ڕاپۆرتی شیکاری پشکنینەکانی خاك (ئە نجام وچارەسەر) بۆ باڵەخانەکانی

(پرۆژەی شاری مامۆستایان)

ئامادەکردنی :

ئەندازیاری شارستانی ڕێگە پێدراو :ئازاد حمەصالح حامد

بەڕێوەبەری پرۆژەی(شاری مامۆستایان)

1.Introduction:

پرۆژەی شاری ماموستایان یەکێکە لە پرۆژە پڕبەهاکانی حکومەتی هەرێمی کوردستان کە تایبەتە بە تۆڕی ماموستایان ، پرۆژەکە لە ژێر سەرپەرشتی (بەڕێوەبەرایەتی گشتی وەبەرهێنانی سلێمانی) جێبەجێ دەکرێت کە دەکەوێتە باکوری ڕۆژهەلاتی شاری سلێمانی سەر پارچە زەویەکانی (کەرتی ی شێخ وەیساوا) لەسەر ڕووبەری (دۆنم).بەرواری دەست بەکاربوون لە پرۆژەکە (- -) ماوەی تەواوبونی پرۆژە بریتیە لە(مانگ).

لەم لێکۆڵینەوە کورتەدا دەمەوێت تیشکێك بخەمە سەر پشکنینەکانی خاك (Soil investigation) و ئە نجامی پشکنینەکان و چارەسەری ئەو کێشانەی کە دێتە ڕێگامان و بڕیاردان لە چۆنیەتی چارەسەر،

ئەوەی زیاتر تیشکی دەخەینە سەر کێشەی ناچونیەك(Non-homogeneity)ی جۆری گڵی ژێر بناغەی هەر باڵەخانەیەکە،بۆ نمونە ئەگە بەشێکی بناغەکە بکەوێتە سەرچینێك تێکەڵە(Granular layer) و بەشەکەی تری بکەوێتەسەر چینێك بەرد(Bed rock layer)،کەوا ئاماژەیەکی ترسناکە بۆ سەلامەتی باڵەخانەکە ئەم حاڵەتە ئەگەر چارەسەر نەکرێت دەبێتە هۆی داچوونی ناچونیەك(Deferential settlement)، هەوڵماندواوە بە شێوازێکی زانستی و بەڕێگای گەیاندنی ئەو بەشەی گڵە هەڵبکەندرێت تادەگاتە چینە بەردەکەی بەشەکەی تەنیشتی و پڕکردنەوەی بە(کۆنکرێتی محجر واتە تێکەڵەی کۆنکرێت لەگەڵ بەردی ساغ) وگەیاندنی بناغەی باڵەخانەکە بە حالەتێکی سەلامەت و تەندروست ،

ئە نجامدانی ئەم کارە پێی دەوترێت (Using pier foundations) کەوا لە پاشتر بەڕوونی باسکراوە.

Shari Mamostayan Project is one of the most prestigiousprojects of Kurdistan Regional Government (KRG), which is merely designed for teachers. The project is under the supervision of General Directorate of Sulaymaniah Investment.

The project located in north east of Sulaymaniah city upon (sect 8th of ShexWaisawa) the total land mass is 88 Dounm. The project commencement is on (1-7-2015), the length of the project completion is 52 weeks.

In this short thesis I would like to focus on Soil investigation and the search results. In addition, find solutions for the obstacles we encounter and decide about right solution.

The focal point is more on the complication of (Non-homogeneity) soil type of each building foundations. For example if a portion of the building foundation located upon (Granular Layer) and other portion located upon (Bed Rock Layer), whereas this is a dangerous sign for the safety of the building. This issue if not solved that could result in (Deferential Settlement).

We have attempted scientifically by digging that type of soil to reach the stone layer of its side and fill with stone concrete (mixture of concrete and solid stone). Therefore, that makes the foundations of the building safe and healthy.

This procedure called (Using Pier Foundations) which explained exclusively in the following sections.

The project consist of: پێکهاتەی پرۆژەکە:.

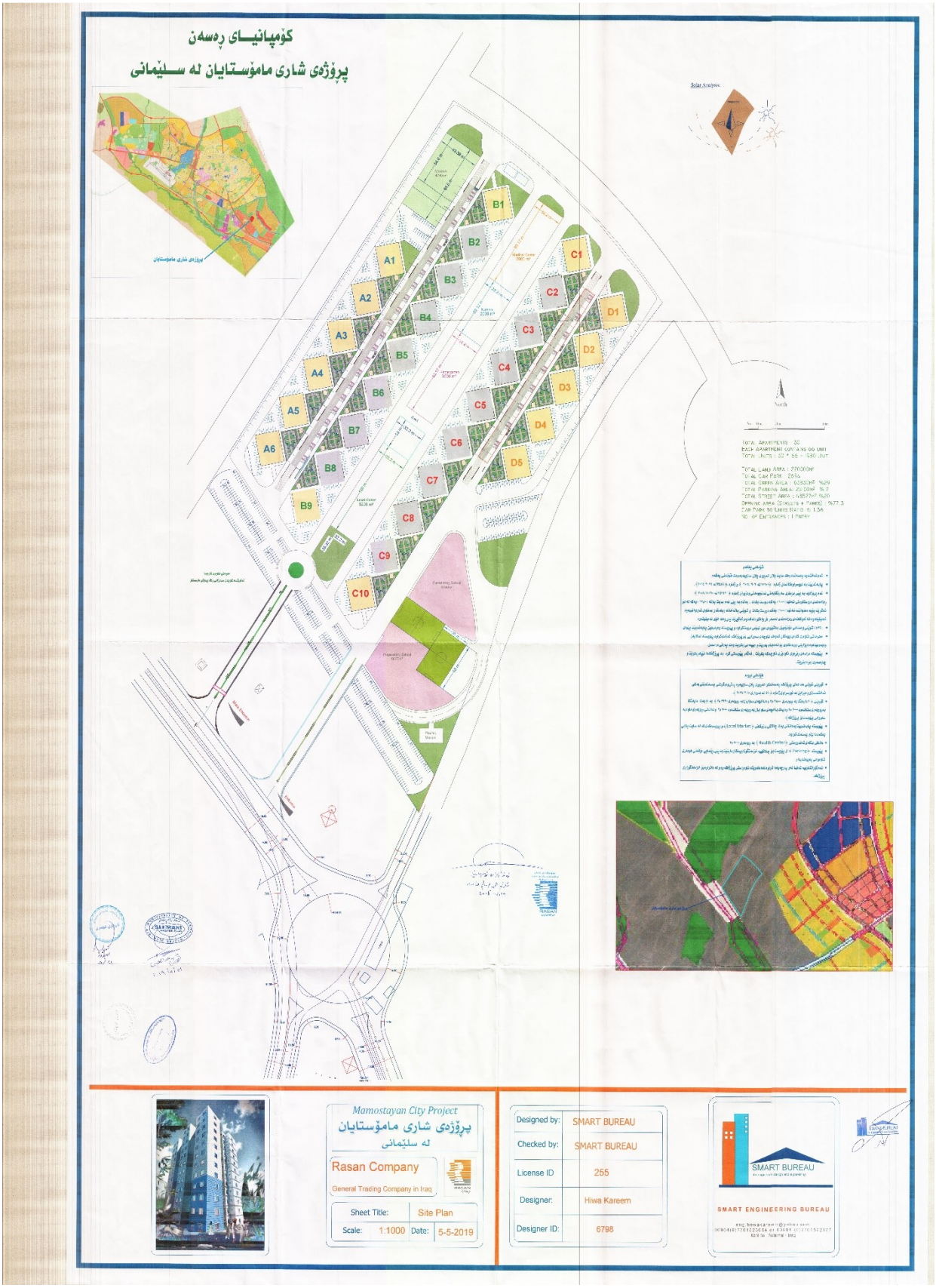
- Total Apartments:30No. * ژمارەی بالّەخانەکان:□□

Each Apartment contains 66unit. * هەر بالّەخانەیەك پێکهاتووە لە□□ یەکەی نیشتەجێبوون

Total Units:30*66=1980Units. * سەرجەم ژمارەی یەکەکان□□□=□□*□□

- Total Land Area:220000m². * سەرجەم ڕووبەری زەوی پرۆژەکە

- Total Car Park :2694 No. * سەرجەم ژمارەی پارکینگی ئۆتۆمبیل
- Total Green Area:63830m² %29. * ڕێژەی سەوزایی
- Total Parking Area :25100m² %12. * ڕێژەی ڕووبەری پارکینگ
- Total street Area :48527m² %20. * ڕێژەی ڕووبەری شەقام
- Opening Area (Street + Park) %77.3. * ڕێژەی ڕووبەری کراوە(شەقام+ پارکینگ)
- Car Park to Unit Ratio is 1.36. * ڕێژەی پارکینگ بۆ ژمارەی یەکەکان
- The Fund Area to Medical Center is 3000m². * ڕووبەری بنکەی تەندروستی
- The Fund Area to Nursery is 2000m². * ڕووبەری دایەنگا
- The Fund Area to Kindergarten is 3000m². * ڕووبەری باخچەی ساوایان
- The Fund Area to Local Market is 3220m². * ڕووبەری بازاڕ
- No. of Main Entrance :1 Entry. * ژمارەی مدخل ی پرۆژە


کۆمپانیـــای ڕەسەن
پرۆژەی شاری مامۆستایان لە ســلێمانی
Solar Analysis:
B1
B2
A1
B3
C1
A2
C2
D1
B4
A3
C3
D2
B5
A4
C4
D3
B6
A5
C5
D4
B7
A6
C6
D5
B8
C7
B9
C8
C9
C10
North
TOTAL APARTMENTS : 30
EACH APARTMENT CONTAINS 66 UNIT
TOTAL UNITS : 30 * 66 = 1980 UNIT
TOTAL LAND AREA : 220000M²
TOTAL CAR PARK : 2644
TOTAL GREEN AREA : 63820M² %29
TOTAL PARKING AREA: 22000M² %7
TOTAL STREET AREA : 148270M² %50
OPENING AREA (CIRCLES & PARKS) : %77.3
CAR PARK TO UNITS RATIO IS 1.34
NO. OF ENTRANCES : 1 ENTRY
Mamostayan City Project
پرۆژەی شاری مامۆستایان
لە سلێمانی
Rasan Company
General Trading Company in Iraq
Sheet Title: Site Plan
Scale: 1:1000 Date: 5-5-2019
Designed by: SMART BUREAU
Checked by: SMART BUREAU
License ID 255
Designer: Hiwa Kareem
Designer ID: 6798
SMART BUREAU
SMART ENGINEERING BUREAU

2.Report Layout

This report includes the results of soil investigation for the project. Also it incorporates the results of subsurface exploration, laboratory testing, discussion of test results and recommendations about requirements for foundation designing of apartment buildings.

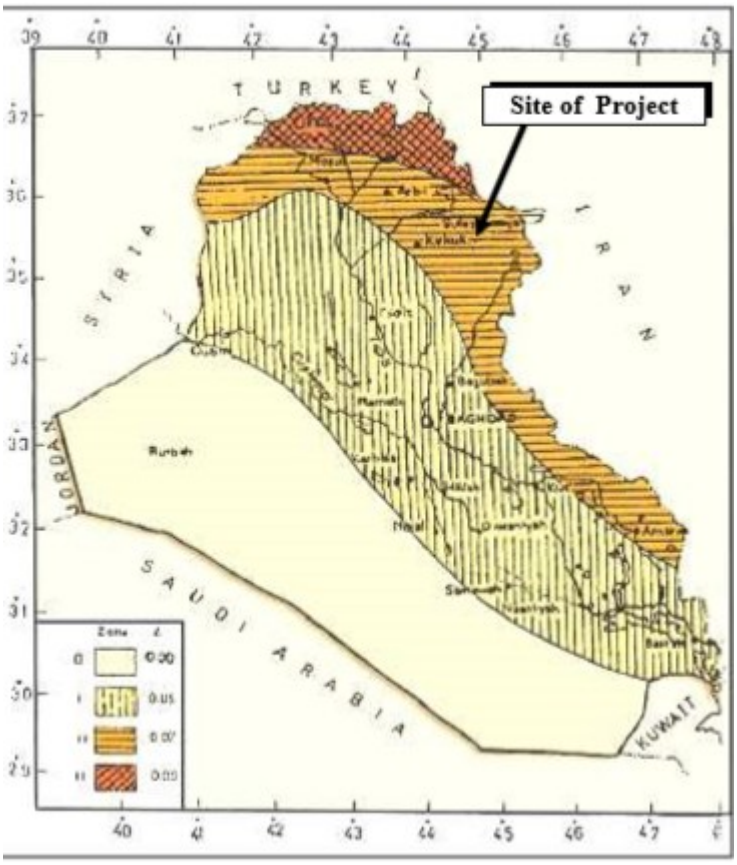
The soil investigation for the apartment buildings includes digging of Sixty bore-holes (two boreholes for each of the apartment buildings) by drilling machines. The boreholes were dug form the existing ground surface, and taking disturbed samples for laboratory testing. This report presents and discusses the laboratory test results as well as recommendations for the foundations of the apartment buildings

3. SEISMICITY OF THE AREA

According to Iraqi seismic code (No. 2/1997), the ordinary structure may be designed by the equivalent static method using conventional liner elastic analysis. The seismic analysis of structures shall take the dynamic properties of the structure into consideration by equivalent static analysis. In this analysis the seismic hazard and zoning coefficient (Z) are required. The evaluation of seismic hazard in different seismic areas for the design of buildings and structures shall be performed according to the seismic zoning map of Iraq, (Fig. 1). The value of coefficient (Z) can be taken as follows:

Zone	Z
I	0.05
II	0.07
III	0.09

The site of the project is located in Zone II, so the value of the coefficient (Z) equals to 0.07 should be used in the design. According to (UBC / 1997), and depending of the type of the foundation soil, the recommended value can be considered as (Seismic zone factor = 0.3)



4. FIELD WORK

Boring Sixty boreholes (i.e. 2 boreholes under each apartment building) were drilled to a different depths varying between 6.0 to 15.0 m. Figures (2) and (3) show a site plan of the entire project, also shows proposed apartment buildings with locations of the bore-holes. The boreholes were advanced by using power drilling machine. The applied method for drilling was continuous flight auger method (Photo No. 1)

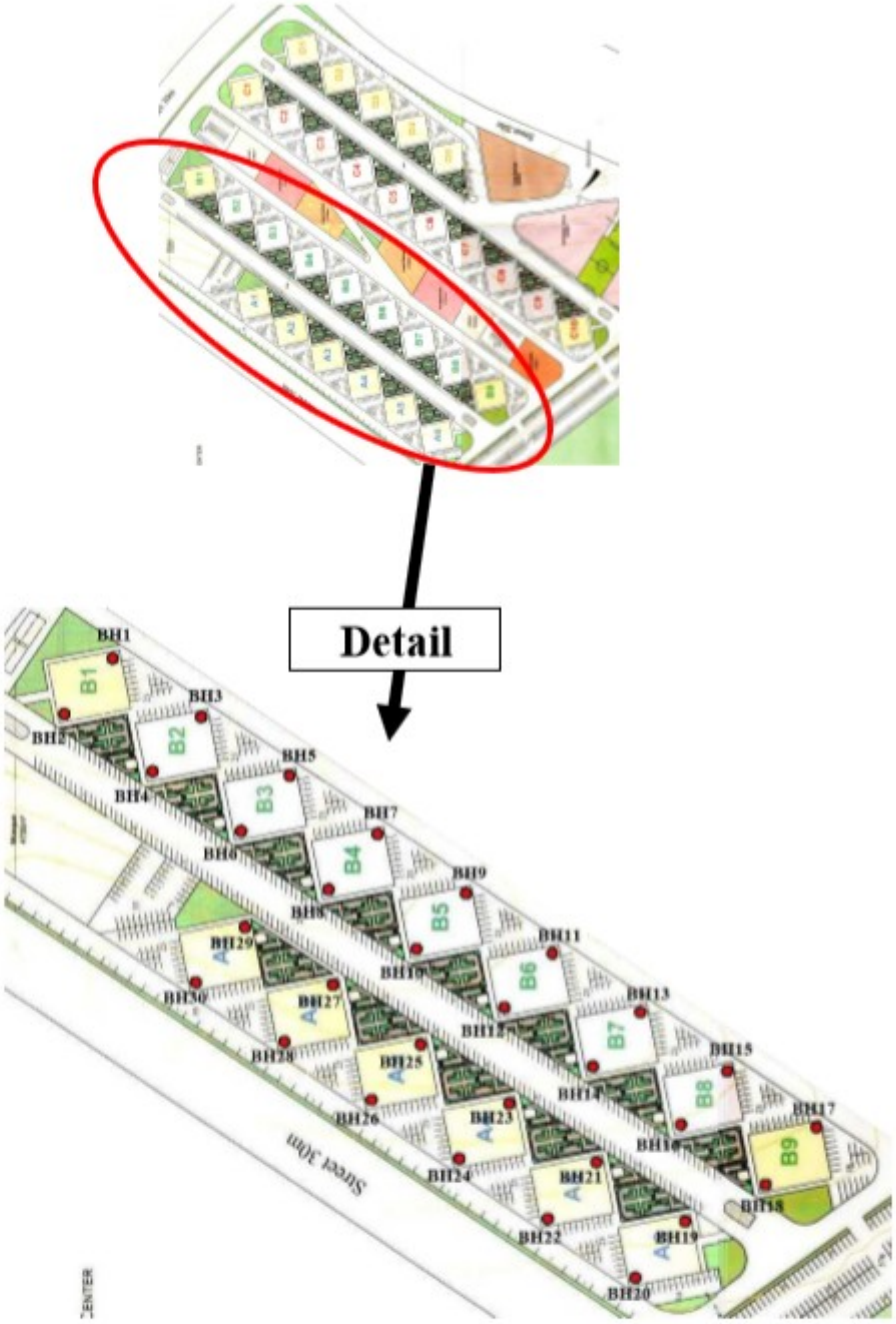


Fig (2) Site plan showing locations of the fifteen apartment buildings with locations of the boreholes.

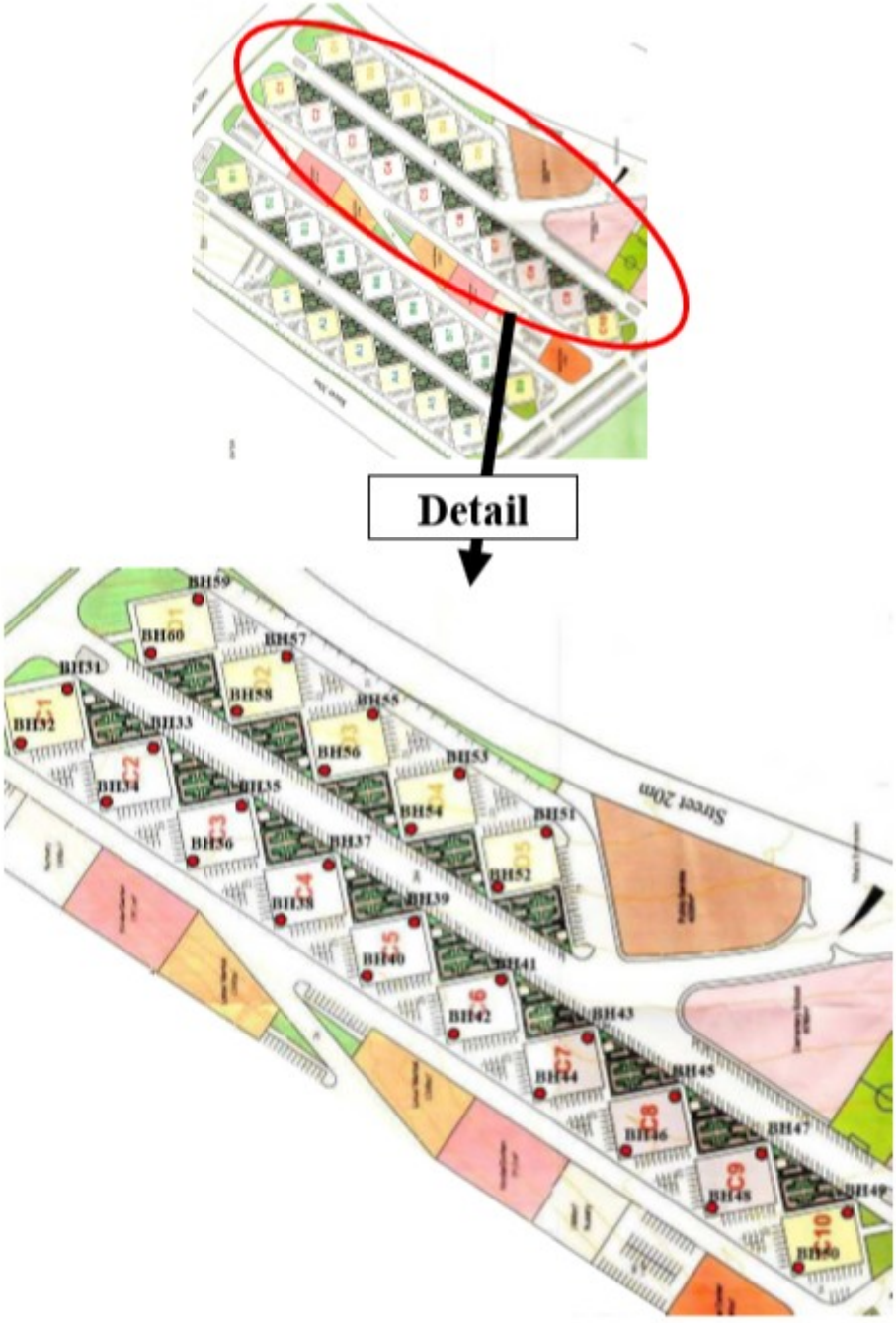


Fig (3) Site plan showing locations of the other fifteen apartment buildings with locations of the boreholes.

Photo (1) power drilling machine using continuous flight auger method for drilling.

Photo (2) Standard Split spoon used for testing SPT.

5- LABORATORY TESTING

5.1 Type of Tests

i) Liquid & Plastic Limits.

ii) Sieve analysis.

5.2 Method of Testing

Disturbed samples available were used for classification tests. All the tests were carried out according to the recommendations and procedures called for by ASTM and B.S as appropriate or applicable for any given case.

5.3 Presentation of Results All the test results are summarized in tables, as shown in the latter sections.

6- SUB-SOIL CONDITION:

6.1-Sub-soil Profile:

- Granular layer of Mixture of gravels, rock fragments & clay.
- Cohesive layer of reddish or brown clay with sand sometimes with rock fragments or carbonate.
- Bed rock layer of greenish Marlston.

6.2 Under - Groundwater Condition

The groundwater level was observed at 48 hours after completion of drilling for each boring point, and it was encountered inside the boreholes (BH 39, BH 51, BH 52, BH 53, BH 54, BH 56, BH 58, and BH 60) at different depths varying between 9.0 to 13.0 m

7- STRUCTURAL DESIGN INFORMATION

The client has provided the following information to us;

(a) It is suggested to construct 30 apartment buildings.

(b) The buildings will be multi-story buildings of 11 stories with additional one story as a basement.

(c) The buildings will be constructed as a reinforced concrete framed structures or may be constructed as a tunnel form method.

8- RECOMMENDATIONS :

8.1 Type of Foundation

Depending on type of the structure which is multi-story building (12 stories), it is recommended to use raft or mat foundation. Thick rigid mat foundation is recommended to be used under the buildings. If the lower recommended values of the allowable bearing capacities are not adequate, then pier foundation of 1.0 m diameter or more can be used under the mat foundation and the tip of the piers should be penetrated either into the bed rock layer or into stronger incompressible layer.

8.2 Depth of Foundation and Allowable Bearing Capacity

From the results of the tests, generally it can be notices that the foundation soil of the most of the buildings will be placed at the nonhomogenous layers. Foundations of most of the buildings will be placed at two different types of soils, granular layer and cohesive layer or bed rock. According to the results of the field test of (SPT), laboratory tests, and subsoil condition, it is recommended to consider the following Allowable Bearing Capacities for tolerable settlement by using rigid mat foundation;-

Building No.	Type of Foundation Soil for the Apartment Buildings	* Depth of Foundation (m)	Allowable bearing Capacity			Modulus of Sub grade Reaction
			KN/m²	Ton/m²	kfs	KN/m²
B1,B2,B3,B4 B5,B6,B7,B8 D1,D2,D3,D4 D5,C5,C6	Placing the foundation on the granular layer of the mixture of gravels, rock fragments, and clay	4.0 m or more	200	20	4.18	24000
C7,C8	Placing the foundation on the Cohesive layer of the brown, reddish, or greenish clay with sand and sometimes with rock fragment	4.0 m or more	170	17	3.55	20400
C2,C3,C4	Placing the foundation on the Cohesive layer of the brown clay with sand or carbonate	4.0 m or more	150	15	3.13	18000
C1,A2	Placing the foundation on the Cohesive layer of the brown,reddish, Or greenish clay with sand and some times with rock fragment	4.0 m or more	190	19	3.97	22800

A1,A3,A4, A5,A6,B9	Placing the foundation on the bed rock layer	4.0 m or more	400	40	8.35	48000

Notes:.

1. In case of constructing multi story building of twelve stories, it is recommended to construct one story as a basement under the building at a depth of 4.0 m or more.
2. There may be a large problem of the non-homogeneity of the foundation soil of the following apartment buildings;Note; Building No. C9, & C10 will need special soil improvement

Building Name	Borehole Numbers
C9	BH 47& BH 48
C10	BH 49& BH 50

At the locations of these apartment buildings, the foundation may be placed at two different types of soils of the bed rock layer of the greenish marlstone and the other part of the foundation may be placed either at the granular layer of the mixture of gravels, rock fragments, and clay or at the cohesive layer of the brown clay with rock fragments. Placing the foundation at these two different types of soils, there may be possibility of occurring differential settlement or tilting of the building. So it is recommended to solve the problem by placing all parts of the foundation at the lower bed rock layer of greenish marlstone. In case of placing all parts of the mat foundation at the bed rock layer of the greenish marlstone, the allowable bearing capacity of 400 kN/m2 (40 ton/m2) (8.35 ksf) can be used

in the design.

BOREHOLE LOG SHEET

Project: Shary Mamostayan

Location: Sulaimani-Qirga

Borehole No.: BH 47 Elevation of G.L.: 771.55

Sample type	Depth (m)	Graphic Log	SPT N-Value	Soil Description
D	1			Darkish clay with rock's fragments
SS	2		12	Brown clay with carbonate
D	3 Foundation			
SS	4		19	
D	5			Brown clay with sand
	6			
SS	7		19	
D	8			
	9			
SS	10		37	
D	11			Greenish marlstone
	12			
SS	13		>50	
		End of BH		
	14			
	15			
	16			

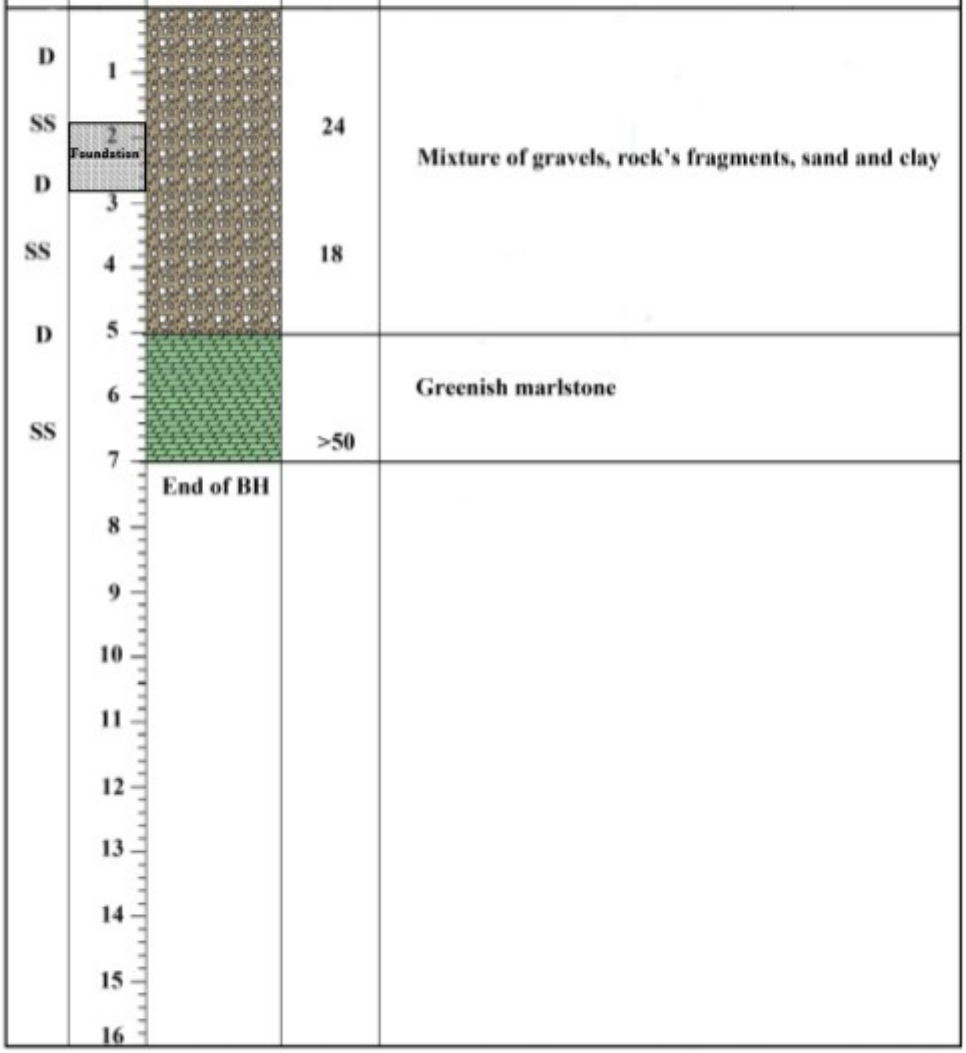
SS=Split Spoon D= Disturbed U= Undisturbed

BOREHOLE LOG SHEET

Project: Shary Mamostayan

Location: Sulaimani-Qirga

Borehole No.: BH 48 Elevation of G.L.: 770.82



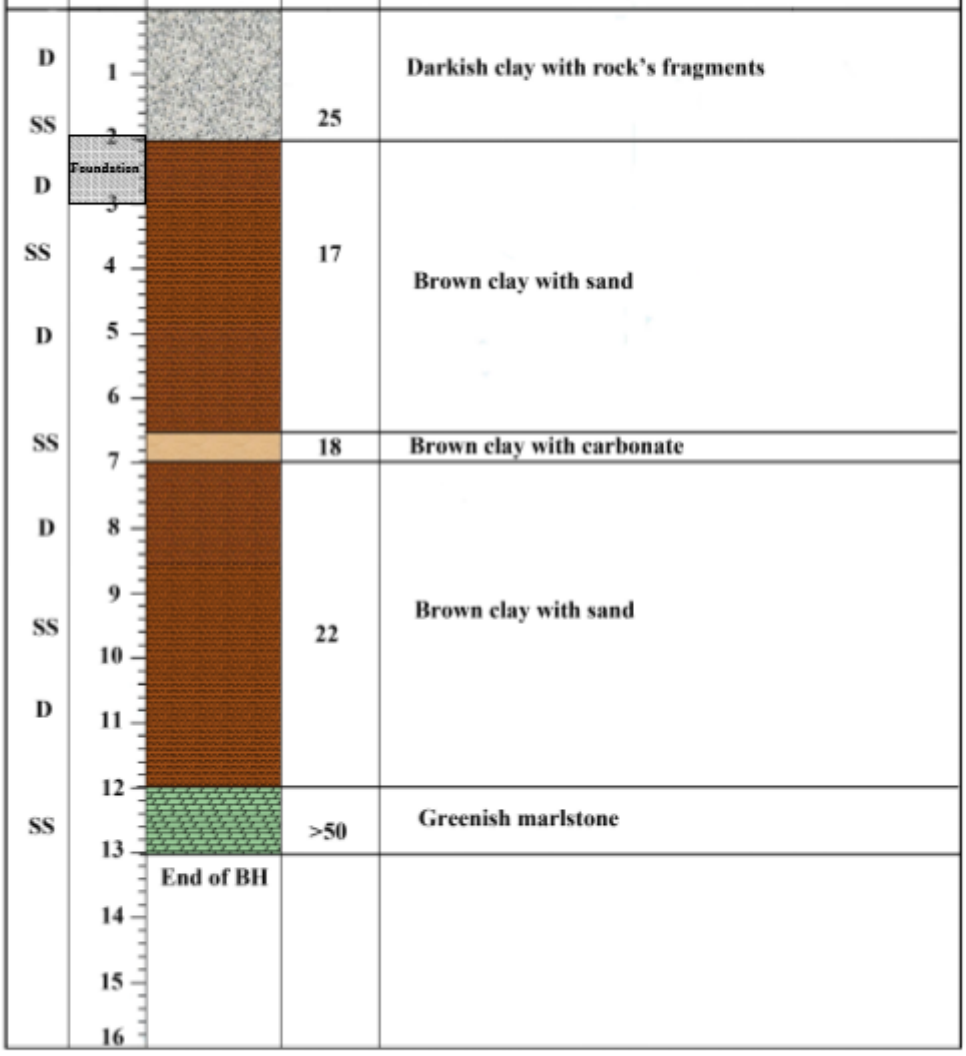
SS=Split Spoon D= Disturbed U= Undisturbed

BOREHOLE LOG SHEET

Project: Shary Mamostayan

Location: Sulaimani-Qirga

Borehole No.: BH 49 Elevation of G.L.: 769.4



SS=Split Spoon D= Disturbed U= Undisturbed

BOREHOLE LOG SHEET

Project: Shary Mamostayan

Location: Sulaimani-Qirga

Borehole No.: BH 50 Elevation of G.L.: 767.0

Sample type	Depth (m) Foundation	Graphic Log	SPT N-Value	Soil Description
D	1			Mixture of gravels, rock's fragments, sand and clay
SS	2		21	
D	3			
SS	4		22	
D	5			Greenish marlstone
	6			
SS	7		>50	
		End of BH		
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			

SS=Split Spoon D= Disturbed U= Undisturbed

So it is recommended to solve the problem of the nonhomogeneity of the foundation soil under some of the buildings. The problem can be solved by using one of the following alternatives:

- By decreasing applied contact pressure on the foundation soil. This can be done by reducing number of stories of the apartment building (may be reduced to ten stories of less).
- By using pier foundations.

In case of using Drilled Piers; Drilled piers are the most popular of deep foundations, because they have the capability that one single pier can easily carry the entire load from a large column for the building.

The advantages of drilled piers are that they can carry large seismic loads, and they are easier to install than driven or single small piles, and usually economical.

Cast-in-place piers with a diameter of 1000 mm or more and to a different depths varying between 6.0 to 12.0 m or more under the mat foundation can be used to transfer the loading to stronger and less compressible bed rock layer of Tanjero Formation. There are three stages in constructing piers as shown in the figure; -

(a) The shaft is excavated to the desired depth.

(b) The reinforcing steel cage is lowered into the excavation

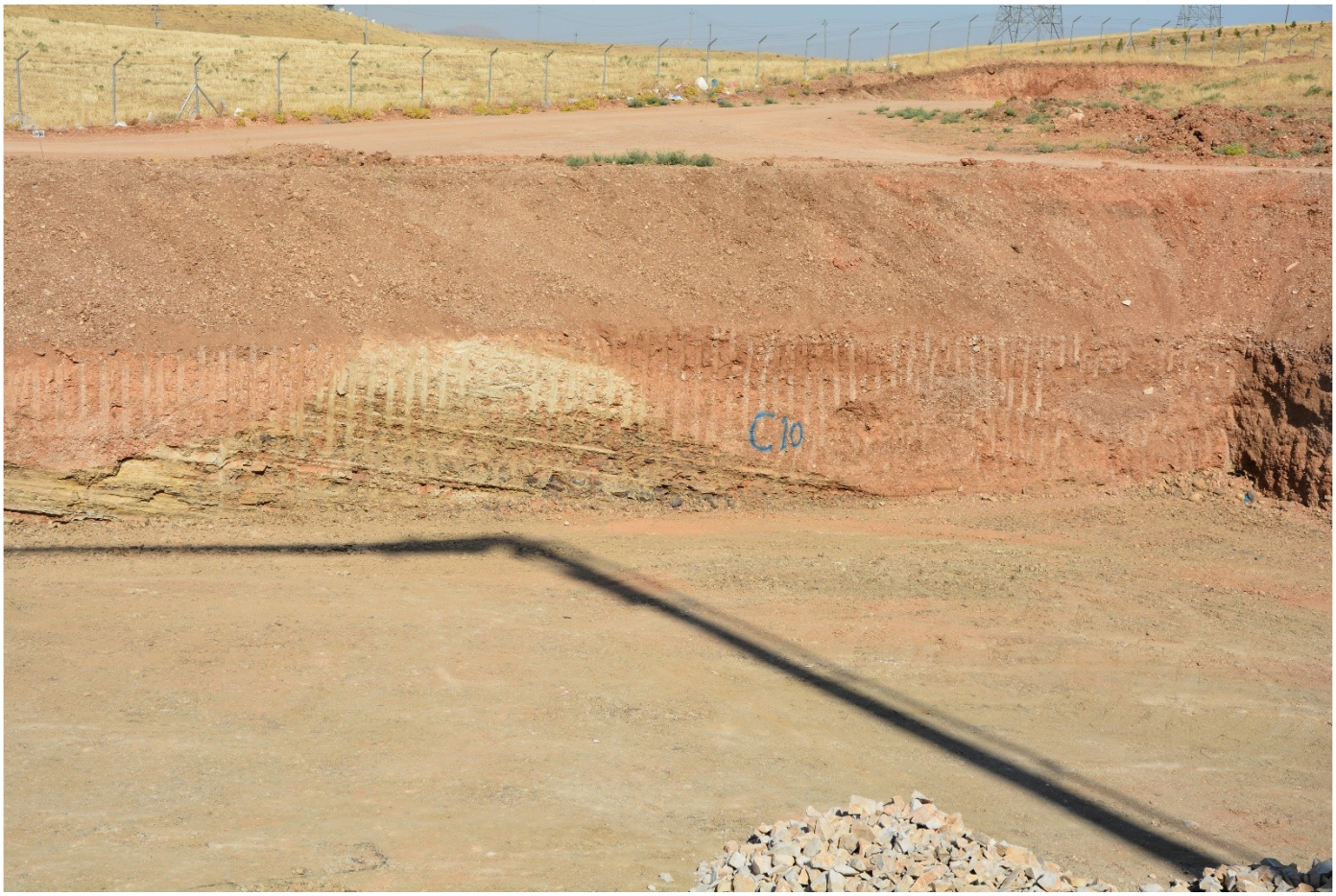
(c) The hole is filled with concrete.

وێنەی ڕوونکردنەوەی حفریات و کۆنکرێتکردنی ئەو بەشانەی پێویست بووە هەڵکەندرێت و بخرێتەوە سەر چینی بەرد کەوا بەهێزەو کێشەی داخزانی نیە لە باڵەخانەی (C9):


LIEBHERR
314


C9

وێنەی ڕوونکردنەوەی حفریات و کۆنکرێتکردنی ئەو بەشانەی پێویست بووە هەڵکەندرێت و بخرێتەوە سەر چینی بەرد کەوا بەهێزەو کێشەی داخزانی نیە لە باڵەخانەی (C10):


C10


S150

9.Conclusion :

پاش ئه نجامدانی تێستی گڵی بناغەی باڵەخانەکان و دەست کەوتنی ئه نجامه جیاوەزەکان ودەرکەوتنی ئەو کێشانەی که پێشتر باسمانکردن بەتایبەت کێشەی ناچونیەکی گڵی ژێر بناغه (non-homogeneity) **پاش ڕاوێژکردن لەگەڵ کەسانی پسپۆڕی بواری خاك و دیزاینەری ئینشائی باڵەخانەکان بۆمان دەرکەوت چارەسەری ئەو کێشەیە بەڕێگەی** (Using pier foundations) **بەتەواوەتی لە سەلامەتی باڵەخانەکە دڵنیا دەبین.**

Following completion of building foundation soil test, obtaining different outcomes and discovering the difficulties raised in this thesis especially (non-homogeneity). Subsequent to thorough consultation with professionals in soil sectorand structural building designers; we

detected the solution for such an issue by (Using pier foundations), and consequently the building safety is irrefutable.

Best regard