4. Construction plan for the implementation of the training on the demonstration forest

4-1 Approaching road

(1) Annual construction plan and its cost

We planned the necessary approaching road to carry out the "Annual plan of the training" in chaper 3.

According to the annual training plan, the training for the skyline yarding is to be carried out at "70" compartment "m" sub-compartment for the 1st year.

But, the training of the tractor is planned at "58 j" as there is no adequate place in "70 m".

For the second year and thereafter, both trainings for the skyline yarding and tractor skidding are planned to be carried out in "58 j" and "58 k".

Considering the above mentioned training plan, we fixed the annual plan of the approaching road.

At the first year, the route from the end of existing road pass through the north edge of "70 m" to "58 d" crossing over the peak, and from there to the center part of "58 j" by the strip road.

As for the plan of the approaching road for the following year, we planned the route from "58 d", passing through the southern edge of "58 j" and go round to the direction of "73" compartment, to the north edge of "58 j".

By this, the annual plan of the approaching road will be completed in two years, and be effectively used in the training plan. (Refer to the location map of the separate sheet)

Annual plan of the approaching road and strip road

Year	Name	(Breadth) Length (m)	Cost (RP)	Labor amount (man-day)	Remarks
1978	Approaching road (A)	(6.0) 846	17,136,883	27,518	Till to "58 d"
	ditto (B)	2,296	47,516,105	76,174	To the center part of "58 j"
	Strip road	1,000	7,400,000	15,533	
	Sub-total	4,142	72,058,988	119,225	
1979	Approaching road	3,000	48,900,000	102,642	To the north edge of "58 j"
	Sub-total				
Total		7,142	120,952,988	221,867	

(2) General aspects of the appointed area

This area is in the region of the skirt of Mt. Willis.

The ranger station is at the side of the Lake Ngebel, and the road is already existing for 5.8 km from here and the terminal of this road is the starting point of the approaching road for this time.

About 20 m long along the planned route of approaching road, is owned by Perum Perhutani, but the farther section of 415 m long passes through the private ground (almost the fields planted with tapioca) and farther depth is the forest zone all belongs to Perhutani.

The land is the hillside slope of about 30 degrees and is rather steep in this district. The soil is the clay and is stiffened, holding seldomly some boulder of graywacke in it.

The amount of rain-fall is said to be more than 3000 mm a year, but the correct amount is unknown as there is no surveying facilities near the place. We probably assume it as more than 4000 mm a year.

Owing to the above mentioned soil, the rain would make erosion to the road surface.

As this area is more than 700 meters high from the sealevel, and major parts of it is occupied with the planted forest of Pinus Merkusii, and seldomly the natural forest or the small scale planted forest of Agathis are seen.

About the planted forest of Pinus Merkusii, the large scale one is seldom, and many of them are planted in small area.

The Pinus Merkusii is cut around the trunk in groove about 1 m high from the ground to get the pine-rosine (Gum-rosine).

The compartment fixed this time as the demonstration forest are 133.2 ha. Among these, the object of the training for the term of 3 years by technical cooperation is 24.3 ha, within this area.

(3) Standard of road construction

No.	Article	Construction standard	Remarks
1	Line	Single line	
2	Breadth	6.0 m	
	Effective breadth	3.0 m	
	Shoulder of road	1.5 m x 2	
3	Side ditch	Triangular section side ditch, digging the ground.	
4	Minimum radius	13 m	
5	Steepest gradient	Ascending: 15 %, descending: 12 %.	
6	Paving of road	Macadam	0.25 m thick.
7	Cut slope	10/4 gradient, banquette: 0.5 m	Banquette is cut every 2 m high.
8	Bank slope	10 - 15 %	
9	Bridges	None	
10	Traversing ditch and culvert	None	
11	Other construction	None	

(A) Widening of road surface

R	Amount of widening	Remarks
13 m	3.1 m	1. Amount of widening is the value at MC. 2. The amount of widening at MC is diminished toward BC and EC or in the adequate distance.
15	2.8	
20	1.9	
25	1.5	
30	1.3	
40	1.0	
50	0.8	
60	0.7	
80	0.5	
100	0.4	
200	0.3	

(B) One-way grade

To the place where the above mentioned widening is done, one- way grade of within 1 : 10 - 1 : 20 of road surface gradient is to be set.

(4) Method of survey

a) Measurement of angle:
To measure the intersection angle, use the transit of one-minute reading.

b) Measurement of distance:
Use the cloth tape measure and read 10 cm order, and the less should be rounded.

c) Setting of the curve:
At the curve, measure and set the pile of BC, MC & EC.

d) Center pile:
At the changing point of the land and within 30 m intervals, set the measuring point piles as the center piles.

e) Longitudinal leveling:
Use the level of the sensibility of within 40 seconds correspond to 2 mm movement of air bubble in the tube, and the rod is read by centimeter and the less is rounded.

f) Cross leveling:
Use the pole, and the unit is meter and decimals, centesimals is rounded.

g) Plane surveying:
For the range, out of the cross leveling, it is shown in sketch with the contour line of 5 m intervals.

h) Construction of roadbed:
As the soil is clayey that we had better make it by cutting the natural ground to construct the road which has an effective breadth for the passing of vehicles.

i) Soil dumping ground:
As we are going to cut and bank by manual operations without using the machines, that the dumping of soil to a remote place is difficult, and surplus soil should be dumped to the brook side near the cut place.

(5) Design drawings and construction process.

a) Location drawing:
Draw the planned road and the extension clearly in the drawing of 1/10,000 scale.

b) Plan view:
Scale is 1/2,000. Draw in it the following items, planned road, IP number, the value of curves, boundary of private area, road, boundary of compartment and sub-compartment, pedestrian road, existing road, field, forest, private house, contour line, direction and legend.

c) Longitudinal section:
Scale is 1/200 for vertical length and 1/2,000 for horizontal length and write in it the following items, station (No.), distance between stations (D), total distance (TD), ground height (GH), cutting height (CH), curve (C), gradient (G), numerical values of the longitudinal section curve.

d) Cross sectional view:

Scale is 1/100. Describe the following items at each station, center line, ground surface line, amount of cutting and tanking height at the center-line, construction standard mask, width of road, side ditch, earth work process, sort of process, volume, cross sectional gradient of the road surface, width and thickness of macadam paving.

e) Ruler drawing:

Scale is 1/50 and describe the following items in it. Width of the construction standard mask, side ditch, gradient of the cutting and tanking, cross sectional gradient of the road surface.

f) Site drawing:

Scale is 1/1,000 and describe the following items in it. Name of the person whose land is to be bought, number of individual persons, survey pile, sort of right on the land, sort of field, area, road.

g) Abbreviated signs:

Name	Abbreviated sign	Name	Abbreviated sign
Intersecting Point	I.P	Bench Mark	B.M
Intersection Angle	I.A	Station	No.
Radius of Curve	R	Ground height	G.H
Curve	C	Construction standard mask	F.H
Tangent Length	T.L		
Secant Length	S.L	Banking Height	B.H
Curve Length	C.L	Cutting Height	C.H
Begining of Curve	B.C	Banking Area	B.A
Middle of Curve	M.C	Cutting Area	C.A
End of Curve	E.C	Scale	S
Gradient	G		

h) Numerial calculations:

The ordinary cutting volume and the tanking volume are calcurated by the mean area of both ends method.

Actually, describe the area of the halved ones at each station, and sum up the area of both ends and multiply the distance between these two ends, and you can get the value.

The calculation of the Macadam area is done as follows. Take the halved value of the width of construction at each station, sum up these values of both ends and multiply the distance between these two ends.

i) Construction process:

1) Construction work survey.
Make a survey of plan, longitudinal and cross section, then check the error of station and measurement.

2) Make a negotiation concerning the private ground where the road is planned to pass through and determine the compensation for damage of farm products and standing trees etc.
Complete the bussiness which has relation to these matters.

3) Give out a contract for the work.

4) Start the construction of cutting and banking work and remove the surplus soil.

5) Carry out the macadam paving at every block when its road construction complete to some extent.

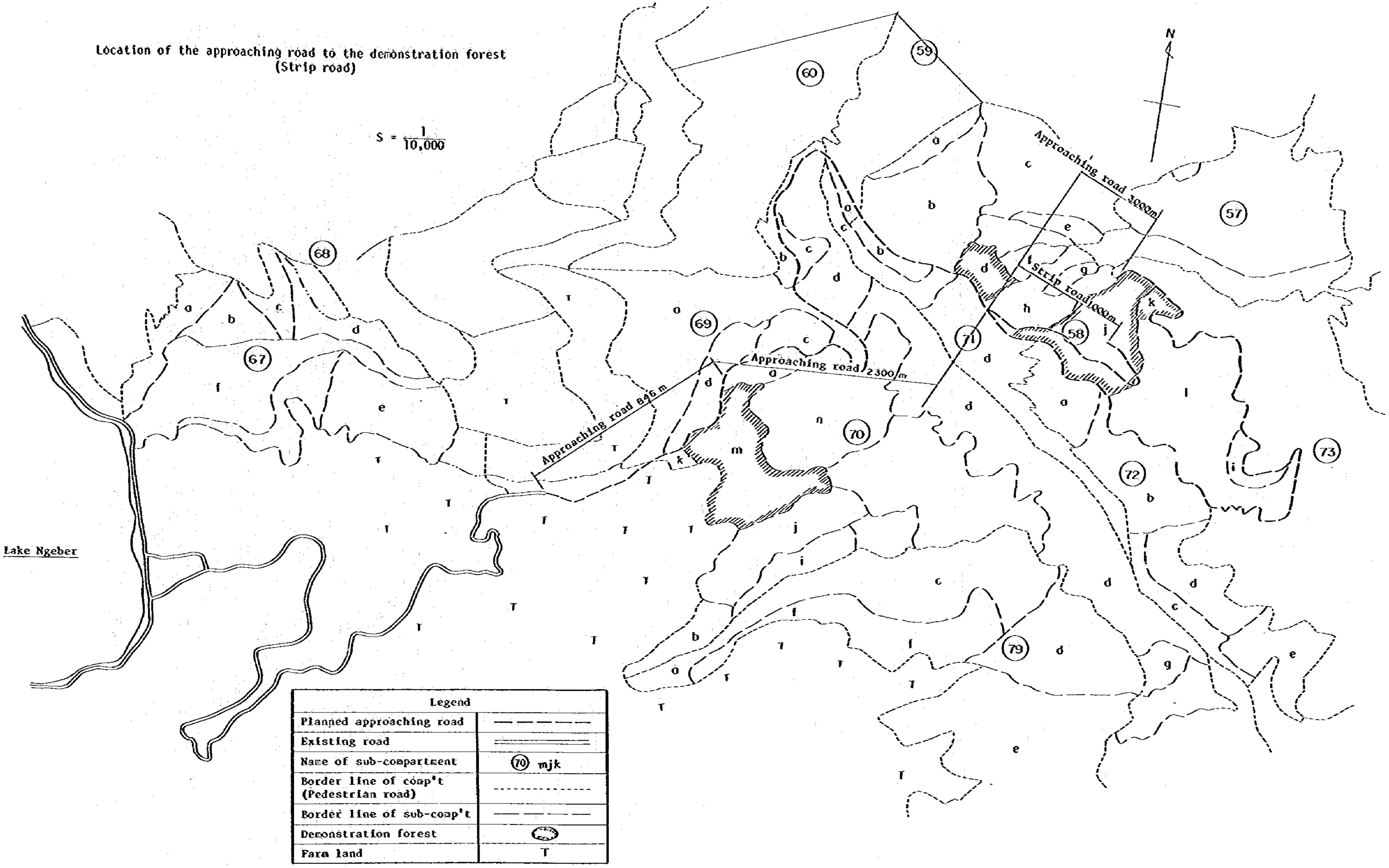
6) Take care of road surface not to be flowed out by the rain water during the construction work.

7) During the cutting and banking works, take care not to cause a damage to farm land or forest land.

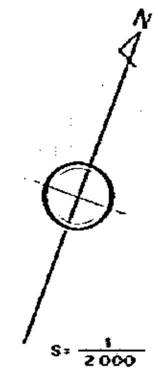
8) Complete the construction work as finishing it one after another from the begining to the end.

9) Inspection of completion:
Inspect a part of local completion, if necessary while the other is under construction.

Location of the approaching road to the demonstration forest
(Strip road)



Plan view (I)



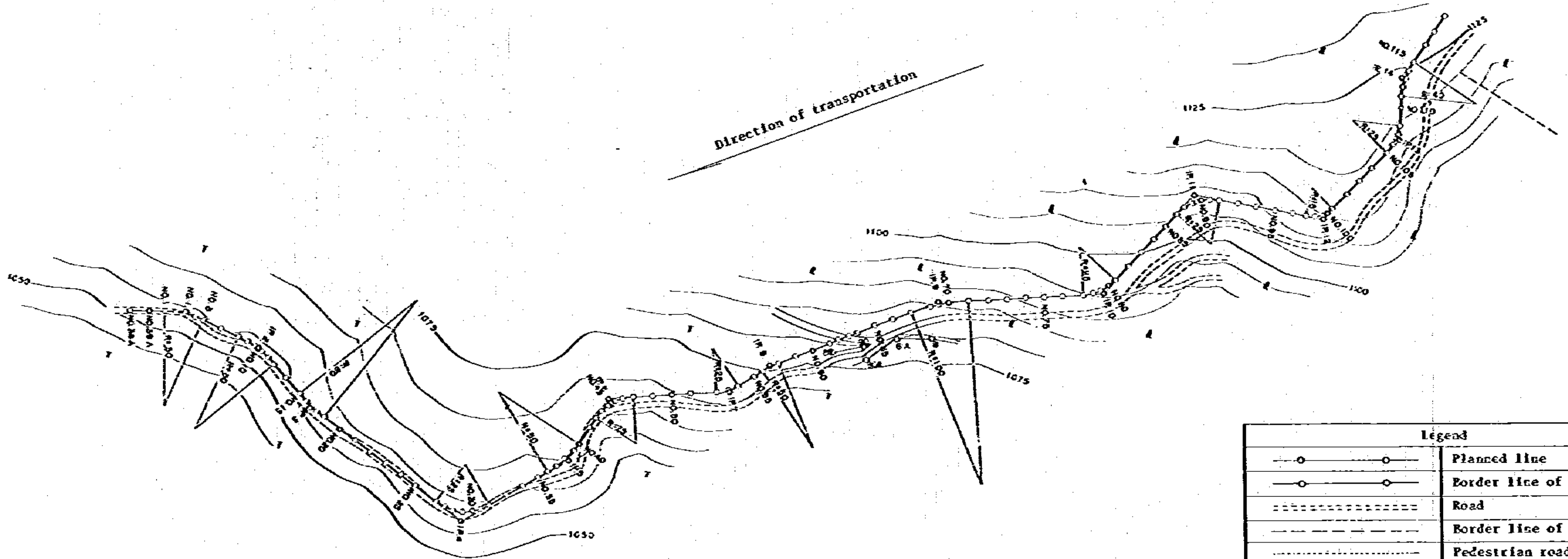
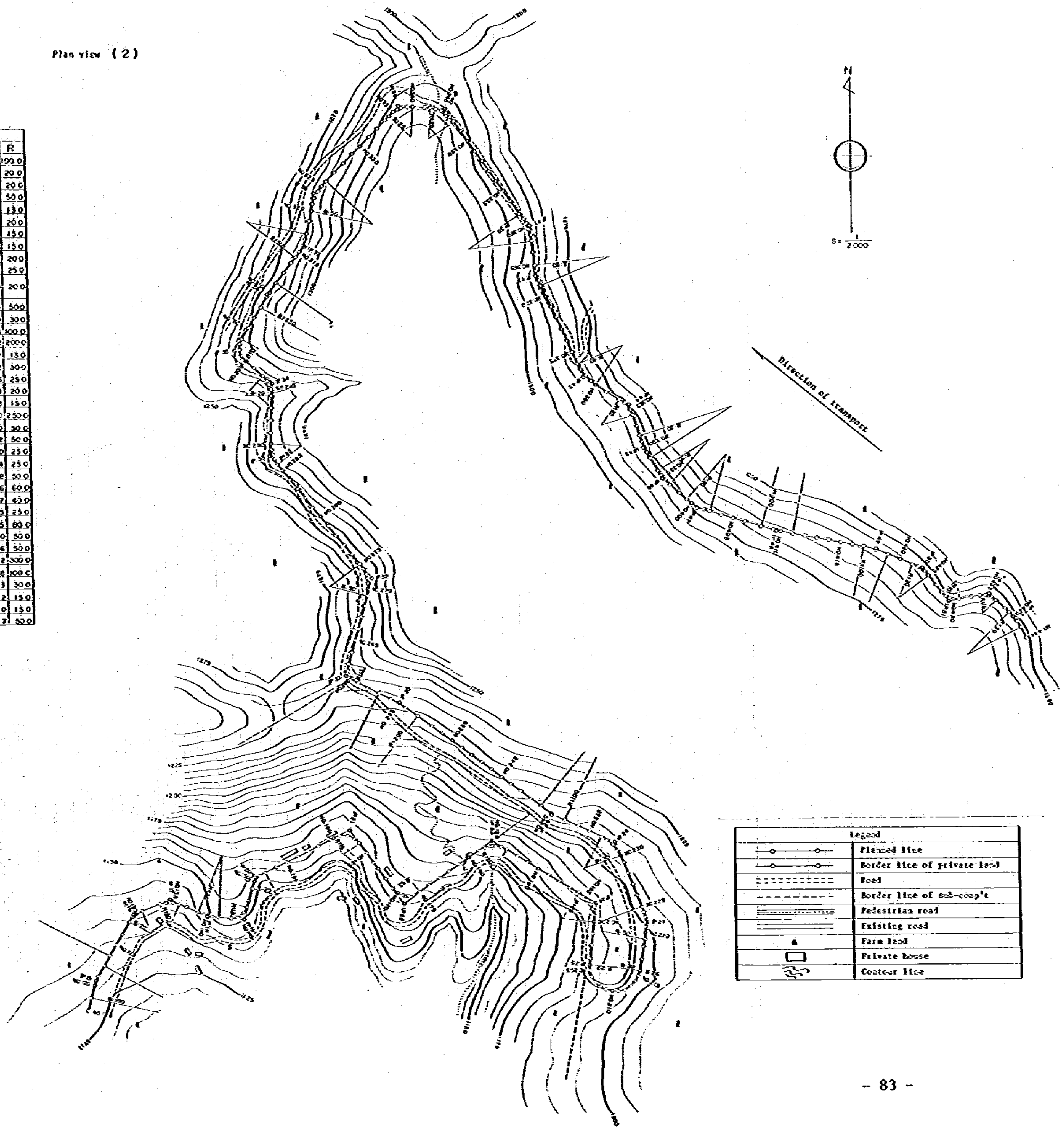


Table of curve						
LP	NO	LA	TL	SL	CL	R
1	3	22 38	10 0	0 99	19.8	50 0
2	10	26 55	12.0	1.41	23 5	50 0
3	17	12 28	8 7	0 48	17.4	80 0
4	29	67 52	16 8	5 13	29 6	25 0
5	38	24 05	10 7	1 13	21 0	50 0
6	45	51 22	12 0	2 74	22.4	25 0
7	53	26 25	5 9	0 68	11 5	25 0
8	57	9 52	4 3	0 19	8 6	50 0
9	69	17 02	15 0	1 12	29 7	100 0
10	79	46 47	10 8	2 24	20 4	25 0
1	89	58 15	13 9	3 62	25 4	25 0
2	99	55 48	7 9	1 97	14 6	15 0
3	107	36 28	8 3	1 33	16 0	25 0
4	113	27 40	9 8	1 19	19 3	40 0

Legend	
—o———o—	Planned line
—o———o—	Border line of private land
=========	Road
— — — —	Border line of sub-comp't
....	Pedestrian road
═════════	Existing road
T	Farm land
ɑ	Forest
≈	Contour line

Plan view (2)

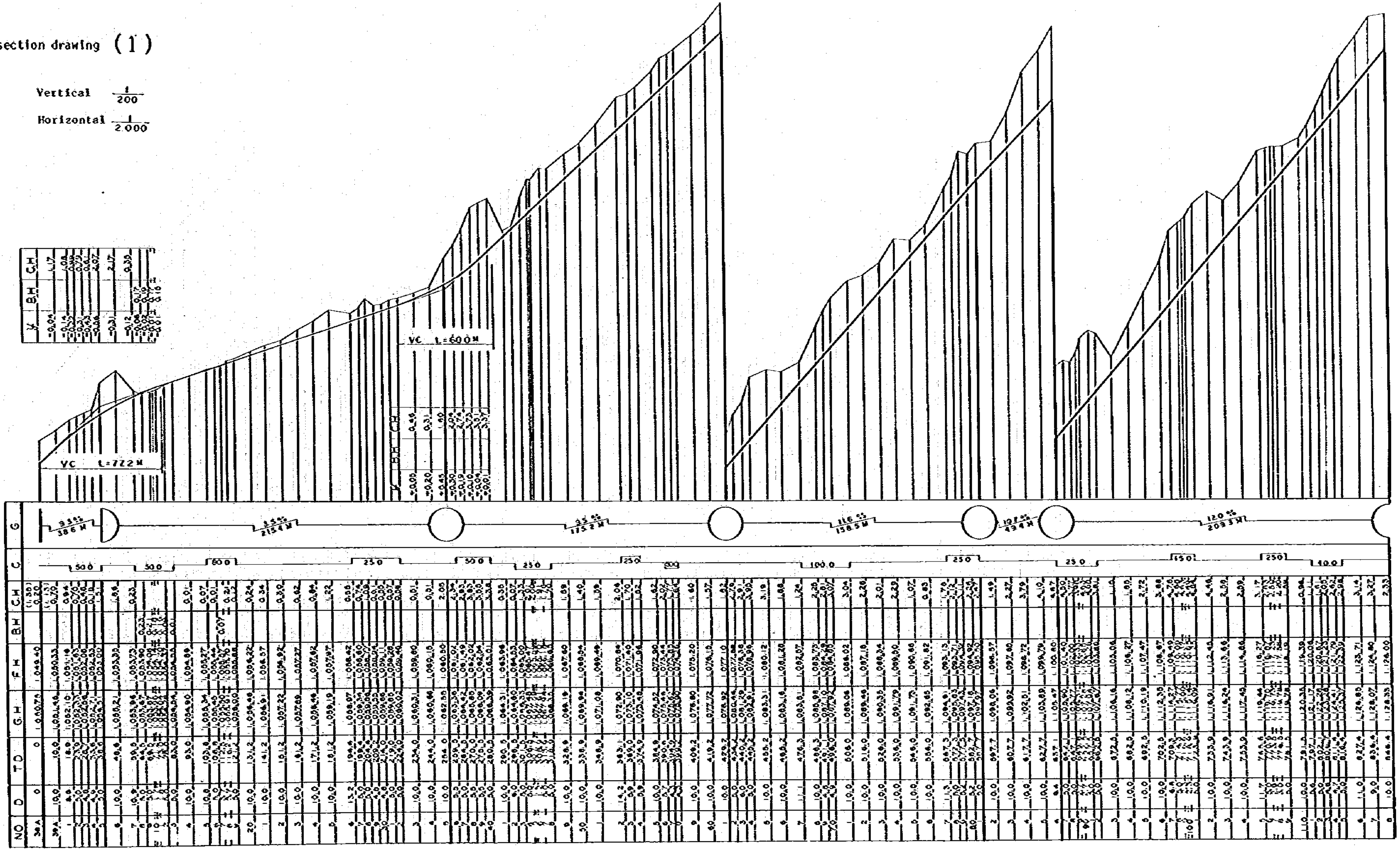
Table of curve						
IP	NO	IA	TL	SL	CL	R
15	121	17 02	15 0	1 12	29 7	100 0
6	129	38 37	7 1	1 21	13 6	20 0
7	134	45 27	8 4	1 68	15 9	20 0
8	140	21 46	9 6	0 92	19 0	50 0
9	145	75 20	10 0	3 42	17 1	13 0
20	151	46 58	8 7	1 81	16 4	20 0
1	162	80 31	12 8	4 70	21 2	15 0
2	172	86 49	14 2	5 62	22 7	15 0
3	184	66 26	13 1	3 91	23 2	20 0
4	197	65 59	16 2	4 61	28 8	25 0
5 6	210	171 43			60 0	20 0
7	222	30 08	13 5	1 78	26 3	50 0
8	232	42 00	11 5	2 13	22 0	30 0
9	239	13 24	11 7	0 69	23 4	100 0
30	255	8 56	15 6	0 61	31 2	200 0
1	261	75 43	10 1	3 43	17 2	13 0
2	272	53 50	15 2	3 65	28 2	30 0
3	288	42 37	9 8	1 63	18 6	25 0
4	296	48 24	8 0	1 93	16 9	20 0
5	302	87 03	14 2	5 69	22 8	15 0
6	309	5 30	12 0	0 29	24 0	250 0
7	316	24 03	10 7	1 12	21 0	50 0
8	323	30 01	13 4	1 77	26 2	50 0
9	337	52 41	12 4	2 69	23 0	25 0
40	345	52 35	12 4	2 91	23 1	25 0
1	360	28 24	12 7	1 56	24 8	50 0
2	367	18 43	9 9	0 81	19 6	60 0
3	378	31 04	11 1	1 52	21 7	40 0
4	384	37 43	8 6	1 42	16 5	25 0
5	390	12 32	8 8	0 43	17 5	80 0
6	395	16 02	7 0	0 43	14 0	50 0
7	401	25 53	11 5	1 30	22 6	50 0
8	409	5 00	13 1	0 29	29 2	300 0
9	418	12 29	10 9	0 59	21 8	100 0
50	423	29 10	7 8	1 00	15 3	30 0
1	429	61 51	9 0	2 43	16 2	15 0
2	435	57 16	8 2	2 09	15 0	15 0
3	441	17 59	7 9	0 62	15 7	50 0



Longitudinal section drawing (1)

Vertical $\frac{1}{200}$

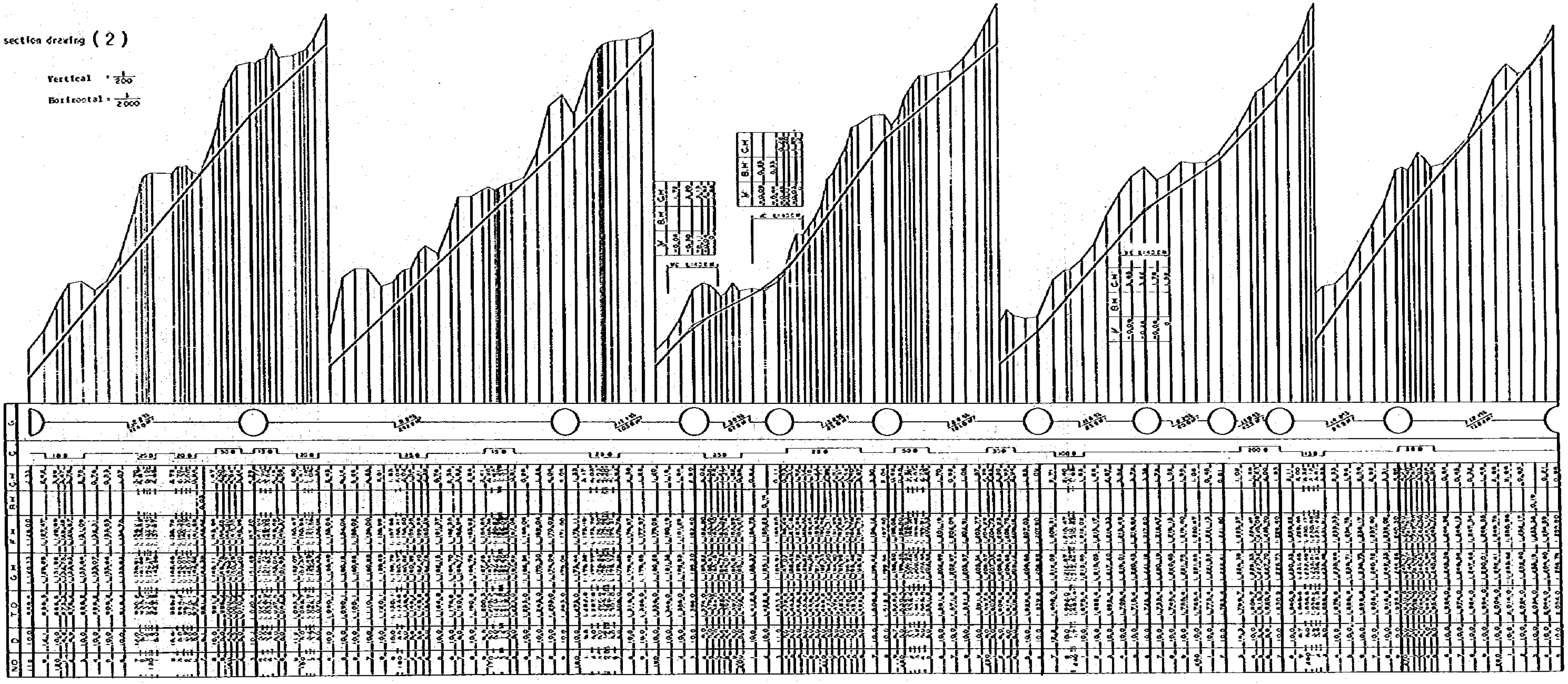
Horizontal $\frac{1}{2000}$



Longitudinal section drawing (2)

Vertical = 1/200

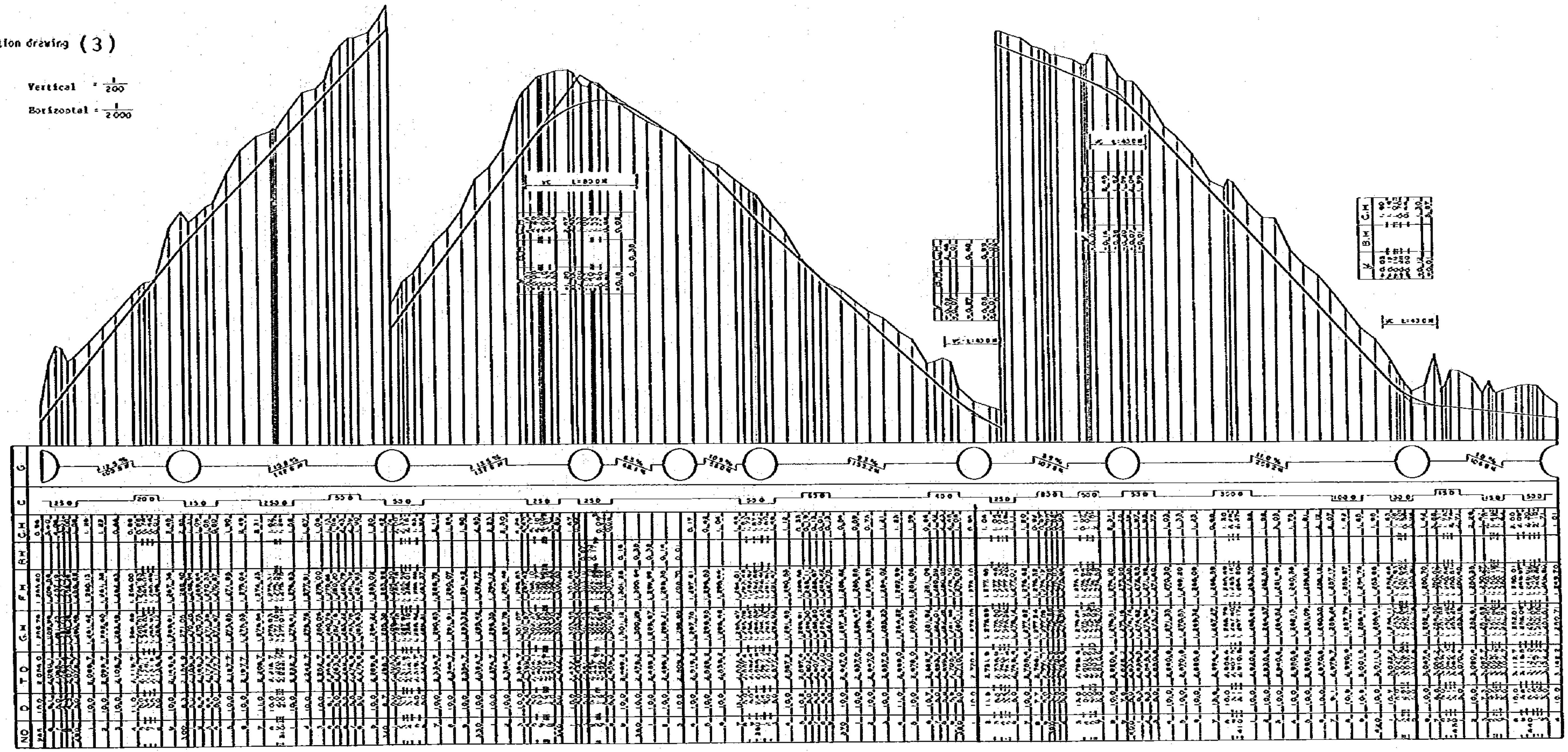
Horizontal = 1/2000



Longitudinal section drawing (3)

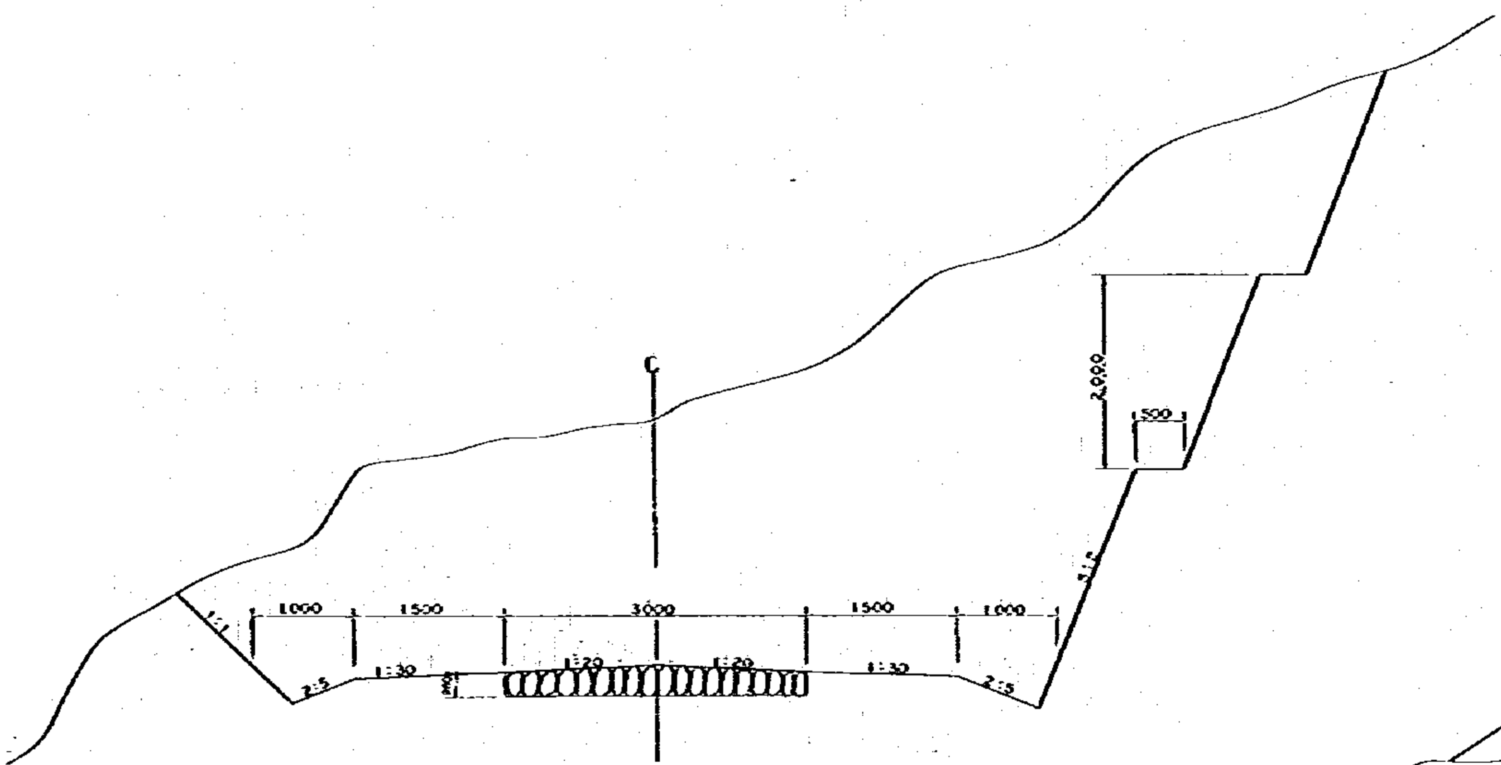
Vertical = 1/200

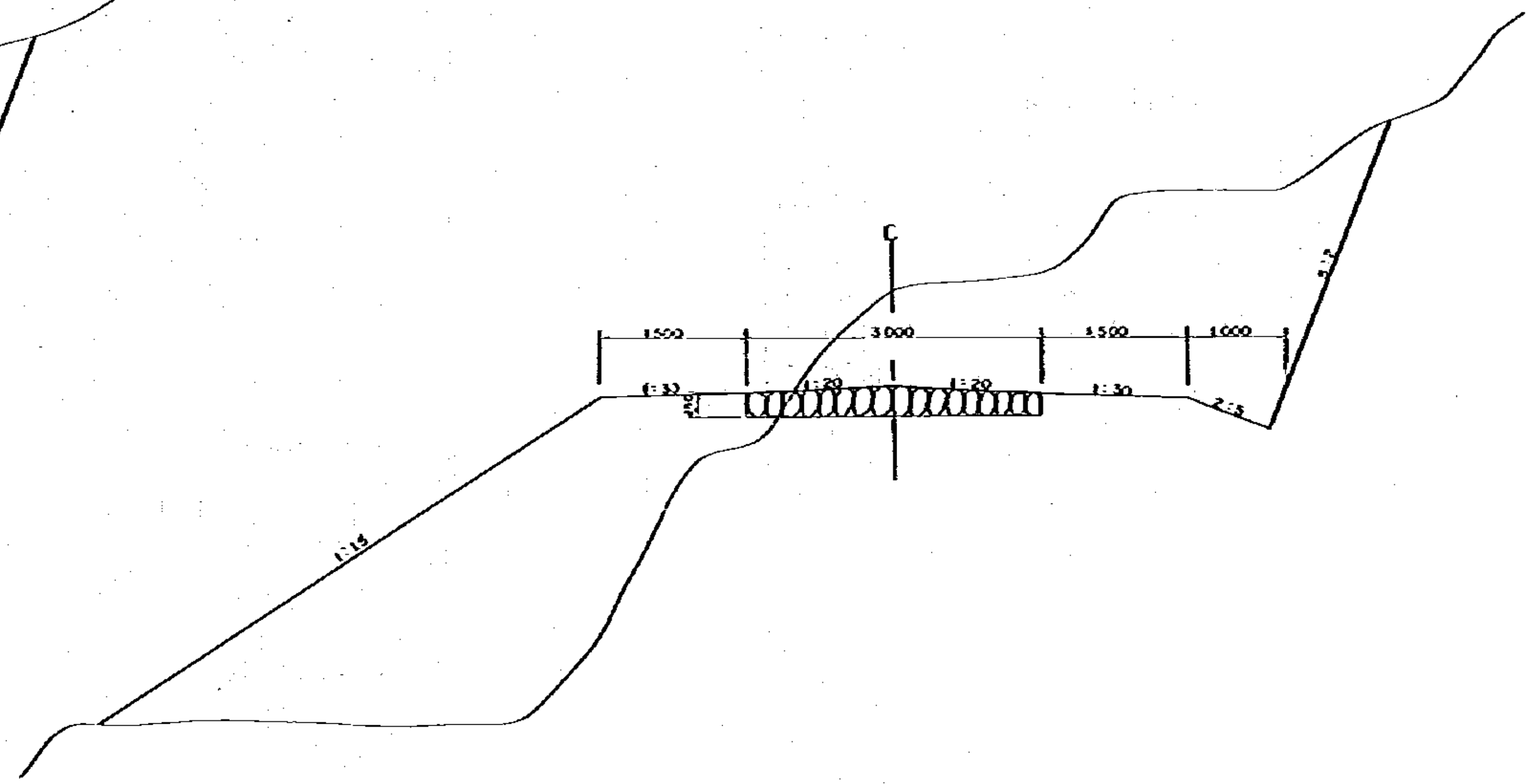
Horizontal = 1/2000

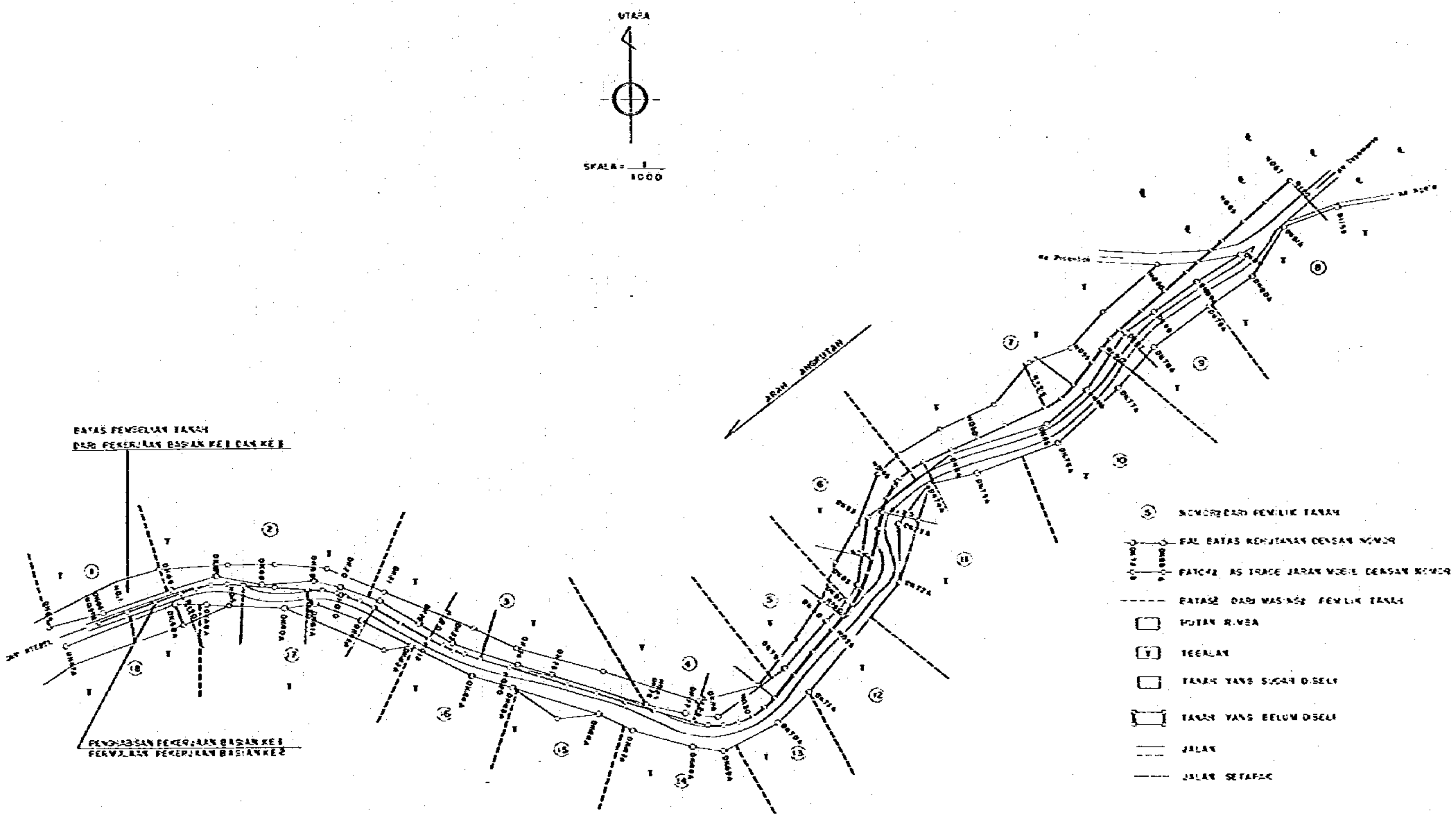


Ruler drawings of earth work

$S = \frac{1}{50}$







DAERAH TINGKAT I JAWA - TIMUR

KERESIDENAN : MADIUN			KABUPATEN : PONOROGO				
DISTRIK : PULUNG			KECAMATAN : NGEBEL				
DESA GONDOWIDO			DUKUHAN NGELO				
NO URUT	NAMA - NAMA PEMILIK TANAH	LETAKNYA DI PATOK No	HAK APA	RUPA TANAH	PERP No	LUAS DALAM M	
						[illegible]	[illegible]
1	SARNI	34ᴬ½ 39ᴬ/1M	TANAH MILK	TEGALAN		75+234	
2	JAHMOEN	39ᴬ/A½ 12/13P	WARISAN	TEGALAN			36250
3	SOEMODIAN	12/13P½ 24/25	WARISAN	TEGALAN			51950
4	SAIMOEN	24/25½ 32P/33	WARISAN	TEGALAN			20250
5	SOMINANGOEN	32P/33½ 37	WARISAN	TEGALAN			16000
6	KODJAN(SARNI)	32½ 46/47	TANAH YASAN	TEGALAN			33000
7	SOMINANGOEN	46/47½ 62[illegible]	WARISAN	TEGALAN			151900
8	PARDI	[illegible] 61	WARISAN	TEGALAN			
9	CENTOENG	61½ 56M	WARISAN	TEGALAN			
10	MBOK DONOSOEMITO	56M½ 51	TANAH YASAN	TEGALAN			
11	PARDI	51½ 37	TANAH MILIK	TEGALAN			8250
12	PAK SOLIKIN	37½ 33	TANAH YASAN	TEGALAN			
13	PARTO - PARNI ASAL - KAMIDJAN	33½ 28	TANAH MILIK	TEGALAN			
14	PARI - PARNI	28½ 24/25	WARISAN	TEGALAN			
15	SARAGNO	24/25½ 20/21	WARISAN	TEGALAN			7250
16	SAKIRAN	20/21½ 14/15M	WARISAN	TEGALAN			
17	SALAMET(DJAMAL)	14/15½ 2	TANAH MILIK	TEGALAN			18350
18	SARIMAN	30A/31A½ 2	TANAH MILIK	TEGALAN		23250	3900
					JUMLAH	54150	326850

.... TANGGAL .... BULAN .... TAHUN ....

DIBUAT OLEH ....

KOMISI

1 ....

2 ....

3 ....

Construction of the approaching road to the training forest.

Total length : 846 m   Width : 6.0 m

Details of construction cost : Finally 9,710,000 Yen

Yen rate:

Total of the currency on the spot

$$17,136,883\ RP \times \frac{1\$\ 234\ Yen}{1\$\ 413\ RP} = 9,709,517\ Yen$$

Article	Quantity	Unit	Unit price	Price	Remarks
Cutting	24754	m^3	520	12872080	Cutting soil is mud and stone.
Banking	873	m^3	260	226980	
Macadam paving	2907	m^2	1389	4037823	
Total				17136883	RP

Construction of the approaching road to the training forest.

Total length : 2296 m   Width : 6.0 m

Details of construction cost : Finally 26,922,000 Yen

Yen rate:

Total of the currency on the spot

$$47,516,105\ RP \times \frac{1\$\ 234\ Yen}{1\$\ 413\ RP} = 26,921,955\ Yen$$

Article	Quntity	Unit	Unit price	Price	Remarks
Cutting	68589	m^3	520	35666280	Cutting soil is mud and stone.
Banking	2170	m^3	260	564200	
Macadam paving	8125	m^2	1389	11285625	
Total				47516105	RP

4-2 Design of structure

About the structure, there is no need for it at present. However, we show you the example design of structures which might be essential in future.

These are as follows :

(1) Protection work of side ditch

There is a trouble of flow out the ditch's part during a long period by rain water.

It is better to protect the ditch with round stones or macadams as shown in Fig 4-1.

(2) Road crossing ditch (Traverse ditch)

It is effective to protect the ditch by (1) above mentioned, however, it is essential to drain the water in short distance from the road line.

For this purpose, crossing ditch is more effective one as shown in Fig 4-2 or Fig 4-3.

In constructing the road crossing ditch, take care of following items.

(a) The location of crossing ditch should be straight or incurve part of road line and it is better to make a slight slope from entrance to outlet for easy drainage.

When the road line is straight without cant and the direction of cross ditch makes right angle to the road line, then ditch line becomes horizontal and it shows wrong drainage.

(b) The slope or forest land is apt to subject the drain damage at the outlet point of cross ditch and near here.

Then it is important to reduce the drain speed by spreading the drain water in wide range with gabion and others.

Fig 4-1 Protection work of side ditch (Cross section drawing)

S = 1/50

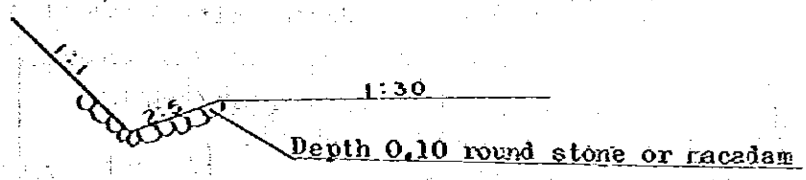
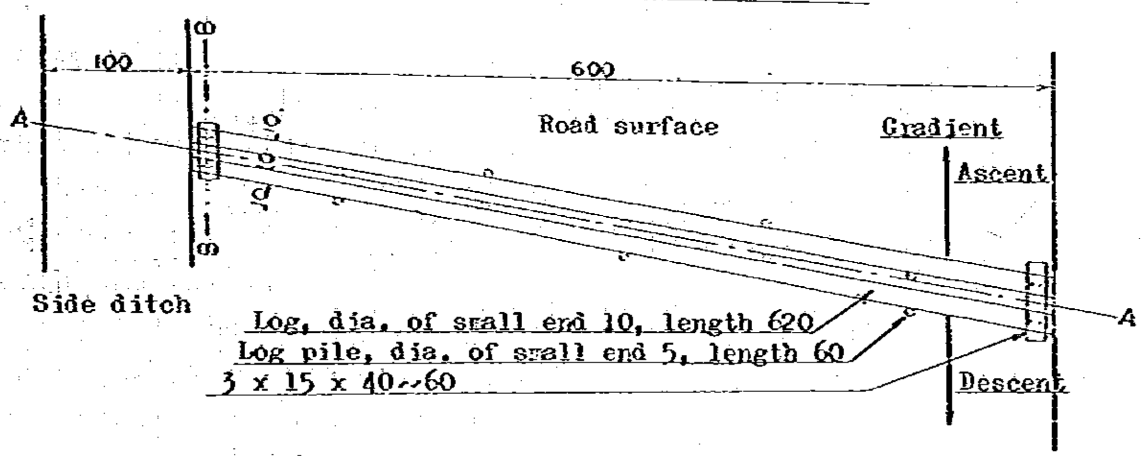


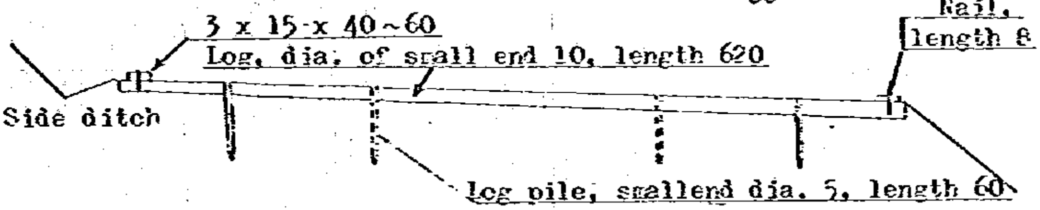
Fig 4-2 Ttaverce ditch (Wooden construction)

S = 1/50

Plan view Scale unit: cm



A-A Cross section S = 1/50



B-B Cross section S = 1/10

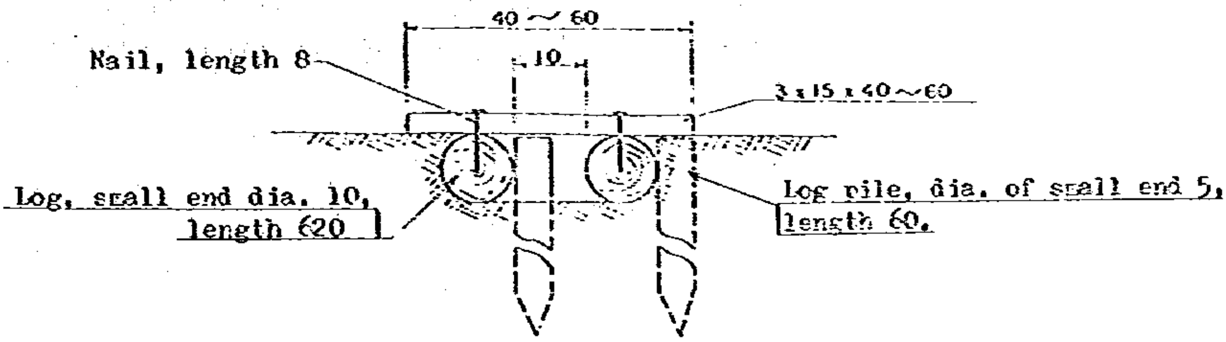
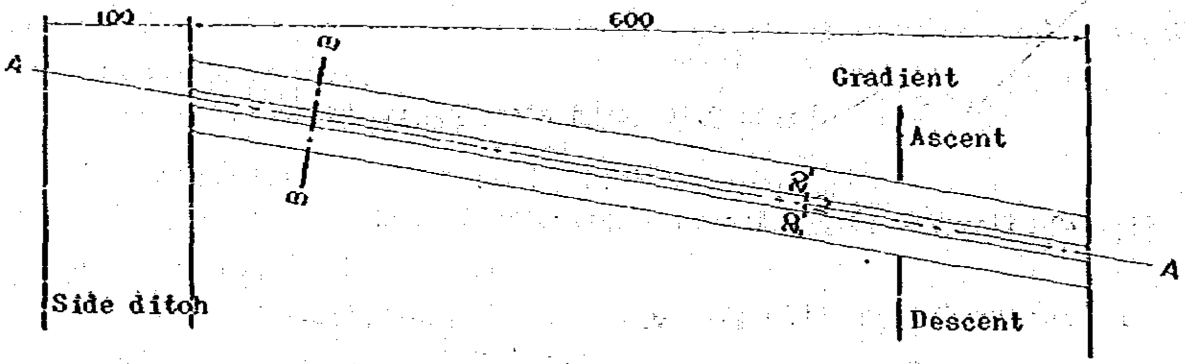


Fig 4-3 Traverce ditch (concrete)

Plan view

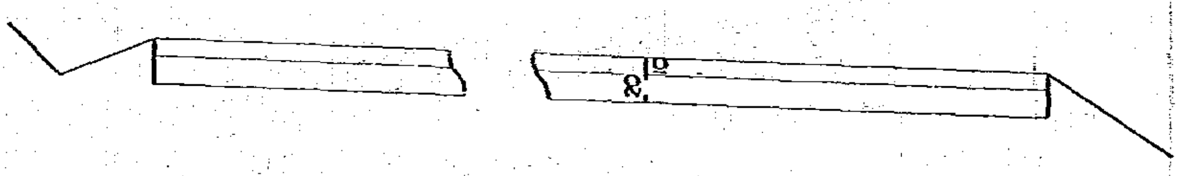
S: 1/50

Scale unit- - cm



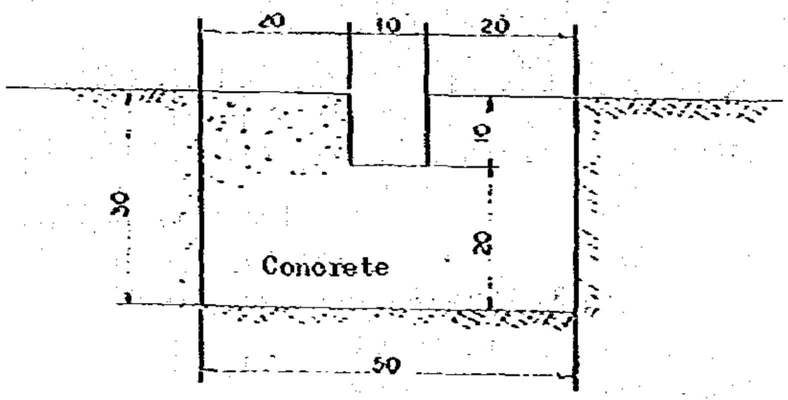
A - A Section

S: 1/50



B - B Section

S: 1/10



(c) Cross ditch should not be constructed at the place of outcurve road line.

(d) It is important to make the space between cross ditches shorter than usually when the slope of road is steep.

Example of cross ditch construction standard.

Slope	Space length of ditch
~5 %	100 m
~8 %	70 m
8 % ~	50 m

(3) Bridge

It is better to construct the bridge at a site of narrow width and has solid base rock on both banks of the river.

When we cannot get a suitable site, we are obliged to construct the bridge at a site where the road line pass through the river.

Fig 4-4 shows the example of wooden bridge which has 3-6 m span. The base of bridge is gravity type and constructed with concrete without reinforcement.

Clearance under the beam is more than 1.0 m from H.W.L.

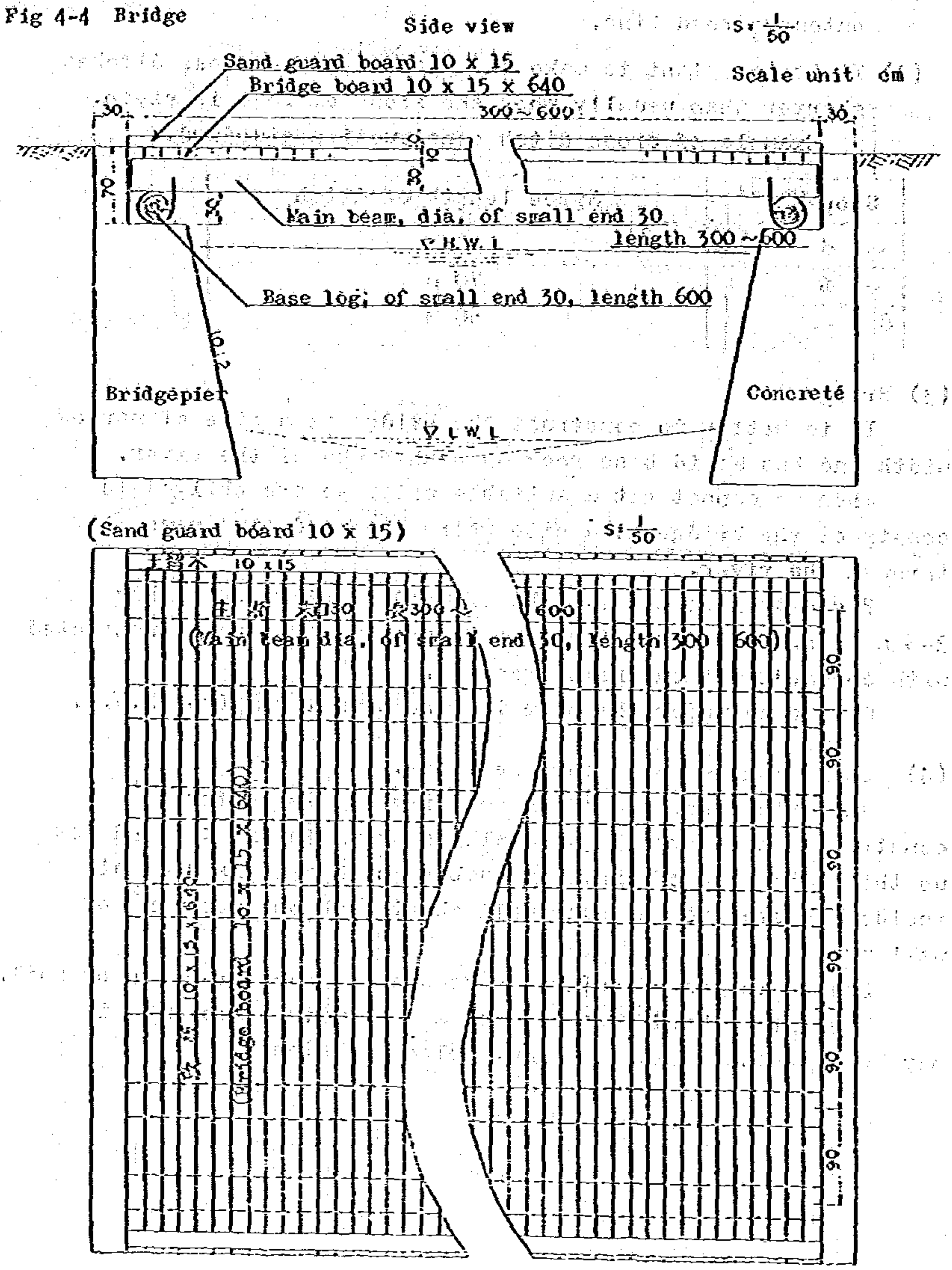
(4) Concrete defence wall for the slope.

When the slope ground is not firm, it is better to construct the concrete guardwall as shown in Fig 4-5 and set up the drain pipe of vinyl or bamboo which size is 3 cm at inside diameter to the guardwall about each one per 3 m^2 of wall area.

Drain pipe is effective to reduce the back pressure by soil.

When it is hard to construct a wall with concrete it may be acceptable with concrete block or stone.

Fig 4-4 Bridge



Front view

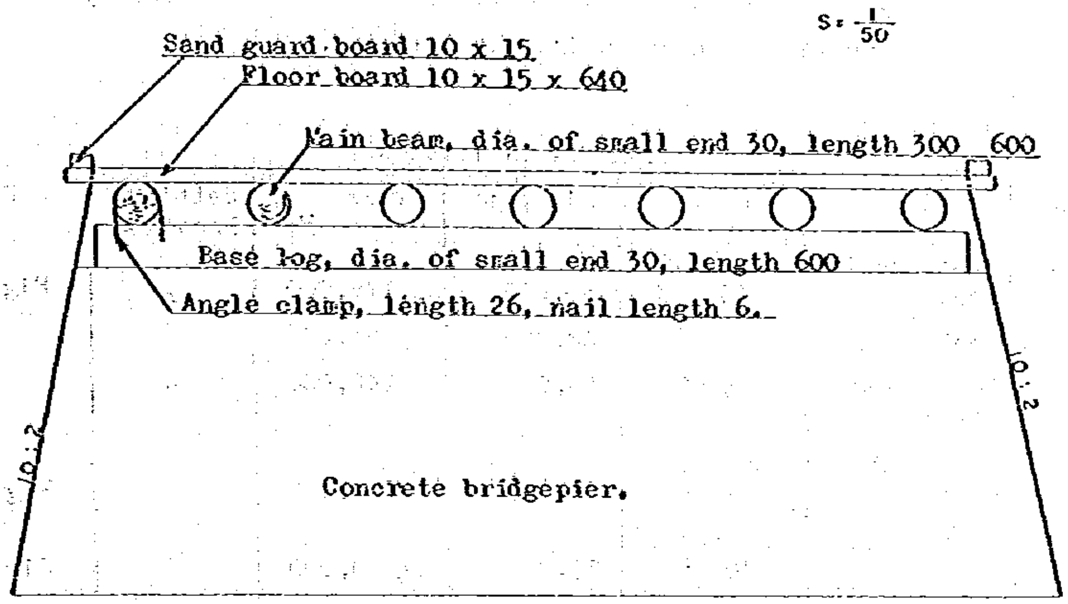
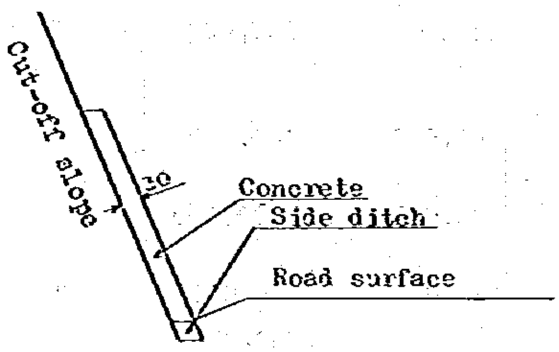


Fig 4-5 Concrete defence wall for the slope
(Retaining wall)

S = 1/100

Scale unit cm



(Remarks) Concrete frame is applied to the front and side face, not to the back.

4-3 Pran of the facilities for the demonstration forest

The plan of the annual arrangement for the necessary facilities in executing the training.

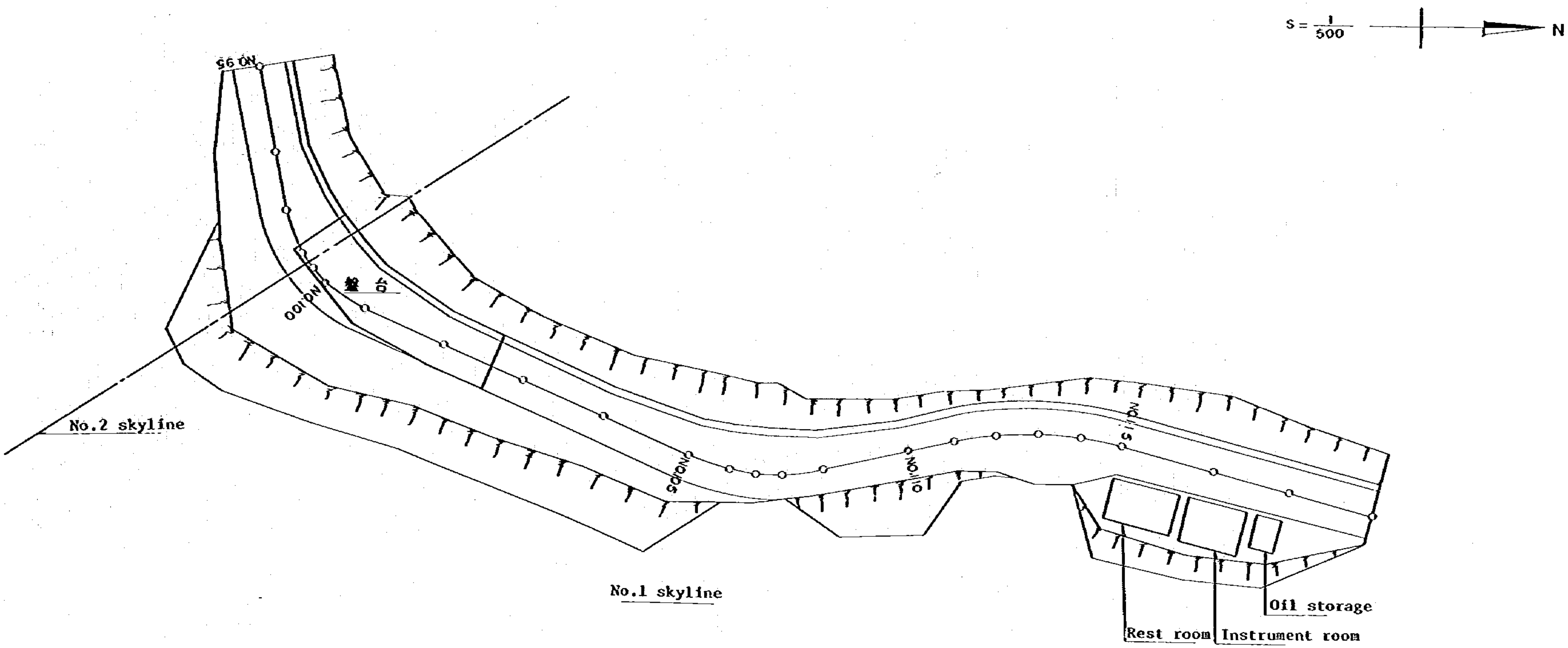
Plan for facilities

Term	Item	Number	Unit price	Price R.P	Setting location	Remarks
1st	Instruments room	one house 39.2 m²	30,000	1,176,000	70 m	Fig 4 (7)
	Tool stand	2 m²	42,000	84,000	"	
	Instrument stand	4 m²	35,000	140,000	"	
	Oil storage house	one house 12 m²	40,000	480,000	"	Fig 4 (6)
	Rest house	one house 40 m²	25,000	1,000,000	"	Fig 4 (8)
	Total			2,880,000	"	
2nd	Instruments room	one house 39.2 m²	30,000	1176,000	73 a	Fig 4 (7)
	Tool stand	2 m²	42,000	84,000	"	
	Instrument stand	4 m²	35,000	140,000	"	
	Oil storage house	one house 12 m²	40,000	480,000	"	Fig 4 (6)
	Rest house	one house 40 m²	25,000	1,000,000	"	Fig 4 (8)
	Garage	One house 60 m²	20,000	1,200,000	"	Fig 4 (9)
	Total			4,080,000		

Note 1. About the structure and etc. see the figures noted in the remarks.

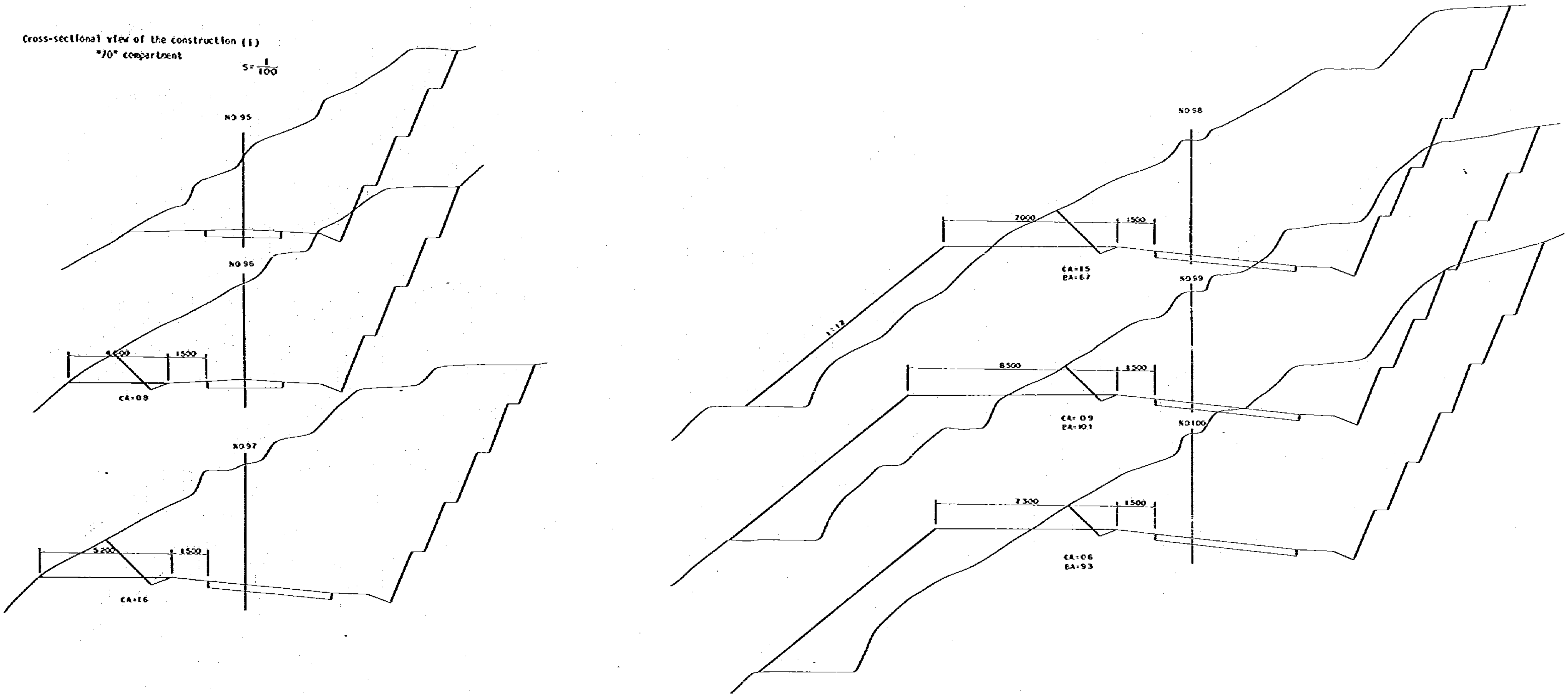
Note 2. About the location of setting, see Fig 3 (5) for the 1st term and Fig (p 125,126) for the cross section of it. About the 2nd term see Fig (p 172) for the location of setting.

Plan view of facilities "70" compartment "m"



Cross-sectional view of the construction (1)
"70" compartment

$S = \frac{1}{100}$



Cross-sectional view of the construction (2)
"70" compartment

$S = \frac{1}{100}$

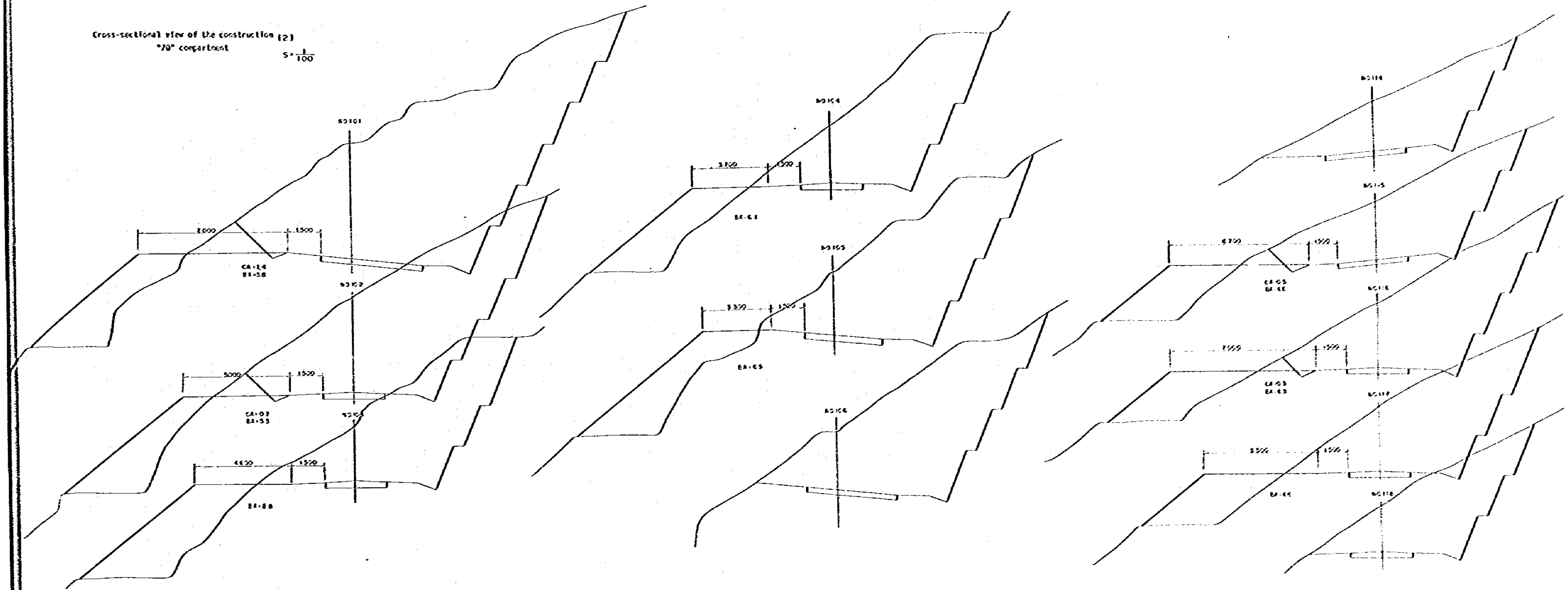


Fig 4 (6) Oil storage house $S = \frac{1}{100}$

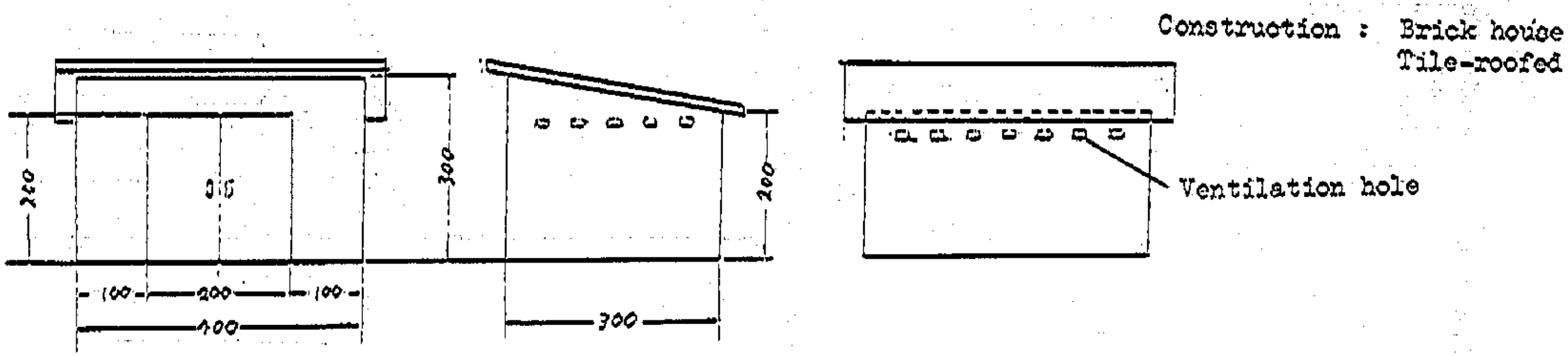


Fig 4 (7) Instrument room $S = \frac{1}{100}$

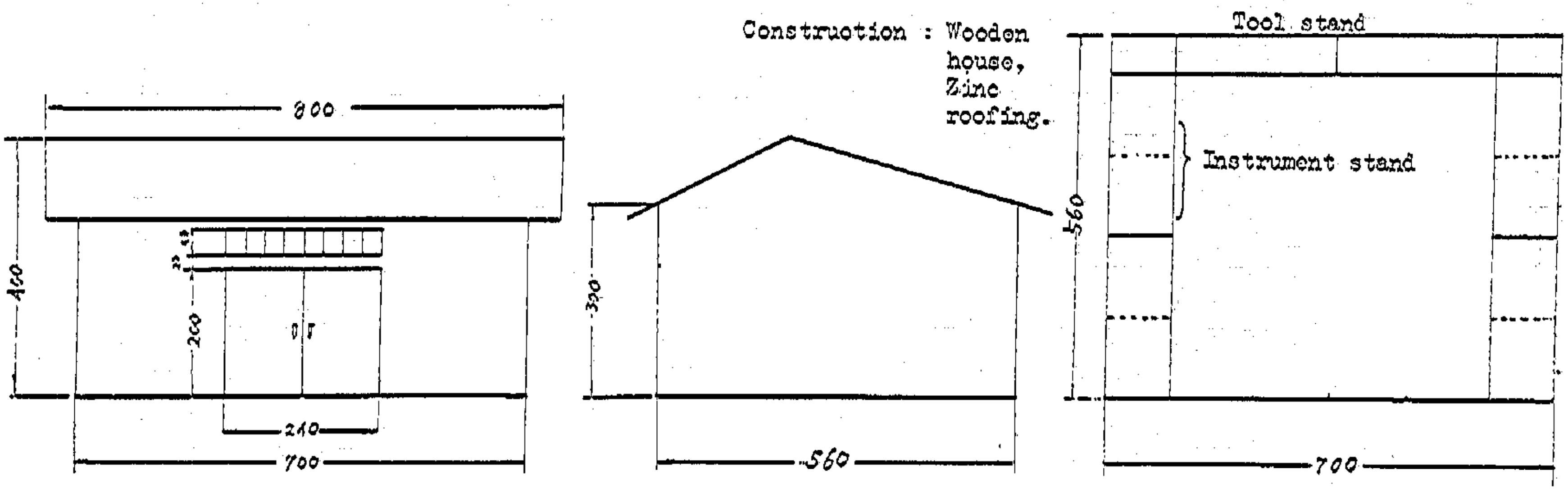
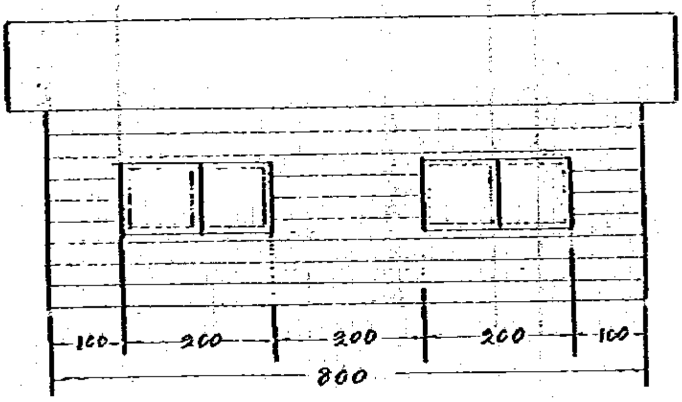
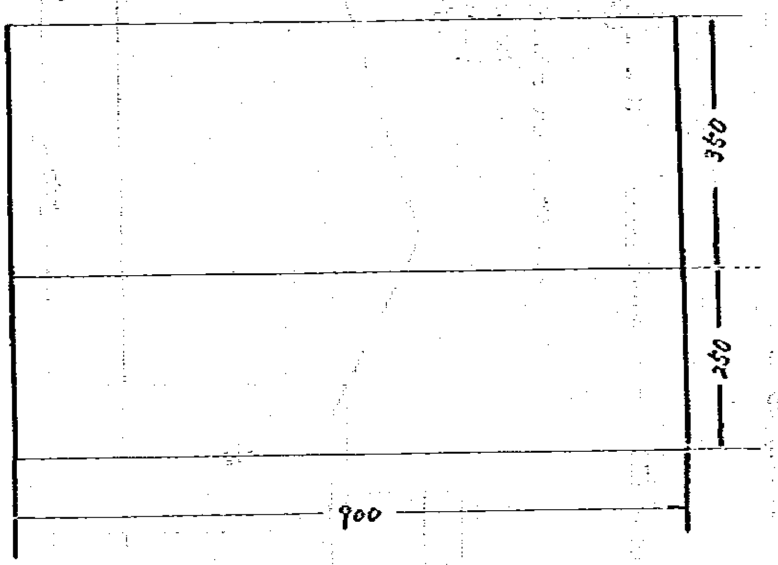


Fig 4 (8) Rest house

$S = \frac{1}{100}$



Construction: Wooden one-story house,
Zinc roofing.



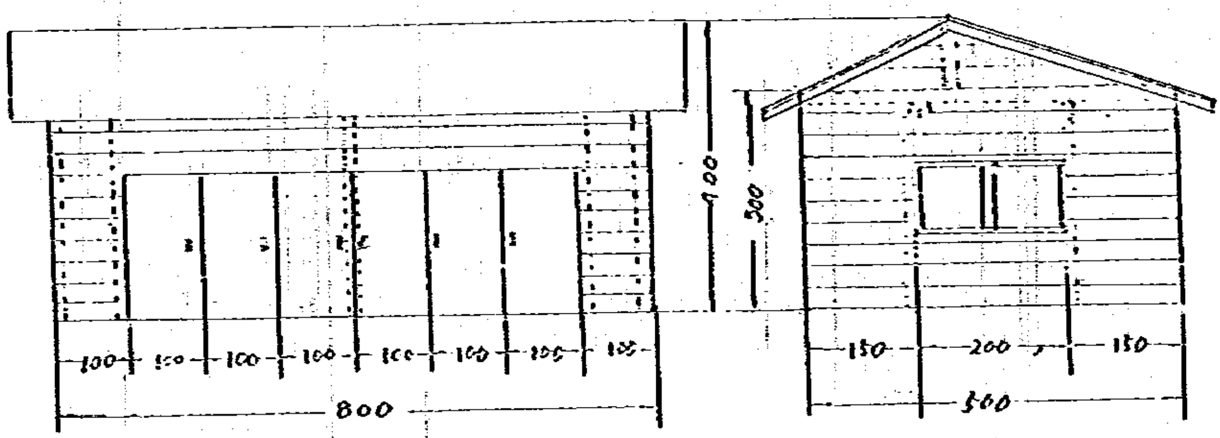
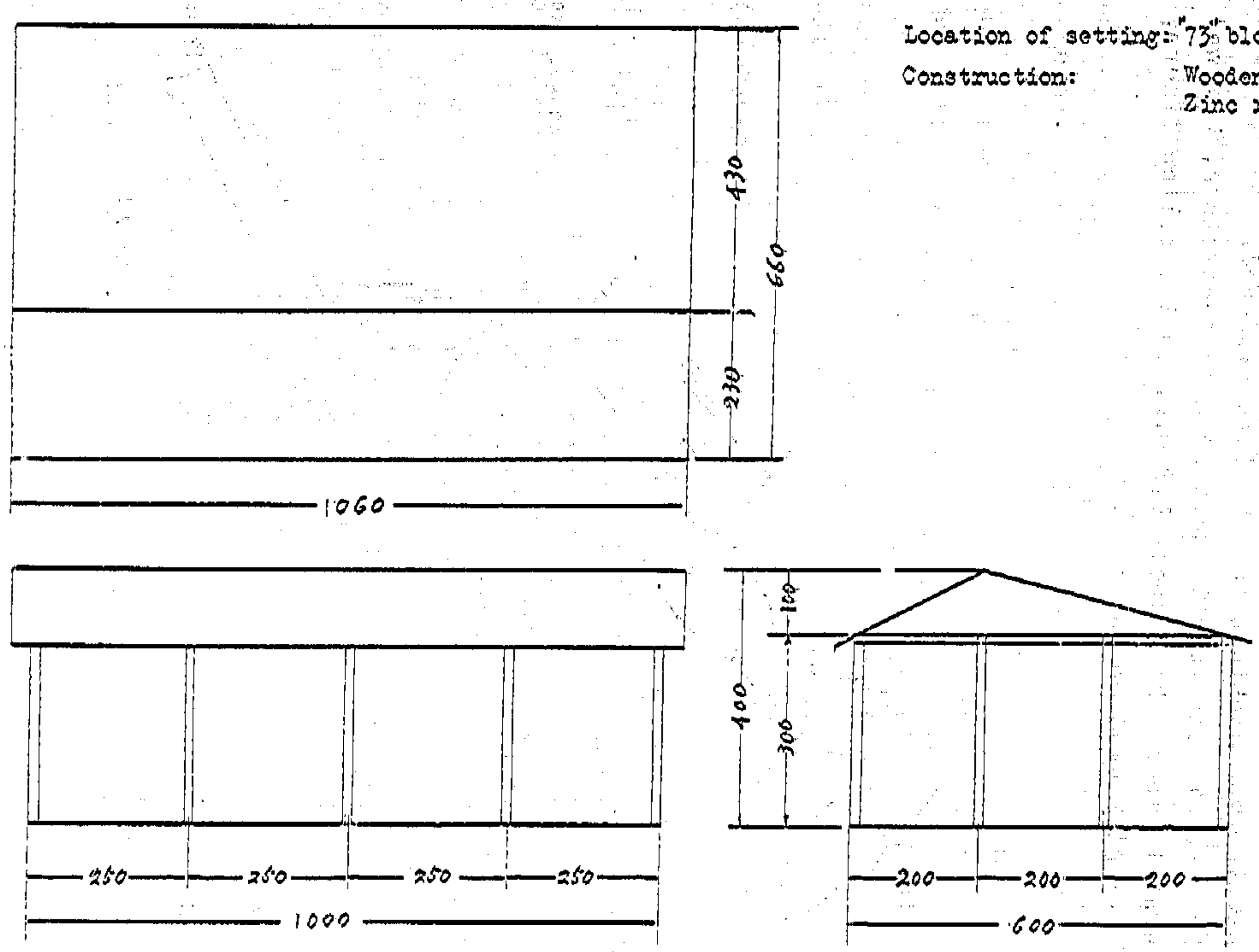


Fig 4 (9) Garage $S = \frac{1}{100}$



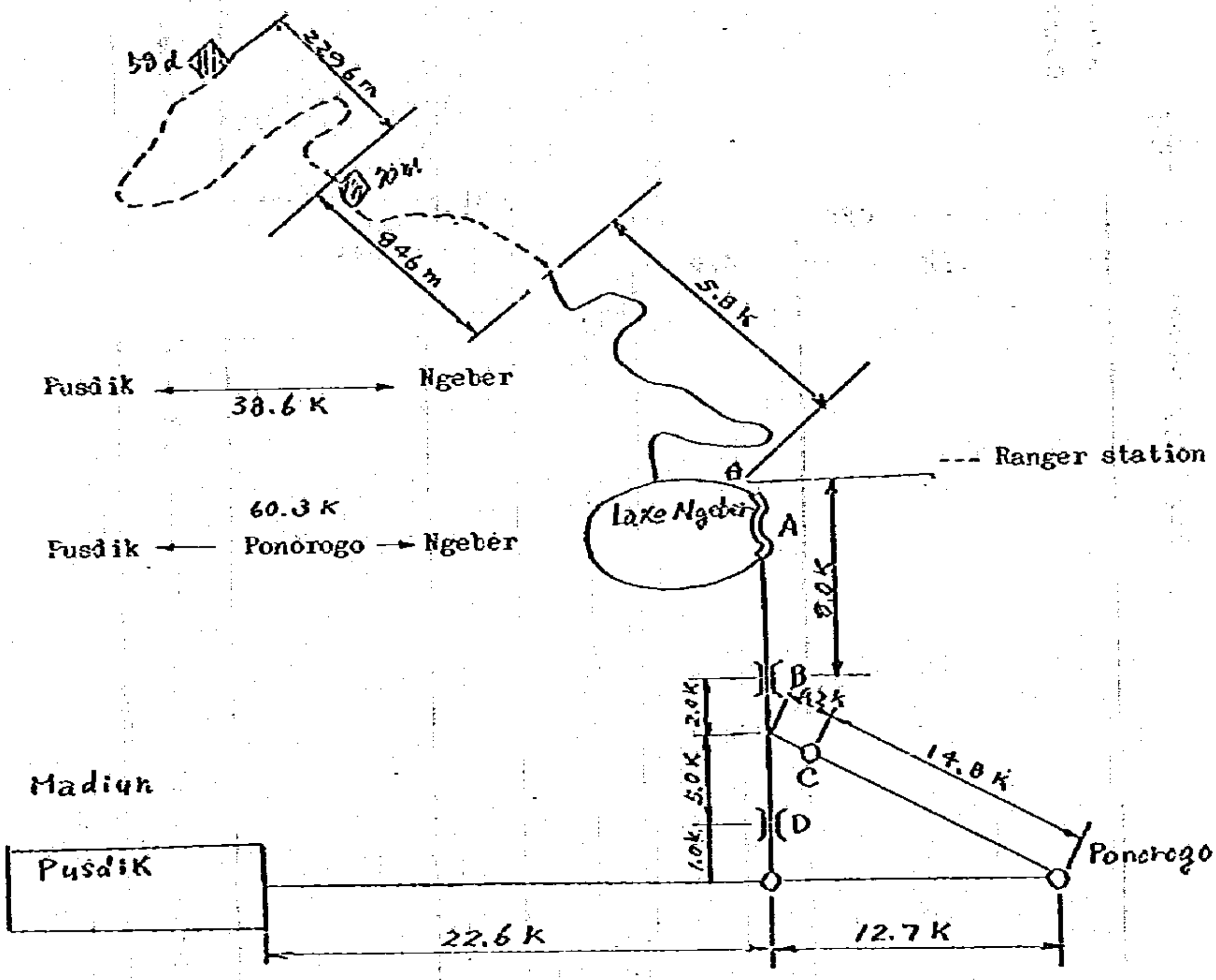
Location of setting: "73" block, a sub-block

Construction: Wooden house.
Zinc roofing.

4-4 Improvement plan of the approaching road.

About the public road (including the farm road) from Madiun to the Training Forest, we checked the necessity of improvment by survey, to affirm if any trouble will exist in transporting the machines and the logs produced.

In general, the road is kept in good conditions. but we will explain about the 4 spots A,B,C,D, in the bellow figure, which are discussed on the spot.



(1) Point A

The road is passing through the top surface of the concrete arch dam of lake NGJ3ER, but there is a spot where the radius of curve is 6.5 m. and the dam itself is leaking pretty much that to transport the heavy thing is considered to be dangerous. In the upper side of this dam is an earth dam and the crest of it is a road.

Between this earth dam and the concrete dam is filled with earth. The road on the crest is closed for passing by staking concrete piles on both entrances.

But this road, though it is so narrow as 2.8 m in width at the spot where the drainage gate is set, the remaining part has sufficient width and can pass the heavy things.

If we can not pass this part for a certain reason, the heavy things alone may pass around the lake side road and the problem will be solved.

(2) Point B

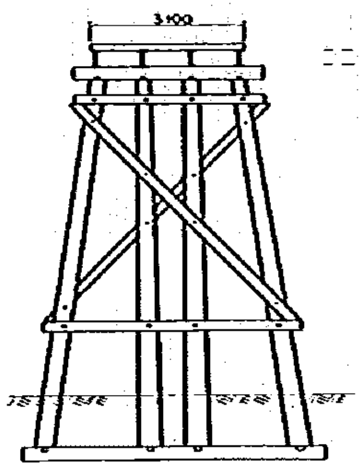
H-beam bridge, Single pier, 19.5 m span, (see the separate drawing) and the span is divided in two of 13.4 m and 5.2 m .

In comparison with the sectional area of the beam, the span of 13.4 m is too long and would cause the excesseve strain when the heavy load passes, and now, already the slight permanent deformation is seen.

This spot has no detour road, and will be used fully in the future. For this reason, the reinforcement is necessary, and ideally, set another pier of the permanent construction however we designed the wooden pier. (See separate drawing)

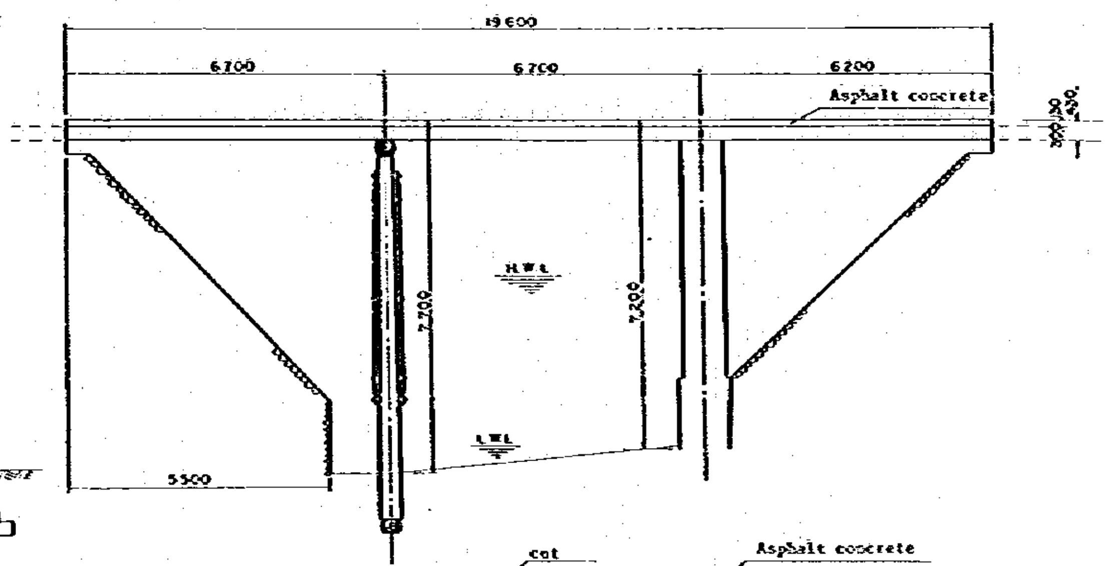
Bridge at 8 point

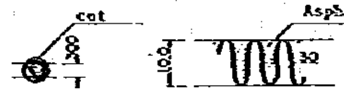
Side view of the reinforcing pier



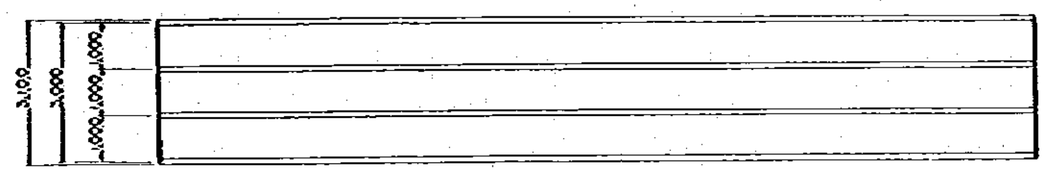
Side view

S = 1/100



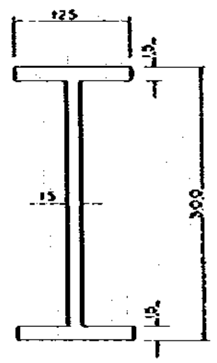


Plan view of main beam



Cross-section of the main beam (H-shape steel))

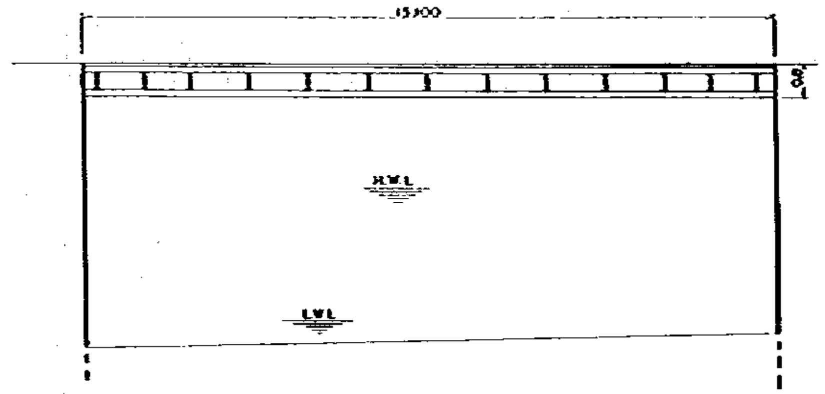
S = 1/20



Bridge at 0 point

Side view

S = 1/100



List of materials for reinforcement					
Item	Dimensions	Quantity	Unit price	Price	Remarks
Lateral beam	Top end dia.: 0.40 m Length: 4.0 m	1			Finish to 0.30 thick
Pier log	Top end dia.: 0.30 m Length: 8.1 m	2			Both ends 0.10 tenon-joint
Pier log	Top end dia.: 0.30 m Length: 8.3 m	2			Both ends 0.10 tenon-joint
Foundation log	Top end dia.: 0.40 m Length: 6.5 m	1			Finish to 0.30 thick
Bolt	∮12 mm, length: 55 cm	4			For upper bracing strips
Bolt	∮12 mm, length: 45 cm	2			For upper diagonal stay strips
Bolt	∮12 mm, length: 50 cm	4			For middle diagonal stay strips
Bolt	∮12 mm, length: 53 cm	2			For lower diagonal stay strips
Bolt	∮12 mm, length: 60 cm	4			For lower bracing strips
Clamp	Length: 20 cm, leg-length: 6 cm	16			For lateral beam, pier, foundation log.
Total					

Worst still, this bridge has no support member of main beam at the part of bridgepier, then if we se. this part newly, we can reduce the span length in some amount.

And as a method of reinforcement, to set the angle brace and auxiliary beam is considered. But the NG23ER side is covered with small size stone wall, then supporting strength at the receiving part of angle brace seems to weak.

Moreover, in the opposite side the pier will receive the angle brace at its middle, and this cause the unbalanced load to it.

Therefore, we decided to set a vertical pier, though it needs a long and big log.

(Reference)

Strength caluculation of the reinforcement of the bridge at point B.

In the case, newly add the pier in the middle of the span 13.4 m.

Position of the maximum bending moment----- x

The 1st load from the live load of 9 tons----- $P_1 = 3600$ kg

The 2nd load from the live load of 9 tons----- $P_2 = 900$ kg

Distance between the 1st and the 2nd load----- $\alpha_1 = 3.0$ m

Span------------------------------------ $\ell = 6.7$ m

Then $$x = \frac{P_1 l + P_2(l - \alpha_1)}{2(P_1 + P_2)} = \frac{3600 \times 6.7 + 900(6.7-3.0)}{2(3600+900)} = 3.05 \text{ m}$$

$$\alpha_2 = l - \alpha_1 = 6.7 - 3.0 = 3.7 \text{ m}$$

Maximum bending moment from the load of 9 ton truck, as Me.

$$Me = \frac{1}{\ell}\left[P_1(\ell - x) + P_2\alpha_2\right]x$$

$$= \frac{1}{6.7}\left[3600(6.7-3.05) + 900 \times 3.7\right]3.05$$

$$= 7497 \text{ kg.m} = 749700 \text{ kg.cm}$$

Maximum bending moment for the dead load as Md, and assume the dead load per meter.

Wd as 362 kg/m, then

$$Md = \frac{1}{8} Wd\ell^2 = \frac{1}{8} \times 362 \times 6.7^2 = 2,031 \text{ kg.m} = 203100 \text{ kg.cm}$$

∴ Maximum bending moment M max,

$$M\ max = Me + Md = 749700 + 203100 = 952800 \text{ kg.cm}$$

here assuming,

bending stress ------ σ

distance to the neutral axis of beam --- $Y = \frac{30cm}{2} = 15$ cm

geometrical moment of inertia of the beam --- $I = 12,317$ cm^4 (from the table)

then, $$\sigma = \frac{My}{I} = \frac{952800 \times 15}{12\ 317} = 1160 \text{ kg/cm}^2$$

Now, allowable bending stress --- $\sigma a = 1300$ kg/cm$^2 > \sigma = 1160$ kg/cm^2

Therefore, if we set a pier at the middle of the span 13.4 m, it will become safe.

(3) Point C

This is the concrete culvert of 1.2 m dia, 0.2 m thick, semi-circle section, and as the present state it can pass the vehicle sufficiently, but the arching part of concrete is exposed to the road surface and causes the impact whenever the vehicle passes.
To dissolve these troubles and enable the smooth passing of the vehicles, lay the earth in 6.0 m wide, 0.15 m thick, and 10 m long and this will be sufficient.

(4) Point D

This is the H-beam, rail jointly used bridge of 15.1 m span wooden layered, and can not allow the passing of heavy things. In the present state it allows the passing of the Mini-bus (4 tons) and the like, but if the utilization increases, re-laying of the wooden layer is considered necessary.

As for the heavy things, the course to pass Ponorogo is considered, instead of passing this spot.

5. Arrangement plan of Madiun Training Center

5-1 Improvement plan of the facilities in the Training Center.

As for the improvement of the facilities in the Training Center, we can roughly divide it, one for the facilities directly necessary for the training and the inderectly necessary ones like the rooms for teachers and others and so on. In the survey of this time we checked about the directly necessary facilities for the training.

As a principle, paying regards to the preliminary survey, of 1977, check it further in details, also taking up the opinions of the specialists of the spot, and designed.

(1) A room for tools and parts

This is a ware-house needed for storing and preserving the tools, meters, instruments and parts necessary for the assembling, disassembling, adjusting and checking of the machines and the skylines for yarding.

We checked about.

1 Design and arrangement of the tools stand.

2 Design and arrangement of the parts stand.

3 Lighting of the room, etc.

(See Fig 5(1) - (3))

(2) A room for instruments

The ware-house storing mainly the wire ropes for the exercise of splicing in the work shop and the instruments necessary for the skyline setting, and rather heavy materials are stored.

1 Design and arrangement of the instrument stand.

2 Interim lighting and etc,

(See Fig 5(1) - (3))

(3) Work shop

The place for the training on the actual machine to learn the construction and the performance of it.

1 Design and arrangement of the working table.
2 Arrangement of lightings and wall outlets.
3 Design and arrengement of the floor paving and the fixed anchors to be used in moving the heavy things. (See 5 -(3))
4 Set the door newly for carrying in and out the machines & etc. and so on are checked. (See Fig 5(4) - (6))

(4) Garage.

Checked the design and arrangement of the Garage necessary for the storing and preserving the vehicles like all kinds of automobiles and the tractors, and also the yarder, etc. (See Fig 5(7))

(5) Oil storage house (See Fig 5(8))

5-2 Design of model skyline.

Designed the model skyline for yarding, set in the site of the Madiun Training Center.

(1) General view of the model skyline.
As Fig 5(9)

(2) Design of the model skyline.
As the design sheet of yarding skyline, and Fig 5(10)

(3) Design of each spar and anchor.
Head spar, guide spar, tail spar, and the fixing of main cable etc. as shown in Fig 5(11) - Fig 5(13)

Fig 5 (1)

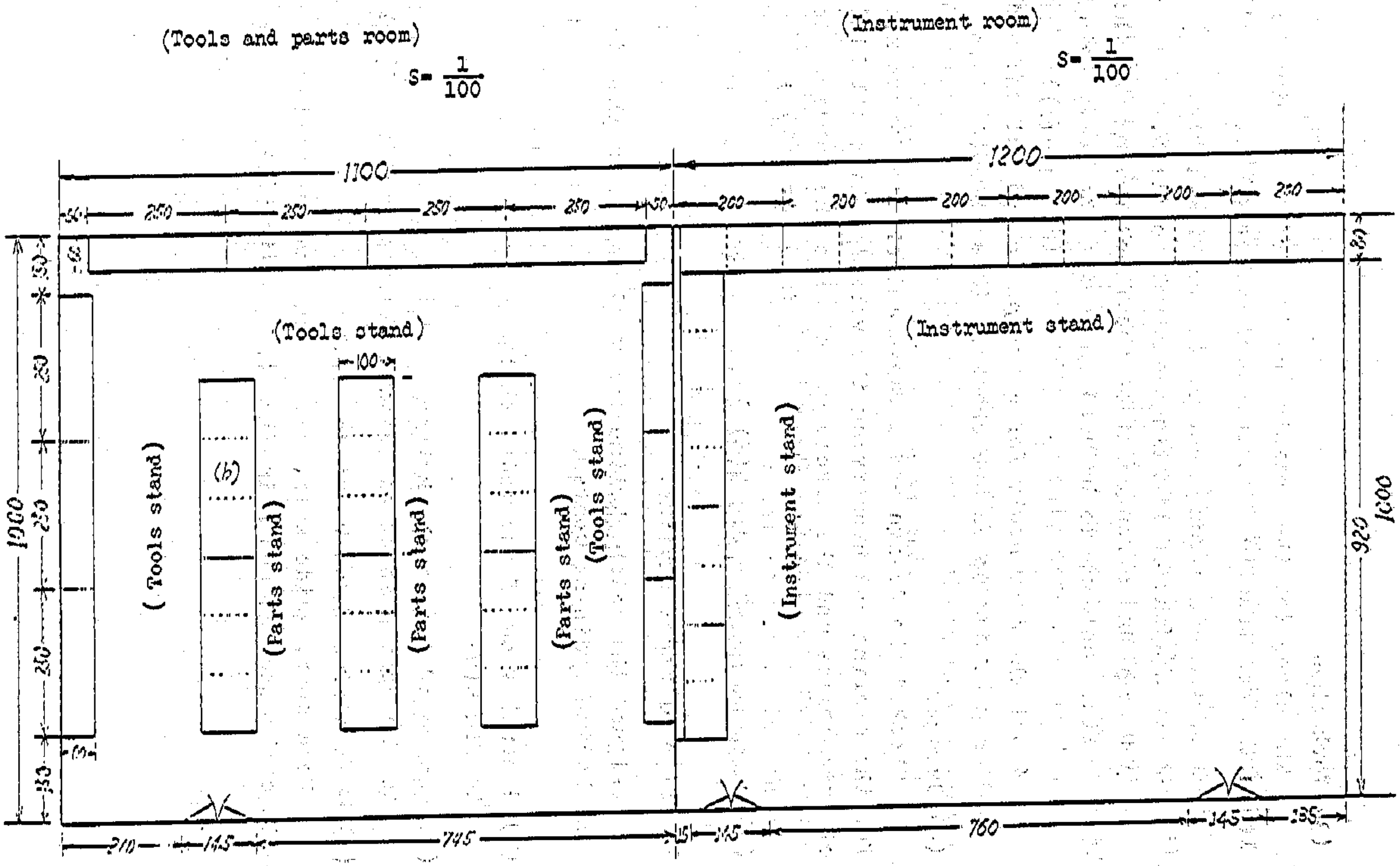
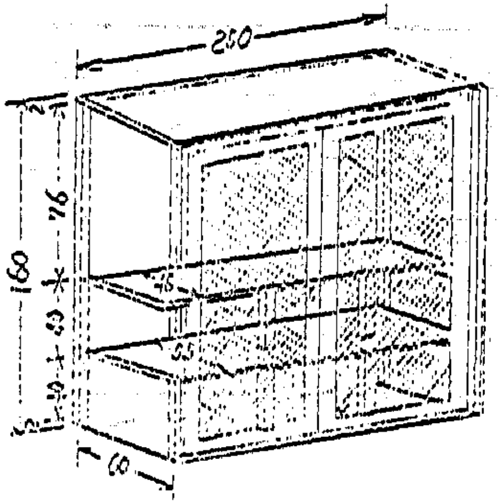
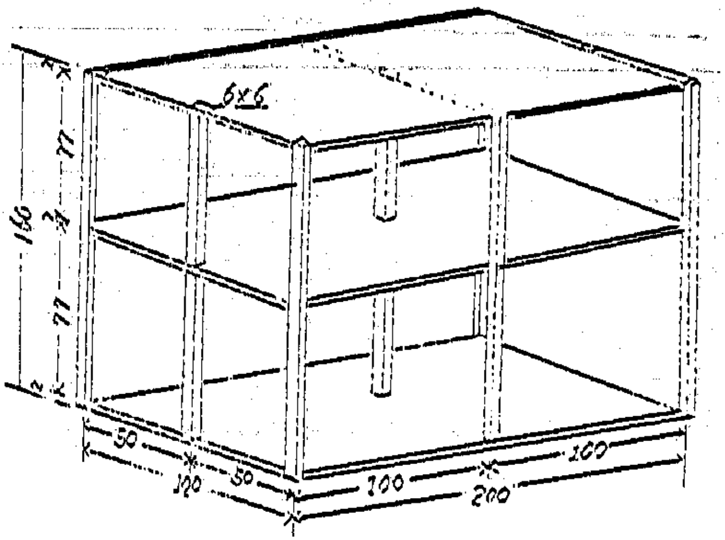

(Tools and parts room)
S= 1/100
(Instrument room)
S= 1/100
1100
1200
250
200
(Tools stand)
(Parts stand)
(Instrument stand)
100
1000
920
745
760
145

Fig 5 (2)

(Tools stand)



(Instrument stand)



(Parts stand)

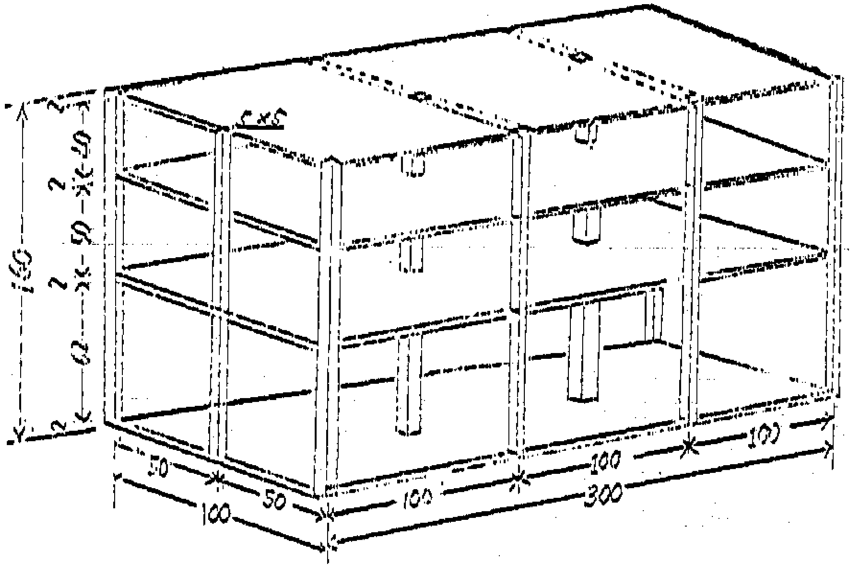


Fig 5 (3) Lighting

$S = \frac{1}{100}$

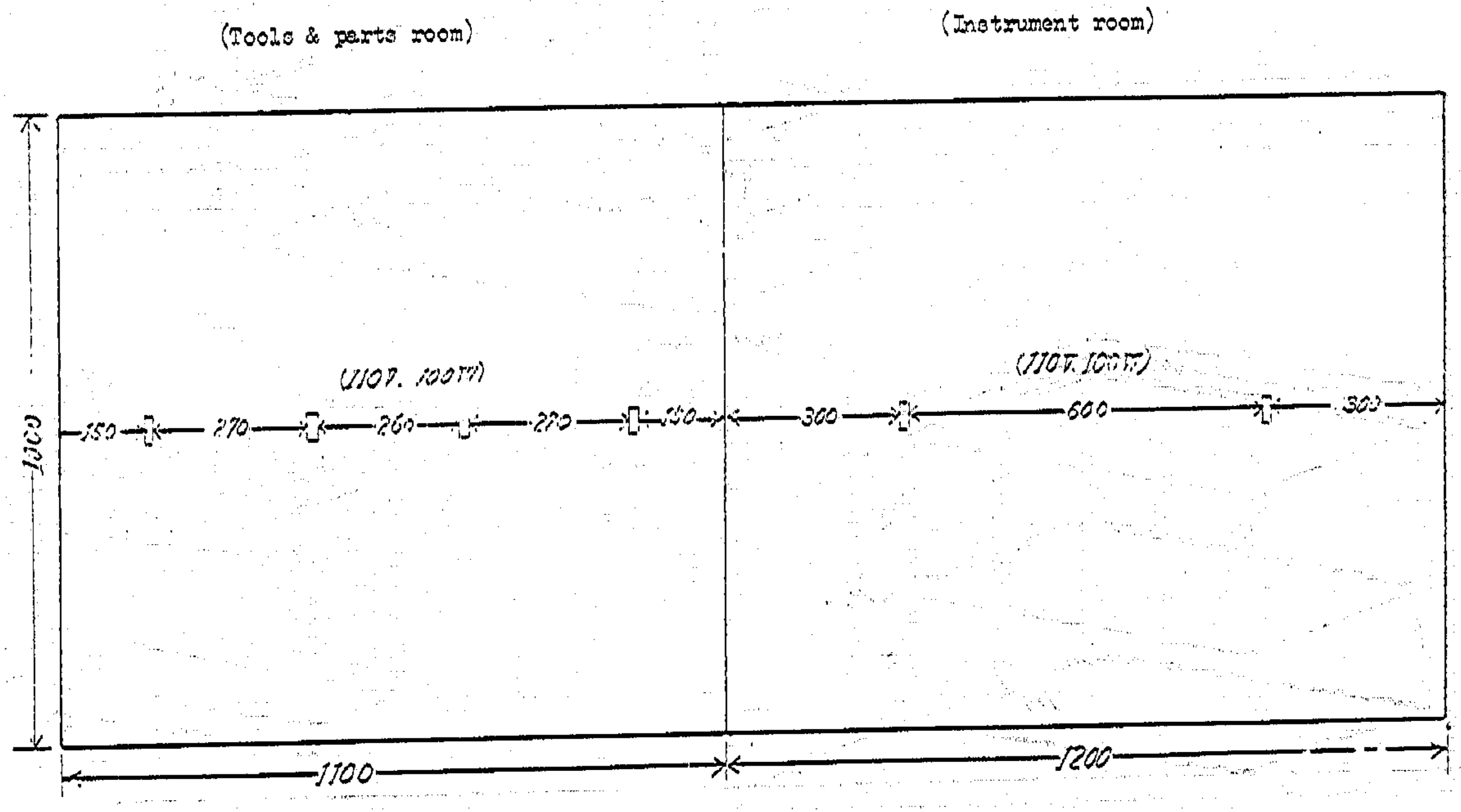


Fig 5 (4) Workshop

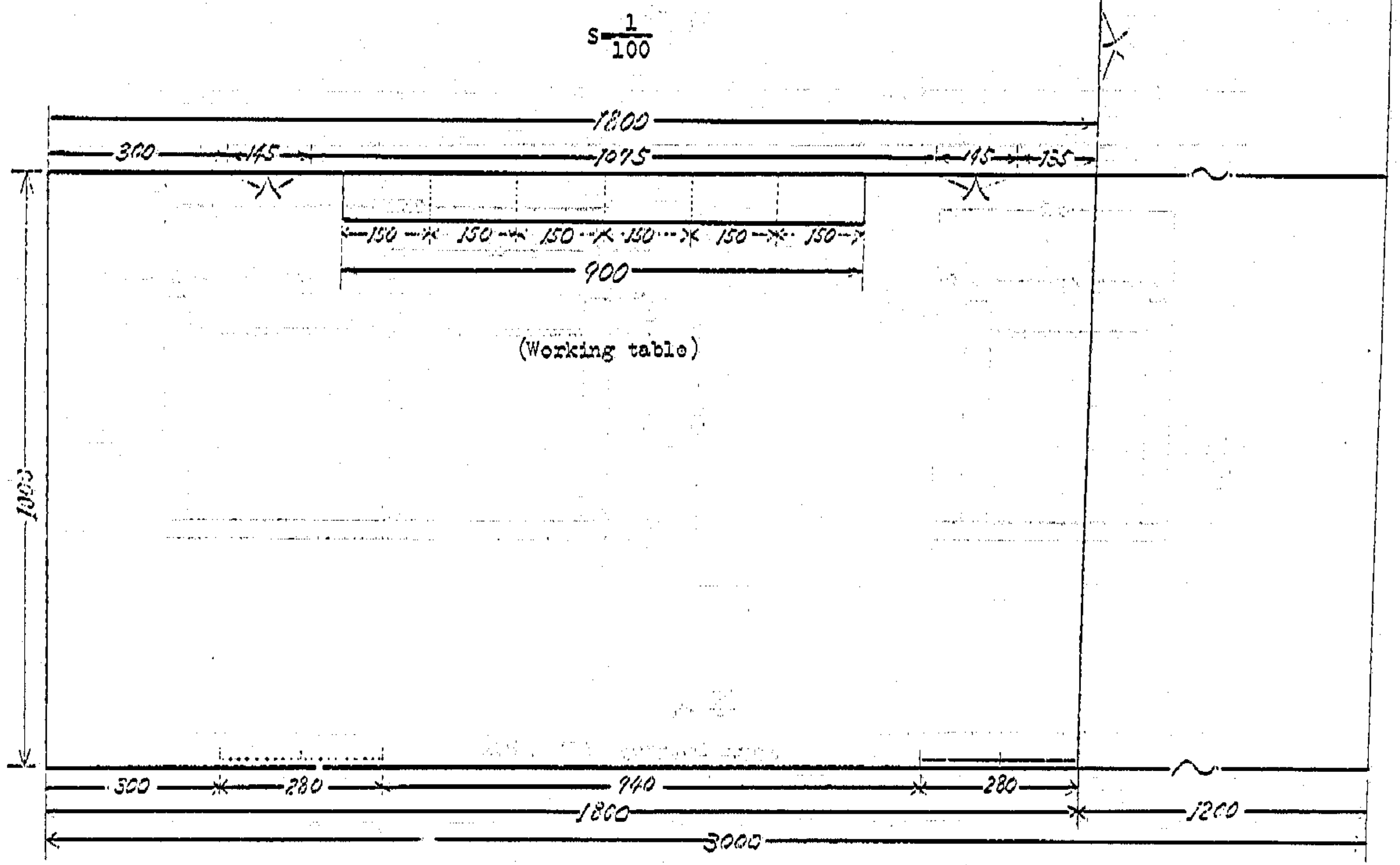


Fig 5 (5) Working table

$S = \frac{1}{20}$

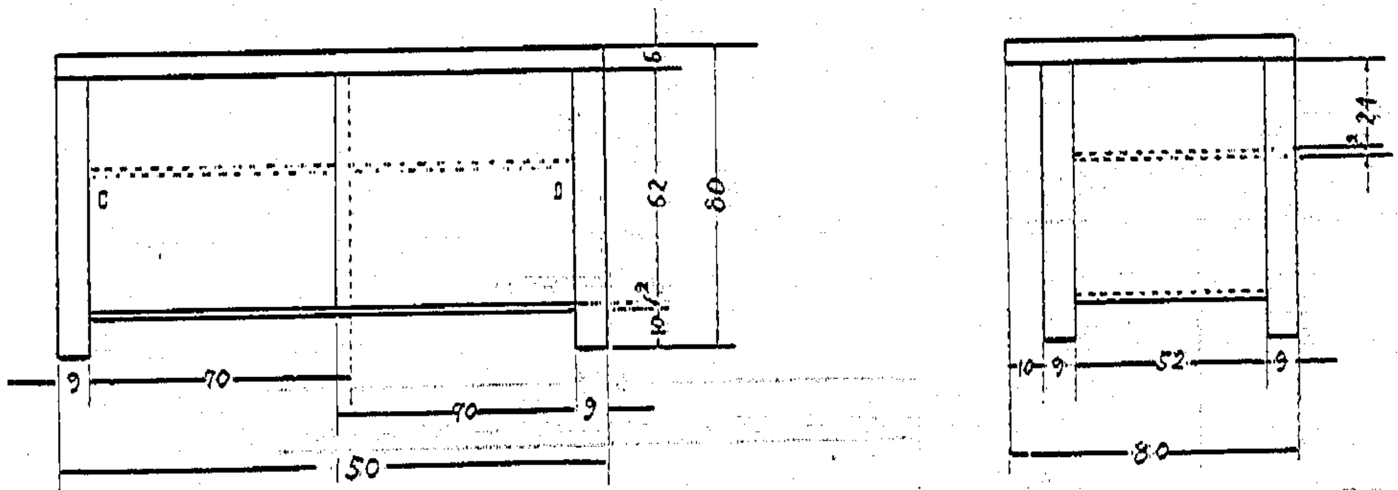
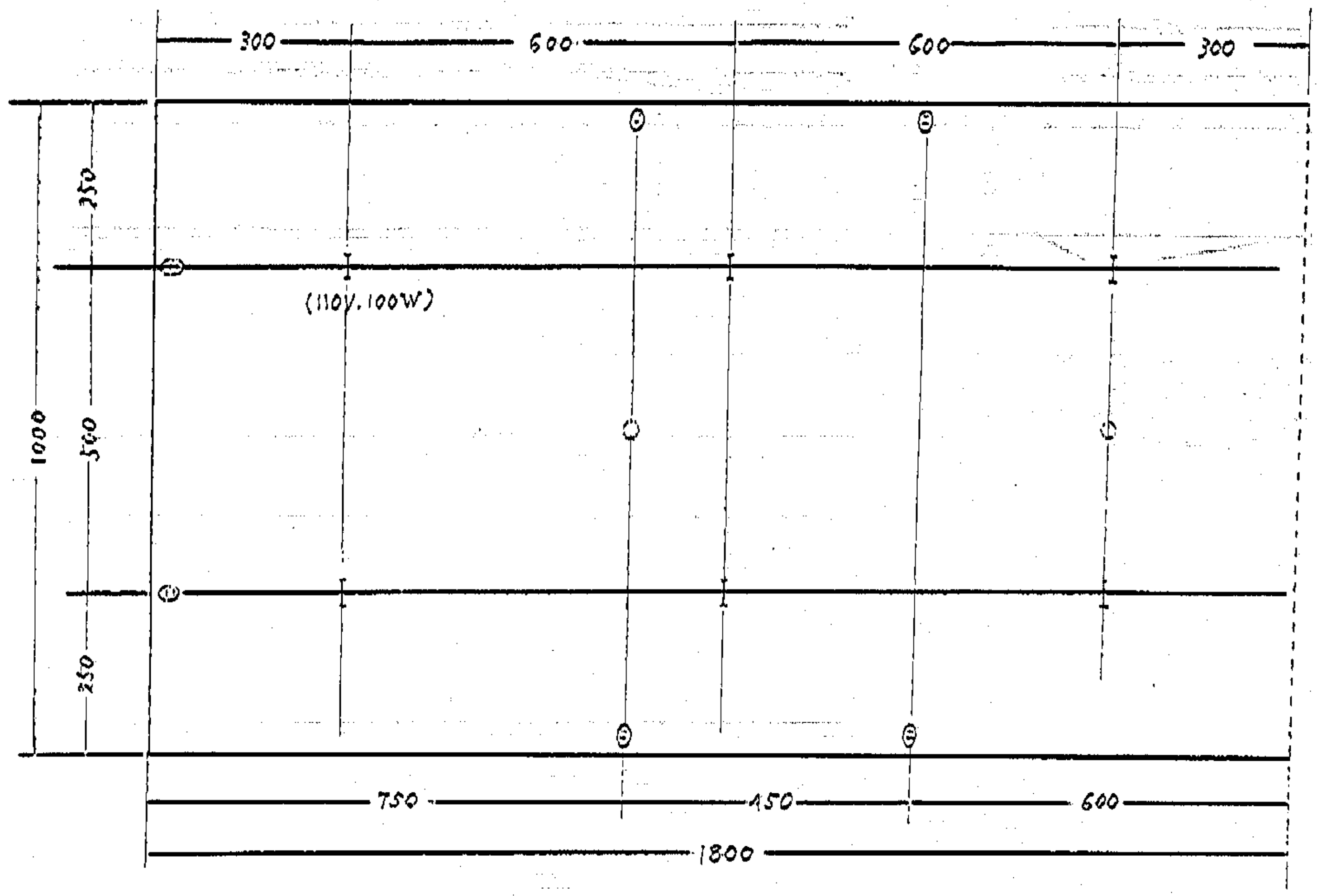


Fig 5 (6) Lighting of workshop

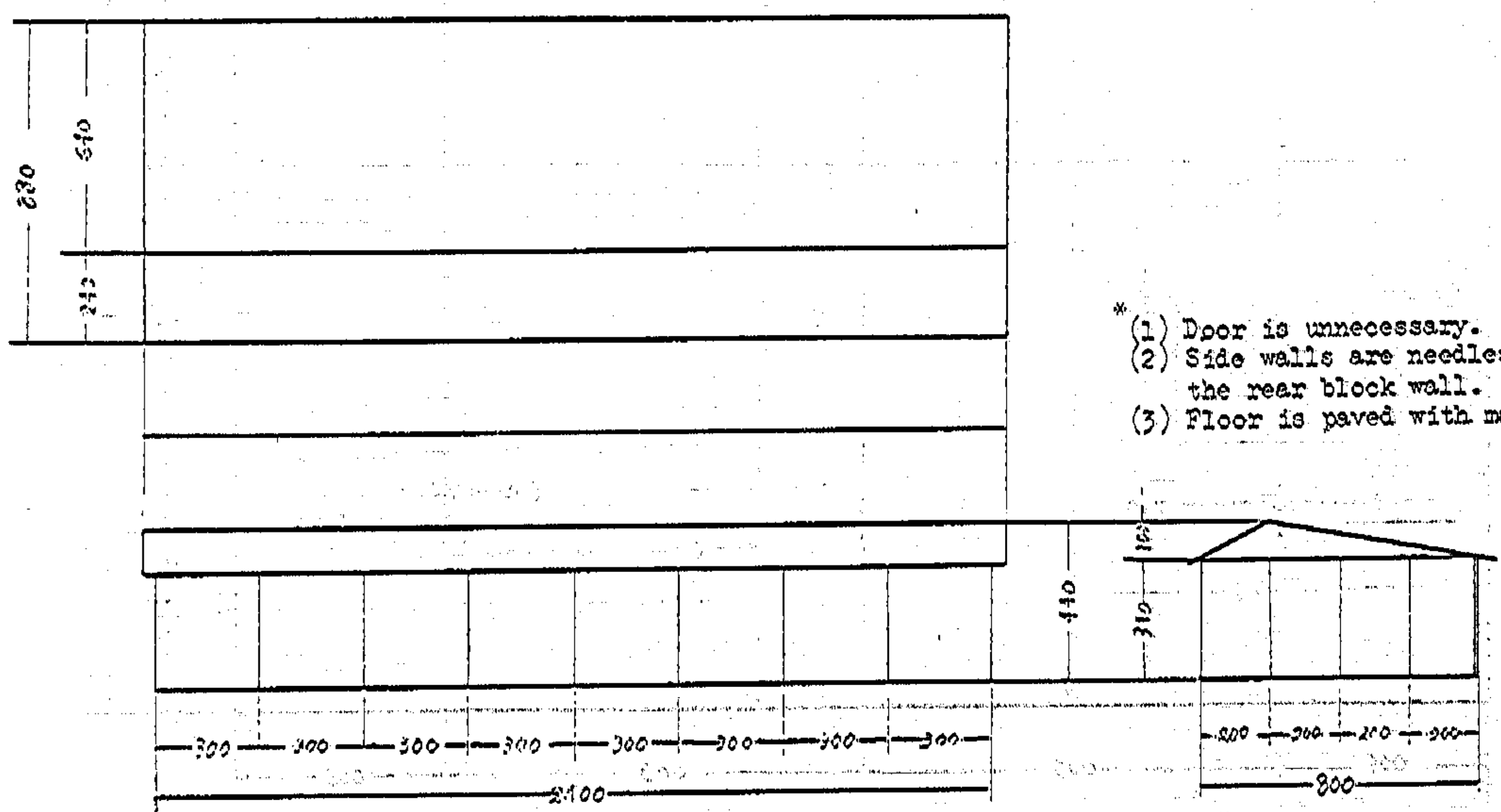
$S=\frac{1}{200}$



(The height of wall outlet is 1 meter from the floor.)

Fig (5 (7) Garage

$S = \frac{1}{200}$

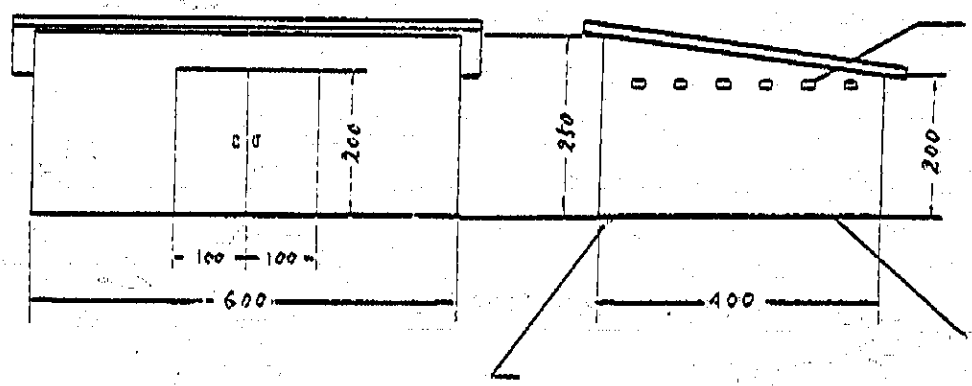


* (1) Door is unnecessary.
(2) Side walls are needless. except the rear block wall.
(3) Floor is paved with macadam.

(4) Light weight steel structures are desirable. but if impossible wooden ones will do.
(5) Zinc roofing or tile-roofed.

Fig 5 (8) Oil storage house

$S = \frac{1}{100}$



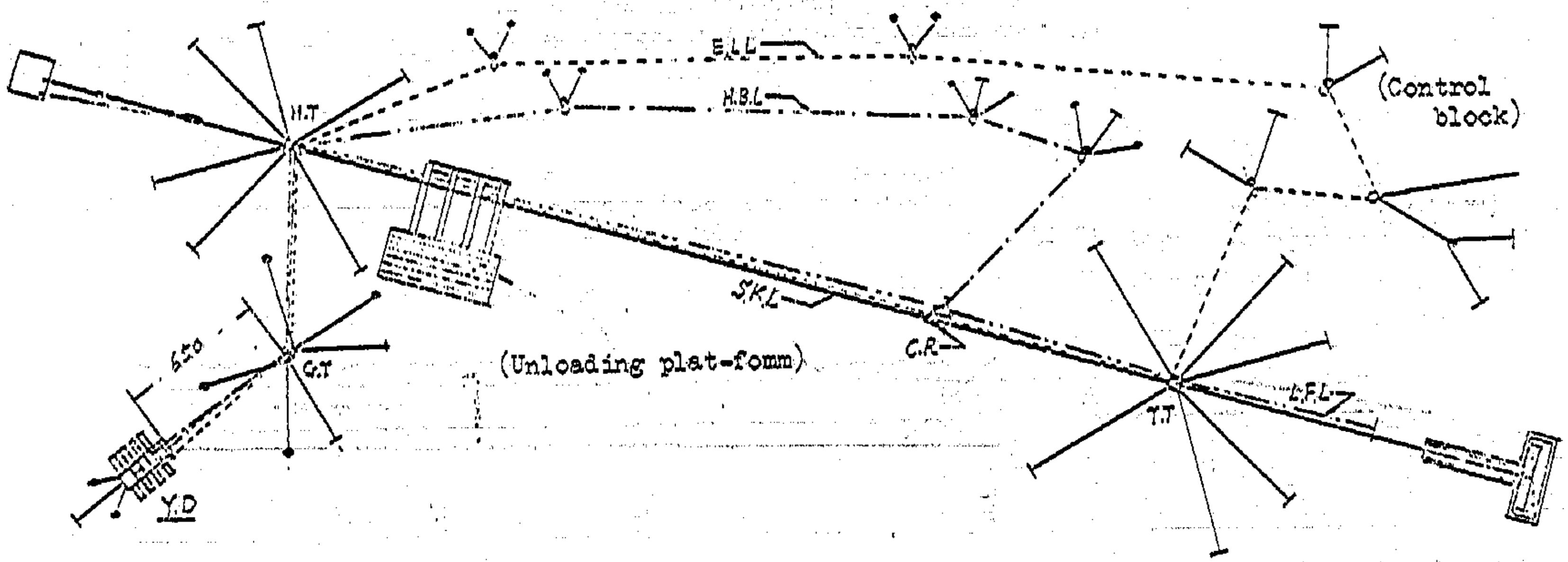
*(1) Brick building. (In case of wooden one. the walls shoud be coveredwith galvanized iron sheet both inside and outside)
(2) Tiled roof or zinc roof.
(3) Floor should be finished by concrete of 20 cm thick.
(4) As for ventilation, usually set the ventilator. but ventilation holes shown in the picture will do.
(5) Door should be covered with galvanized iron sheet on both inside & outside.
(6) Make the draining ditch near the entrance. and make the drained oil be exhausted from the house.
(7) Set the lightning rod.

Fig 5 (9) General view of model skyline

$S = \frac{1}{300}$

Span 40 m

Endless Tyler System



- Wood spar
- Guide block
- Fix the guyline to the submerged anchor.
- Fix the guyline to the pile.

Table 5 (1) Design Sheet of Skyline for Yarding: Model skyline of Madiun Training Center

I. Fundamental terms (Type of wiring system: Endless Tyler System)

Span

(1) Horizontal distance of the span	(2) Inclination angle of the span	(3) Oblique distance	(4) Height difference	(5) Sag-span ratio of original skyline
l_o = 40 m	α = 1° 26′	l = 40 m	h = 1 m	s_o = 0.025

Wire rope

Uses	Construction of rope	Rope diameter	(6) Guaranteed breaking force	(7) Weight of rope per meter	(8) Weight (7) x (3)
Skyline	6 x 7 C/L . A	24 mm	B = 34900 kg	P = 2.14 /	W = 86 kg
Lifting line	6 x 19 O/O . A	12 mm	B_1' = 7920 kg	P_1' = 0.562 /	W_1' = 21 kg
Haul back line Endless line	6 x 19 O/O . A	10 mm	B_2' = 5500 kg	P_2' = 0.364 /	W_2' = 15 kg

Load

(9) Weight of load P	Weight of empty carriage P	Impact load coefficient I	Weight of operating line W + W	(10) Weight of the carriage load (designed) P
(1500 kg + 139 kg) x (1 + 0.2) + 23 kg = 1990 kg				

(11) Displacement of the supporting point Δl = (   ) m

(12) Displacement ratio of the supporting point $\Delta d = \Delta l / l$ = (   )

II. Caluculation of the safety factor of skyline

(13)	Total load		$(W^{(8)} + P^{(10)})$	= 2076 kg
(14)	Load ratio	n	$= P^{(10)} / W^{(8)}$	= 23
(15)	Equivalent coefficient of sag-span ratio	Z_1	$= \frac{1+n}{\sqrt{1+3n+3n^2}}$	= 0.590

(16)	Corrected sag-span ratio	s	$= \overset{(5)}{s_0} \times \overset{(21)}{\varepsilon}$		Corrected value = 0.014
(17)	Equivalent sag-span ratio	s_1	$= \overset{(15)}{Z_1} \times \overset{(5)}{s_0}$ or $\overset{(15)}{Z_1} \times \overset{(16)}{s}$	= 0.148	" " = 0.0242
(18)	Coefficient of maximum tension	ψ_1	$= \frac{\sqrt{1+(4s_1+\tan\alpha)^2}}{8s_1}$	8.48	" " = 5.2
(19)	Maximum tension	T_1	$= \overset{(13)}{(W+P)} \cdot \overset{(18)}{\psi_1}$	= 17604 kg	" " = 10795 kg
(20)	Safety factor	N	$= \overset{(6)}{B} / \overset{(19)}{T_1}$	= 1.98	" " = 3.2 ≥ 2.7

(21) Calculation of the correcting coefficient.

This calculation should be done when the value of the safety factor N, which is derived as the result of the calculation (1) - (10) & (13) - (20), come out to be less than 2.7

Wire tension of no load	Coefficient of maximum tension	ψ_0	$= \frac{\sqrt{1+(4s_0+\tan\alpha)^2}}{8s_0}$	5.04
	Maximum tension	T_0	$= \overset{(3)}{W} \times \psi_0$	= 433 kg
Wire tensoon with load (non corrected)	Equivalent sag-span ratio	s_1	$= \overset{(15)}{Z_1} \times \overset{(5)}{s_0}$	= 0.0148
	Coefficient of maximum tension	ψ_1	Same as (18)	8.48
	Maximum tension	T_1	$= \overset{(13)}{(W+P)} \cdot \psi_1$	= 17604 kg
	Difference of tension	T_d	$= T_1 - T_0$	= 17171 kg
Elastic elongation ratio	Per 1 ton of tension	λ	Refer to "Wire rope table"	0.00042/t
	Elastic elongation	Δe	$= \lambda \times T_d$	= 0.00721
Coefficient of correction	For elastic elongation	ε_e	$= \frac{1}{2}\left\{1+\sqrt{1+\left(1+\frac{3}{8s_0^2\cos^2\alpha}\right)\Delta e}\right\}$	1.65
	For displacement of supporting point	ε_d	$= \sqrt{\frac{1+\frac{3}{8s_0^2\cos^2\alpha}\Delta d}{1-\Delta d}}$	1.0
	Over-all	ε	$= \varepsilon_e \times \varepsilon_d$	= (1.65) ⟶ (16)

III. Calculation of the safety factor of operating lines.

(a) Lifting line (Hoisting line, haul back line of Falling Block system)

(22)	Maximum lifting stroke	h_1		5 m
(23)	Load on loading block	P_ℓ	Weight of logs, loading block and ballast.	1592 kg 368 " 1960 kg

* In case the haul back line is fixed to the loading block, the resultant force of above calculated one and the tension of haul back line should be used. In this case, we must calculate the tension of haul back line prior to (a).

(24)	Number of ply of the lifting line	n_o		2
(25)	Maximum tension	T_1'	$= P_\ell / n_o + P_1' h'$	983 kg
(26)	Safety factor	N	$= B_1' / T_1'$	$8.0 \geqq 6.0$

(b) Haul back line or endless line

(i) Load pulling force: TP

Coefficient of load pulling force: ($\sin\beta$)
(if apply the value of $\sin\alpha$ instead of $\sin\beta$, increase it as (30)'.)

(27)		SB	$= 0.8 \times s$	0.041
(27)'		SB	$= (1 + 2n) \times s$	

(When the carriage can approach to the upper supporting point within 10 % of span, use (27)'.)

(28)	Coefficient of load pulling force	$\sin\beta$	SB	0.185
(29)	Load	P	(10)	1990 kg
(30)	Load pulling force	TP	$= P \times (\sin\beta)$	= 368 kg
(30)'	Replaced by $\sin\alpha$	TP	$= P \times (\sin\alpha \times 1.4)$	

(ii) Fundamental tension of endless line: To

(Needless for other system than Endless Tyler System)

(31)	Fundamental sag-span ratio	s'	$= \overset{(21)}{s} \times (1.2 - 1.3)$	= 0.053
(32)	Coefficient of maximum tension	ψ_o'	$= \frac{\sqrt{1 + (4s' + \tan\alpha)^2}}{8s'}$	2.425
(33)	Fundamental tension	T_o'	$= \overset{(20)}{W_2'} \times \psi_o'$	= 36 kg

(iii) Maximum tensions.

(34)	Haul back line, Tyler system	T_2'	$= \overset{(30)}{TP} \times 1.4$	= 515 kg
	Endless line, Endless Tyler system	T_2'	$= \overset{(30)}{TP} + \overset{(33)}{T_o'}$	= 404 kg
	Falling Block system	T_2'	$= \overset{(30)}{TP} + T_1'^{(25)}$	=
	Endless system	T_2'	$= \overset{(30)}{TP} + T_1'^{(25)}$	=
(35)	Safety factor	N	$= \overset{(6)}{B_2'} / T_2'$	Haul back line: 10.6 ≧4.0 Endless line: 13.6
	For the endless line of Endless system			≧6.0

(10) Details of the weight of the carriage load (Designed).

Item		Maker's standard	Quantity	Unit weight	Weight	Remarks
Carriage	PC	BCC 22	1	27 kg	27 kg	
Guide block	PC	BS 9	2	10	20	
Loading block	PC	BLA 21	1	17	17	
Loading hook	PC					
Ballast	PC	MB - 70 s	1	70	70	
Sling & etc.	PC				5	PC: sub-total 139 kg
Lifting line	W_1'	$\frac{1}{2} W_1'$			11	
Haul line	W_2'					
Haul back line	W_2'	$\frac{1}{2} W_2'$			4	
Endless line	W_2'	$\frac{1}{2} W_2'$			8	W_1' & W_2' 23 kg
Loading weight	P_o				1500	
Total: P					1639 kg	

Remarks:

1. In the column " Type of wiring system " of the fundamental terms I. write the name of system like Tylor. Endless Tyler. Falling block. Endless or Snapping etc.

2. In the column " Construction of rope " of wire rope of the fundamental terms I. write like " 6 x 7. C/L. A ".

3. " Impact load coefficient I " in the column of load of the fundamental terms I. need not fill up when calculated without correction. but if calculate with correction. take I = 0.2 – 0.3

4. As for the "Displacement ratio of the supporting point Δd (12). if the displacement Δl at the supporting point is difficult to measure. use the value $\Delta d \leq 1/2000$.

5. Defining the length of the operating lines to calculate their weights. refer to the following standard.

   Tyler system: $W' = \frac{1}{2} W_1' + \frac{1}{2} W_2'$ Endless Tylor system: $W' = \frac{1}{2} W_1' + \frac{1}{2} W_2'$

   Falling block system: $W' = \frac{1}{2} W_1' + \frac{1}{2} W_2'$ Endless system: $W' = \frac{1}{2} W_2'$

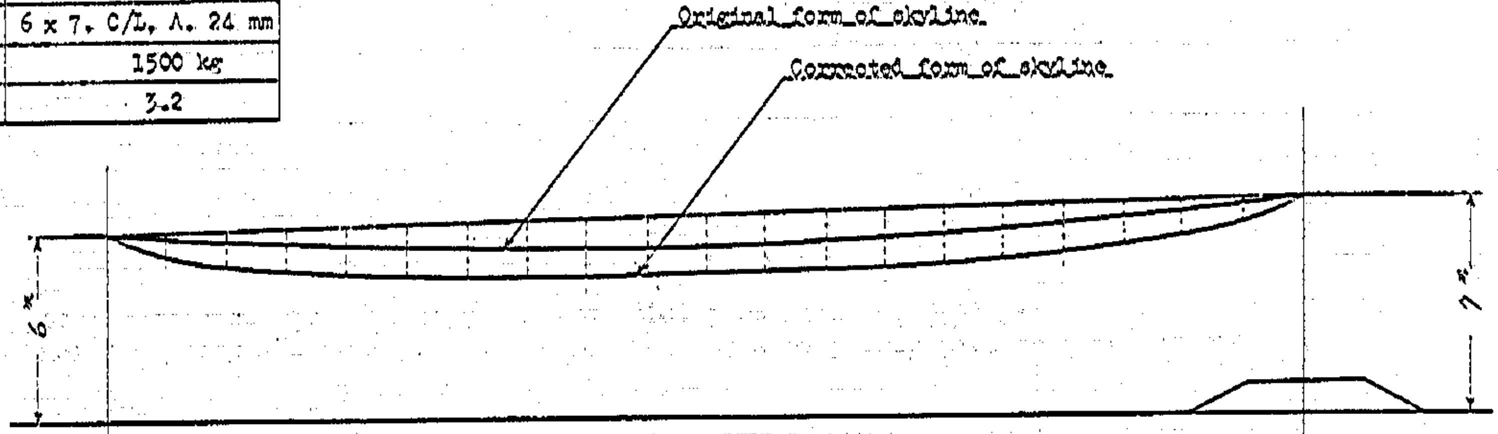
   Snapping system: $W' = \frac{1}{2} W_1'$

6. About the Falling block system & Endless system. when the haul back line is fixed to the loading block. the value (34) T_2' should use the upper line value of (23) P_ℓ.

Fig 5 (10) Original form of skyline and load locus curve of model skyline in Madiun Training Center

S - 1/200

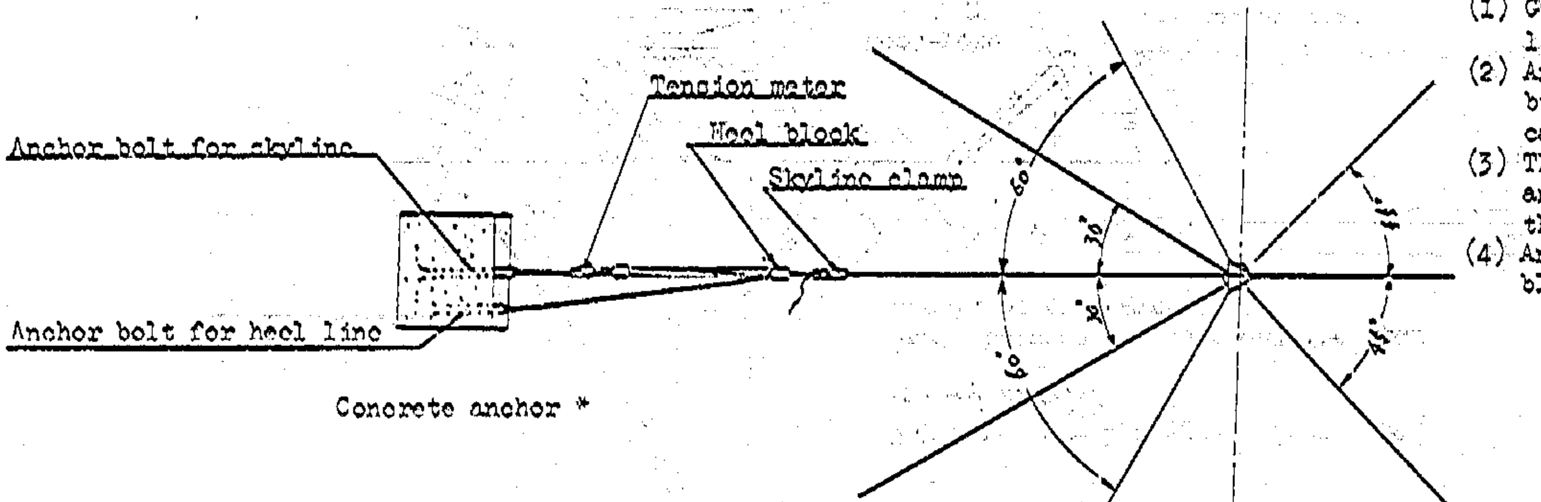
Horizontal distance	40 m
Inclination angle	1° 26′
Central sag-span ratio	0.025
Main cable	6 x 7, C/L, A. 24 mm
Maximum loading weight	1500 kg
Safety factor	3.2



Distance coefficient	l_2	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
Horizontal distance	x	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
Form coefficient	m	0.19	0.36	0.51	0.64	0.75	0.84	0.91	0.96	0.99	1.0	0.99	0.96	0.91	0.84	0.75	0.64	0.51	0.36	0.19
Original form	f_r	0.19	0.36	0.51	0.64	0.75	0.84	0.91	0.96	0.99	1.0	0.99	0.96	0.91	0.84	0.75	0.64	0.51	0.36	0.19
Sag increase coefficient	r	2.65	1.92	1.62	1.44	1.33	1.26	1.21	1.18	1.16	1.15	1.16	1.18	1.21	1.26	1.33	1.44	1.62	1.92	2.65
Load locus curve	f_R	0.50	0.69	0.83	0.92	1.00	1.06	1.10	1.13	1.15	1.15	1.15	1.13	1.10	1.06	1.00	0.92	0.83	0.69	0.50
Coefficient of correction	E										1.65									
Corrected form	f_o'	0.83	1.14	1.37	1.52	1.65	1.75	1.82	1.86	1.90	1.90	1.90	1.86	1.82	1.75	1.65	1.52	1.37	1.14	0.83
Span	l_o										40 m									

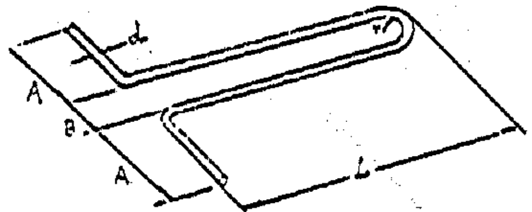
Fig 5 (11) Details of head spar and skyline anchor

(1) Guy lines of head spar are 1 stage-6 lines type.
(2) Anchor of guy line is the buried log type. same as the case of guide spar.
(3) The angle between guy line and the spar should be less than 45 degrees.
(4) Anchor of skyline is concrete block construction.

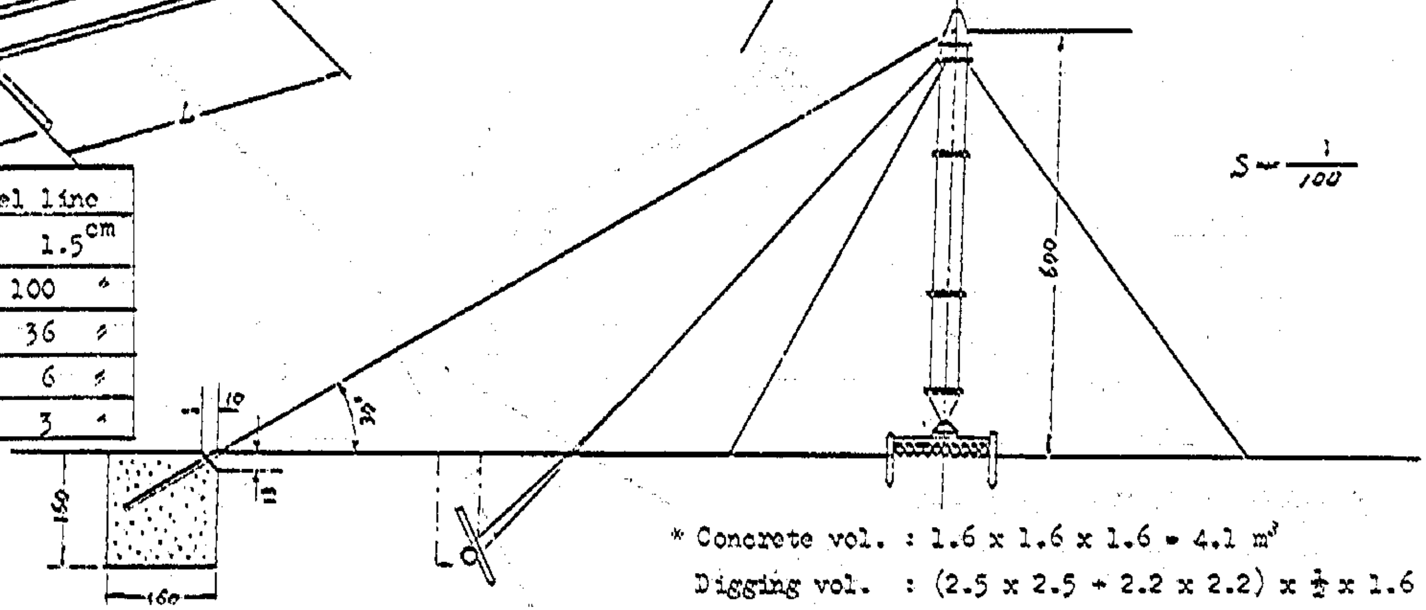


Concrete anchor *

Anchor bolt



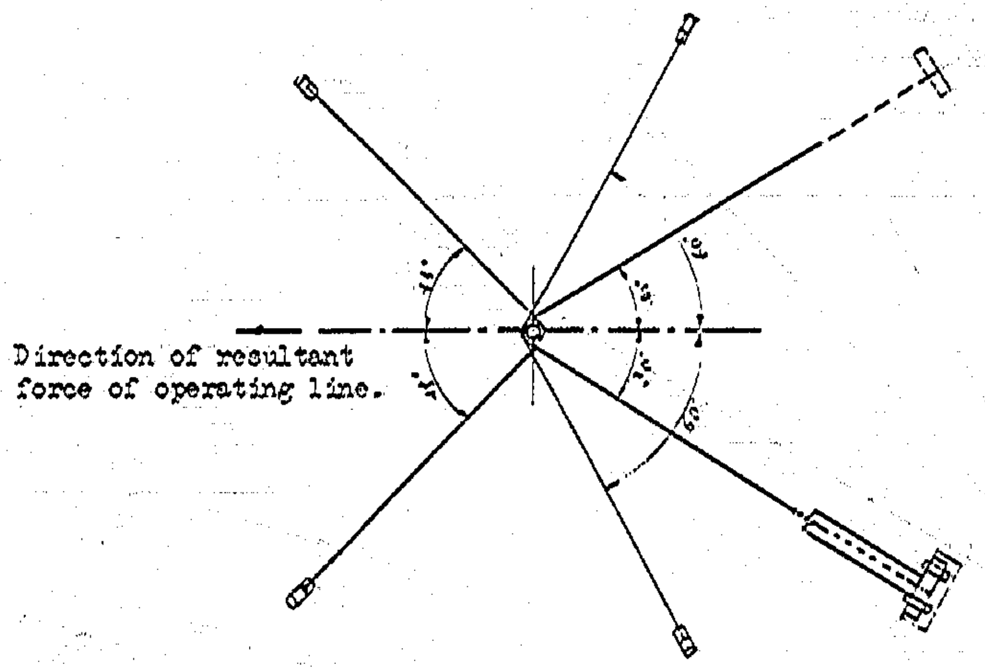
Sign	Skyline	Heel line
d	2.5^{cm}	1.5^{cm}
L	150 〃	200 〃
A	60 〃	36 〃
B	10 〃	6 〃
r	5 〃	3 〃



* Concrete vol. : 1.6 x 1.6 x 1.6 = 4.1 m^3
Digging vol. : (2.5 x 2.5 + 2.2 x 2.2) x $\frac{1}{2}$ x 1.6 = 9.0 m^3
Concrete frame size: (1.6 x 1.6) x 4 = 10 m^2

Fig 5 (12) Details of guide spar

S = 1/100



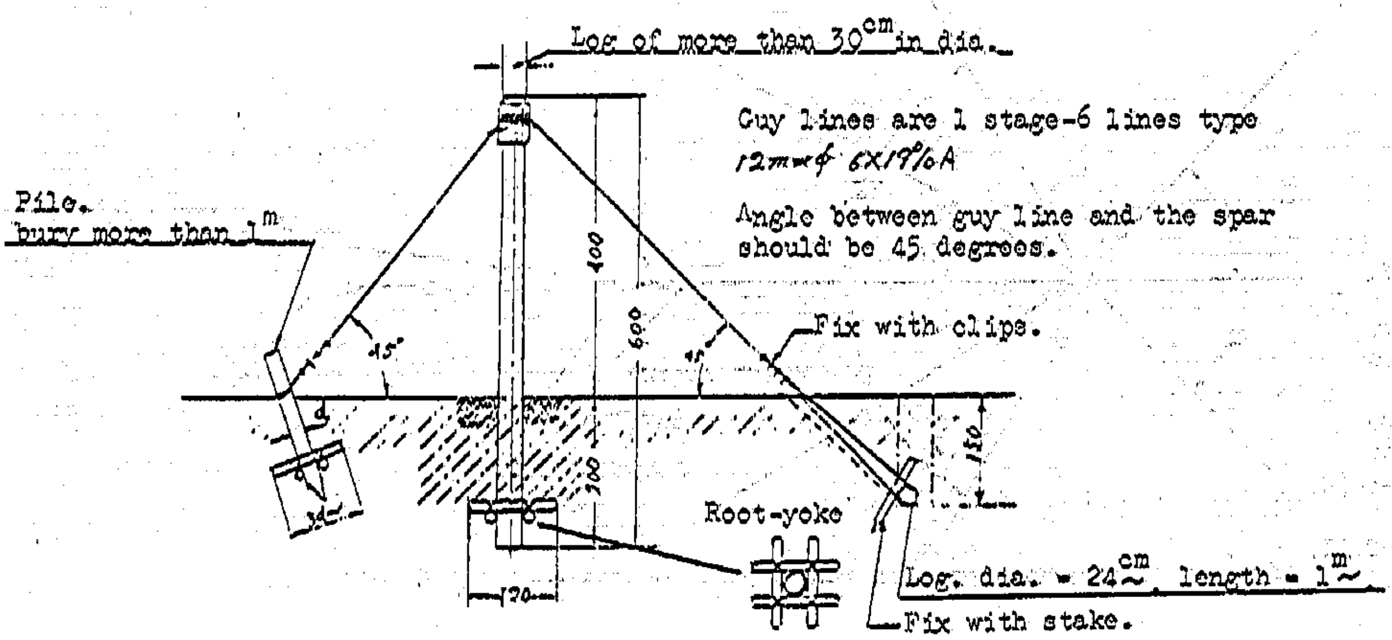
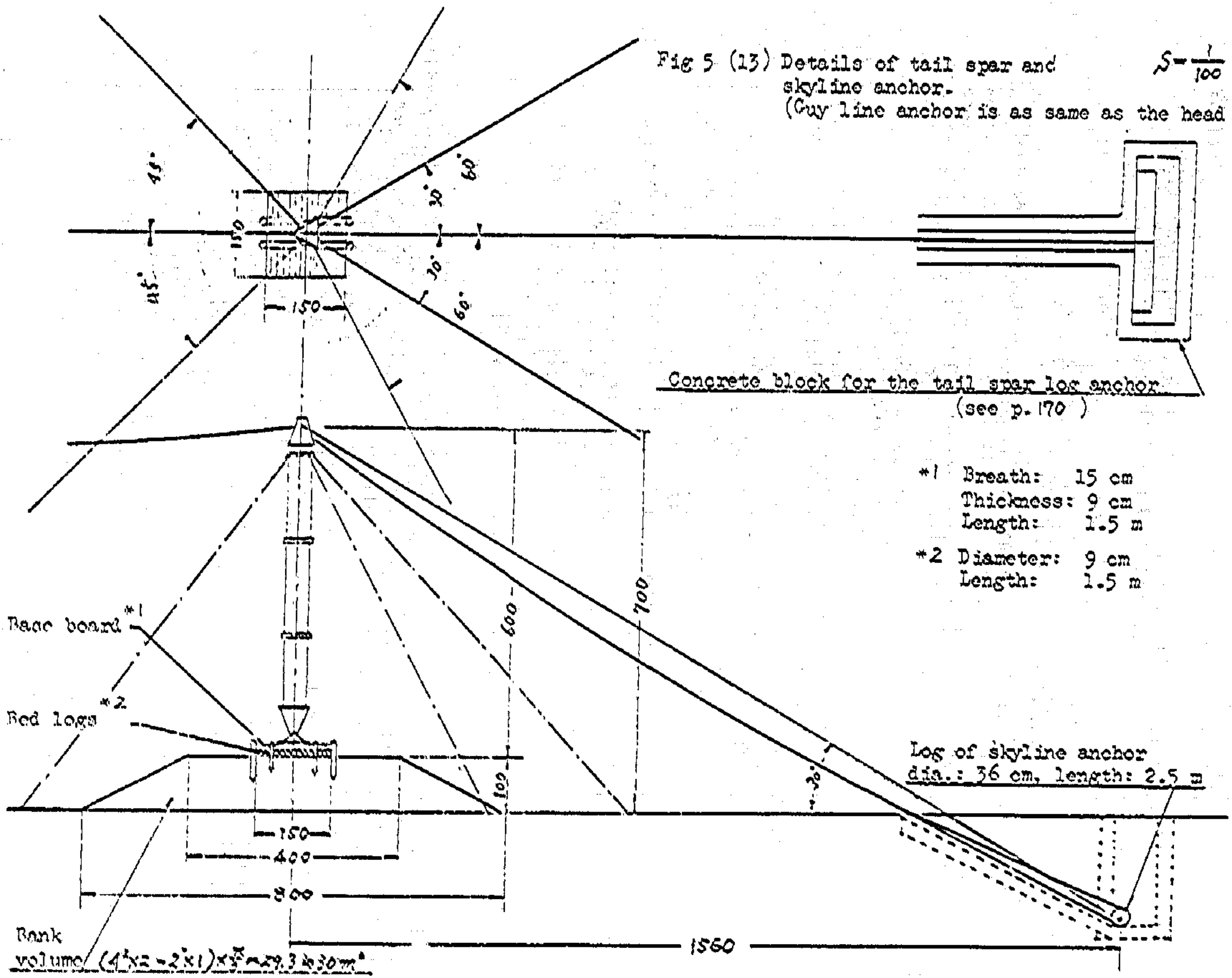


Fig 5 (13) Details of tail spar and skyline anchor.
(Guy line anchor is as same as the head spar)

$S = \frac{1}{100}$



(Reference)

Data used in making the design sheet of the model skyline in Madiun Training Center.

1. Design sheet: (15) Equivalent coefficient of sag-span ratio Z_1 is derived from the following formula.

$$Z_1 = \frac{1+n}{\sqrt{1+3n+3n^2}} \qquad \text{Where, } n = \text{load ratio.}$$

$$Z = \frac{1+23}{\sqrt{1+3\times 23+3\times 23^2}} = \frac{24}{\sqrt{1657}} \fallingdotseq \frac{24}{40.7} \fallingdotseq 0.59$$

2. Design sheet: (18) Coefficient of maximum tension ψ_1 is derived from the following formula.

$$\psi_1 = \frac{\sqrt{1+(4S_1+\tan\alpha)^2}}{8S_1} = \frac{\sqrt{1+(4\times 0.0148+\tan 1°28')^2}}{8\times 0.0148}$$

$$= \frac{\sqrt{1+(0.0592+0.0256)^2}}{0.1184}$$

$$\fallingdotseq 8.48$$

3. Coefficient of maximum tension ψ_0 of no-load wire tension in the calculation of the correcting coefficient (21) is as follows.

$$\psi_0 = \frac{\sqrt{1+(4S_0+\tan\alpha)^2}}{8S_0} = \frac{\sqrt{1+(4\times 0.025+\tan 1°28')^2}}{8\times 0.025}$$

$$= \frac{1.00778}{0.2}$$

$$= 5.04$$

4. Elastic elongation ratio per 1 ton of tension difference λ.

$$\lambda = \frac{1}{A\times E}$$

Where, A: Effective sectional area of wire (mm^2)

E: Elastic coefficient of wire (t/mm^2)

Express these value in the form of table, it will be as follows.

Elastic elongation per 1 ton by tension difference. (Apply to new rope)

Diameter of wire rope (mm)	Elastic elongation per 1 ton by tension difference λ	Diameter of wire rope (mm)	Elastic elongation per 1 ton by tension difference λ
8	0.00384	22	0.00053
9	0.00303	24	0.00042
10	0.00250	26	0.00036
12	0.00180	28	0.00032
14	0.00135	30	0.00028
16	0.00094	32	0.00025
18	0.00076	34	0.00021
20	0.00063	36	0.00019

Note: JIS 6 x 7 Lang's lay.

In case of used rope, adjust the value of the above table, as follows.

Table value x 1/1.4 (or 0.7)

5. Correction coefficient of elastic elongation ε_e will be derived from the Following formula,

$$= \frac{1}{2}\left\{1 + \sqrt{1 + \left(1 + \frac{3}{8 \cdot S_o^2 \cos^4\alpha}\right)\Delta\ell}\right\}$$

$$= \frac{1}{2}\left\{1 + \sqrt{1 + \left(1 + \frac{3}{8 \times 0.025^2 \times \cos^4 1^\circ 26'}\right) \times 0.00721}\right\} = 1.655 \doteq 1.65$$

6. As for the correction of the displacement of the supporting points, we did not consider in this case, because wethought that the displasement of the saddle blocks are neglegible small owing to the application of the artificial spar, but in general, the correction coefiicient of the displacement of the supporting point are derived from the following formula,

$$\varepsilon_d = \sqrt{\frac{1 + \frac{3}{8\,S_o^2\,\cos^4\alpha}\Delta d}{1 - \Delta d}}$$

7. In calculating the safety coefficient of operating line, (28)Load pulling coefficient $\sin\beta$ will be derived from the following equation,

$$\tan\beta = \tan\alpha + 4 \cdot SB \quad ----(1)$$

here, SB will be got from (27) or (27), then we can get the value of $\tan\beta$. Search the value of $\tan\beta$ in the Trigonometrical Function Table and read the corresponding $\sin\beta$ from it.

Or, we can get by calculation as follows,

$$\sin\beta = \frac{\tan\beta}{\sqrt{1 + \tan^2\beta}} \quad ----(2)$$

from (1) $\tan\beta = \tan 1^\circ 26' + 4 \times 0.041$
$= 0.025 + 0.164 = 0.189$

from (2) $\sin\beta = \frac{0.189}{\sqrt{1 + 0.189^2}} \doteq 0.185$

8. Drawing the original cable form and the load-locus curve.

(1) Distance coefficient: K   Rate of horizontal distance by $\frac{1}{20}$, in order.

(2) Coefficient determined by the horizontal distance from lower end: m
Correspond to K and be derived from $m = 4\ (K - K^2)$

Table of value m

COefficient of distance. K	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
	0.95	0.90	0.85	0.80	0.75	0.70	0.65	0.60	0.55	
Form coefficient. m	0.19	0.36	0.51	0.64	0.75	0.84	0.91	0.96	0.99	1.00

(3) Original cable form f_x will be derived fromethe equation: $f_x = f_o \times m$
That is, the value f_x is derived from the central sag multiplied by coefficient m.

(4) Coefficient of sag increasement r will be derived from the following equation,

$$r = \frac{1 + 2n}{\sqrt{1 + 12(n + n^2)(K - K^2)}}$$

where n: Load ratio, $n = P/W$

K: Coefficient of distance

or also be derived from the varied form of above equation,

$$r = \frac{1 + 2n}{\sqrt{1 + 3m\,(n + n^2)}}$$

where, m: Coefficient (Form) $m = 4\,(K - K^2)$

(5) Load-locus curve f_D will be got as follows:

Coefficient of sag incresment (r) x Sag amount (f_r)

(6) Corrected load locus f_D' willbe got as follows:

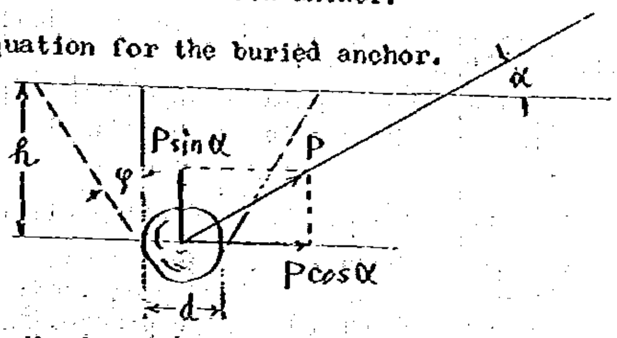
Coefficient of correction (ε) x Load-locus curve (f_D)

(Reference)

About the strength of the buried anchor.

1. Strength calculating equation for the buried anchor.

Fig. 1



As shown in fig 1, bury the log in h meter deep horizontally.
If we set the angle between the connecting wire and the horizontal line as α, tension force as P kg then the force to pull out the log is "P sinα".
For this, the volume of earth on the upper side of the log weighing it and the shearing force of the earth exert on the sides as they pulled out will resist on four sides and come to ballance.

In this case, neglect the weight of the log buried then:

(1) Weight of earth on the upper side of the log = $d \times h \times \ell \times r$
Where ℓ = Length of log (m)
r = Weight of earth per unit vol. (kg/ m^3)

(2) Shearing resistance of earth = $r \cdot h^2 (\ell + d) \tan\varphi$
Where φ = Repose angle of earth and sand.

Therefore, from (1) & (2)

$$P \sin\alpha = r\left\{h \cdot d \cdot \ell + h^2 (\ell + d) \tan\varphi\right\}$$

$$\therefore \; P = r\left\{\frac{h \cdot d \cdot \ell + h^2 (\ell + d) \tan\varphi}{\sin\alpha}\right\}$$

2. Angle of repose and the weight of earth & sand.

Angle of repose and the weight of earth & sand vary with the location, but as for the anchor used in the spot, it need not so serious value from our experience.

Actually, the angle of repose as 30 degree and the weight as 1800 kg/ m^3 will do.

3. Calculation chart

Next charts are derived from the value calculated by the equation already mentioned. we set α= 15°, 20°, 25°, 30° and in actual case, this range will do sufficiently.

The strength of anchor is small in case of h =1.0 m, the small size anchor is used frequently in setting the wiring system, for instance the fixing of yarder, guide block anchor, etc. and so we adopted these ones.

Now, the idea for the factor used in making these chart is as follow.

(1) Depth of burying: h
As the hole to bury the log becomes deeper, the excavation of soil becomes harder and inefficient.
In general, 2 m is the limit.

(2) Length and diameter of the log: ℓ, d
The longer the log, the stronger the strength of anchor. But, the log is slender we fear that the log will be sheared by the connecting wire if it used for long period.

Therefore, about 2.5 m length is the limit and for greater capacity cover the length by the size.

In some case, the transportation of big size log is not easy, then the maximum is thought to be 55 cm in diameter.

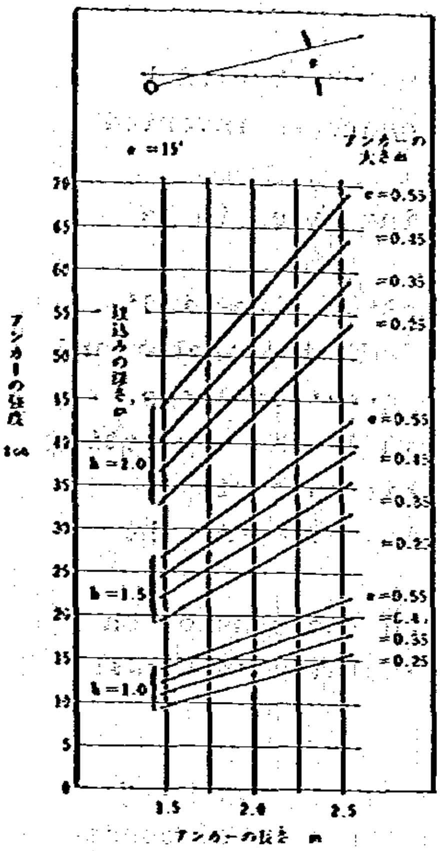
(3) Inclination angle of the connecting wire: α

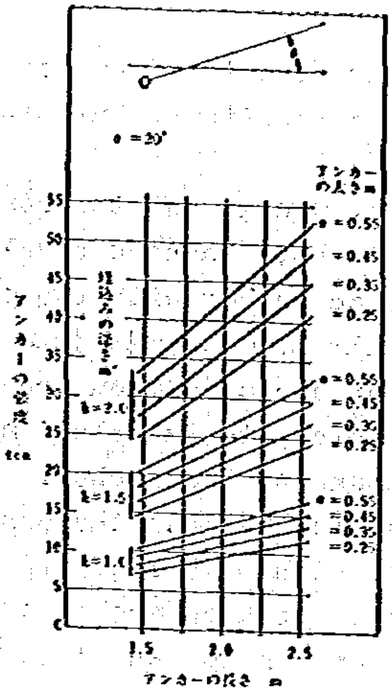
It is good to bury the log in the distance more than twice of the height of spar like head spar ,tail spar, etc.
Thatis the inclination of the connecting wire is less than 30 degrees, and select the size of the log to be buried.

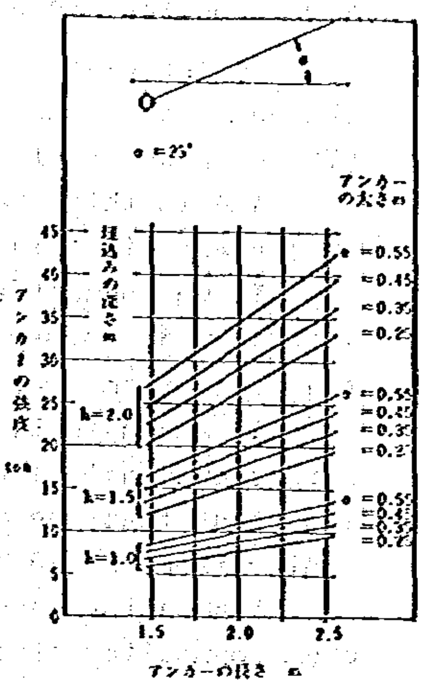
4. Safety factor

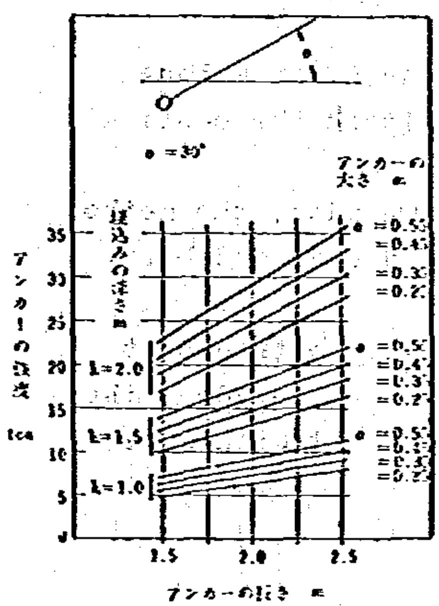
The strength of the anchor would be enough, if it is three times of the maximum tension exeerted on the connecting wire.

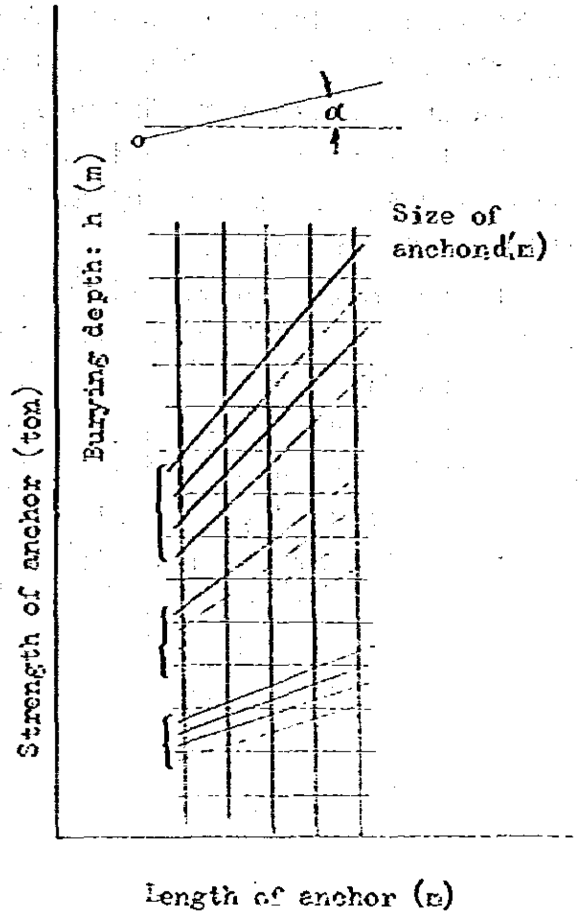
Or, the anchor strength equal to the breaking strength of the wire used.


α = 15°
アンカーの大きさ m
アンカーの強度 ton
埋込みの深さ h m
h = 2.0
h = 1.5
h = 1.0
アンカーの長さ m


α = 20°
アンカーの大きさ m
アンカーの強度 ton
埋込みの深さ m
h = 2.0
h = 1.5
h = 1.0
アンカーの長さ m


α = 25°
アンカーの大きさ m
アンカーの強度 ton
埋込みの深さ m
h = 2.0
h = 1.5
h = 1.0
アンカーの長さ m


α = 30°
アンカーの大きさ m
アンカーの強度 ton
埋込みの深さ m
h = 2.0
h = 1.5
h = 1.0
アンカーの長さ m


α
Size of anchond(m)
Burying depth: h (m)
Strength of anchor (ton)
Length of anchor (m)

5 Combination anchor.

In the case, where the large anchor can not be buried by the conditions and the locations, bury two anchors in inverted "V" as shown in Fig 2.

And in this case, manage the two connecting wires to be in one and fix this to both anchors equally.

If we connect each anchor with two connecting wires indivisually, it causes the one side loading and both the anchor and the connection wire of one side alone receive great tensions.

As shown in Example 1 to Example 4 and Fig 3, the connecting wire should not be wound to the anchor. In this case, it is important that the angle β between the connecting wire and the center line should be within 15° degree.

Assume the tension work on anchor as P, and the tension on each connecting wire and anchor as P', then calculated as follows:

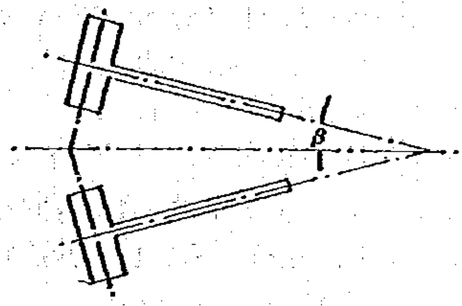
$$P' \fallingdotseq \frac{P}{2\cos\beta}$$

It is important, that in calculating the strength of connecting wire, it must be ballanced to the strength of each anchor, as shown in Example 1 to Example 4.

The logs to be buried is slender and be used for a long period, and is anxious about to be sheared, attach the couling wood as shown in Fig 3.

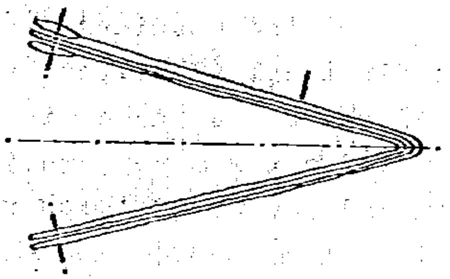
If the anchor is considered to be weak, we adopt the method to apply several pillows to the log on its load side and bury, as shown in Fig 3.

And in case, if we can not get or difficult to transport the log as big in diameter as the calculated size, we adopt the method to assemble several slender ones and bind it with wire or strand and bury as shown in Fig 3.

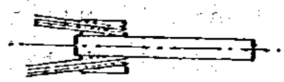


(Fig 2)

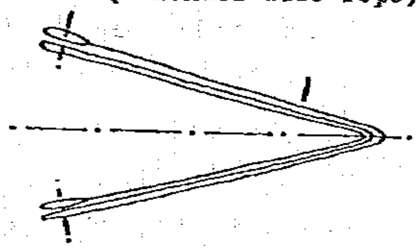
(Example I) Connecting wire (Slender wire rope)



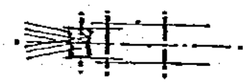
(Example 3) Special clamp, as fixed.



(Example 2) Connecting wire (Slender wire rope)

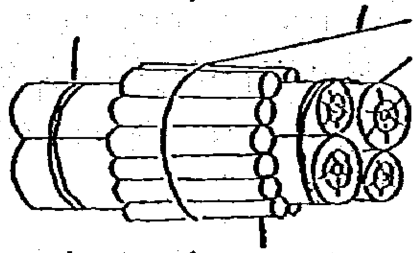


(Example 4) Heel block, as attached.



(Connecting wire)

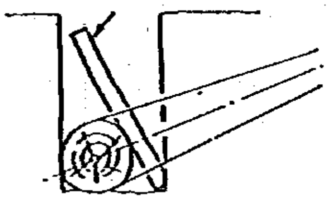
(Wire or strand)



Wood protector(Coul ing)

(Fig 3)

(Pillow)



(Fig 4)

5-3 Base construction of the Training facilities in the Training Center.

(1) Work shop. (See the separate drawing).

Divide the existing building of 10 m wide by 30 m long in two of 10 m by 18 m for this work shop and 10 m x 12 m for the training of saw-sharpening, as it is now.

The floor of this building is the earth & sand, covered with tile, but it must be reconstructed to the stronger one in order to draw in the heavy machines like yarder & tractor, and execute the training on adjusting the machines.

For this purpose remove at first all the tiles and dig 35 cm in depth and especially the place where the anchor is to be constructed (7 spots in total, and 2 m x 2 m per spot) is 50 cm in depth, as the base excavation and lay 20 cm thick macadam in this base excavation and over this, lay 15 cm thick, in general place and 30 cm thick in anchor place of concrete pavement.

And as for the anchor, fix the special anchor metal fittings beneath the floor surface and cover the anchor cave with wooden cover.

(2) Warehouse and Loading & unloading place.

This construction work has 3 items in it, the Macadam paving of 1923 m^3 at the warehouse and the loading & unloading place, the concrete paving (two spots of 4 m wide, 5 m long) in front of the entrance of work shop, and the Macadam paving of the new road (3 m wide, 27.5 m long)

The warehouse and the loading & unloading place are now earth & sand and some part is swamp, that we fear it to become muddy when used, and so we planned to pave there by Macadam in order to strenghen the base.

The western side entrance of the work shop is one now, but to ease the taking in and taking out of machines ——— ——→ we make another entrance in the northern side and pave the concrete of 10 cm thick ————————————→ over Macadam pavement already desribed.

The Macadam paving of new road is the one which allows the vehicle to pass to the Instrument room and Tools & Parts room.

(3) Check Pit.

For the inspection and adjustment of tractor and truck, etc and loading & unloading of tractor. we made it with concrete, and details are shown in the separte drawing.

(4) Arch, loading & unloading.

To unload & load the heavy things to be carried into the work-shop like yarder, etc. we are going to construct this arch near the southern side entrance of work shop with the iron framing, the details of which is shown in the separte drawing.

(5) Base for the Model skyline .

The construction of Model skyline is planned in the west side opening of the ware-house, but this place is, in general, mostly of low and marshy one, and is suspected to become the obstacles in executing the training operations, that we planned to fill up the whole area as shown in the separate drawing.

Also, as the construction of bases of the model skyline , we planned the anchors for head and tail spars, the banking for the tail spar, and the excavations of holes of 41 spots, 97 m^3, necessary for the wiring.

About the details, see the separte drawing.

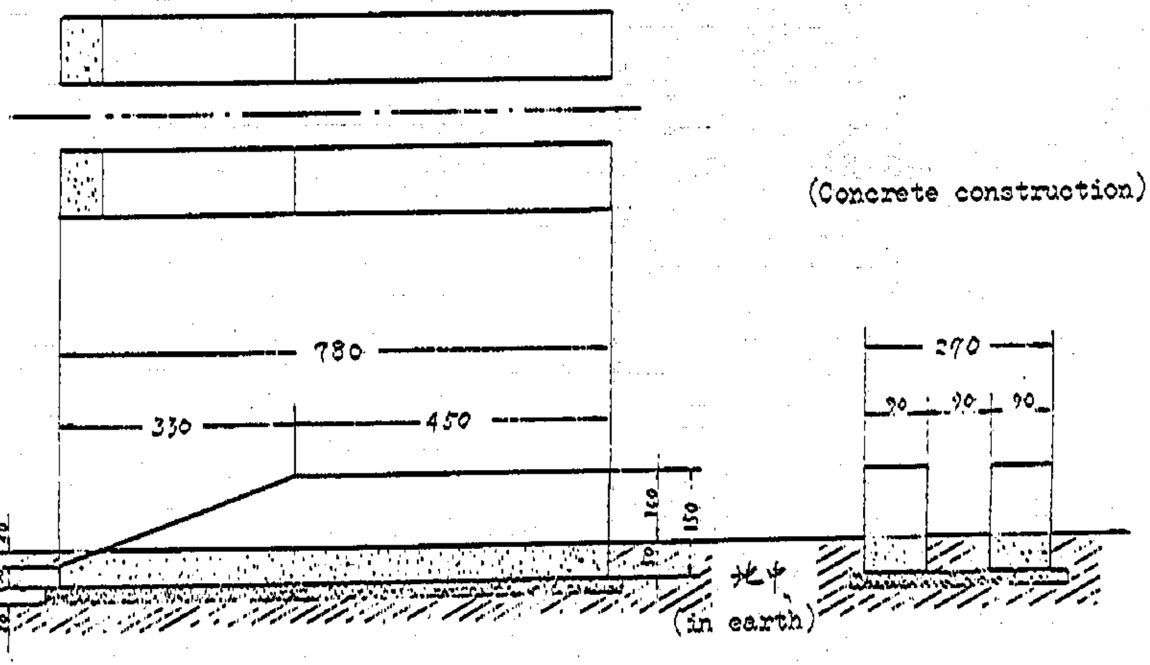
(5) Tractor training stand.

This is planned to the south of the location of Model skyline , and is mostly of flat ground, but for the trainings of the operations in the sloped land, we construct the trapezoid banking with 10°, 15°, 20° and 30° degrees inclination gradients.

Pit $S = \frac{1}{100}$

(Concrete frame area)

(0.30+1.5)½ × 3.3 × 4	11.88
4.5 × 1.5 × 4	27.00
0.3 × 0.9 × 2	0.54
0.9 × 1.5 × 2	2.70
計	42.12
	≒ 42 m²



Concrete: $\{(7.8 \times 0.9 \times 1.5) - (3.3 \times 0.9 \times 1.2 \times \frac{1}{2})\} \times 2 = 17.5 m^3$

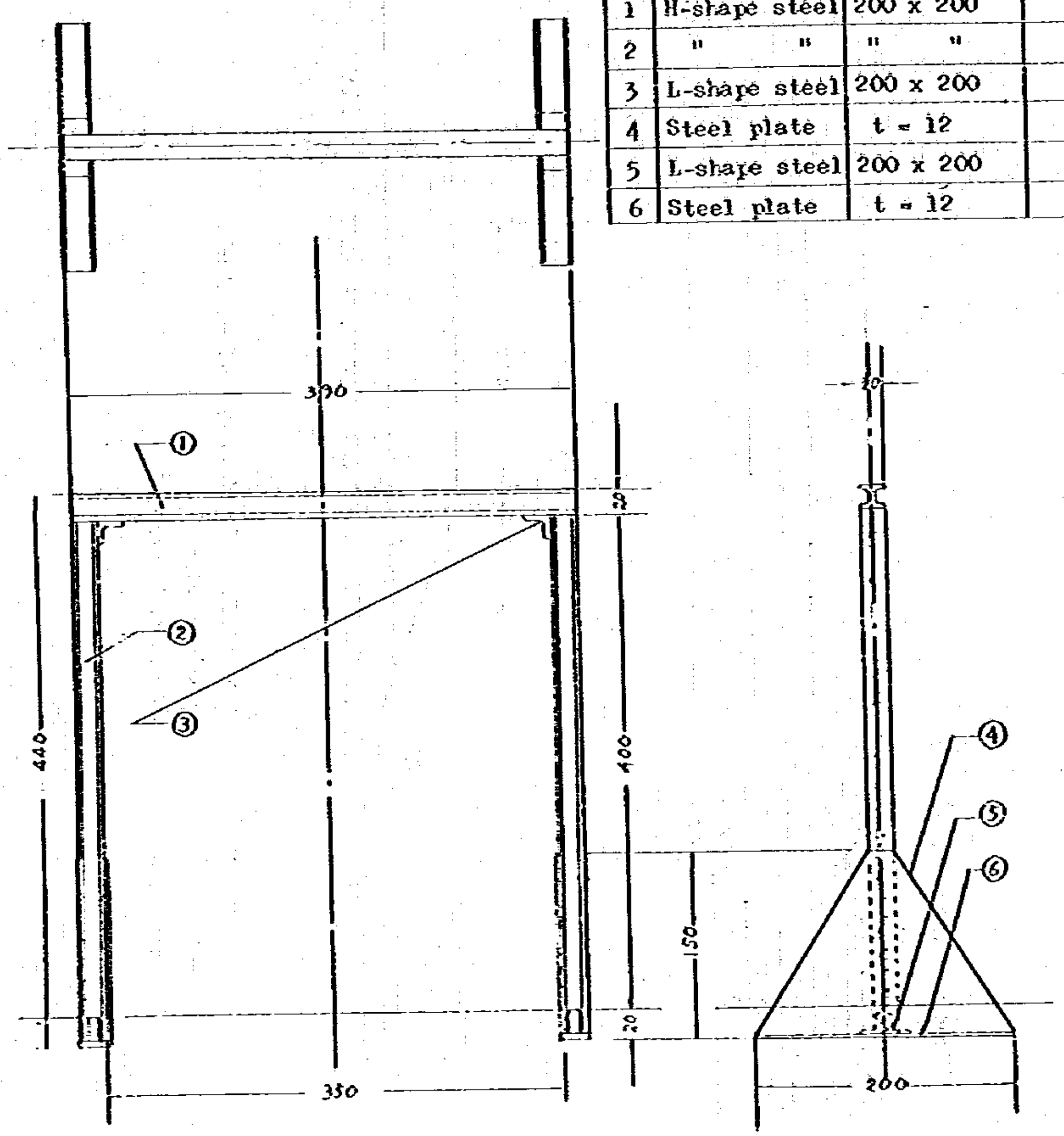
Macadam: $8.2 \times 3.1 = 25.4 m^2$

Base excavation: $8.2 \times 3.1 \times 0.5 = 12.7 m^3$

Arch, Loading/ Unloading.

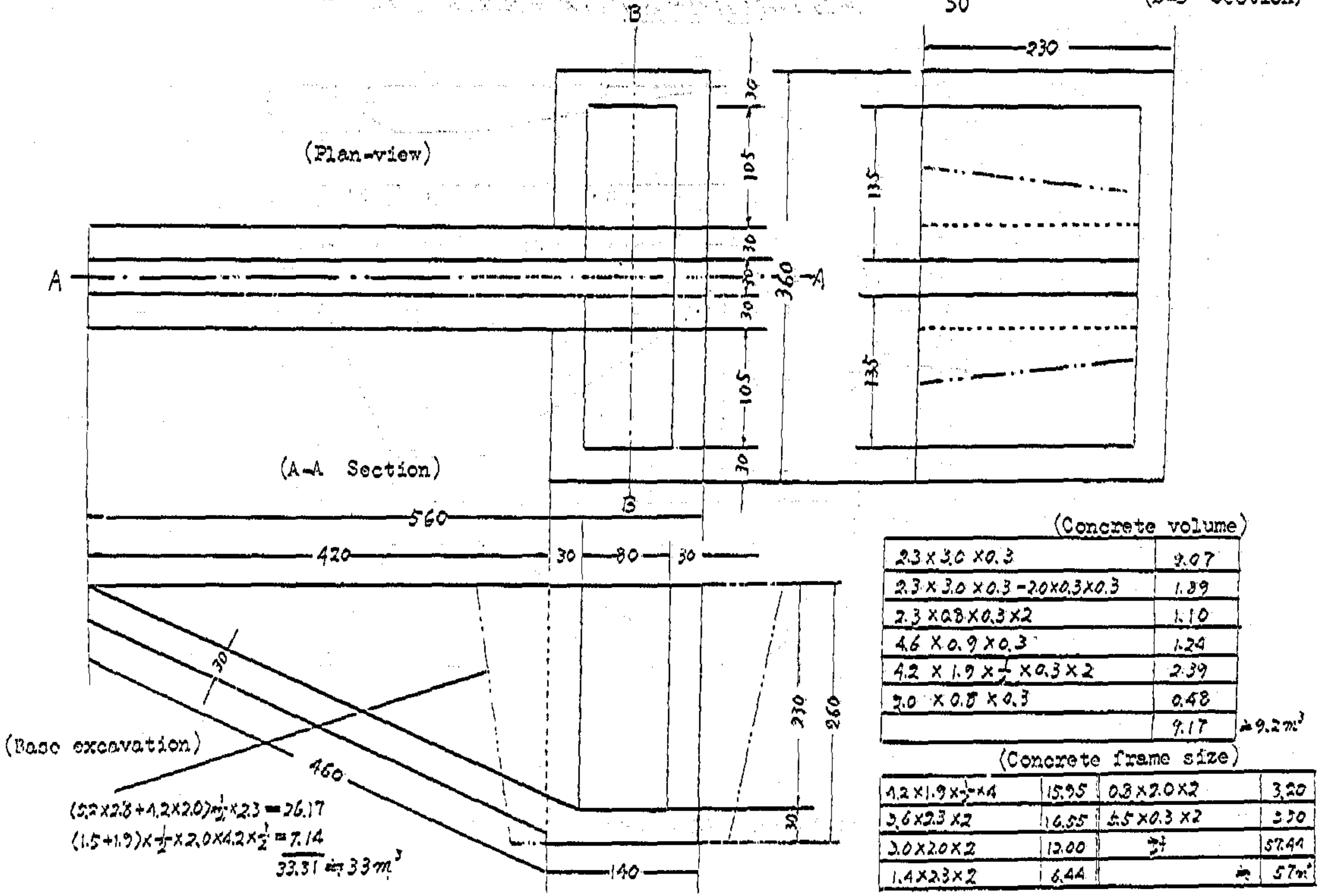
$S = \frac{1}{50}$

No.	Material	Size (mm)	Quantity
1	H-shape steel	200 x 200	1
2	" "	" "	2
3	L-shape steel	200 x 200	2
4	Steel plate	t = 12	4
5	L-shape steel	200 x 200	4
6	Steel plate	t = 12	2



Concrete anchor of tail spar

$S = \frac{1}{50}$



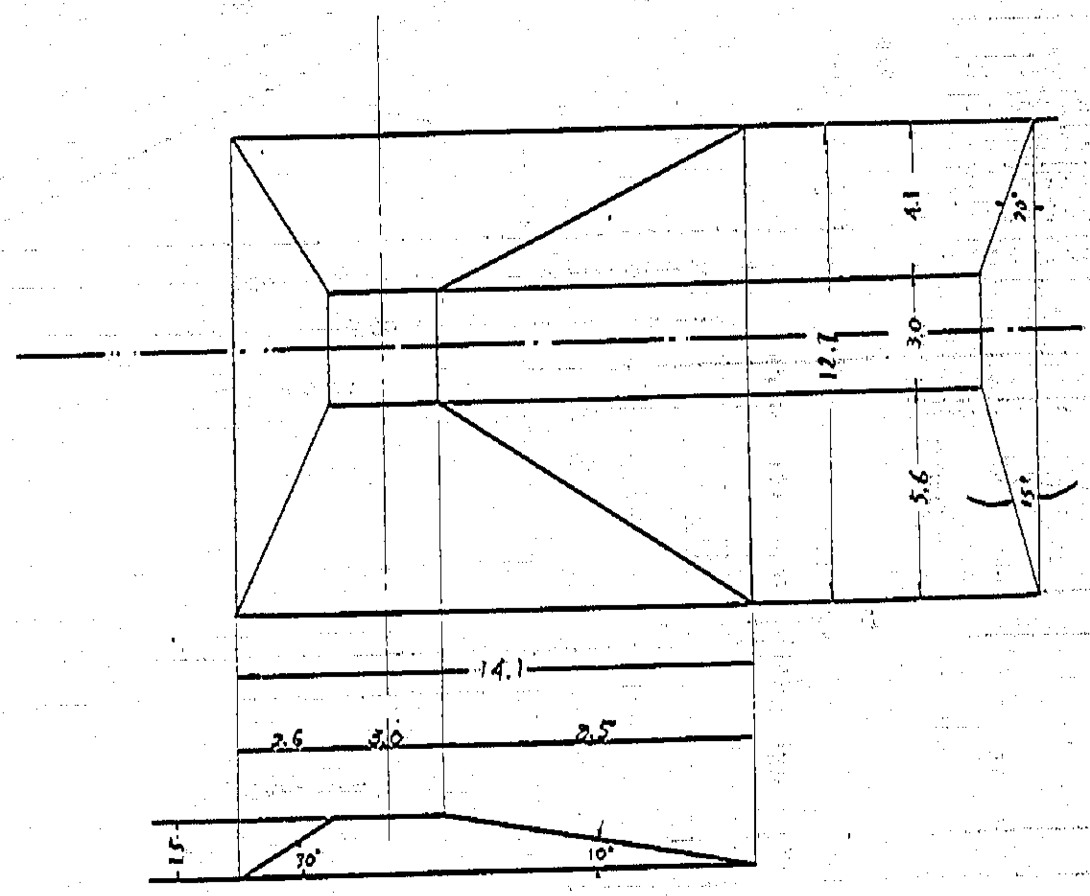
(Concrete volume)

2.3 × 3.0 × 0.3	2.07
2.3 × 3.0 × 0.3 − 2.0×0.3×0.3	1.89
2.3 × 0.8 × 0.3 × 2	1.10
4.6 × 0.9 × 0.3	1.24
4.2 × 1.9 × 1/2 × 0.3 × 2	2.39
2.0 × 0.8 × 0.3	0.48
	9.17 ≒ 9.2 m³

(Concrete frame size)

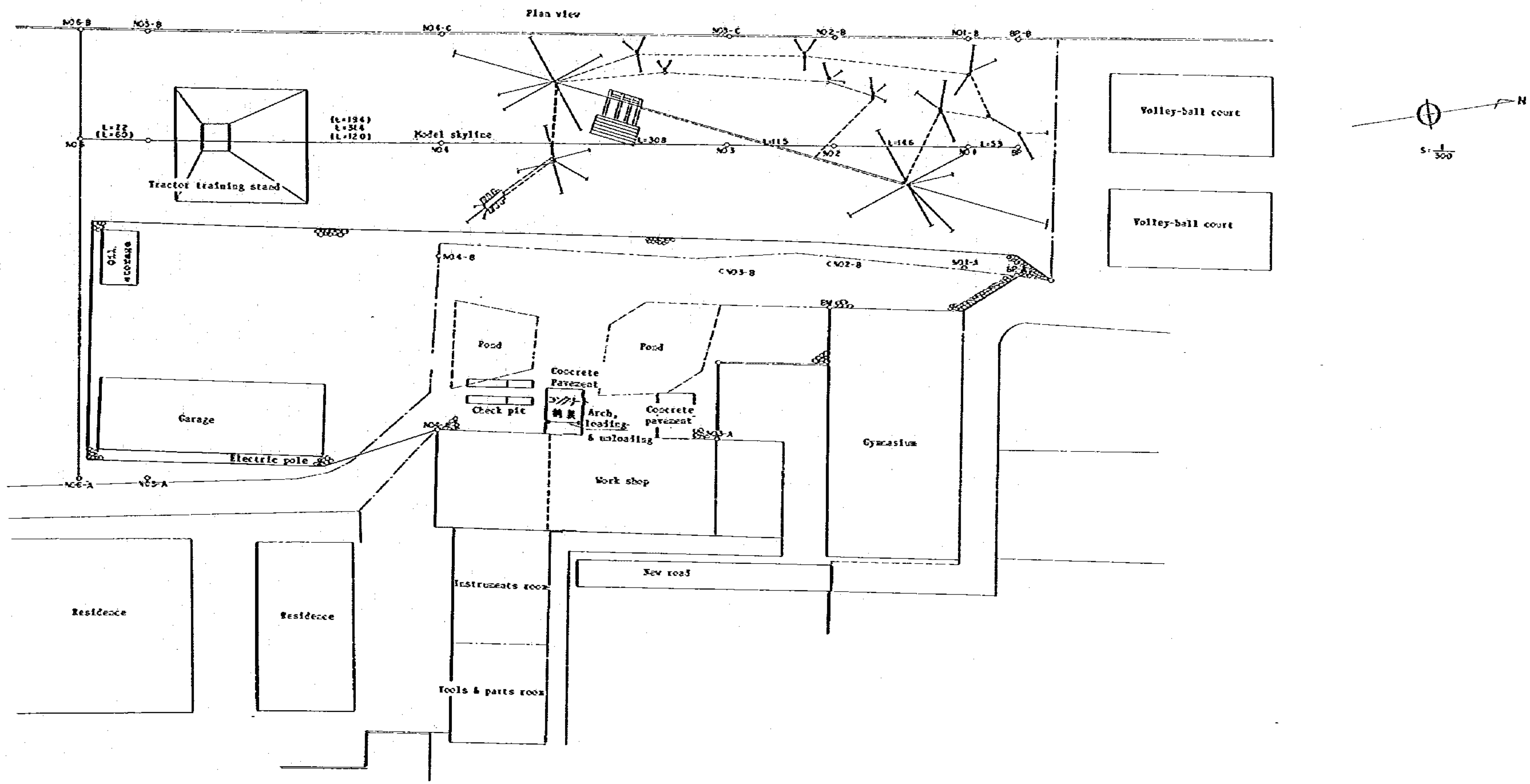
4.2 × 1.9 × 1/2 × 4	15.95	0.8 × 2.0 × 2	3.20
3.6 × 2.3 × 2	16.55	5.5 × 0.3 × 2	3.30
3.0 × 2.0 × 2	12.00	計	57.44
1.4 × 2.3 × 2	6.44	≒	57 m²

Tractor training stand

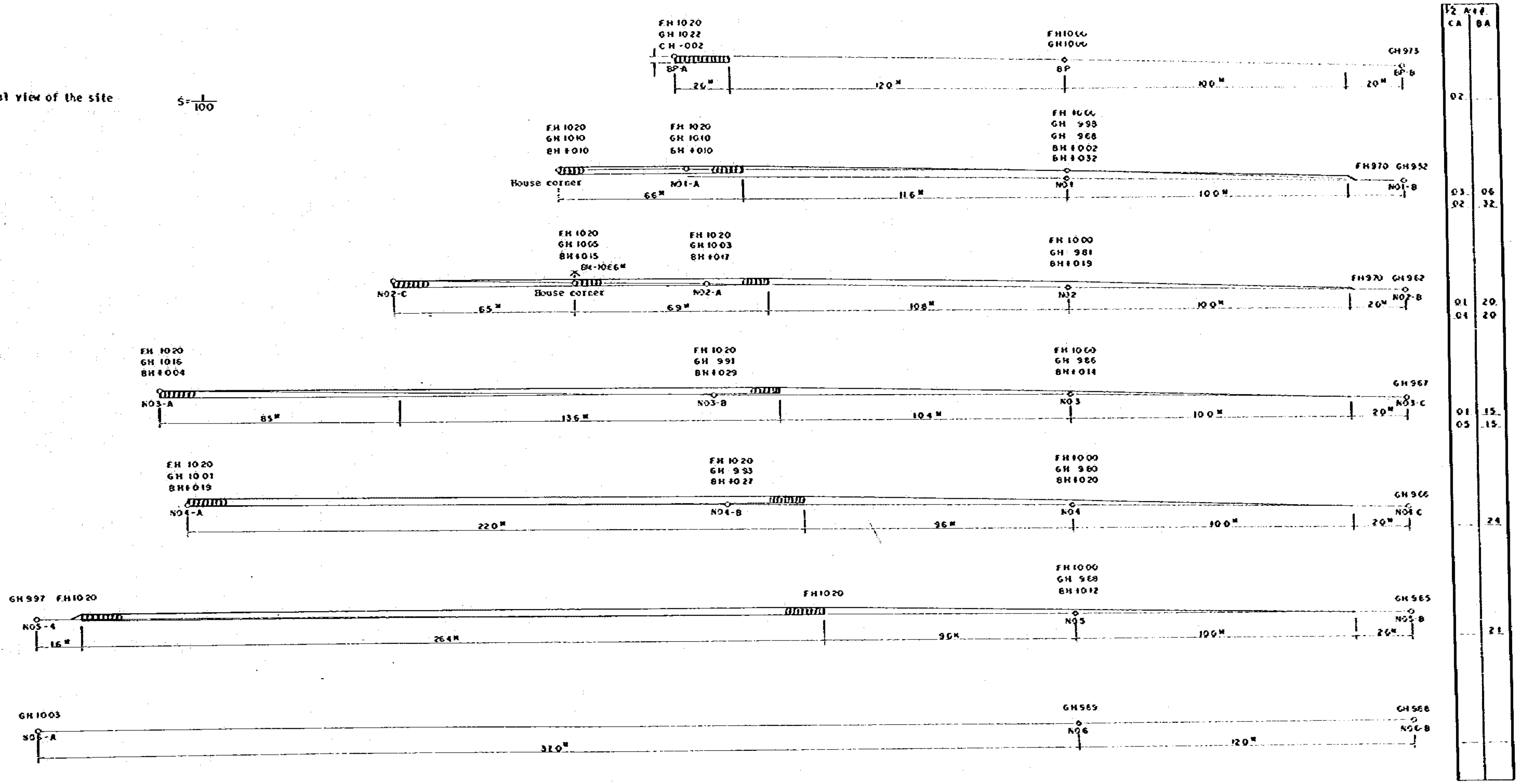


$$V = \frac{1}{3} \times 1.5 \, (14.1 \times 12.7 + 3 \times 3 + \sqrt{14.1 \times 12.7 \times 3 \times 3}\,) = 114.1\,m^3$$

Base construction of the facilities for the machine training in the Training Center

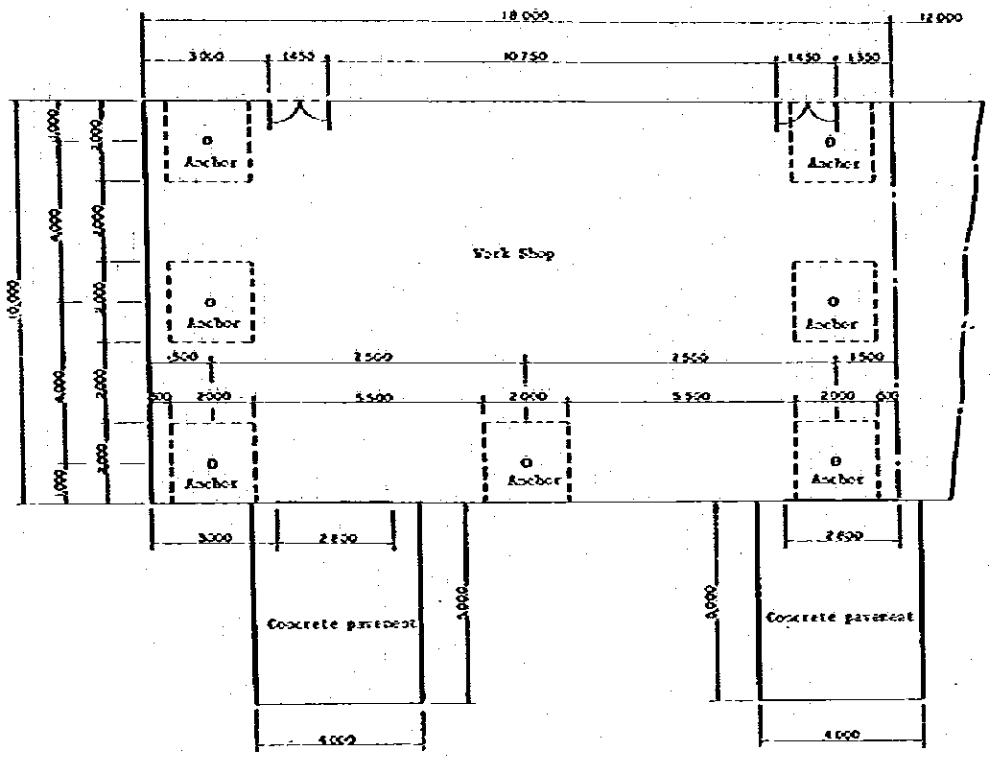


Cross-sectional view of the site $S=\frac{1}{100}$



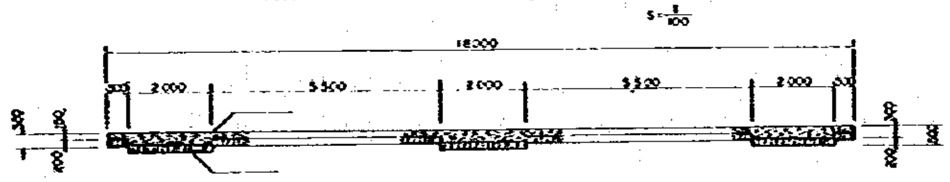
Plan view of the work shop for the machine adjustment

S= 1/100



Sectional view of the work shop for machine adjustment

S= 1/100



Details of the anchor in the work shop for the machine adjustment

S= 1/5

Plan

Cover

Section

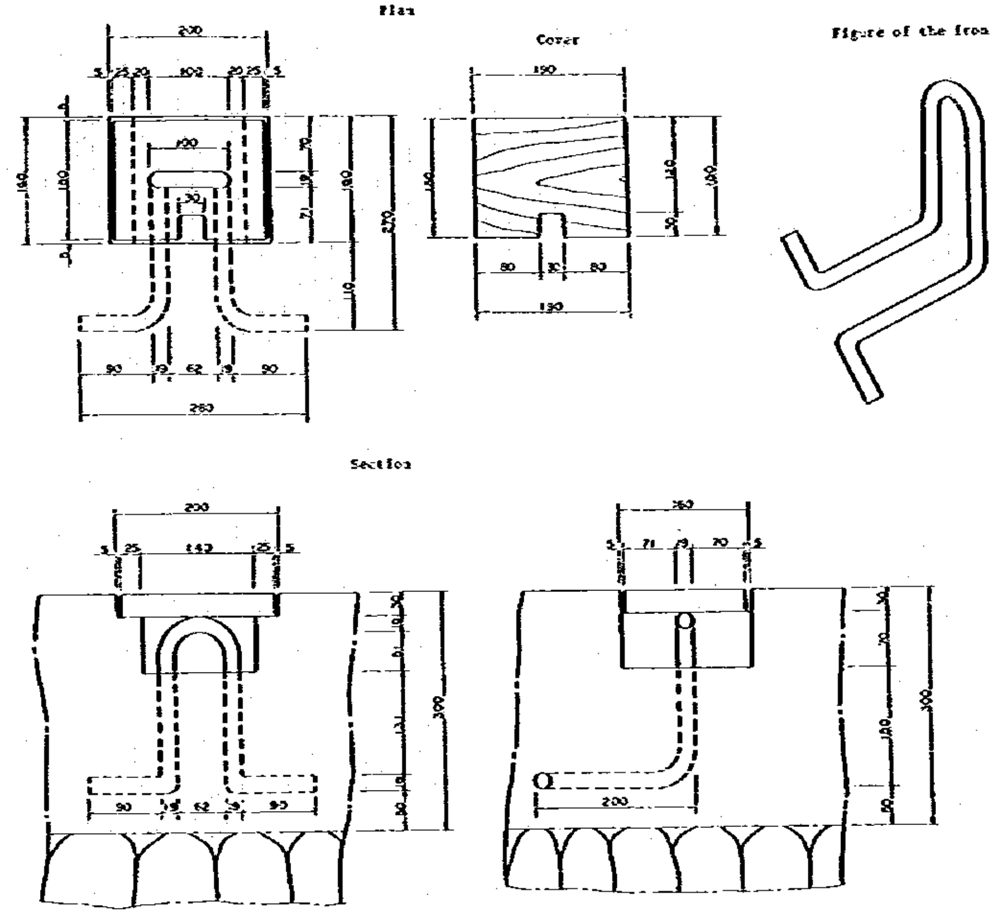
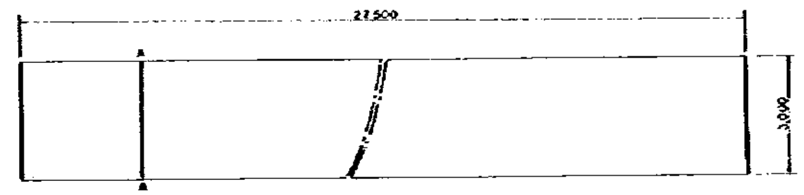


Figure of the iron fitting

New road

S= 1/100

Plan



A — A Section

S= 1/50

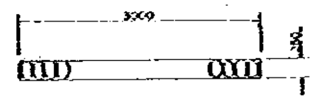


Table of the numerical calculation of the work shop for the machine adjustment		
Item	Calculation formula	Quantity
Floor concrete	{(0.15 x 18.0 x 10.0) + (0.15 x 2.0 x 2.0) x 7}	31.2 m³
Macadam	18.0 x 10.0	180.0 m²
Base excavation	{(0.35 x 18.0 x 10.0) + (0.35 x 2.0 x 2.0) x 7}	67.2 m³
Removing the tile	18.0 x 10.0	180.0 m²
Steel anchor 19∅	1.11 m x 2.23 kg/m x 7	17.3 kg
Concrete pavement	(0.1 x 4.0 x 5.0) x 2	4.0 m³

Table of the numerical calculations for the new road		
Item	Calculation formula	Quantity
Macadam	3.0 x 27.5	82.5 m²
Base excavation	0.25 x 3.0 x 27.5	20.6 m³

5-4 The arranging cost of Madiun Training Center

The arranging cost of Madiun Training Center is 24,500 thousand RP. in total.

The items and details of this is as follows.

The summary table of the cost for the arrangement of Madiun Training Center.

Article	Building	Construction work	Utensils	Improvement	Total	Remarks
Tool and parts room			690	32	722	Unit is 1.000 RP
Instrument room			350	16	366	Number is rounded.
Work shop		3.275	270	230	3,775	
Garage	5.760				5,760	
Oil storage house	960				960	
Model skyline		2,895	720		3.615	
Warehouse & loading and unloading place		6,631			6,631	
Check pit		1.773			1,773	
Arch. loading & unloading		560			560	
Tractor trining stand		338			338	
Total	6,720	15,472	2,030	278	24,500	

Articles of cost for building, utensil and improvement.

Section	Article	Dimension	Quantity	Unit price	Price	Remarks
Building	Oil storage house	Brick bldg. 6 m x 4 m	One house 24 m^2	40	960	Unit: 1,000 RP
	Garage	Wooden bldg. 24 m x 8 m	One house 192 m^2	30	5,760	
	Total		216 m^2		6,720	
Utensils	Tool stand	250 x 160 x 60 cm	10	42	420	
	Parts stand	300 x 160 x 100	6	45	270	
	Instrument stand	200 x 160 x 100	10	35	350	
	Working table	150 x 80 x 80	6	45	270	
	Supplies for model skyline	Details are in separate paper	1 set		720	
	Total				2,030	
Improvement	Lighting, new set	100V, 100 W	10	8	80	Instrument room: 2 Tool & parts room: 4 Work shop: 4
	Wall socket, new set		6	8	48	Work shop: 6
	Door of work shop, new set		1	150	150	
	Total				278	
Sum total					9,028	

Details of the costs of logs purchased for the model skyline

Dimensions	Volume (m^3)	Unit price	Price	Public market price	Remarks
Smaller than 23 cm dia. less than 1 m long.	1.142	16,100	18,400	29,500	Refer to the list of unit price.
Smaller than 23 cm dia. 1.0 - 2.25 m long.	2.674	27,600	73,800	118,400	
Smaller than 23 cm dia. 2.4 - 4.00 m long.	0.960	35,800	34,400	55,200	
24 - 26 cm dia. 1.0 - 2.25 m long.	0.869	29,400	25,300	40,600	
24 cm dia. 5 m long.	5.184	(46,000)	238,500	382,800	38,200 yen is upped by 20 %.
30 cm dia. 2 m long.	0.72	33,100	23,800	38,200	
30 cm dia. 6 m long.	0.577	(55,000)	37,700	50,900	42,300 yen is upped by 30 %.
Sub-total	12.126		445,900	715,600	

Details of costs for the supplies for the model skyline

Item	Dimensions	Quantity	Unit price	Price	Remarks
Logs		12.126 m		715,600	
Clamp	12ϕ mm x 240 mm	40 Pcs.	50	2,000	
Wire	# 10.	16 kg	150	2,400	
Total				720,000	

Log (Teak wood). Unit price list

Diameter \ Length	Less than 1 m	1 - 2.25 m	2.5 - 4.00 m	remarks
21 -23 cm	16,100	27,600	35,800	(1) Price per 1 m. (2) To this price 7% is added.
24 -26 cm	17,100	29,400	38,200	
27 -29 cm	19,300	33,100	42,300	

Note: Public market price is about 50 % added to the above described 7 % up prices.

Details of supplies used in the model skyline

Articles	Item	Dimensions Dia(cm) x Length(m)	Quantity	Volume(m^3)	Remarks
Machine platform	Log	15 x 2	17	0.315	
	"	24 x 1	1	0.058	
	"	12 x 1	8	0.112	
Guide spar	"	30 x 6	1	0.577	Pole
	"	24 x 1	2	0.116	Pillow
	"	20 x 2	4	0.320	Stake
	"	12 x 1.2	4	0.068	Root yoke of pole
	"	12 x 0.8	16	0.192	Root yoke
Head & tail spar	"	24 x 1	12	0.695	Pillow
	"	12 x 1.5	24	0.552	Pillow stopper
Stamp	"	20 x 3	8	0.96	Pole
	"	18 x 1.5	12	0.624	Pile
	"	12 x 0.8	80	0.950	Root yoke
	"	20 x 1	6	0.240	Pillow
	"	12 x 1.5	12	0.275	Pillow stopper
Platform	"	24 x 5	18	5.184	
	"	30 x 2	4	0.720	
	"	12 x 1	12	0.168	
	Clamp	12 φ x 240 mm	40 pcs.		
	Wire	#10	16 kg		
Total				12.126 m^3	

Base construction works of the facilities for Machine Training in the Training Center.

Details of the cost of construction.

Total Sum 6,912,000 Yen

Rate for Yen

Total of the currency on the spot

12,199,747 RP X $\frac{1\ \$\ 234\ \text{yen}}{1\ \$\ 413}$ current on the spot

6,912,206 Yen

RP.(Rupiah) unit of Indonesian Currency

Articles	Quantity	Unit	Unit price	Price	Unit price list No.	Remarks
Ware house and loading & unloading place	2,006	m^2	RP 3,306	RP 6,631,836		
Check pit	1	unit	1,773,870	1,773,870		
Arch. loading & unloading	1	unit	560,613	560,613		
Foundation for model skyline	1	set	2,895,030	2,895,030		
Banking of the tractor training stand	141	m^3	2,400	338,400		
Total				12,199,749		

(Reference)

Construction process

1. Construction work survey

(1) Before to work, orderer or contractor (contractor, in general) should make a essencial survey and make a confirmation of station pile, center line, longitudinal and cross leveling etc.

(2) If there are some differences between spots and drawings as a result of the survey, contractor should inform the result to superintendent and ask for his confirmation.

Note: Superintendent has duties which manage and control the construction work on the part of orderer and so forth.

2. Earth work

(1) Ruler drawing

(a) Breadth of land clearing and road construction, slope gradient etc. should be conformed to the ruler drawing, except for special indications.

(b) Slope adjustment on the spot where slope gradient must be changed by the kind of soil etc. should be worked favourably.

(2) Setting up the finishing stake

Finishing stake should be set up every 20 m or less at the straight part of cutting or banking construction, on the other hand, should be set up with suitable intervals according to the condition of curve, lay of the land and structures.

However, we can omit these one when it is considered to be unnecessary as easy construction.

(3) Land clearing and rooting out

(a) Land clearing

(i) Land clearing work is to fell the standing trees and remove them with weeds, felled trees and other obstacles from the land clearing range indicated by the ruler drawing.

However, when it is considered to be harmless for the stability of banking soil or surplus soil by the tree which stand near the end of banking slope, in spite of the land clearing area, we leave them as they are, instructed by superintendent.

(ii) In case of special indications as to the felling of tree, buck them by the standard size and transport them to the appointed place not to cover with soil or sand.

(iii) The tree which obstruct the traffic and damage the road bed by its branches or it is in danger of fall down, should be cut off the branches or removed as instructed by superintendent.

(iv) Construction work should be started after conclusion of land clearing process.

(b) Root out work

The stump which lie within the cut-off section should be removed, on the contrary, do not remove the stump which lie in the fill-up ground, nevertheless, remove it which lies under the depth less than 50 cm from the formation level to the top of stump.

(4) Raking and scraping

(a) Raking operation

Rake off the covering material of ground surface and remove it, then finish the road in favorable conditions accompanied with cutting and tanking of the road surface.

(b) Scraping

Scraping operation levels the irregular road surface removing the mud on rutted or holey road and make it in good condition covering with gravel or earth and sand of good quality.

(5) Cutting work

(a) Cut off operation

(i) Cut off operation excavate the earth following the finishing stake. When the quality of soil changes on its way, slope gradient should be varied based on ruler drawing.

(ii) Take care, not to excavate deeper than the construction standard mask. When excavate deeper, we must tank up with earth and sand which has a sufficient bearing power of the ground.

(iii) River side part of the natural ground where it is cut off in both sides should be remained as possible as it is, but excepted from this rule with superintendent's permission.

(iv) If the slope containes the slippery soil layer and there is in danger of break down, you must ask for the indication of superintendent.

(b) Cutting slope

(i) Finish the face of slope favourably with indicated gradient, not to have a irregular or curved surface.

(ii) Pay attention not to cut the slope deeper, if failed in cutting, finished the slope as same as indicated slope gradient.

(iii) We must remove the cobble stone, boulder and rock which lie on the slope in unstable conditions.

(c) Side ditch

(i) Side ditch should be excavated according to the ruler drawing.

(ii) The end of side ditch is led to the favourable place not to flow the water into the tanking or structures.

(6) Removal of surplus soil

(a) Surplus soil should be removed to specified spoil-bank and must be followed the instruction of superintendent when we dispose the soil at other places.

(b) For the slope gradient of surplus soil applys correspondingly to the tanking slope, in principle.

If there is the posibility that mud and sand flow out, ask for the indication of superintendent.

(7) Banking work

(a) Banking work

(i) Make a cleaning of banking site before work.

(ii) After cleaning of banking site, set the finishing stake following to the ruler drawing, then determine the starting point of the slope referring to the condition of the spot.
After that, bank up layer by layer with soil and rock pieces without mixing the weed , root and others.

(b) Banking slope

Banking slope should be worked following the finishing stake and the spot condition, from the bottom layer by layer parallel to the top edge with good soil.
The breadth of compaction must be more than 30 cm, except the spot where bank up with rock pieces.
The spot where it is essential to set a berm, should be worked based on the drawing or earth work ruler drawing.

(c) Extra-banking

We must excute extra-banking work to get the expected construction standard mask, except in case of special indications.

(8) Macadam paving

Pave a road with cobble stones or macadams, flat and tight, based on ruler drawing.
We must care of sharp edges on these materials which come out to the road surface not to injure the wheel tire.
Sharp edges of material should be rounded with metal hammer and etc.

3. Inspection

(1) Inspection in the midst of the work

We must go through the inspection of superintendent in the midst of the work where it is hard to inspect after complete the work or important working step,as indicated by superintendent beforehand.
We cannot start the following work before completion of inspection.

(2) Inspection of construction

(a) On the occasion of final inspection, inspection of partial completion based on the direction and partial inspection, representative of the spot, chief engineer and other persons concerned who are requested their presence should be submitted it to inspection in their presence.

(b) Presentation of data which are essential to the inspection, survey and other steps should be followed by the indication of inspector.