شرکت فولاد آلیاژی ایران (سهامی عام)

شرکت فولاد آلیاژی ایران

پیوست شماره 13-1

مطالعات خاک

Attachment 17

Iran Alloy Steel Company

Geotechnical study of the site proposed for erection of Steel Making Plant (Yazd1)

PEY-KAV Consulting Engineers
29.Jab.2014

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Iran Alloy Steel Company

Subject: Geotechnical study of the site proposed for Erection of Steel Making Plant (Yazd 1)

1- INTRODUCTION AND THE AIM OF THE STUDY

a) Following our negotiations and in accordance with the contents of the contract signed concerning the geotechnical study of the above site, we as the Geotechnical Engineers have prepared the present report dealing with soil conditions of the site. The report is based on field operations and laboratory tests of the samples obtained.

b) The present report covers the outcome of all our field operations and laboratory tests and their analysis together with our recommendations concerning the soil characteristics of the site.

c) Engineer Gholampour has been technically in charge of the entire study Dr. H.Sanii has analyses the results and compiled the report.

d) The principle aim of this study is to provide the consultant and Design structural engineers with information related to various geotechnical aspects of the site and thus enable them to prepare the detailed design.

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e) Our assessment and recommendation are based on field operations and laboratory tests which specifically deal with the followings:

I) The results of our subsurface explorations samplings and field testings.
II) The results of our laboratory testings.
III) The soil conditions in general.

The most suitable type of foundations giving relevant values to be incorporated in design such as safe bearing capacity , depth of embedments , suitable cement for foundations concrete and the expected settlement of the footing.

2-FIELD OPERATION

2.1 – Boring

To accomplish the boring rotary drilling was adopted by using corebarel. Rotary Mobile Drills type B-40L and Craelius D750, were used for drilling operation.

This firm drilling a number of 11 boreholes in total with maximum depth of 20m in the specified area of the site, the location of these wells are shown in Fig.1 .

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2.2 – Standard Penetration Test

During the drilling operation the resistance of the ground to penetration at different depths has been measured by means of percussion machine within 1.5 to 3m intervals. The measured blow count (SPT) are given on column No. 16-17 figs 4 to 14.

The standard Penetration Tests were performed according to ASTM Designation: D 1586-82. This test consists of driving a split spoon sampler , having inside and outside diameters of 3.5 and 5 centimeters, respectively , with a 64 kilograms weight falling from 75cm high.

2.3 – Sampling

Disturbed samples were extracted using SPT sampler and corebarrel during the drilling operation form different layers.

Due to presence of grained particles and high stiffness of the ground it was not possible to collect undisturbed samples, except few samples from cohesive layers therefore the intact samples were gathered by use of corebarrel tube. Measurement of natural dry density of core samples and the field density measurement that would be described in section 2-4 were taken as a base for preparation of samples at laboratory to perform mechanical tests.

2.4 – Field Density (ASTM D-1556)

For evaluation of shallow depths stiffness and natural dry density of ground the field density were measured by means of sand bottle method.

The obtained results are shown on column no.12 of boring logs.

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2.5 – Plate Loading

Two plate load tests that shown by PLT1 to PLT4 on fig.1 were conducted according to ASTM D-1194, the plate diameter is 30cm and loads were applied by hydraulic jack. The obtained results are illustrated on figs. 14 and 15.

2.6 – Soil Resistivity Tests

Electrical resistivity of ground was measured on this site in eleven locations which are shown on fig.1. These tests were carried out in accordance of ASTM G-57 by Wenner procedure. The obtained resuls are illustrated in table No.2.

2.7– Soil Permeabity

Subsoil permeability was measured by lefrane method in borehole no.6. The obtained result is given in following sections.

3- LABORATORY INVESTIGATION

A number of laboratory tests were performed on different samples obtained from drilling operations. ASTM standard were applied for execution of these tests.

3.1 – Particle Size Distribution

Grain size distribution of the selected samples has been determined and the results are shown by graph in fig.s 26 to 49.

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3.2 – Atterberg Limits and Plastic Index

Liquid and plastic limits of some selected samples were determined and are given on columns No. 8 to 10 of the boring logs (Fig.s 4 to 14)

3.3 – Direct Shear Test ASTM D-3080

Shearing strength of few samples which prepared at laboratory conform to the natural dry density were determined by means of direct shear test.
The obtained results are illustrated on Fig.s. 17 to 25 and the shear parameters are shown in column 13 and 14 of boring logs.

3.4 – Chemical Test

Sulphate , PH and Choloride of some soil samples extracted form different depths were determined. The obtained results are given in table no. 1.

4. GENERAL SOIL CONDITION

4.1- Surface Condition

Topographic condition of site shows that the area is nearly flat and superficial layer with 30^{cm} thickness consist of root and undesirable materials.

4.2- Subsurface Condition

The subsurface soil and its physical properties, field exploration and laboratory testing program are presented in detail in log of boring fig.s. 4 to 14. However we have provided as an aid for planning and design, the following general description of subsurface soil strata and their key engineering properties.

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4.2.1 –Soil Description

Subsurface conditions and layers sequency resulted from each drilled boreholes are illustrated on the boring logs and section A-A and B-B. The underlaying layer consistes of sand and gravel mixed with some clayey silt and large paticles such as cobble and boulders, Based on USCS soil classification GC, GP-GC to SC are the most suitable designation for this formation.

4.2.2 - Stiffness

In order to show the behaviour of ground to the SPT blow counts on fig "a" we have put together all results obtained from various depth of boreholes.

Looking through this diagram and based on SPT blow counts performed at different depth of borholes it has been found a very high resistance to SPT, so that all measured blow counts are above 100 .

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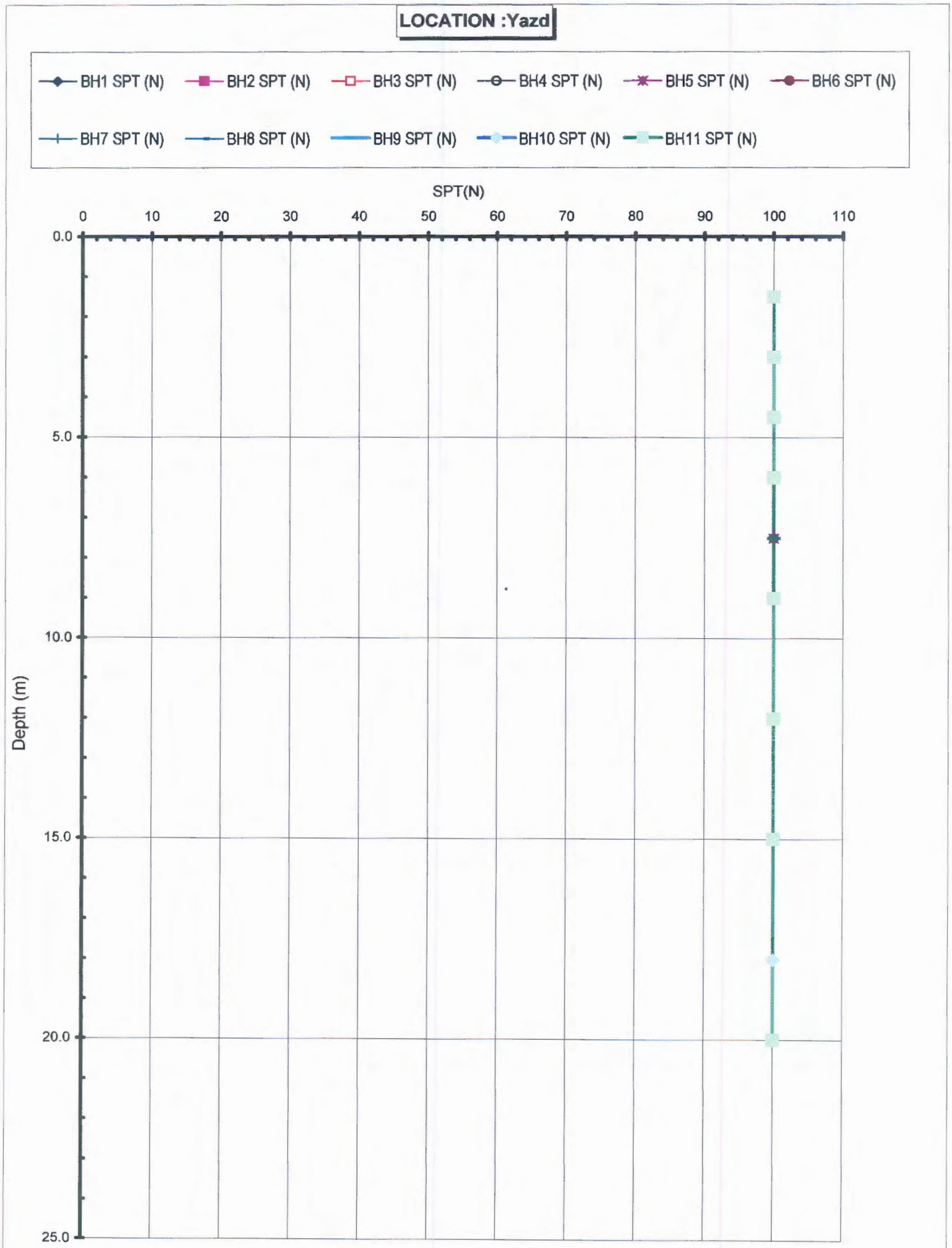

SPT vs Depth Diagram

FIG No. : a

4.2.3 –*Geotechnical Properties of Subsoil Strata*

Based on laboratory and in situ tests performed on this site we presume the following parameters for ground encountered in this site.

Soil Description	USCS Classification	N_{SPT} (ave.)	C Kg/cm^2	ϕ	E Kg/cm^2		γ_d gr/cm^3	υ
					By SPT	By PLT		
Sand and gravel + some clayey silt	GC to SC	>100	0 to 0.01	35.5 to 38	821	783 to 857	1.88	0.3

E : Compressibility Modulus kg/cm^2

γ_d : Dry density gr/cm^3

Φ ,C : Shear Parametes

υ : Poisson's Ratio

N SPT : Standard Penetration Test

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4.2.4 –Ground Water

The ground water table was not encountered within the maximum depth penetrated by boring.

5–FOUNDATION ENGINEERING RECOMMENDATIONS

5.1- General

The recommendations presented in this report are based on subsurface conditions encountered at the boring locations as described in this report. Should different subsurface conditions be encountered due to far distance of boreholes and non-uniformity of the natural soils, we should be contacted to evaluate if corrective measures or revised recommendations are required.

5.2- Static Foudnation Design

5.2.1- Introduction

- A minimum of 0.6m continuous footing and 1m for spread footings has to be considered, smaller footing would probably the subjected to local shear and may produce the foundation settlement.

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Based on metaological records of this site the frost penetration is nearly equal to one meter, therefore we recommend 1m should be considered as foundation embedment. This recommendation is for preventing possibility of surface erosion through water flow.

- Wherever the building loads are so heavy the individual footings would cover more than about half of the building area a raft foundation is recommended.

For being in the safe side we assume the following parameters for evaluating the allowable bearing capacity.

$$C=0$$
$$\Phi= 36$$
$$\gamma d= 1.88 \quad gr/cm^3$$

5.2.2- <u>Allowable Bearing Capacity</u>

Estimated allowable bearing capacity against failure with a factor of safety equal to 3 can be defined by the following relationship.

$$q_a = 23.6\, D_f K_1 + 16.2\, BK_2 \quad t/m^2$$

$$K_1= (1 + 0.2B/L)(1- 1.5\, H/V)$$

$$K_2= (1 - 0.3B/L)(1- 1.5H/V)^2$$

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The meaning of the symboles in the above relationship are as follow:

q_a= Allowable bearing capacity in t/m^2

B= Width of footing in meter

L= Length of footing in meter

H= Horizontal force applied on the footing

V= Vertical Load applied on the footing

For calculating the allowable bearing capacity of circular foundations B in above formula should be replaced by diameter of foundation .

Hanson's formula has been used for evaluation of the bearing capacity.

We should notify that D_f in above formulas may probably be loss than the depth of excavation for erection of foundation "D". Therefore D_f is the minimum thickness of soil which would remain adjacent to the footing, in other word the true existing overburden after erection of foundation (see fig I).

Remark 1: Finally the above allowable bearing capacity are valid under the condition that the footing space is at least three means foundation width from center to center. For shorter space a reduction factor β must be applied to allowable bearing capacity (see fig. 1^a).

$$q' = q\beta$$

$$\beta = \frac{B + 0.5F}{2B}$$

In above relationship "F" is space between adjacent footing measured fro the sides.

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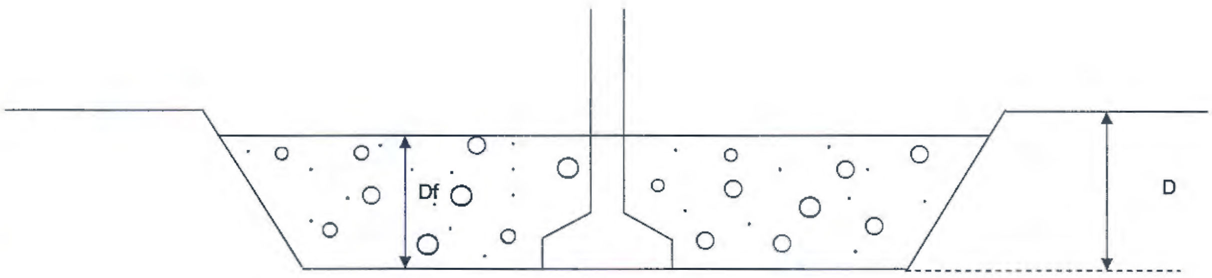

FIG : I

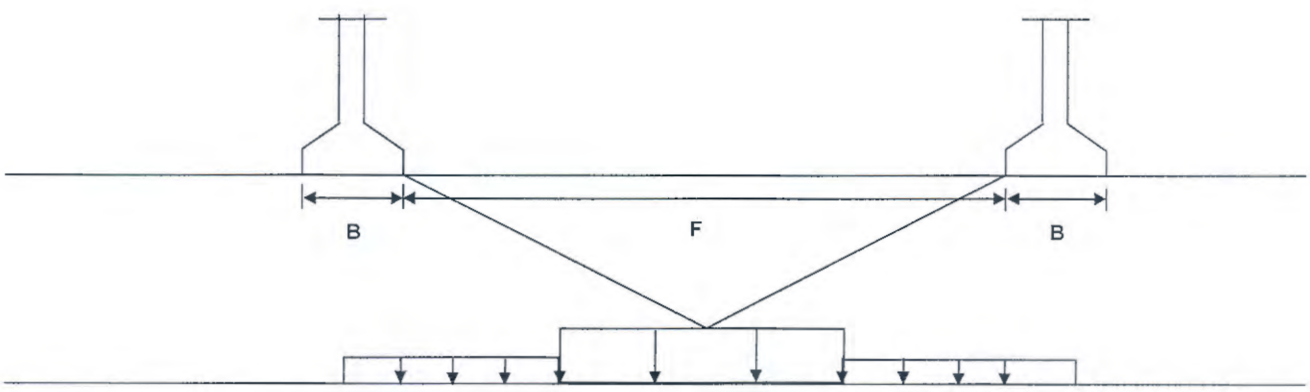

FIG : Ia

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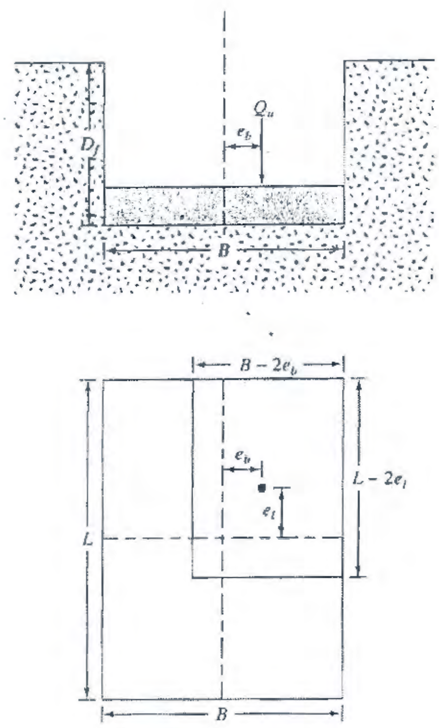
Remark 2: The above bearing capacities with relevant footing size “B” , “L” are applicable when there is no eccontrie load on footing. In case of excentric load as shown below, the real footing must be replaced by a fictional on whose $B' = B-2e_b$ and $L' = L-2e_L$.



Remark 3: The above mentioned allowable bearing capacities are with the assumption that there is no limitation for foundations settlements. So attention should be drawn to next section contains allowable foundations pressure and also studies strength and settlement conjunctly.

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5. 3-Shallow Foundation Settlement

We have estimated the total settlement of shallow foundation. The obtained results are illustrated on following figs.

Fig II= gives settlement for square footing (L/B=1)
Fig III= gives settlement for continuous footing (L/B=10)

We should notify that these analysis are based on the minimum geotechnical characteristic of subsoil strata recognized in bore holes drilled on this site.

5.4-Allowable Shallow Foundation Pressure

The preceeding analysis of ultimate bearing capacity are based on the assumption that there is no limitation for settlement.

Therefore for those foundation which are sensitive to settlement the foundation design should be based on allowable pressure for which an acceptable settlement would be occured.

In response to this requirement we've established the allowable footing pressure diagrams based on two following criteria.

-Maximum allowable settlement = 2.5 cm
-Maximum allowable settlement = 5 cm

Therefore the engineer could select the suitable diagram which conforms to acceptable structural settlement.

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Following table gives the address of each diagram knowing the criteria for allowable settlement and footing shape.

Fig No.	Maximum Allowable Settlement (Cm)	Shape of Foundation
IV	2.5	L/B = 1
V	5	L/B = 1
VI	2.5	L/B = 10
VII	5	L/B = 10

For evaluating the allowable pressure we assume H/V = 0.1 and $D_f = 1m$.

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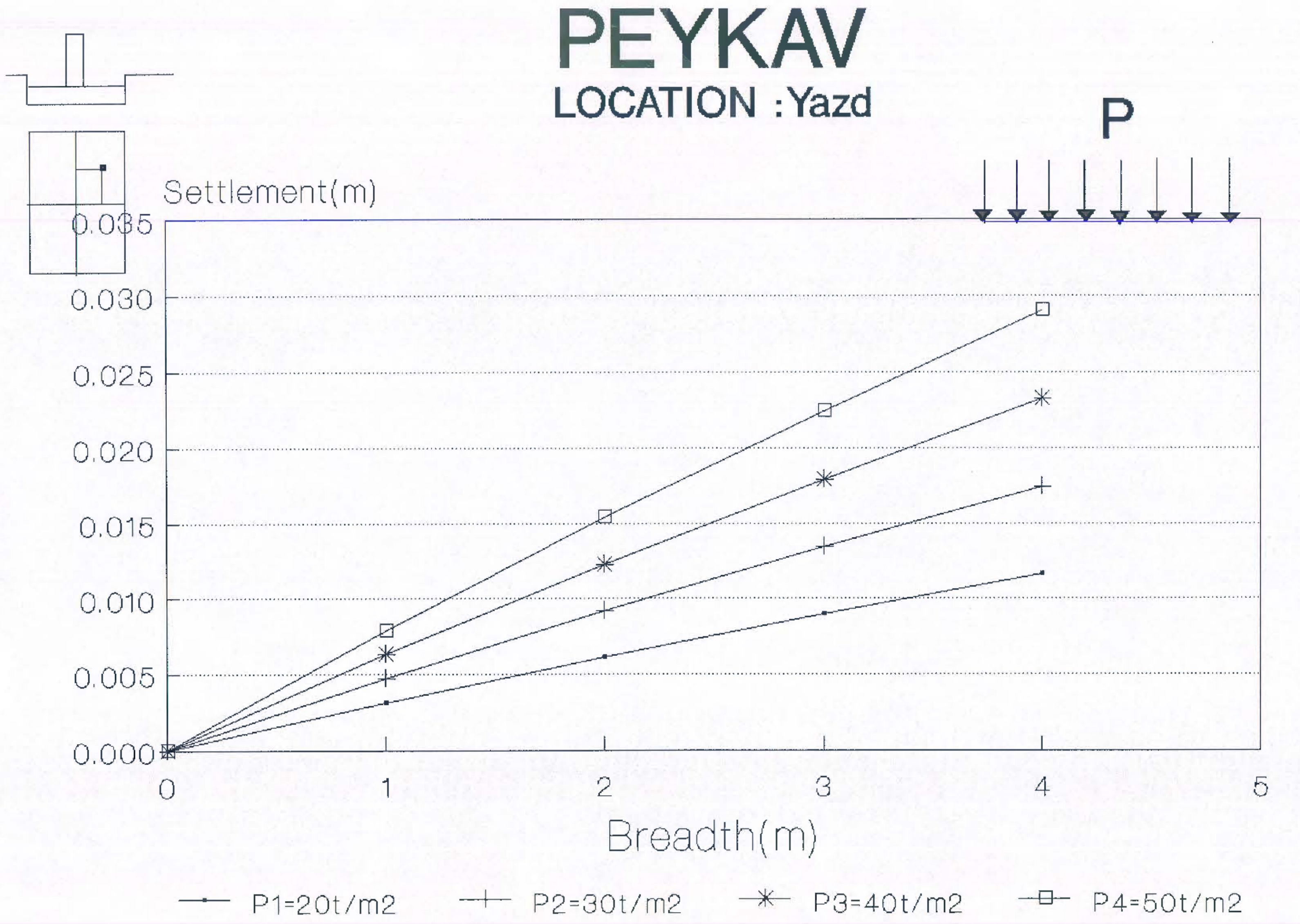

FIG:II Settlement For Spread Square Footing(L/B=1)

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LOCATION : Yazd

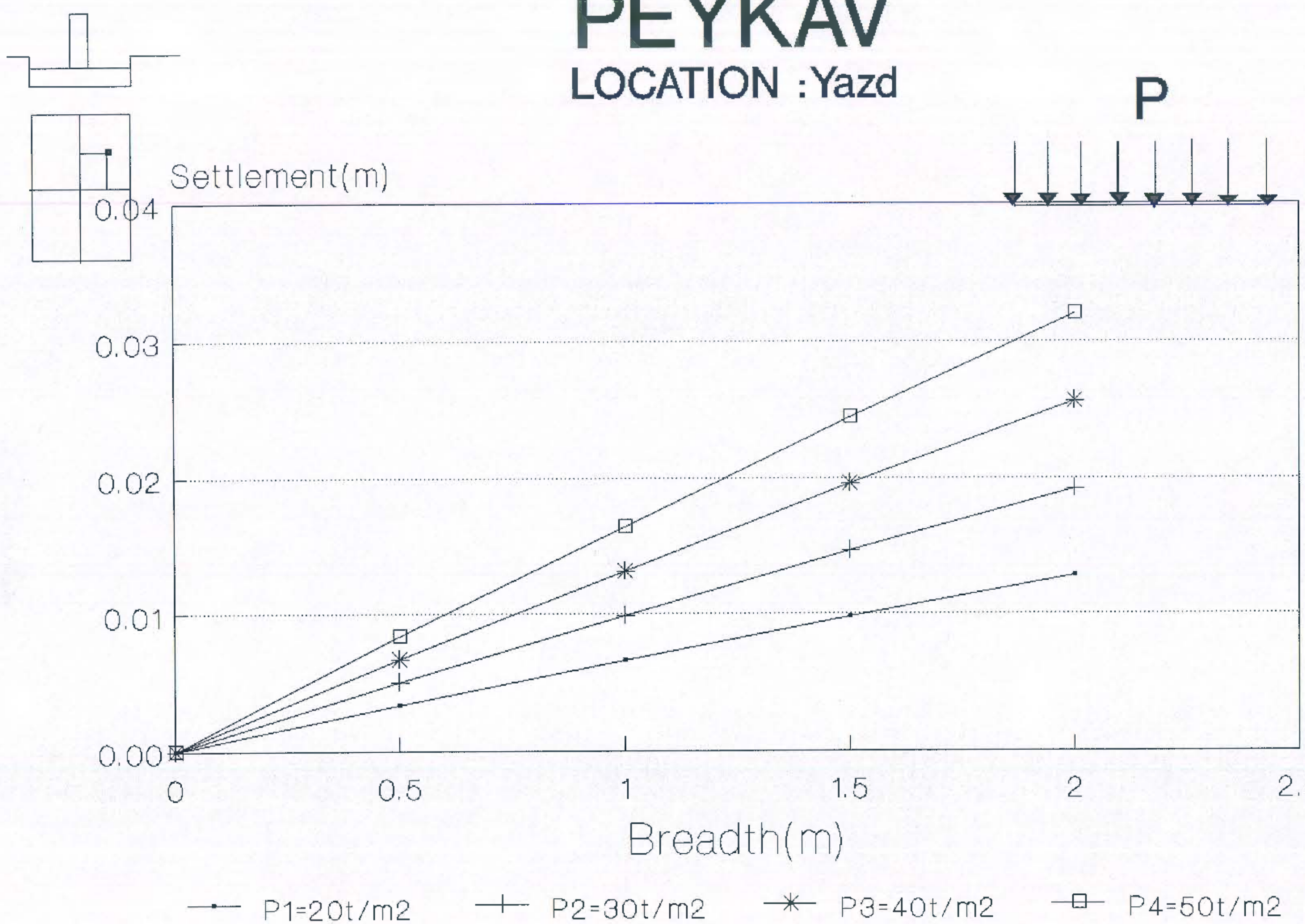

FIG:III Settlement For Continuous Footing(L/B=10)

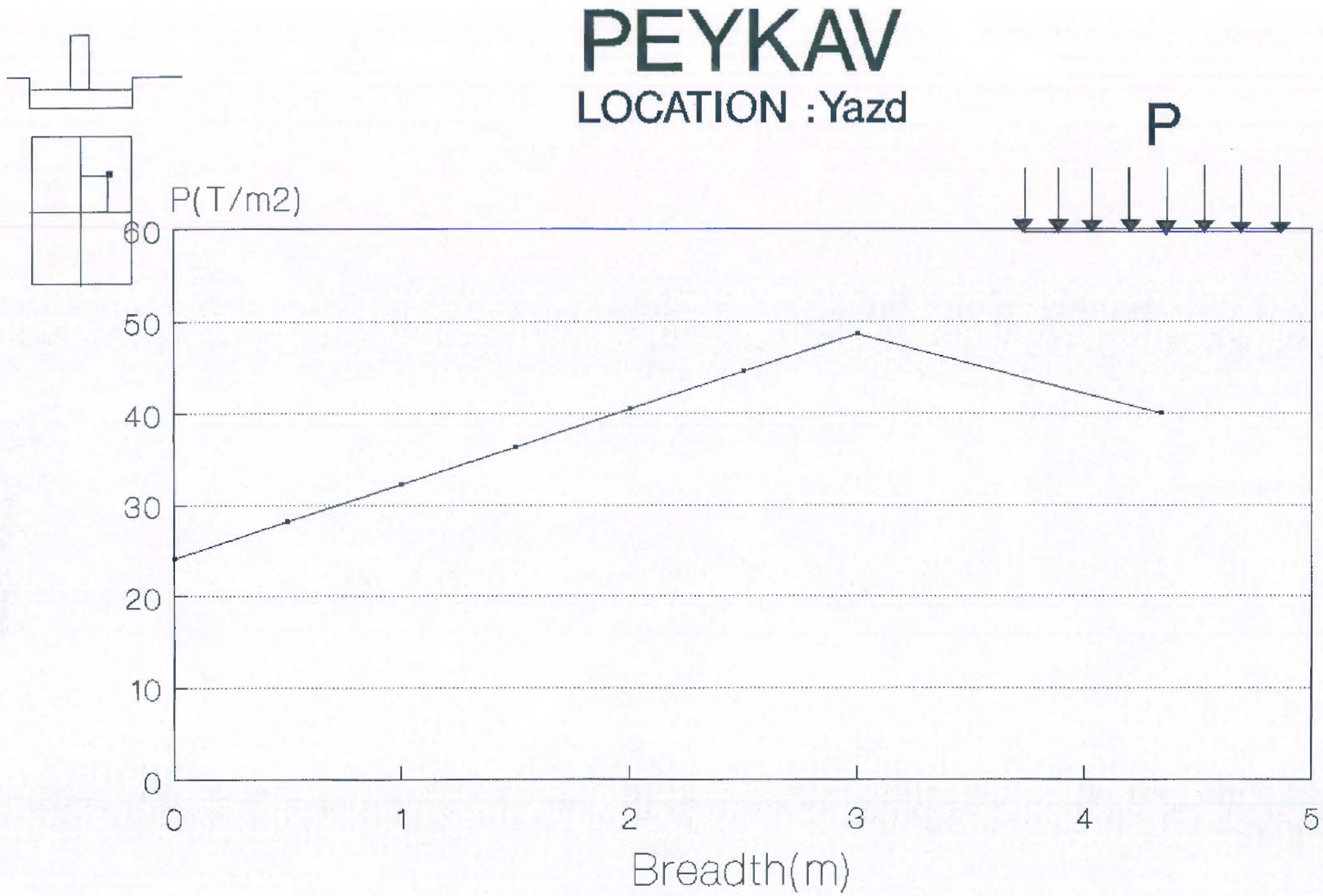

FIG:IV Allowable Pressure For Square Footing(L/B=1)With Max Set=2.5Cm

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LOCATION : Yazd

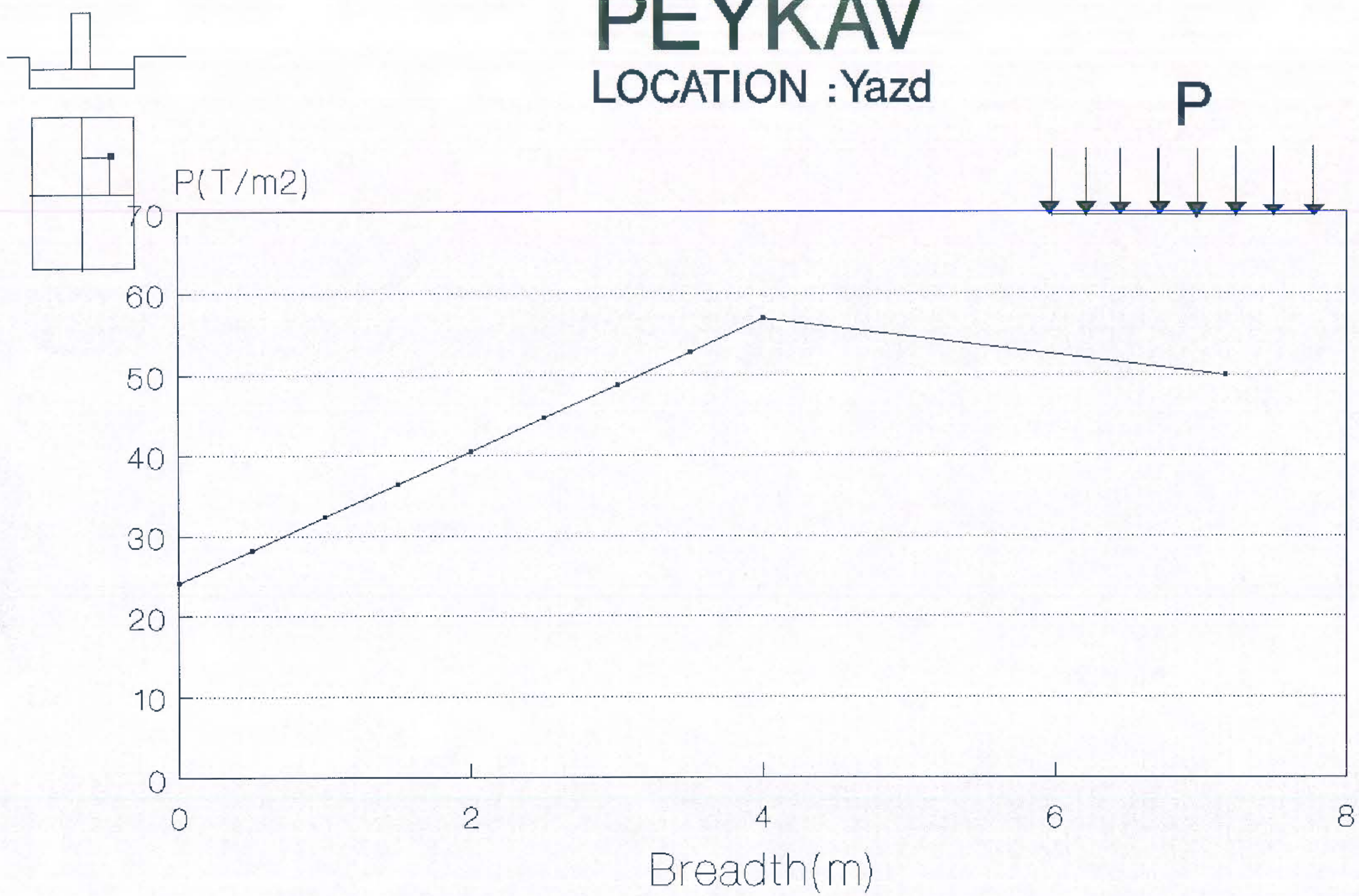

FIG:V Allowable Pressure For Square Footing(L/B=1)With Max Settlement=5Cm

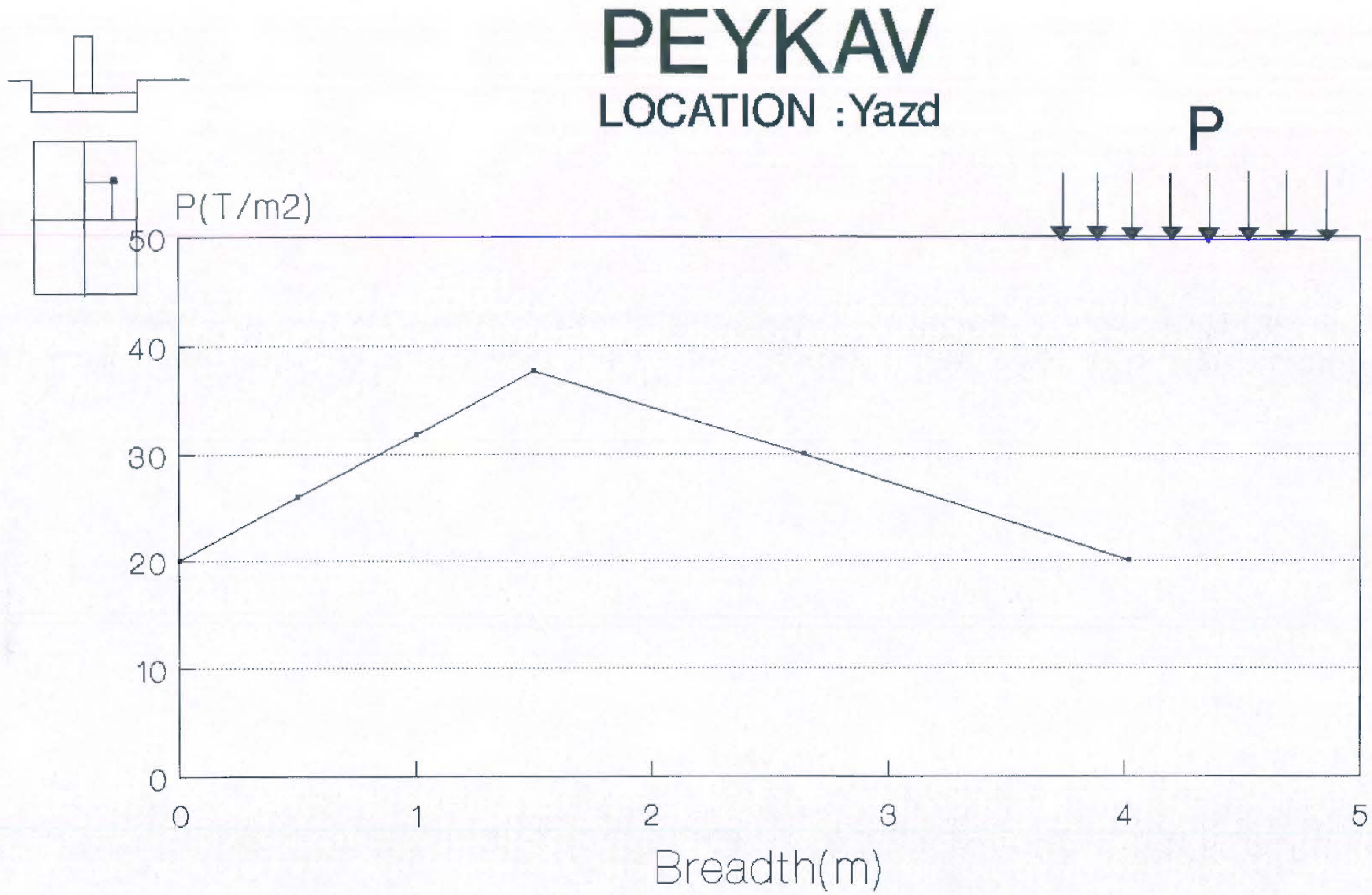

FIG:VI Allowable Pressure For
Continuous Footing(L/B=10)With Max
Settlement=2.5Cm

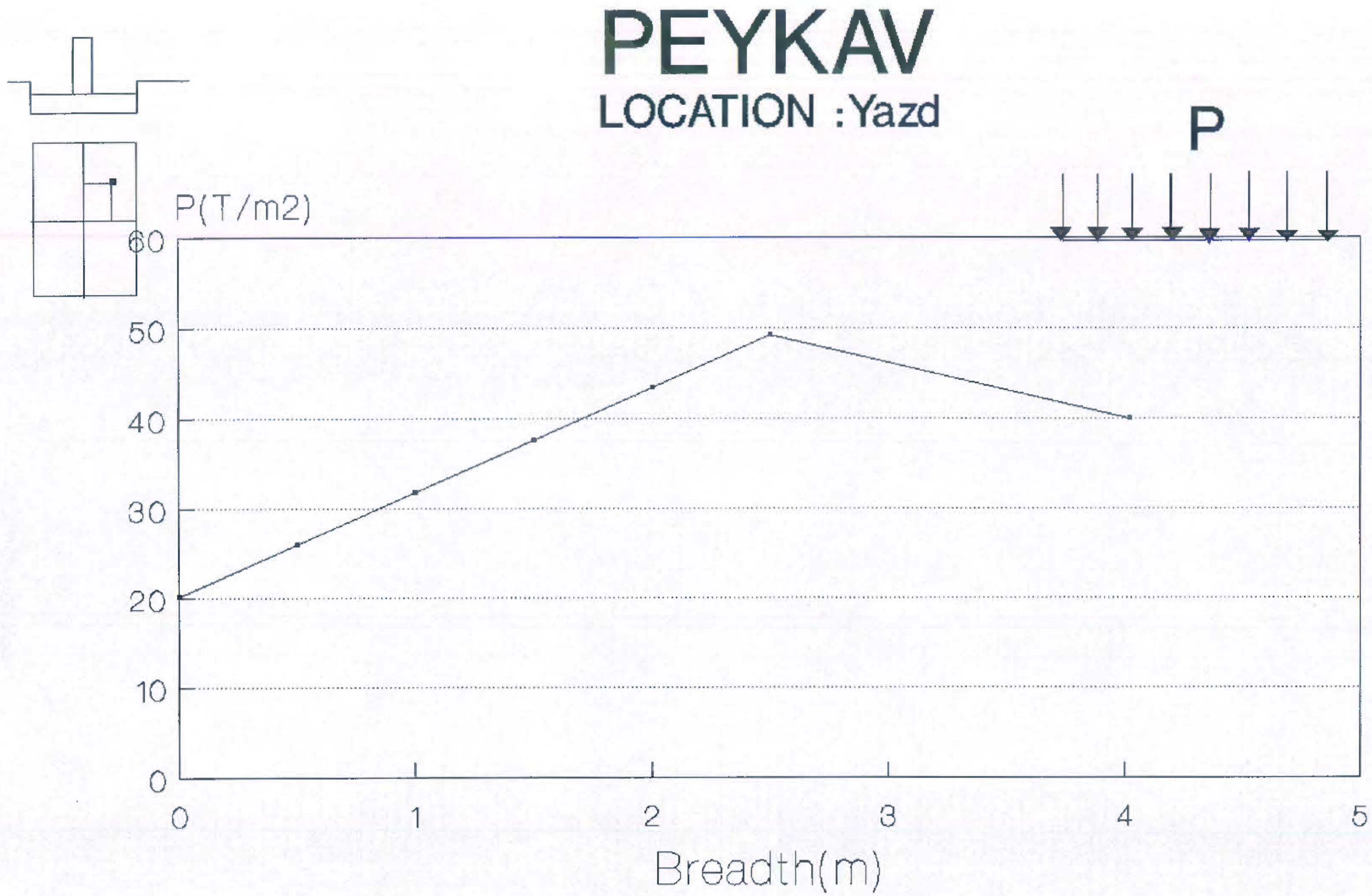

FIG:VII Allowable pressure For Continuous Footing(L/B=10) With Max Settlement=5Cm

5-5-Guide for safe design of footing

In order to fulfill this requirements. Diagrams established for settlements and allowable footing pressure must be considered .

a) The control of allowable settlement ρmax

The maximum allowable settlement of any footing is determined with regard to the structural design and its sensitivity to settlement. In the absence of such Sekmpton & Mac Donald a information Sekempton & MacDonald have suggested to take the limits reflected in table "II" . For example a spread footing on sand, shouldn't settle more than 5cm.

b) Control of tilt and Angular distortion

If ρ1 and ρ2 are the absolute settlements of two spread footing with distance "L", the angular distortion σ will be;

$$\sigma = \frac{\Delta\rho}{L} = \frac{\rho 2 - \rho 1}{L}$$

Where ρ1 and ρ2 could be determined from settlement diagams.

According to Bjerrum the allowable angular distortion is between 1/150 and 1/750 based on type of structure as indicated in the table III.

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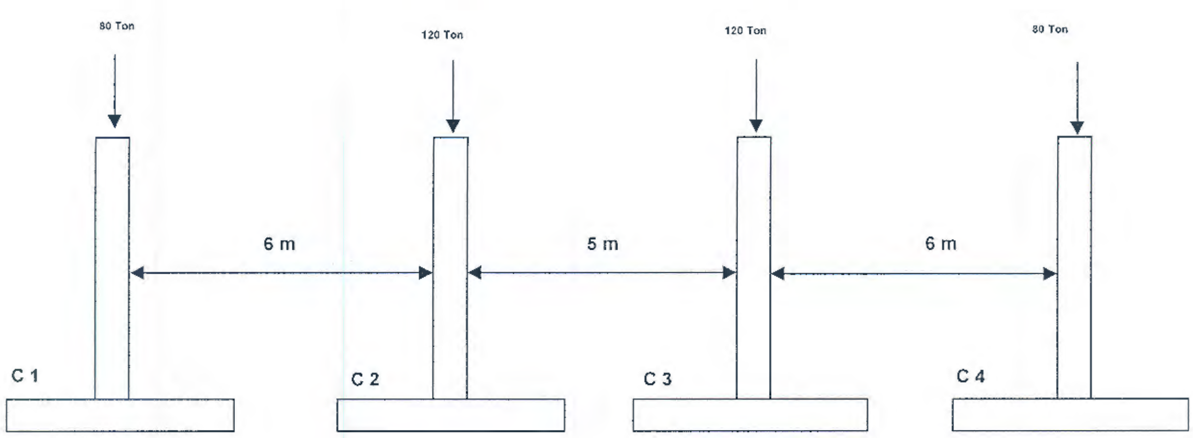
Example: Considering square footing C-1 to C-4.where cracking is not permissible. If the individual column load be as shown on the following sketch find the footing size.

80 ton *120 ton* *120 ton* *80 ton*



Since the soil in is a mixture of sand and gravel therefore in order to be on the safe side we take ρmax=5cm as the limit of settlement, recommended in table II.

For the square footing in above schem, Fig V gives us the allowable pressure, if we follow exactly the graph on this figure there would be no differential settlement. In such a case we have to take trial method in order to follow exactly the curve on that diagram.

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Table:II:**Settlementlimitations(SkemptionandMacDonald)**

Criterlon	Independent Footings		Rafts
Angular distortion ($\delta\rho/L$)		**1/300**	**1/300**
Greatest differential Settlement ($(\delta\rho)_{max}$)	**sands**	**$1\frac{1}{4}$ in (30 mm)**	**$1\frac{1}{4}$ in (30mm)**
	clays	**$1\frac{3}{4}$ in (45 mm)**	**$1\frac{3}{4}$ in (45 mm)**
Maximum settlement (ρ_{max})	**sands**	**2 in (50 mm)**	**2-3 in (50-75 mm)**
	Clays	**3 in (75 mm)**	**3-5 in (75-125 mm)**

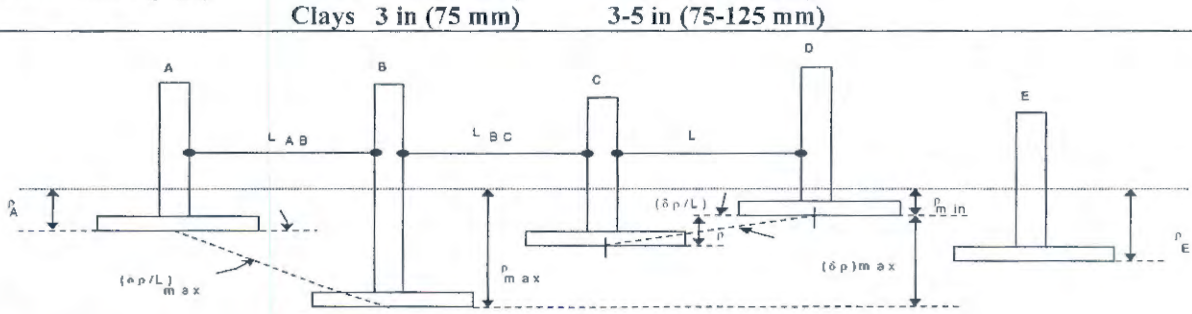

Table: III: Tentative damage criteria (Bjerrum)

Angular distoration ($\delta\rho/L$)	
1/750	**Limit where difficulties with machinery sensitive to settlements re to be feared**
1/600	**Limit of danger for frames with diagonals**
1/500	**Safe limit for buildings where cracking is not permissible**
1/300	**Limit where first cracking in panel walls is to be expected** **Limit where difficulties with overhead cranes are to be expected**
1/250	**Limit where tilting of high, rigid buildings might becomes visible**
1/150	**Considerable cracking in panel walls and trick walls safe limit for flexible brick walls heigh/length**

$< \frac{1}{4}$ limit where structural damage of general buildings is to be feared.

$B_{c1} = B_{c4} = 1.49$ m   P =36.3 t/m^2

$B_{c2} = B_{c3} = 1.64$ m   P=37.5 t/m^2

Another procedure is to select allowable pressure under the limit curve shown on the same graph, doing so we have:

Footing No.	B (m)	P t/m^2	ρmax t/m^2	settlement (mm)		$\sigma = \Delta\delta / L$	
				δmm	δ_a mm	σ	Allowable τ
C-1	2.0	20	40.5	6.25	50	1/2034	1/500
C-2	2.0	30	40.5	9.2	50	0	1/500
C-3	2.0	30	40.5	9.2	50	1/2034	1/500
C-4	2.0	20	40.5	6.25	50		

P_{max} = Maximum Allowable pressure (Fig V)
P = Footing Pressure
δ = Footing Settlement (Fig II)
δa = Allowable Settlement

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5.6 -Mat Foundation

informed

Bearing capacity and also settlement of mat foundations are depends on size and depth of embedment , which are unknown for us by now, although we have in formed by project engineers that mat foundations with $10^m \times 10^m$ dimensions were used in this project.
So the bearing capacity and settlement of mat foundations will be considered below.

5. 6.1 – Allowable Bearing Capacity

Failure under a large footing such as raft or mat foundation is different compared to the normal small footing . This matter has to be taken into account when bearing capacity of a mat foundation is needed to be known.

The allowable bearing capacity of mat foundations against failure with a factor of safty equal to 3 can be defined by the following formula.

$$q_a = 7.3\ D_f K_1 + 3\ BK_2 \qquad t/m^2$$

For example we have calculated the allowable bearing capacity of some mat foundations by using above relationships for a case where H/V = 0.1 as give in below table.

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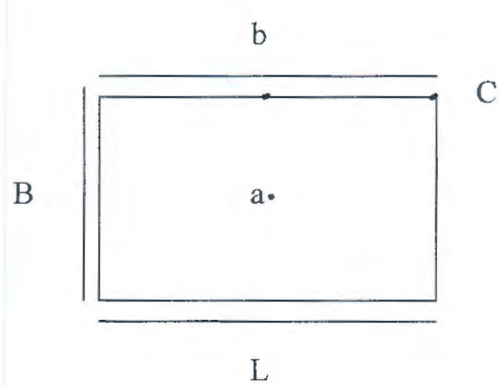
Mat Description L×B=(m×m)	D_f (m)	Allowable Bearing Capacity $q_a(t/m^2)$
8×8	1	19.6
	2	27
	3	34.5
10×10	1	22.6
	2	30.1
	3	37.5
15×15	1	30.2
	2	37.6
	3	45.1
20×20	1	37.8
	2	45.2
	3	52.7

5. 6 .2 – Settlement of mat foundations

Due to large surface of loading , mat settlements are more than a spread footing with the same average pressure transferred to the bearing soil. Therefore we have calculated the total settlement of various points of mat foundations carring differenet pressures. The obtained results are shown on below table.



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Point	Total Settlement (cm)							
	$8^m \times 8^m$		$10^m \times 10^m$		$15^m \times 15^m$		$20^m \times 20^m$	
	P=5 t/m²	P=10 t/m²	P=5 t/m²	P=10 t/m²	P=5 t/m²	P=10 t/m²	P=5 t/m²	P=10 t/m²
a	0.4cm	0.8cm	0.75cm	1.45cm	1.05cm	2.1cm	1.4cm	2.7cm
b	0.3cm	0.6cm	0.5cm	0.96cm	0.7cm	1.3cm	1.85cm	1.65cm
c	0.2cm	0.4cm	0.35cm	0.65cm	0.4cm	0.9cm	0.6cm	1.05cm

Renmark: The above estimated settlements are the total settlement and due to subsoil condition the part of settlement of any structure due to dead load will occure during the construction operation.

5.7 - Static Modulus of Subgrade Reaction

Subgrade modulus of reaction "K" for mat foundation depends mostly to the ground and concrete deformability characteristic. Mat stiffness plays also an important role on this coefficient.

Generally K is the proportioning coefficient difined by the ratio of applied pressure "P" to relevant settlement "S" of a common shallow footing.

$$K_S = \frac{P}{S}$$

In case of mat foundation S is generally too high which leads to a very small value of K if the above relationship is considered. As a matter of fact S is the settlement generated at center of raft in which pressures applied on entire surface of mat intervene, while modulus of subgrade reaction define the behaviour of soil-footing.

Interaction in a limited area surrounding the point at which K is required. So taking into account of entire surface of footing is out of engineering definition of this modulus.

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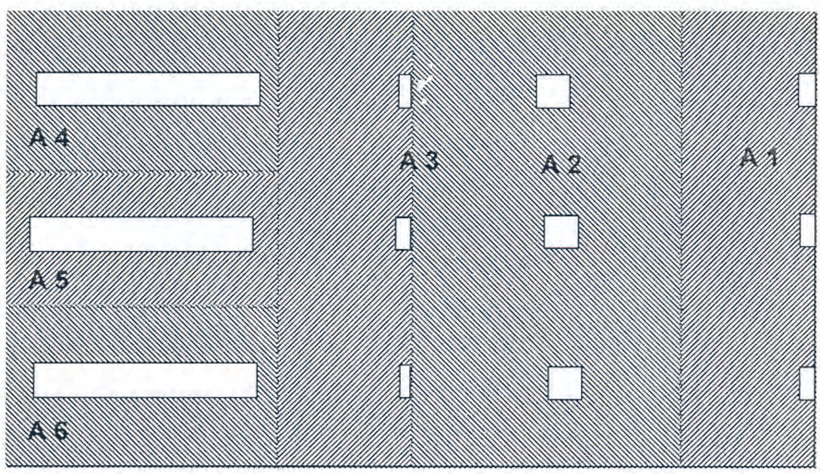
With regard to above description K should define with the following relationship.(Please see annex 3).

$$K=\frac{E}{a\sqrt{A}} \quad Kg/cm^3$$

Where A is part of mat surface bearing an obviouse column or wall of building as shown in the following figure by: A_1 , A_2 , ...A_6.



L/B	1	2	4
a	0.45	0.42	0.35

a = Shape factor, as given in the following table.

E = Compressibility modulus deductable as given in the table of mean geotechnical parameters (section 4-2-3 page 7).

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- Another procedure to face this problems is the use of following relationship which recommended by us:

$$K_S = \frac{E}{aLn\sqrt{10A}}$$

K_S = Subgrade reaction T/m^3
A = Footing Area (m^2)

As example for square mat foundation with 10×10^m in dimension that placed at 3^m below existing ground level subgrade reaction is given below .

$$A=10\times10=100^m \longrightarrow k_s=\frac{8210}{0.45\ln\sqrt{1000}}=5282t/m^2=5.282kg/cm^3$$

And finally for isolated footing K_s should be defined by using the following formula:

$$K_s=12.9\left(\frac{B+0.3}{2B}\right)^2\left(1+\frac{0.5B}{L}\right)\ \text{Kg/cm}^3$$

In above relationship L,B are length and breath of footing in meter.

For example modulus subgrade reaction for a square footing $B=2^m$ is equal to 6.4 kg/cm^3 .

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6-EARTH PRESSURE

6-1-Static Condition

Distribution of lateral pressure between a soil mass and an adjoining retaining structure depends on direction of the wall movement, away or toward the soil mass. These conditions are designated by active and passive made of yielding from which coefficient of lateral pressure would be determined as follows:

$$K_a = tg^2\,(\pi/4-\Phi/2)= 0.26$$

$$K_p = tg^2\,(\pi/4+\Phi/2)=3.85$$

$$K_o = 1-\sin\Phi=0.412$$

In above relationship K_a and K_p and K_0 are respectively the earth pressure coefficient in case of active , passive and at rest and therefore specific lateral pressure would be determined from following relationships.

$$P_a = K_a\,P_{V}+ P_W- 2C\sqrt{K_a}$$

$$P_p = K_p\,P_{V}+ P_W+ 2C\sqrt{Kp}$$

In above relationships P_a and P_p are the earth pressures in case of active and passive and P_V is effective vertical pressure generated by overburden pressure and surface load and P_W is the water pressure.

Vertical stress "P_V" is directly related to the depth "Z" and equal to :

$$Pv=\gamma Z+P_o$$

Where γ is density and P_o is ground surcharge.

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6-2- Dynamic Condition (Earthquake)

The earth pressure in case of active and passive during the earthquake shaking can be evaluated by the following relationships.

$$\text{Active pressure} = P_{ae} = \tfrac{1}{2}\ \gamma H^2 (1-K_V)\, K_{ae}$$

$$K_{ae} = \frac{\sin^2(\phi+\beta-\theta')}{\cos\theta' \sin^2\beta \sin(\beta-\theta'-\delta)\left[1+\sqrt{\dfrac{\sin(\phi+\delta)\sin(\phi-\theta'-\alpha)}{\sin(\beta-\delta-\theta')\sin(\alpha+\beta)}}\right]^2}$$

$$\theta' = \tan^{-1}\left[\frac{K_h}{1-K_v}\right]$$

$$\text{Passive pressure} = P_p = \tfrac{1}{2}\ \gamma H^2 (1-K_V)\, K_{pe}$$

$$K_{pe} = \frac{\sin^2(\beta+\theta'-\phi)}{\cos\theta' \sin^2\beta \sin(\delta+\beta+\theta'-90)\times\left[1-\sqrt{\dfrac{\sin(\phi+\delta)\sin(\phi-\alpha-\theta')}{\sin(\beta+\delta+\theta')\sin(\alpha+\beta)}}\right]^2}$$

The meaning of the symbols in above relationships are as below:

H = height of wall
γ = soil density
Φ = angle of internal friction
α, β= have shown in below diagram
K_v and K_h are component of earthquake in vertical and Horrizontal

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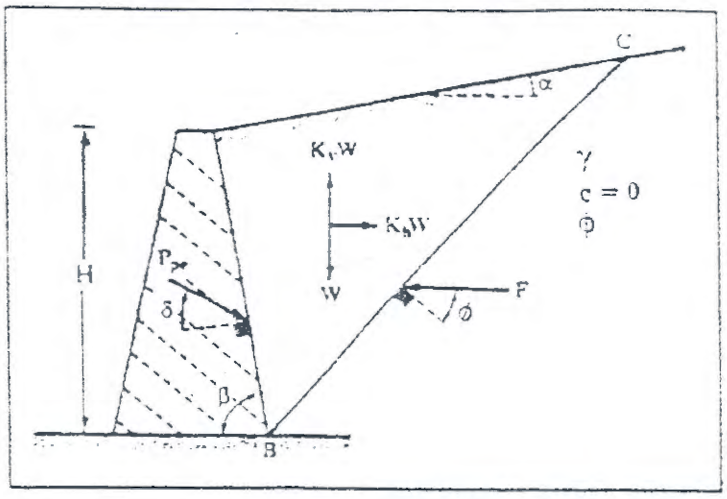
$$\delta = 0.67\Phi = 24.1°$$



Remark:
Seed and Whitman proposed a procedure to determine the location of the line of action of resultant P_{ae} as below:

$$h_{ae} = \frac{(0.6H)(\Delta P_{ae}) + H/3(P_a)}{P_{ae}}$$

$$P_{ae} = P_a + \Delta P_{ae}$$

Generally P_a will act at H/3 and ΔP_{ae} will act at 0.6H from the base of wall.

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7 - CEMENT FOR FOUNDATION CONCRETE

Based on chemical tests performed on selected samples, due to sulphate content, (see table 1), we recommend Portland cement type II for making concrete.

Fore safe guard of concrete from sulphate attack we recommend a low permeable concrete be considered by taking a suitable mix design, moreover by using microcylicate with superplasticizer can reduce water-cement ratio, permeability and increased workability, strength and durability of concrete.

8 - SEISMICITY

Based on Iranian code No.2800 for seismic resistant design of building and with regards to the soils type encountered and shear wave velocity measured on this site earthquake response spectra of building (B coefficiet) could be classified as type II: Iranian code and S_C UBC 97.

According to arranged area map against damage of earthquake in Iran documented in above building code the site is located in moderate damaged zone, Therefore the acceleration is equal to 0.25 g.

9 - Liquefation

Due to soil type and high stiffness of layers there is no liquefaction hazard in this site.

10 – EXCAVATION and site Preparation

In case that deep excavation is requiring for foundation construction, the behaviour of the foundation depends highly on the method of excavation. Indeed due to low ground water level . The change of effective stresses wouldn't be significant during the excavation. The most important factor is the degree to which the ground is disturbed during the excavation process.

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excavation. The most important factor is the degree to which the ground is disturbed during the excavation process.

If the ground surface next to the excavation area is not overloaded, unsupported vertical cut sandy gravel formation with maximum 4^m with would be stable for temporary purposes such as construction works . In addition to that the penetration of water into soil must be prevented.

Initial surface preparation will consist of stripping about 30 centimeters of top soil , and other undesirable material. Therefore these materials should be removed from the site and then surface soils scarified and compacted to 95% of maximum dry density according to ASTM-D1557.
Existing superficial layers consist of sand and gravel mixed with some clayey silt. According to AASHTO soil classification this formation designated by A1 to A3 which classified as suitable for filling and subgrade layers in condition to be compacted to 95% of maximum dry density based on ASTM D1557 and thickness of layers not exceed than 20^{cm}.

The following table shows the grading requirements for base and subbase as given by AASHTO specification.

Percent by Weight Passing Square Mesh Sieves

Sieve Dasiqnation	Gradung A	Gradung B	Gradung C	Gradung D	Gradung E	Gradung F
2 in.	100	100				
1 in.	---	75-95	100	100	100	100
3/8 in.	30-65	40-75	50-85	60-100		
No.4	25-55	30-60	35-65	50-85	55-100	70-100
No.10	15-40	20-45	25-50	40-70	40-100	55-100

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Other specification of base and subbase should be as below:

Layer Type	Liquid Limit %	Plasticity Index %	Sand equivalent %	Loss Angeles %	Soundness % By Na_2So4	CBR %	Crushed Material %
Base	Max.25	Max=6	≥35	≤45	<12	>80	>50
Subbase	Max. 25	Max.=6	≥25	≤50	---	>20	---

Remark: Because of disturbance condition of soil beneath the foundation due to excavation it should be compacted to minimum its natural density.

11 – SOIL RESISTIVITY

Soil resistivity measurements performed over the site in 11 points that shown on fig 1. The obtained results are given in tables No. 2 .

Wenner procedure has been adopted for this investigation.

The below table shows the average value of soil resistivity in function of depth.

Depth (m)	P (ohm-m)	Corrosivity potential
0-5	186.7	Very low
5-10	62.3	Low

Generally soil corrosivity classified as below:

$0 < \rho < 10$	ohm.m.	Very high
$10 < \rho < 20$	ohm.m.	high
$20 < \rho < 50$	ohm.m.	Moderate
$50 < \rho < 100$	ohm.m.	Low
$\rho > 100$	ohm.m.	Very Low

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E-mail : Peykav_Co@Yahoo.Com

12 – Soil Permeability

Subsoil permeability was measured by lefrance meathod in BH6 The obtained results is given below .

$$K=2.6\times10^{-3}\ \text{cm/sec}$$

Sincerely yours.
Pey-Kav Consulting Engineers

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CHEMICAL TEST RESULTS

Table No. 1

BH No.	Depth m.	So_4^{--} %	CL^- %	pH
1	3	0.3	0.04	7.3
2	1.5	0.32	0.3	6.9
3	3	0.04	0.01	7.2
4	1.5	0.28	0.16	7.2
5	1.5	0.31	0.26	6.7
6	1.5	0.02	0.01	6.9
7	1.5	0.19	0.06	7.1
8	3	0.16	0.03	7.2
9	1.5	0.02	0.02	7.2
10	1.5	0.18	0.22	7.1
11	3	0.02	0.01	7.4

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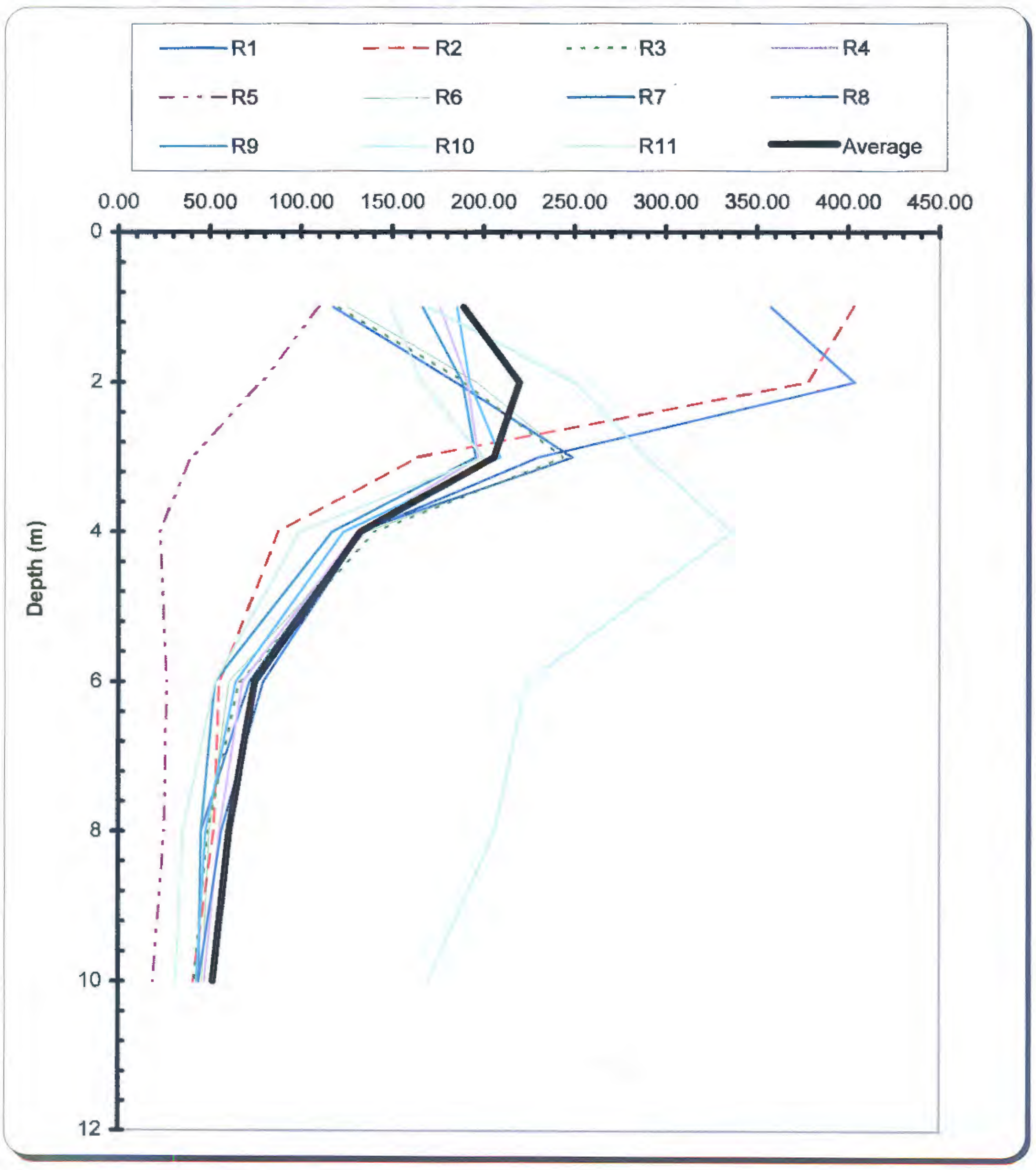
(Yazd)

Table No.2

a (m)	Resistivity(Ohm-m)											
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	Average
1	117.44	403.18	120.58	175.84	109.71	125.29	166.42	357.332	185.26	169.56	148.84	189.04
2	184.63	376.80	189.66	190.91	77.87	195.94	188.15	403.176	192.17	249.94	165.79	219.55
3	248.69	163.53	243.04	196.88	39.56	246.8	195.56	229.848	209.12	289.57	199.7	205.66
4	130.62	87.67	140.67	130.62	22.61	135.65	116.81	133.136	123.09	336.11	99.224	132.38
6	71.59	55.01	65.94	67.82	26.38	60.288	52.752	79.128	64.056	223.44	52.752	74.47
8	45.22	52.25	48.73	55.26	25.12	49.738	45.216	56.2688	47.728	205.98	35.168	60.61
10	43.96	40.82	41.45	47.10	18.84	45.844	43.96	43.96	42.704	169.56	31.4	51.78



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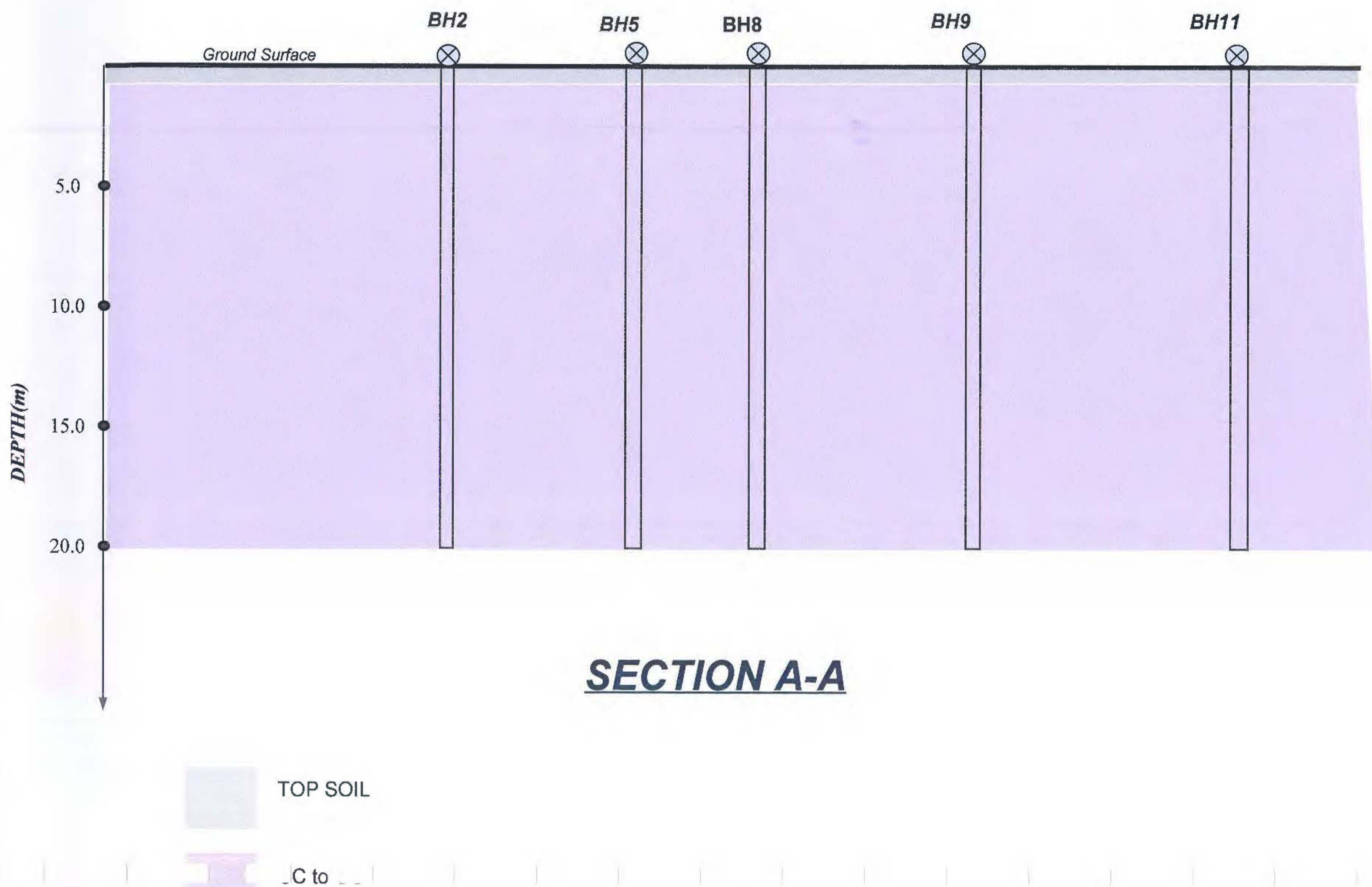
Yazd

2D Sections

Fig No. : 2



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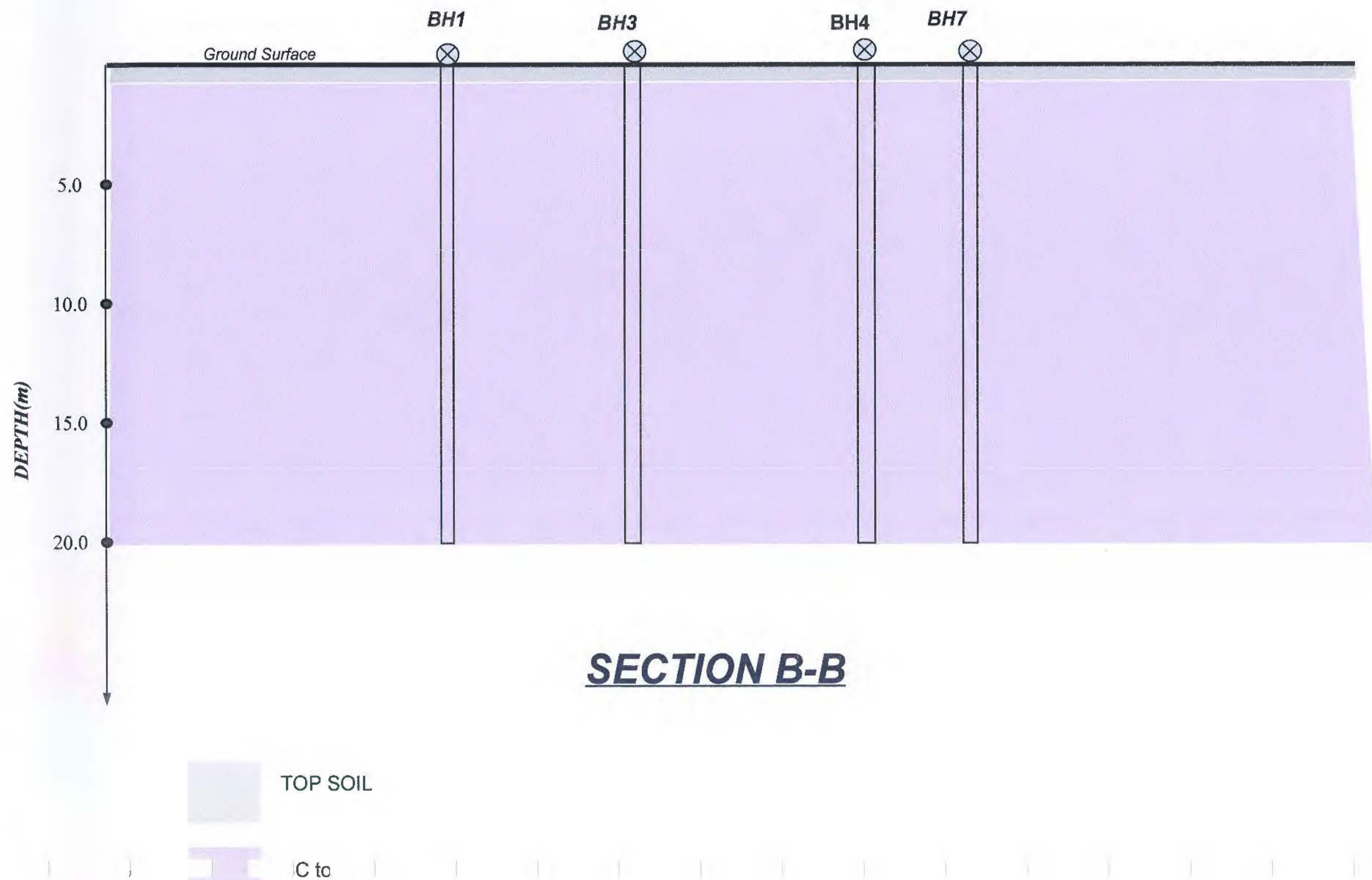
Yazd

2D Sections

Fig No. : 3



SECTION B-B

LOG OF BORING

Project No. : 1099
Project : Foolad e Aliagie Yazd
Client :
Location :
Borehole No. : 1
Co-ordinates :
Elevation : -
Fig No. : 4

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Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γd (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0 25 50 75 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0	Top soil.															
1.5	Light Brown, very dense gravel and sand + some Clayey silt + Cobbles.		SM/GM	1			none	none	none	3.1	1.9	d=38	d=0		67/3	>100
3.0	Light Brown, very dense sandy gravel + some Clayey Silt + Cobbles.		GC	2			32	19	13						67/7	>100
4.5				3											67/5	>100
6.0	Light Brown, very dense Sandy gravel + some Clayey Silt + Cobbles.		GC	4			32.9	20	12.9						67/4	>100
7.5	Light Brown, very dense sandy Gravel + some Clayey Silt + Cobbles.						31.7	19.6	12.1							
9.0				5											67/3	>100
12.0	Light Brown, very dense sandy gravel + some Silt and trace of Clay + Cobbles.		GC	6			35	21	14						67/3	>100
15.0	Light Brown, very dense sandy Gravel with some Silt and trace of Clay + Cobbles.		GC	7			33	19.7	13.3						67/5	>100
18.0				8											67/3	>100
19.5				9											67/4	>100
20.0																

Clay
Sand
Silt
Gravel
Organic
Ground Water Table (G.W.T)

Disturbed Sample
Undisturbed Sample

General Abbreviations

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Triaxial Abbreviations

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LOG OF BORING

Project No. : 1099
Project : Foolad e Aliagie Yazd
Client :
Location :

Borehole No. : 2
Co-ordinates :
Elevation : -
Fig No. : 5

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Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0 25 50 75 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0	Top soil.															
1.5	Light Brown, very dense gravely Sand + some Clayey Silt + Cobbles.		SM-SC	1			24	17.1	6.9		1.84	d=36	d=0		67/12	>100
3.0				2											67/8	>100
4.5	Light Brown, very dense Sand and Gravel + some Silt and trace of Clay + Cobbles.		Sc/GC	3			33	20	13						67/5	>100
6.0				4											67/4	>100
9.0				5											67/5	>100
10.5	Light Brown, very dense silty gravely Sand + trace of Clay.		SC				36.3	21.2	15.1							
12.0				6											67/4	>100
15.0	Light Brown, very dense sandy Gravel + some Clayey Silt + Cobbles.		GC	7			29	19	10						67/3	>100
19.0	Light Brown, very dense silty sandy Gravel + trace of Clay.		GC	8			27	18	9						67/4	>100

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LOG OF BORING

Project No. : 1099
Project : Foolad e Aliagie Yazd
Client :
Location :

Borehole No. : 3
Co-ordinates :
Elevation : -
Fig No. : 6

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Pey Kav

Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0 25 50 75 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0–0.5	Top soil.															
0.5–3.0	Light Brown, very dense sandy Gravel + some Clayey Silt + Cobbles.															
1.5			GC	1			38	22	16	3.5	1.88	d=36.5	d=0.1		67/11	>100
3.0–6.0	Light Brown, very dense gravely Sand + some Clayey Silt + Cobbles.															
3.0			SC	2			37.1	22	15.1						67/6	>100
4.5				3											67/3	>100
6.0–15.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.															
6.0			GC	4			36.5	21.8	14.7						67/3	>100
9.0				5											67/3	>100
12.0				6											67/5	>100
15.0–20.0	Light Brown, very dense Sand and Gravel + some Silt and trace of Clay + Cobbles															
15.0			SC/GC	7			37.5	21.4	16.1						67/3	>100
19.5				8											67/3	>100

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LOG OF BORING

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Project No.	: 1099	***Borehole No.***	: 4
Project	: Foolad e Aliagie Yazd	***Co-ordinates***	:
Client	:	***Elevation***	: -
Location	:	***Fig No.***	:

Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0, 25, 50, 75, 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
0.0	Ground Surface															
0.0–0.5	Top soil.															
0.5–3.0	Light Brown, very dense Sandy gravel + some Clayey Silt + Cobbles	Gravel														
1.5			GC	1	Disturbed		28.2	18.1	10.1	2.9	1.85	d=36	d=0.1		67/9	>100
3.0–9.0	Light Brown, very dense sandy Gravel + some Clayey Silt + Cobbles	Gravel														
3.0			GC	2	Disturbed		29	18.6	10.4						67/3	>100
4.5				3	Disturbed										67/6	>100
6.0				4	Disturbed										67/4	>100
9.0–15.0	Light Brown, very dense Sandy Gravel + some Clayey Silt + Cobbles.	Gravel														
9.0			GC	5	Disturbed		34	21	13						67/4	>100
12.0				6	Disturbed										67/3	>100
15.0–20.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay + Cobbles.	Gravel														
15.0			GC	7	Disturbed		35.5	21.1	14.4						67/3	>100
18.0				8	Disturbed										67/3	>100
19.5				9	Disturbed										67/3	>100

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LOG OF BORING

PEYKAV
Geotechnical Consulting Engineers

Project No.	: 1099	**Borehole No.**	: 5
Project	: Foolad e Aliagie Yazd	**Co-ordinates**	:
Client	:	**Elevation**	: -
Location	:	**Fig No.**	: 8

Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0 25 50 75 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0	Top soil + Roots															
0.5–4.5	Light Brown, very dense sandy Gravel + some Claye Silt + Cobbles		GC	1	Disturbed		34.2	20.8	13.4						67/11	>100
				2	Disturbed					3.5	1.87	d=37	d=0.05		67/10	>100
4.5–9.0	Light Brown, very dense silty Gravely Sand + trace of Clay.		Sc	3	Disturbed		36.5	21	15.5						67/8	>100
				4	Disturbed										67/5	>100
				5	Disturbed										67/6	>100
9.0–15.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.		GC	6	Disturbed		38.5	22	16.5						67/4	>100
				7	Disturbed										67/4	>100
15.0–20.0	Light Brown, very dense sandy Gravel + some clayey Silt.		GC	8	Disturbed		34.7	21	13.7						67/3	>100
				9	Disturbed										67/3	>100

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LOG OF BORING

Project No. : 1099
Project : Foolad e Aliagie Yazd
Client :
Location :

Borehole No. : 6
Co-ordinates :
Elevation : -
Fig No. : 9

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Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0 25 50 75 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0	Top soil															
1.5	Light Brown, very dense sandy Gravel + some clayey Silt + Cobbles.		GC	1	Disturbed		27	18	9	2.8	1.89	d=37	d=0		67/11	>100
3.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay + Cobbles		GC	2	Disturbed		30.8	19	11.8						67/6	>100
4.5				3	Disturbed										67/4	>100
6.0	Light Brown, very dense sandy gravel + some clayey Silt.		GP-GC	4	Disturbed		36	22	14						67/3	>100
7.5	Light Brown, very dense gravely sand + some Silt and trace of Clay.		SC	5	Disturbed		35	21.1	13.9						67/3	>100
9.0				6	Disturbed										67/5	>100
12.0	Light Brown, very dense sandy gravel + some Silt and trace of Clay.		GC	7	Disturbed		38	22.2	15.8						67/5	>100
15.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.		GC	8	Disturbed		37.4	22	15.4						67/3	>100
19.0	Light Brown, very dense sandy Gravel + some Clayey Silt.		GC	9	Disturbed		34	20.9	13.1						67/3	>100

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LOG OF BORING

PEYKAV
Geotechnical Consulting Engineers

Project No.	: 1099	**Borehole No.**	: 7
Project	: Foolad e Aliagie Yazd	**Co-ordinates**	:
Client	:	**Elevation**	: -
Location	:	**Fig No.**	: 10

Depth (m)	Soil Description	Symbols	USCS	Sample No.	Sample Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth (blows/ft)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0	Top soil															
0.5–4.5	Light Brown, very dense sandy Gravel + some Silt and trace of Clay + Cobbles															
1.5			GC	1	Disturbed		39.6	22	17.6						67/7	>100
3.0				2	Disturbed										67/4	>100
4.5–9.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay + Cobbles.		GC	3	Disturbed		38.7	22.2	16.5						67/2	>100
6.0				4	Disturbed										67/3	>100
9.0–15.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.		GC	5	Disturbed		39	21.4	17.6						67/5	>100
12.0				6	Disturbed										67/5	>100
15.0–19.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.		GC	7	Disturbed		38.3	21.5	6.8						67/3	>100
19.0–20.0	Light Brown, very dense Sand and Gravel + some Silt and trace of Clay.		GC	8	Disturbed		26.7	18	8.7						67/3	>100

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LOG OF BORING

Project No.	: 1099	**Borehole No.**	: 8
Project	: Folade Aliagei Yaze	**Co-ordinates**	:
Client	: .	**Elevation**	: -
Location	:	**Fig No.**	: 11

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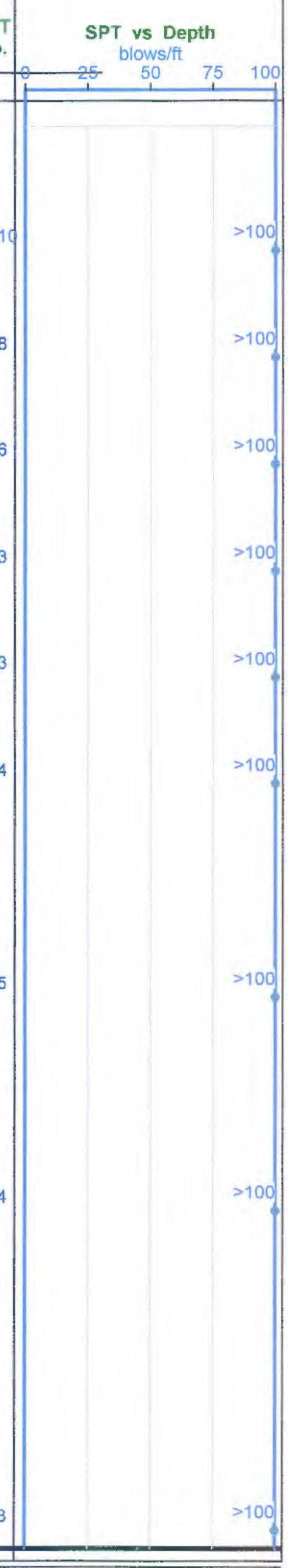
Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Ground Surface														
0.0	Top soil														
1.5	Light Brown, very dense sandy Gravel + some Clayey Silt + Cobbles		GC	1	Disturbed		32	20	12		1.89	d=35.5	d=0.1		67/10
3.0				2	Disturbed										67/8
4.5				3	Disturbed										67/6
6.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.		GC	4	Disturbed		31.7	20	11.7						67/3
7.5				5	Disturbed										67/3
9.0	Light Brown, very dense Sandy Gravel + some Silt and trace of Clay.		GC	6	Disturbed		33.9	20.3	13.6						67/4
12.0				7	Disturbed										67/5
15.0	Light Brown, very dense sandy Gravel + some Silt and trace of Clay.		GC	8	Disturbed		32	19.7	12.3						67/4
19.5				9	Disturbed										67/3
20.0															



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LOG OF BORING

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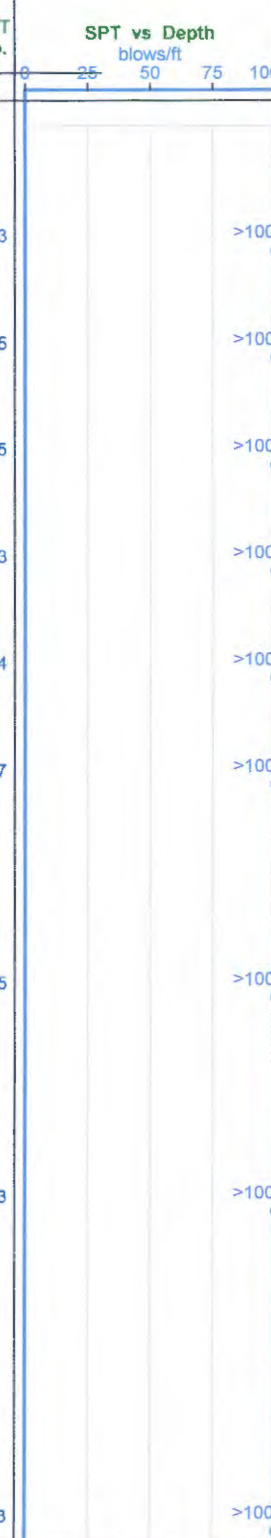
Project No.	: 1099	**Borehole No.**	: 9
Project	: Foolad e Aliagie Yazd	**Co-ordinates**	:
Client	:	**Elevation**	: 0
Location	: Yazd	**Fig No.**	: 12

Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0.0	Ground Surface														
0.0–0.5	Top Soil														
0.5–3.0	Light Brown,Very Dense,Sandy Gravel+Trace Of Clayey Sil+Cobbles		GW-GM	1	Disturbed		none	none	none						67/3
3.0–4.5	Light Brown,Very Dense,Sandy Gravel +Some Silt & Trace Of Clay +Cobbles		GM-GC	2	Disturbed		23.5	16.8	6.7						67/5
4.5–6.0	Light Brown,Very Dense,Silty Sandy Gravel+Trace Of Clay +Cobbles		GC	3	Disturbed		27.1	17.3	9.8						67/5
6.0–7.5	Light Brown,Very Dense Sandy Silt With Some Gravel +Some Clay		SC	4	Disturbed		40	22	18						67/3
7.5–12.0	Light Brown,Very Dense,Sandy Gravel +Some Clayey Silt		GC	5	Disturbed		36	21.5	14.5						67/4
9.0				6	Disturbed										67/7
12.0–19.0	Light Brown,Very Dense,Sandy Gravel+Some Silt &Trace Of Clay		GC	7	Disturbed		36.5	21.7	14.8						67/5
15.0				8	Disturbed										67/3
19.0–20.0	light Brown,Very Dense,Sandy Gravel+Some Silt & Trace Of Clay		GC	9	Disturbed		34	20	14						67/3



Clay	Disturbed Sample
Sand	Undisturbed Sample
Silt	
Gravel	
Organic	
▼ Ground Water Table (G.W.T)	

General Abbreviations

d = Direct Shear
u = Unconfined
p = Compressive Strength
t = Triaxial

Triaxial Abbreviations

CD = Consolidated - Drained
CU = Consolidated - Undrained
UU = Unconsolidated - Undrained

LOG OF BORING

Project No. : 1099
Project : Foolad e Aliagie Yazd
Client :
Location : Yazd

Borehole No. : 10
Co-ordinates :
Elevation : 0
Fig No. : 13

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Geotechnical Consulting Engineers

Depth (m)	Soil Description	USCS	Sample No.	Sample Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth (blows/ft)
1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	
0.0	Ground Surface														
0.0–0.5	Top Soil														
0.5–3.0	Light Brown,Very Dense,Sandy Gravel+Trace Of Clayey Silt+Cobbles	GP-GC	1	Disturbed		23.6	17	6.6		1.86	d=36.5	d=0		67/12	>100
3.0–6.0	Light Brown,Very Dense,Sandy gravel +Some Clayey Silt+Cobbles	GC	2	Disturbed		28	19	9						67/8	>100
			3	Disturbed										67/5	>100
6.0–9.0	Light Brown,Very Dense,Sandy Gravel +Some Clayey Silt+Cobbles	GC	4	Disturbed		26	17	9						67/5	>100
9.0–15.0	Light Brown,Very Dense,Silty Gravely Snd+Trace Of Clay+Cobbles	SC	5	Disturbed		28	19.4	8.6						67/3	>100
			6	Disturbed										67/3	>100
15.0–20.0	Light Brown,Very Dense,Silty Gravely Sand+Trace Of Clay	SC	7	Disturbed		27.8	18.4	9.4						67/4	>100
			8	Disturbed										67/3	>100
			9	Disturbed										67/3	>100

Clay
Sand
Silt
Gravel
Organic
Ground Water Table (G.W.T)

Disturbed Sample
Undisturbed Sample

General Abbreviations

d = Direct Shear
u = Unconfined
p = Compressive Strength
t = Triaxial

Triaxial Abbreviations

CD = Consolidated - Drained
CU = Consolidated - Undrained
UU = Unconsolidated - Undrained

LOG OF BORING

PEYKAV
Geotechnical Consulting Engineers
پیکاو
Pey Kav

Project No.	: 1099	**Borehole No.**	: 11
Project	: Foolad eAliagie Yazd	**Co-ordinates**	:
Client	:	**Elevation**	: 0
Location	: Yazd	**Fig No.**	: 14

Depth (m)	Soil Description	Symbols	USCS	Sample Data No.	Sample Data Type	G.W.T	LL (%)	LP (%)	PI (%)	W (%)	γ_d (gr/Cm³)	ϕ (degree)	C (Kg/Cm²)	C_u (Kg/Cm²)	SPT No.	SPT vs Depth blows/ft (0 25 50 75 100)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	Ground Surface															
0.0	Top Soil															
0.5	Light Brown,Very Dense,Sandy Gravel With Some Silt +Trace Of Clay															
1.5			GC	1			none	none	none	2.9	1.9	d=37	d=0.1		65/5	>100
3.0	Light Brown,Very Dense,Sandy Gravel+Trace Of Silt & Trace Of Clay		GP-GC	2			32	19	13						67/9	>100
4.0–4.5				3											67/4	>100
6.0	Light Brown,Very Dense,Sandy Gravel With Some Silt+Trace Of Clay		GC	4			32.9	20	12.9						67/5	>100
7.5	Light Brown,Gracely Sand With Some Silt+Trace Of Clay		SC				31.7	19.6	12.1							
9.0				5											67/3	>100
12.0	Light Brown,Very Dense,GravelySand With Some Silt +Trace Of Clay		SC	6			35	21	14						67/4	>100
15.0				7			33	19.7	13.3						67/3	>100
18.0	Light Brown,Gravely Sand With Some Silt +Trace Clay		SC													
19.5				8											67/3	>100
20.0																

Clay
Sand
Silt
Gravel
Organic
Ground Water Table (G.W.T)

Disturbed Sample
Undisturbed Sample

General Abbreviations

d = Direct Shear
u = Unconfined
p = Compressive Strength
t = Triaxial

Triaxial Abbreviations

CD = Consolidated - Drained
CU = Consolidated - Undrained
UU = Unconsolidated - Undrained

Plate Load Test

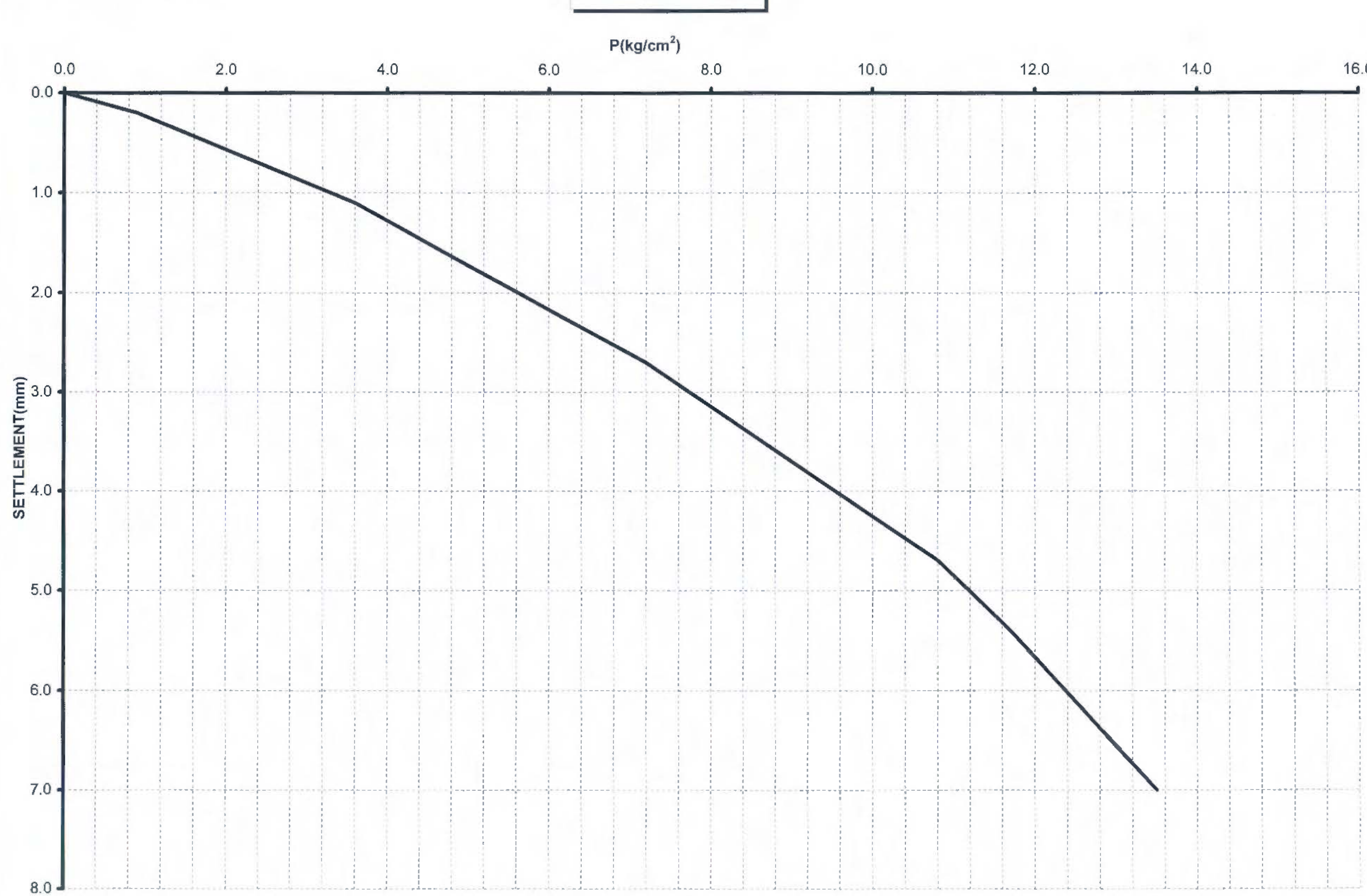

FIG: 15 PLT:1 Near BH:2 Depth:1.5m

Plate Load Test

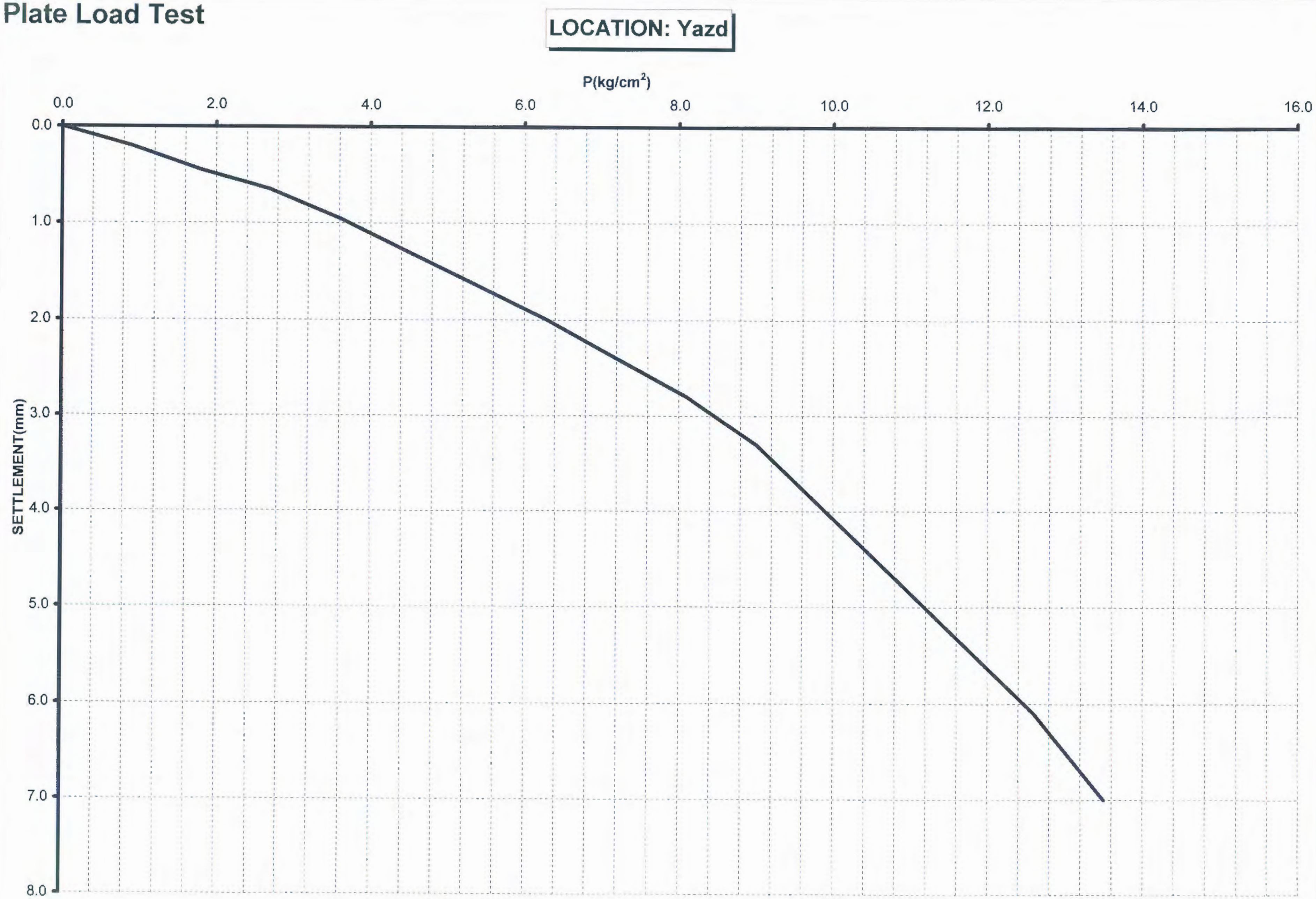

FIG: 16 PLT:2 Near BH:5

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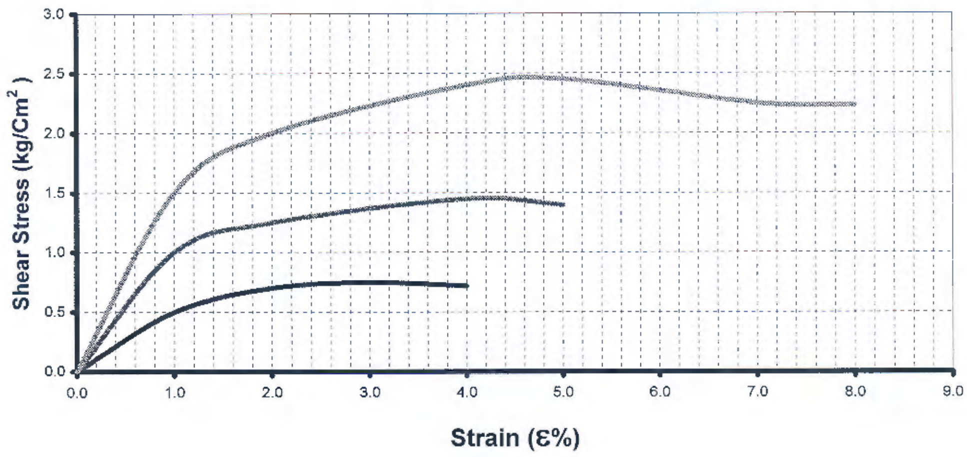
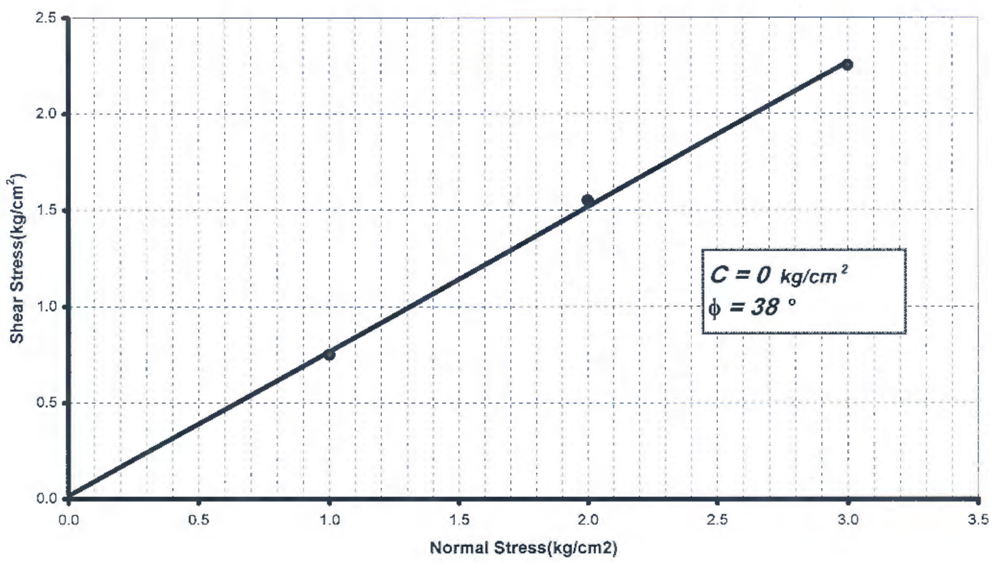
DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 1		1.5	Remolded	

Symbol	Dry Density (gr/cm^3)	Moisture Content (%)	Normal Stress (kg/cm^2)	Shear Stress (kg/cm^2)	***Remarks:***
•	1.900		1	0.75	Dimention
•	1.900		2	1.55	30*30 Cm^2
•	1.900		3	2.25	

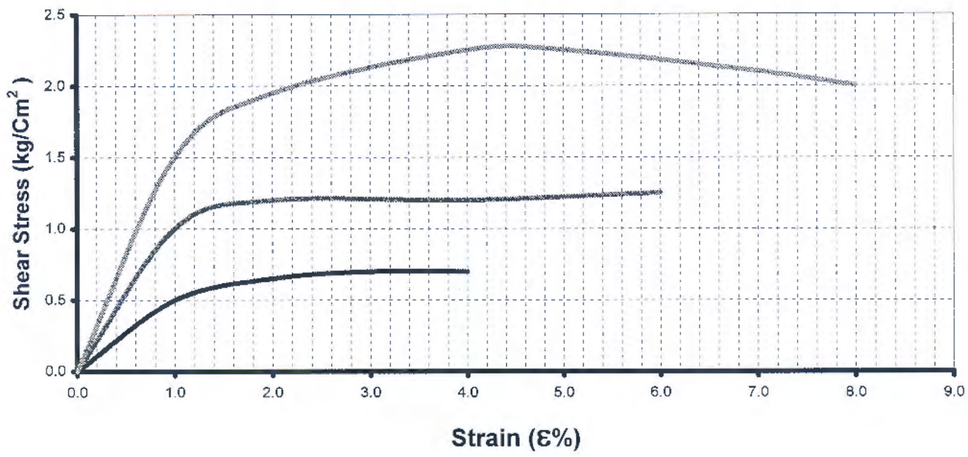
FIG:17

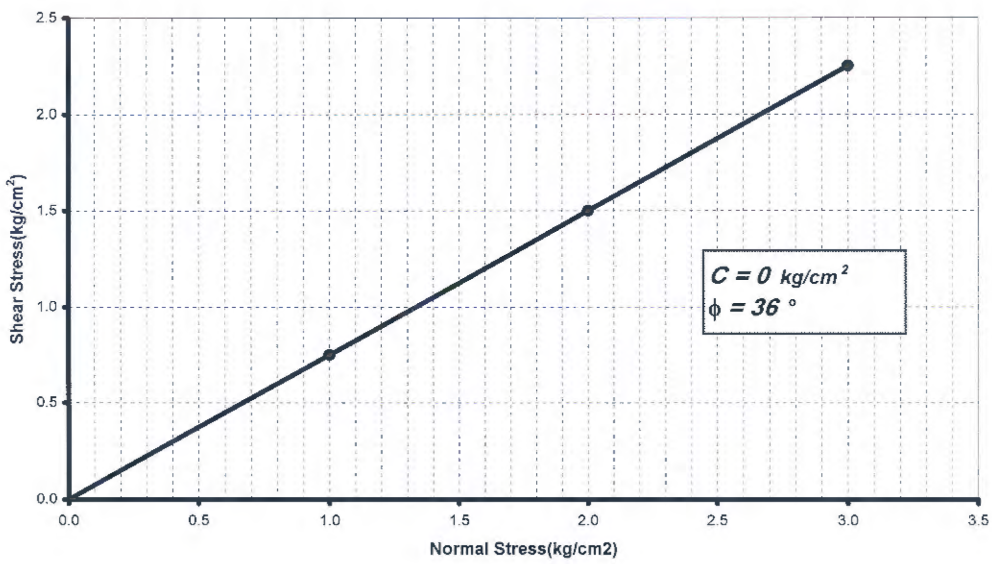
PEYKAV CONSULTING ENGINEERS

DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 2		1.5	Remolded	

Symbol	Dry Density (gr/cm^3)	Moisture Content (%)	Normal Stress (kg/cm^2)	Shear Stress (kg/cm^2)	*Remarks:*
•	1.840		1	0.75	Dimention
•	1.840		2	1.50	30*30 Cm^2
•	1.840		3	2.25	

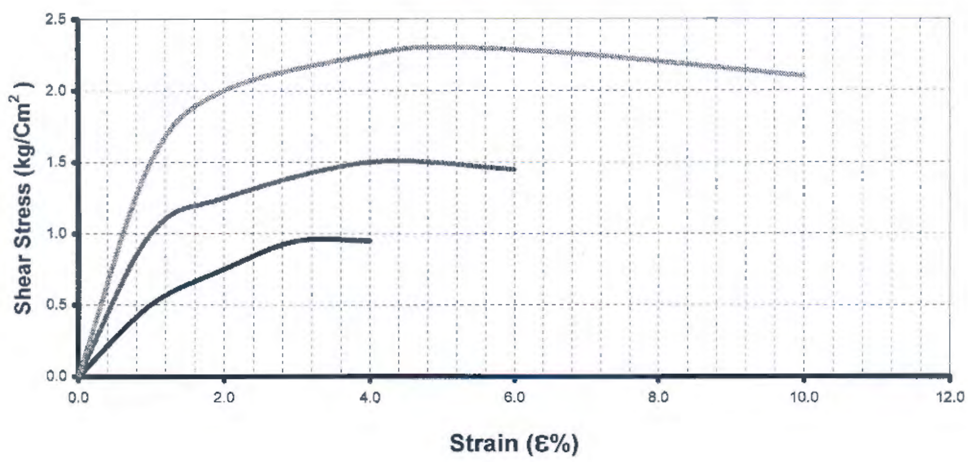
FIG:18

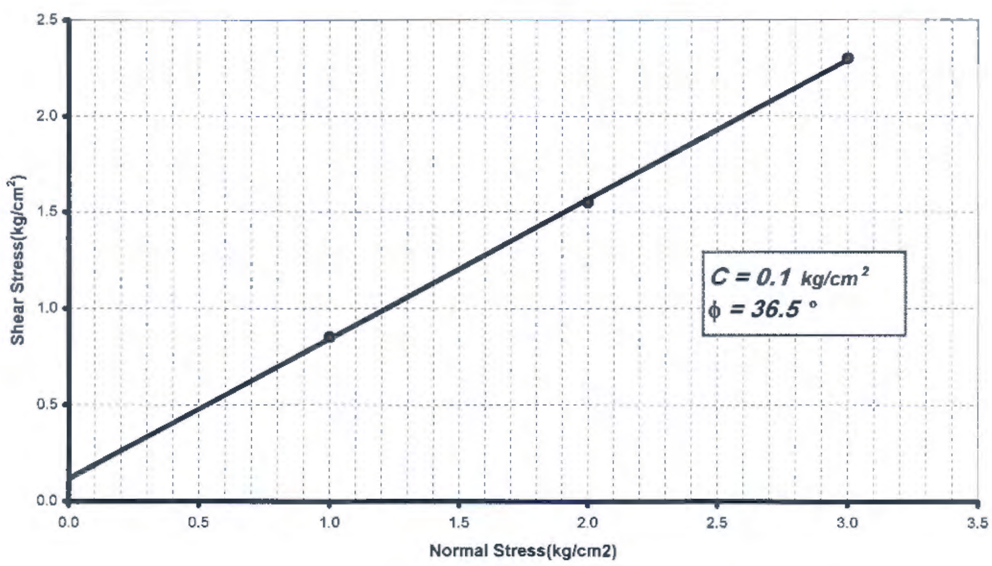
PEYKAV CONSULTING ENGINEERS

DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 3		1.5	Remolded	

Symbol	Dry Density (gr/cm³)	Moisture Content (%)	Normal Stress (kg/cm²)	Shear Stress (kg/cm²)	Remarks:
•	1.880		1	0.85	Dimention
•	1.880		2	1.55	30*30 Cm²
•	1.880		3	2.30	

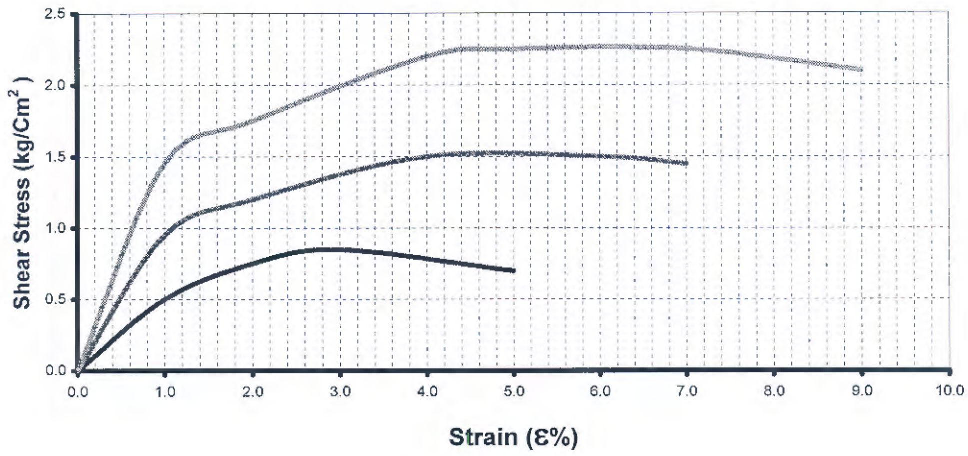
FIG:19

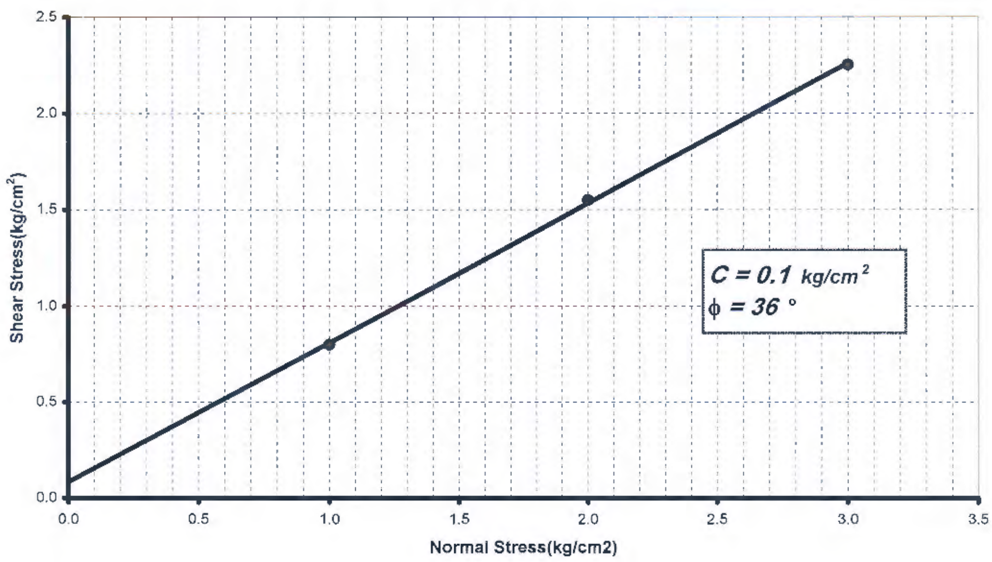
PEYKAV CONSULTING ENGINEERS

DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 4		1.5	Remolded	

Symbol	Dry Density (gr/cm^3)	Moisture Content (%)	Normal Stress (kg/cm^2)	Shear Stress (kg/cm^2)	***Remarks:***
•	1.850		1	0.80	Dimention
•	1.850		2	1.55	30*30 Cm^2
•	1.850		3	2.25	

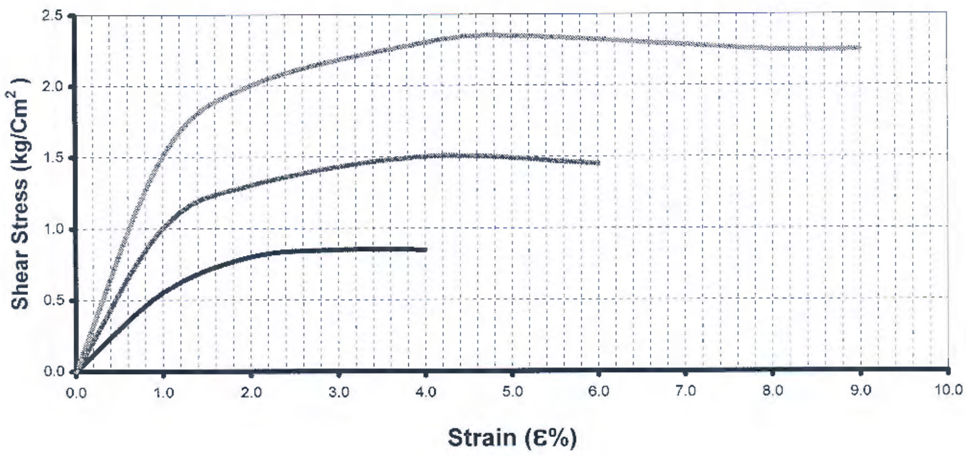
FIG:20

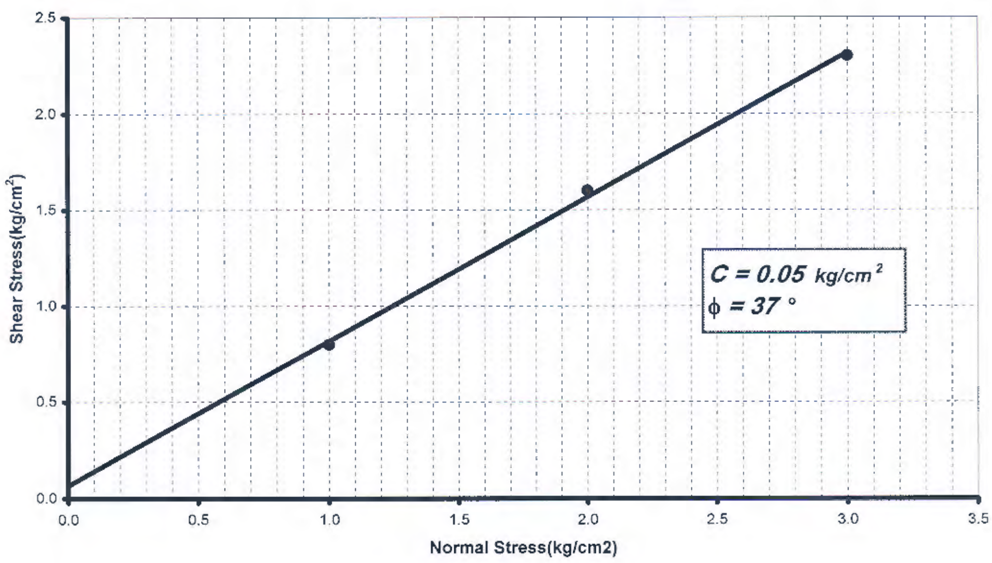
PEYKAV CONSULTING ENGINEERS

DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 5		1.5	Remolded	

Symbol	Dry Density (gr/cm^3)	Moisture Content (%)	Normal Stress (kg/cm^2)	Shear Stress (kg/cm^2)	***Remarks:***
•	1.870		1	0.80	Dimention
•	1.870		2	1.60	30*30 Cm^2
•	1.870		3	2.30	

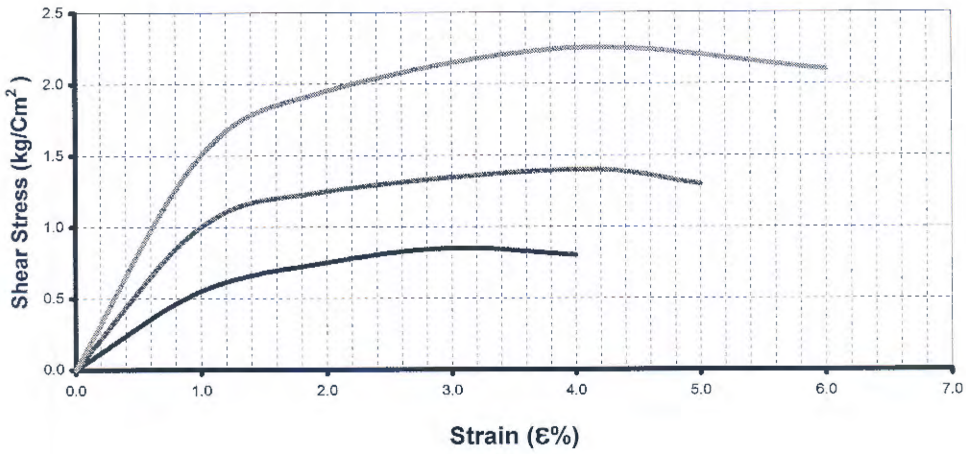
FIG:21

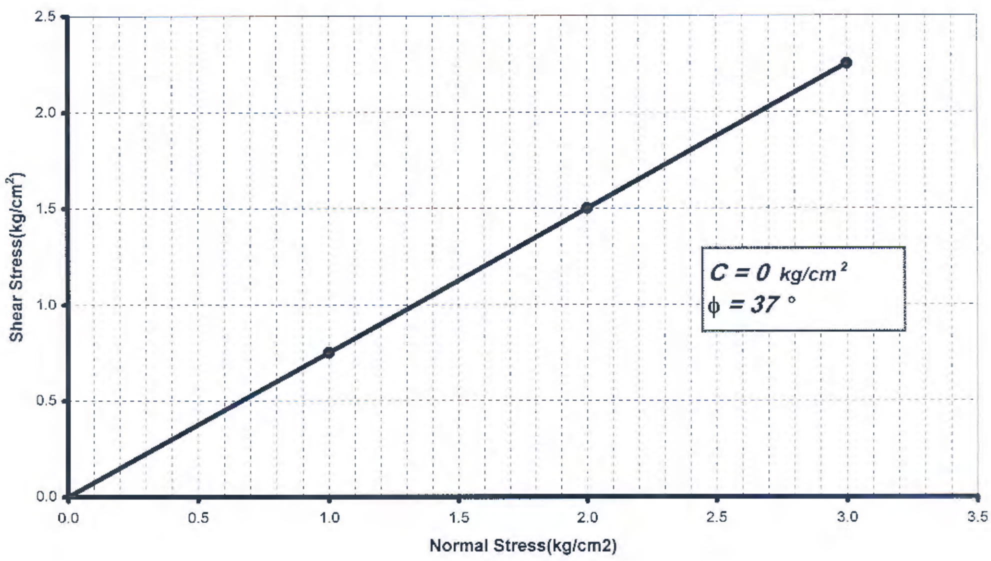
PEYKAV CONSULTING ENGINEERS

DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 6		1.5	Remolded	

Symbol	Dry Density (gr/cm^3)	Moisture Content (%)	Normal Stress (kg/cm^2)	Shear Stress (kg/cm^2)	***Remarks:***
•	1.890		1	0.75	Dimention
•	1.890		2	1.50	30*30 Cm^2
•	1.890		3	2.25	

FIG:22

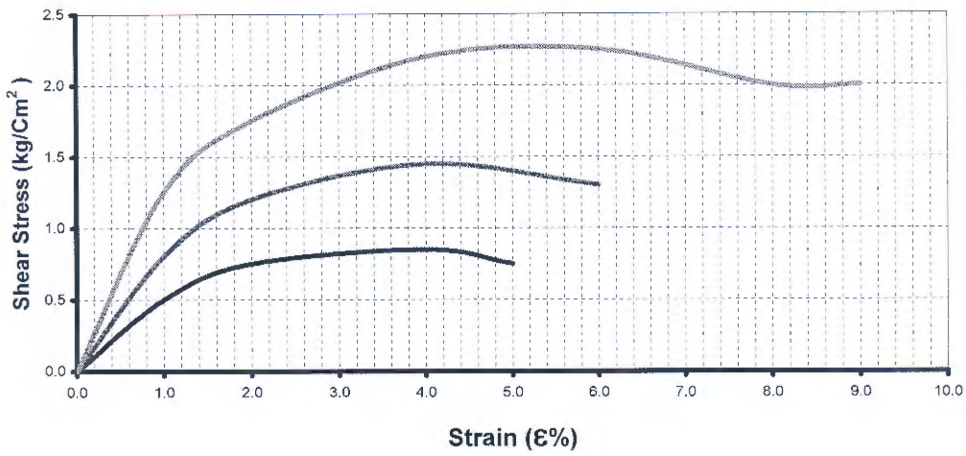
PEYKAV CONSULTING ENGINEERS

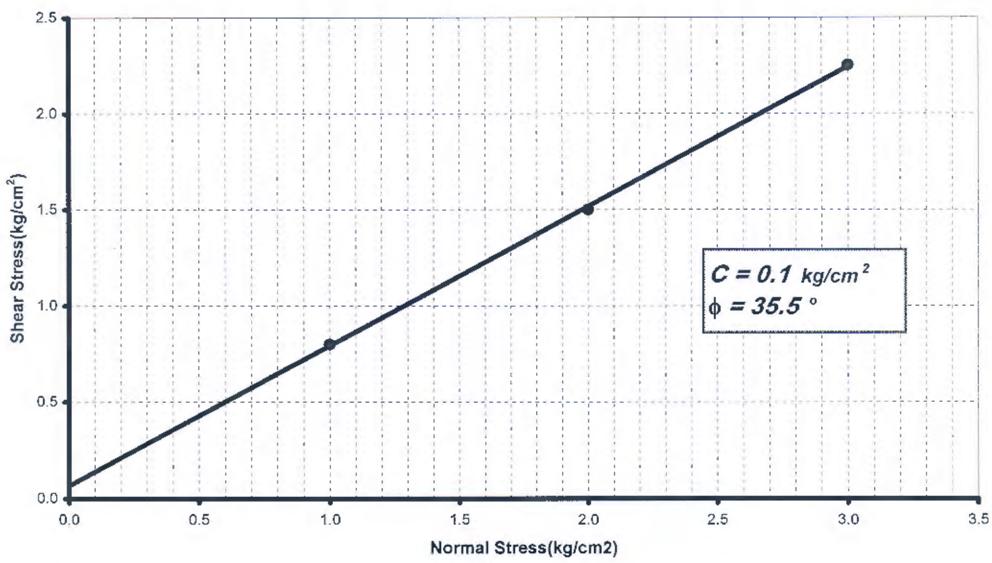
DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

Pey Kav

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 8		1.5	Remolded	

Symbol	Dry Density (gr/cm³)	Moisture Content (%)	Normal Stress (kg/cm²)	Shear Stress (kg/cm²)	Remarks:
•	1.890		1	0.80	Dimention
•	1.890		2	1.50	30*30 Cm²
•	1.890		3	2.25	

FIG:23

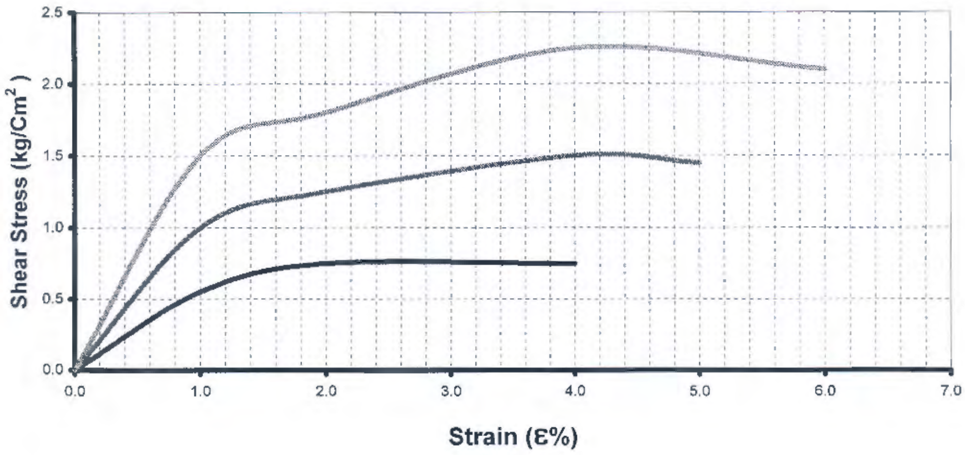
PEYKAV CONSULTING ENGINEERS

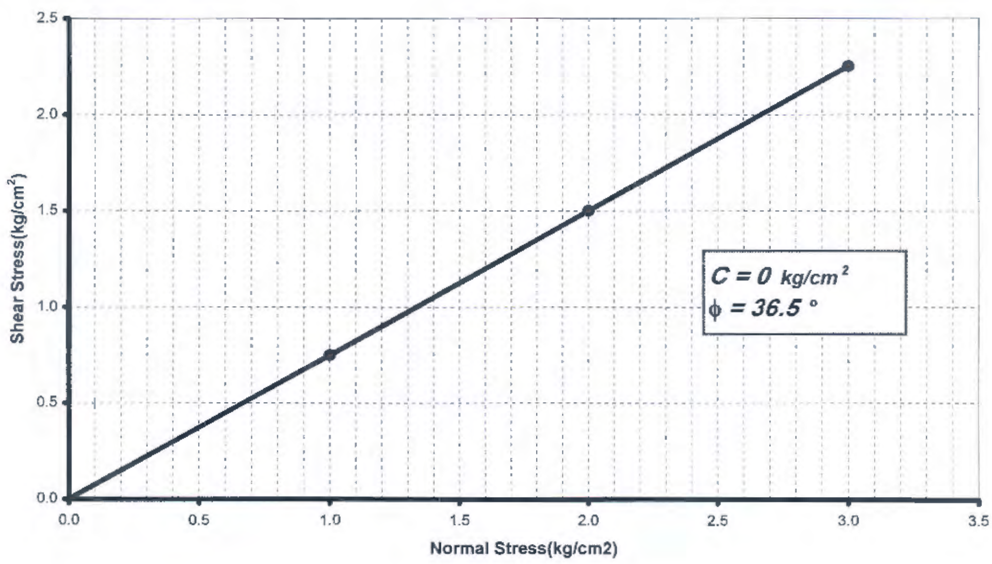
DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

Pey Kav

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 10		1.5	Remolded	

Symbol	Dry Density (gr/cm³)	Moisture Content (%)	Normal Stress (kg/cm²)	Shear Stress (kg/cm²)	Remarks:
•	1.860		1	0.75	Dimention
•	1.860		2	1.50	30*30 Cm²
•	1.860		3	2.25	

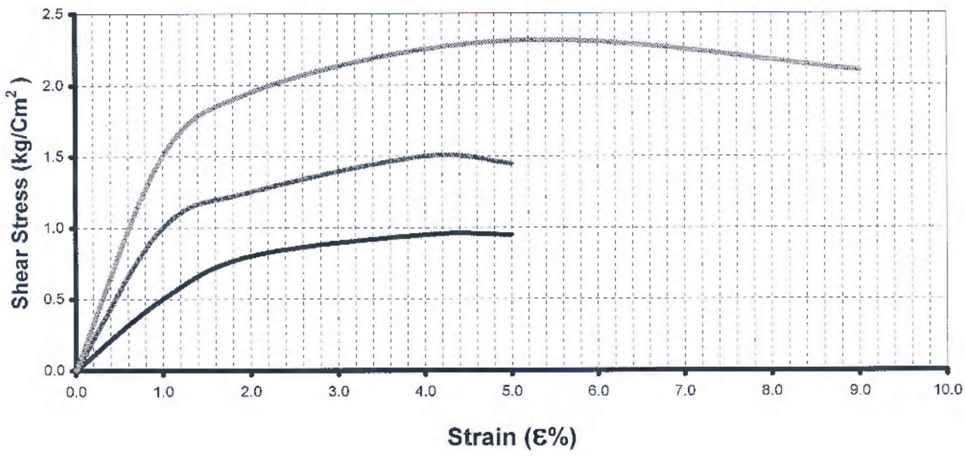
FIG:24

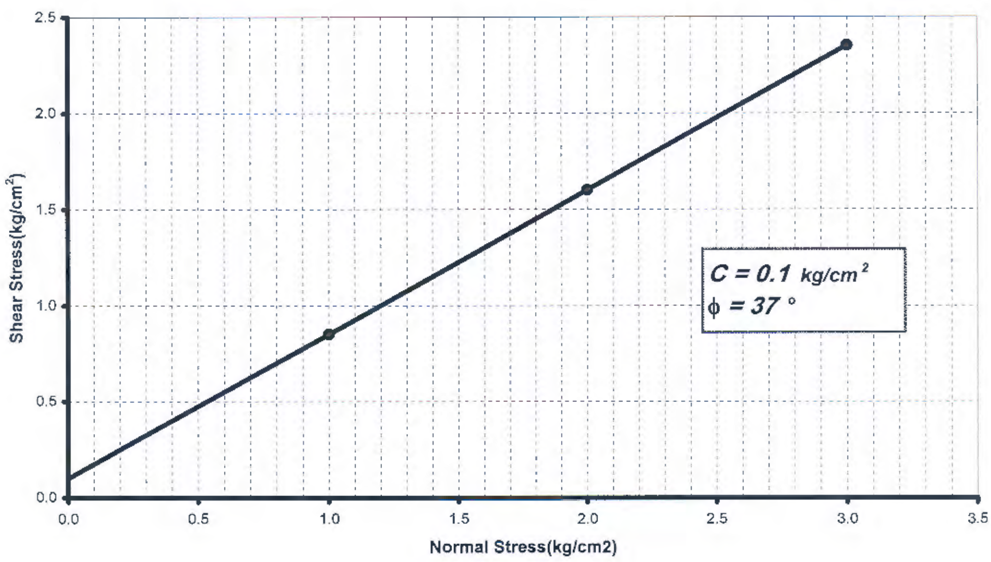
PEYKAV CONSULTING ENGINEERS

DIRECT SHEAR TEST

PROJECT : Foolad e Aliagieh Yazd

LOCATION:Yazd





Boring/Test Pit No.	Sample No	Depth(m)	Sample Type	Test Method:UU
BH - 11		1.5	Remolded	

Symbol	Dry Density (gr/cm^3)	Moisture Content (%)	Normal Stress (kg/cm^2)	Shear Stress (kg/cm^2)	Remarks:
•	1.860		1	0.85	Dimention
•	1.860		2	1.60	30*30 Cm^2
•	1.860		3	2.35	

FIG:25

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد

Borehole No. : BH - 1

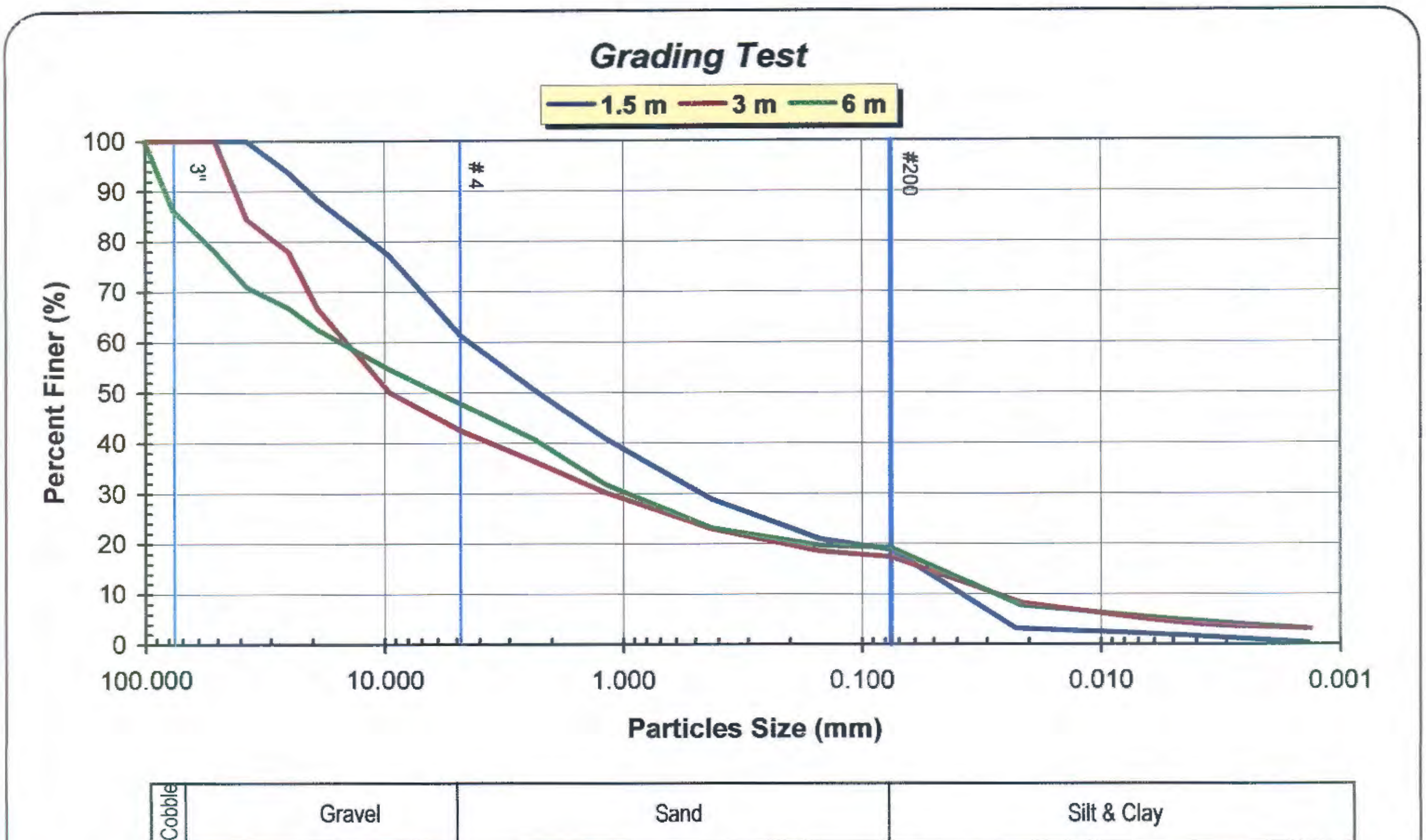


Fig. No. : 26

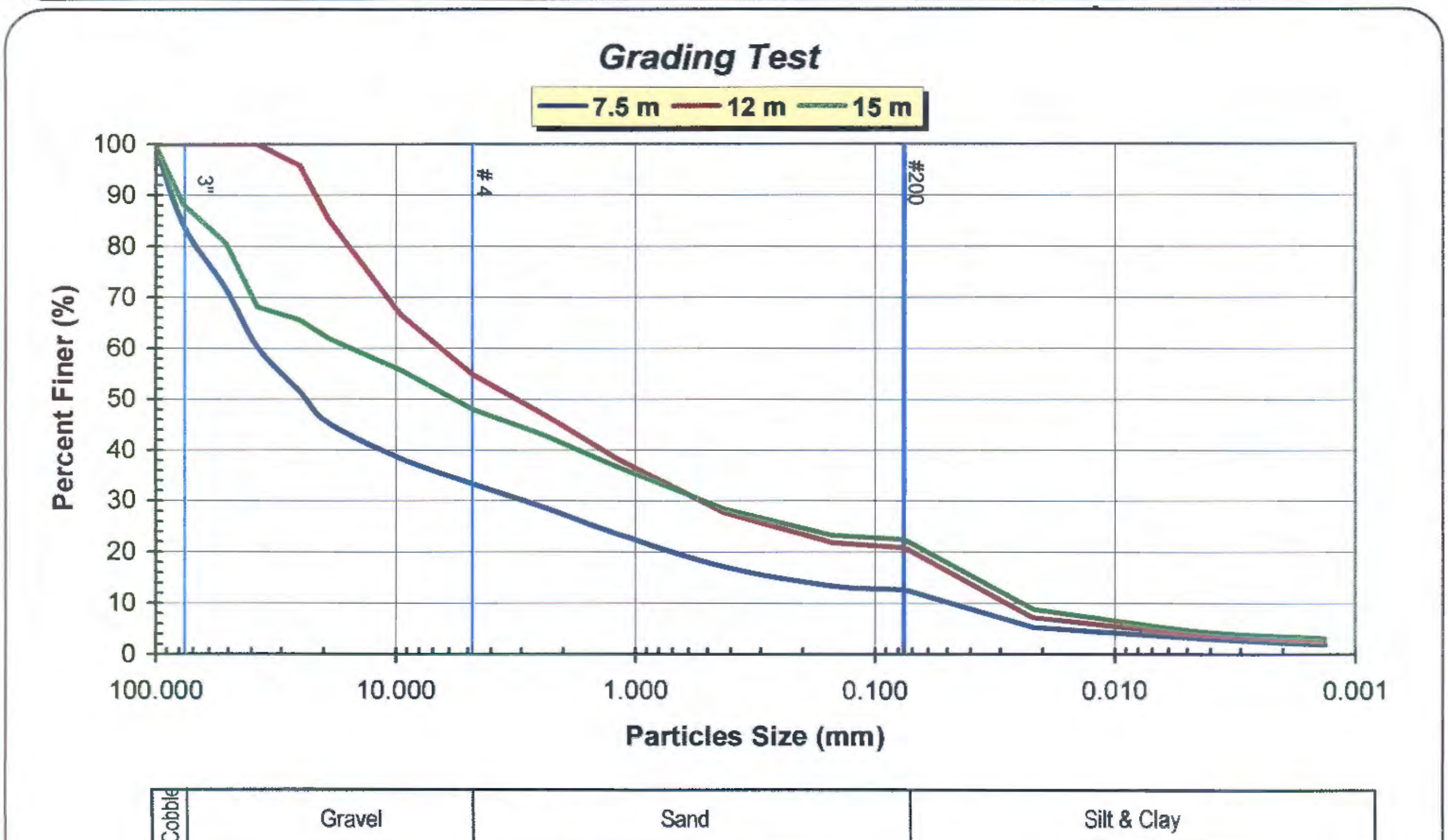


Fig. No. : 27

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد

Borehole No. : BH - 2

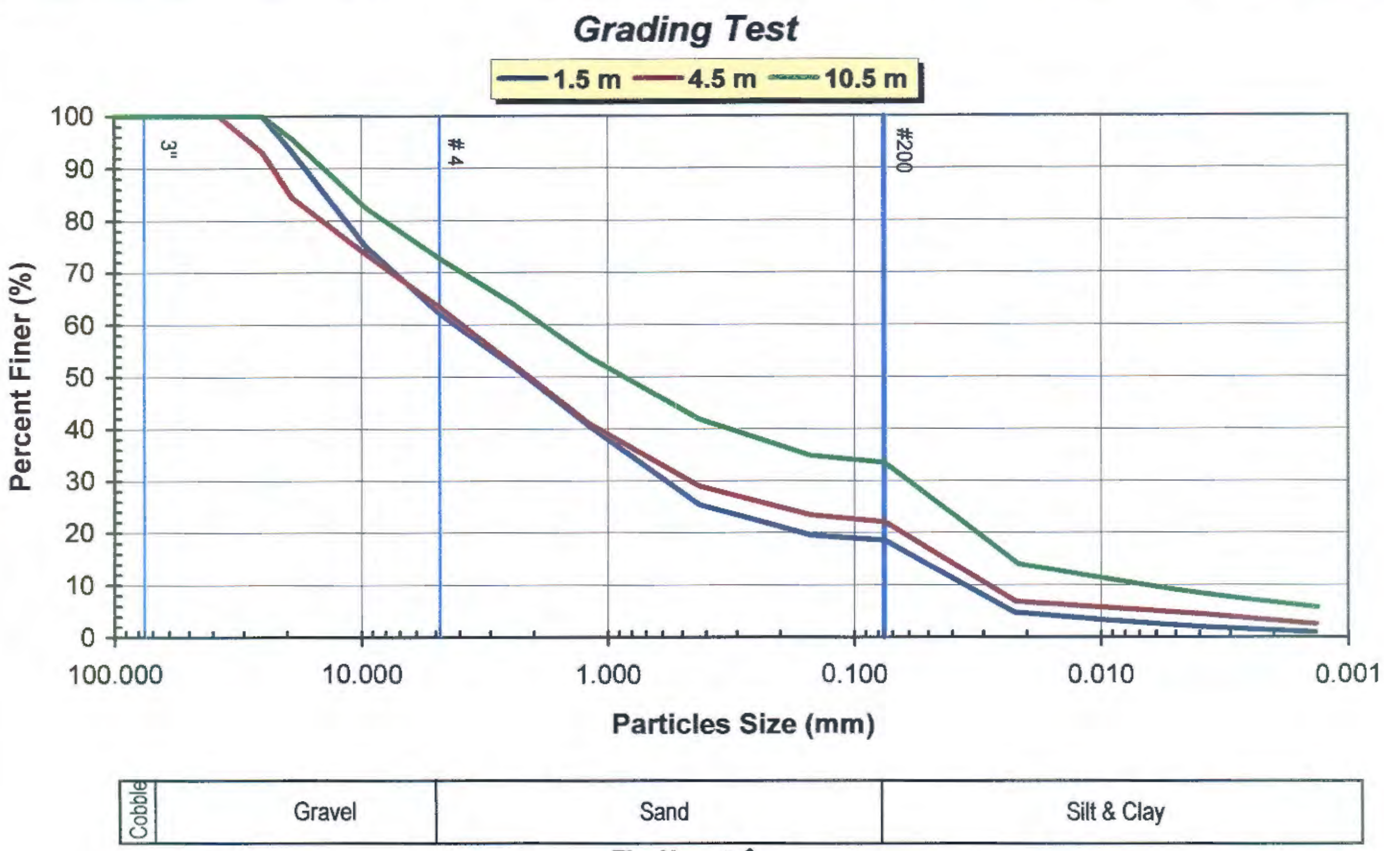


Fig. No. : 28

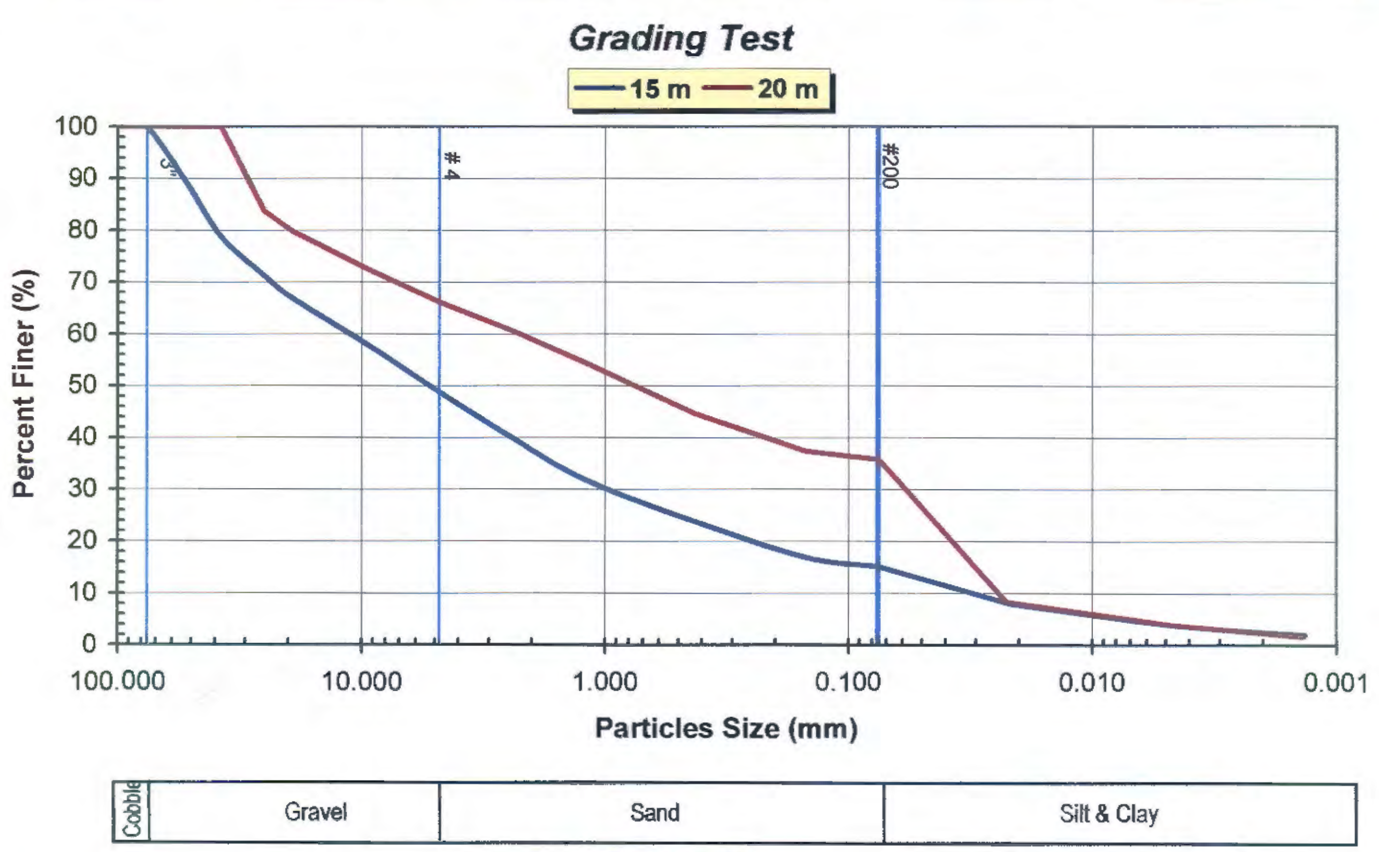


Fig. No. : 29

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد
Borehole No. : BH - 3

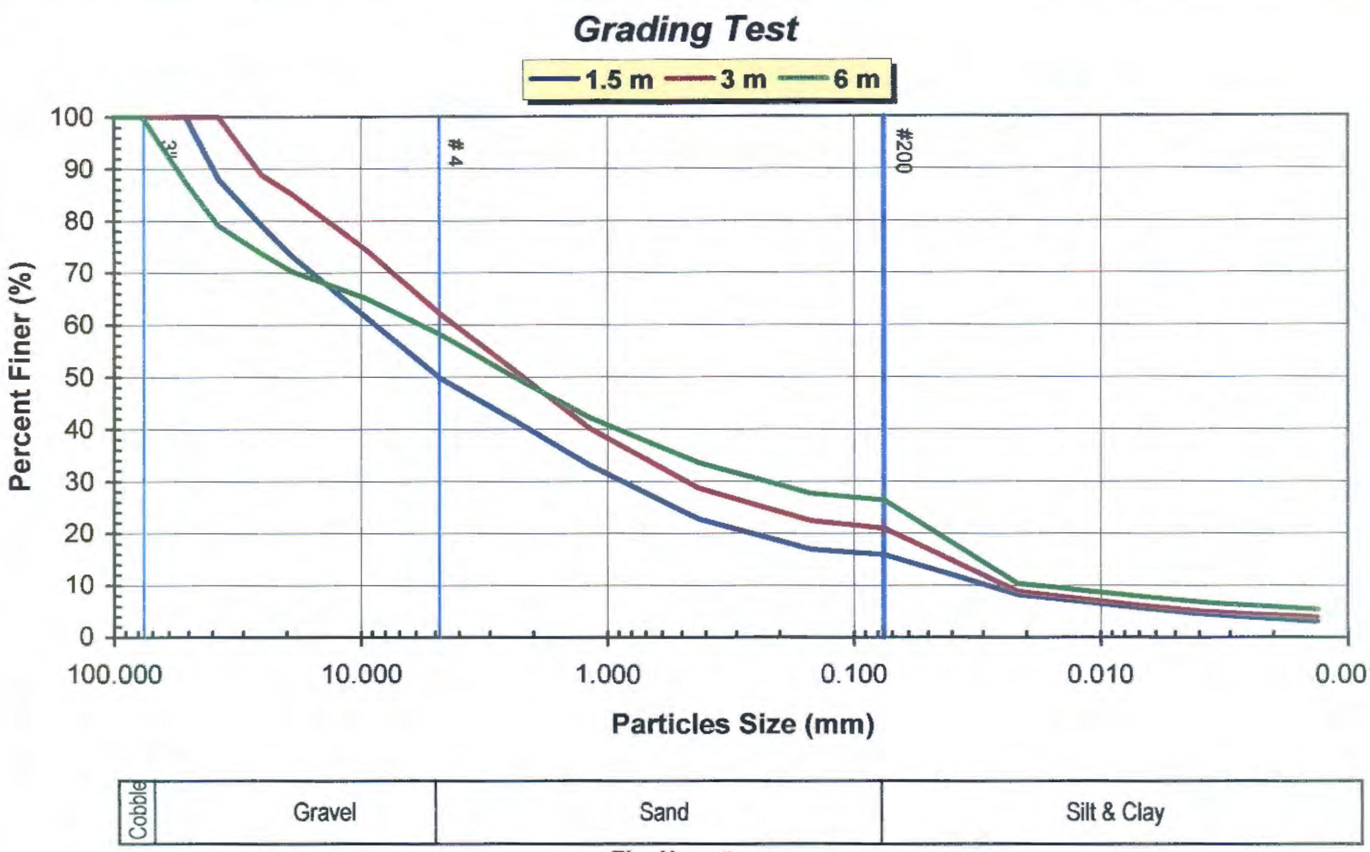


Fig. No. : 30

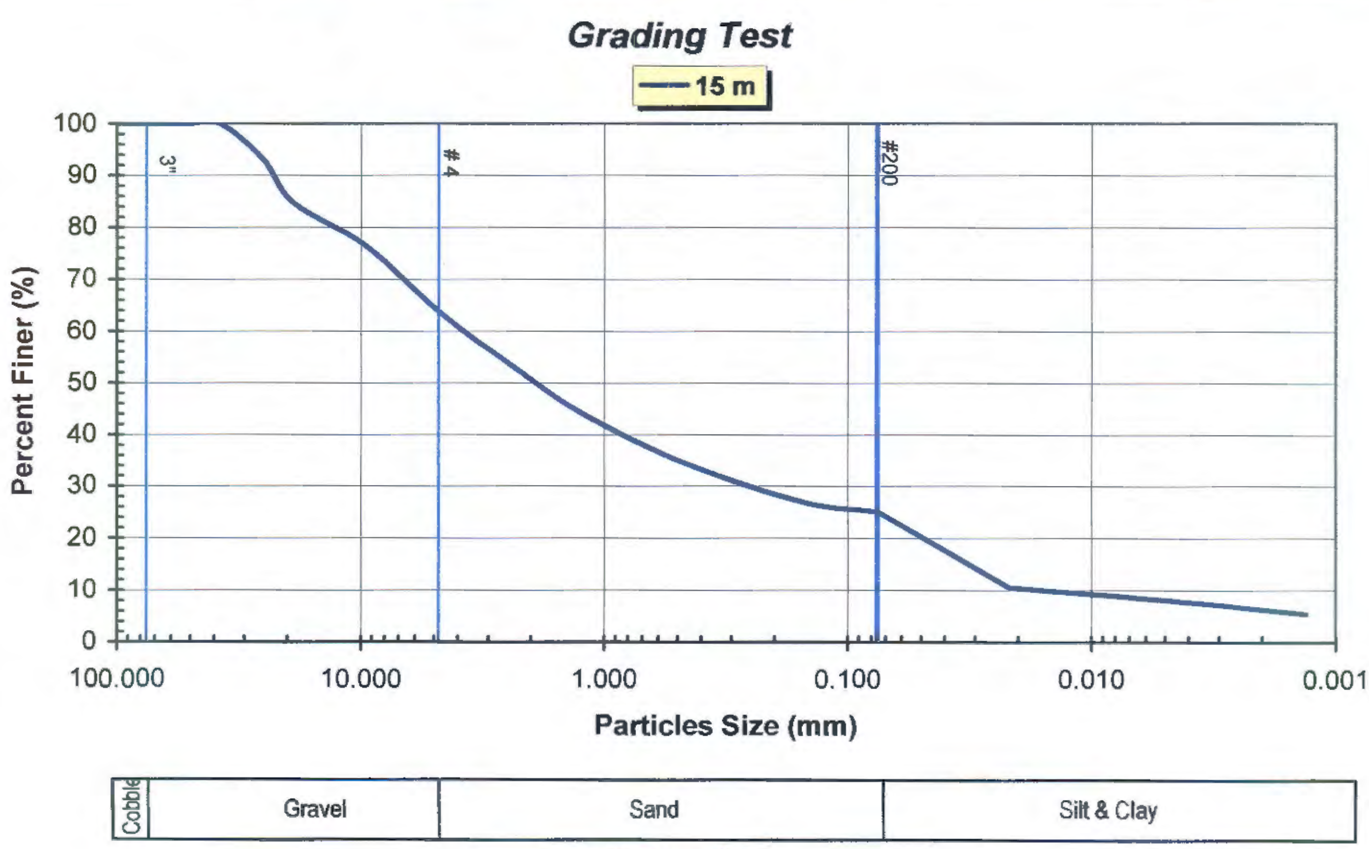


Fig. No. : 31

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد
Borehole No. : BH - 4

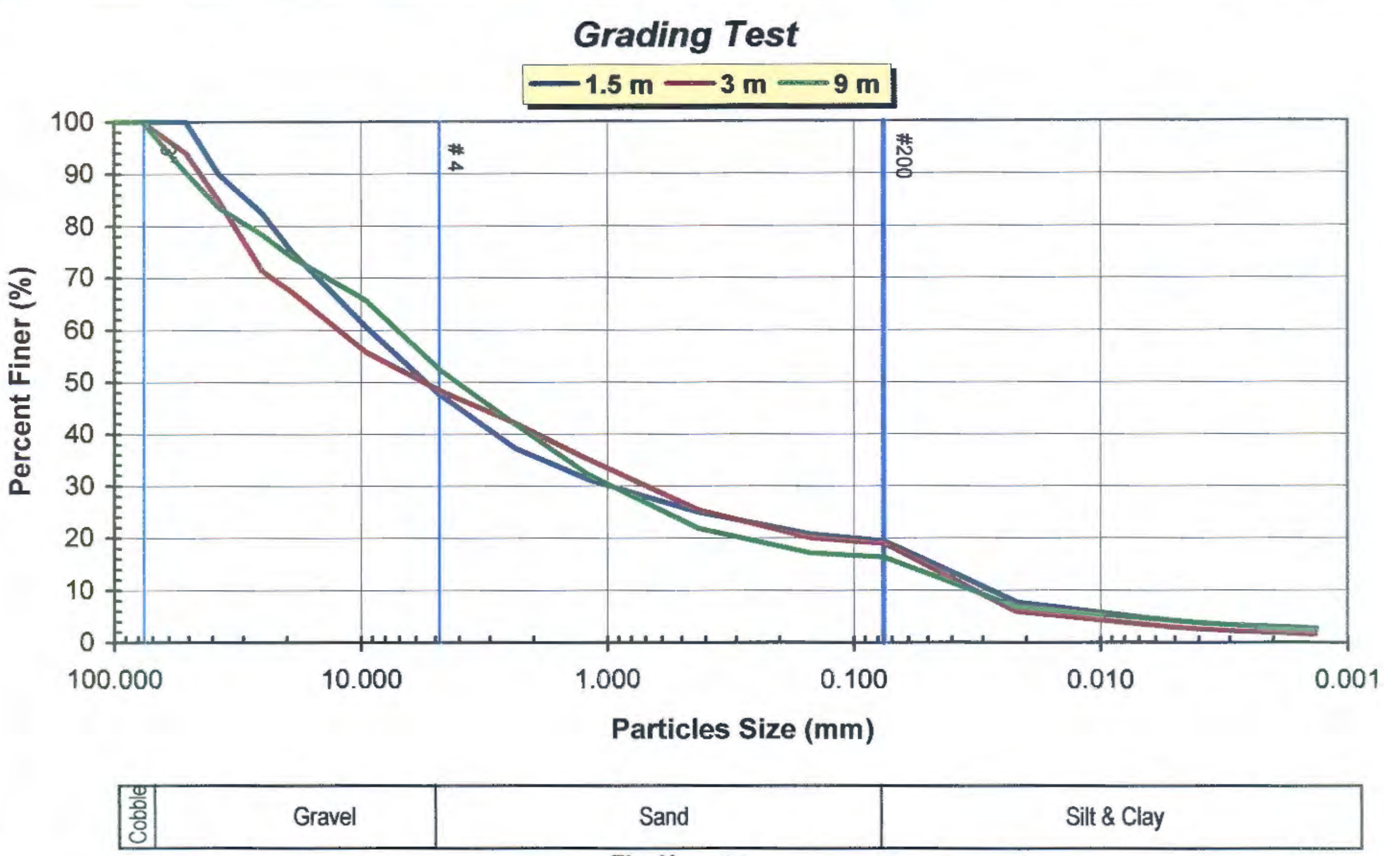


Fig. No. : 32

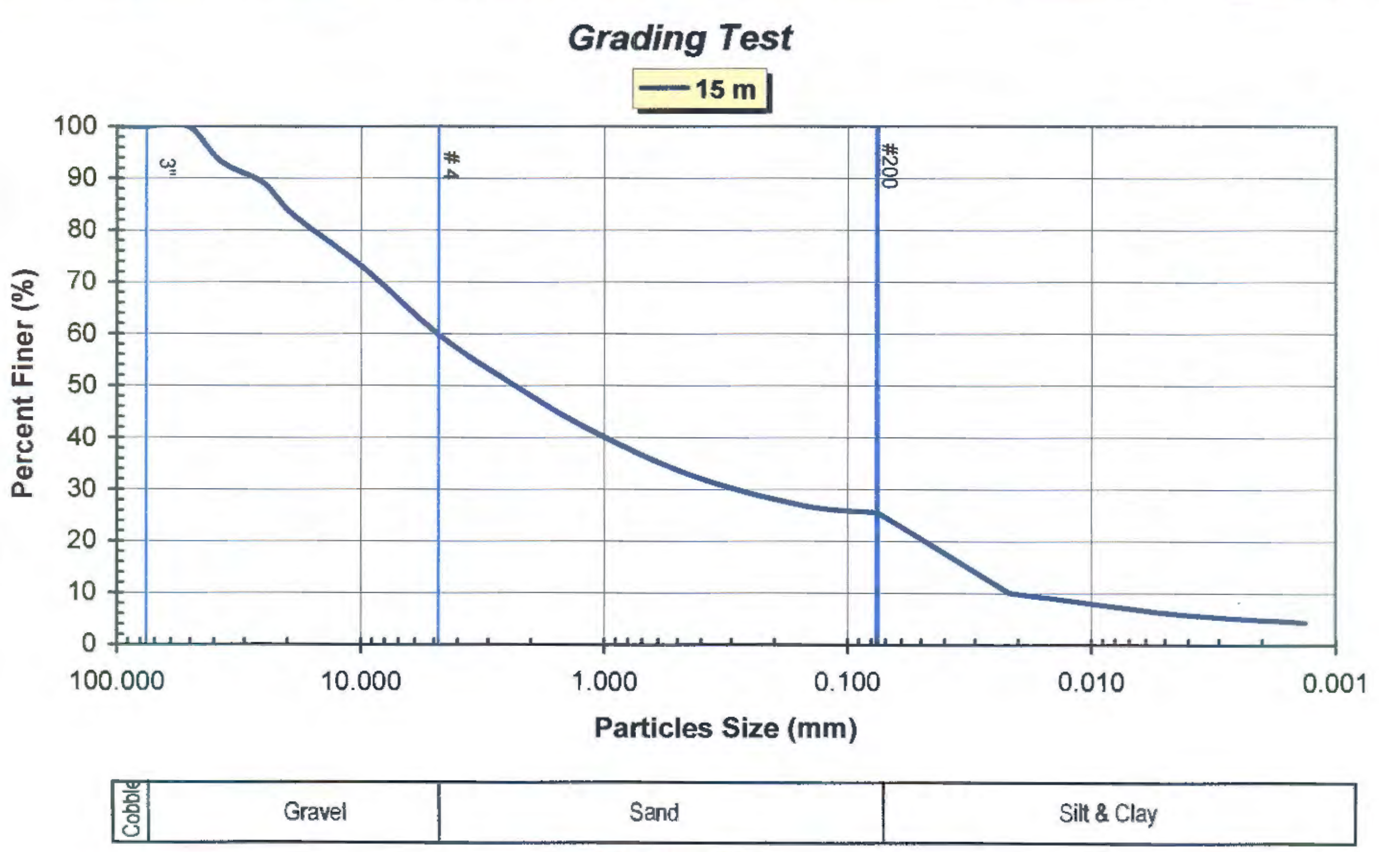


Fig. No. : 33

PEY-KAV Geotechnical Consulting Engineers

Project **:** فولاد آلياژي يزد
Borehole No. : ***BH - 5***

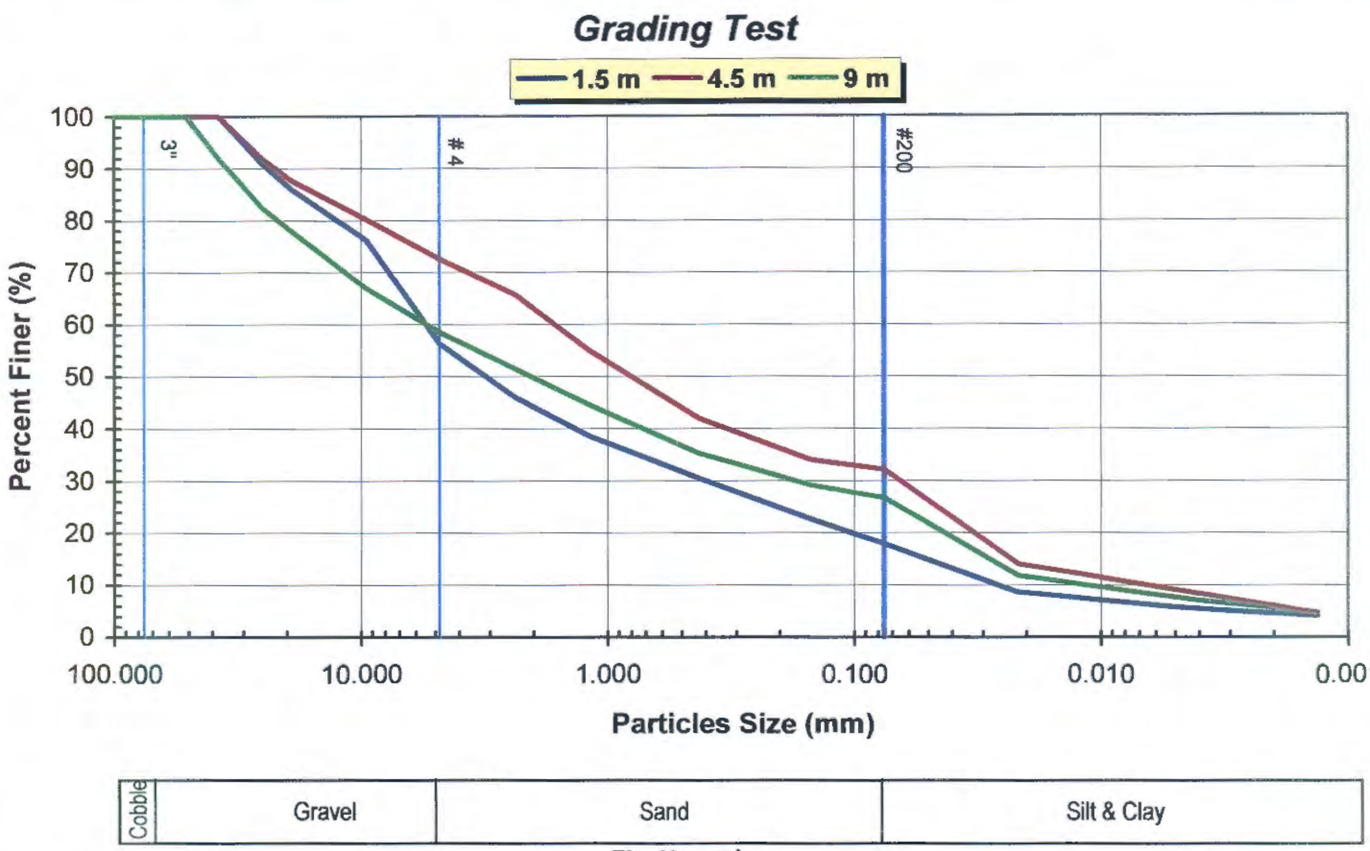


Fig. No. : 34

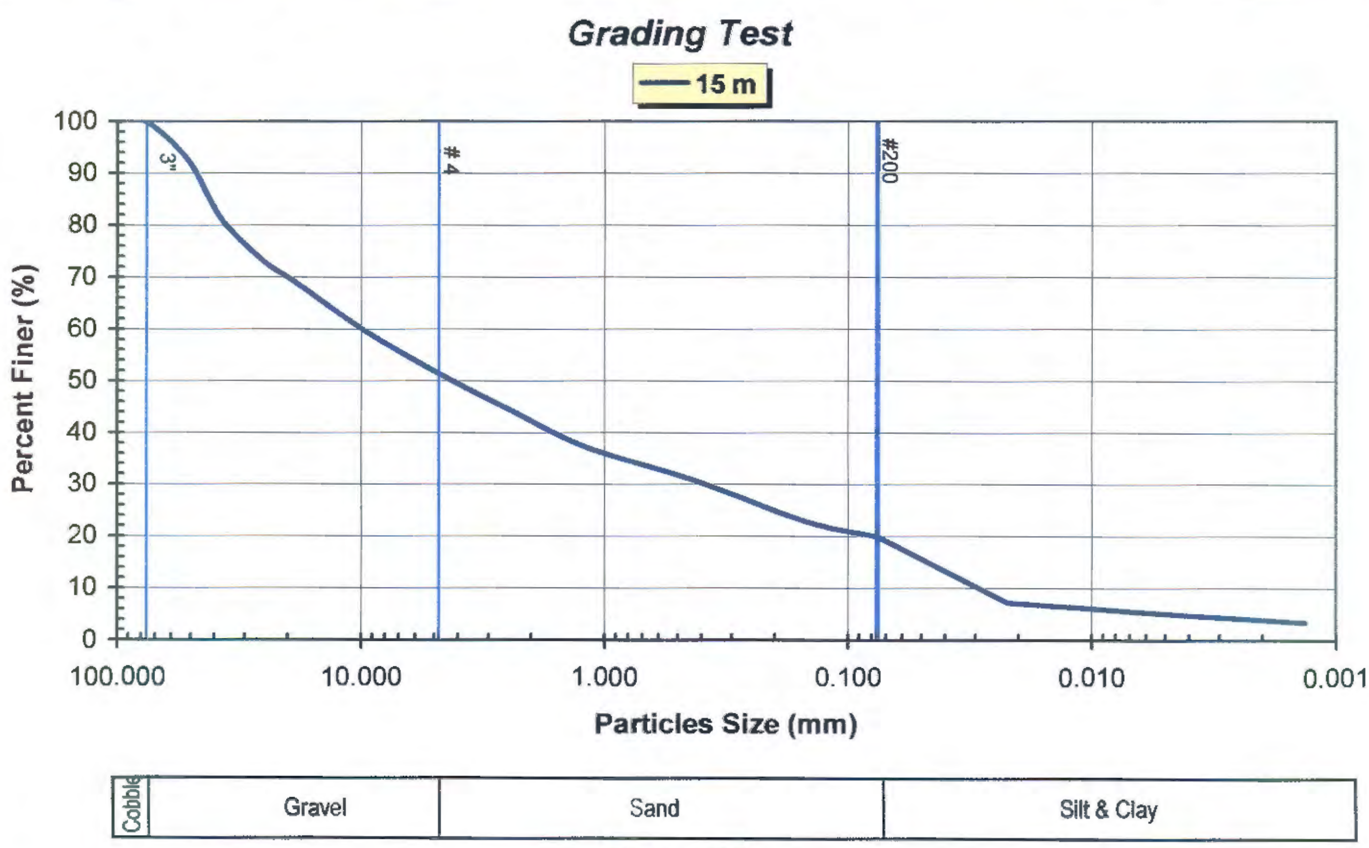


Fig. No. : 35

Project : فولاد آلیاژی یزد
Borehole No. : BH - 6

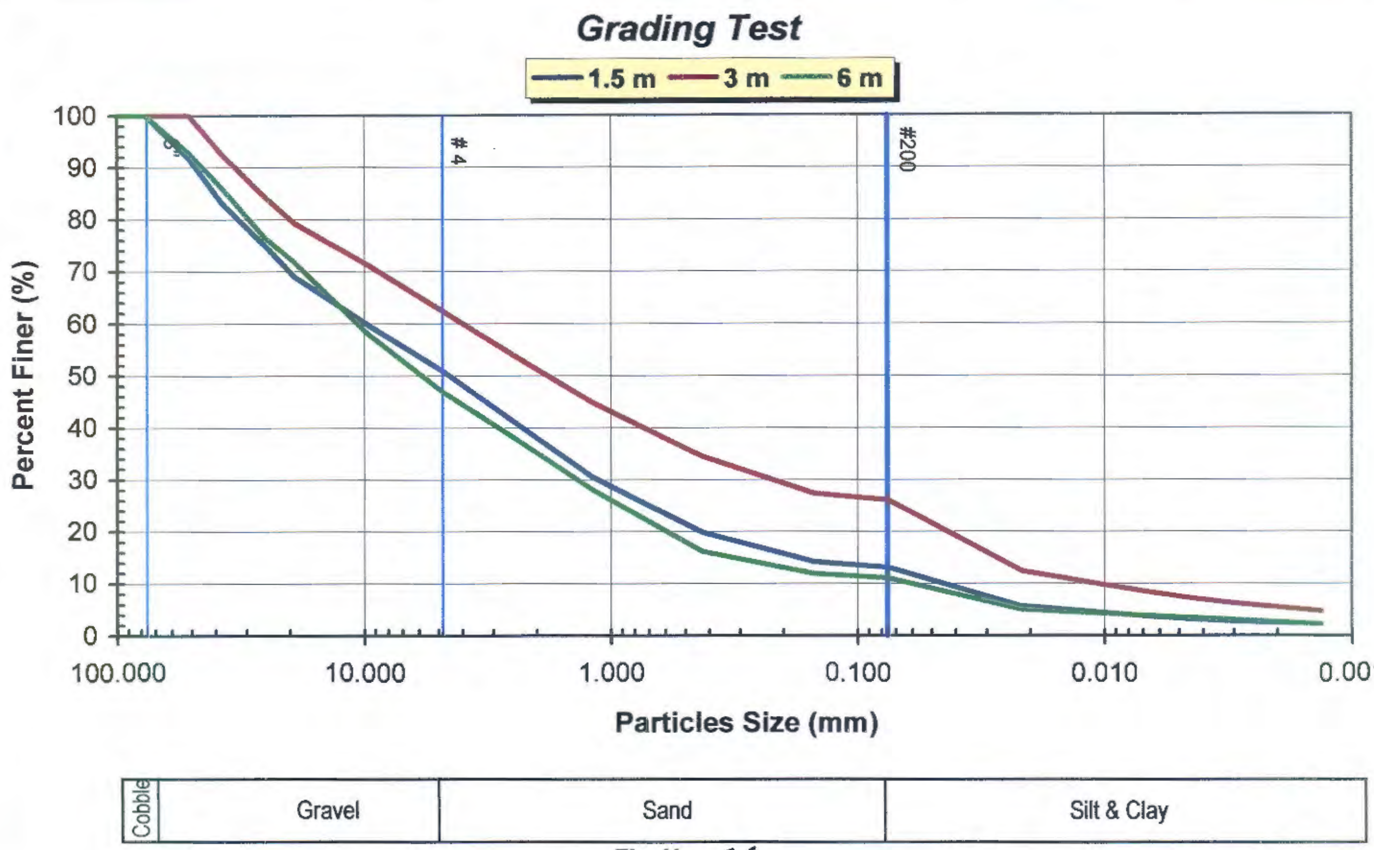


Fig. No. : 36

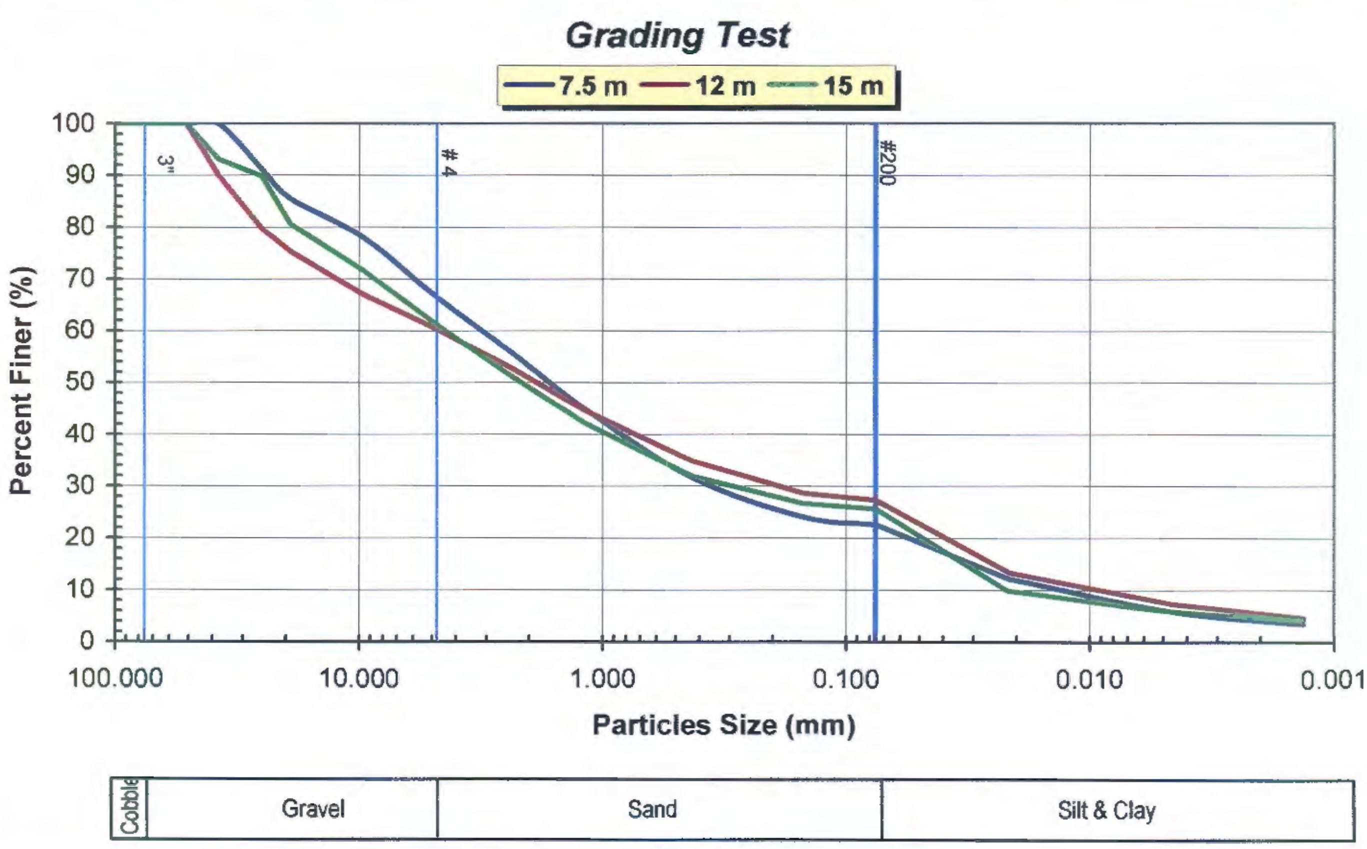


Fig. No. : 37

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد
Borehole No. : BH - 6

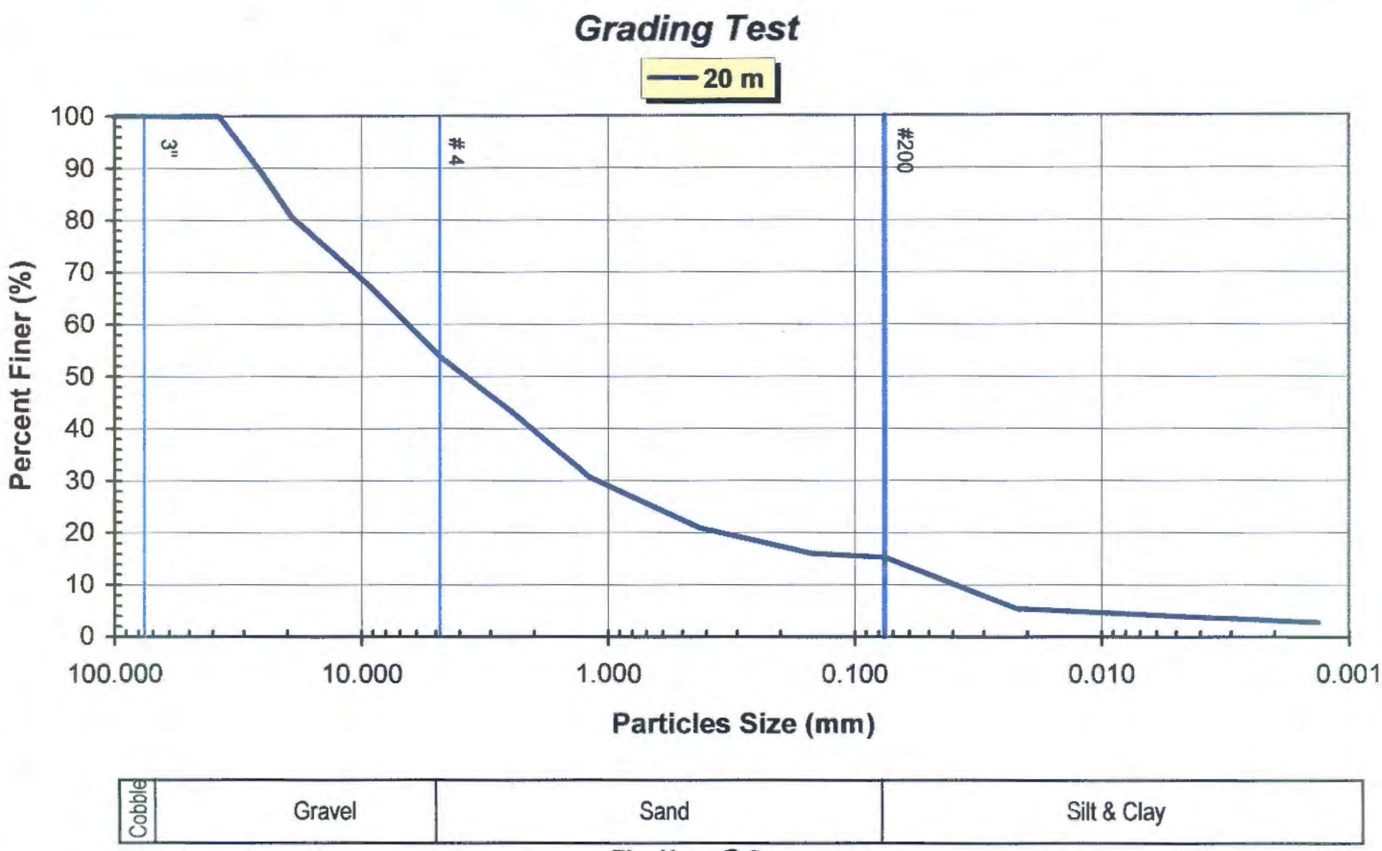


Fig. No. : 38

Project : فولاد آلياژي يزد
Borehole No. : BH - 7

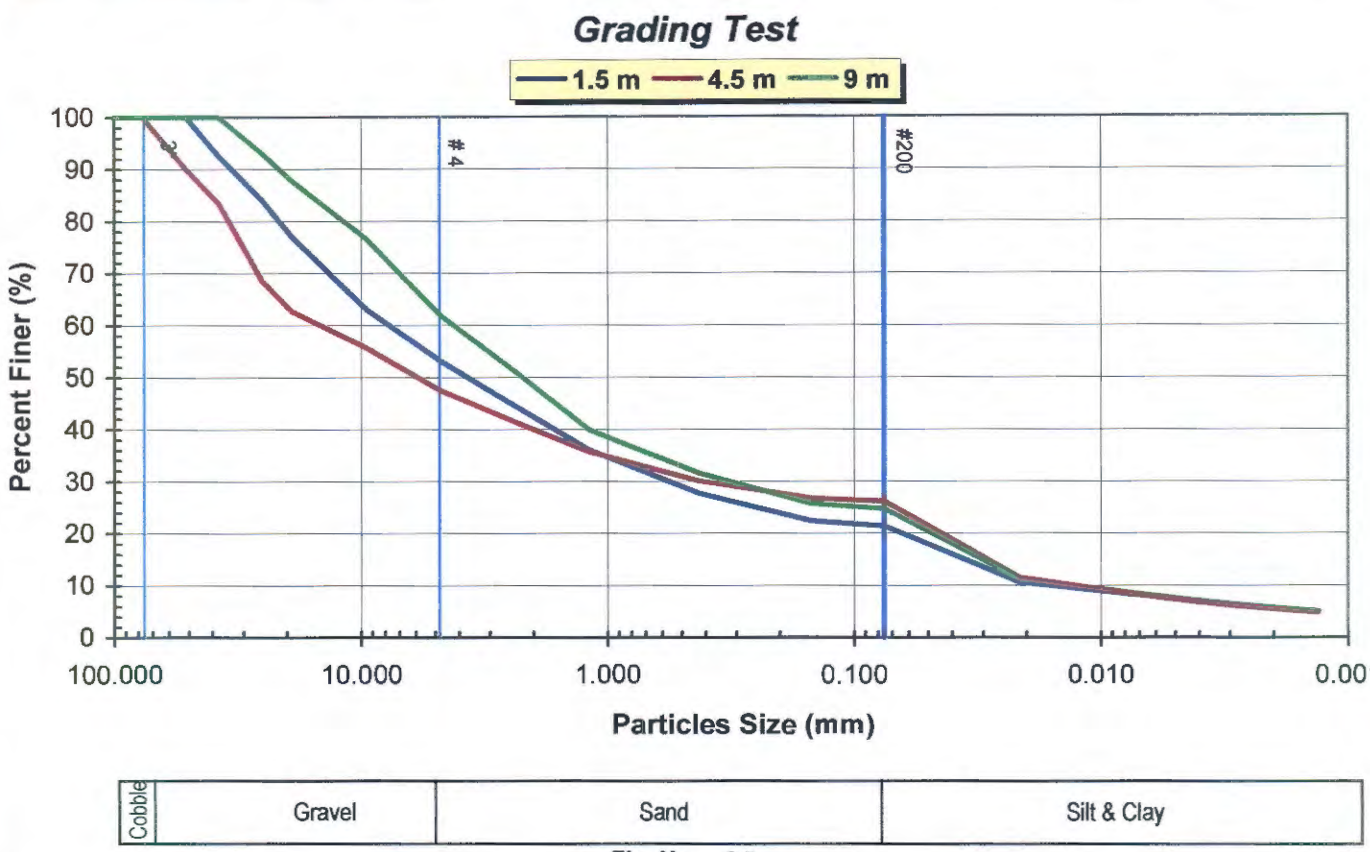


Fig. No. : 39

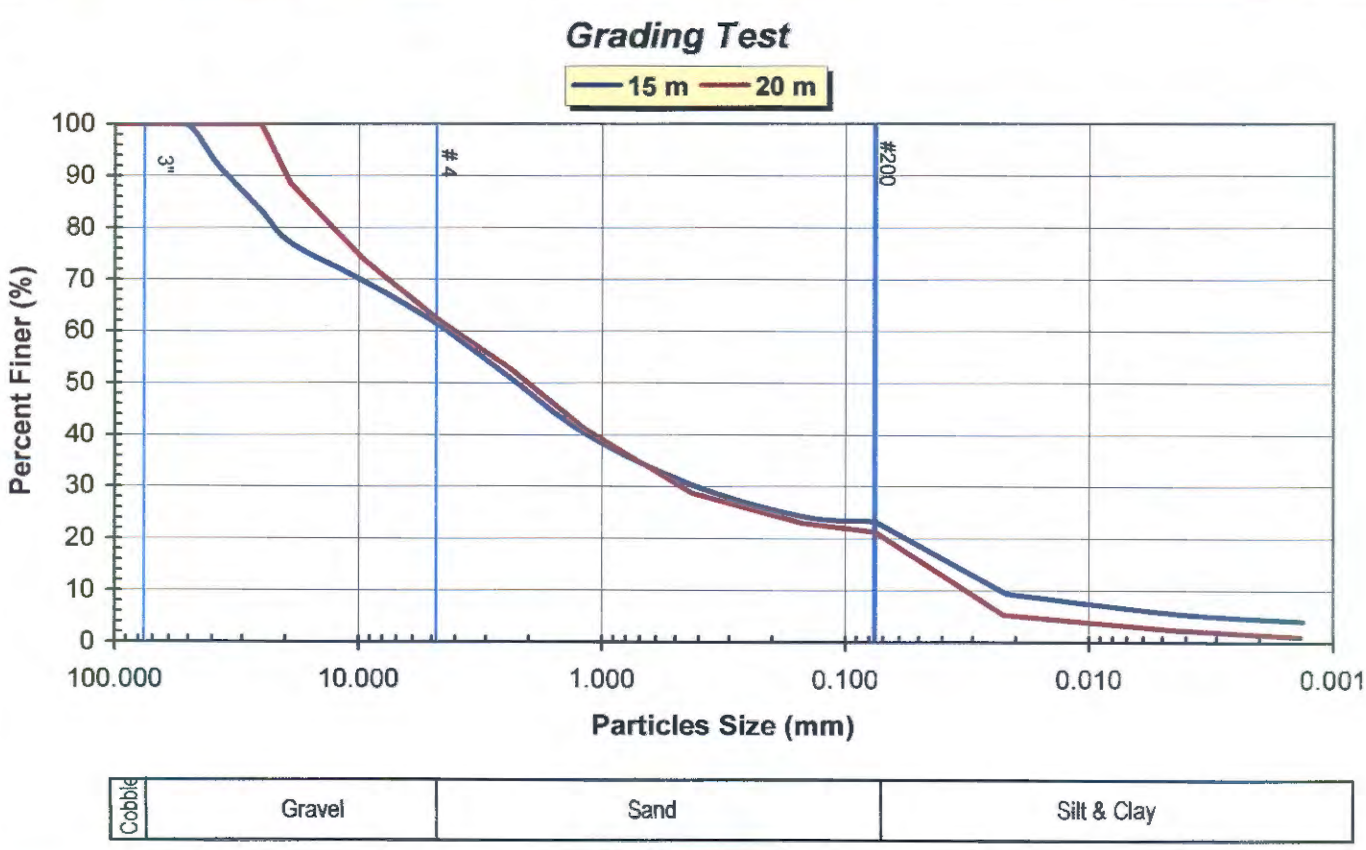


Fig. No. : 40

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد
Borehole No. : BH - 8

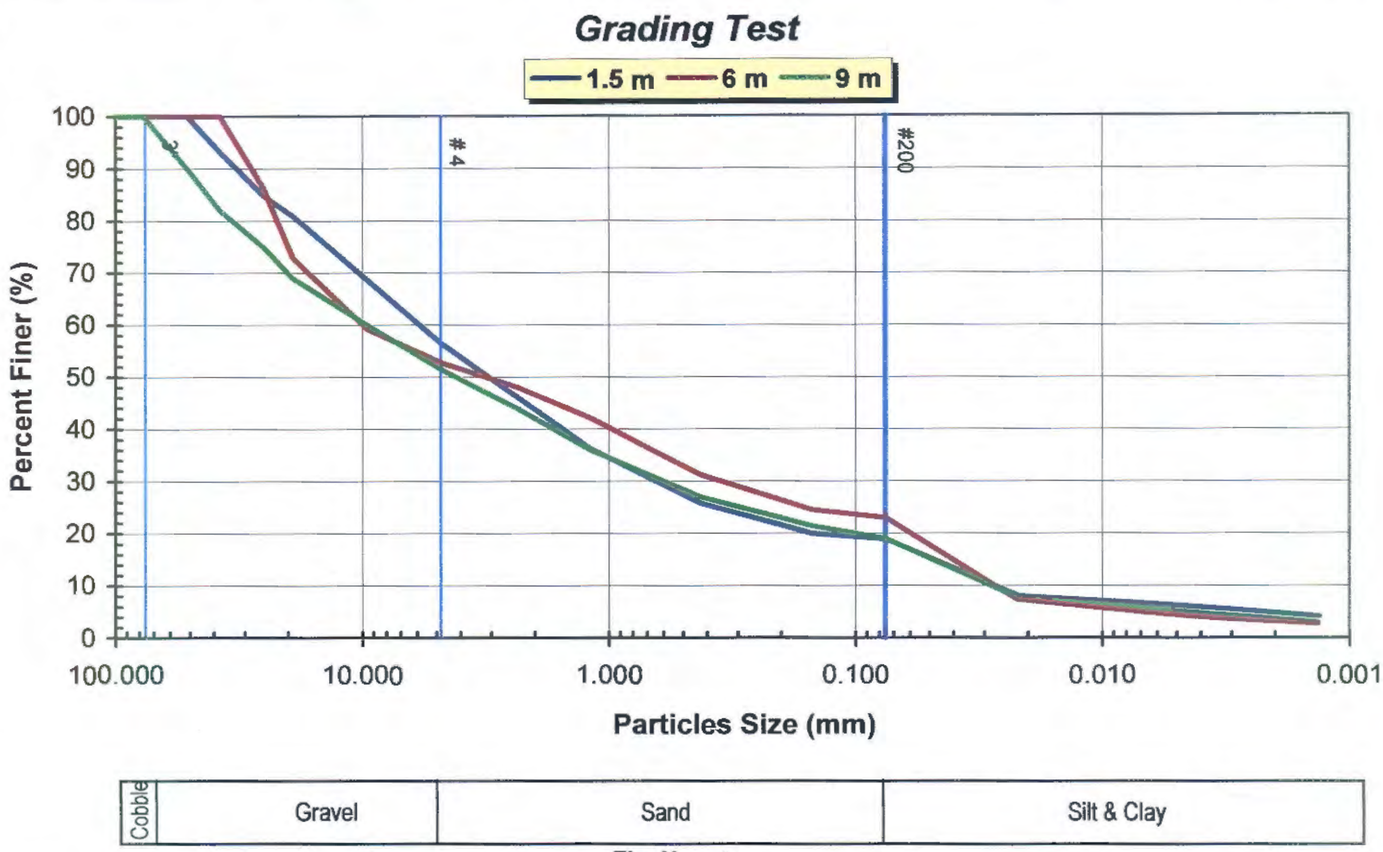


Fig. No. : 41

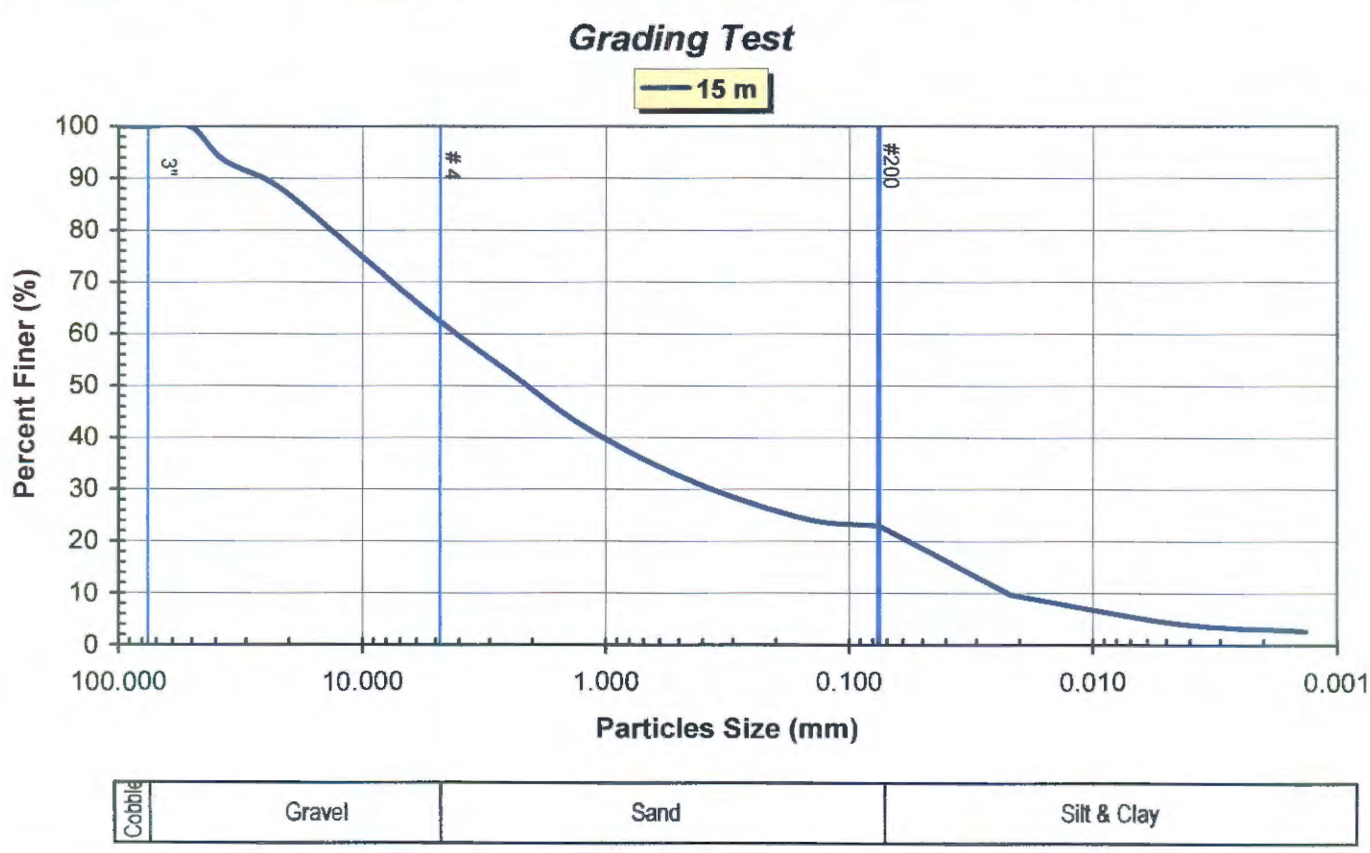


Fig. No. : 42

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد
Borehole No. : BH - 9

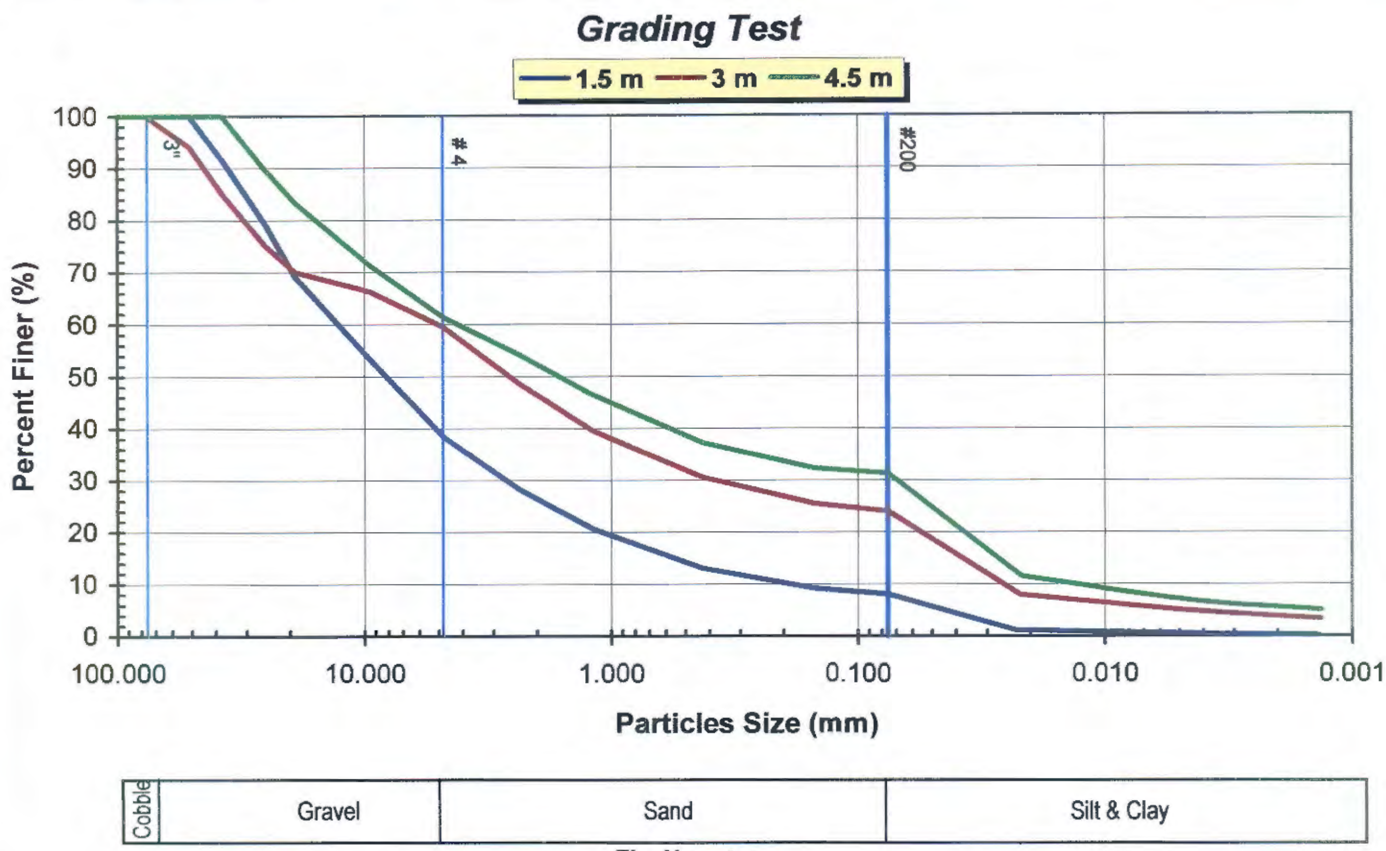


Fig. No. : 43

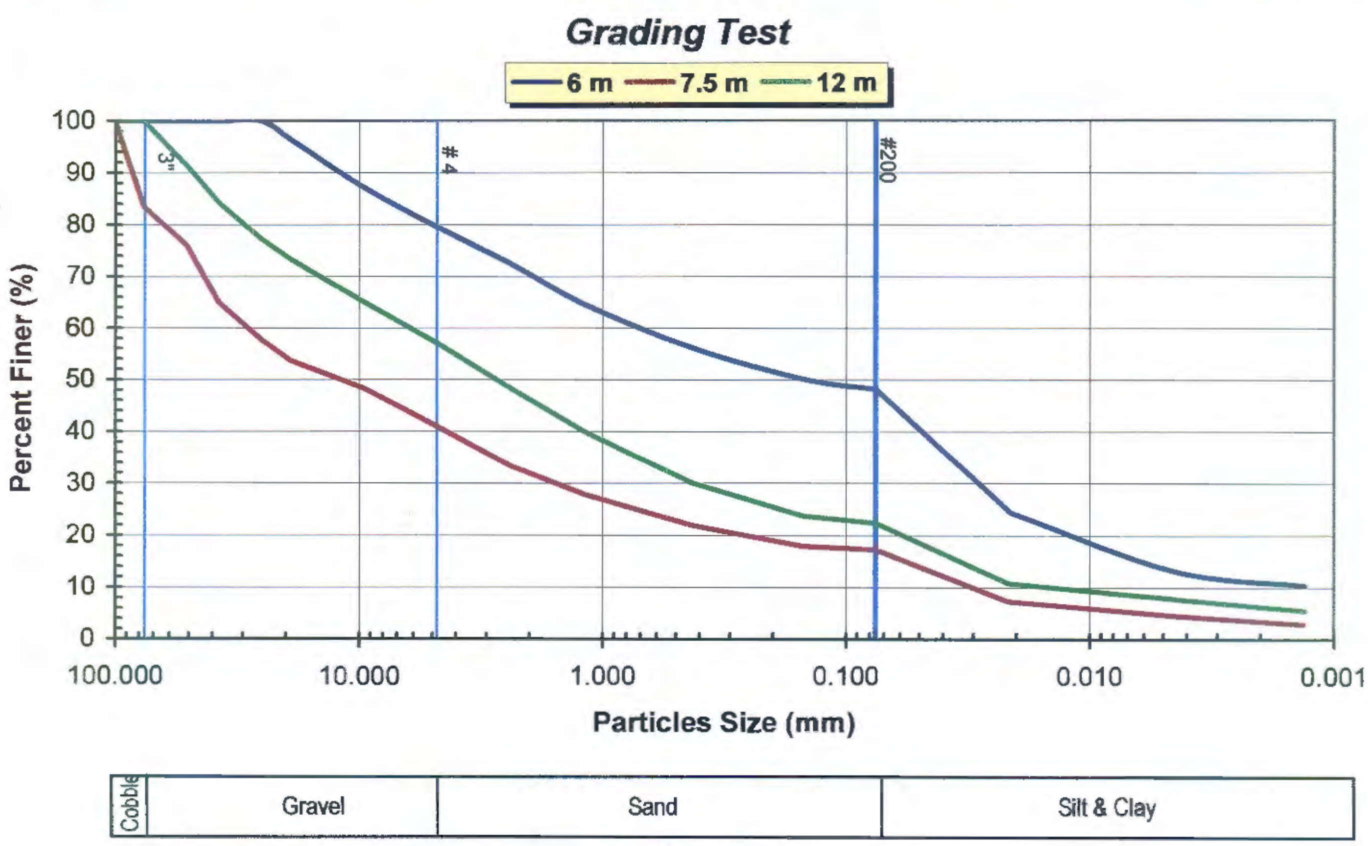


Fig. No. : 44

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد
Borehole No. : BH - 9

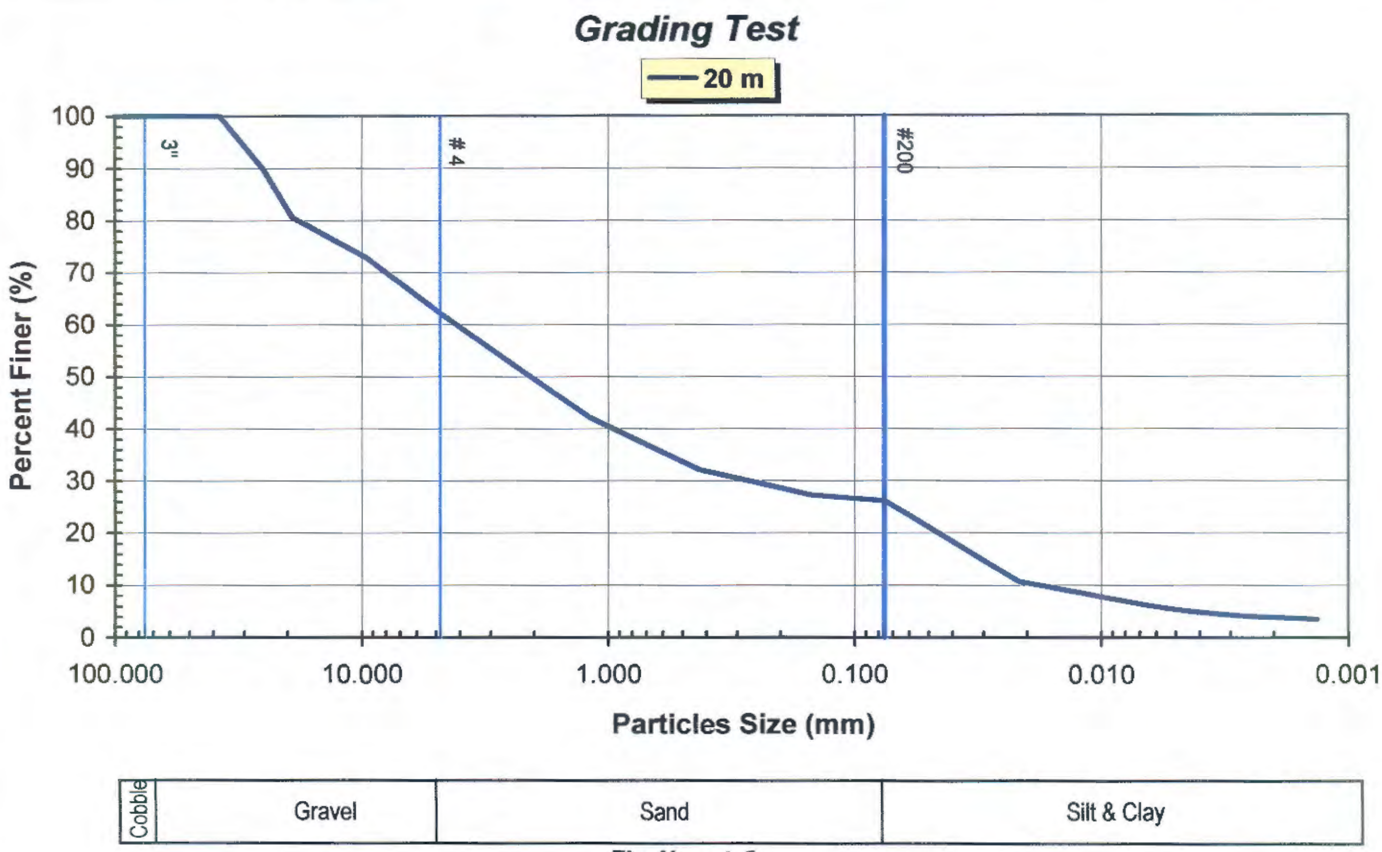


Fig. No. : 45

PEY-KAV Geotechnical Consulting Engineers

Project : فولاد آلياژي يزد

Borehole No. : BH - 10

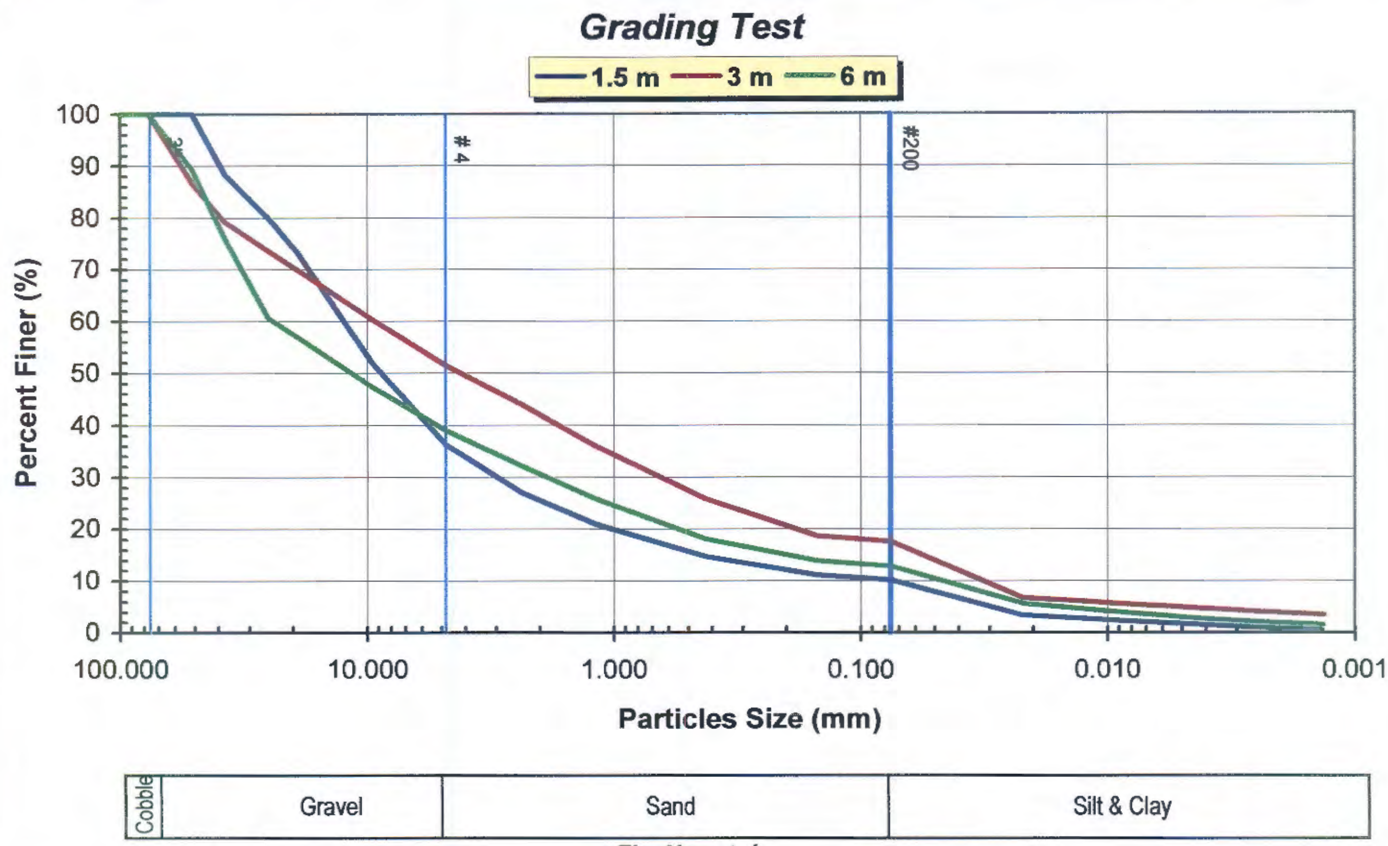


Fig. No. : 46

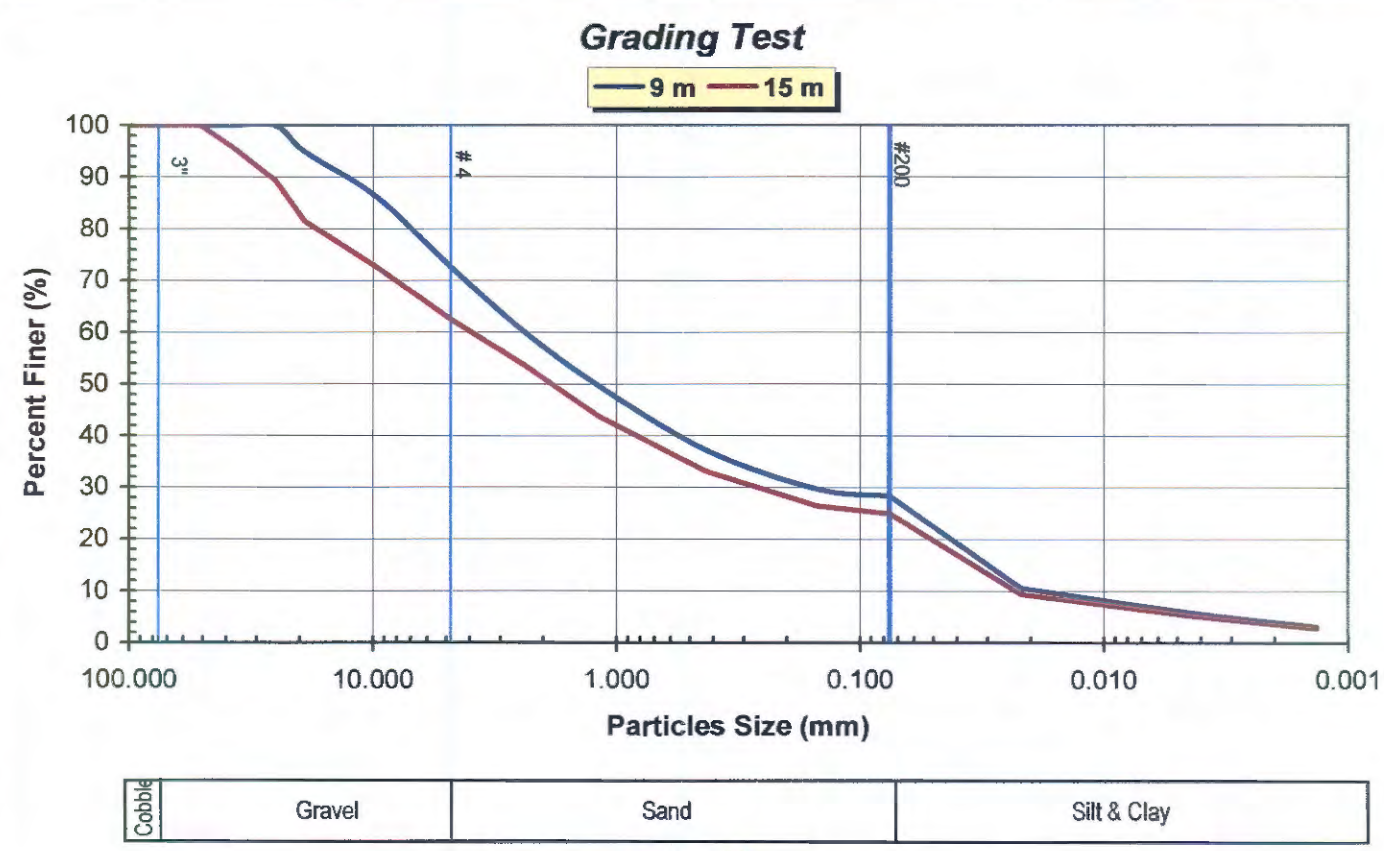


Fig. No. : 47