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Greinargerðasafn

Project No: 600 506

Birgir Jonsson, Orkustofnun
Thorolfur H. Hafstad, Orkustofnun
Jon Skulason, Almenna Consulting

EIDAR, EAST ICELAND
AM Guyed Transmission Tower Site
Geotechnical Report

For RUV, Iceland National Broadcasting Service

BJ/PHH - 97/02 May 1997

MÁ EKKI FJARLÆGJA



Eidar, East Iceland

Long Wave Transmission Tower Site, Geotechnical Report

1. Abstract

An 800 foot guyed tower for AM transmission will be erected at Eidar, East Iceland, at the same site where two 240 foot guyed towers are standing now. The topsoil at the site is an undrained peat-bog, which is useless for any kind of foundation work, so it has to be removed, both at the tower foundation and at all the nine anchor points. The thickness of the peat-bog is from 1 meter up to almost 5 meters. Under the peat there is gravelly sand (USCS group SP), that can be used as foundation material for concrete blocks at seven of the nine anchor points. At the other two anchor points (A3 and B3), the concrete blocks can be founded directly on the basaltic bedrock, which is very sound.

At the tower itself, the safest option is to take the base of the foundation down to bedrock at 8 meters depth. Still it is probably feasible to place the foundation on top of the gravelly sand at 4 meters depth, but then a one meter thick silty layer under the sand (from 6.4-7.3 meters depth) must be examined prior to construction, e.g. by digging a backhoe trench down to the layer.

2. Introduction

RUV, The Icelandic National Broadcasting Service is having an 800 foot guyed tower erected at Eidar, East Iceland for AM radio transmission. Eidar is located 15 km north of the small town of Egilsstaðir (pop. 2000), which has scheduled flight service from Reykjavik 2-3 times daily. See figures 1 and 2 for location.

In april ten holes were drilled with a percussion hammer rig, supervised by a geologist from the National Energy Authority of Iceland (Orkustofnun), who took samples of the soil at close to 2 meters intervals from all the holes, and noted any change in the material that was flushed up the casing.

Almenna Consulting, Reykjavik, supervised the the testing of the gravelly sand, that will probably be the foundation base at most of the anchor points. Almenna also wrote chapter 7 of the report, which deals with the test results.

3. Geological Setting

The bedrock at Eidar is late Tertiary (Pliocene, 6-8 Million years old) basalts, dipping 6 - 8° towards SW, see geological map of Iceland in figure 1 and a schematic geological cross section of the Eidar area in figure 3. The tower site is a mostly undrained peat bog at an elevation of 40-50 meters above sea level.

During the Ice Age, glaciers flowing north have scoured the basalts and removed all broken or weak rock on the surface of the bedrock. The glaciers retreated up the valley (south) from the Eidar area about 10.000 years ago.

As can be seen in the geological sketch, the tower site is a peat bog between rock outcrops. The peat is generally 2 - 4 meters thick (max 4.8 m) and undrained, because of the ground radials. Under the peat we have unconsolidated alluvium, a mixture of gravel and sand and sometimes silt near the bedrock, deposited in the depression between the basalt outcrops. When digging for the anchor blocks of the two present towers (in 1951 and 1965), a layer of gravelly sand was found to be immediately beneath the peat.

The bedrock is quite sound porphyritic basalt, RQD is over 90 and the UCS (uniaxial compression strength) is commonly 150 - 250 MPa.

The anchors for the present 70 meters high towers are cemented into concrete anchor blocks sitting on the gravel surface or excavated a few feet down into to the gravelly sand.

The thickness of the peat bog is about 2.5 meters at the eastern tower from 1965 and according to the resident radio engineer at Eidar (Julius Bjarnason), the foundations for the western tower were dug by hand down to about 2.5 - 3 meters, to the top of the gravelly sand.

Midway between the two present towers, (i.e. where the new tower will be located, at the center of the ground radial system), the thickness of the peat was during the drilling found to be 2.7 meters under a 0.9 meters thick man made gravel fill. Locations of the drillholes and backhoe trenches are shown in figure 4.

4. Description of Soil Types and Bedrock

The peat is undrained, having the water-table almost at surface. The drilling could be done without difficulties because of the frozen surface. The thickness is variable 1.4 m - 4.8 m according to the soundings. An undisturbed sample was collected from the peat from a backhoe-trench near B - 1. The degree of decomposition according to von Proust-scale is H_3 (little decomposed peat), having pH-value around pH 5.

The gravelly sand is also variable in thickness, but its geotechnical character seems to be very uniform throughout the formation. An experienced geologist was present during the drilling and described the samples almost as soon as they emerged from the borehole. The gravelly sand mainly consists of loosely packed coarse sand and fine gravel. A sample was collected from the sandy gravel from the backhoe-trench near B -1. According to the USCS classification system this unit is classified as SP, or poorly graded sand - gravelly sand; see grain size curve in figure 5.

The silt and the till layers are sometimes to be found between the gravel and the bedrock. Samples from these layers are somewhat disturbed, lacking some of the fines due to washing during drilling.

The bedrock in the area is late Tertiary, basaltic lava pile, dipping 6° - 8° towards SW. The basalt is exposed in whaleback-outcrops around the tower-site bog. Each whaleback is in fact the edge of an individual lava flow. In all cases the rock appears to be quite strong, with small, scattered phenocrysts.

Porphyritic basalt can either have the characteristics of olivine-tholeiite or tholeiite basalts. Porphyritic basalt contains more than 5% phenocrysts, mostly plagioclase. It is usually thought to be the strongest rock type found in Iceland, being quarried when large boulders and strength is required. Porphyritic basalt can be divided into two subgroups, one of them being

(pom): porphyritic basalt, massive. The layers are most often 10 - 20 m thick and the scoriaceous part being only 1 - 5% of the total.

The bedrock at the proposed tower site at Eidar is of this type!

Rock type	Common thickness	R Q D %	Q	U C S MPa	S R N	D R I	B W I
Porphyritic basalt	10 (2-32)	93 (70-100)	8-30	215 (144-334)	43 (33-56)	very low to medium	low to medium

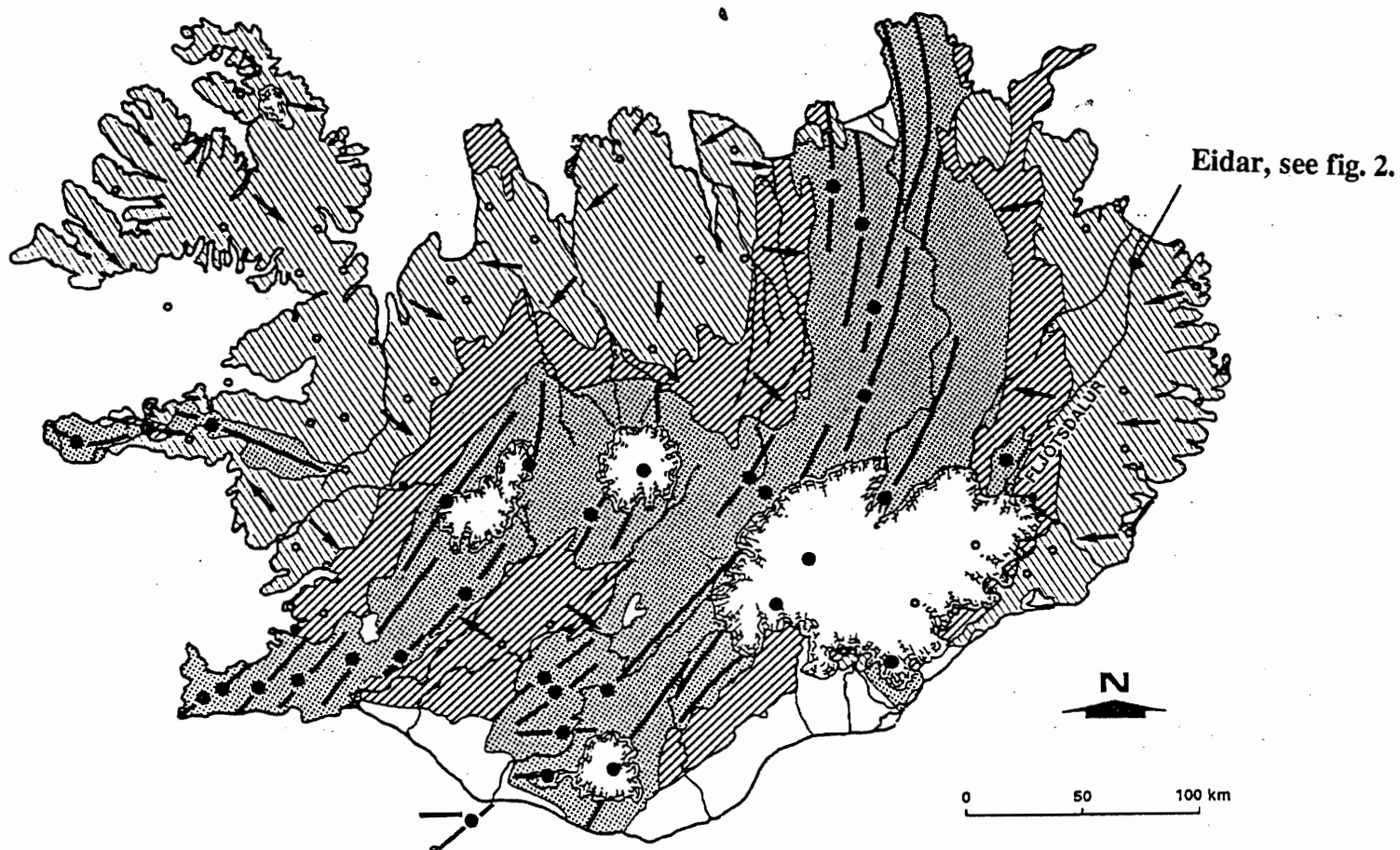
R Q D: Rock Quality Designation. Q: Rock Mass Quality Classification.

S R N: Schmidt Hammer Rebound Number. U C S: Uniaxial Compressive Strength.

D R I: Drilling Rate Index. B W I: Bit Wear Index.

GENERAL GEOLOGY OF ICELAND

Fig. 1



SKÝRINGAR / LEGEND

- ÚTKULNAÐAR MEGINELDSTÖÐVAR FRÁ TERTÍER OG ÁRKVARTER (0,7 - 15 m. á.)
EXTINGT CENTRAL VOLCANOES, TERTIARY AND PLIO-PLEISTOCENE (0.7 - 15 m. y.)
- VIRKAR EÐA DORMANDI MEGINELDSTÖÐVAR (YNGRI EN 0,7 m. á.)
ACTIVE OR DORMANT CENTRAL VOLCANOES (≤ 0.7 m. y.)
- SPRUNGUREINAR
FISSURE SWARMS
- ALMENNUR JARÐLAGAHALLI
GENERAL DIP OF LAVAS

- ▨ TERTÍER BERGGRUNNUR (ELDRI EN 3,1 m. á.)
TERTIARY BEDROCK (> 3.1 m. y.)
- ▨ ÁRKVARTER BERGLÖG (0,7 - 3,1 m. á.)
PLIO-PLEISTOCENE BEDROCK 0.7 - 3.1 m. y.)
- ▨ SÍÐKVARTER BERGGRUNNUR (YNGRI EN 0,7 m. á.)
UPPER PLEIST. AND POSTGLAC. BEDROCK ≤ 0.7 m. y.)
- SETFYLLUR FRÁ NÚTÍMA
OUTWASH PLAINS

HAUKUR JÓHANNESSON 1989 (LÚTILSH. BREYTT)
(SLIGHTLY MODIFIED)

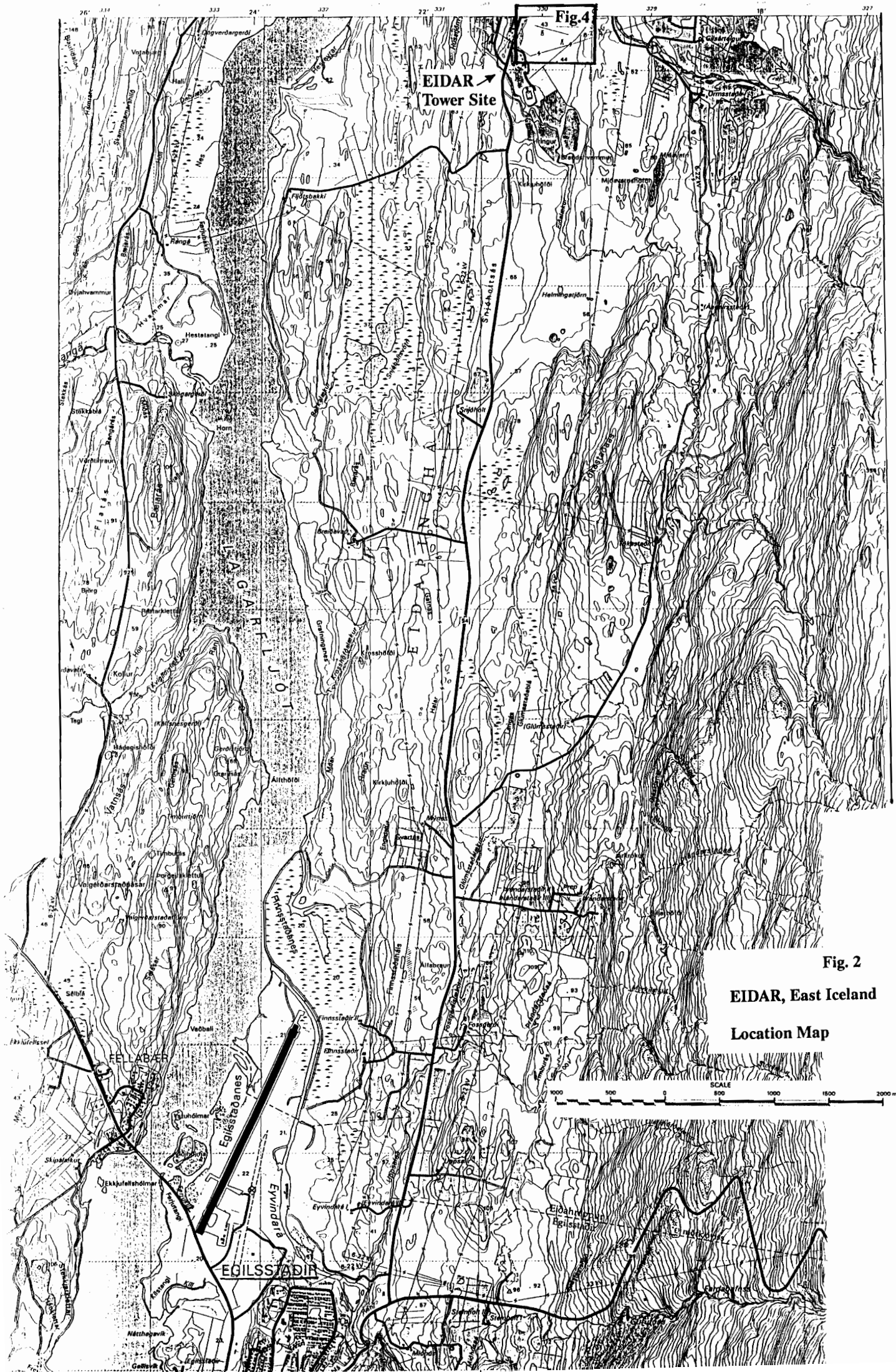
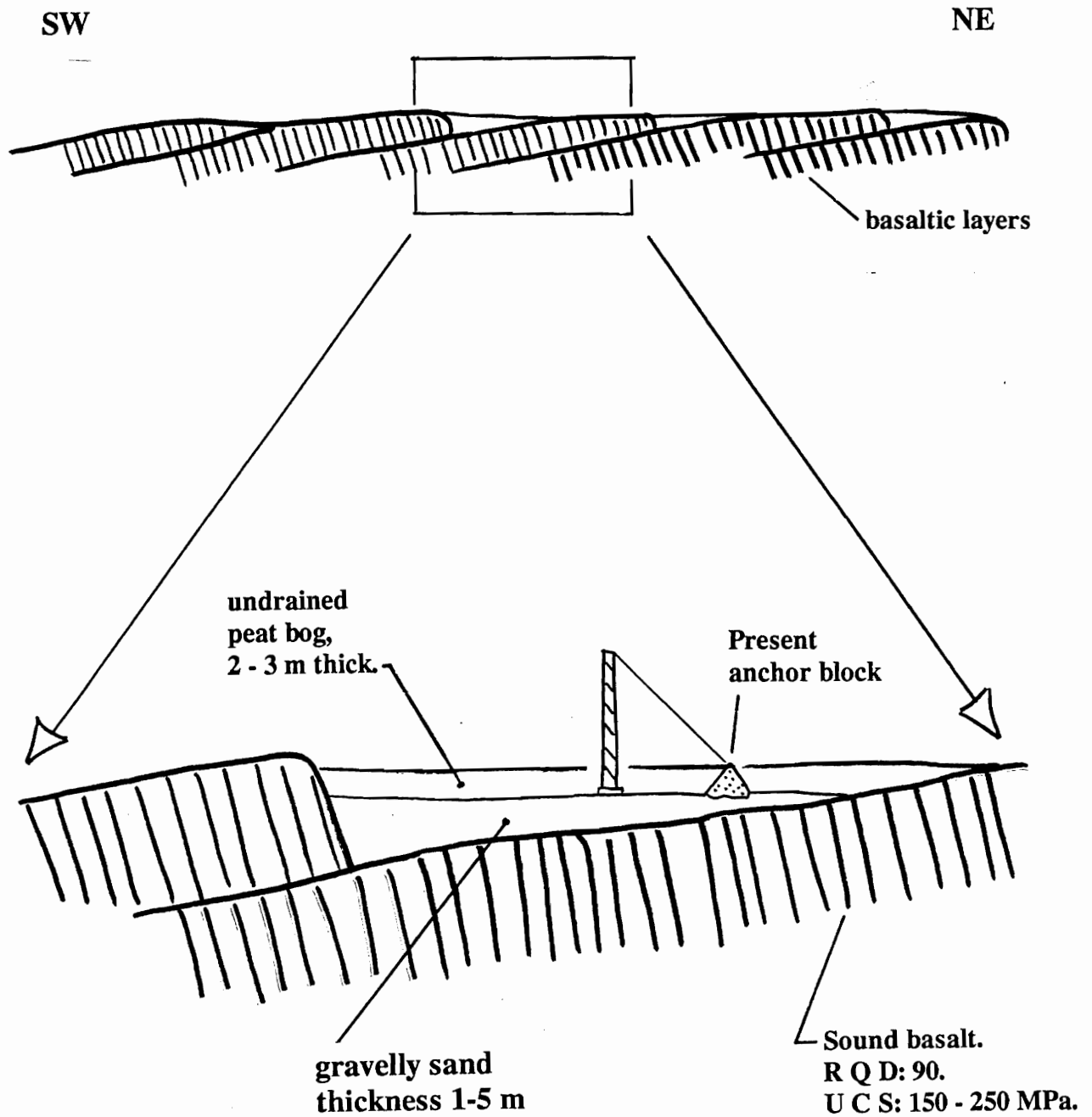
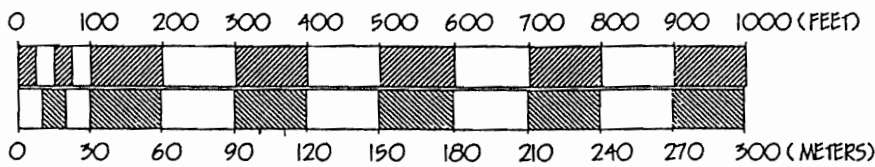
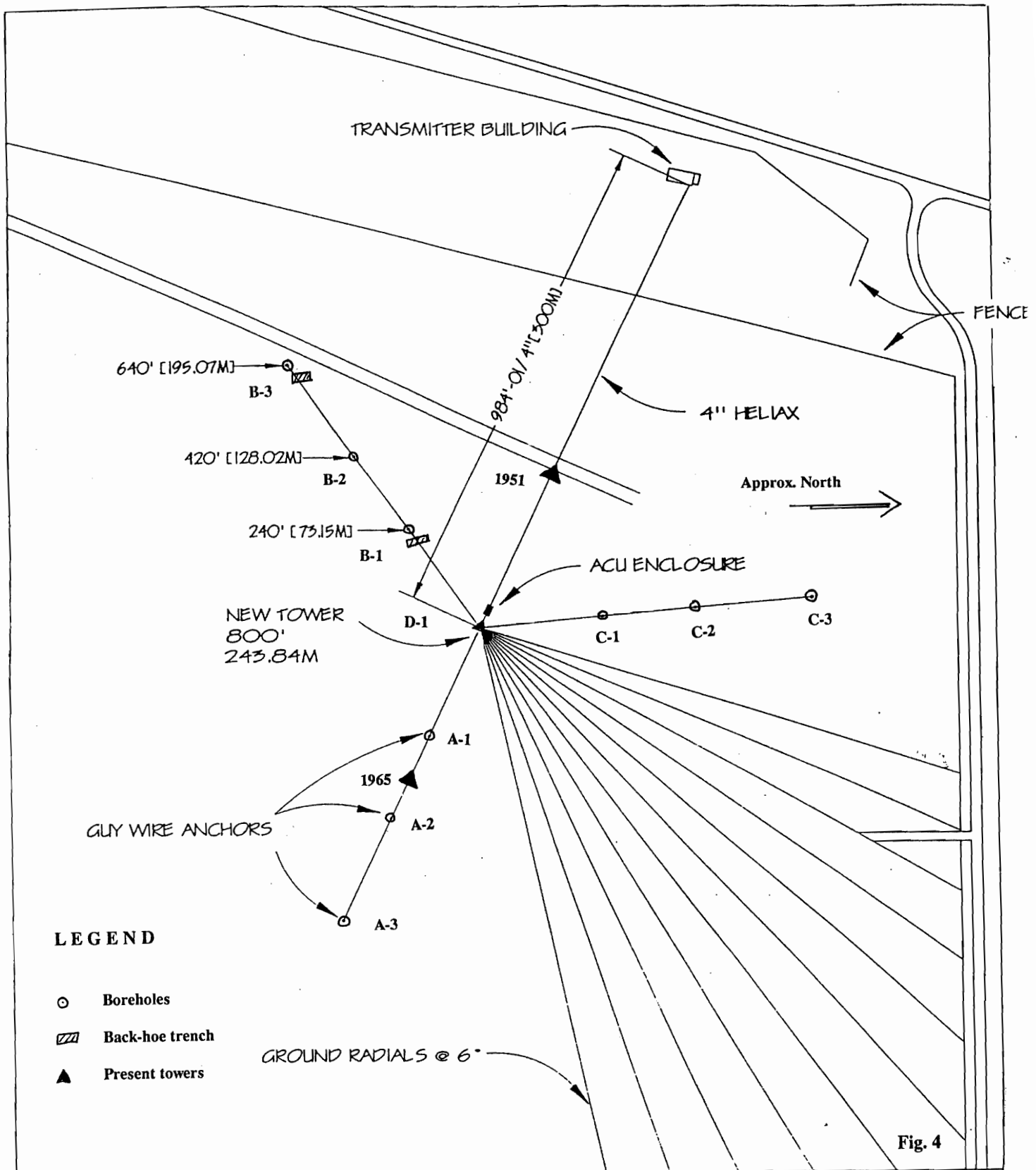


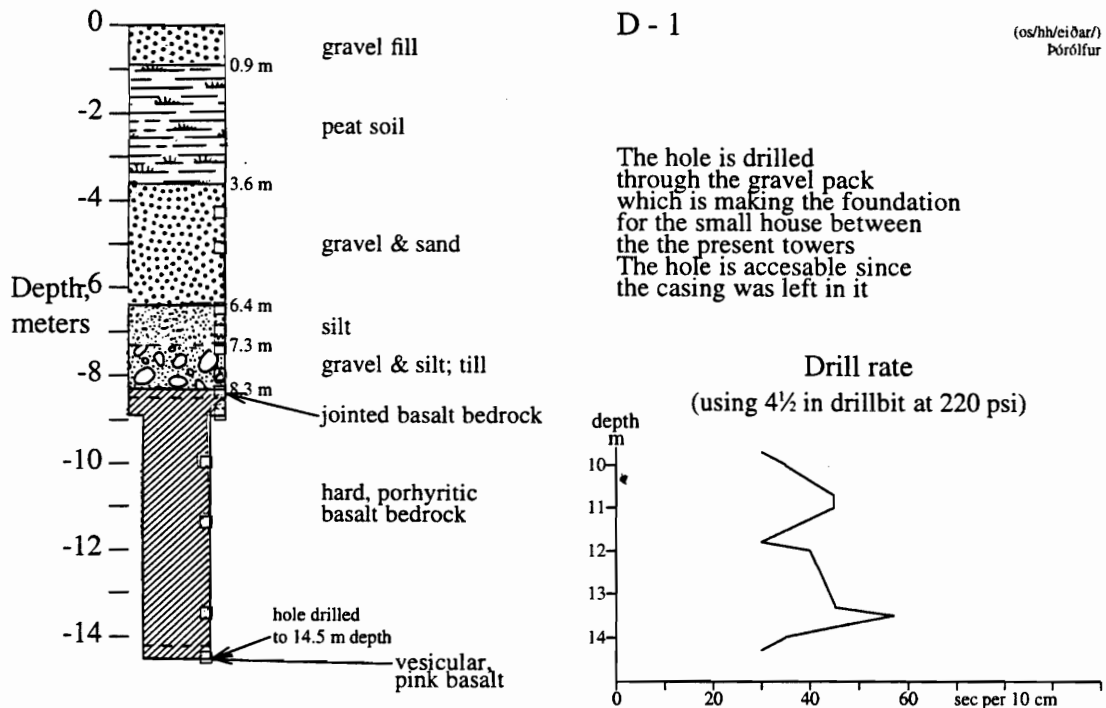
Fig. 3





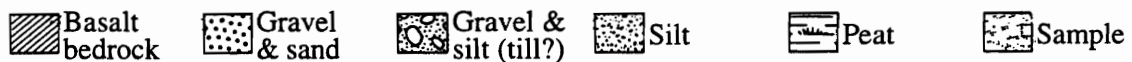
EIDAR, East Iceland.
AM Guyed Transmission Tower Site
Location of Borings

Eiðar, East Iceland Transmission Tower Site



D - 1; This drillhole is situated approximately 9 meters south of the proposed tower site. As the ridges and depressions in the bedrock are elongated S - N, the information obtained here is thought to be quite dependable.

Legend for the drillhole profiles:



Location of drillholes is shown in figure 4.

Tecnical information:

Contractor: Jarðboranir h/f (Iceland Drilling Co. Ltd.).

Crew: Hermann Guðmundsson & Karl S. Steinbergsson.

Drill type: Canterra CT 312, buggy mounted (Canadian).

Air compressor: 500 ft³/min, (usual drill pressure; 220 psi).

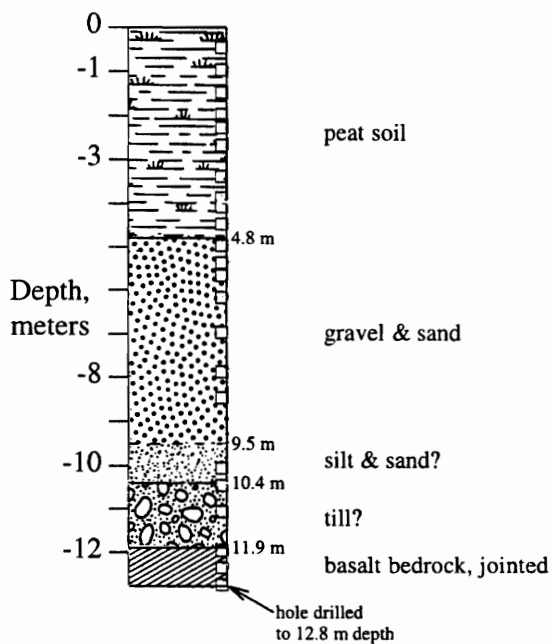
DTH hammer: Ø 5 1/2", ODEX-type (and Ø 6 5/8" from 8.9 - 14.5 meters depth in D - 1).

Casing: Steel, Ø 6 5/8" OD. Usually removed after use.

Rods: Ø 3 1/2".

Sampling: Continuous; samples inspected on site. Representative samples collected for further investigation (total number of collected samles; 85).

Eiðar, East Iceland Transmission Tower Site

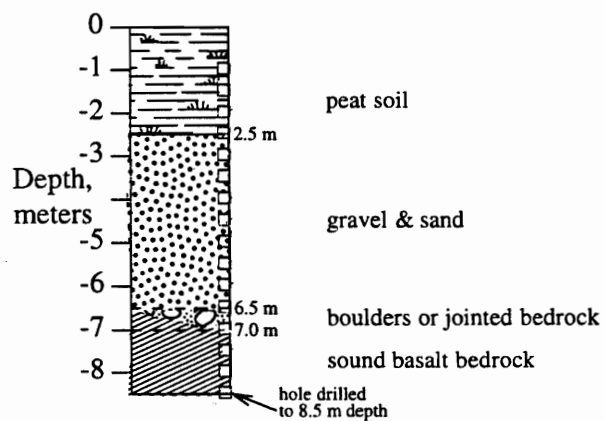


A - 1

(os/hh/eiðar/)
Þórólfur

Note:
Casing was damaged during drilling.
Some samples might contain soil from outside the casing

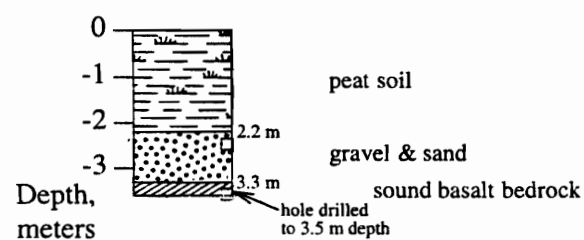
A - 1; 73 m SE of the proposed tower site



A - 2

(os/hh/eiðar/)
Þórólfur

A - 2; 128 m SE of the proposed tower site

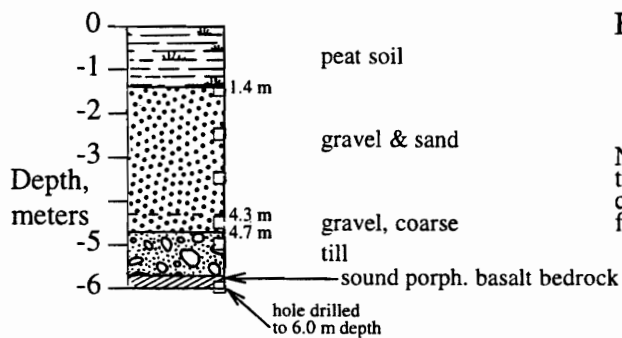


A - 3

(os/hh/eiðar/)
Þórólfur

A - 3; 195 m SE of the proposed tower site

Eiðar, East Iceland **Transmission Tower Site**

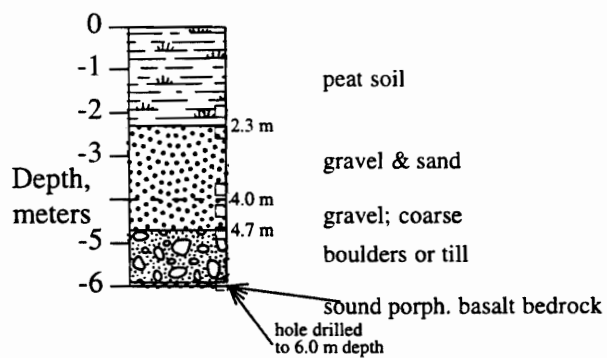


B - 1

(os/hh/eiðar)
Þórólfur

Near the hole a backhoe trench was dug for collecting gravel sample for grain-size analysis

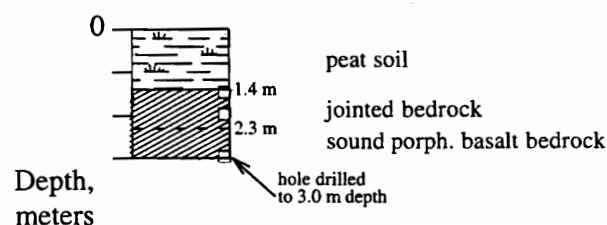
B - 1; 73 m SW of the proposed tower site



B - 2

(os/hh/eiðar)
Þórólfur

B - 2; 128 m SW of the proposed tower site



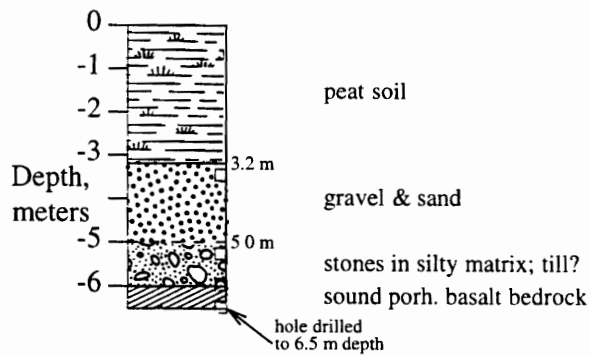
B - 3

(os/hh/eiðar)
Þórólfur

Near the hole a backhoe trench was dug for collecting rock sample

B - 3; 195 m SW of the proposed tower site

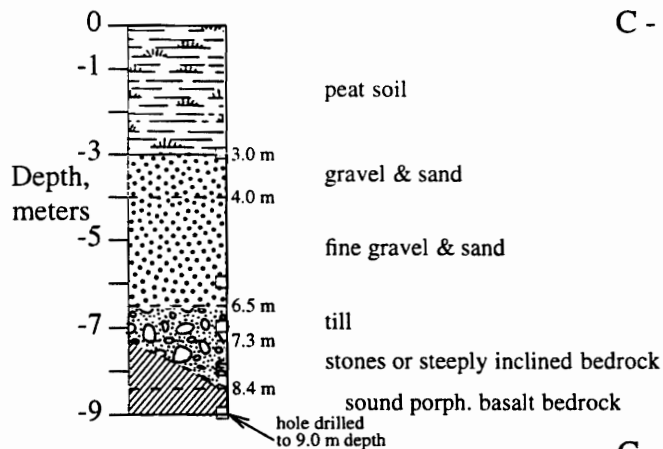
Eiðar, East Iceland Transmission Tower Site



C - 1

(os/hh/eiðar/
Þórólfur

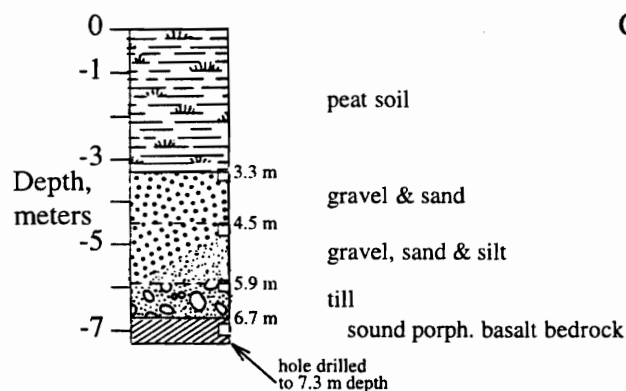
C - 1; 73 m north of the proposed tower site



C - 2

(os/hh/eiðar/
Þórólfur

C - 2; 128 m north of the proposed tower site



C - 3

(os/hh/eiðar/
Þórólfur

C - 3; 195 m north of the proposed tower site

5. Geotechnical Properties of the Gravelly Sand

Laboratory tests done on the loosely packed gravelly sand are;

- a) **grain size analysis**, b) **specific gravity and relative density measurements**,
c) **compaction** and d) **triaxial tests (Consolidated Isotropic Undrained)**.

The tests are done at the **Building Research Institute** laboratories. See chapter 7 for the test results.

- a) The grain size analysis curve can be seen in figure 5. The material is classified according to the USCS system as SP; poorly graded gravelly sand with good all round foundation properties.
- b) It was not possible to obtain proper in situ density measurement in the field, but density measurements were made in the laboratory, both as a very loosely packed material and as a compacted material (Standard Proctor). This should give the possible range for minimum and maximum density of the gravelly sand in the project area.
- c) As the ground water table is at the surface, all the soil materials will be saturated at all times. The moisture content was measured in the triaxial/density tests.
- d) As the rig that was available at the time in Eastern Iceland did not have equipment for standard penetration testing (SPT) or cone penetration testing (CPT), these tests were not done, so standard penetration values are not known for the material. However, it is more common in Iceland to base design on the friction angle (ϕ). Therefore triaxial tests were done, which gave both the friction angle and the cohesion of the material. The cohesion of the gravelly sand is close to zero, as the amount of fines (<US mesh 200) is only 3%. The coefficient of permeability (k), can also be calculated in these triaxial tests.

The above mentioned tests (a - d) give all the relevant properties of the gravelly sand, suggested by ROHN, except the SPT value.

6. Other items of interest

ROHN sent a list to RUV with the following items that should be discussed in the geotechnical report. The discussion follows herewith. Numbers of the items are the same as in the list from ROHN.

1. Geologic description of site: See chapter 3 on Geological Setting.
2. Observed and expected ground water conditions: The ground water will be at the surface or very close to the surface at all times as the bog is undrained because of the ground radials.
3. Expected frost penetration: At this elevation in Eastern Iceland (40-50 meters above sea level), the frost penetration in an undrained bog during a normal winter is commonly over half a meter, often up to 0.7 meters. In severe winters the frost depth can exceed one meter. The frost disappears from the ground usually in May, but in severe weather conditions not until June. Frost has not damaged the ground radials that are at an approximate depth of 1 foot. However, where the peat is replaced by gravel and concrete structures, the frost

penetration can reach at least 1.5 meters.

4. Corrosion potential of the soil: The average precipitation in Iceland is rather acid, or pH 5.2. Ten pH measurements were made on samples from the peat. The values varied from pH 4.7 to 5.6, most commonly around pH 5. With this acidity the ground water is expected to be corrosive, so protective coating is recommended for material that will be in contact with the ground water.
5. Site access and potential construction difficulties: The site is adjacent to a main road, but as the site is an undrained bog or marshland, only tracked vehicles (with extra wide tracks), e.g. track type backhoe excavators can move about the area, except when frozen. However inexpensive construction "roads" are commonly laid over such bogs in Iceland by contractors. Then geotextiles (about 140 g/m²) are laid directly on top of the vegetation mat and about 20-30 cm thick fill of sandy gravel is laid on top of the geotextile. This type of "road" can carry the necessary weights across the project area.
6. Dewatering or site drainage requirements: The peat itself is not very permeable, but when the bottom of a pit or excavation meets the gravelly sand underneath, the pit fills up very quickly. The estimated coefficient of permeability (k) for the gravelly sand can be estimated from the grain size curve by using the Hazen equation.
7. Backfill material recommendations: There is a lot of gravel/sandy gravel about 10 km south of the site (at Mynes). This is "frost free" material (GW/GP-SP/SW material, USCS), but cannot be used for concrete. Good aggregate for concrete is located at Holl (ca. 25 km north of Eidar and at Litlibakki, at the river Jökulsá á Dal, about 50 km from Eidar. There is a concrete batching plant for ready mix concrete at the nearby town of Egilsstaðir, 15 km south from Eidar.
8. Settlement considerations: As the gravelly sand in question is thin (1 to 4 meters thick), there is little room for settlement, but as the sand is rather loosely packed, there might be slight "instantaneous" settlement or packing of the sand during the construction activity. A long term settlement is not expected. Anyway, the gravelly sand would be compacted if used as a base for the concrete anchor blocks. A silty layer at D-1, the tower foundation should be checked prior to construction by digging a backhoe trench down to the layer at 6.5 meters.
9. Additional information: Icelandic contractors are quite used to carry out constructions in this type of terrain, such as the foundations in this project.
10. Recommended types of foundations: See locations of drill logs on pages 8 to 11 and test results in chapter 7.
Tower foundation. Location D-1. The tower could either be founded on the gravelly sand, at a depth of about 4 meters (see drill log) or directly on the bedrock, at about 8 meters depth. The geotechnical designers must choose between these options. Prior to the construction of the foundations, a trench

should be excavated down to a silty layer at a depth of 6.4 to 7.3 meters. An examination of the layer would help in deciding the depth of the foundations.

Anchor points. At two of the anchor points, A-3 and B-3, depth to bedrock is very small, so there concrete anchor blocks can be founded directly on the bedrock. In the seven remaining anchor points, concrete anchor blocks might rest on the gravelly sand or could be dug into the sand. In these cases the surface of the sand should be compacted at least to Modified Proctor standard.

It is also possible to further enhance the foundation qualities of the gravelly sand by removing 1-2 meters of the sand and putting in rockfill or coarser gravel that should be compacted in 0.5 meter thick layers.

The geotechnical designers must compare these options or come up with other solutions.

7 LABORATORY TESTING

7.1 General

Laboratory tests were performed at the Building Research Institute in Reykjavík. Following is a description of each test together with reference to the standard testing method used in the laboratory. The sample (From Eiðablá, depth 2m) was taken by the National Energy Authority from a test pite, for location see Dwgs 04.

7.2 Grain-size analysis

The grain-size distribution is determined according to ASTM C-136. The soil is classified according to the Unified Soil Classification System (USCS), ASTM D-2487. The results from one test are shown on Dwgs. 05 and the following table:

Sieve size	#200	#100	#50	#30	#16	#8	#4	3/8"	1/2"	3/4"	1"
Percent passing	2,7	4	7	23	44	59	71	81	84	91	99

The particle size distribution of the material show that the material is gravelly sand, poorly graded (SP) with 2,7 % fines.

7.3 Specific gravity

The specific gravity is determined with a pycnometer according to ASTM D-854. The results from one test are 29,23 kN/m³.

7.4 Relative density

The relative density measurement is performed according to ASTM D 4253 and D 4254. The results are the following:

Max dry density 19,95 kN/m³

Min dry density 16,43 kN/m³

Relative density:

Sample 1 Dr = 41%

Sample 3 Dr = 74%

Sample 5 Dr = 66%

Sample 6 Dr = 79%

7.5 Compaction

Compaction were performed according to Standard Proctor ASTM D-698.

7.6 Triaxial tests

Triaxial tests were carried out on loose and compacted sampels with a diameter of 4" and a height of 8". The tests are conducted according to "General Procedure in Investigation, Design and

Controll During Construction of Earth- and Rock Fill Dams in Norway” by B. Kjærnsli NGI Publ. nr. 80 Oslo 1968.

The triaxial tests were performed on material finer than 19 mm. Two triaxial tests were performed on loose material and two on compacted material according to Standard Proctor ASTM D 698. The results from the loose tests are shown on Dwgs. 06, 07, 10 and 12 and from the compacted tests on Dwgs 08, 09 11 and 12.

The results from the triaxial tests are shown on the following tables:

	σ_1	σ_3	τ	τ/σ_{1c}	τ/σ_1	φ	$\varepsilon\%$
Sample 1, loose material							
Water content (%)	Before Cons. 18,6%			After Cons. 17,1%			
Saturated density	Before Cons. 20,4 kN/m ³			After Cons. 20,7 kN/m ³			
Dry density	Before Cons. 17,2 kN/m ³			After Cons. 17,7 kN/m ³			
Test CIU (Consolidated Isotropic Undrained) (Consolidation pressure 50 kPa)							
At $\varepsilon = 1\%$	143	33	55	0,66	0,38	38,7	0,9
At $\varepsilon = 2\%$	171	34	68	1,36	0,40	41,3	2,0
At $\varepsilon = 10\%$	263	55	104	2,08	0,40	40,9	10,0
At σ_3/σ_1 min	202	39	82	1,64	0,41	42,7	3,5
Sample, 3 loose material							
Water content (%)	Before Cons. 18,1%			After Cons. 13,5%			
Saturated density	Before Cons. 20,5 kN/m ³			After Cons. 21,4 kN/m ³			
Dry density	Before Cons. 17,4 kN/m ³			After Cons. 18,9 kN/m ³			
Test CIU (Consolidation pressure 100 kPa)							
At $\varepsilon = 1\%$	247	66	91	0,91	0,37	35,4	1,0
At $\varepsilon = 2\%$	278	61	109	1,09	0,39	40,2	2,0
At $\varepsilon = 10\%$	382	79	152	1,52	0,40	41,4	9,9
At σ_3/σ_1 min	328	65	131	1,31	0,40	41,9	4,3

All stresses are in kPa.

	σ_1	σ_3	τ	τ/σ_{1c}	τ/σ_1	φ	$\varepsilon\%$
Sample 5, compacted material							
Water content (%)	Before Cons. 16,1%			After Cons. 16,1%			
Saturated density	Before Cons. 21,5 kN/m ³			After Cons. 21,5 kN/m ³			
Dry density	Before Cons. 18,6 kN/m ³			After Cons. 18,6 kN/m ³			
Test CIU (Consolidated Isotropic Undrained) (Consolidation pressure 50 kPa)							
At $\varepsilon = 1\%$	340	56	142	2,84	0,42	45,8	0,9
At $\varepsilon = 2\%$	469	78	196	3,92	0,42	45,9	2,0
At $\varepsilon = 10\%$	681	139	271	5,42	0,40	41,4	9,8
At σ_3/σ_1 min	444	73	186	3,72	0,42	46,1	1,7
Sample 6, compacted material							
Water content (%)	Before Cons. 15,1%			After Cons. 15,1%			
Saturated density	Before Cons. 22,0 kN/m ³			After Cons. 22,0 kN/m ³			
Dry density	Before Cons. 19,1kN/m ³			After Cons. 19,1 kN/m ³			
Test CIU (Consolidation pressure 100 kPa)							
At $\varepsilon = 1\%$	493	94	200	2,00	0,41	42,9	0,9
At $\varepsilon = 2\%$	636	114	261	2,61	0,41	44,1	1,9
At $\varepsilon = 10\%$	891	183	354	3,54	0,40	41,2	10,2
At σ_3/σ_1 min	686	123	282	2,82	0,41	44,3	2,4

All stresses are in kPa.

8. RECOMMENDATIONS

According to the results from these tests, it is recommended to use the following material parameters for the investigated material:

Loose material:

Saturated density 20 kN/m³

Cohesion 0

Friction angle 40 °

Compacted material:

Saturated density 21 kN/m³

Cohesion 0

Friction angle 42 °

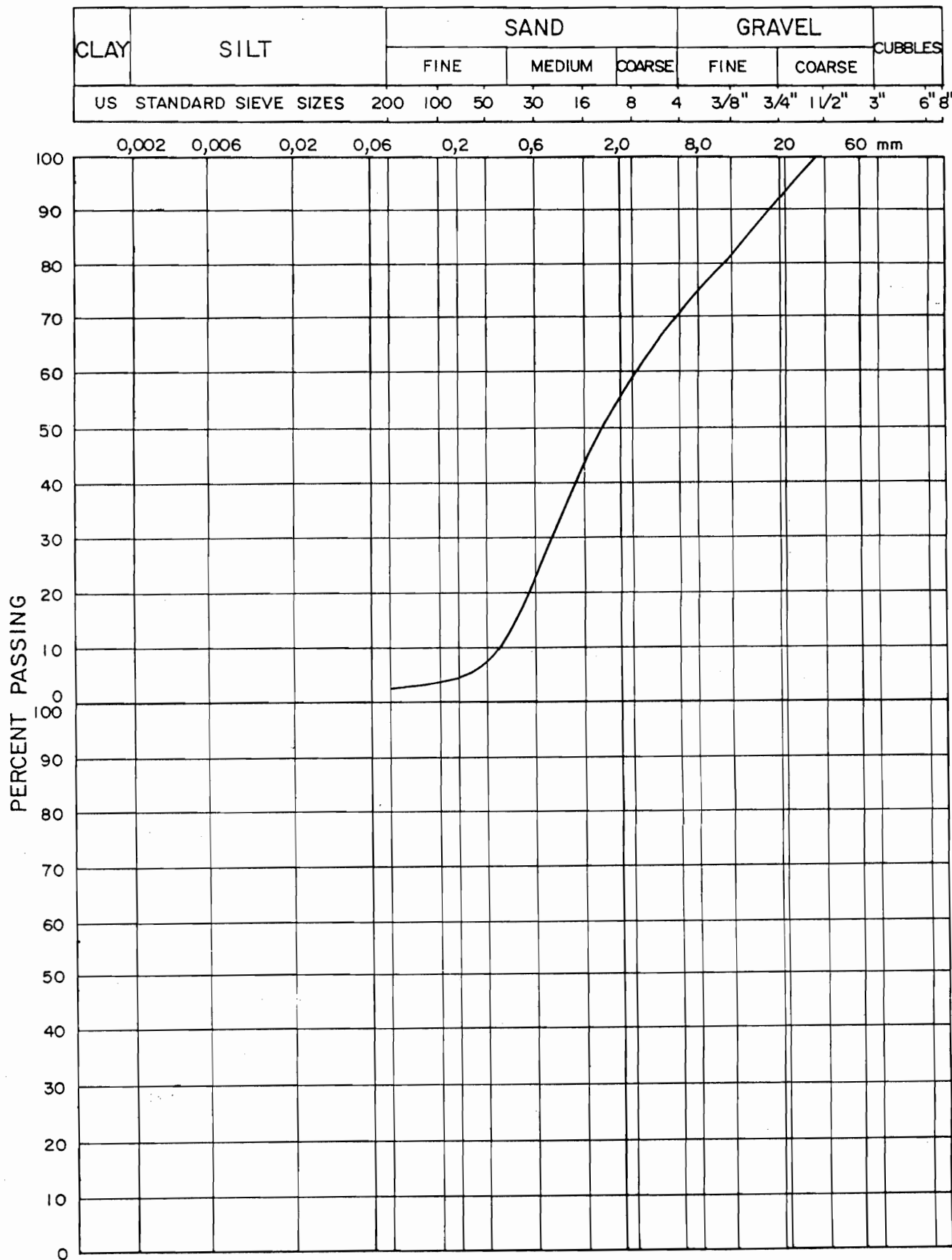
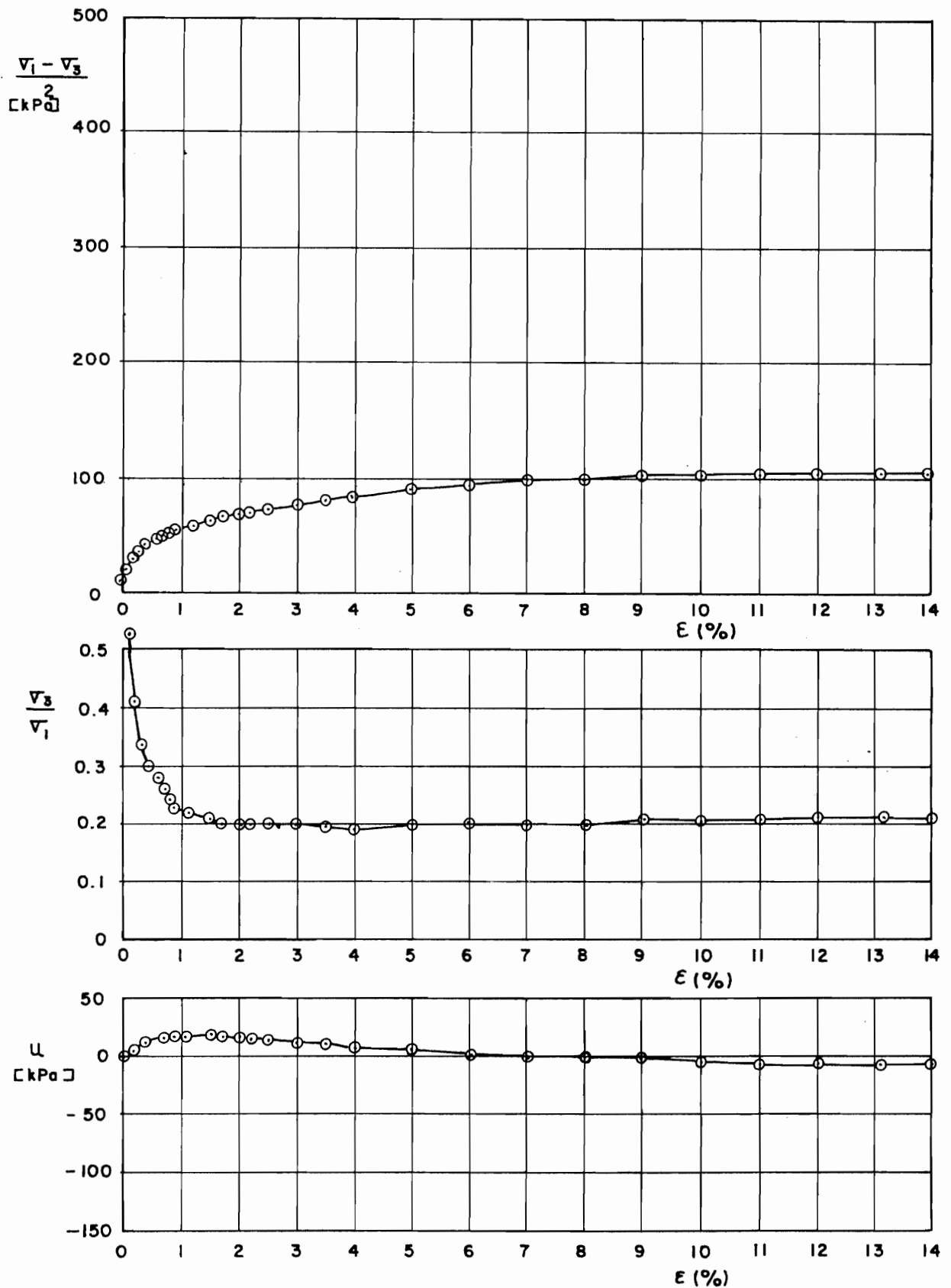


Fig. 5

		ICELANDIC NATIONAL BROADCASTING SERVICE					
		AM GUYED TRANSMISSION TOWER SITE					
		GRAIN SIZE DISTRIBUTION					
		EIDABLA; DEPTH 2 m					
ALMENNA VERKFRÆÐISTOFAN H/F						F R V	
FELLSMULA 26 108 REYKJAVÍK 8SMÍ (91) 878 100 FAX (91) 880 284							
Hannað	Teknað	M.					
Athugað	Samb.	JS	Daga. Mýr 97	Nr.	J 05		



SAMPLE 1

Fig. 6

		ICELANDIC NATIONAL BROADCASTING SERVICE			
		AM GUYED TRANSMISSION TOWER SITE			
		TRIAXIAL SHEAR TEST			
		LOOSE MATERIAL			
ALMENNA VERKFRÆÐISTOFAN H/F FELLISMULA 26 108 REYKJAVÍK SMÍ (91) 678 100 FAX (91) 680 284		F	R	Y	
Hannað	Teknað	M.			
Athugað	Samb.	JS	Daga	May 97	Nr.
					J
					06

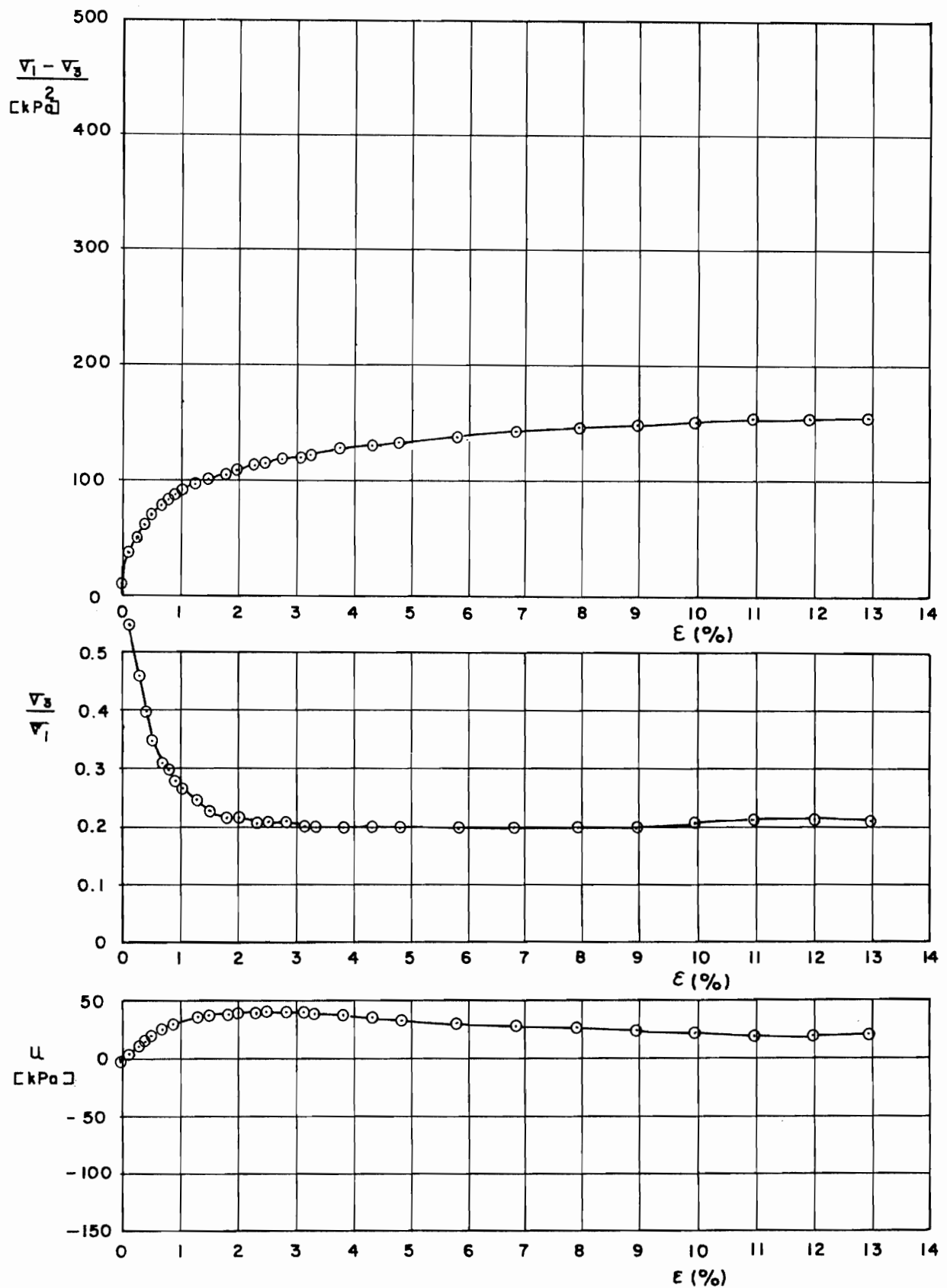
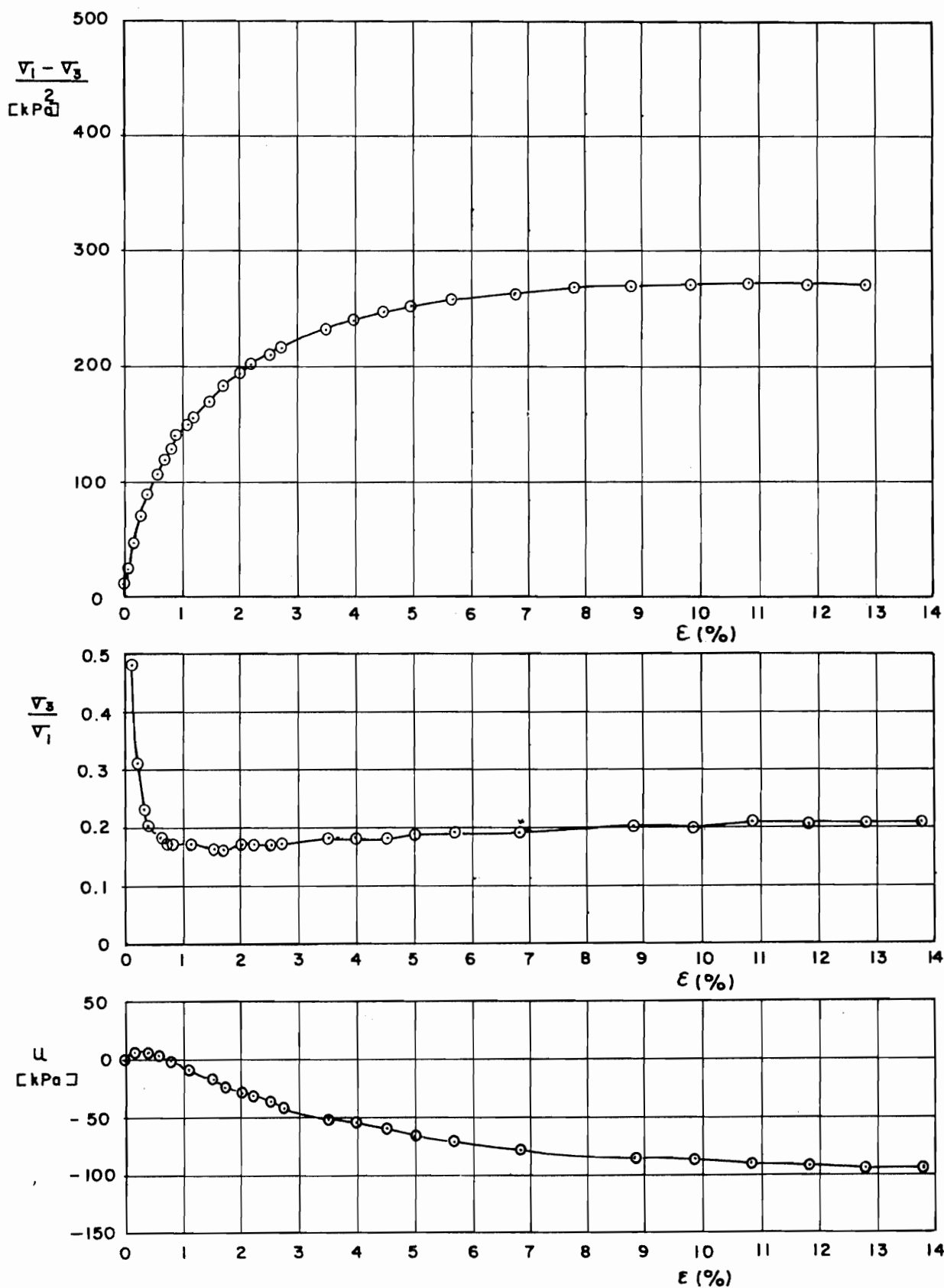


Fig. 7

SAMPLE 3

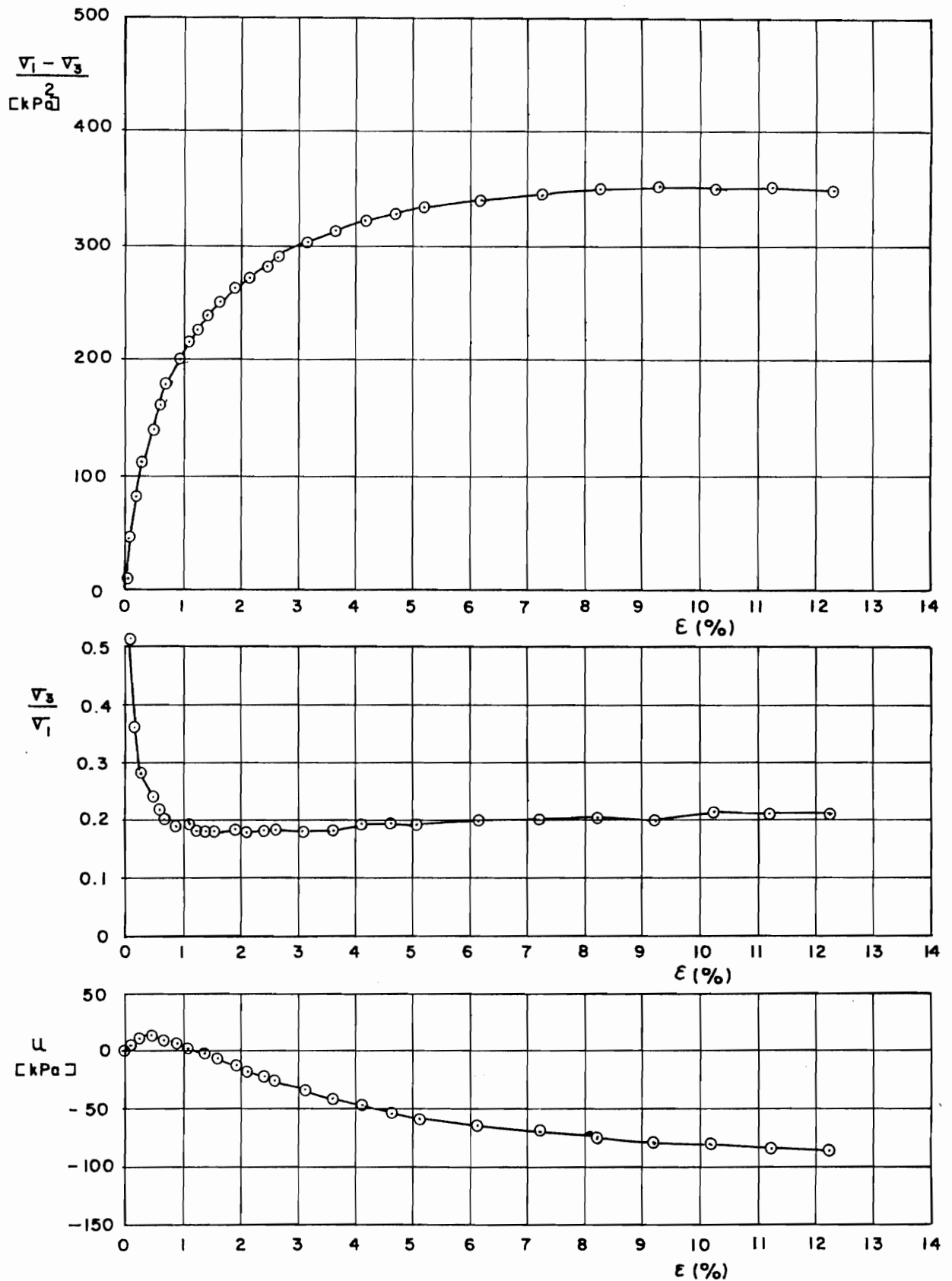
		ICELANDIC NATIONAL BROADCASTING SERVICE				
		AM GUYED TRANSMISSION TOWER SITE				
		TRIAXIAL SHEAR TEST				
		LOOSE MATERIAL				
ALMENNA VERKFRÆÐISTOFAN H/F FELLSMÚLA 26 108 REYKJAVÍK SMÍ (91) 878 100 FAX (91) 880 284		F	R	V		
Hannað	Teknað	M.				
Athugað	Samp.	JS	Daga.	May 97	Nr.	J 07



SAMPLE 5

Fig. 8

		ICELANDIC NATIONAL BROADCASTING SERVICE				
		AM GUYED TRANSMISSION TOWER SITE				
		TRIAXIAL SHEAR TEST				
		COMPACTED MATERIAL				
ALMENNA VERKFRÆÐISTOFAN H/F FELLSMULA 26 106 REYKJAVÍK 51M (91) 678 100 FAX (91) 880 284						
Hannað	Teknað	M.				
Alhugað	Samb.	JS	Daga.	May 97	Nr.	J 08



SAMPLE 6

Fig. 9

		ICELANDIC NATIONAL BROADCASTING SERVICE				
		AM GUYED TRANSMISSION TOWER SITE				
		TRIAXIAL SHEAR TEST				
		COMPACTED MATERIAL				
ALMENNA VERKFRÆÐISTOFAN H/F FELLSMÚLA 26 108 REYKJAVÍK SMÍ (91) 678 100 FAX (91) 680 284		F R V				
Hannað	Teknað	M.				
Athugað	Samþ.	JS	Daga.	May 97	Nr.	J 00

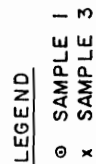
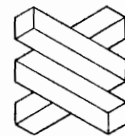


Fig. 10



ICELANDIC NATIONAL BROADCASTING SERVICE

AM GUYED TRANSMISSION TOWER SITE

TRIAXIAL SHEAR TEST

SUMMARY, LOOSE MATERIAL

ALMENNA VERKFRÆÐISTOFAN H/F
WELLSHALLA 26 108 REYKJAVÍK SMÍÐ (01) 579 109 FAX (01) 669 204

2000

Date	May 97	Nr.	J	10
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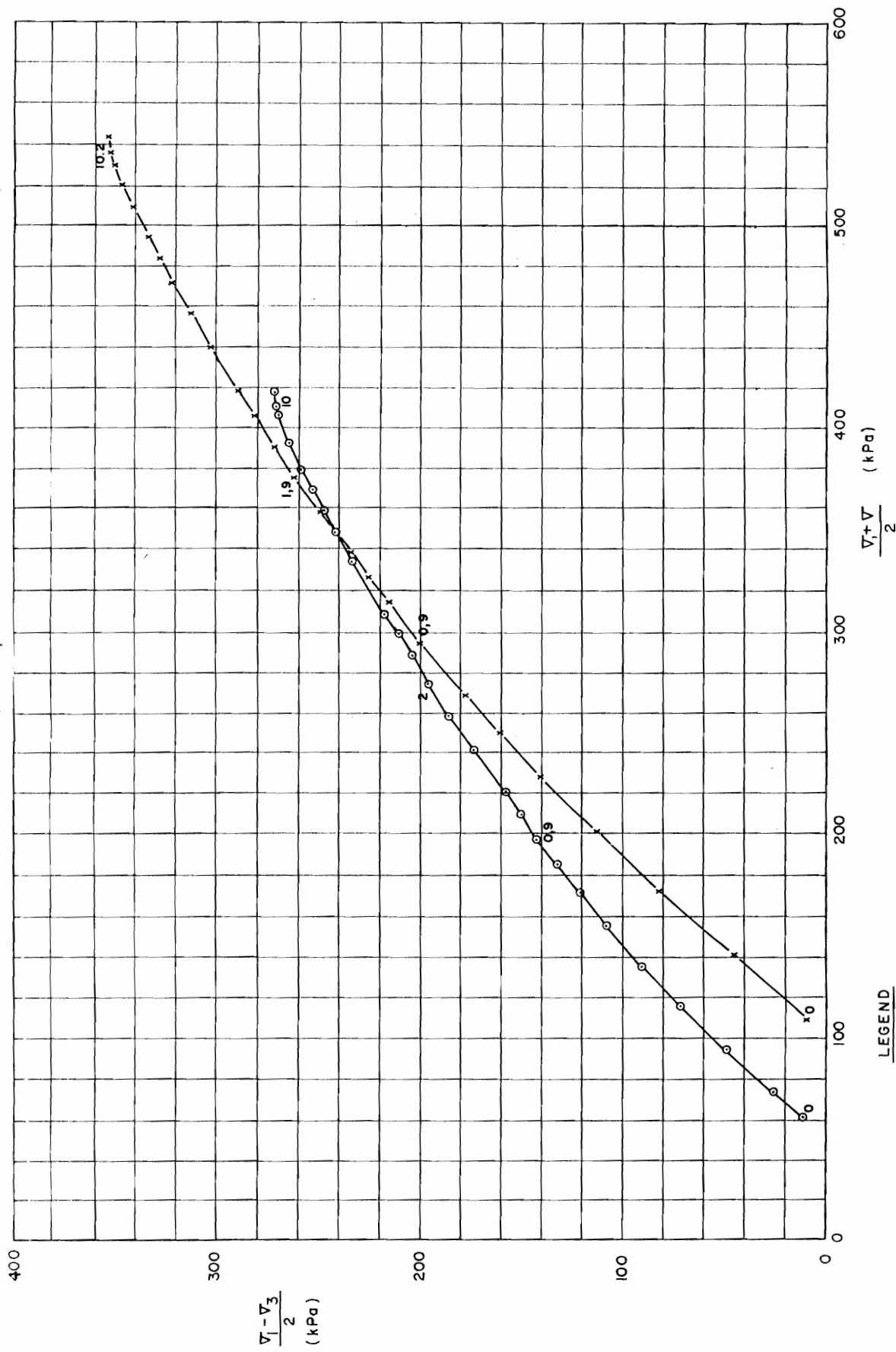
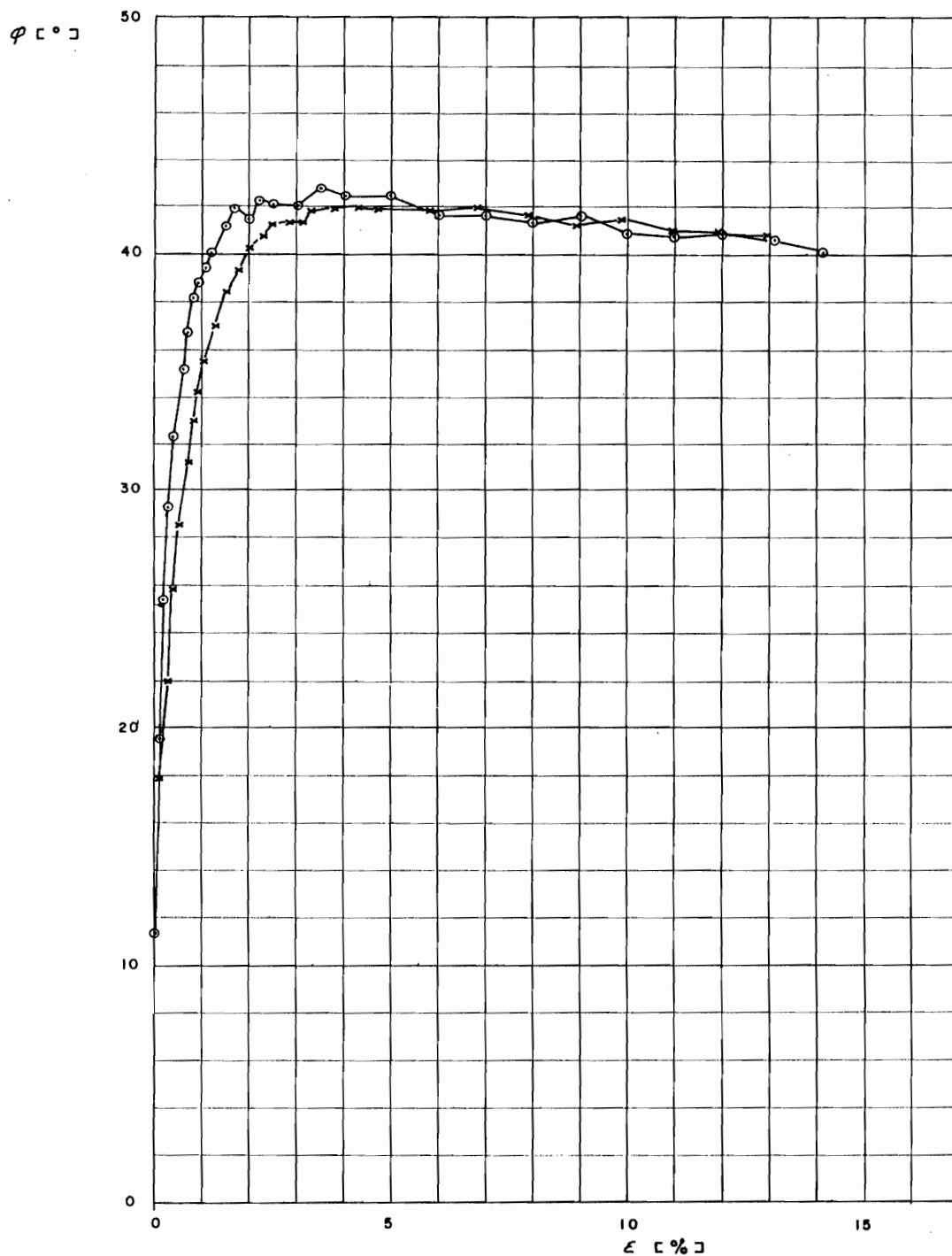


Fig. 11

Fig. 12

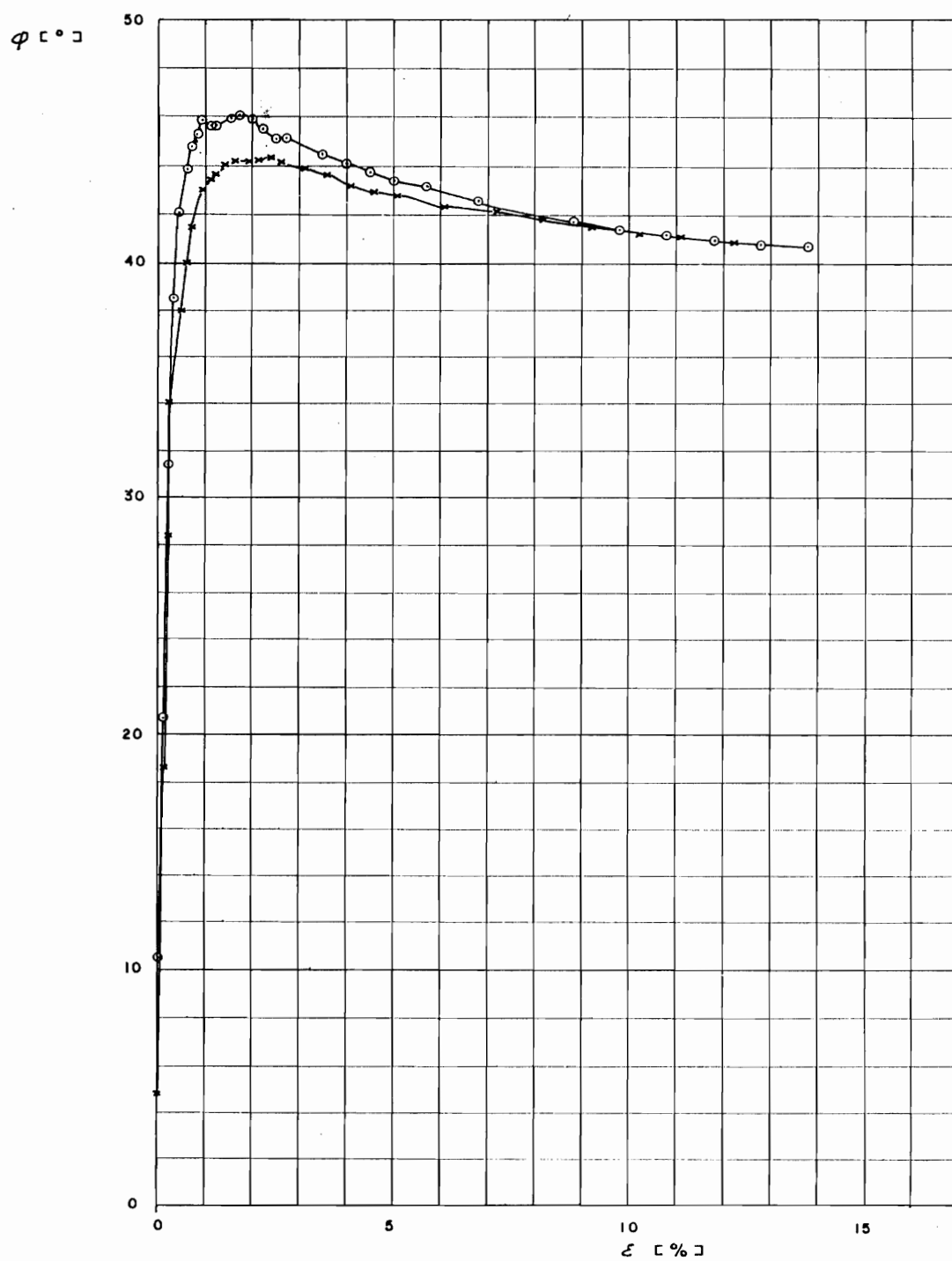


LEGEND

- SAMPLE 1
- x SAMPLE 3

		ICELANDIC NATIONAL BROADCASTING SERVICE	
		AM GUYED TRANSMISSION TOWER SITE TRIAXIAL SHEAR TEST SUMMARY, LOOSE MATERIAL	
ALMENNA VERKFRÆÐISTOFAN H/F PELLISKA 88 106 REYKJAVÍK 800 (01) 876 100 FAX (01) 880 284			
Herrað Tölvað M.	Almenn Samg. 28	Daga May 97	Nr. 12

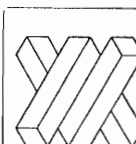
Fig. 13



LEGEND

© SAMPLE 5

x SAMPLE 6



ICELANDIC NATIONAL BROADCASTING SERVICE

AM GUYED TRANSMISSION TOWER SITE

TRIAXIAL SHEAR TEST

SUMMARY, COMPACTED MATERIAL

AL: IENNA VERKFRÆÐISTOFAN H/VF

FELLSMULA 26 108 REYKJAVÍK SÍMI (91) 878 100 FAX (91) 680 284

Hannað		Teiknað		M.	
Athugað		Sæmp. JS		Daga. May 97	
				Nr.	
				J 13	