Report of geological investigation works for Stung Chinit multi-purpose project Royal Kingdom of Cambodia

REPORT
OF
GEOLOGICAL INVESTIGATION WORKS
FOR
STUNG CHINIT MULTI-PURPOSE PROJECT
ROYAL KINGDOM OF CAMBODIA

JULY 1969

OVERSEAS TECHNICAL COOPERATION AGENCY
GOVERNMENT OF JAPAN

F O R E W O R D

This report is describing a summary of results for geological investigation works for feasibility study on the Stung Chinit Multi-purpose Project, Royal Kingdom of Cambodia. The investigation works aim to obtain a brief information about conditions of foundation and properties of construction materials for main structures of the Project.

The Works consist of seismic prospecting, drilling, standard penetration test, permeability test, undisturbed sampling, excavation of test pit and soil test.

The Works were carried out by Sanyu Company Limited, as the main contractor, and Nippon Geophysical Prospecting Company Limited, under the supervision of OTCA. The staff members for the Works are Eng. M. Yoshikawa, supervising engineer, Eng. I. Hamada, site manager and chief of the drilling team and Eng. H. Yoshida, chief of geophysical team, and seven technicians.

The Geological Investigation Team of OTCA wishes to express its grateful appreciation to H.E. Mr. Pou Pong Hao, Governor of Khet Kompong Thom, H.E. Mr. Phlek-Chhat, Permanent Representative of Mekong Committee in Cambodia and President of Societe Nationale des Grands Barrages, Mr. Khy Taing Lim, Dupty Representative of Mekong Committee in Cambodia and Director of Technical Division, SNGB, Mr. Songthara Om-Kar, Principal Engineer of SNGB and Liaison Officer for OTCA Team, Mr. Khoeung I-Sar, Principal Engineer of SNGB, Arm Forces of Royal Kingdom of Cambodia, Provincial Police of Khet Kompong Thom and other persons connected with the Investigation Works for their kind consideration and friendly and invaluable assistance in the Works.

The Team hopes that this report will contribute in carrying forward the Project, and in benefiting to the peoples in the country.

C O N T E N T S

Drawings Attached

1. Conclusions

The bed rock in the investigated area is pressumed to be volcanic products and basaltic lava of Pliocene Stage. The depth to the bed rock from the ground surface is approximately 23 meters at a part of Bangki Tangren Dam Site and more than 45 meters at the other sites.

The alluvial deposits covering thickly and widely the bed rock are classified into two members; Young and Old Alluvials. Young Alluvial deposits consist of compacted medium sandy and loamy layers. Old Alluvial deposits are composed of highly compacted loamy layer.

The result of seismic prospecting shows that the velocities of elastic wave through Young Alluvial deposits are about 1.0 kilometer per second and those through Old Alluvial deposits indicate 1.7 to 2.5 kilometers per second.

In every sites, the typical tropical laterite is developing. The laterite in the investigated area is not an original laterite but mainly a laterite secondly developed from deposit.

Permeability coefficients of the loamy and clayey layer show an order of 10^{-5} to 10^{-6} centimeters per second, and those of sandy layer indicate an order of 10^{-3} to 10^{-4} centimeters per second. Furthermore, Old Alluvial deposits are generally impermeable.

The result of measurement of velocity of transversal wave through the upper layer of alluvial deposits shows Poisson's Ratio of 0.45 and an allowable bearing capacity is pressumed as nearly 50 tons per square meter. The result of standard penetration test indicates that, Young Alluvial deposits get 17 in an averaged N-value, Old Alluvial deposits have 40 in an averaged value.

Judging from the above facts, as the foundation of structures for the Project, the whole layers at the sites will not be sufficient to bear heavy structures without some treatment or piling.

Construction materials for concrete aggregate and for rip rap zone are not economically available in the investigated area. Materials for embanking purpose, however, are abundant around every sites.

As the result of classification test, soil materials in the area are classified into three groups; group of MH, CH and SC, group of SP, SM and SC and group of CH. The result of mechanical test for soil materials shows that by watering, the properties of whole embanking material, such as compacting effort, shearing strength and permeability, become better in the construction period of the dry season.

2. Topography and Geology

Cambodia is a very plainy country, with the exception of mountain areas where locate at the borders of Thailand, Viet-Nam and Laos.

In the west half of the country, the Grand Lake occupies an area of about 3,000 square kilometers in the dry season, and in the eastern parts of the country, the Mekong flows gently down to the South China Sea through the southern parts of South Viet-Nam.

Topographical feature of Cambodia shows the latest period of erosion cycle, i.e. the feature of peneplane, and residual-hills locate everywhere in the country, however, summit levels are disappered. In the southwestern area of Cambodia, general topographical trend, as is shown by the arrangement of the Grand Lake, the Tonle Sap and the Mekong, is recognized at northwest to southeast and north-northwest to south-southeast directions. And the tributaries of the Grand Lake, the Tonle Sap and the Mekong pour perpendicularly in to them. The drainage system of the area, therefore, shows a dendritic pattern and rivers and tributaries are generally moderatly meandering.

In the east area of Cambodia, the Mekong flows down trending north to south direction. Most of tributaries pouring into the Mekong are trending northwest to southeast or north-northwest to south-southeast directions. These trends are considered to be influenced by general geological structure.

Almost all areas of Cambodia are belonging to the Savannah climatologic region, however, partly there are tropical dense and clear forests and especially in the clear forests there are gullies which peculiar to young stage of erosion cycle.

The bed rocks of the Indochina Peninsula are metamorphic rock or granite of the Polaerozoic Era and sandstone or geniss of the Mesozoic Era, being covered by volcanic products and basaltic lava of Pliocene Stage for a vast area. These volcanic products and lava are mostly eroded out and covered by alluvial deposits, therefore they are cropping out only in the eastern and central areas where form a part of Khet Kompong Thom and Khet Kompong Cham. At a part of the southwest and

northeast of Cambodia, the bed rock exposes directly.

In the central area of Cambodia around the Grand Lake, the Tonle Sap and the Mekong, the alluvial deposits spread widely out. The bed rocks without coverings are generally weathered up to considerably deep zone.

In the investigated area, almost all hills consist of decomposed products of basalt lava. The highly and poorly decomposed products are red soil, terres rouge, and laterite and residual boulders respectively. When the lateritizated bands and residual bouldors are observed carefully, an original texture of basalt is recognized obviously and almost all texture are showing fluidal. At the left bank cliff of the Stung Chinit near Phum Kompong Krabei, an exposure shows a typical pillow structure.

As for the alluvial deposit, it spreads out vastly in the investigated area, and chiefly consists of well sorted medium to fine sand, loam and clay, rarely containing granule sized gravel and silt layers. The alluvial deposits are covering hilly lands and existing river bed as well as flood plain. In general, the deposits are comparatively loose and soft, however, there are also compacted and hard facies. It is considered that the former is younger and the later is older.

3. Investigation Works and Their Results

3-1. General

In order to grasp the preliminary information of conditions of foundation and properties of construction materials for main structures of the Project, a series of geological investigation works consisting of seismic prospecting, drilling, standard penetration test, permeability test, undisturbed sampling, excavation of test pit and soil test, were performed.

The works were carried out at the main dam sites under comparing, Bangki Tangren and Phnom Takho dam sites, diversion dam sites, Andaot and Kom Kompong Thma diversion dam sites, and polder dike site. The locations of these sites are indicated in General Map.

The works and their quantities and locations carried out at each site are shown Table 2-1 to 2-4, and Drawing No.1002 to 1005 alternately.

The machinaries and equipments utilized for the works are listed as follows;

Drilling machine	oil feed type	2 sets
Water pump	piston type	4 sets
Engine	Diesel	4 sets
Permeability Tester		2 sets
Equipment for standard Penetration Test		2 sets
Sampler	Fixed piston type	2 sets
Sampler	Denison type	1 set
Geophone		1 set
Amplifier	N.G.P. type	1 set
Oscillograph	100-A type	1 set
Galvanometer	G-100 type	1 set
Timer		1 set
Telephone and Bluster		1 set

Table 3-1 Observation Lines of Seismic Prospecting per Site

Site	Line	Distance (m)	Spread	Recording Frequency
Bangki Tangren Dam Site	A - A'	990	9	63
	B - B'	770	7	48
	C - C'	330	3	21
	D - D'	440	4	28
	E - E'	330	3	21
	Sub-total	2,860	26	181
Phnom Takho Dam Site	A - A'	1,430	13	91
	B - B'	990	9	63
	C - C'	440	4	29
	D - D'	440	4	30
	E - E'	440	4	28
	F - F'	330	3	21
	G - G'	330	3	21
	Sub-total	4,400	40	283
Andaot Diversion Dam Site	A - A'	660	6	42
	B - B'	220	2	14
	Sub-total	880	8	56
Kg. Thma Diversion Dam Site	A - A'	660	6	42
	B - B'	220	2	14
	Sub-total	880	8	56
Total		9,020	82	576

Table 3-2 Drillings and Tests In-Situ per Site

Site	No.	Depth (m)	Standard Penetration (times)	Permeability Test (times)	Undisturbed Sampling (times)
Bangki Tangren Dam Site	B - 1	40	23	7	-
	B - 2	20	19	3	-
	B - 3	20	20	3	-
	Sub-total	80	62	13	-
Phnom Takho Dam Site	B - 4	30	29	5	-
	B - 5	30	29	5	-
	B - 6	50	50	9	1
	B - 7	20	19	3	-
	B - 8	20	19	3	-
	B - 9	20	19	3	-
	Sub-total	170	165	28	1
Andaot Diversion Dam Site	B - 10	20	20	3	-
	B - 11	20	19	3	2
	B - 12	20	20	3	-
	Sub-total	60	59	9	2
Kg. Thma Diversion Dam Site	B - 13	20	19	3	1
	B - 14	20	20	3	-
	B - 15	20	20	3	-
	Sub-total	60	59	9	1
Polder Dike Site	B - 16	20	19	4	1
	B - 17	20	20	4	-
	B - 18	20	20	4	-
	Sub-total	60	59	12	1
Total	18 holes	430	404	71	5

Table 3-3 Test Pits and Soil Sample per Site

Site	No.	Depth (m)	Sampling for Classification Test	Sampling for Mechanical Test
			pcs.	pcs.
Phnom Takho Dam Site	TP - 1	5.0	4	1
	TP - 2	5.0	-	-
	TP - 3	5.0	4	-
	TP - 4	5.0	5	-
	TP - 5	5.0	4	1
	TP - 6	5.0	-	-
	TP - 7	5.0	-	-
	Sub-total	35.0	17	2
Polder Dike Site	TP - 8	5.0	2	1
	TP - 9	3.0	2	-
	TP - 10	3.5	2	-
	TP - 11	3.5	3	-
	Sub-total	15.0	9	1
Total	11 Holes	50.0	26	3

Table 3-4 Items of Soil Test

		Undisturbed Sample	Disturbed Sample
		(times)	(times)
Classification Test	Field Moisture Content	8	26
	Soil Classification	8	26
	Consistency	8	26
	Shrincage	0	26
	Unit Weight	8	0
	Spacific Gravity	8	26
Mechanical Test	Moisture Density	0	9
	Direct Shear (C-U)	0	15
	Triaxial Compression (C-U)	0	8
	Triaxial Compression (U-U)	1	15
	Unconfident Compressive Strength	1	0
	Permeability	0	9
	One dimensionnal Consolidation	2	9
	Swelling Test	0	2
	Slaking Test	0	3

3-2. Bangki Tangren Dam Site

The Bangki Tangren dam site is located at the most up-stream point among the sites of the Project and at 40 kilometers east from Kompong Thma and seven kilometers southwest from Phum Bangki Tangren.

In the up-stream area of the site, a flood plain developes widely and the Stung Chinit repeats meandering. From about the site, the flood plain becomes narrower. The left bank of the site forms very flat slope with about 400 meters wide flood plain just near the existing river route and an averaged slope is about one to 150. The right bank composes of foot slope of a hill which occupies the south of the site and is at the elevation of 70 meters. The slope is one to 100 on an average.

The plan and geological profile of the dam site are illustrated as in Drawing No.1002 and 1015 respectively.

That is:

From the result of seismic prospecting, the bed rock at the central part of the site lies itself about 80 meters below the ground surface and inclines from the left to the right bank side. The drilling hole B-1 reached the weathered zone of bed rock at the depth of about 23 meters, and bed rock is composed of pyroxene porphyrite. The velocity of elastic wave through the weathered rock zone is 3.0 kilometers per second. The sound bed rock considered to be underlying the weathered zone is only known from the result of seismic prospecting and shows high velocity of 6.0 kilometers per second.

Overlapping the bed rock, clayey layer is developing for about ten meters thick and is considered to be completely decomposed zone of bed rock.

Immediately upper part of this layer, loamy to sandy deposits are recognized for more than 15 meters in thickness. And directly below the flood plain loose sandy deposits are developing for around six meters.

At the portion higher than the flood plain in the both banks, laterite layers of two to three meters thick are forming the top layer.

The deposits described above are considered to be Young Alluvial

deposits for their compactness. These deposits are showing the velocity values up to 1.7 kilometers per second and are indicating penetration resistance of around 20.

Permeability coefficients measured at the loamy layer of Alluvial deposits are ordered in 10^{-4} to 10^{-5} centimeters per second. On the other hand, those of sandy layer are ranged in 10^{-2} to 10^{-3} centimeters per second.

3-3. Phnom Takho Dam Site

Phnom Takho is located at the point of about 28 kilometers east from Kompong Thma and about five kilometers southeast from Phum Thma Samlien. One of proposed main dam sites under comparison is selected on the point.

On the left bank abutment of the dam, the southern hillfoot of Phnom Takho makes a cliff in front of the Stung Chinit and the slope continues up to the hill top at the elevation of about 60 meters. On the right bank, there develops a flat flood plain of 300 to 400 meters wide. Beyond the plain, a very gentle slope continues. At the immediately upstream of the site, two major tributaries join with the Stung Chinit.

From the result of seismic prospecting, the bed rock at the site seems to be existing more than 60 meters below the ground surface. A well compacted and very thick loamy layer which is considered to be Old Alluvial deposit lies itself over the bed rock. The top surface of this layer is about horizontal and at about sea level. On the left bank it rises radically to the elevation of 20 meters. On the right bank side, a sandy layer considered to be Young Alluvial deposit composes of the top most layer overlapping Old Alluvial deposit stated above. The layer is about 20 meters thick and partly bears with lateritic or humic layers. The lateritic layer spreads out to the both banks, especially on the left bank, thin but wide spreading of the layer is recognized at the depth of around eight meters.

The N-values of Young Alluvial deposit are measured at 20 to 30. The permeability coefficients of that are ordered at 10^{-3} to 10^{-4} centimeters per second in a layer predominated by sand and 10^{-5} centimeters per second in a loamy layer. The result of seismic prospecting shows that the velocities of elastic wave passing through Young Alluvial deposit are less than 1.0 kilometer per second and those through Old Alluvials are one to two kilometers per second. The velocity through the bed rock is more than 3.8 kilometers per second.

The construction materials around the site are only available for two kinds of soil. One is impervious soil and classified as a group of MH, CH and SC in the unified classification. Another is pervious material and in a group of SM and SP. The former is very suitable for impervious zone of dam, however the later may be applicable for randum zone but is essentially desirable for only drain material.

The former is chiefly available at the left bank area of the site and the later is widely spreading out on the left bank area.

The detailed information of mechanical properties of the materials is stated in the chapter of construction materials.

The matters mentioned above are illustrated in Drawing Nos. 1003 and 1016.

3-4. Andaot Diversion Dam Site

Andaot Diversion Dam Site is located at the point about 20 kilometers east from Kompong Thma and about five kilometers west from Phum Thma Samlien. The both banks of the Stung Chinit form flat flood plain, however the right bank is about seven meters higher than the left one. This difference of high between the right and the left plains is presumed to indicate the different period of development of the plains. It seems that the developing period of the right bank is older than the left.

The depth to the bed rock is estimated at more than 60 meters, juding from the fact that no information on the bed rock was available even from the both results of drilling and seismic prospecting. The lowest layer being reached by the investigation works is highly compacted loamy layer. The layer seems to be belonging to Old Alluvial deposit and its lower limit could not be measured, however the upper surface is approximately 13 meters below the ground surface at the left bank and about five meters at the right one. At the left bank, the loamy layer with four to five meters covers this Old Alluvials and furthermore sandy layer overlaps all of them. The loamy layer bears coaled woods and gravels, and the sandy layer, though some granules are partly contained, in general, is of medium sand. At the left bank, some top soil and following loamy soil layer covers these layers. At the right bank, Young Alluvials are missed and the laterite layer exposes to the surface with thickness of about five meters covering Old Alluvials.

The sandy layer of Young Alluvium is loose and its permeability coefficient is more than 10^{-4} centimeters per second, the N-values of loamy layer in the same epoch is around 20, and its permeability coefficient is about 10^{-5} centimeters per second. Old Alluvials are highly compacted and impervious in general. From the result of seismic prospecting, the velocities of elastic wave through Young Alluvials are measured as less than 2.0 kilometers per second, and those through Old Alluvials are more than 2.0 kilometers per second.

The plan and geological profile of the dam site are illustrated as in Drawing Nos. 1004 and 1017 respectively.

3-5. Kompong Thma Diversion Dam Site

Kompong Thma diversion dam site is at about 1.5 kilometers east from Kompong Thma, located at the most downstream point of the Stung Chinit within the Project. On the both banks, a vast and flat flood plain spreads out. The river slope of the Stung Chinit near the site is extremely small as one to 15,000 and the river water flows very slowly down.

The result of seismic prospecting shows that the bed rock exists at a depth of about 70 meters below the ground surface at the central part of the site. In general, the deposits are of well compacted sandy loam or sandy clay, though occasionally they bear thin sandy layer. At the right bank, top soil covers Old Alluvial deposits directly, while at the left bank, Young Alluvial deposits of 10 meters thick covers Old Alluvials. Almost of Young Alluvial deposits consist of sand and loam, and the former is dominant. The sandy layer is composed of fine sand to silt and subject to contain granules.

N-values of Young Alluvials are generally less than 15, whereas those of Old Alluvials are more than 30. The sandy layer of Young Alluvials shows its permeability coefficient of 10^{-3} centimeters per second, the loamy layer of that and Old Alluvials range from 10^{-5} to 10^{-6} centimeter per second. The velocities through the upper part of Young Alluvial layer are less than 1.0 kilometer per second, whereas the velocities through the lower part of Young Alluvials and through the Old Alluvials range from 1.0 to 2.0 kilometers per second.

The facts mentioned above are down in Drawing Nos.1005 and 1018.

3-6. Polder Dike Site

Polder Dike site is proposed at a route from a vast plain extending in the west of the National Highway running from Khum Barai to Phum Tang Krasang to surround an area of about 6,000 hectares which spread out west of National Highway. The topography of the area is very gentle, but it is slightly inclines to the west toward the Grand Lake. the average slope of the area is approximately one to 20,000.

The depth of the bed rock in the area is considered to be very remarkable. the deposits of the area consist of loam, clay and sand of Young Alluvium. The loamy and sandy layers are considered to be riverbed or deltaic deposit, on the other hand the clayey layer is considered to be lucustrine deposit.

The sandy layer is generally fine and its permeability is comparatively small as around 10^{-4} centimeters per second, while the loamy and clayey layers are practically impermeable. N-Values of whole layers become larger to deeper portion, and range from ten to 40.

3-7. Construction Materials

Construction materials to be collected at site for structures of the Project are rock materials to be used to concrete aggregate and rip rap zone and embanking material.

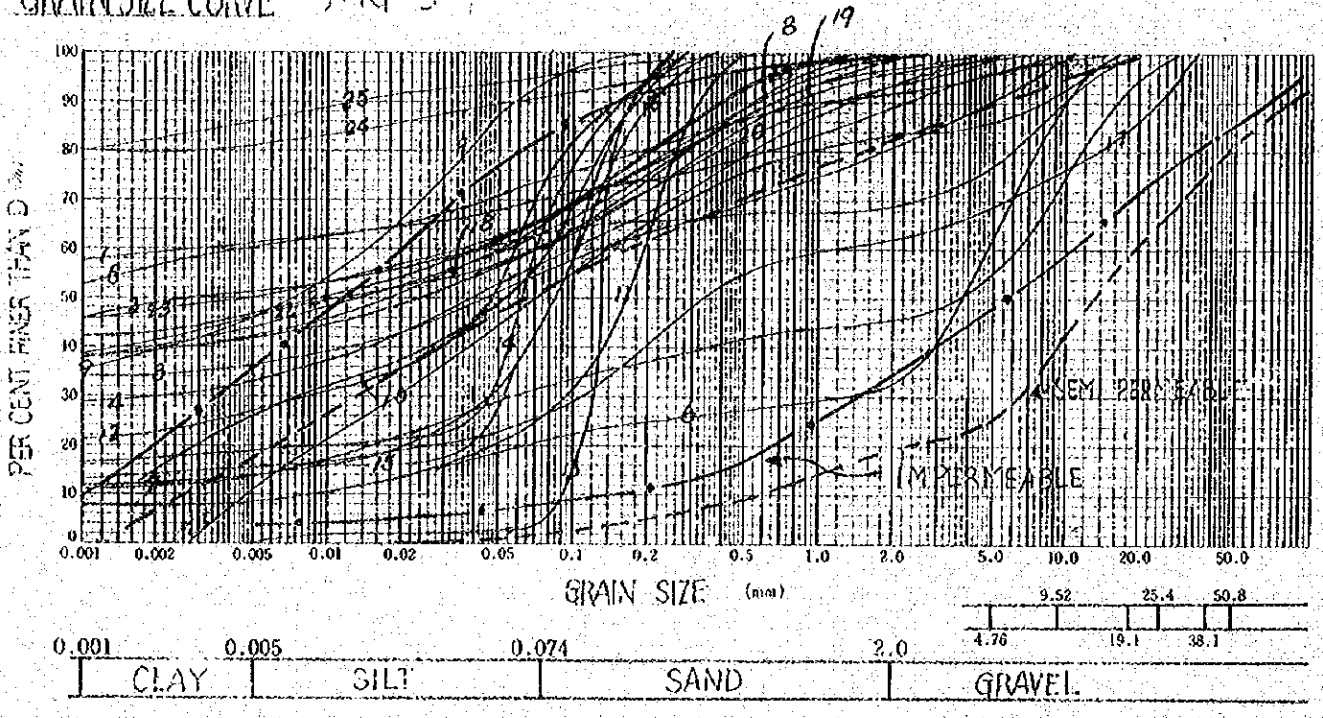
The results from both of seismic prospecting and drilling show that in the investigated area no rock material is practically available.

As for embanking materials for dam and dike, excavation of test pits and soil tests were carried out. The excavated test pits and their locations are shown in Table 3-3 and Drawing Nos.1003 and 1019 alternately. The soil samples taken from these pits and items of soil test are indicated in Tables 3-4 and 3-5.

The soil test is performed in two series; classification test and mechanical test. The method of test is designated in Japanese Industrial Standard (JIS) and ASTM. The results of each test are listed in Tables 3-5 and 3-6.

The soil materials in the investigated area are classified into three groups, *i.e.* group of MH, CH and SC, group of SP, SM and SC and group of CH. Figure 3-1 is shows grain size accumulation curves for all samples. The shaded part in the figure indicates the weakest and unsuitable materials for embanking. The materials of Nos.6, 7, 11, 13, 14, 15 and 17, which are sampled from Phnom Takho Dam Site, and No.23 from Polder Dike Site are considered to be suitable embanking materials, judging from the figure.

GRAIN-SIZE CURVE FIG 3-1



The materials in group of MH, CH and SC and group of CH, which are represented by A and C samples respectively, are nearly all applicable for impervious zone. The materials in group of SP, SM and SC represented by B sample are very desirable for filter material but not so much for random and drain materials, since they are poorly graded.

Figures 3-2, 3-3 and 3-4 are illustrating the relationship of moisture content to cohesion, friction angle, permeability and dry density for A, B and C samples respectively.

Field moisture contents of all materials range in dry side. Particulary B sample will not be suitably compacted in field moisture content if some amount of water is not added to it. The materials represented by A and C samples show the maximum shearing strength in the condition of around field moisture content. Permeability coefficients of all samples indicate orders of 10^{-4} centimeters per second in the condition of field moisture content and this high value is able to

reduce to orders of 10^{-7} to 10^{-8} centimeters per second with some amount of water added to them.

FIG.3-2 STUNG CHINIT MULTI-PURPOSE PROJECT

RELATIONSHIP OF MOISTURE CONTENT TO COHESION, FRICTION ANGLE, PERMEABILITY AND DRY DENSITY

SAMPLE NO. A

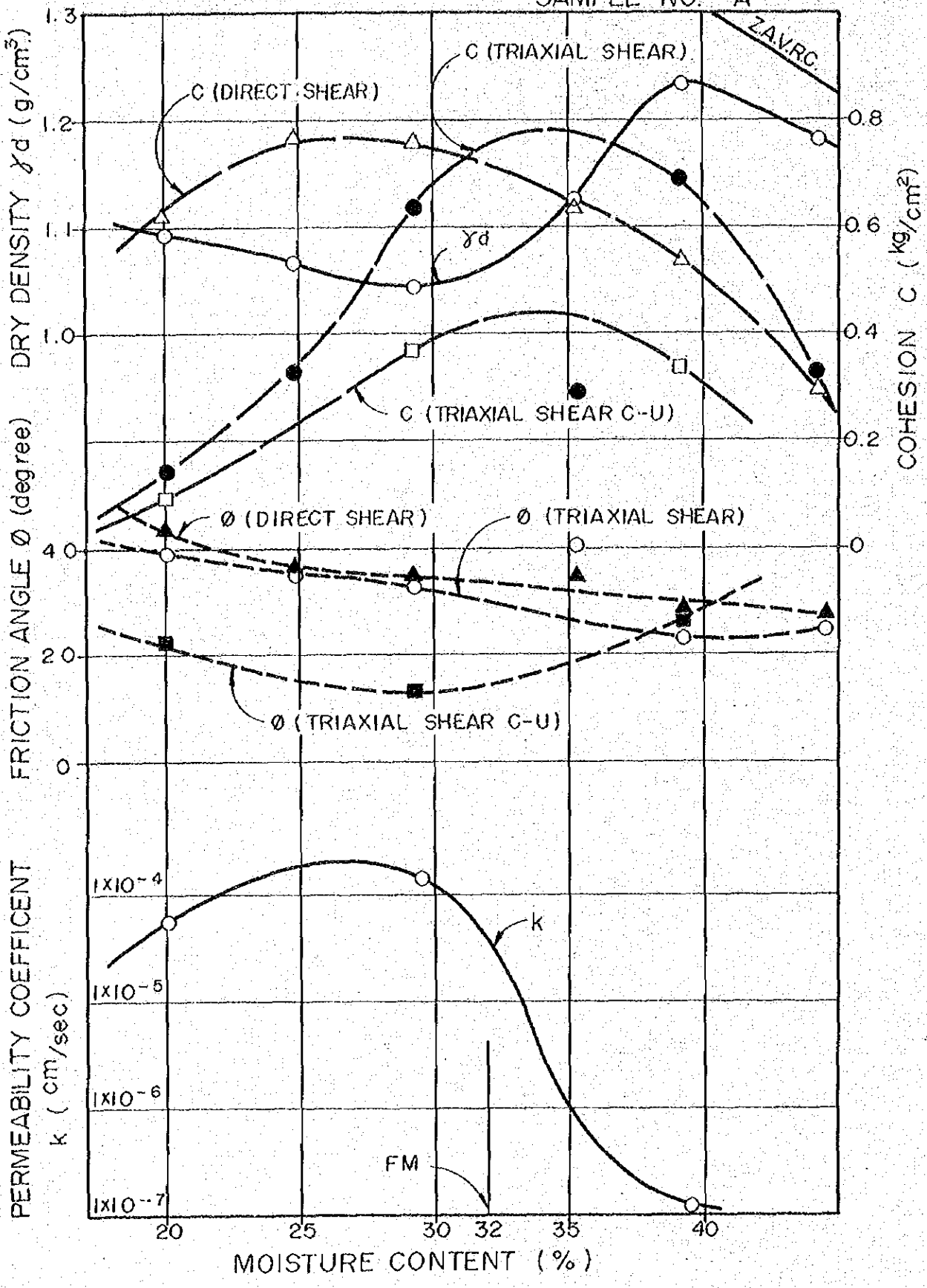


FIG. 3-3 STUNG CHINIT MULTI-PURPOSE PROJECT

RELATIONSHIP OF MOISTURE CONTENT TO COHESION, FRICTION ANGLE, PERMEABILITY AND DRY DENSITY

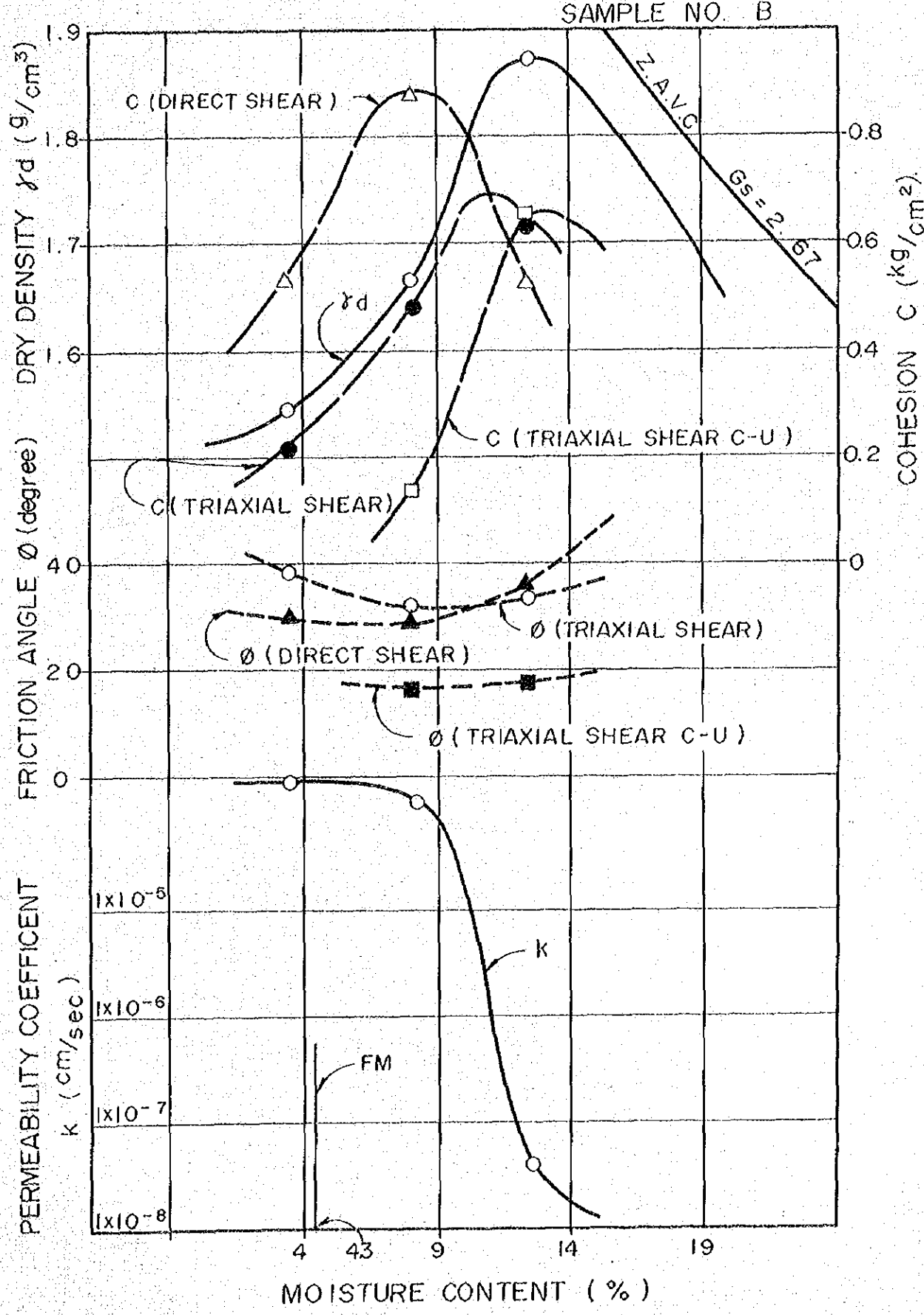


FIG 3-4 STUNG CHINIT MULTI-PURPOSE PROJECT

RELATIONSHIP OF MOISTURE CONTENT TO COHESION, FRICTION ANGLE, PERMEABILITY AND DRY DENSITY

SAMPLE NO. C

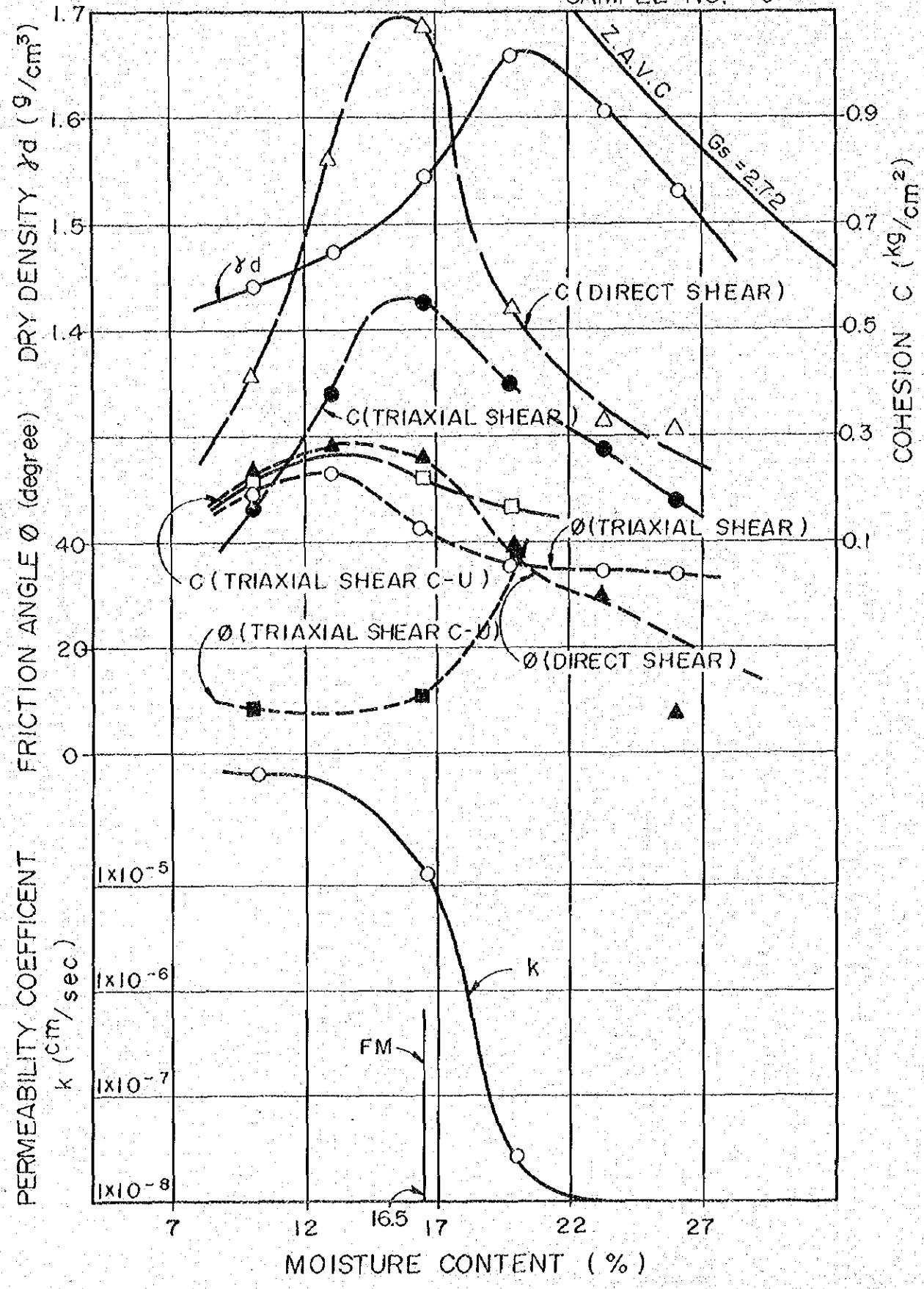


TABLE - 1 STUNG CHINIT MULTI - PURPOSE PROJECT

CLASSIFICATION TEST OF SOIL MATERIAL

	SAMPLE NO.	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	SS-9	SS-10	SS-11	SS-12	SS-13	SS-14	SS-15	SS-16	SS-17	SS-18	SS-19	SS-20	SS-21	SS-22	SS-23	SS-2
	DEPTH (m)	0.3	0.7	2.2	3.4	1.2	2.0	3.0	4.2	0.8	2.0	3.2	3.6	4.5	1.0	2.6	3.4	4.1	0.5	5.0	1.0	2.0	0.5	2.0	0.8
	FIELD MOISTURE CONTENT (%)	32.0	21.4	25.5	34.9	17.9	15.6	12.3	12.6	10.4	11.4	3.8	16.3	21.4	3.8	4.3	6.7	9.3	15.3	15.5	14.8	16.8	16.3	17.4	37.3
	CLASSIFICATION (UNFIED SOIL CLASSIFICATION)	MH	MH	MH	CH	CH	SC	SC	CH	CL	CL	SM~SC	CL	SP	ML~CL	SM~SC	SM~SC	SC	CH	CH	CH	CH	CH	CH	CH
TEXTURE	CLAY (%)	61.5	51.2	36.3	32.3	60.0	8.7	13.7	44.0	46.0	26.2	9.7	25.5	0	17.7	14.9	14.8	17.3	43.9	42.8	42.0	46.4	45.9	50.0	81.1
TEXTURE	SILT (%)	9.5	12.8	19.0	24.3	14.3	12.0	17.5	20.2	48.2	32.8	16.5	46.9	4.0	44.1	27.9	27.2	6.9	14.9	19.0	18.3	18.8	17.1	16.0	9.9
TEXTURE	SAND (%)	20.0	6.0	26.7	38.3	19.7	12.5	14.6	34.8	5.8	41.0	73.8	27.6	96.0	38.2	57.2	58.0	37.5	33.0	36.5	32.8	31.7	33.0	32.5	8.5
TEXTURE	GRAVEL (%)	9.0	30.0	18.0	5.1	6.0	66.8	54.2	1.0	0	0	0	0	0	0	0	0	38.3	8.2	1.7	6.9	3.1	4.0	1.5	0.5
CONSISTENCY	LIQUID LIMIT (%)	91.8	86.8	82.0	78.1	65.9	64.1	56.1	55.3	45.6	26.3	N.P	29.7	N.P	28.4	N.P	N.P	36.0	50.5	60.1	51.9	52.7	53.0	58.0	75.0
CONSISTENCY	PLASTIC LIMIT (%)	44.6	42.3	37.5	32.9	27.5	30.3	28.0	20.6	18.1	13.8	N.P	14.6	N.P	N.P	N.P	N.P	14.9	19.8	18.4	19.6	19.0	21.3	20.9	20.9
CONSISTENCY	PLASTIC INDEX	47.2	44.5	44.5	45.2	38.4	33.8	28.1	34.7	27.5	12.5	N.P	15.1	N.P	N.P	N.P	N.P	21.1	30.7	41.7	32.3	33.7	31.7	37.1	48.1
SHRINKAGE FACTARS	SHRINKAGE LIMIT(%)	30.6	32.9	28.4	24.1	26.6	30.3	23.7	20.7	17.9	19.6	—	19.7	—	20.5	—	20.8	18.5	19.9	18.2	18.4	16.6	20.9	18.7	22.6
SHRINKAGE FACTARS	SHRINKAGE RATIO	1.41	1.46	1.54	1.61	1.55	1.50	1.63	1.66	1.79	1.74	—	1.73	—	1.73	—	1.66	1.73	1.71	1.76	1.76	1.80	1.70	1.74	1.56
SHRINKAGE FACTARS	VOLUMETRIC SHRINKAGE	65.2	64.9	74.6	85.2	48.2	38.3	41.4	44.0	44.2	11.0	—	14.1	—	11.9	—	4.7	28.1	58.1	66.3	49.9	58.8	51.3	64.3	74.2
SHRINKAGE FACTARS	LINEAR SHRINKAGE (%)	16.0	15.1	16.8	18.6	12.2	10.5	11.0	11.5	11.5	3.8	—	4.5	—	3.8	—	2.1	8.2	14.2	15.7	13.3	14.2	12.9	15.6	16.9
SHRINKAGE FACTARS	SPECIFIC GRAVITY (APPROXIMATE)	2.50	2.80	2.72	2.62	2.65	2.62	2.66	2.53	2.63	2.64	—	2.62	—	2.66	—	2.54	2.55	2.60	2.58	2.60	2.57	2.64	2.57	2.42
	SPECIFIC GRAVITY	2.72	2.76	2.81	2.79	2.73	2.80	2.77	2.69	2.66	2.66	2.66	2.67	2.65	2.67	2.67	2.65	2.73	2.73	2.71	2.73	2.73	2.74	2.72	2.68
	UNIT WEIGHT (t/m^3)																								

REMARKS

SS-1~SS-4 : FROM TEST PIT NO.1
SS-5~SS-8 : FROM TEST PIT NO.3
SS-9~SS-13 : FROM TEST PIT NO.4
SS-14~SS-17 : FROM TEST PIT NO.5
SS-18~SS-19 : FROM TEST PIT NO.8
SS-20~SS-21 : FROM TEST PIT NO.9
SS-22~SS-23 : FROM TEST PIT NO.10
SS-24~SS-26 : FROM TEST PIT NO.11

U.D.S-1 : FROM ANDAOT DIVERSION
U.D.S-2 : FROM TEST PIT NO. 4
U.D.S-3 : FROM TEST PIT NO. 4
U.D.S-4 : FROM BORE HOLE NO.6
U.D.S-5 : FROM BORE HOLE NO.11
U.D.S-6 : FROM BORE HOLE NO.13
U.D.S-7 : FROM BORE HOLE NO.16

SS : SMALL SAMPLE
U.D.S : UNDISTURBED SAMPLE

TABLE - 1 STUNG CHINIT MULTI-PURPOSE PROJECT

CLASSIFICATION TEST OF SOIL MATERIAL

7	SS-8	SS-9	SS-10	SS-11	SS-12	SS-13	SS-14	SS-15	SS-16	SS-17	SS-18	SS-19	SS-20	SS-21	SS-22	SS-23	SS-24	SS-25	SS-26	U.D.S-1	U.D.S-2	U.D.S-3	U.D.S-4	U.D.S-5	U.D.S 6-1	U.D.S.6-2	U.D.S-7
)	4.2	0.8	2.0	3.2	3.6	4.5	1.0	2.6	3.4	4.1	0.5	5.0	1.0	2.0	0.5	2.0	0.8	1.5	3.5	1.0 ~ 1.7	4.1 ~ 4.7	4.7 ~ 5.3	3.8 ~ 4.5	5.0 ~ 5.8	1.8 ~ 1.9	1.9 ~ 2.2	1.5 ~ 2.3
)	12.6	10.4	11.4	3.8	16.3	21.4	3.8	4.3	6.7	9.3	15.3	15.5	14.8	16.8	16.3	17.4	37.3	37.9	22.3	36.3	23.7	24.5	22.6	19.3	19.2	10.1	20.2
	CH	CL	CL	SM~SC	CL	S P	ML~CL	SM~SC	SM~SC	SC	CH	CH	CH	CH	CH	CH	CH	CH	CH	SM~SC	S P	S P	S M	SM~SC	C L	SM~SC	C L
	44.0	46.0	26.2	9.7	25.5	0	17.7	14.9	14.8	17.3	43.9	42.8	42.0	46.4	45.9	50.0	81.1	85.6	44.0	2.0	0	0	2.0	7.0	33.0	9.0	54.0
	20.2	48.2	32.8	16.5	46.9	4.0	44.1	27.9	27.2	6.9	14.9	19.0	18.3	18.8	17.1	16.0	9.9	9.6	20.0	26.7	4.5	2.0	24.0	41.0	39.0	32.0	31.0
	34.8	5.8	41.0	73.8	27.6	96.0	38.2	57.2	58.0	37.5	33.0	36.5	32.8	31.7	33.0	32.5	8.5	4.8	34.7	71.3	95.5	98.0	74.0	52.0	28.0	59.0	15.0
	1.0	0	0	0	0	0	0	0	0	38.3	8.2	1.7	6.9	3.1	4.0	1.5	0.5	0	1.3	0	0	0	0	0	0	0	0
	55.3	45.6	26.3	N.P	29.7	N.P	28.4	N.P	N.P	36.0	50.5	60.1	51.9	52.7	53.0	58.0	75.0	75.9	49.7	N.P	N.P	N.P	N.P	N.P	34.2	N.P	39.7
)	20.6	18.1	13.8	N.P	14.6	N.P	N.P	N.P	N.P	14.9	19.8	18.4	19.6	19.0	21.3	20.9	20.9	30.6	18.5	N.P	N.P	N.P	N.P	N.P	14.1	N.P	12.2
)	34.7	27.5	12.5	N.P	15.1	N.P	N.P	N.P	N.P	21.1	30.7	41.7	32.3	33.7	31.7	37.1	48.1	45.3	31.2	N.P	N.P	N.P	N.P	N.P	20.1	N.P	27.5
7	20.7	17.9	19.6	—	19.7	—	20.5	—	20.8	18.5	19.9	18.2	18.4	16.6	20.9	18.7	22.6	22.0	17.9	—	—	—	—	—	—	—	—
3	1.66	1.79	1.74	—	1.73	—	1.73	—	1.66	1.73	1.71	1.76	1.76	1.80	1.70	1.74	1.56	1.63	1.80	—	—	—	—	—	—	—	—
4	44.0	44.2	11.0	—	14.1	—	11.9	—	4.7	28.1	58.1	66.3	49.9	58.8	51.3	64.3	74.2	78.4	54.1	—	—	—	—	—	—	—	—
0	11.5	11.5	3.8	—	4.5	—	3.8	—	2.1	8.2	14.2	15.7	13.3	14.2	12.9	15.6	16.9	17.5	13.3	—	—	—	—	—	—	—	—
6	2.53	2.63	2.64	—	2.62	—	2.66	—	2.54	2.55	2.60	2.58	2.60	2.57	2.64	2.57	2.42	2.54	2.66	—	—	—	—	—	—	—	—
7	2.69	2.66	2.66	2.66	2.67	2.65	2.67	2.67	2.65	2.73	2.73	2.71	2.73	2.73	2.74	2.72	2.68	2.71	2.68	2.62	2.64	2.65	2.65	2.64	2.66	2.65	2.72
																				1.804	1.890	1.902	1.632	1.899	1.628	1.714	2.043

1 : FROM ANDAOT DIVERSION
2 : FROM TEST PIT NO. 4
3. FROM TEST PIT NO. 4
4 : FROM BORE HOLE NO. 6
5 : FROM BORE HOLE NO. 11
6 : FROM BORE HOLE NO. 13
7 : FROM BORE HOLE NO. 16

SS : SMALL SAMPLE
U.D.S : UNDISTURBED SAMPLE

TABLE - 2 STUNG CHINIT MULTI-PURPOSE PROJECT

RESULT OF SOIL TEST

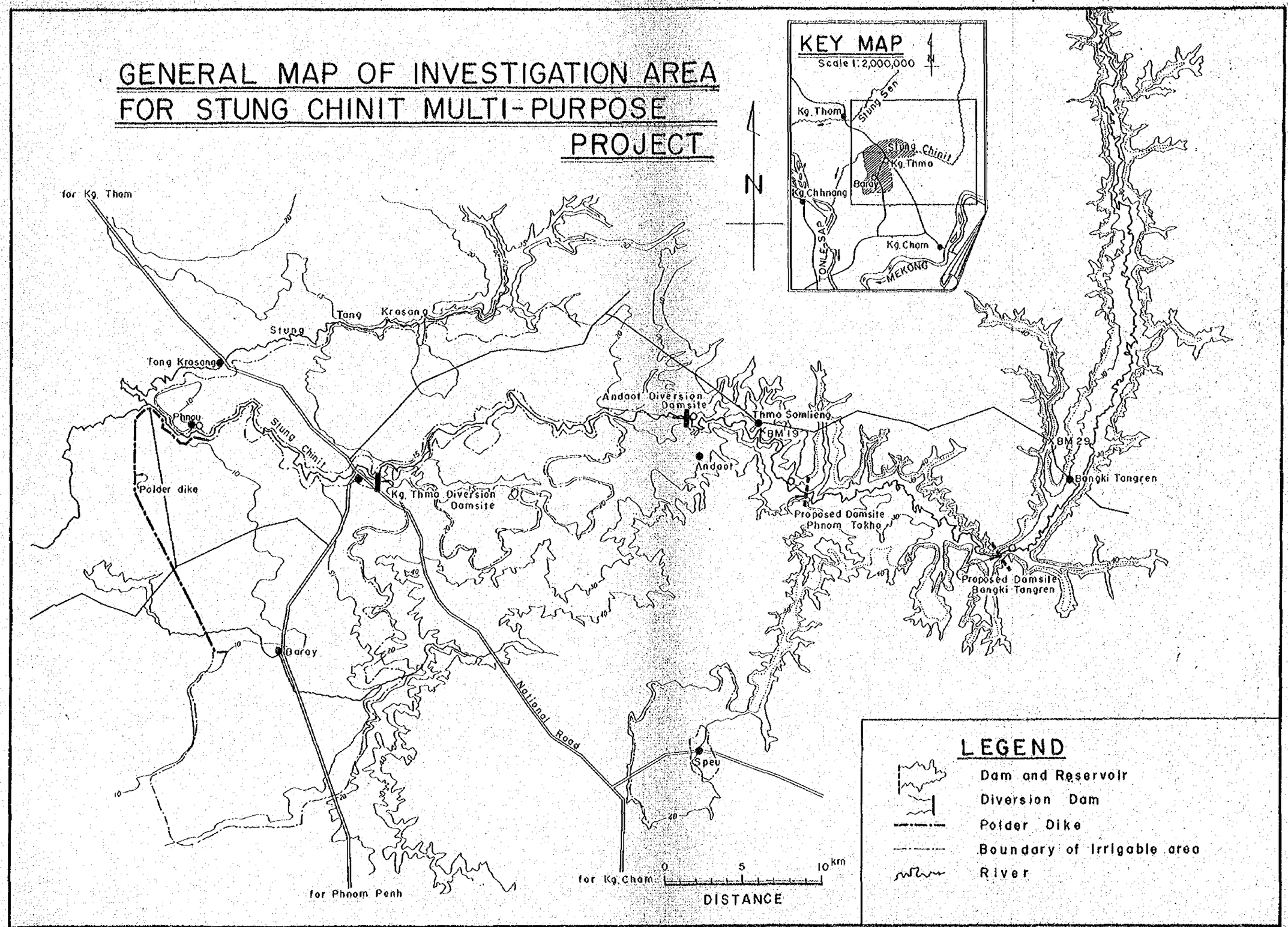
SAMPLE NO.		A						B			C					
TEST NO.		A-1	A-2	A-3	A-4	A-5	A-6	B-1	B-2	B-3	C-1	C-2	C-3	C-4	C-5	C-
SPECIFIC GRAVITY		2.76						2.67			2.72					
FIELD MOISTURE CONTENT F.M.C (%)		2.95						3.5			16.5					
CLASSIFICATION	UNIFIED	M.H						ML ~ CL			C H					
	TRIANGULAR	C						L			C					
CONSISTENCY	LIQUID LIMIT (%)	86.8						28.4			50.5					
	PLASTIC LIMIT (%)	42.3						N.P			19.8					
	PLASTIC INDEX	44.5						———			30.7					
MOISTURE-DENSITY RELATION	COMPACTION EFFORT (%)	JIS 100		JIS 80		JIS 60		JIS 100	JIS 80	JIS 60	JIS 100		JIS 80		JIS 60	
	OPTIMUM MOISTURE CONTENT (%)	38.8		33.4		40.0		11.8	12.4	12.8	20.0		20.3		20.6	
	MAXIMUM DRY DENSITY (t/m^3)	1.241		1.233		1.223		1.881	1.873	1.862	1.675		1.661		1.635	
	MINIMUM VOID RATIO	1.224		1.238		1.257		0.419	0.426	0.434	0.624		0.638		0.664	
	F.M.C.-O.M.C (%)	-9.3		-9.9		-10.5		-8.3	-8.9	-9.3	-3.5		-3.8		-4.1	
INITIAL CONDITION OF SAMPLE	COMPACTION EFFORT (%)	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS
	MAXIMUM DRY DENSITYx (%)	88.06	86.46	85.00	91.40	100.00	95.86	82.49	88.68	100.00	86.69	88.80	92.90	99.70	96.33	91.
	MOISTURE CONTENT (%)	20.2	25.0	29.5	35.5	39.4	44.5	3.5	8.0	12.4	10.0	13.0	16.5	19.8	23.3	26.
	DRY DENSITY (t/m^3)	1.092	1.060	1.048	1.127	1.233	1.182	1.545	1.661	1.873	1.440	1.475	1.543	1.656	1.600	1.5
	VOID RATIO	1.527	1.589	1.634	1.449	1.238	1.335	0.728	0.607	0.426	0.889	0.844	0.763	0.643	0.700	0.7
	DEGREE OF SATURATION (%)	36.5	43.4	49.8	67.6	87.8	92.0	12.8	35.2	77.7	30.6	41.9	58.8	83.8	90.5	90.
DIRECT SHEAR VALUE	COHESION (t/m^2)	6.1	7.7	7.6	6.4	5.4	3.0	5.5	8.8	5.3	4.1	8.2	10.7	5.4	3.3	3
	FRICTION ANGLE (degree)	44° 30'	37° 45'	36° 00'	35° 15'	29° 30'	28° 00'	30°, 30'	30° 00'	37° 00'	53° 30'	58° 00'	55° 45'	38° 30'	30° 00'	8°
TRIAXIAL SHEAR (C.U)	COHESION (t/m^2)	1.6	3.3	6.4	3.0	7.0	3.3	2.2	4.8	6.4	1.7	3.8	5.5	4.0	2.8	1.
	FRICTION ANGLE (degree)	40° 00'	37° 00'	34° 00'	41° 30'	23° 45'	25° 15'	39° 15'	33° 00'	34° 00'	50° 00'	53° 00'	43° 00'	37° 00'	35° 00'	34°
TRIAXIAL SHEAR (C.D)	COHESION (t/m^2)	1.0	——	3.7	——	3.4	——	——	1.4	6.5	2.2	——	2.2	1.7	——	——
	FRICTION ANGLE (degree)	23° 30'	——	19° 30'	——	27° 15'	——	——	17° 40'	18° 00'	9° 30'	——	11° 00'	35° 00'	——	——
PERMEABILITY COEFFICIENT (cm/sec)		5.18×10^{-5}	——	1.44×10^{-4}	——	1.14×10^{-7}	——	1.41×10^{-4}	8.32×10^{-5}	3.46×10^{-6}	9.21×10^{-5}	——	1.19×10^{-5}	2.49×10^{-6}	——	——
CONSOLIDATION TEST	COEFFICIENT OF CONSOLIDATION (C_v)	5.06×10^{-4} ~555×10^{-3}	——	9.39×10^{-4} ~9.07×10^{-3}	——	2.57×10^{-3} ~6.74×10^{-3}	——	9.75×10^{-4} ~8.92×10^{-3}	1.33×10^{-3} ~1.12×10^{-2}	2.14×10^{-3} ~8.00×10^{-3}	1.75×10^{-3} ~1.34×10^{-2}	——	1.63×10^{-3} ~1.52×10^{-2}	3.38×10^{-3} ~7.90×10^{-3}	——	——
	COEFFICIENT OF VOLUME COMPRESSIBILITY (cm^2/g)	9.94×10^{-6} ~8.23×10^{-5}	——	4.70×10^{-6} ~8.23×10^{-5}	——	5.77×10^{-6} ~5.37×10^{-5}	——	6.29×10^{-5} ~6.99×10^{-5}	5.18×10^{-6} ~2.51×10^{-5}	1.76×10^{-6} ~3.61×10^{-6}	8.73×10^{-5} ~1.02×10^{-4}	——	6.23×10^{-6} ~5.17×10^{-5}	5.73×10^{-6} ~3.06×10^{-6}	——	——
	COEFFICIENT OF PERMEABILITY (cm/sec)	1.26×10^{-6} ~9.97×10^{-6}	——	3.22×10^{-8} ~4.81×10^{-7}	——	1.46×10^{-8} ~3.20×10^{-7}	——	4.24×10^{-6} ~5.45×10^{-7}	1.66×10^{-8} ~8.39×10^{-8}	7.98×10^{-9} ~4.07×10^{-7}	5.65×10^{-8} ~6.08×10^{-7}	——	5.54×10^{-8} ~2.61×10^{-7}	3.62×10^{-8} ~1.12×10^{-7}	——	——
	COMPRESSION INDEX	0.40	——	0.28	——	0.23	——	0.33	0.17	0.04	0.36	——	0.25	0.23	——	——
	SWELLING RATIO (%)	4.53	——	2.46	——	0.10	——	0.49	0.47	0.02	3.14	——	0.70	0.07	——	——
SHEAR TEST	ANGLE OF REPOSE (degree)	——	——	——	——	——	——	29° 15'	35° 30'	39° 30'	——	——	——	——	——	——

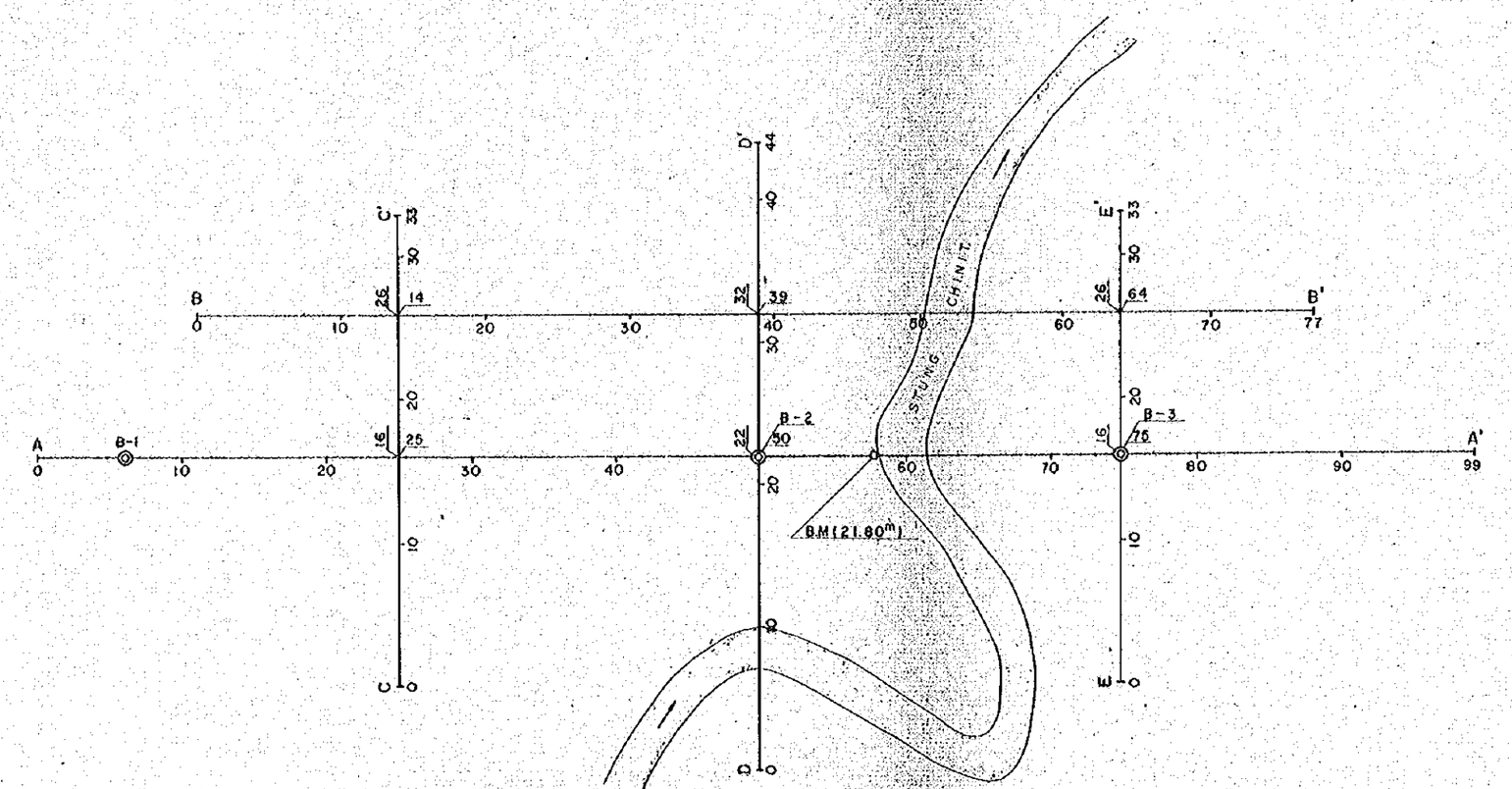
TABLE - 2 STUNG CHINIT MULTI-PURPOSE PROJECT

RESULT OF SOIL TEST

A					B			C						U.D.S. 6	U.D.S. 7	REMARKS
	A-3	A-4	A-5	A-6	B-1	B-2	B-3	C-1	C-2	C-3	C-4	C-5	C-6			
	2.76				2.67			2.72						266	2.72	(U-U) : UNCONSOLIDATED AND UNDRAINED TEST.
	2.95				3.5			16.5								
	M.H				ML ~ CL			C H						CL	CL	(C-U) : CONSOLIDATED AND UNDRAINED TEST.
	C				L			C						C	C	
	86.8				284			50.5						34.2	39.7	SWELLING RATIO : PERCENTAGE OF INITIAL HEIGHT.
	42.3				N.P			19.8						14.1	12.2	
	44.5				———			30.7						20.1	27.5	
O	JIS 80		JIS 60		JIS 100	JIS 80	JIS 60	JIS 100		JIS 80		JIS 60		——	——	A : SAMPLE FROM TEST PIT NO. 1
	334		40.0		11.8	12.4	12.8	20.0		20.3		20.6		——	——	
	1.233		1.223		1.881	1.873	1.862	1.675		1.661		1.635		——	——	B : SAMPLE FROM TEST PIT NO. 5
	1.238		1.257		0.419	0.426	0.434	0.624		0.638		0.664		——	——	C : SAMPLE FROM TEST PIT NO. 8
	- 9.9		-10.5		- 8.3	-8.9	-9.3	- 3.5		- 3.8		-4.1		——	——	
O	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	JIS 80	——	——	U.D.S : UNDISTURBED SAMPLE.
6	85.00	91.40	100.00	95.86	82.49	88.68	100.00	86.69	88.80	92.90	99.70	96.33	91.87	——	——	
	29.5	35.5	39.4	44.5	3.5	8.0	12.4	10.0	13.0	16.5	19.8	23.3	26.0	——	——	
O	1.048	1.127	1.233	1.182	1.545	1.661	1.873	1.440	1.475	1.543	1.656	1.600	1.529	——	——	
9	1.634	1.449	1.238	1.335	0.728	0.607	0.426	0.889	0.844	0.763	0.643	0.700	0.782	——	——	
	49.8	67.6	87.8	92.0	12.8	35.2	77.7	30.6	41.9	58.8	83.8	90.5	90.4	——	——	
	7.6	6.4	5.4	3.0	5.5	8.8	5.3	4.1	8.2	10.7	5.4	3.3	3.1	——	——	
5'	36° 00'	35° 15'	29° 30'	28° 00'	30°, 30'	30° 00'	37° 00'	53° 30'	58° 00'	55° 45'	38° 30'	30° 00'	8°. 00'	——	——	
	6.4	3.0	7.0	3.3	2.2	4.8	6.4	1.7	3.8	5.5	4.0	2.8	1.8	——	5.0	
0'	34° 00'	41° 30'	23° 45'	25° 15'	39° 15'	33° 00'	34° 00'	50° 00'	53° 00'	43° 00'	37° 00'	35° 00'	34° 00'	——	10° 00'	
	3.7	——	3.4	——	——	1.4	6.5	2.2	——	2.2	1.7	——	——	——	——	
	14° 30'	——	27° 15'	——	——	17° 40'	18° 00'	9° 30'	——	11° 00'	35° 00'	——	——	——	——	
	1.44×10^{-4}	——	1.14×10^{-7}	——	1.41×10^{-4}	8.32×10^{-5}	3.46×10^{-8}	9.21×10^{-5}	——	1.19×10^{-6}	2.49×10^{-8}	——	——	——	——	
	9.29×10^{-4} ~ 9.07×10^{-3}	——	2.57×10^{-3} ~ 6.74×10^{-3}	——	9.75×10^{-4} ~ 8.92×10^{-3}	1.33×10^{-3} ~ 1.12×10^{-2}	2.14×10^{-3} ~ 8.00×10^{-3}	1.75×10^{-3} ~ 1.34×10^{-2}	——	1.63×10^{-3} ~ 1.52×10^{-2}	3.38×10^{-3} ~ 7.90×10^{-3}	——	——	7.18×10^{-3} ~ 1.18×10^{-2}	1.06×10^{-3} ~ 1.19×10^{-2}	
	4.70×10^{-6} ~ 8.23×10^{-6}	——	5.77×10^{-6} ~ 5.37×10^{-6}	——	6.29×10^{-6} ~ 6.99×10^{-5}	5.18×10^{-6} ~ 2.61×10^{-5}	1.76×10^{-6} ~ 3.61×10^{-5}	8.73×10^{-6} ~ 1.02×10^{-4}	——	6.23×10^{-6} ~ 5.17×10^{-6}	5.73×10^{-6} ~ 3.06×10^{-5}	——	——	4.52×10^{-6} ~ 5.71×10^{-5}	6.01×10^{-6} ~ 1.14×10^{-4}	
	3.22×10^{-8} ~ 4.61×10^{-7}	——	1.48×10^{-8} ~ 3.20×10^{-7}	——	4.24×10^{-8} ~ 5.45×10^{-7}	1.66×10^{-8} ~ 8.39×10^{-8}	7.98×10^{-9} ~ 4.07×10^{-7}	5.65×10^{-8} ~ 6.08×10^{-7}	——	5.54×10^{-8} ~ 2.61×10^{-7}	3.62×10^{-8} ~ 1.12×10^{-7}	——	——	3.39×10^{-8} ~ 4.67×10^{-7}	6.37×10^{-9} ~ 1.36×10^{-6}	
	0.28	——	0.23	——	0.23	0.17	0.04	0.36	——	0.25	0.23	——	——	0.14	0.18	
	2.46	——	0.10	——	0.49	0.47	0.02	3.14	——	0.70	0.07	——	——	UNCONFINED COMPRESSIVE STRENGTH	q_u = 1.097	
	——	——	——	——	29° 15'	35° 30'	39° 30'	——	——	——	——	——	——			

GENERAL MAP OF INVESTIGATION AREA FOR STUNG CHINIT MULTI-PURPOSE PROJECT





OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

STUNG CHINIT MULTI-PURPOSE PROJECT
BANGKI TANGREN DAM SITE
LOCATION MAP

SUBMITTED	DATE JULY, 1962
APPROVED	DRAWING NO. 1002

N

VIA THMA SAMLIEN

STUNG CHINIT

TP-20

T.P-3

T.P-4

T.P-5

T.P-6

T.P-7

A

B

B'

C

C'

D

D'

E

E'

F

F'

G

G'

B-4

B-5

B-6

B-7

B-8

B-9

LEGEND

OBSERVATION LIN
SEISMIC PROSPE
DRILLING POIN
TEST PIT POIN

N

VIA THMA SAMLIEH

STUNG CHINIT

B-5 T.P-4 B-6 T.P-5 B-7 T.P-6 B-8 T.P-7 B-9

A' B'

D' E' F' G'

LEGEND

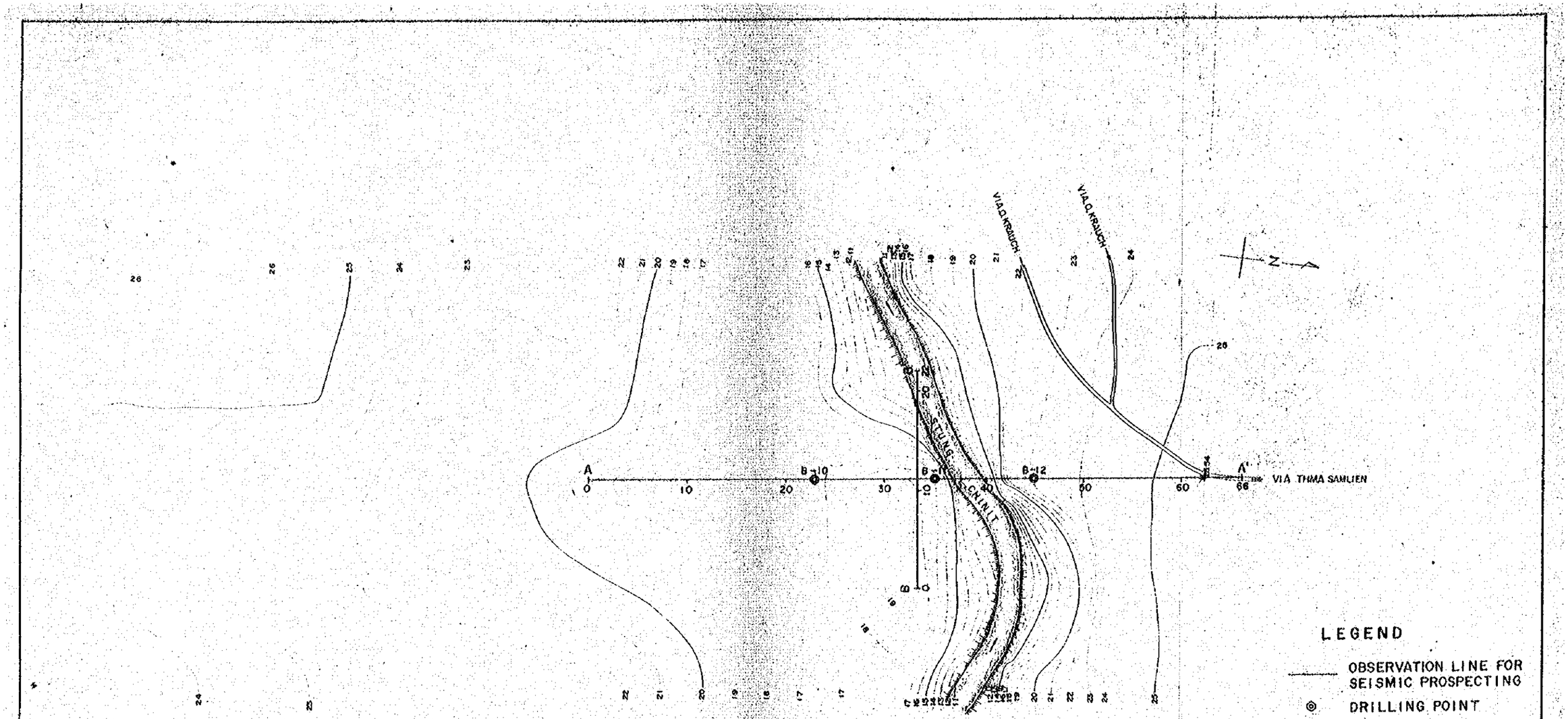
- OBSERVATION LINE FOR SEISMIC PROSPECTING
- ◎ DRILLING POINT
- ○ TEST PIT POINT

0 100 200m
SCALE

OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

STUNG CHINIT MULTI-PURPOSE PROJECT
PHNOM TAKHO DAM SITE
LOCATION MAP

SUBMITTED	DATE JULY, 1969
APPROVED	DRAWING NO. 1003

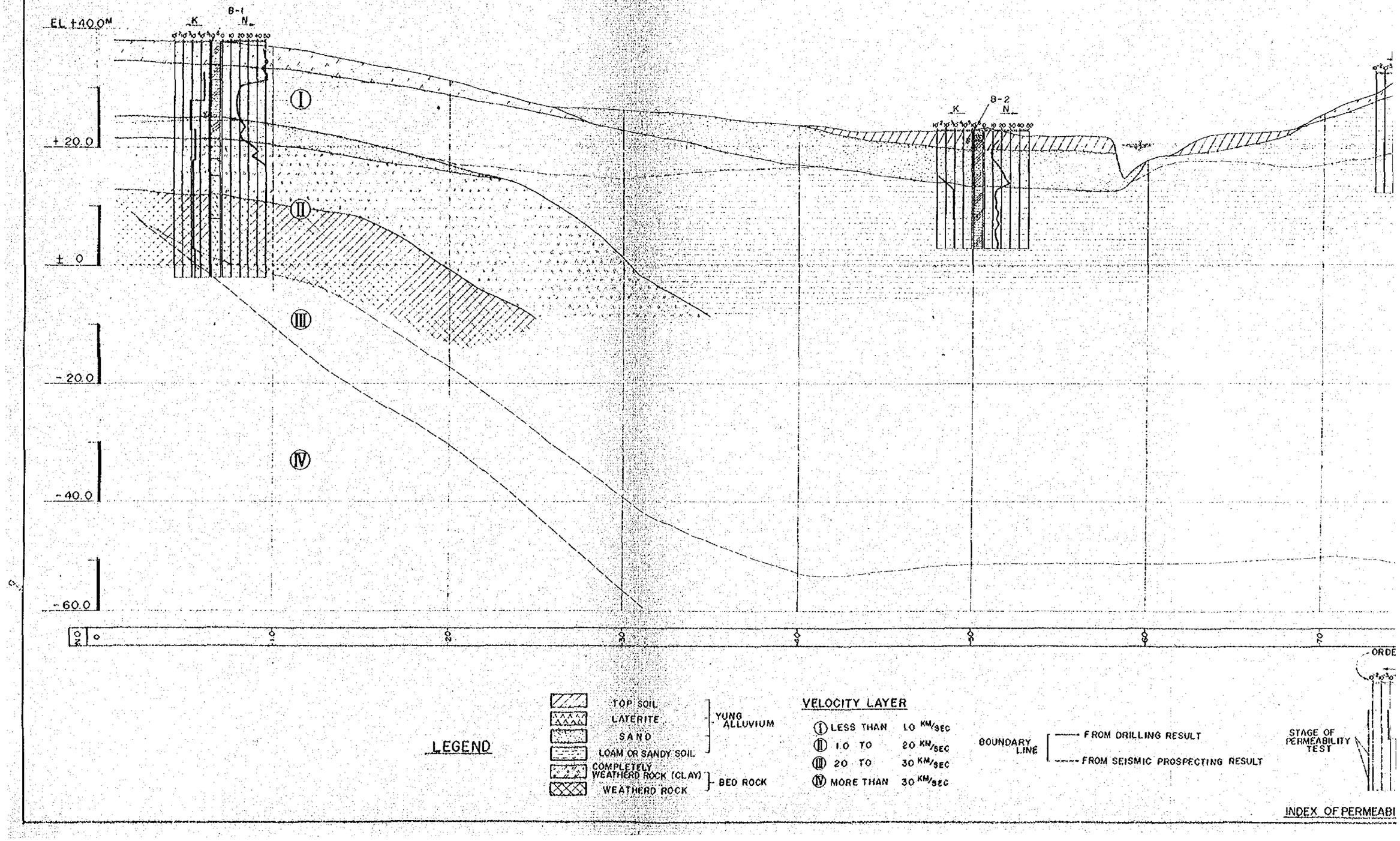


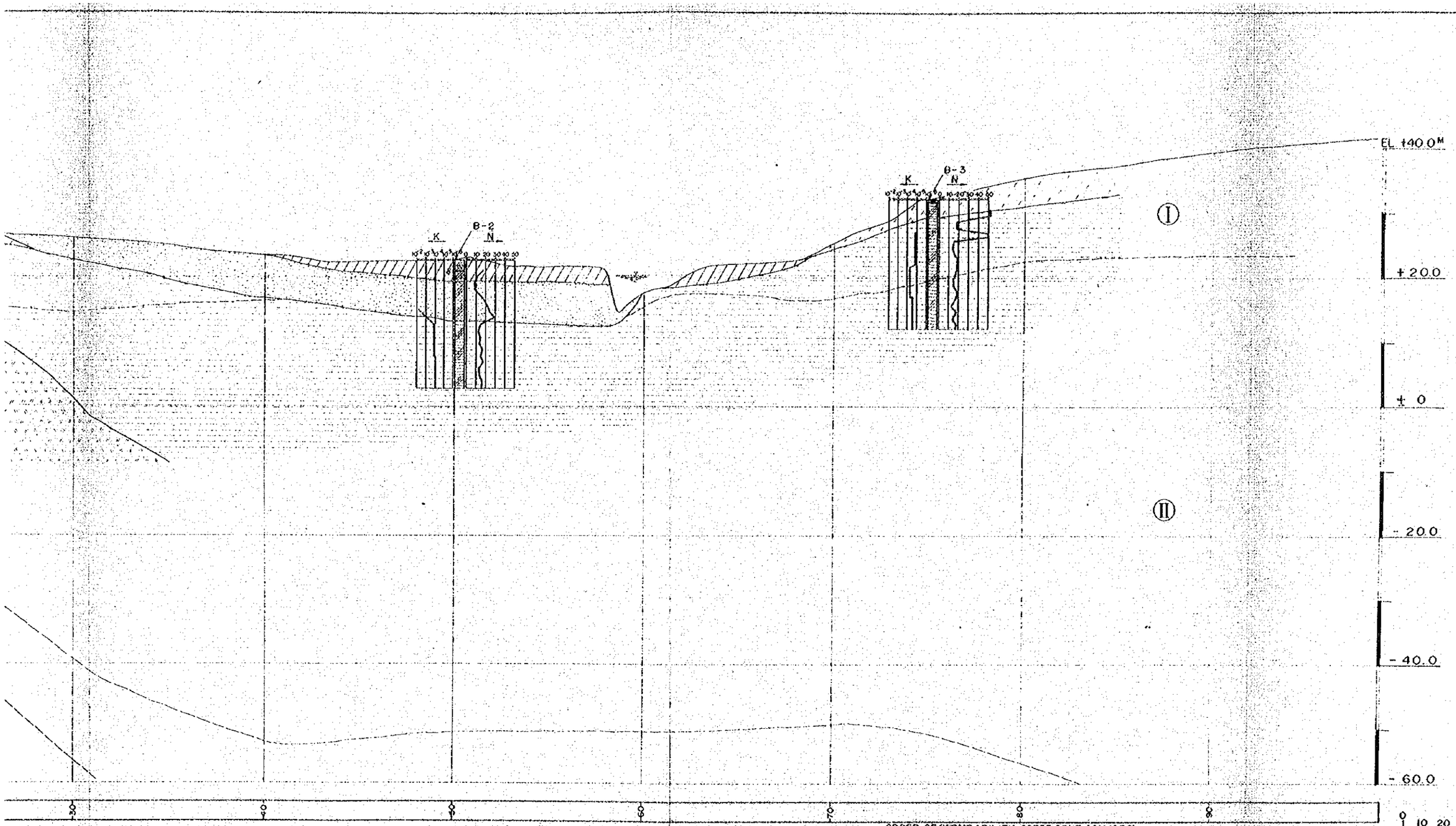
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

STUNG CHINIT MULTI-PURPOSE PROJECT
ANDAOT DIVERSION DAM SITE
LOCATION MAP

SUBMITTED	DATE JULY, 1969
APPROVED	DRAWING NO. 1004


N
STUNG CHINIT
B-12
B-13
B-14
B-15
A
A'
LEGEND
OBSERVATION LINE FOR SEISMIC PROSPECTING
DRILLING POINT
0
50
100m
SCALE
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN
STUNG CHINIT MULTI-PURPOSE PROJECT
KG. THMA DIVERSION DAM SITE
LOCATION MAP
SUBMITTED
DATE JULY, 1965
APPROVED
DRAWING NO. 1005


EL +40.0M
B-1
K
N
B-2
+ 20.0
± 0
- 20.0
- 40.0
- 60.0
I
II
III
IV
0
10
20
30
40
50
60
70
ORDE
LEGEND
TOP SOIL
LATERITE
SAND
LOAM OR SANDY SOIL
YUNG ALLUVIUM
COMPLETELY WEATHERD ROCK (CLAY)
WEATHERD ROCK
BED ROCK
VELOCITY LAYER
I LESS THAN 1.0 KM/SEC
II 1.0 TO 2.0 KM/SEC
III 2.0 TO 3.0 KM/SEC
IV MORE THAN 3.0 KM/SEC
BOUNDARY LINE
FROM DRILLING RESULT
FROM SEISMIC PROSPECTING RESULT
STAGE OF PERMEABILITY TEST
INDEX OF PERMEABI

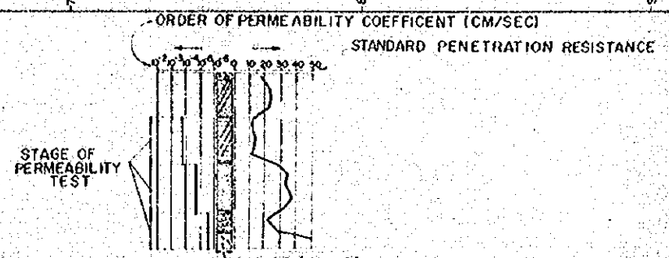


TOP SOIL
LATERITE
SAND
LOAM OR SANDY SOIL
} YUNG ALLUVIUM
COMPLETELY WEATHERD ROCK (CLAY)
WEATHERD ROCK
} BED ROCK

VELOCITY LAYER

Ⅰ	LESS THAN	1.0 KM/SEC
Ⅱ	1.0 TO	2.0 KM/SEC
Ⅲ	2.0 TO	3.0 KM/SEC
Ⅳ	MORE THAN	3.0 KM/SEC

BOUNDARY LINE —— FROM DRILLING RESULT
------ FROM SEISMIC PROSPECTING RESULT



INDEX OF PERMEABILITY AND STANDARD PENETRATION TEST

OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

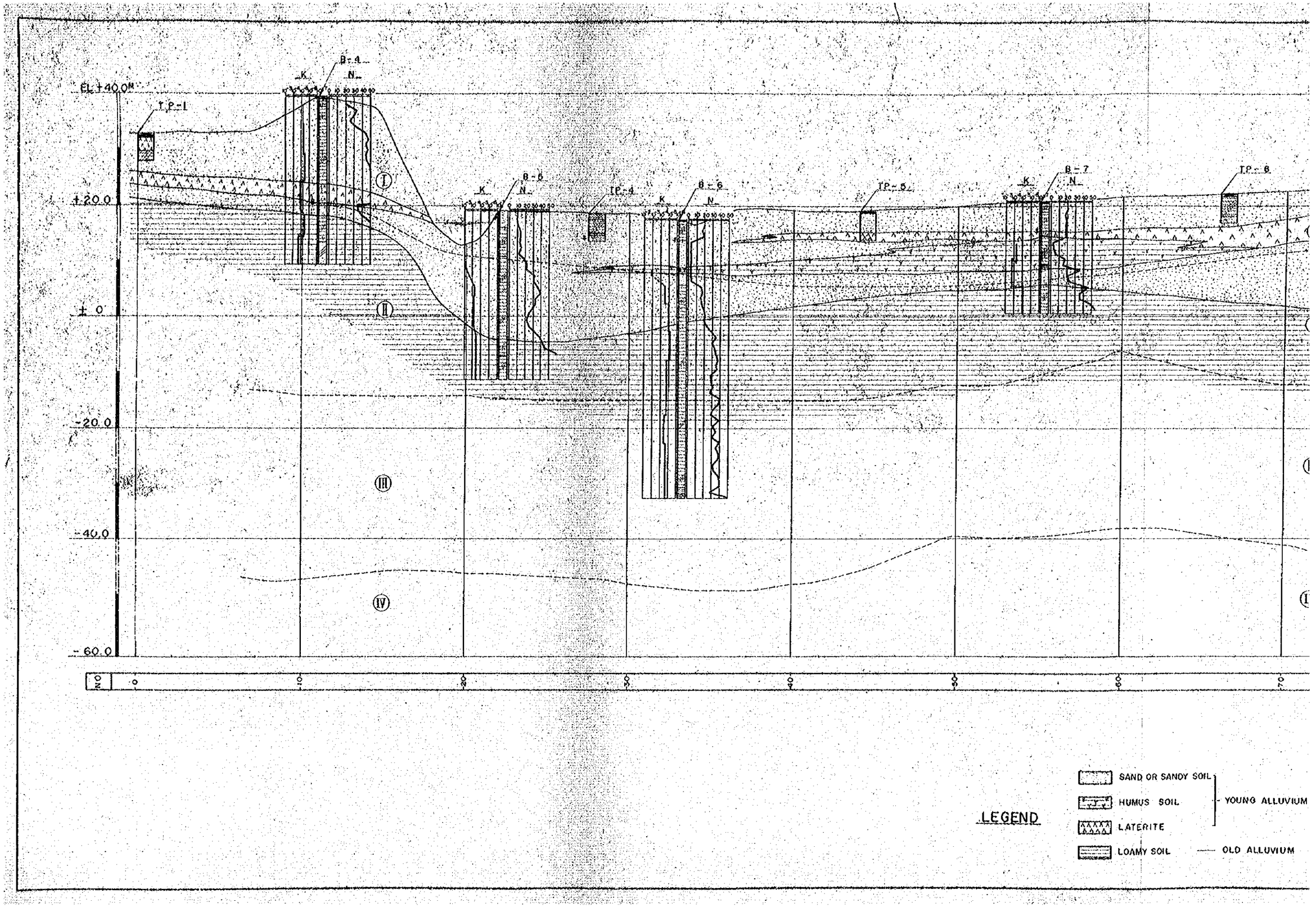
STUNG CHINIT MULTI-PURPOSE PROJECT

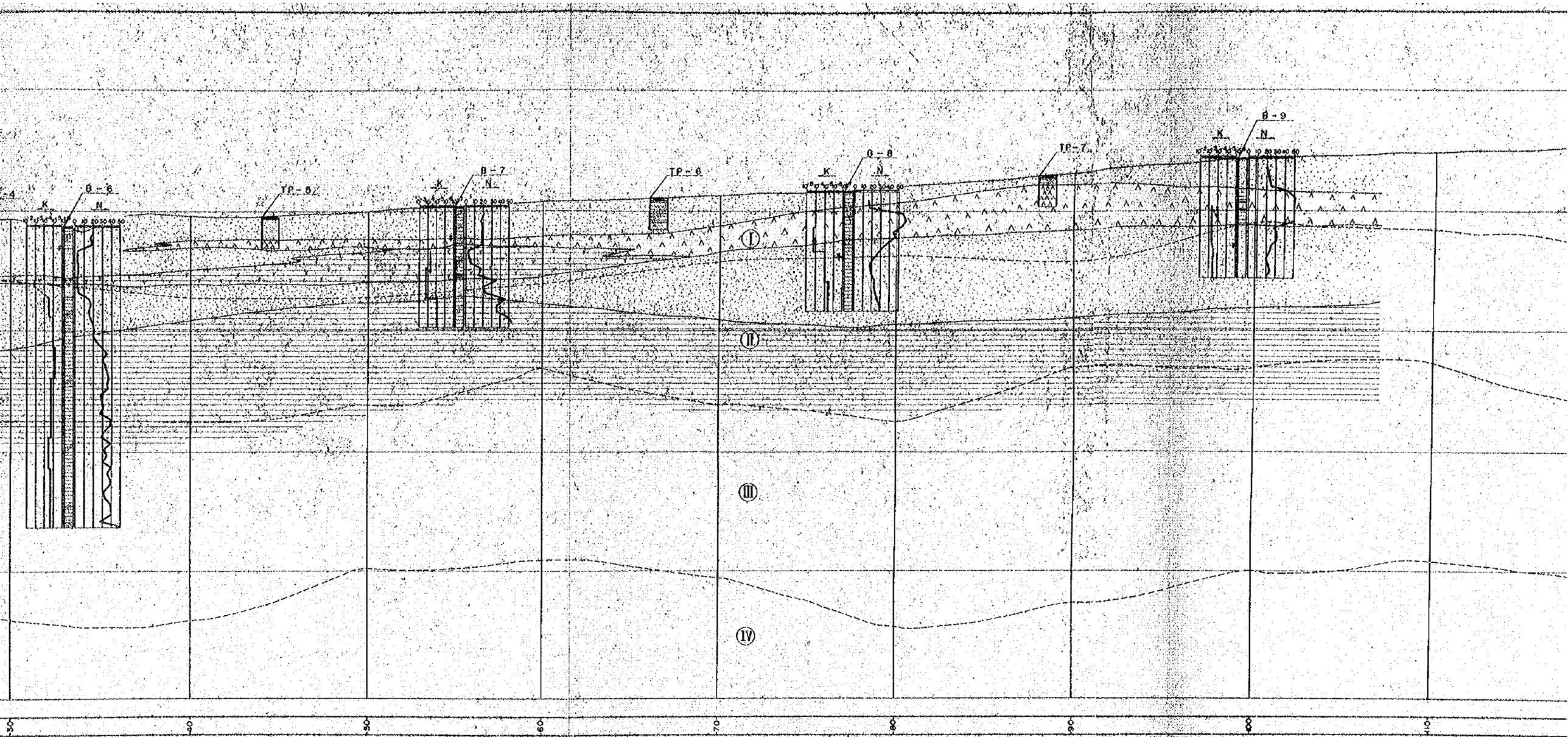
BUNGKI TANGREN DAM SITE

GENERAL GEOLOGICAL PROFILE (LINE A-A')

SUBMITTED [signature] DATE JULY, 1969

APPROVED [signature] DRAWING NO 1015


EL +40.0M
+20.0
± 0
-20.0
-40.0
-60.0
T.P-1
B-4
K
N
B-5
T.P-4
B-6
T.P-5
B-7
T.P-6
Ⅰ
Ⅱ
Ⅲ
Ⅳ
0
10
20
30
40
50
60
70
M
LEGEND
SAND OR SANDY SOIL
HUMUS SOIL
LATERITE
LOAMY SOIL
YOUNG ALLUVIUM
OLD ALLUVIUM



LEGEND

- SAND OR SANDY SOIL
- HUMUS SOIL
- LATERITE
- LOAMY SOIL

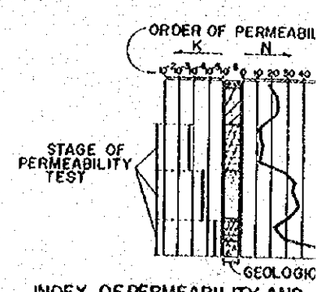
— YOUNG ALLUVIUM

— OLD ALLUVIUM

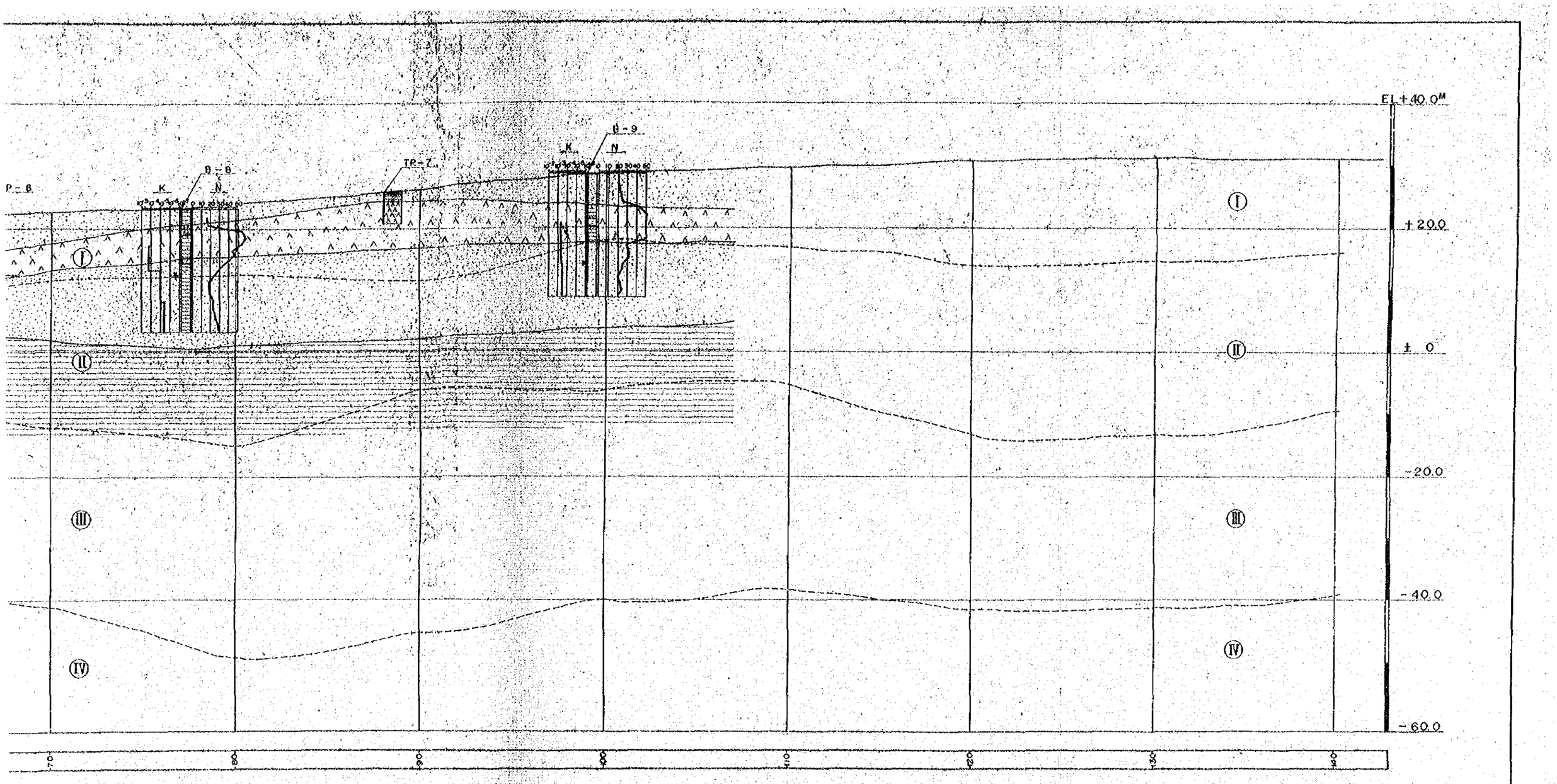
VELOCITY LAYER

- Ⅰ LESS THAN 1.0 KM/SEC
- Ⅱ 1.0 TO 2.0 KM/SEC
- Ⅲ 2.0 TO 3.0 KM/SEC
- Ⅳ MORE THAN 3.0 KM/SEC

BOUNDARY LINE
- —— FROM DRILLING RESULT
- ----- FROM SEISMIC PROSPECTING RESULT



INDEX OF PERMEABILITY AND



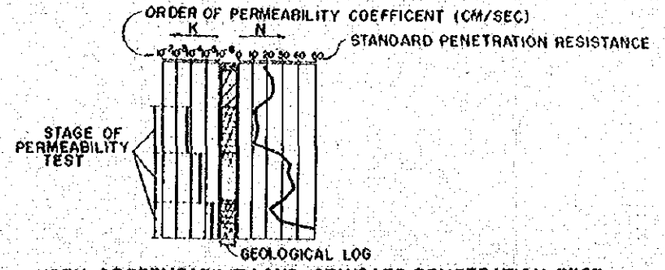
VELOCITY LAYER

I	LESS THAN	1.0 KM/SEC
II	1.0 TO	2.0 KM/SEC
III	2.0 TO	3.0 KM/SEC
IV	MORE THAN	3.0 KM/SEC

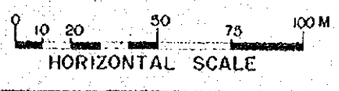
NG ALLUVIUM

ALLUVIUM

BOUNDARY LINE
- —— FROM DRILLING RESULT
- ----- FROM SEISMIC PROSPECTING RESULT



INDEX OF PERMEABILITY AND STANDARD PENETRATION TEST



HORIZONTAL SCALE

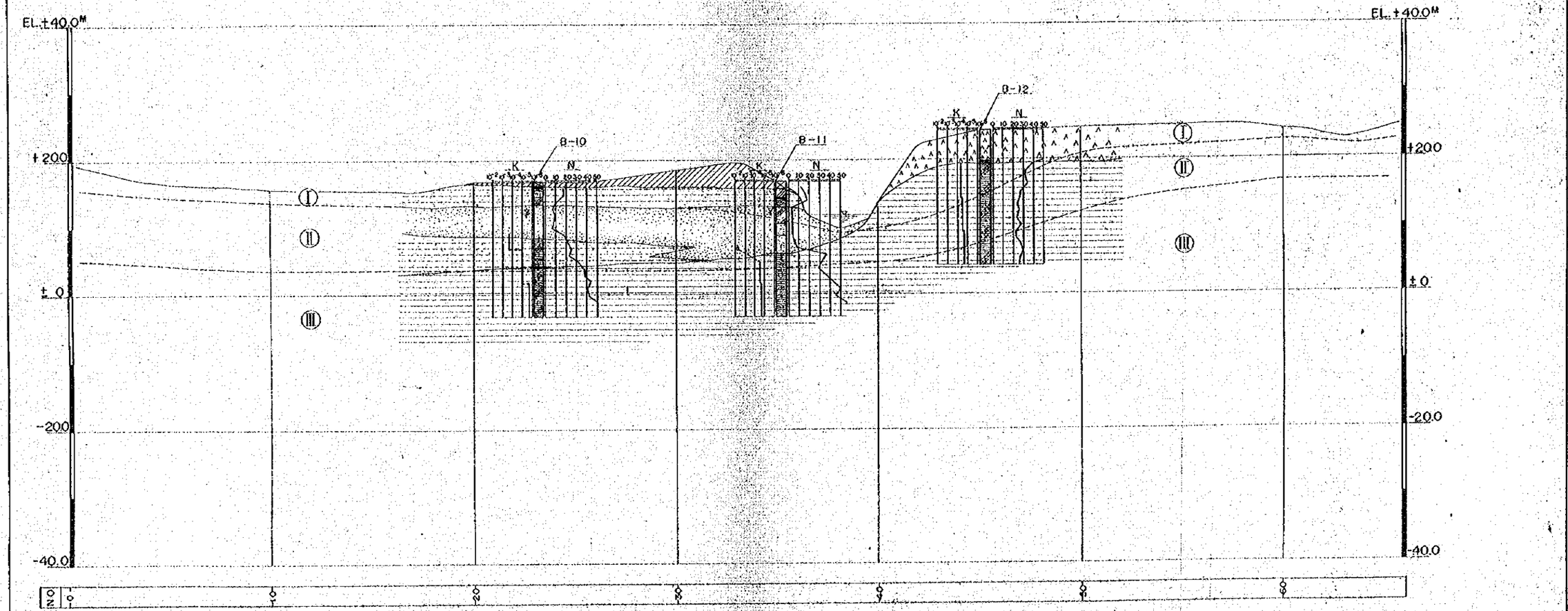
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

STUNG CHINIT MULTI-PURPOSE PROJECT

PHNOM TAKHO DAM SITE

GENERAL GEOLOGICAL PROFILE (LINE A-A')

SUBMITTED	DATE JULY, 1969
APPROVED Yoshikawa	DRAWING NO. 1016



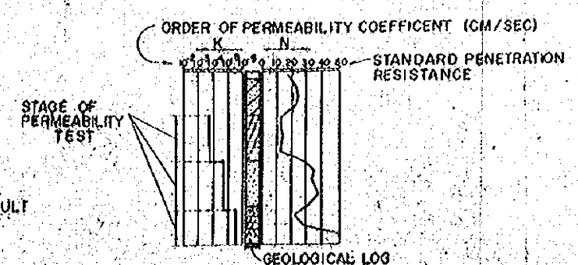
LEGEND

- TOP SOIL
- SANDY SOIL — YOUNG ALLUVIUM
- LATERITE — YOUNG ALLUVIUM
- SAND — YOUNG ALLUVIUM
- LOAM OR CLAY SOIL — OLD ALLUVIUM

VELOCITY LAYER

- (I) LESS THAN 1.0 KM/SEC
- (II) 1.0 TO 2.0 KM/SEC
- (III) MORE THAN 2.0 KM/SEC

BOUNDARY LINE
- —— FROM DRILLING RESULT
- ---- FROM SEISMIC PROSPECTING RESULT



INDEX OF PERMEABILITY AND STANDARD PENETRATION TEST

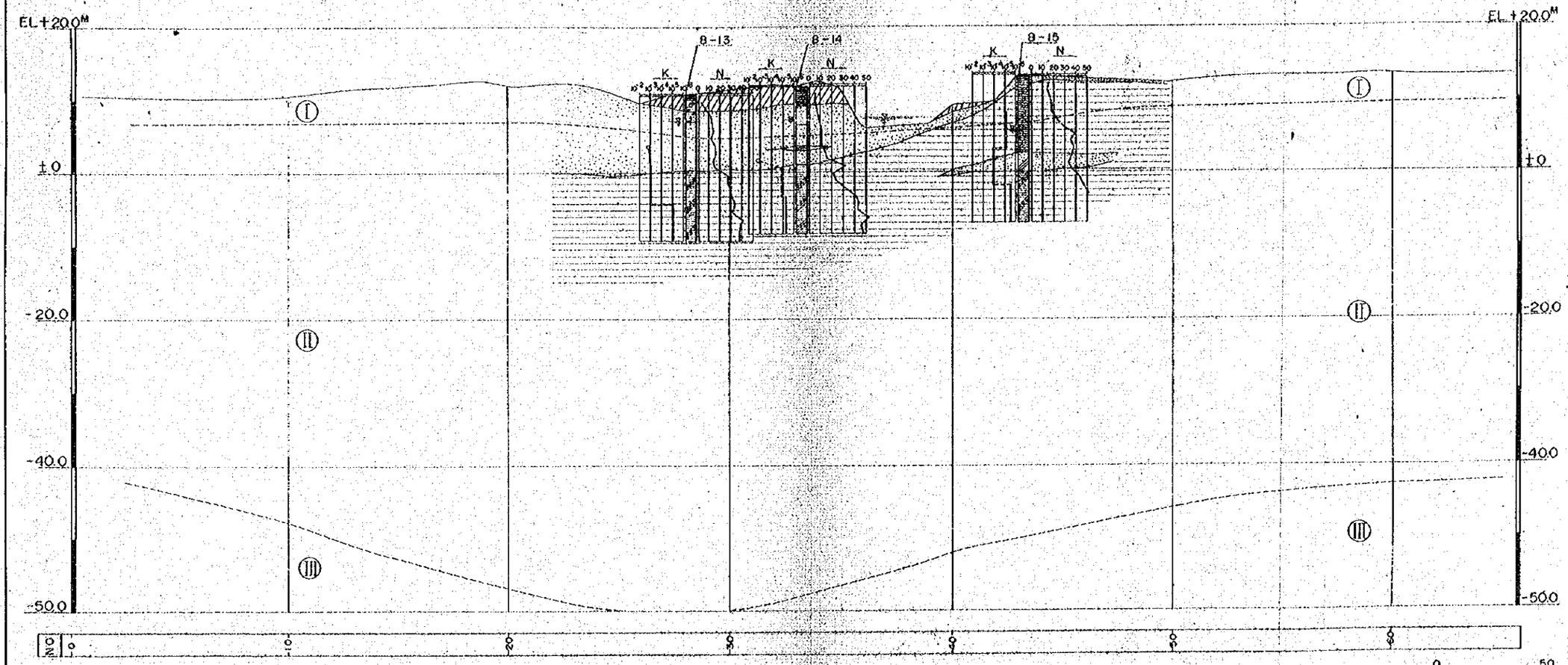
OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

STUNG CHINIT MULTI-PURPOSE PROJECT

ANDAOT DIVERSION DAM SITE

GENERAL GEOLOGICAL PROFILE (LINE A-A')

SUBMITTED	DATE JULY, 1969
APPROVED Yoshikawa	DRAWING NO. 1017



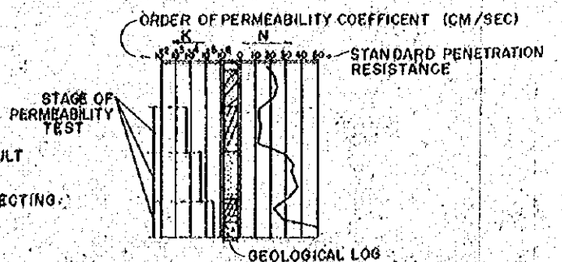
LEGEND

- TOP SOIL
- SAND
- CLAY
- YOUNG ALLUVIUM
- LOAM OR CLAY--OLD ALLUVIUM

VELOCITY LAYER

- (I) LESS THAN 1.0 KM/SEC
- (II) 1.0 TO 2.0 KM/SEC
- (III) MORE THAN 3.0 KM/SEC

BOUNDARY LINE
- FROM DRILLING RESULT
- FROM SEISMIC PROSPECTING RESULT



INDEX OF PERMEABILITY AND STANDARD PENETRATION TEST.

OVERSEAS TECHNICAL COOPERATION AGENCY, JAPAN

STUNG CHINIT MULTI-PURPOSE PROJECT

KG. THMA DIVERSION DAM SITE

GENERAL GEOLOGICAL PROFILE (LINE A-A')

SUBMITTED	DATE JULY, 1969
APPROVED	DRAWING NO. 1018

EL.+200M

TP-8 B-16 TP-10 TP-9 B-17 TP-11 B-18

K N

± 0

-200

NO. 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

LEGEND

LOAM OR CLAY SOIL

SAND

ORDER OF PERMEABILITY COEFFICENT (CM/SEC)

K N STANDARD PENETRATION RESISTANCE

STAGE OF PERMEABILITY TEST

GEOLOGICAL LOG

INDEX OF PERMEABILITY AND STANDARD PENETRATION TEST