D. OTHER SUPPLEMENTAL SURVEY REPORTS FOR DESIGN

ENVIRONMENTAL CONSIDERATION

Environmental Consideration

1. Methodology

'Environmental Consideration' has been done in the project is composed of the following examinations:

- analysing environmental impacts of development activities on the project site and its surrounding areas during the stages of both construction and operation,
- proposing necessary mitigation measures to avoid and/or alleviate significant adverse impacts on natural and human environment.

However, because of the project nature which environmental impacts of the development activities are minor, the environmental consideration did not include environmental impact assessment based upon simulation works to forecast and evaluate environmental impacts using simulation models. As shown in below it mainly examined the impacts caused by the development activities with qualitative expressions for evaluating.

(1) pre-assessment

- Reviews of the previous environmental studies

(2) analysis of existing constraints and potential impacts

- Collection of further data and maps
- On-site survey by JICA Study Team
- Discussion with experts of JICA Study Team and the authorities concerned

(3) mitigation measures

- On-site survey
- Literatural survey
- Discussion with experts of JICA Study Team and the authorities concerned

As the Jordanian Government does not have its own guidelines on environmental assessment, basically taking into consideration of the Environmental Consideration Guidelines of JICA and OECF, the important environmental items were carefully assessed through the above process.

The environmental examination was undertaken in each work component of the project from the viewpoints of both natural and social environment, mainly focussing on unclear or significant environmental issues pointed out in the previous environmental studies. Based upon such comprehensive environmental examination, the major negative and positive impacts at both construction and operational phases caused by the project implementation were identified. The possible impacts were classified according to the natures of the development activities such as site location and project scale. In addition, to reduce or avoid the negative impacts, some mitigation measures were proposed.

2. Previous assessment

2.1. Initial Environmental Examination (IEE):

The IEE identified the potential negative impacts which summarise as follows:

- change in the landscape and remote atmosphere of wild nature
- pressure on water resource availability
- degradation of the water quality
- increased exposure to the risk of natural disaster (landslide and erosion)

The IEE concluded that an EIA was required focussing upon the 1) landslide potential, 2) wildlife survey, 3) archaeological survey and 4) potential for an oasis garden and use of wastewater.

2.2. Environmental consideration by SAPROF:

An EIA is not required for the Panoramic Complex Sub-project given that the sub-project no longer comprise hotel accommodation which is the major cause for concern.

- increase of impacts on wildlife
- increase of impacts on archaeological sites
- increase of tourist litters
- increase of traffic nuisance

The project site is one of unique qualities and environmental sensitivities which require the establishment of appropriate institutional system to ensure these very qualities which provide the tourist attraction are not adversely effects considering the above issues.

3. Examination on potential environmental impacts and proposed mitigation measures

According to severe geographic condition, the major environmental impacts at the stage of construction stage and operational stage are damage on archaeological features, vegetation and wildlife near the project site.

Most of the impacts have adverse and long-term impacts. Therefore, careful mitigation measures are necessary. The sensitive issues are as follow:

(1) water management

Waste water and soil discharged by construction works may cause sever direct impacts on vegetation and aquatic animals. They should be required to take appropriate measures to alleviate the adverse impacts on natural environment although no laws and regulations which control construction wastewater have not been established in Jordan (see Table 1). Mitigation measures such as purification and septic tanks that could avoid or alleviate that wastewater generated from temporary facilities or plants directly effects aquatic habitats are required.

In addition, extraction from well and wadi in adjacent to the project would reduce water flow of wadis and springs and cause significant adverse impacts on habitats and ecosystem around the project site, because wadis around the site have not sufficient water flow. Therefore, water supply systems for construction works construction stage and for tourists operational

stage should be established.

(2) solid waste management (including construction wastes)

The development project would generate a large amount of construction wastes including hazardous substances which may do harm to human. It is expected to establish a temporary waste management system of construction wastes securing transporting vehicles and appropriate disposal areas.

The project are composed of construction of viewpoints and a museum that would enhance visit of tourists, in the meanwhile, which would also accumulate general wastes of tourists. Incineration having sufficient capacity against future increase of tourists litters or waste collection system should be established.

(3) archaeological remain

There is a few archaeological remains identified around the project site. As they are not so important in the light of archaeological aspects and far from the site, significant adverse impacts are not expected.

However, construction work would meet deposited archaeological sites in the ground. In order to avoid or minimise the damage on such remains, it is required to maintain observation in consultation with experts of the Department of Antiquities (DOA) construction stage stage.

Table 1 Potential impacts

Factors	Actions	Impacts	Stage	Impact ranking	Type
Water Pollution	- discharge of wastewater from plants, temporary facilities and accommodation into wadis	- degrade water quality in the wadis by wastewater and suspended particles	construction	○	direct
Waste Pollution	- construction works - increase of tourists	- construction wastes -generate huge amount of general wastes	construction operational	○	direct cumulative
Landscape	- construction of structure and road etc.	deterioration of landscape	construction	○	direct
Ecology	- wastewater from plants and temporary into wadis - water extraction from wadis	- effects on vegetation along wadis and aquatic habits	construction	○	direct
Archaeological remains	- cut and embankment - provide temporary facilities and road etc. - transportation	- damage on the existing archaeological remains and newly discovered sites	construction	○	direct

○ major △ minor

Source: JICA Study Team

Table 2 Proposed Mitigation Measures

	Impacts	Mitigation measures
mitigation measures should be clarified in the tender document	Archaeological remains	**[construction stage]** - construction work plans including temporary facilities and road should be admitted by DOA **[construction stage]** - observe in consultation with experts of DOA to avoid direct impacts on potential archaeological remains
	Waste pollution	**[construction stage]** - ensure disposal site for construction wastes near the project site
	Water pollution	**[construction stage]** - avoid rainy season - avoid of using water supply from wadis - avoid direct discharge of waste water
others	Waste Pollution	**[operational stage]** - place litter bin - provide new collection system of solid wastes
	Landscape	**[construction stage]** - careful attention to be paid to height, colour, and feature of construction to alleviate drastic landscape changes
	Ecology	**[construction stage]** - use bridge and culvert for water courses - avoid rainy season as much as possible
	Archaeological remains	**[operational stage]** - place signage and fences should be to protect important sites

Source: JICA Study Team

Environmental Checklist of Dead Sea Complex

Construction Stage

		Major	Minor	None	Not Clear	Problems	Actions & Mitigation measures proposed	Remarks
Pollution	1. Air Pollution			*				
	2. Water Pollution		—			• discharge of wastewater from construction plants etc. into wadis may cause water pollution	• provide wastewate treatment facilities	no legal requirement for the control of wastewater from construction works
	3. Soil contamination			*				
	4. Noise and vibration			*				no residential areas around the project site
	5. Subsidence			*				
	6. Waste generation		—			• construction wastes	• secure disposal site • enhance recycling of construction wastes	
Natural Environment	1. Effect on ecology		—			• water extraction from wadis may damage on aquatic habitats	• avoid dumping of waste soil into wadis and extraction of water from wadis	
	2. Effect on landscape		—			• structures may change natural landscape	• use construction materials which will not cause drastic landscape considering color and height	
Human Environment	1. Historical and cultural heritage		—			• construction works and transportation may cause damage on the exsiting and newly dicovered archaeological sites	• observe in consultation with experts of DOA	identified archaeological sites are far from the project site.
	2. Effect on existing infrastructure			*				
	3. Relocation			*				
	4. Traffic congestion and safety			*				
	5. Socio-economic effects			*				
	6. Infrastructure pressures			*				

Operational Stage

		Major	Minor	None	Not Clear	Problems	Actions & Mitigation measures proposed	Remarks
Pollution	1. Air Pollution			*				
	2. Water Pollution			*				
	3. Soil contamination			*				
	4. Noise and vibration			*				
	5. Subsidence			*				
	6. Waste generation		—			• potential increase of tourist litters	• place litter boxes • provide solid waste collection system	
Natural Environm	1. Effect on ecology			*				
	2. Effect on landscape			*				The area around the project site is owned by JVA which controls the development plan.
Human Environment	1. Historical and cultural heritage		—			• increase of tourists may cause damage on archaeological sites	• place signs and fence on important sites	
	2. Effect on existing infrastructure			*				
	3. Relocation			*				
	4. Traffic congestion and safety		—			• increase of tourist cars may cause traffic accidents with sheeps	• place signs to notify and fence to reduce accidents • raise awareness by environmental education	
	5. Socio-economic effects		+			• potential increase of business opportunity		
	6. Others			*				

+: positive impacts —: negative impacts

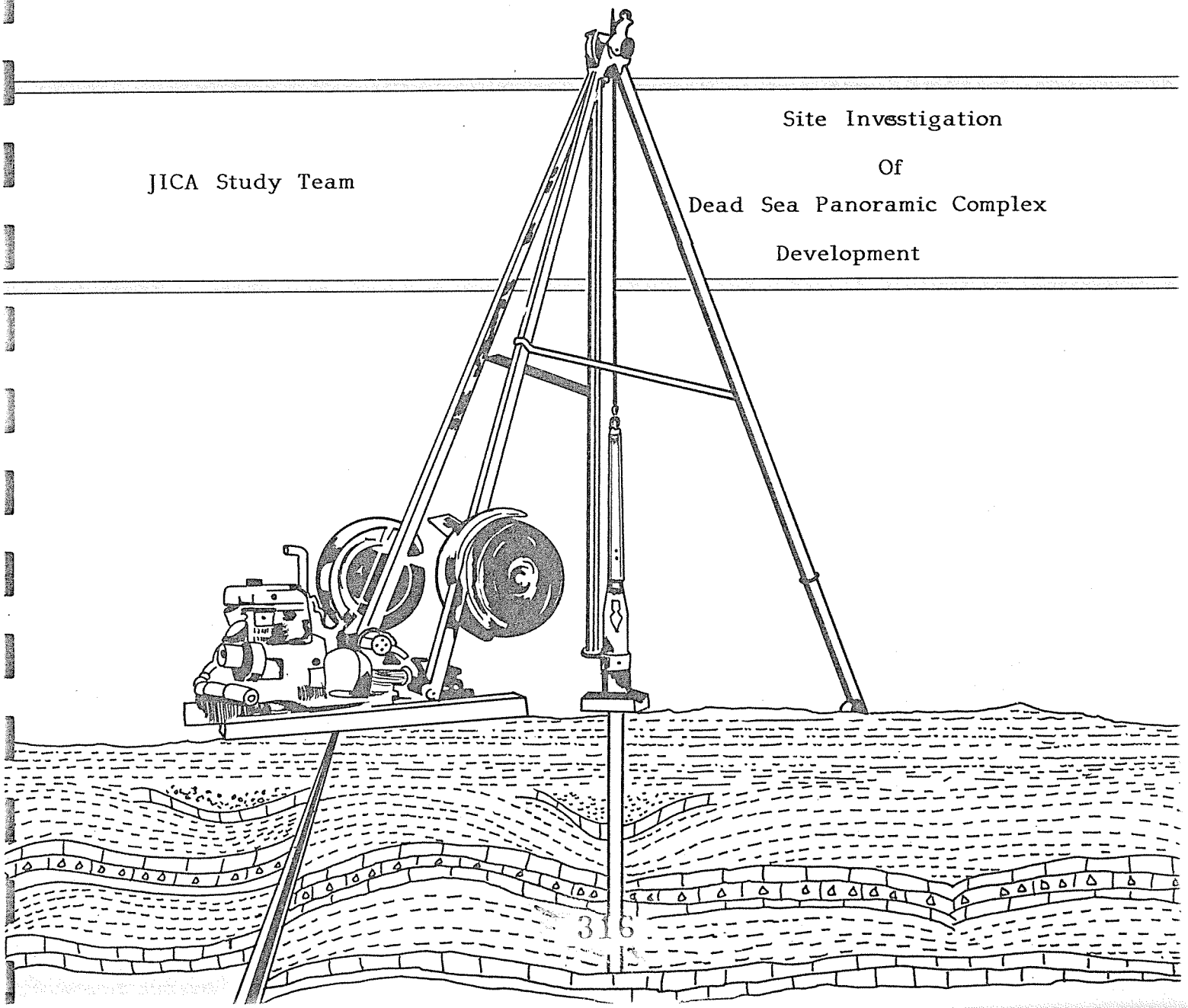
SOIL INVESTIGATION REPORT

TOUKAN AND SAKET Geo-Research

Foundation Engineering & Material Testing

JICA Study Team

Site Investigation Of Dead Sea Panoramic Complex Development



TOUKAN & SAKET
Geo - Research & Foundation
Engineering Office
Drilling , Sampling , Testing
Engineering Geology , Foundations,
Geomechanics,
& Material Testing

مكتب طوقان والساكت
للدراسات الهندسية الجيولوجية والأساسات
تثقيب ، اخذ عينات ، تحليل ،
مسح هندسي جيولوجي ، دراسة
اساسات وميكانيكا الصخور والتربة
وفحص المـــواد

Ref : R99/18/1999

Date: 19/6/1999

Messrs : JICA Study Team

Site Investigation
Of
Dead Sea Panoramic Complex Development

Dear Sirs,

Upon your request, concerning the above mentioned project , we have the honour to submit for your consideration the attached report in which we summarized the results of the investigation undertaken by our firm.

We take the opportunity to express to you our highest consideration

Best Regards

Sincerely yours,
Toukan & Saket

ص.ب ٩٢٦٨٩٧ - تلفون ٦٦٢٤٠٥ - فاكس ٦٦٤٤٨٣ - تلكس : ٢١٥٤٢ طوقان جو عمان - الأردن
P.O.Box 926897 - Telephone 662405 - Fax. 664483 Telex : 21542 Toukan Jo - Amman - Jordan

Site Investigation
Of
Dead Sea Panoramic Complex Development

1.0 Introduction

Upon the request of Messrs. JICA Study Team , sub-soil investigation was carried out at the proposed site in accordance with the British Standards Specification, CP 2001 for site investigation and with the Jordanian Code .

The investigation was carried out by performing 4 boreholes, drilled at locations determined by the geotechnical Engineer to a depth of 10.0 meters each .

The proposed structure is panoramic complex over viewing the dead sea .

The site of the structure is semi flat . (see site plan , figure - 1)

2.0 Scope of Work

The purpose of this study was to determine the ground conditions at the site , in order to provide full information about the ground conditions and geotechnical properties of foundation materials and all other information that would assists in the Engineer in the design of proper and safe foundation .

The works included the following

- Setting up locations of boreholes.
- Drilling 4 boreholes and carrying out the necessary field tests.
- Recovery of disturbed representative samples .
- Carrying out the required laboratory tests.

Analysis of the site investigation data, laboratory testing and geotechnical interpretation form the basis of this report.

3.0 General Geology

The exposed rock within the study area is a clastic sedimentary rocks , belong to kurnub sandstone group of lower Cretaceous in age . These rocks characterized by white . medium to coarse – grained and pebbly , planar cross – bedded sandstone passing up ward to trough cross – bedding sandstones . The upper part is varicoloured and medium - grained with burrow – mottled horizons and both planar and trough cross – bedding to ward the top channels with plants fragment are common .

The sandstone rocks formed a very high cliff near to the Dead Sea , many circumferrential joints and rock falls were observed at the cliff edge . (Figure 2) .

4.0 Method of Investigation

All drilling, sampling and testing were performed in accordance with the British Standards, CP 2001.

The sub-surface was explored by using Simco 280 type rig advance by rotary drilling allowing the performance of Standard and cone penetration tests and taking representative samples.

Dry drilling to refusal in boreholes was used to recover representative samples.
The boreholes were monitored for any ingress of water during dry drilling.

Representative soil samples were obtained during the drilling operation and were placed in tight plastic bags and wooden boxes for description.

Standard and cone penetration tests were carried out in accordance with the BS Standards 1377(Test 19) and the results were recorded on the boreholes logs at depths to which they refer.

The penetration tests were executed with 2 inchs standard sampling spoon with catchers and driven by dropping a 140 Ibs. Weight hammer with a 30 inches fall height. The 2 inches diameter spoon was lowered to the bottom of the boreholes and penetrated about 6 inches in the materials, whereupon the penetration test was started.

The "N" value is the number of blows required to produce one foot of penetration.

In defining the density of the non-cohesive materials, very loose material was considered to have standard penetration values less than 4 blows per foot, loose, between 4 and 10 blows per foot, medium dense, between 10 and 30 blows per foot, dense, between 30 and 50 blows per foot , and very dense, more than 50 blows per foot .

5.0 Field Works

5.1 Drilling

The locations of boreholes were chosen so as to represent the study area and provide as much information as possible.

A total of 4 boreholes were drilled . The locations of the drilled boreholes are shown on the attached plan .

The positioning and depth of the boreholes were determined by the geotechnical Engineer .

5.2 Sampling

Continuous samples of the drilled materials were collected at regular depth intervals of 1.0m and at each lithological change of the material . The samples were labeled, described and logged. Representative samples were also obtained for laboratory testing and classification .

5.3 Insitu Testing

In order to obtain an estimate of the density insitu , cone Penetration tests were performed on the foundation material .

The penetration tests results indicate that the penetrated material is very dense with the CPT, "N" value, more than 30 blows per foot . (see borehole logs).

Refusal results were obtained on strongly cemented parts of the sandstone .

5.4 Drilling Results

The drilled boreholes show that the penetrated rock is mainly vari-coloured sandstone of kurnub group . The upper 1-1.5m of the bedrock is strongly cemented while the lower part is very weakly cemented , friable sandstone .
For more details see borehole logs .

- No cavities or water table were detected in any of the drilled boreholes . Only jointed rock was encountered where partial loss of drilling air circulation was observed .

6.0 Geomechanics

A laboratory testing program was devised and performed on representative samples obtained from the study area , to establish the engineering properties of the material involved. The only tests that could be performed on such material are :

- Grainsize analysis
- Unconfined compression test
- Direct sheer test
- Compaction
- California Bearing Ratio

The results of the grainsize analysis of the tested samples are summarized in (Table 1). The material is composed of and silt, between 2.9 % and 5.6 % , sand between 86.6% and 95.4 and gravel between 00% and 9.6 % .
The unconfined compressive strength of the tested samples show a range between 230 kg/cm² and 259 kg/cm² (table 2) .
The direct shear test performed on remoulded samples of sandy material obtained from the drilled boreholes , show that the cohesion is 0.0 with a peak friction angles between 35 and 42 degrees . The results are summarized in table (3) and shown as curves .

The specific gravity of the tested samples show a range between 2.641 and 2.652 (Table 4) .

The compaction tests performed on a two samples obtained from the surface, show that the maximum dry density is ranged between 1.95gr/cm^3 and 2.0gr/cm^3 with an optimum moisture content of 3.8 % to 4.0 % . The results are presented as curves and summarized on table (5) attached .

The CBR values of the same samples ranged between 24 % and 28 %curves are attached to this report and summarized on table (4) attached .

7.0 Conclusions & Recommendation

As a result of this study and tests, the following conclusions could be summarized :

- The drilled boreholes show that the penetrated materials are vary – colored sandstone , medium to coarse grained .

- The upper 1.5m of the bedrock is strongly cemented while the lower part is very weakly cemented and friable .

- The material is uniform in terms of lithology and density .

- The bedrock was encountered in all of the drilled boreholes .

- No cavities or water table were encountered in the drilled boreholes . Partial loss of drilling air circulation was observed indicating the presence of open joints in the bedrock .

In order to have a safe and stable foundation, the following is recommended :

6.1 Foundation Type and Depth

In order to have safe structures , the foundation materials beneath the structures must have an adequate bearing capacity to support the design loads with an appropriate factor of safety and acceptable tolerable settlements.
To have safe foundation to support the structure, the following is suggested :

- Since the structure is located at a minimum distance of 30m from the edge of the Slope , footing type foundation could be employed at a depth of 0.25m into bedrock with an allowable bearing capacity of 4.0 kg/cm² .If the design foundation depth is more than 1.5m , then the suggested bearing capacity would be 2.5kg/cm² due to the friable nature of the sandstone rock .

Generally , the following parameter could be estimated to be used for design :

Friction angle (Ø)	= 35 – 42°
Cohesion (C)	= 0°
Wet unit weight	= 2.0 T/m³
Poisson's Ratio	= 0.23
Stiffness Modulus	= 1150 kg/cm²
Coefficient of Friction at base	= 0.81
Subgrade Modulus	= 50 – 100 kg/cm³ .

* The study area is characterized by semi – arid climate, warm and dry in the summer with rainy winter .

* As far as the seismic activity in the area , Jordan has not witnessed any serious earth quakes in the last 60 years . It is a general practice to consider the study area within zone 1 of the unified building code . Research in Jordan concluded that one earth quake with magnitude 6½ every 100 years and one earth quake with magnitude 7½ every 500 years might take place .

  The intensity factor is 0.75 for zone A and it is 0.5 for zone B . of mercalli scale .

* A horizontal peak ground acceleration of at least 0.19g is suggested to be adopted in the design of the foundations .

The excavation and protection measures should be under the supervision of our experienced geotechnical engineers .

The recommendation given in this report are solely based on the results of the drilled boreholes at the time investigation and our understanding , and concept of the project . Further check of the material at the foundation level by our geotechnical engineer is very important . All of treatment , densification and grouting should be supervised by our geotechnical engineers .

Summary Of Tests Results

Borehole No. & Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH1 (2.0-3.0)	0.8	95.2	4.0	---
BH1 (4.0-5.0)	0.2	94.0	5.8	---
BH1 (7.0-8.0)	0.9	94.9	4.2	---
BH2 (1.0-2.0)	1.0	95.3	3.7	---
BH2 (3.0-4.0)	0.7	95.4	3.9	---
BH2 (6.0-7.0)	0.9	95.0	4.1	---
BH3 (1.0-2.0)	---	94.4	5.6	---
BH3 (5.0-6.0)	0.1	94.7	5.2	---
BH3 (7.0-8.0)	0.2	94.7	5.1	---
BH4 (1.5-3.0)	9.6	86.6	3.8	---
BH4 (5.0-6.0)	3.2	93.9	2.9	---
BH4 (9.0-10.0)	4.9	91.3	3.8	---

Table (1)

Unconfined Compression Test Results

Boreholes No and Depth (m)	Unconfined Compressive Strength (kg/cm²)
BH.4 1.85m	235
BH.4 2.35	230
BH.4 3.95	238
BH.4 4.30	245
BH.4 5.20	258
BH.4 5.75	259

Table(2)

Direct Shear Test Results

Trial Pits No. & Depth (m)	Cohesion (kg/cm^2)	Friction Angle (Degree)
	Cp	ØP
BH.1 2.7	0.00	35
BH.2 4.5	0.00	37
BH.3 6.9	0.00	40
BH.4 8.1	0.00	42

Table(3)

Specific Gravity Tests Results

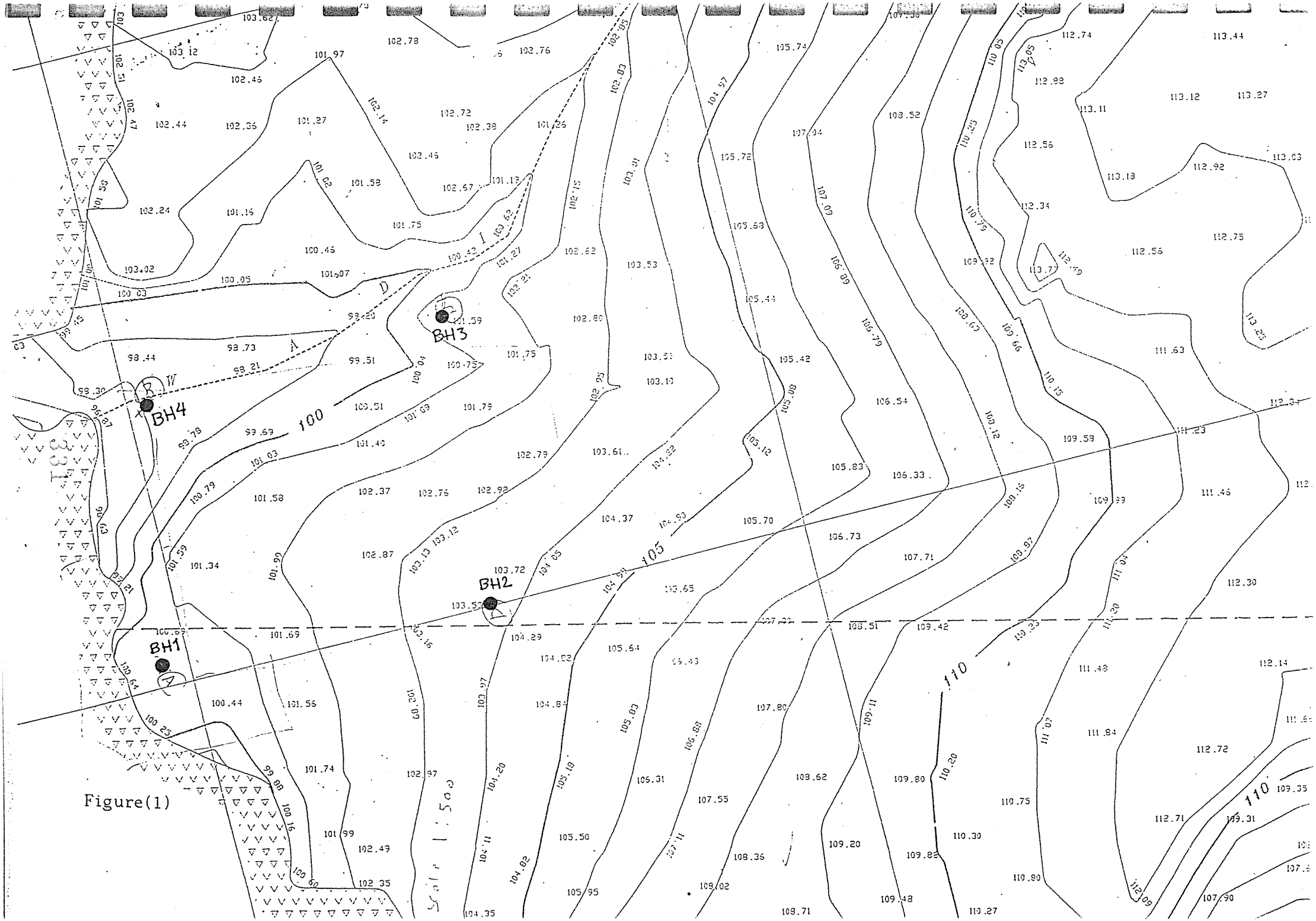
Boreholes No.and Depth (m)	Specific Gravity
BH.1 1.5	2.652
BH.1 2.5	2.641
BH.2 3.0	2.651
BH.2 4.0	2.645
BH.3 5.5	2.644
BH.3 7.0	2.65
BH.4 8.5	2.643
BH.4 9.5	2.6448

Table(4)

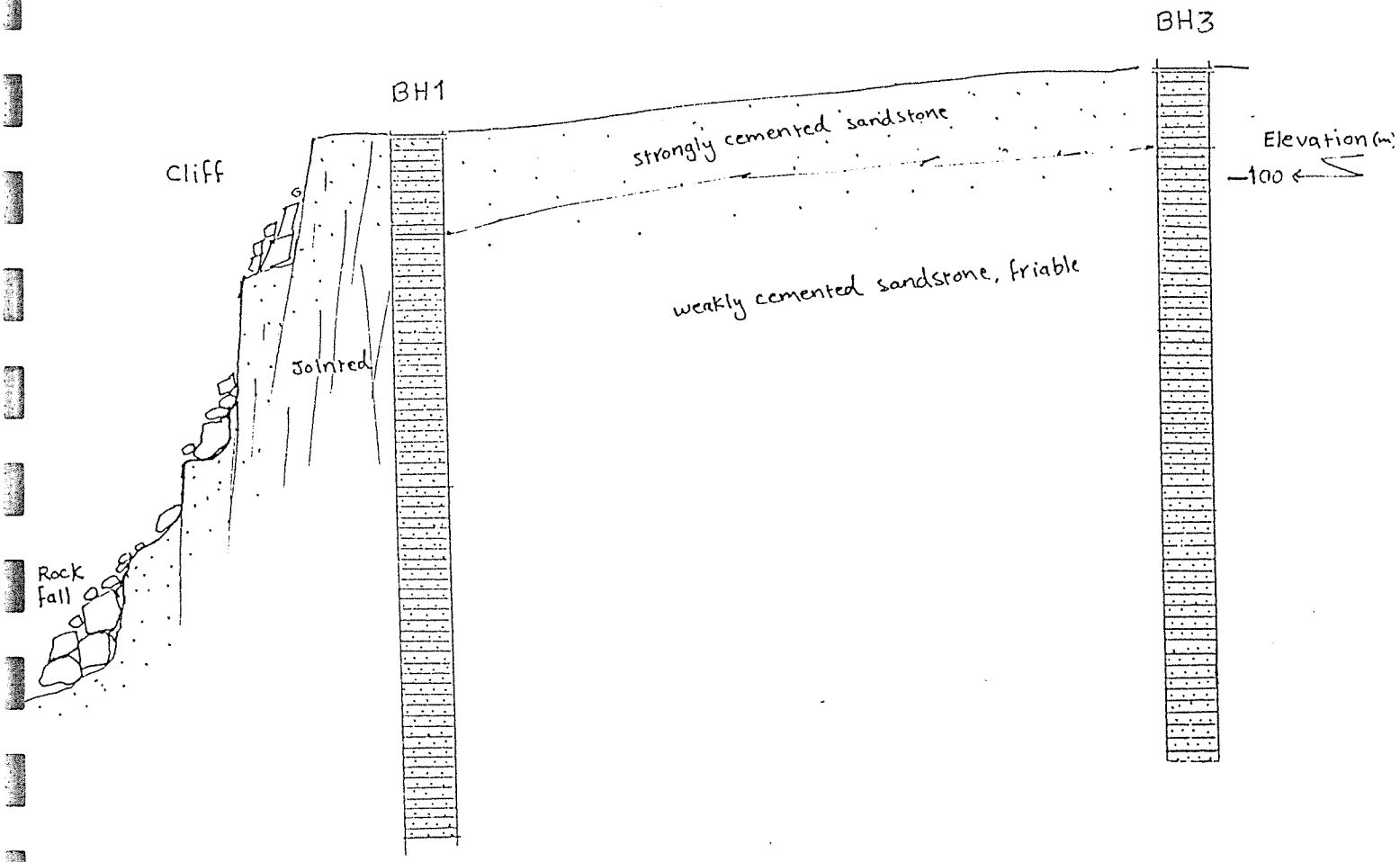
Compaction and CBR Tests Results

Borehole No. & Depth (m)	Max . Dry Density (gr/cm³)	O. M . C (%)	C B R at O.M.C (%)
BH.1 4.10	2.00	3.8	28.0
BH.3 3.15	1.95	4.0	24.0

Table (5)



Figure(1)


BH3
BH1
Cliff
strongly cemented sandstone
Elevation (m)
100
weakly cemented sandstone, friable
Jointed
Rock Fall

Figure(2)

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BOREHOLE LOG DATA SHEET

PROJECT : Panoramic complex	TYPE & SIZE OF DRILLING: Rotary 4½"
BOREHOLE NO : BH.1	Started : 10/6/99 Date: Finished: 10/6/99

Depth (M)	L O G	DESCRIPTION ELEVATION : 100.50	REC (%)	RQD. (%)	SPT. "N"	MC. (%)	LL	PI	γ (gr/cm³)	sample No.
1		SANDSTONE , medium to coarse , vary in coloring , strongly cemented .			50/2cm					
2		SANDSTONE , fine to medium , dark grey , friable , ferrous , weakly cemented .			100/30cm					
3		* Strongly cemented in parts .			100/28cm					
4					50/23cm					
5					50/28m					
6		SANDSTONE , fine to medium greyish white , friable , weakly cemented . * Strongly cemented in parts .			50/25cm					
7					50/19cm					
8					50/14cm					
9					50/8cm					
10					50/9cm					
11		Final depth (10.0 m)								
12										
13		Remark : * Partial loss of drilling air circulation , very friable material below 5.0m .								
14										

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Geo. Research

BOREHOLE LOG DATA SHEET

PROJECT : Panoramic complex			TYPE & SIZE OF DRILLING:						Rotary 4½"	
BOREHOLE NO : BH.2			Date:		Started :				12/6/99	
					Finished:				12/6/99	
Depth (M)	L O G	DESCRIPTION ELEVATION : 103.80	REC (%)	RQD. (%)	SPT. "N"	MC. (%)	LL	PI	γ (gr/cm³)	sample No.
1		SANDSTONE , medium to coarse , vary in coloring , strongly cemented .			Ref					
2					Ref					
3					100/28cm					
4					100/30cm					
5		SANDSTONE , fine to medium , weakly cemented , vary in coloring , friable .			50/25cm					
6					100/30cm					
7					50/18cm					
8					50/16cm					
9					50/13cm					
10					50/13cm					
11		Final depth (10.0 m)								
12										
13		Remark : * Caving in , very friable material below 6.0m .								
14										

TOUKAN & SAKET
Geo. Research

BOREHOLE LOG DATA SHEET

PROJECT : Panoramic.			TYPE & SIZE OF DRILLING: Rotary 4½"							
BOREHOLE NO : BH.3			Started : 12/6/99 Date: Finished: 12/6/99							
Depth (M)	L. O G	DESCRIPTION ELEVATION : 101.3	REC (%)	RQD. (%)	SPT. "N"	MC. (%)	LL	PI	γ (gr/cm³)	sample No.
1		SANDSTONE , medium to coarse, strongly cemented , vary in coloring .			50/10cm					
2					78/30cm					
3		SANDSTONE , Fine to medium,weekly cemented , friable, vary in coloring .			108/30cm					
4		* Strongly cemented in parts .			Ref					
5					50/25cm					
6					50/18cm					
7					Ref					
8					50/10cm					
9					50/8cm					
10					50/10cm					
11		Final depth (10.0 m)								
12										
13										
14										

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Geo. Research

BOREHOLE LOG DATA SHEET

PROJECT : Panoramic.			TYPE & SIZE OF DRILLING: Rotary 4½"							
BOREHOLE NO : BH.4			Date: Started : 13/6/99 Finished: 13/6/99							
Depth (M)	L O G	DESCRIPTION ELEVATION : 98.2	REC (%)	RQD. (%)	SPT. "N"	MC. (%)	LL	PI	γ (gr/cm³)	sample No.
1		SANDSTONE , fine to coarse , strongly cemented , dark grey , moderately strong , ferrous .			Ref					
2			68	22						
					Ref					
4			78	23						
5					Ref					
6			68	28	100/15cm					
7					50/9cm					
8										
9			72	0	50/15cm					
10					50/10cm					
		Final depth (10.0 m)								
12										
13										
14										

TOUKAN & SAKET

Geo. Research

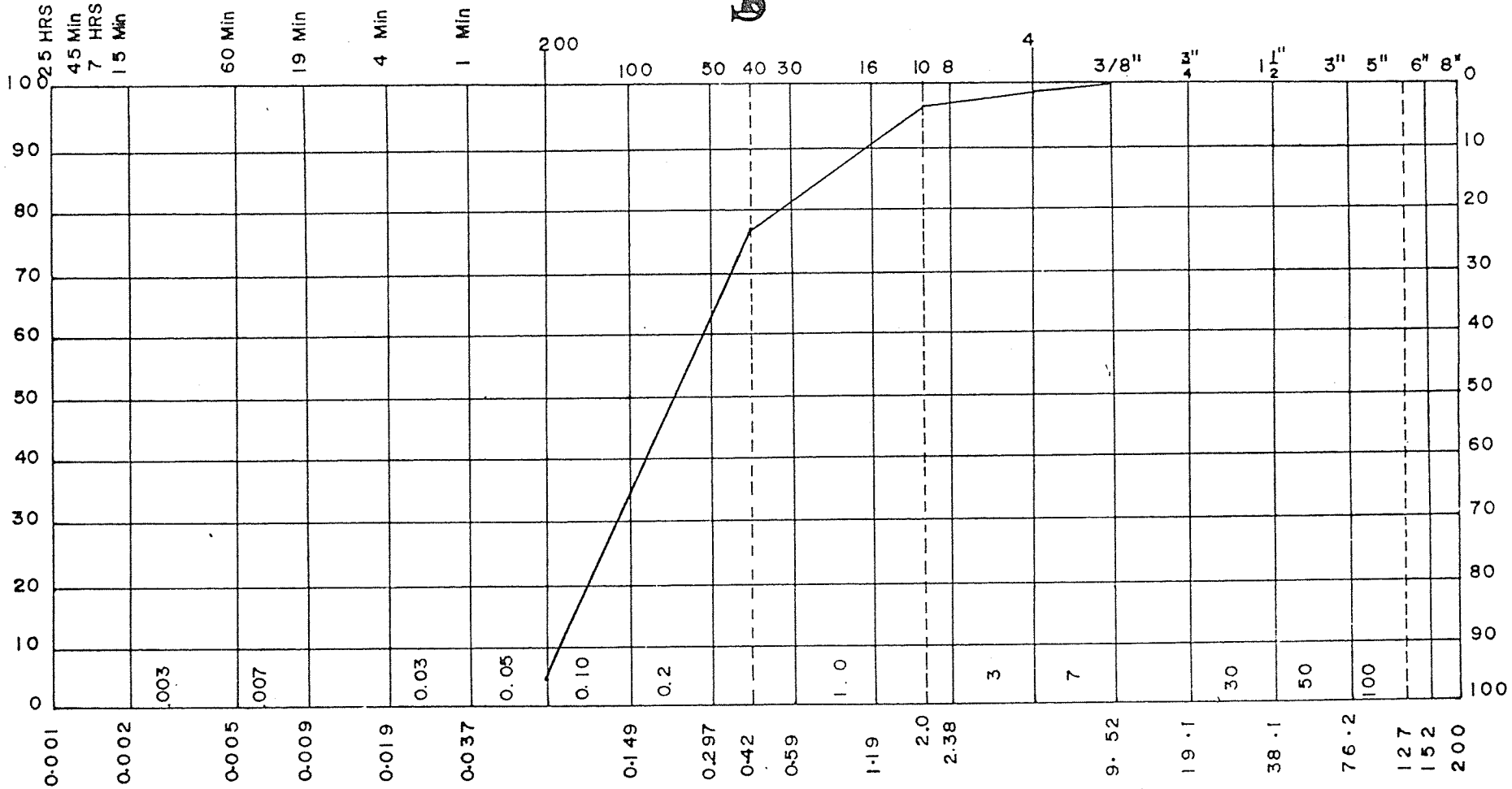
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



0.074 4.76

CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH-1				
2.0 - 3.0 m	0.8	95.2	4.0	—

REMARKS _____

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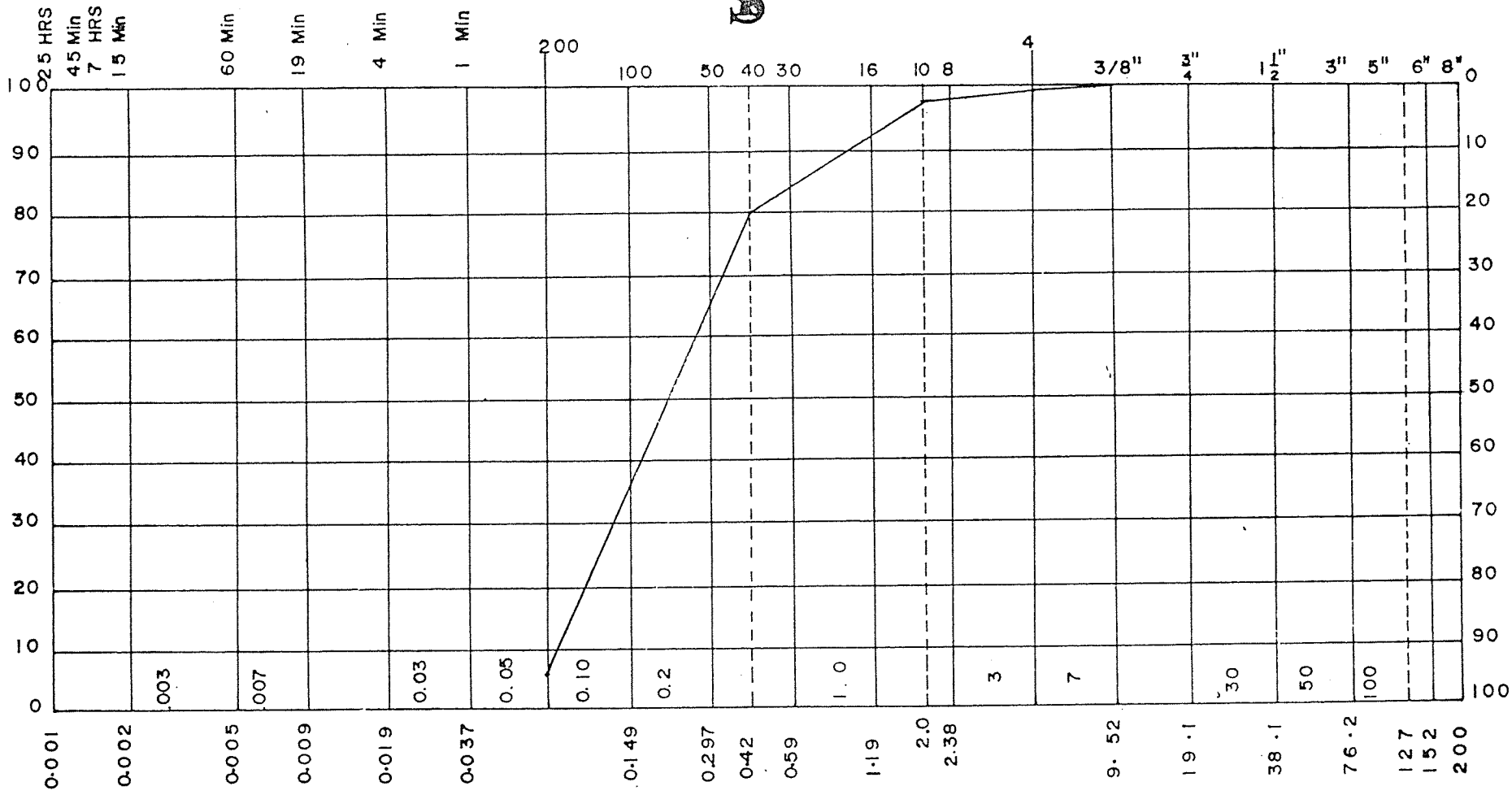
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



0.074 4.76

CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH1				
4.0–5.0m	0.2	94.0	5.8	—

REMARKS _____

TOUKAN & SAKET

Geo. Research

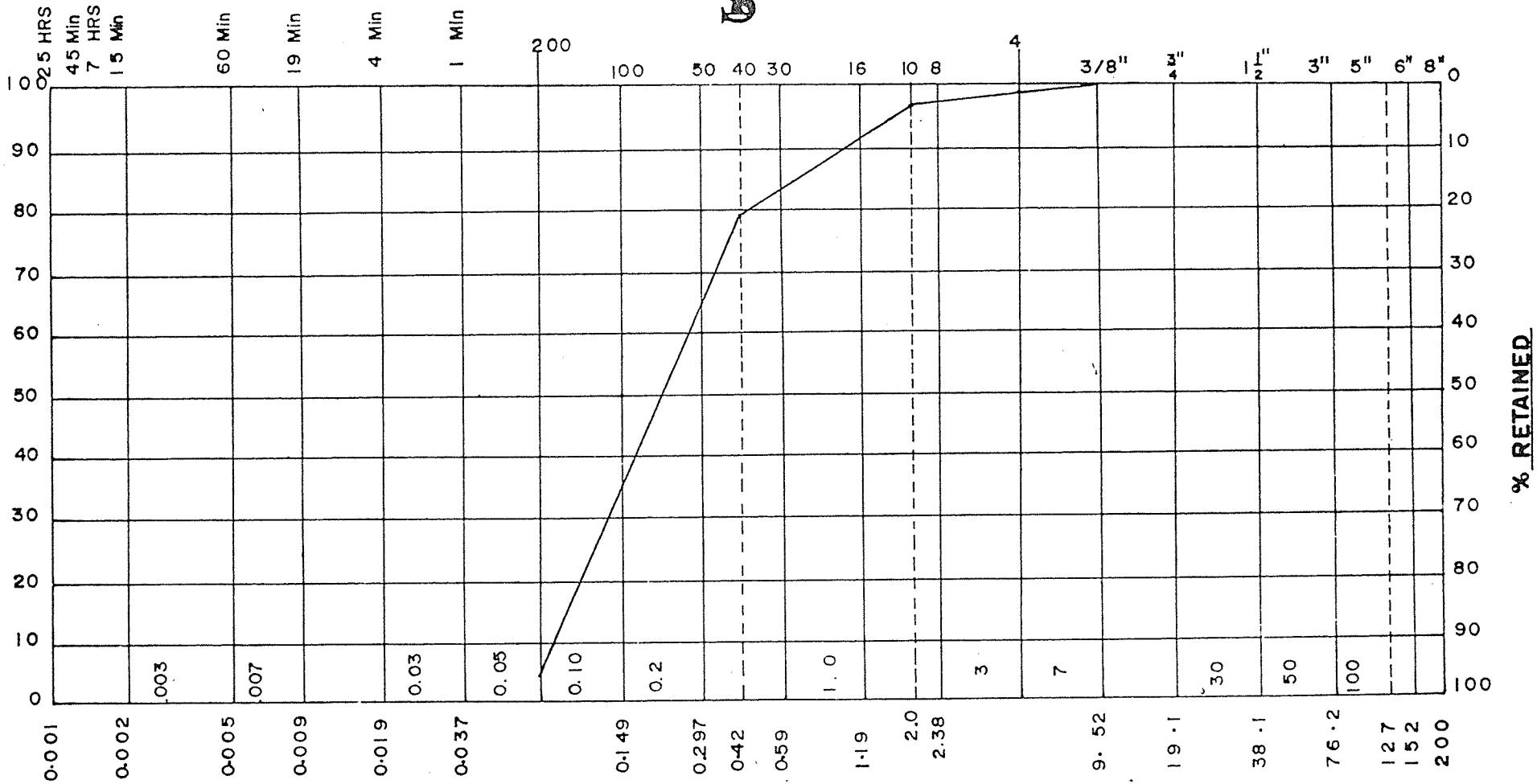
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



0.074 4.76

CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH-1				
7.0 – 8.0 m	0.9	94.9	4.2	—

REMARKS _____

339

TOUKAN & SAKET

Geo. Research

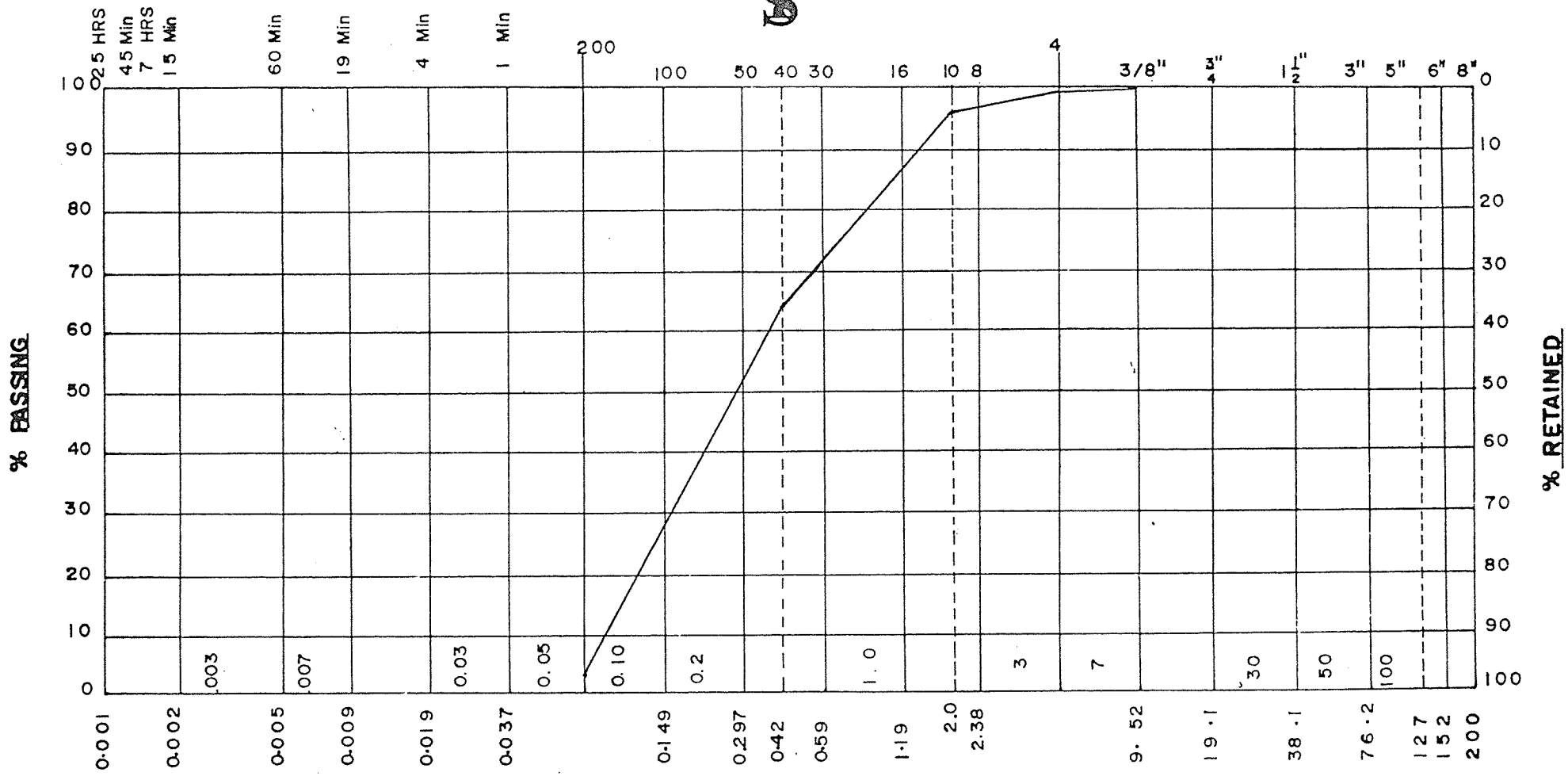
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	
		0.074			4.76		

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH2				
1.0–2.0 m	1.0	95.3	3.7	—

REMARKS _____

340

TOUKAN & SAKET

Geo. Research

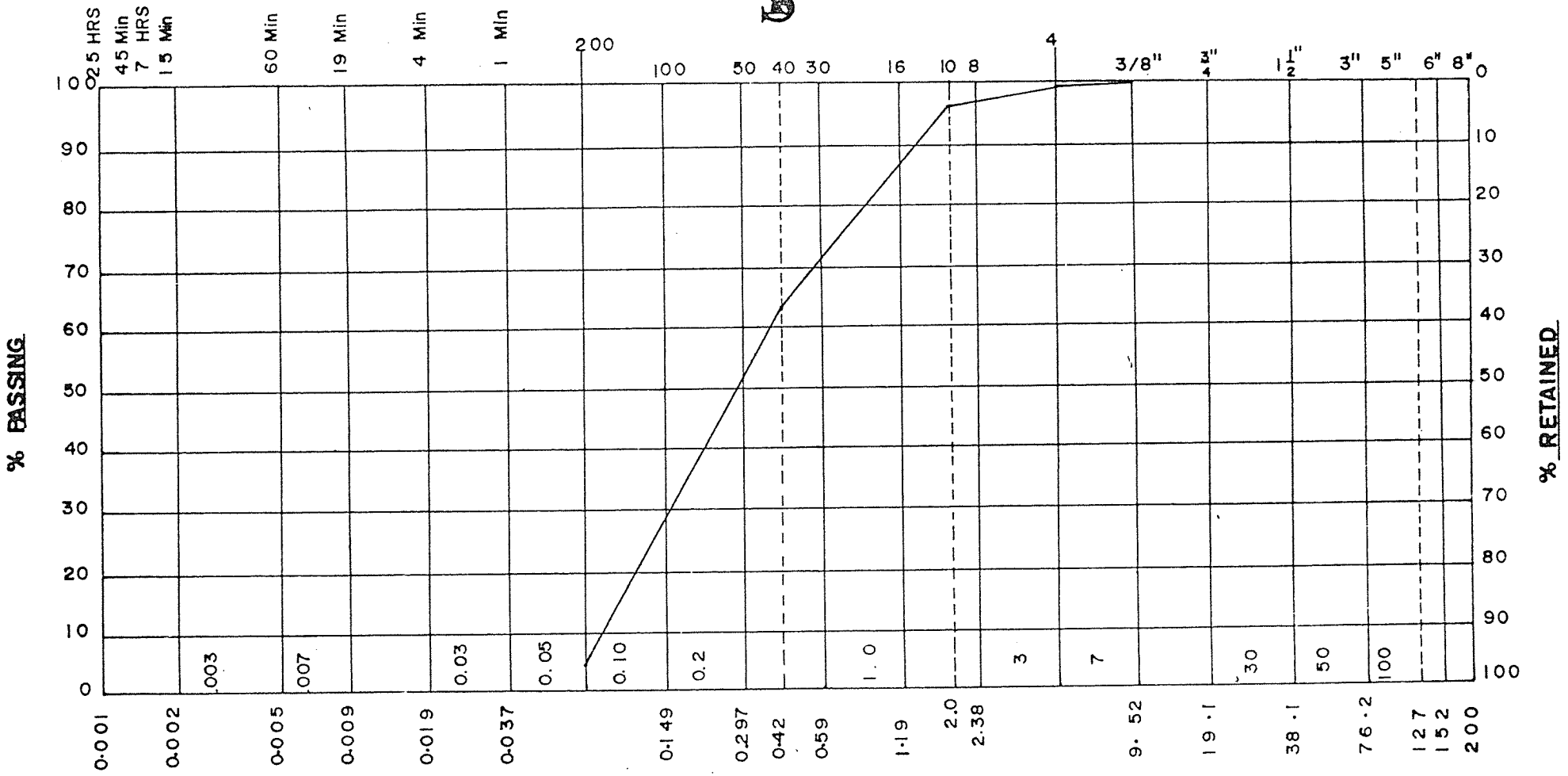
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



0.074 4.76

CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH2				
3.0 – 4.0 m	0.7	95.4	3.9	–

REMARKS _____

341

TOUKAN & SAKET

Geo. Research

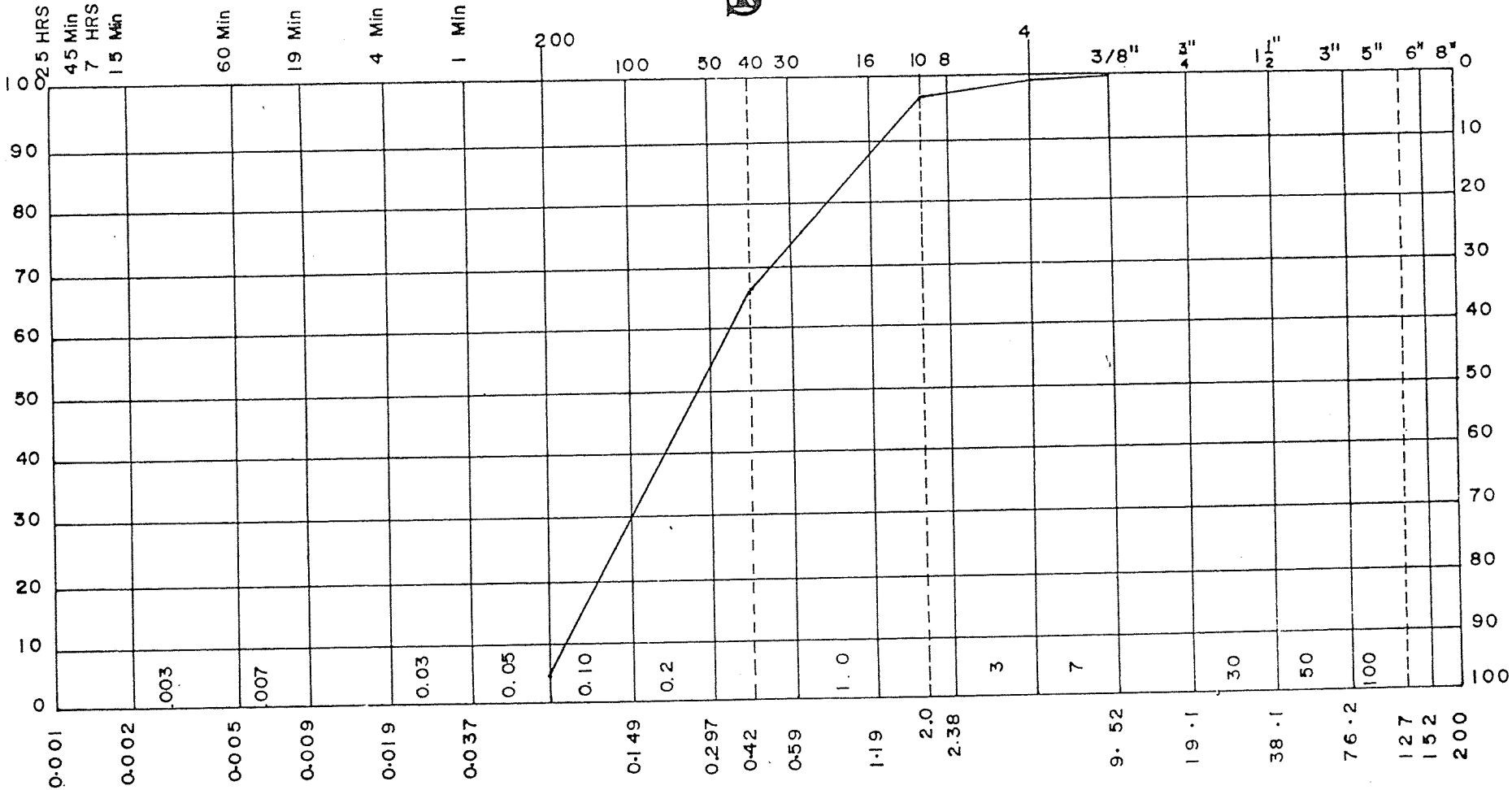
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



CLAY	SILT	0.074	SAND			4.76 GRAVEL		COBBLES
			FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH2				
6.0 – 7.0 m	0.9	95.0	4.1	–

REMARKS _____

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TOUKAN & SAKET

Geo. Research

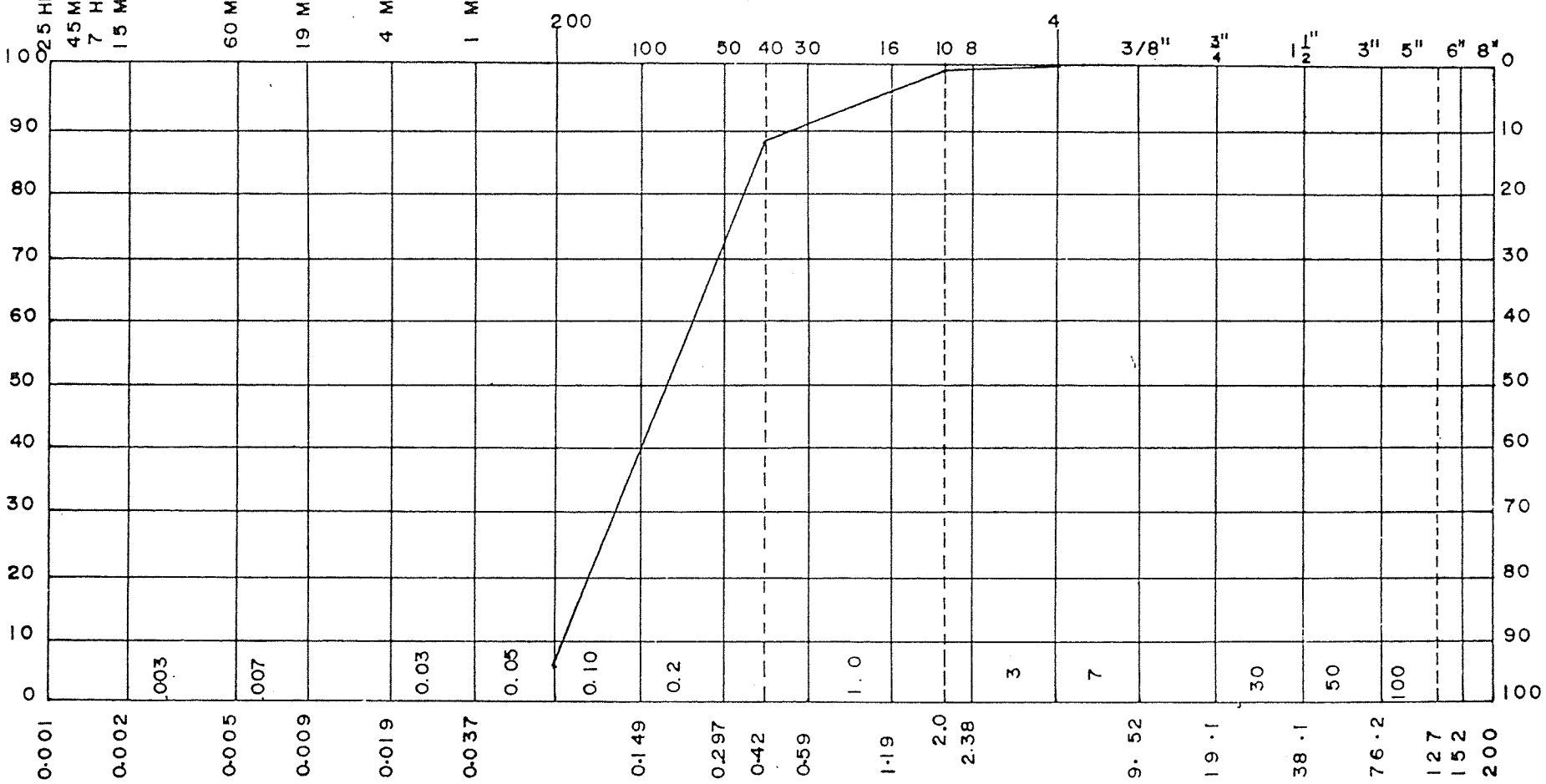
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



CLAY	SILT	0.074	SAND			4.76 GRAVEL		COBBLES
			FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH3				
1.0 - 2.0 m	—	94.4	5.6	—

REMARKS _____

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TOUKAN & SAKET
Geo. Research

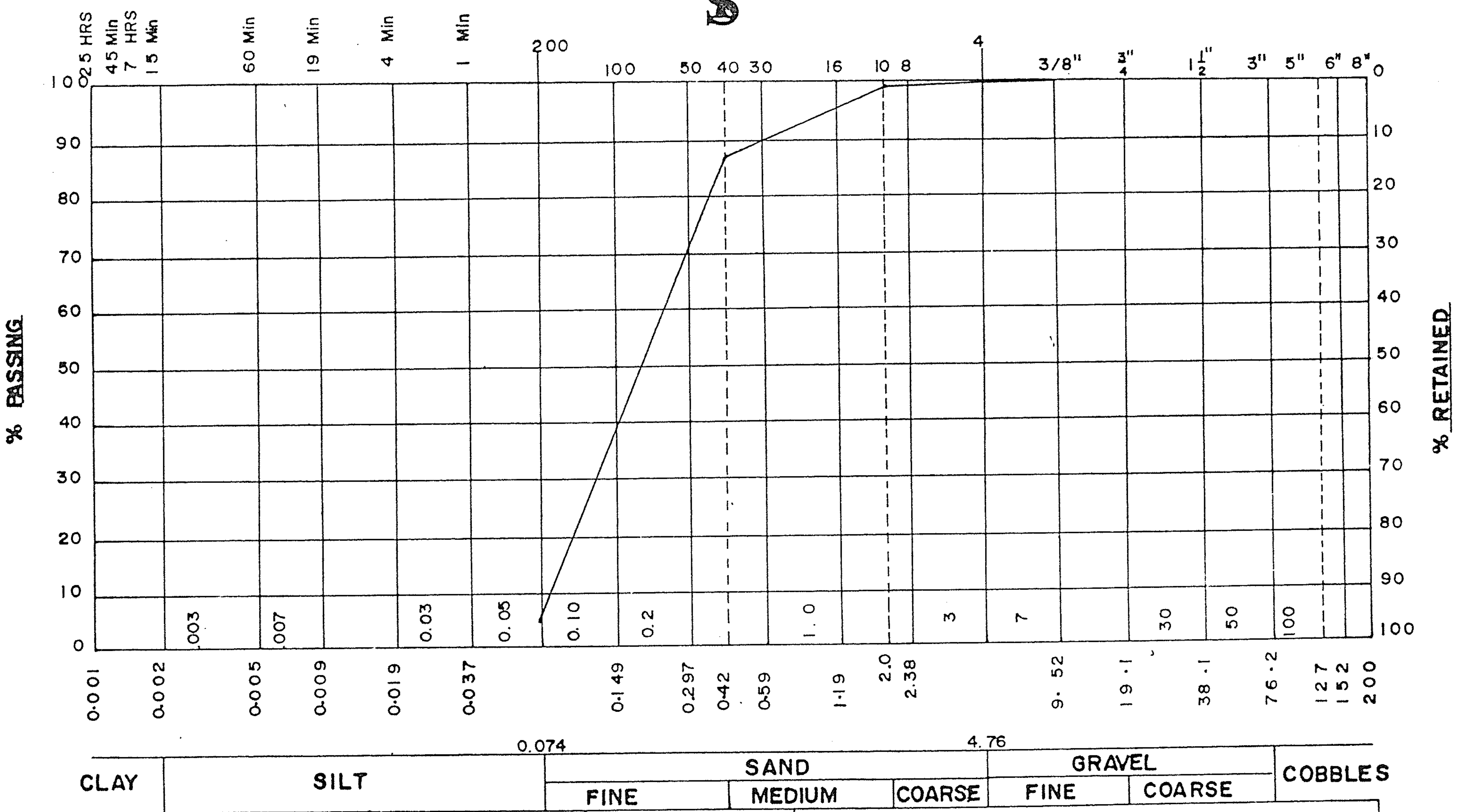
PROJECT ______

DATE ______

SAMPLE No ______

HYDROMETER ANALYSIS

SIEVE ANALYSIS



SAMPLE No	GRAVEL %	SAND%	SILT %	CLAY %
BH3 5.0–6.0	0.1	94.7	5.2	–

REMARKS ______

TOUKAN & SAKET

Geo. Research

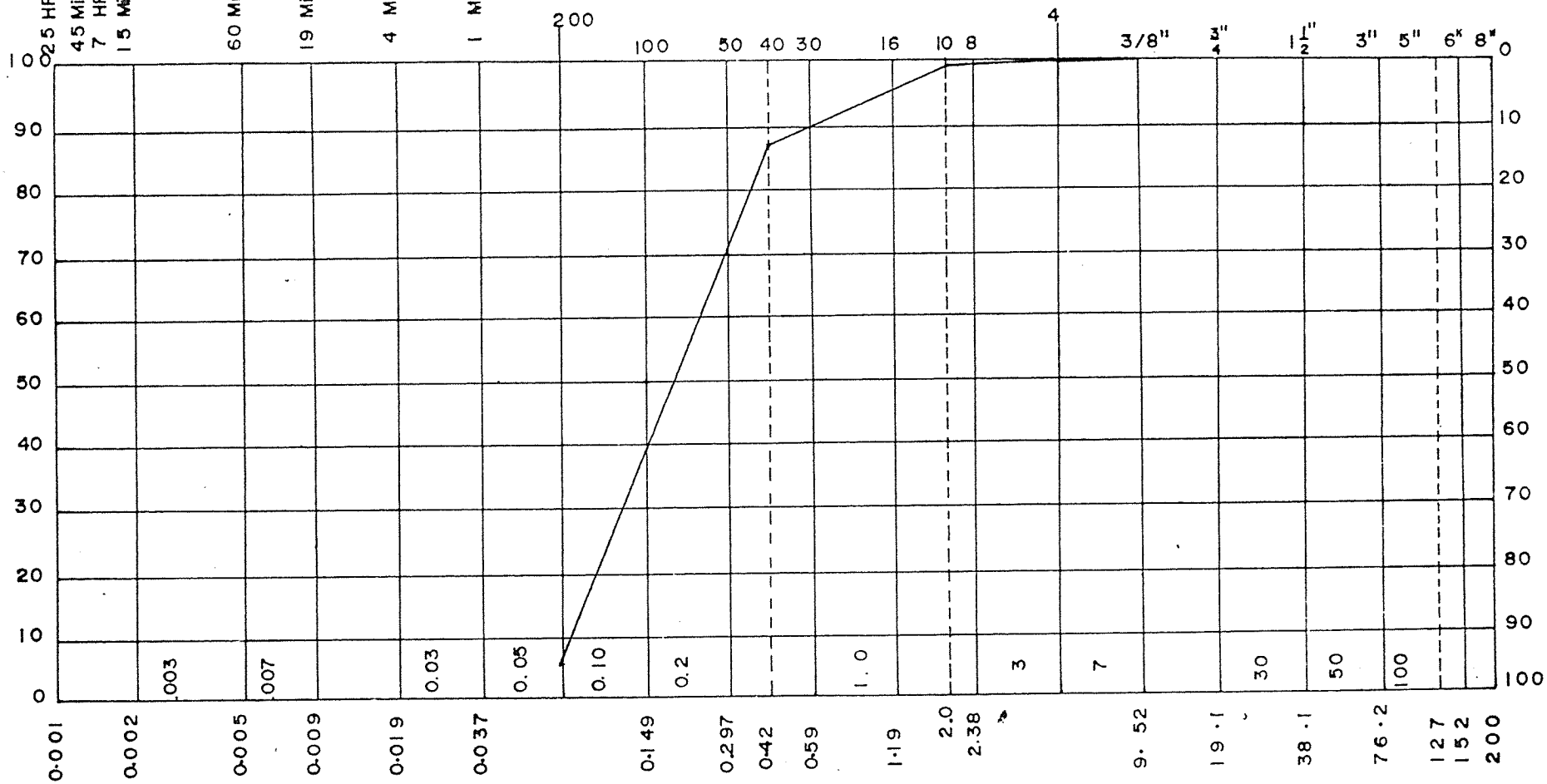
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	
		0.074			4.76		

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH 3				
7.0 - 8.0	0.2	94.7	5.1	-

REMARKS _____

TOUKAN & SAKET

Geo. Research

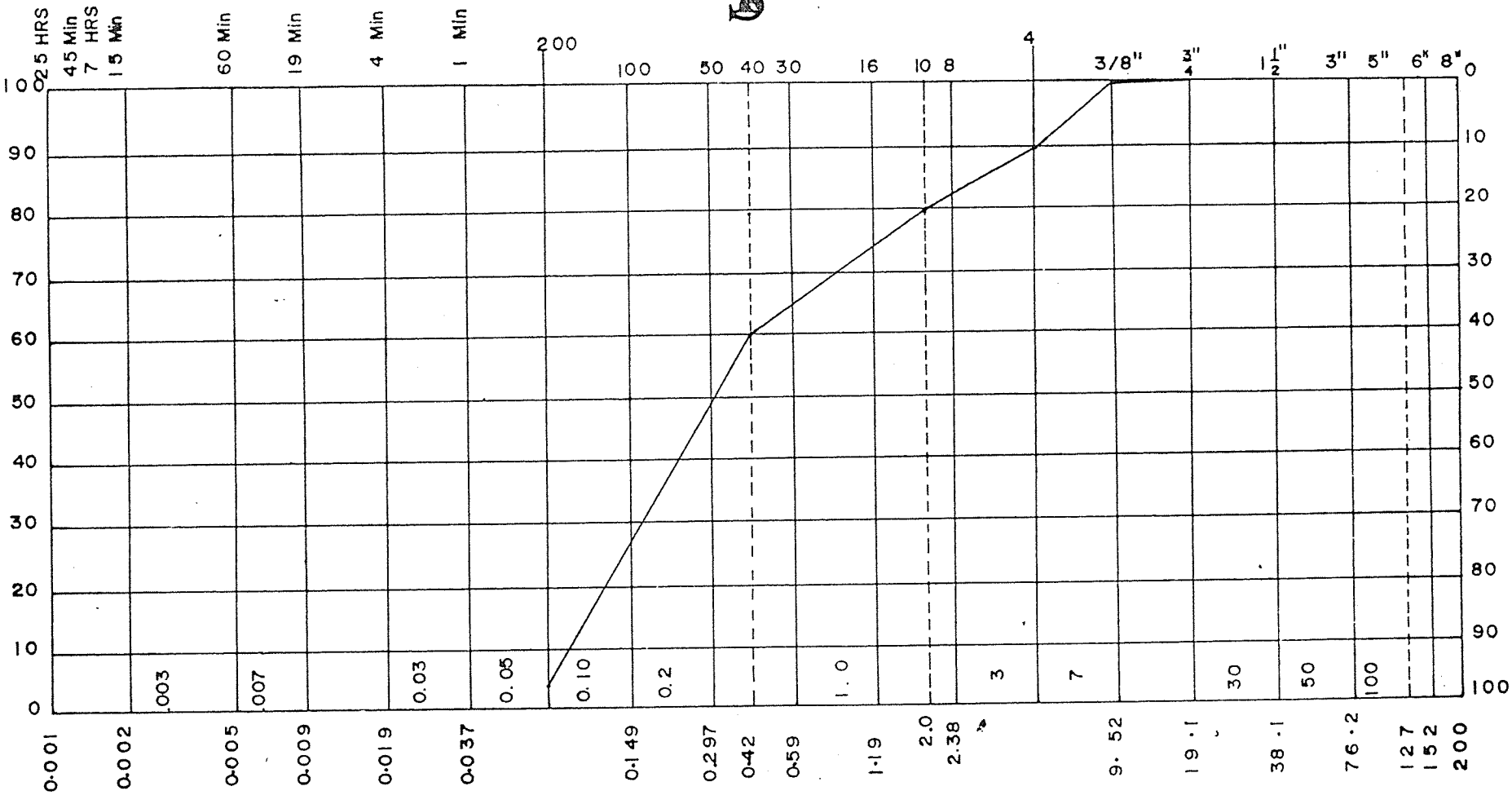
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



CLAY	SILT	0.074	SAND			4.76 GRAVEL		COBBLES
			FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH4				
1.5 - 3.0 m	9.6	86.6	3.8	—

REMARKS _____

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TOUKAN & SAKET

Geo. Research

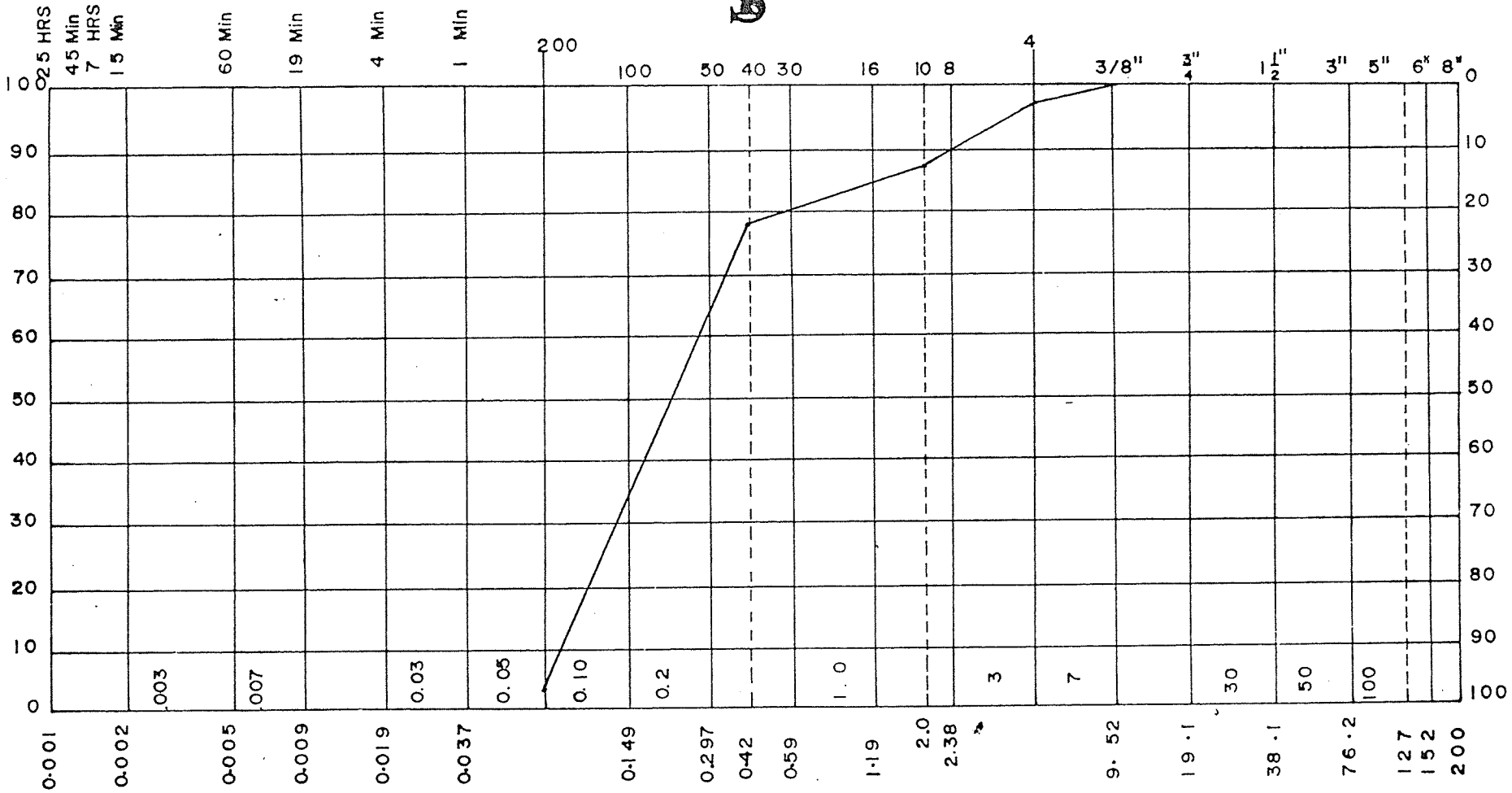
PROJECT _____

DATE _____

SAMPLE No _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	
		0.074			4.76		

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH4				
5.0 – 6.0 m	3.2	93.9	2.9	–

REMARKS _____

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TOUKAN & SAKET

Geo. Research

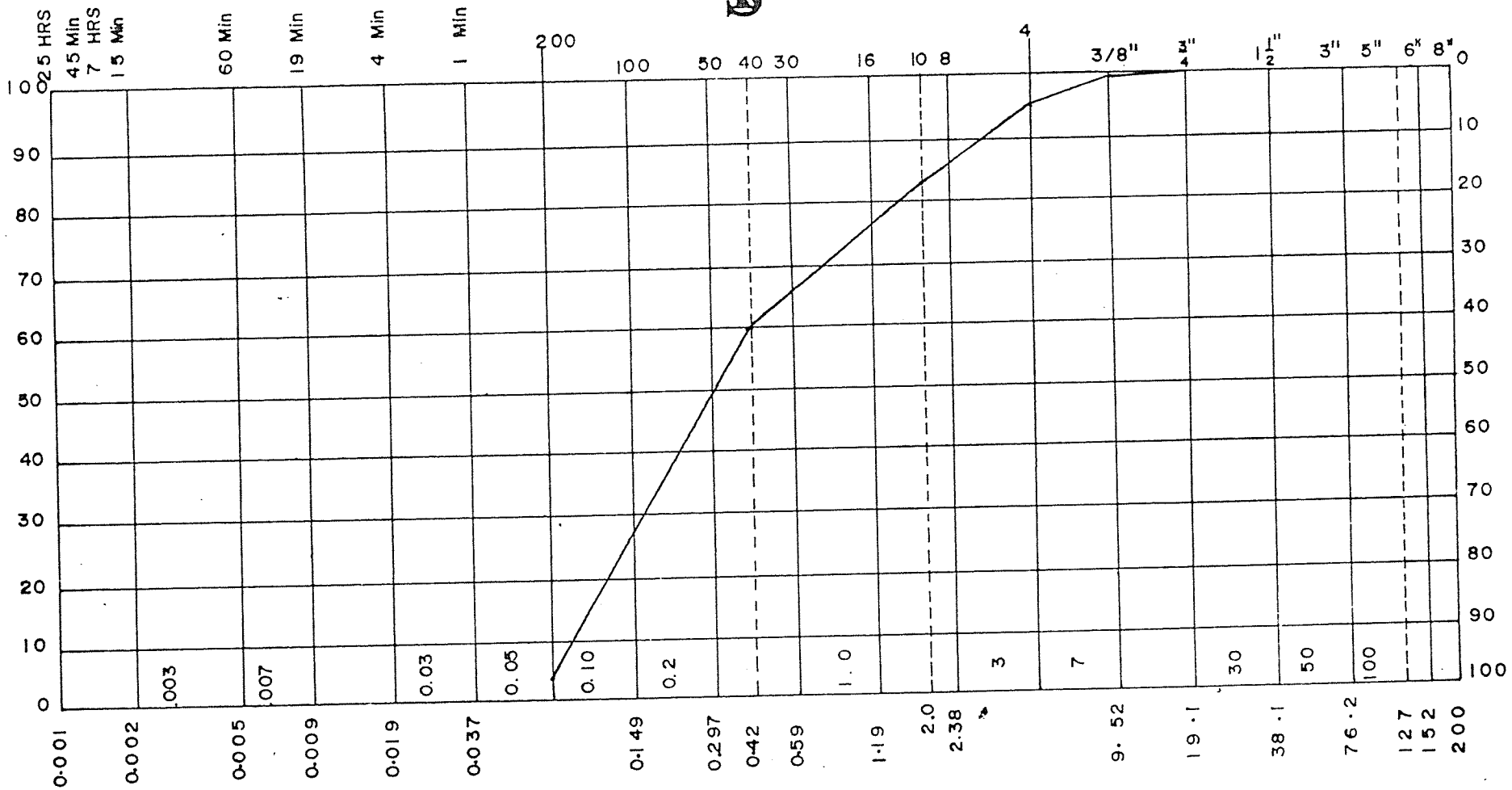
DATE _____

SAMPLE No _____

PROJECT _____

HYDROMETER ANALYSIS

SIEVE ANALYSIS



0.074 4.76

CLAY	SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

SAMPLE No	GRAVEL %	SAND %	SILT %	CLAY %
BH.4				
9.0 – 10.0 m	4.9	91.3	3.8	–

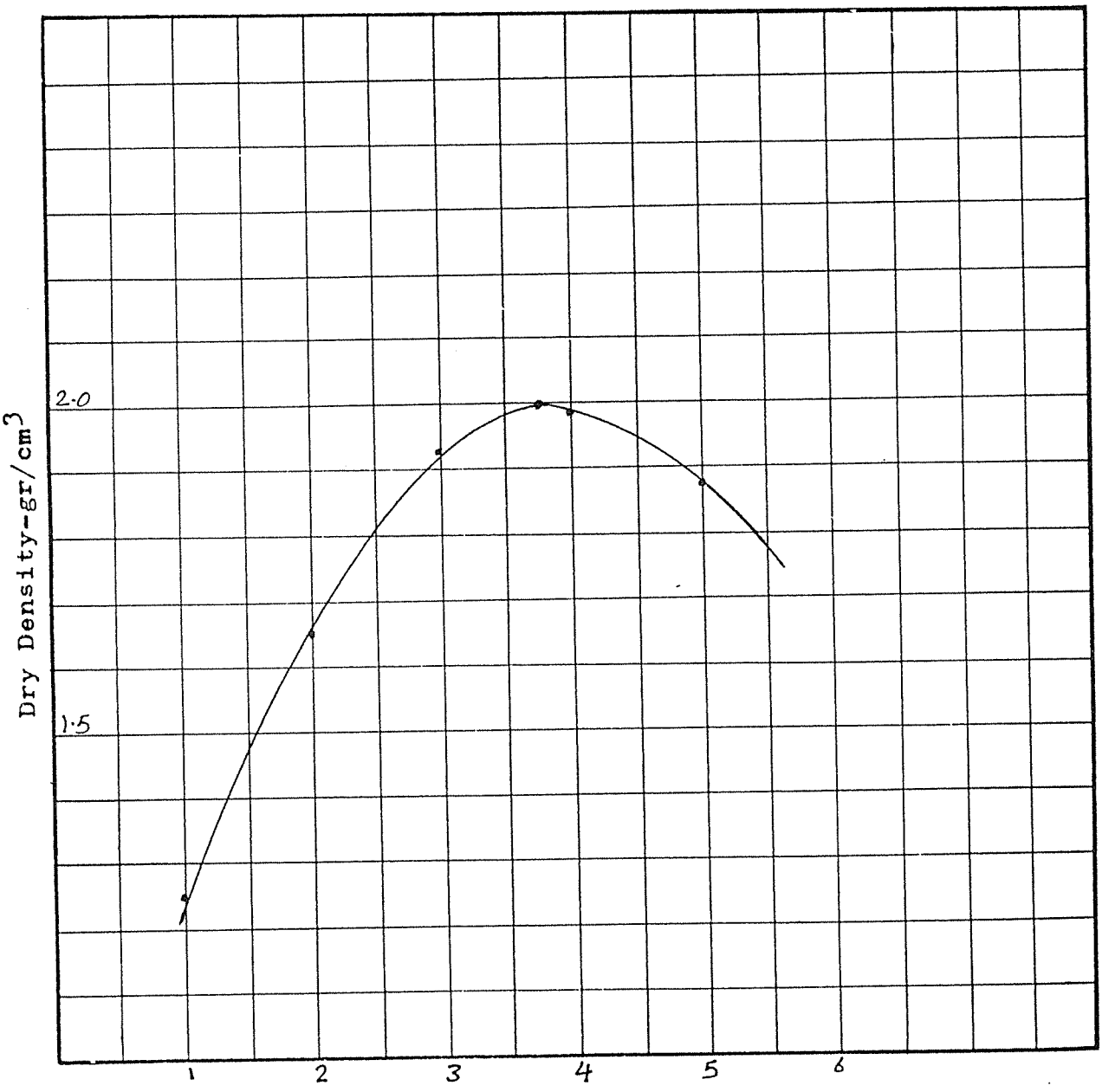
REMARKS _____

348

Geo-Research

Proctor Compaction Test

Sample No.: BH1 4.1m Project:



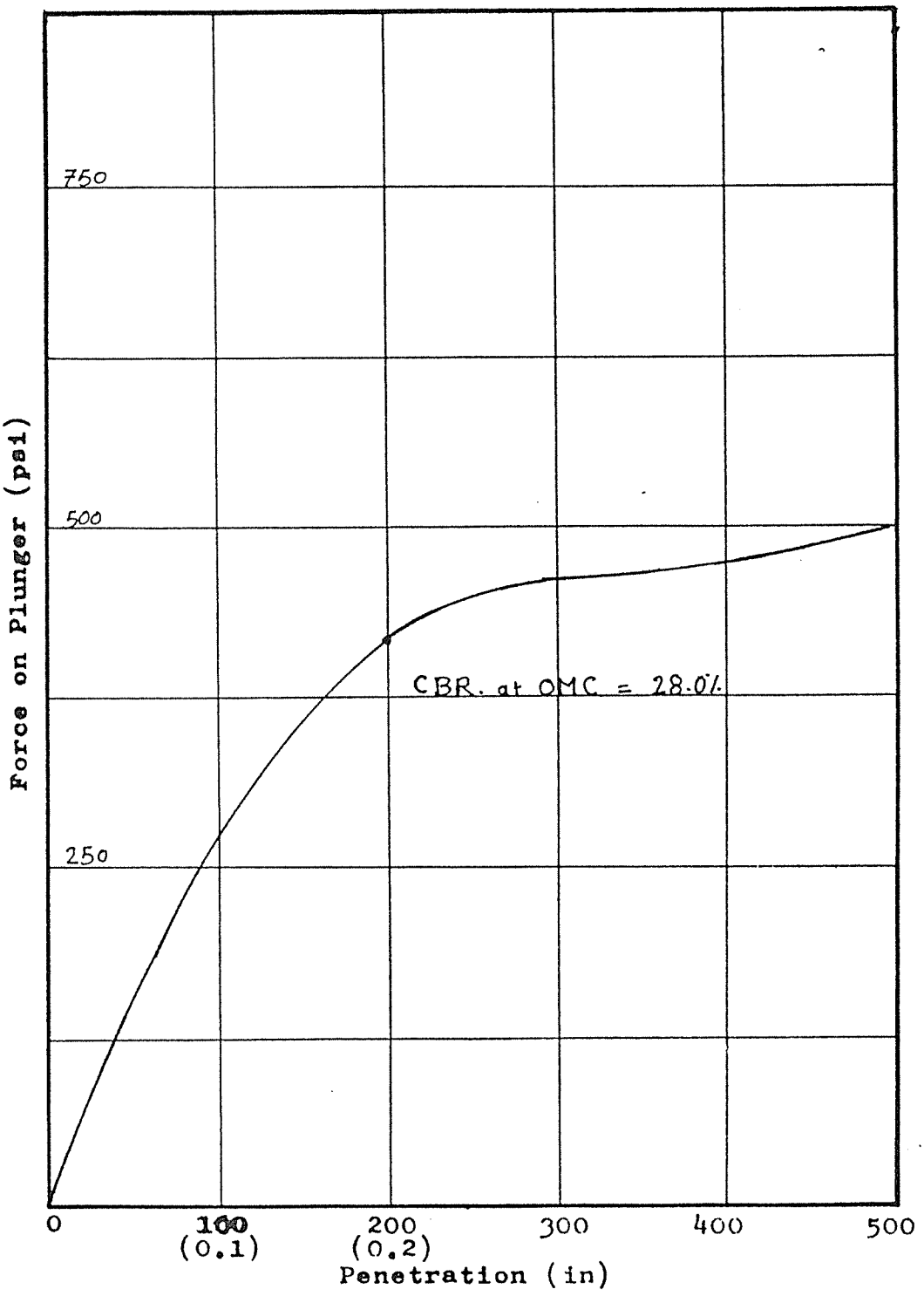
Max. Dry Density = 2.0 gr/cm³

Optimum Moisture Content = 3.8%

Geo-Research

California Bearing Ratio

Project: **Sample No.:** BH1 4.1m

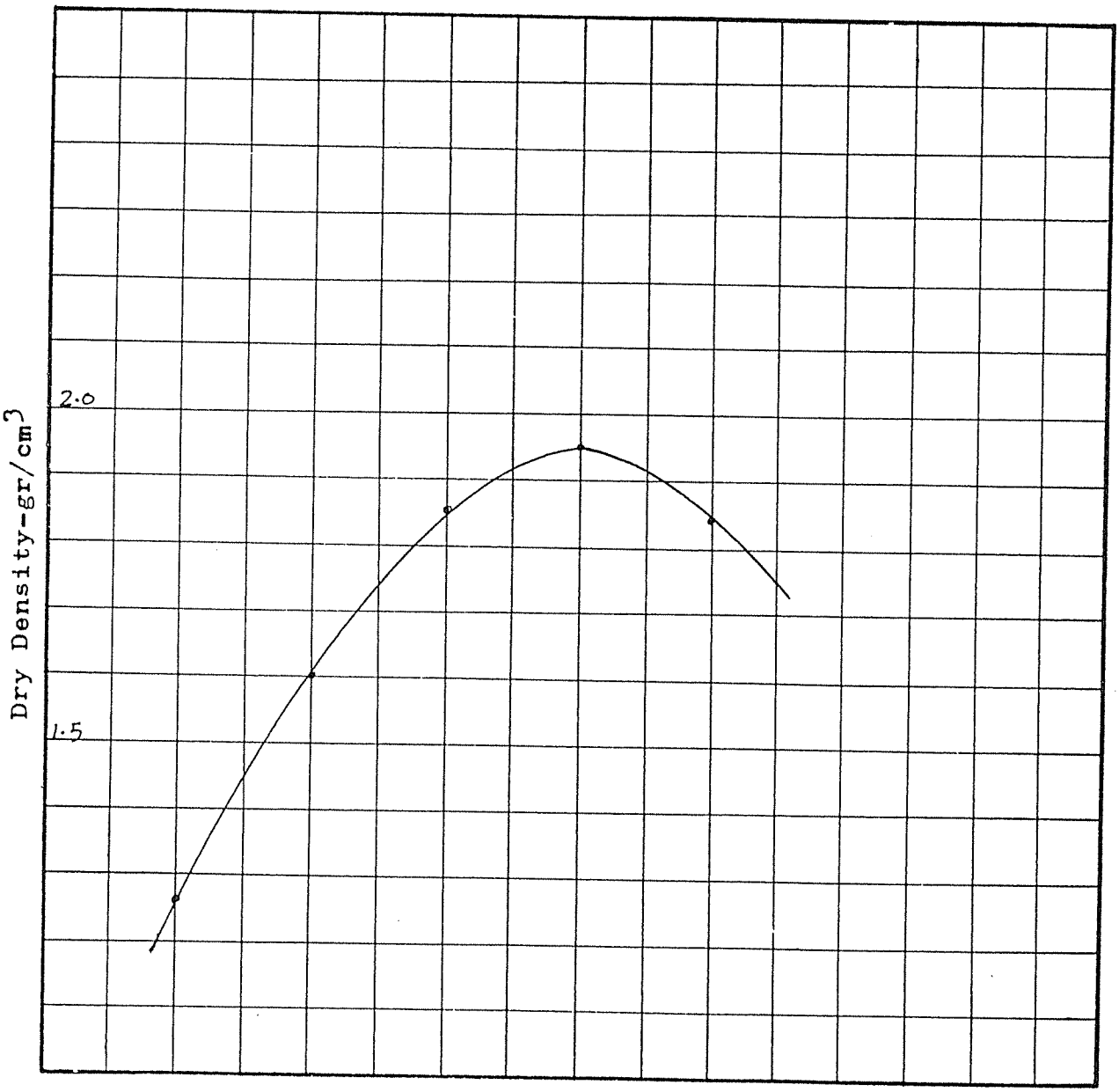


Remarks:

Geo-Research

Proctor Compaction Test

Sample No.: BH3 3.15m Project:



Max. Dry Density = 1.95 gr/cm³

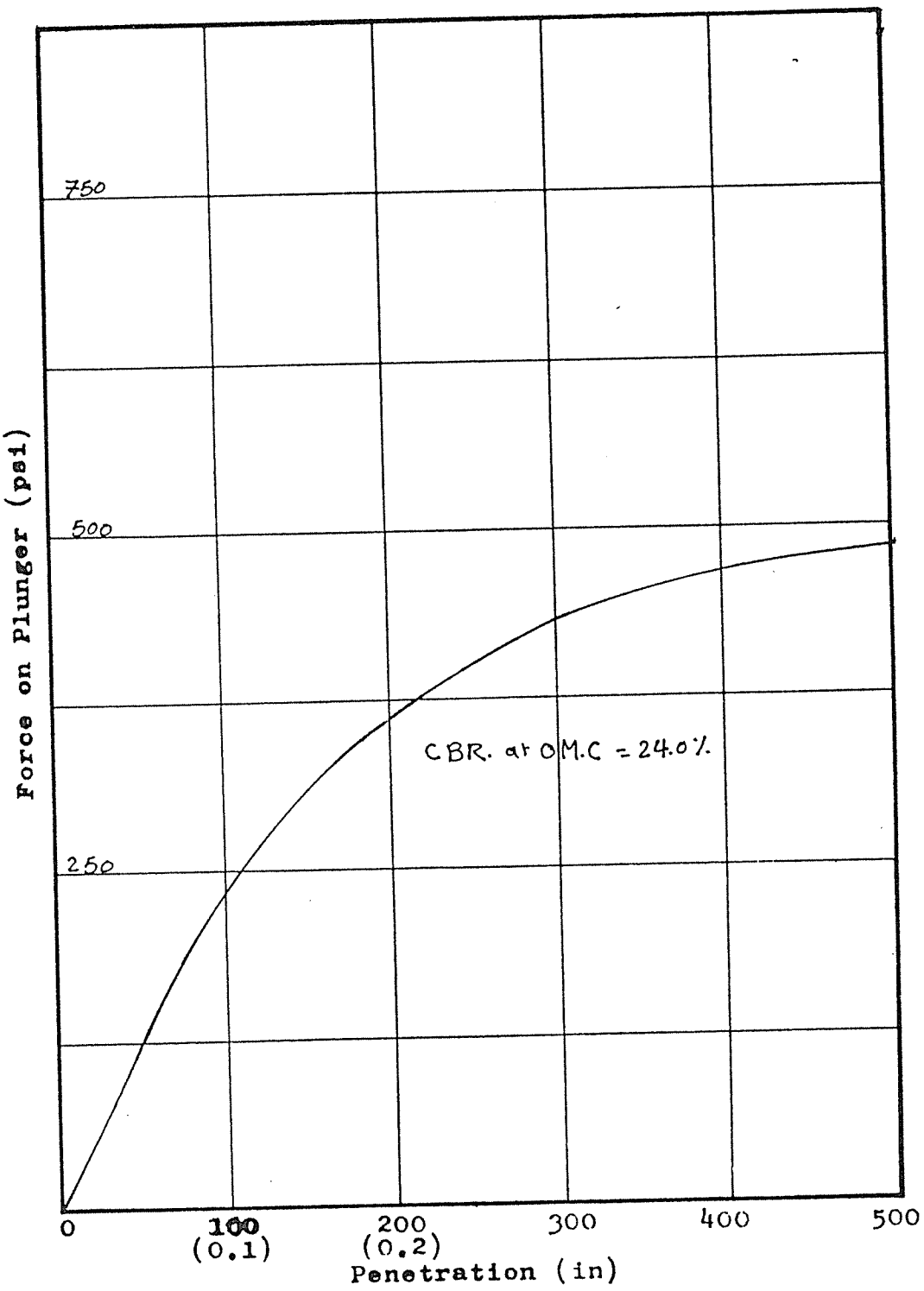
Optimum Moisture Content = 4.0%

Geo-Research

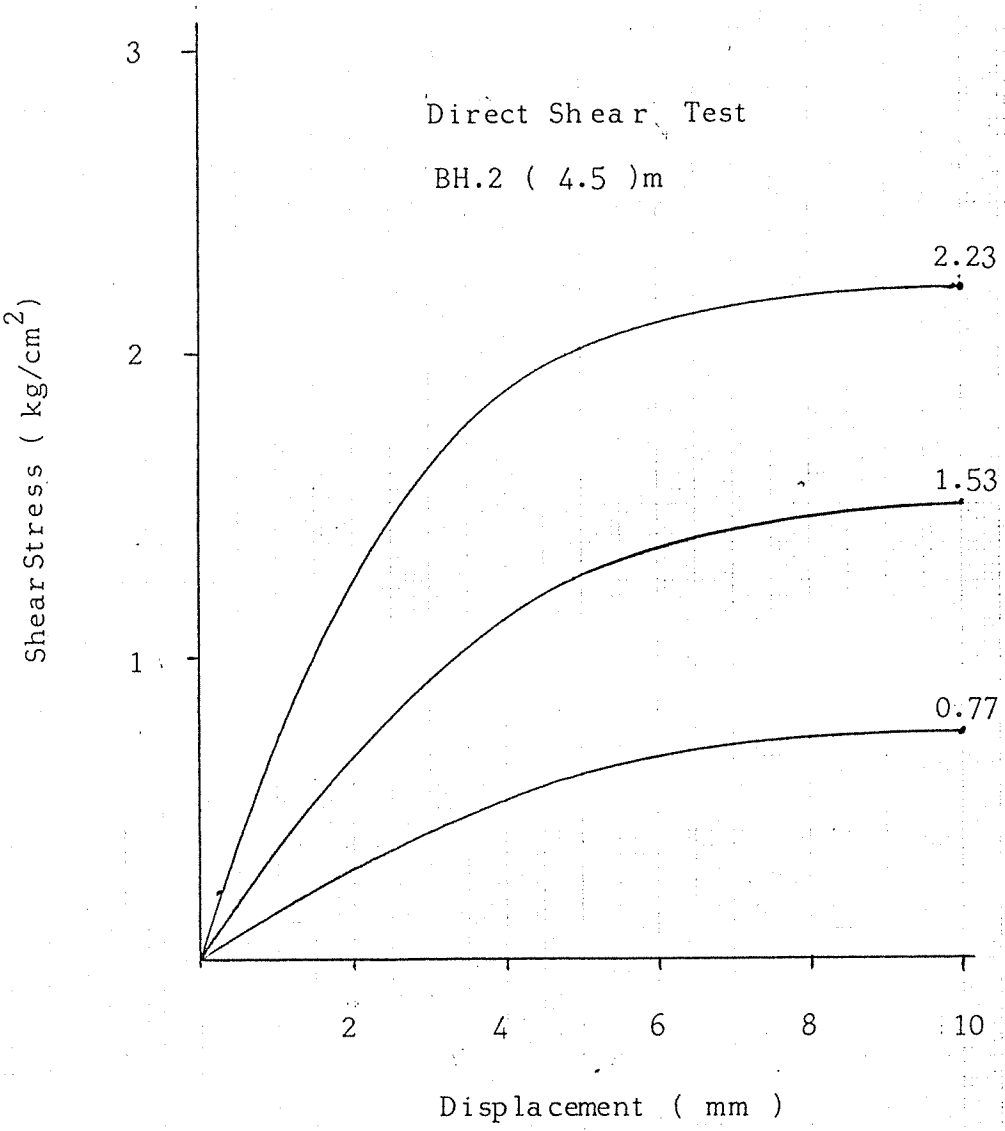
California Bearing Ratio

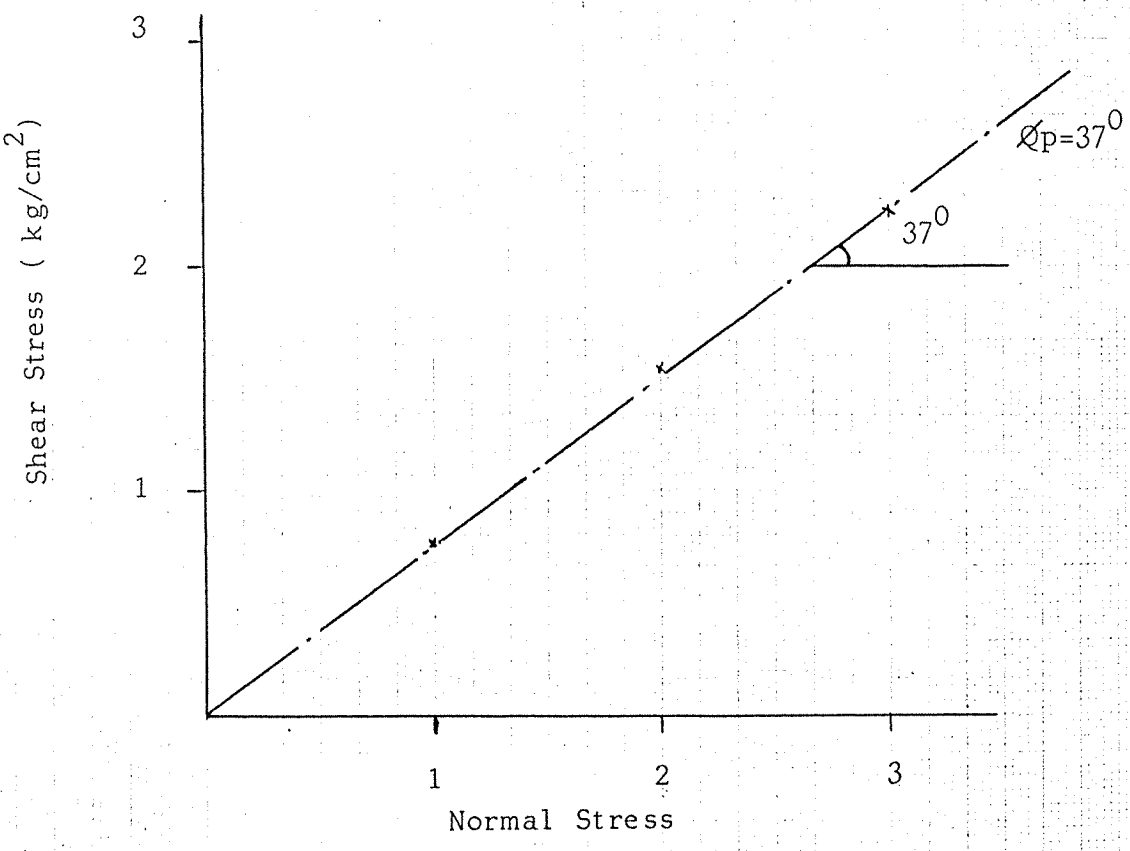
Project:

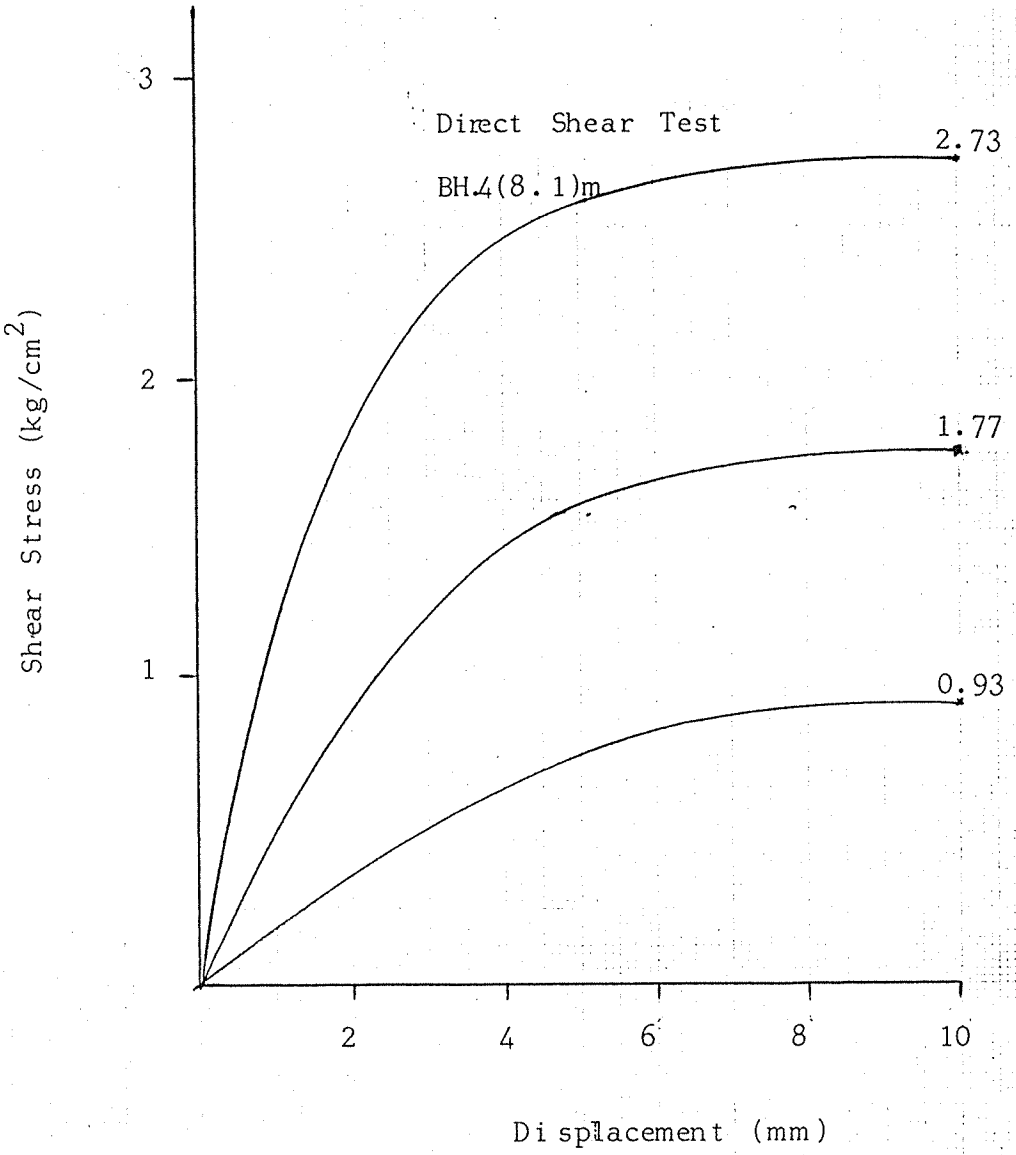
Sample No.: BH3 3.15m

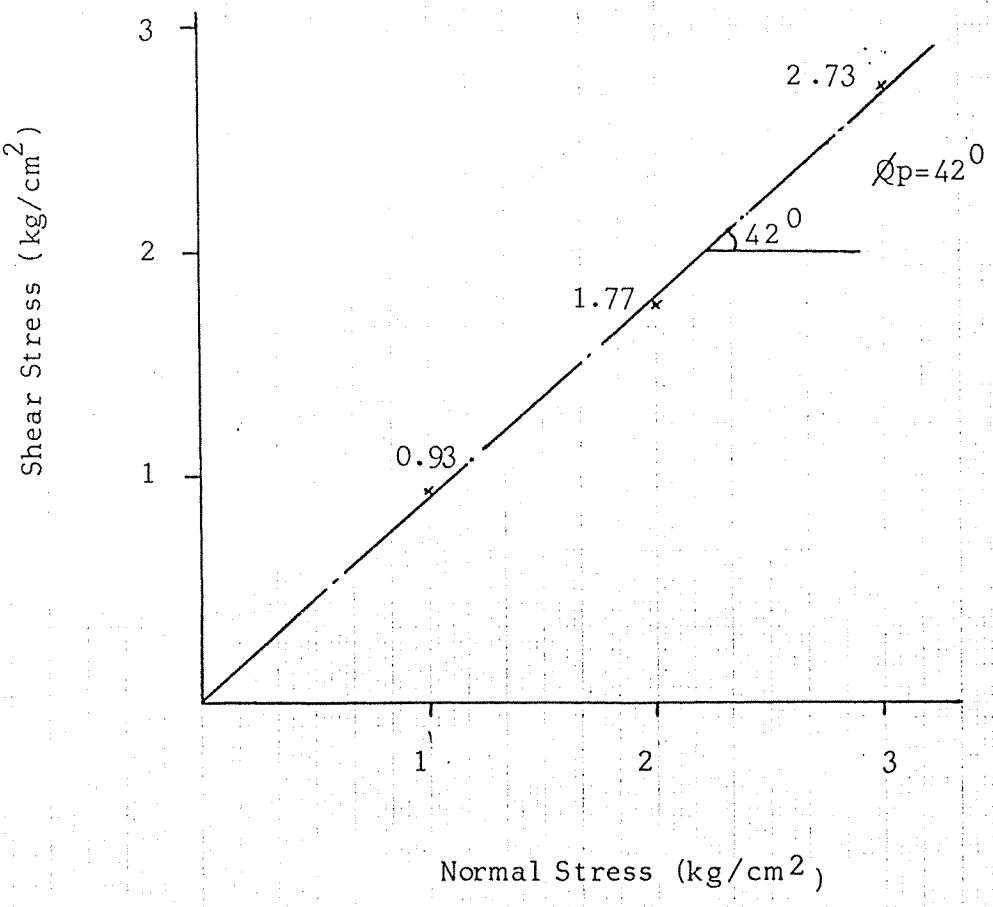


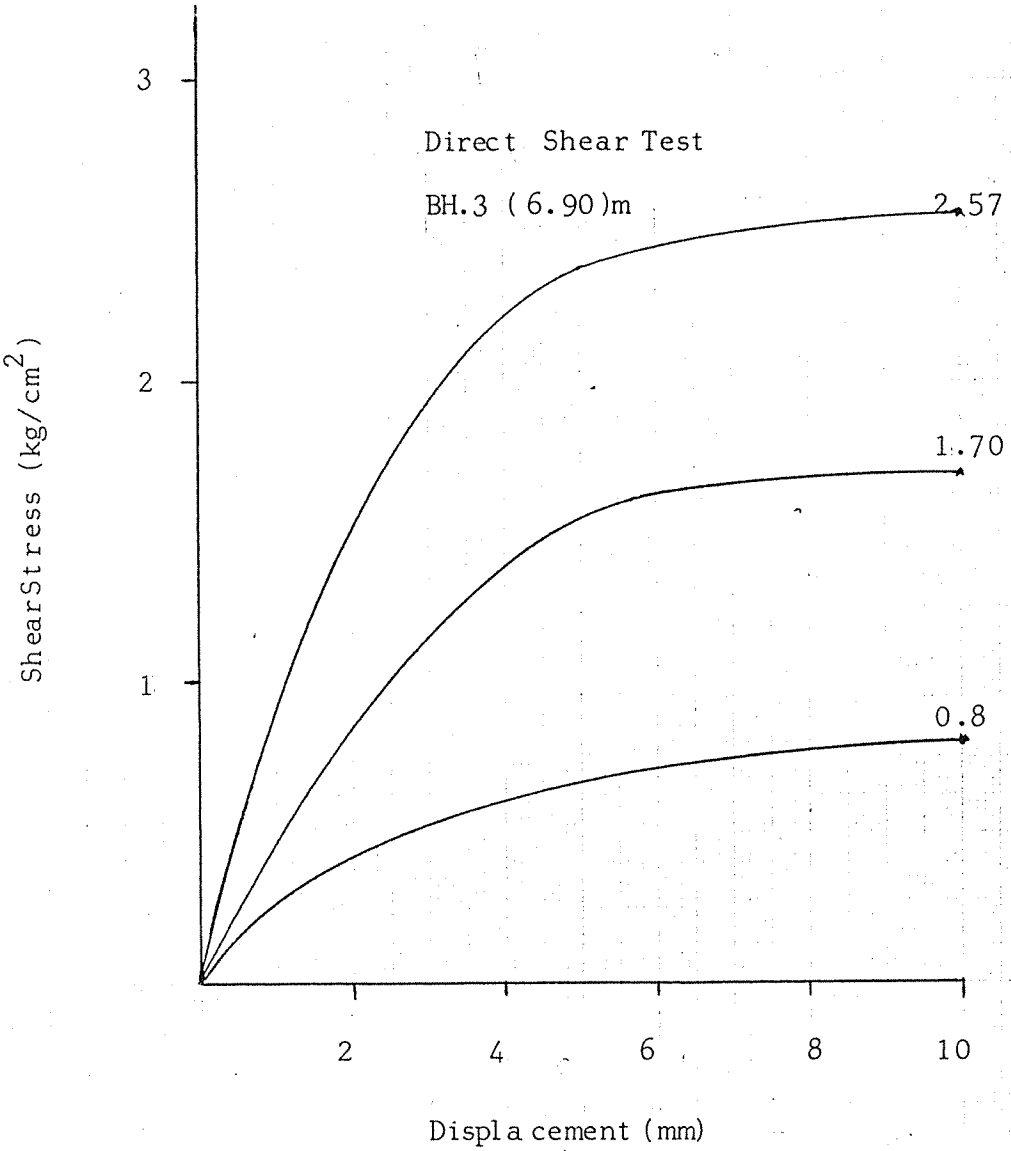
Remarks:

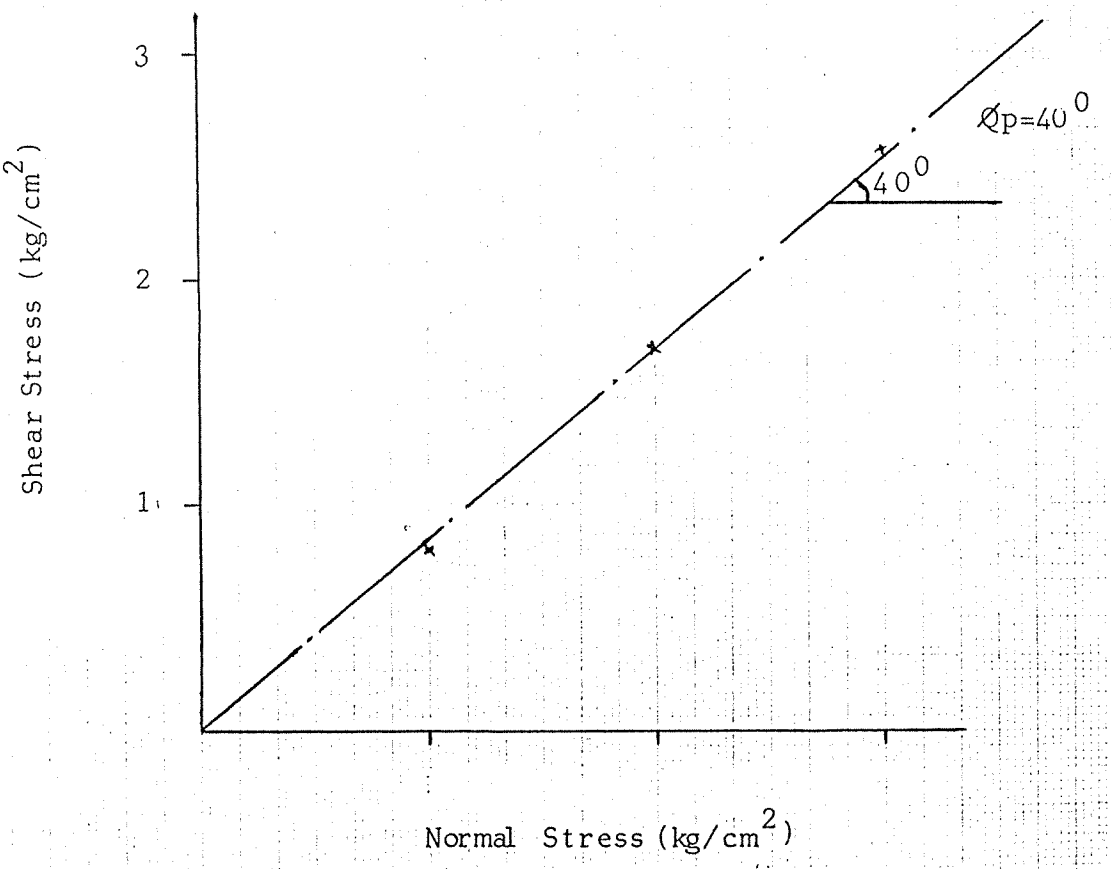

Direct Shear Test
BH.2 (4.5)m
Shear Stress (kg/cm2)
3
2
1
2.23
1.53
0.77
2
4
6
8
10
Displacement (mm)

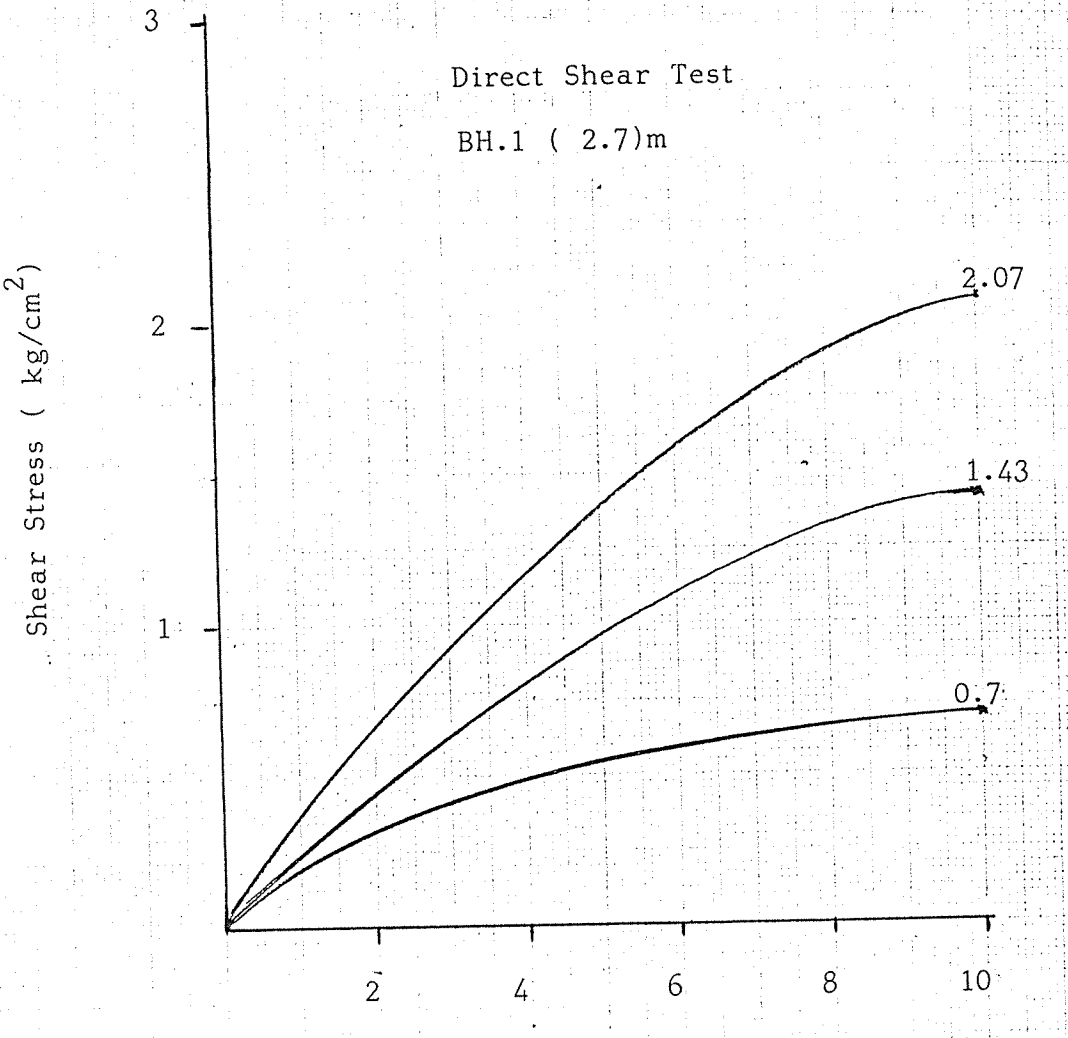

Shear Stress (kg/cm2)
3
2
1
Øp=37°
37°
1
2
3
Normal Stress


Direct Shear Test
BH.4(8.1)m
2.73
1.77
0.93
Shear Stress (kg/cm2)
Displacement (mm)
1
2
3
2
4
6
8
10


2.73
Øp=42°
42°
1.77
0.93
Shear Stress (kg/cm2)
Normal Stress (kg/cm2)
1
2
3


Direct Shear Test
BH.3 (6.90)m
2.57
1.70
0.8
Shear Stress (kg/cm²)
3
2
1
2
4
6
8
10
Displacement (mm)


Øp=40°
40°
Shear Stress (kg/cm²)
3
2
1
Normal Stress (kg/cm²)


Direct Shear Test
BH.1 (2.7)m
Shear Stress (kg/cm2)
3
2
1
2.07
1.43
0.7
2
4
6
8
10
Displacement (mm)

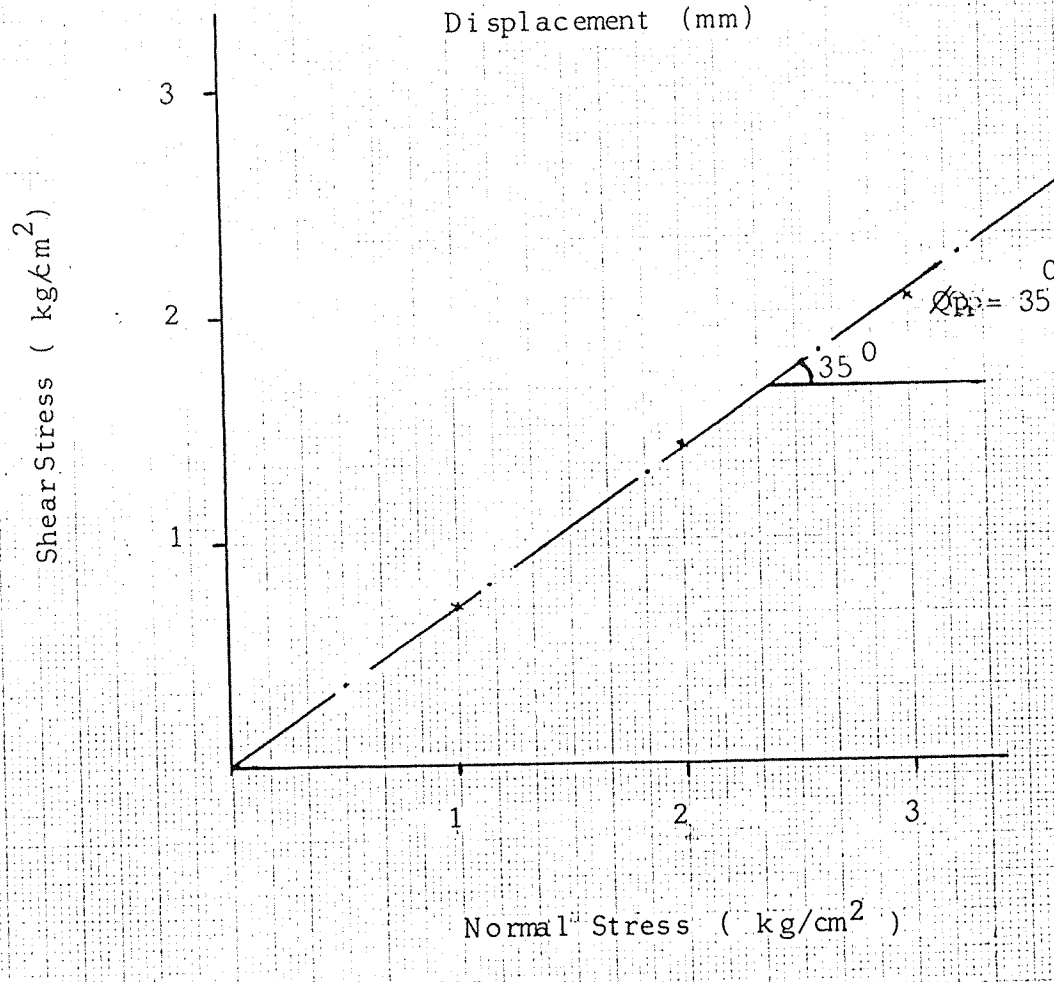

Shear Stress (kg/cm2)
3
2
1
0
Øp = 35
35 0
1
2
3
Normal Stress (kg/cm2)

Table 1.Dead Sea Museum Exhibition List

Theme & Sub-theme		Exhibition Subject (**Bold**:Major Items)	Media	Amount	Exhibition Type	Jordanian Responsibility	Obtained From	Remarks
1	Introduction	**Topography of Dead Sea**	model/map	1	open	software supply	Royal Geographic center	
2	Origin of Dead Sea(Geology)	Sign of the exhibition room	text & drawing	1	panel	software supply		
2-1.	Origin of Dead Sea	Geological origin of Dead Sea	text & drawing	3	panel	software supply	Natural Resource Authority(NRA)	
2-2.	Minerals & rocks of Dead Sea	Explanation of mineral	text & drawing	3	panel	software supply	Natural Resource Authority(NRA)	
		Cruziana	original	1	stage	**collection**	NRA	
		Varicoloured Sandstones	original	1	stage	**collection**	NRA	
		Coal	original	1	stage	**collection**	NRA	
		Pisolites	original	1	stage	**collection**	NRA	
		Red Sandstone	original	1	stage	**collection**	NRA	
		Alabaster	original	1	stage	**collection**	NRA	
		Quartzite	original	1	stage	**collection**	NRA	
		Mudcracks	original	1	stage	**collection**	NRA	
		Burrows	original	1	stage	**collection**	NRA	
		Bivalves	original	1	stage	**collection**	NRA	
		Highly burrowed limestone	original	1	stage	**collection**	NRA	
		Plant fossils	original	1	stage	**collection**	NRA	
		White sandstone	original	1	stage	**collection**	NRA	
		Rudist	original	1	stage	**collection**	NRA	
		Thallassinoides	original	1	stage	**collection**	NRA	
		Ammonites	original	1	stage	**collection**	NRA	
		Massive gypsum	original	1	stage	**collection**	NRA	
		Fibrous gypsum	original	1	stage	**collection**	NRA	
		Limestone	original	1	stage	**collection**	NRA	
		Echinoids	original	1	stage	**collection**	NRA	

Theme & Sub-theme	Exhibition Subject (**Bold**:Major Items)	Media	Amount	Exhibition Type	Jordanian Responsibility	Obtained From	Remarks
	Trioprli	original	1	stage	**collection**	NRA	
	Geods	original	1	stage	**collection**	NRA	
	Chalk	original	1	stage	**collection**	NRA	
	Gastropoda	original	1	stage	**collection**	NRA	
	Shark teeth	original	1	stage	**collection**	NRA	
	Coquina	original	1	stage	**collection**	NRA	
	Plg(Aggregates)	original	1	stage	**collection**	NRA	
	Laminites	original	1	stage	**collection**	NRA	
	Sulperhur	original	1	stage	**collection**	NRA	
	Sandstone dykes	original	1	stage	**collection**	NRA	
	Igneous dykes	original	1	stage	**collection**	NRA	
	Basalt	original	1	stage	**collection**	NRA	
	Soft travertine	original	1	stage	**collection**	NRA	
	Hard travertine	original	1	stage	**collection**	NRA	
	Iron ferruginous sandstone	original	1	stage	**collection**	NRA	
	Stalactite	original	1	stage	**collection**	NRA	
	Clay for medical(Treatment)	original	1	stage	**collection**	NRA	
	Chert	original	1	stage	**collection**	NRA	
	Conglomerate	original	1	stage	**collection**	NRA	
	Tar sand	original	1	stage	**collection**	NRA	
	Asphalt	original	1	stage	**collection**	NRA	
	Dolerite	original	1	stage	**collection**	NRA	
	Saramuj conglomerate	original	1	stage	**collection**	NRA	
	Copper	original	1	stage	**collection**	NRA	
	Phosphatic limestone	original	1	stage	**collection**	NRA	
	Calcarenite	original	1	stage	**collection**	NRA	

Theme & Sub-theme		Exhibition Subject (**Bold**:Major Items)	Media	Amount	Exhibition Type	Jordanian Responsibility	Obtained From	Remarks
		Qunia Diorite	original	1	stage	**collection**	NRA	
		Bituminous limestone	original	1	stage	**collection**	NRA	
		Salt	original	1	stage	**collection**	NRA	
		Exogyra	original	1	stage	**collection**	NRA	
		Volcanic tuff	original	1	stage	**collection**	NRA	
2-3.	Outcrop & hold in Dead Sea area	Outcrop & hold in Dead Sea area	text,drawing,photo	2	panel	software supply	NRA	
3	Symbiosis(ecology,biology)	Sign of the exhibition room	text & drawing	1	panel	software supply		
		Nature of Dead Sea	AV	1	TV monitor	software supply	RSCN	information
3-1.	Animal and plants in Dead Sea Area	**Stuffed animals from Dead sea area**	original	5	case	**collection**		
		Dried Plants	original	5	case	**collection**		
		Animal and plant in Dead Sea Area	text,drawing,photo	2	panel	software supply	RSCN	information,text,photo
		Immigrant birds in Dead Sea area	text,drawing,photo	2	panel	software supply	RSCN	information,text,photo
3-2.	Ecosystem in Dead Sea area	Ecosystem in Dead Sea area	text,drawing,photo	4	panel	software supply	RSCN	information,text,photo
		Ecological map	map,drawing,text	2	panel	software supply	RSCN	information,map,text
		Adaptation of plants to Dead Sean environment	text,drawing,photo	2	panel	software supply	RSCN	information,text,photo
4	Man and Dead Sea(Archaeology,Folklore,Therapy)	Sign of the exhibition room	text & drawing	1	panel	software supply		
4-1.	Baptism site:The holy water	Baptism site/Baptise of Jesus Christ	text,drawing,photo	2	panel	software supply	DOA	information,text,photo
		Skull found in Baptism site	original	1	airtight case	**collection**	DOA	
		Scene of Baptism of Jesus Christ from european painting	photo	1	panel	software supply	DOA	photo
		Traveling route of Jesus Christ	map,drawing,photo	1	panel	software supply	DOA	map,drawing
		Pottery vessel found in Baptism site	original	4	case	**collection**	DOA	
		Lamp found in Baptism site	original	4	case	**collection**	DOA	
4-2.	Dead Sea Scroll	**Dead Sea Scroll (copper scroll)**	original	2 box	airtight case	**collection**	National museum in Amman	
		Vessel of Dead Sea scroll	original	1	airtight case	**collection**	National museum in Amman	
		Explanation of Dead Sea scroll	text,map,drawing, photo	2	panel	software supply	DOA	text,map,photo

Theme & Sub-theme		Exhibition Subject (**Bold**:Major Items)	Media	Amount	Exhibition Type	Jordanian Responsibility	Obtained From	Remarks
4-3.	The transportation route on Dead Sea in Roman period	Zara Roman Harvor in Dead Sea	text,drawing,photo	1	panel	software supply	DOA	text,photo
		The reconstruction drawing of Zara harbor in Roman period	drawing	1	panel	software supply	DOA	information
		The transportation route on Dead Sea in Roman period	map & drawing	1	panel	software supply	DOA	map
4-4.	Traditional utilization of natural resources in Dead Sea Area	Therapy with Dead Sea mineral	text,drawing,photo	1	panel	software supply	DOA	text,photo
		Traditional salt production	text,drawing,photo	2	panel	software supply	DOA	text,photo
		The utilization of copper in Wadi Feinan	text,drawing,photo	2	panel	software supply	DOA	text,photo
		Copper ore in Wadi Feinan	original	10	case	**collection**	DOA	
		The utilization of asphalt form Dead Sea	text,drawing,photo	1	panel	software supply	DOA	text,photo
		Hot spring in Dead Sea area	text & photo	1	panel	software supply	Ministry of tourism(photo)?	text,photo
5	Conservation of Dead Sea	Sign of the exhibition room	text & drawing	1	panel	software supply		
		Explanation of the theme	text,drawing,photo	1	panel	software supply	RSCN	text,photo,information
		Dead Sea-past,today and future	AV	1	TV monitor	software supply	RSCN	information
5-1.	Change of water level & shoreline of Dead Sea	Explanation of the theme	text,drawing	1	panel	software supply	RSCN	text
		First satellite photo of Dead Sea	photo	1	exhibition box	software supply	Royal Geographic Center	photo
		Dead sea map drawn by Linch	photo	1	panel	software supply	RSCN	photo
		W.Lynch expedition of Dead Sea	text & photo	1	panel	software supply	RSCN	text,photo
		Dead sea date in 19 century(by W.Linch)	drawing & text	1	panel	software supply	RSCN	text
5-2.	Dead Sea in danger:Will Dead Sea really die?	Explanation of the theme	text,drawing,photo	2	panel	software supply	RSCN	text,photo
		Extinct species in Dead Sea area	drawing & text	1	panel	software supply	RSCN	text
		The landscape of Dead Sea in the future	drawing & text	1	panel	software supply	RSCN	text
		What should we do to protect Dead Sea?	drawing & text	1	panel	software supply	RSCN	text
5-3.	Dead Sea Database	**Scientific date of Dead Sea**	CD-ROM?		desktop computer	software supply	RSCN	Database(CD-ROM etc.)
5-4.	Dead Sea libraly	**Books about Dead Sea**	original		books	software supply	?	