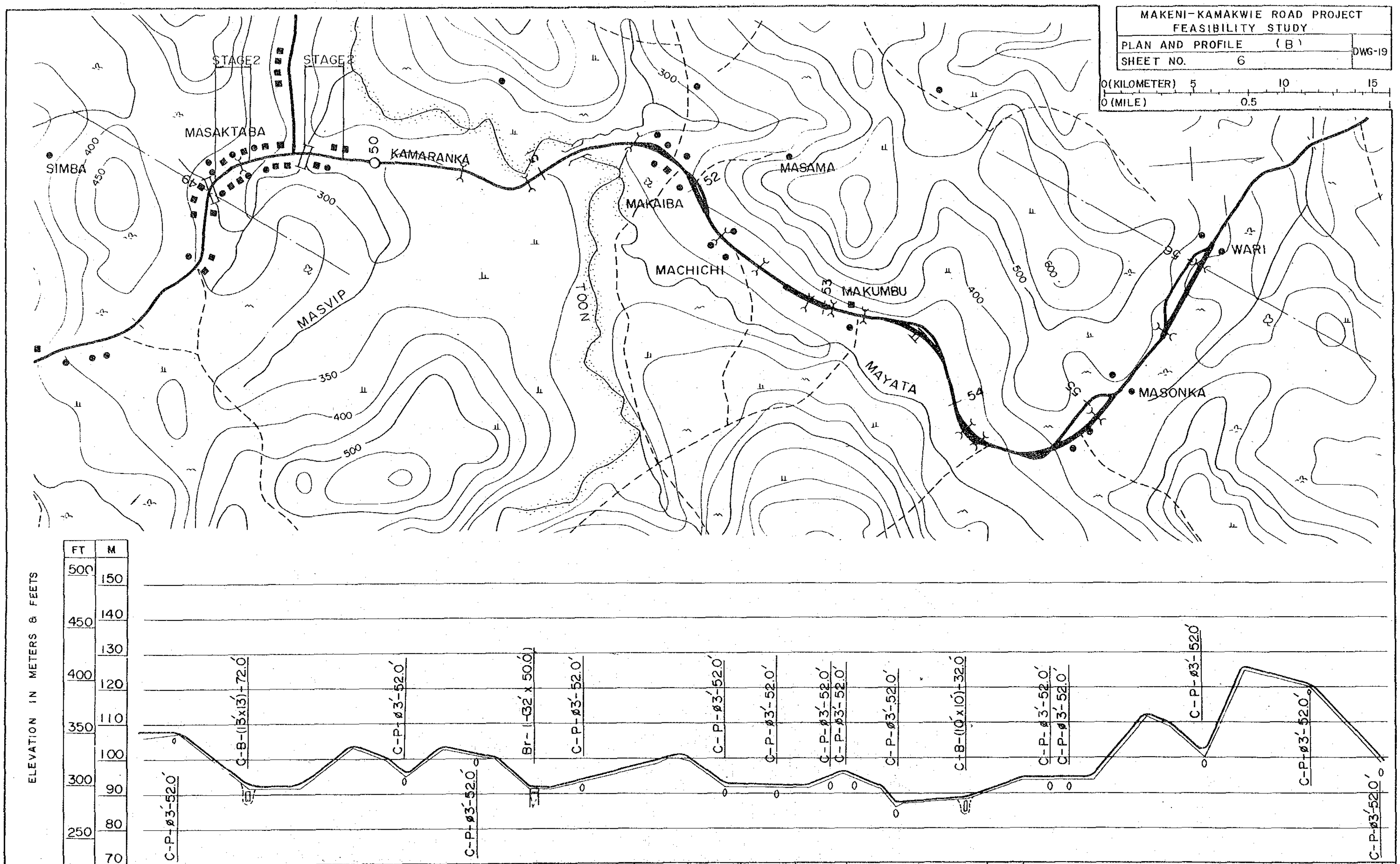


IMPROVEMENT	W	H	W	H	W	H	W	V	W	V	W	
ROAD SURFACE KIND	SURFACE DRESSING			SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING				SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING
C B R OF SUBGRADE	C.B.R > 25											
DISTANCE MILES	9	10	11	12	13							
DISTANCE KILOMETERS	14	15	16	17	18	19	20	21				


MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY
PLAN AND PROFILE (B)
SHEET NO. 4
DWG-17
0 (KILOMETER) 5 10 15
0 (MILE) 0.5
STAGE 2
STAGE 2
STAGE 2
MAKONKO
KALANGBA
MAKAMBI
MATEHUN
300
250
200
350
21
22
23
24
25
26
27
28
ELEVATION IN METERS & FEETS
FT
M
400
350
300
250
200
150
120
110
100
90
80
70
60
50
40
Br - 1 - (32' x 30')
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-B-(7'x7')-32.0'
C-P-ø4'-52.0'
C-P-ø3'-52.0'
Br - 1 -(32' x 30')
C-P-ø3'-62.0'
C-P-ø3'-52.0'
Br - 2 -(32' x 50')
C-B-(13'x13')-32.0'
C-P-ø3'-52.0'
IMPROVEMENT
W
V
W
H
W
V
H
W
ROAD SURFACE KIND
SURFCE DRESSING
SAFACE DRESSING WITH SAND MAT
SURFACE DRESSING
SURFACE DRESSING WITH SAND MAT
SURFACE DRESSING
CBR OF SUBGRADE
C.B.R > 25
DISTANCE
MILES
14
15
16
17
KILOMETERS
21
22
23
24
25
26
27
28



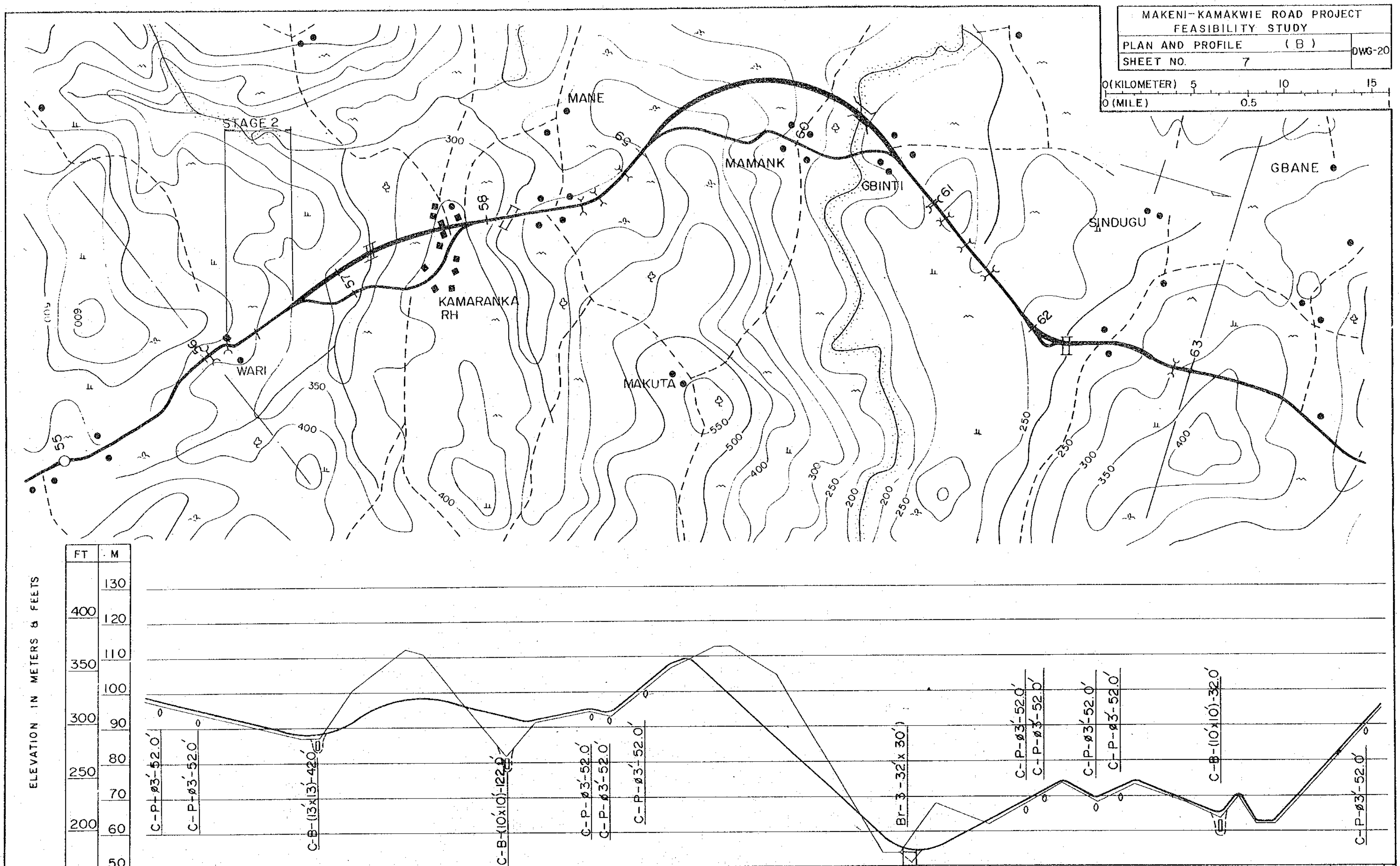
MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY
PLAN AND PROFILE (B)
SHEET NO. 5
DWG-18
0 (KILOMETER) 5 10 15
0 (MILE) 0.5
MAKWI
MASUNGBU
STAGE.2
MAKWAHE
MABUTI
RIBIA
BOM
MAMULE
SIMBA
MASVIP
STAGE.2
ELEVATION IN METERS & FEETS
FT
M
IMPROVEMENT
H
W
H
W
H
W
H
W
H
ROAD SURFACE KIND
SURFACE DRESSING
SURFACE DRESSING WITH SAND MAT
SURFACE DRESSING
SURFACE DRESSING WITH SAND MAT
SURFACE DRESSING
C B R OF SUBGRADE
C.B.R > 25
DISTANCE
MILES
27
28
29
30
KILOMETERS
42
43
44
45
46
47
48
49
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
Br-2-(32'x30')
C-P-ø3'-52.0'
C-B-(5x5)-32.0'
C-P-ø3'-52.0'
C-P-ø3'-52.0'
C-B-(10'x10')-72.0'
Br-1-(32'x30')
C-P-ø3'-52.0'
C-B-(7'x7')-92.0'
C-B-(7'x7')-32.0'



IMPROVEMENT	W	H	W	H	W	H	W	H	W	H	W	H	W	H	W	H
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING											
C B R OF SUBGRADE	C.B.R > 25															
DISTANCE MILES	31	32	33	34												
DISTANCE KILOMETERS	49	50	51	52	53	54	55	56								

MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE	(B)	DWG-20
SHEET NO.	7	



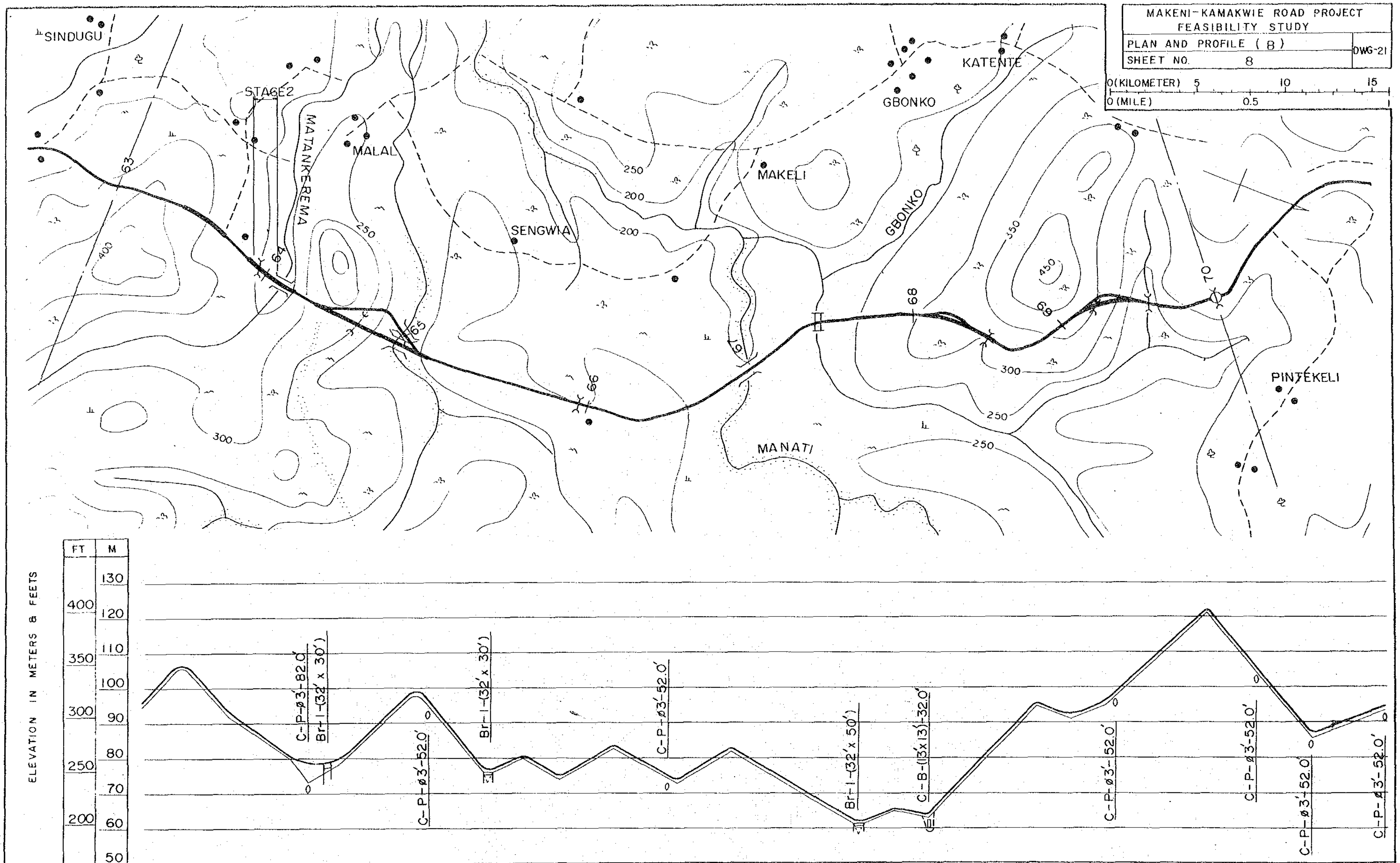
IMPROVEMENT: H | V | H | V | W | H | W | H | W

ROAD SURFACE KIND: SURFACE DRESSING WITH SAND MAT | SURFACE DRESSING | SURFACE DRESSING WITH SAND MAT | SURFACE DRESSING | SURFACE DRESSING WITH SAND MAT | SURFACE DRESSING

C B R OF SUBGRADE: C. B. R > 25

DISTANCE									
MILES		35	36		37	38		39	
KILOMETERS	56	57	58	59	60	61	62		63

MAKENI-KAMAKWIE ROAD PROJECT FEASIBILITY STUDY	
PLAN AND PROFILE (8)	DWG-21
SHEET NO. 8	



IMPROVEMENT	W	H.	W	H	W	H	W	H	W	H	W
ROAD SURFACE KIND	SURFACE DRESSING	SURFACE DRESSING WITH SAND MAT			SURFACE DRESSING		SURFACE DRESSING WITH SAND MAT	SURFACE DRESSING			
C B R OF SUBGRADE	C. B. R > 25										
DISTANCE MILES	40	41	42	43							
DISTANCE KILOMETERS	63	64	65	66	67	68	69	70			

MAKENI-KAMAKWIE ROAD PROJECT
FEASIBILITY STUDY

PLAN AND PROFILE (B) — DWG-22

SHEET NO. 9