SITE INVESTIGATION REPORT

For The Proposed

JAIPCO PROJECT
Zone 1 - Industrial Zone

LOCATED

JERICHO - PALESTINE

SI 13/637

SUBMITTED TO:

International Building Systems Factory Co.

SUBMITTED BY:

GEOTECHNICAL & MATERIAL TESTING CENTER
(GMT)
A SUBSIDIARY OF
ENVIRONMENTAL & CIVIL
ENGINEERING STUDIES CO.

June, 2013

GEOTECHNICAL & MATERIAL TESTING CENTER

GMT

Date: 22/06/2013
Our Ref.: Report SI 13/0637

Messers : International Building systems Factory Co.

Subject: Site Investigation Report for JAIPCO Project in Industrial zone - Jericho

Dear Sir,

It is of our pleasure to submit you this geotechnical report for the site mentioned above. This investigation was carried out according to your request.

This report includes the results of field investigation, laboratory results, and the required conclusions and recommendations needed for the design & construction of the most suitable and economical foundation.

For any further information or clarifications, please don't hesitate to contact us.

We would like to thank you for your condience, hoping to cooperate with you in the near future.

Yours Sincerely,

Eng. Mahmoud Abdallah
General Manager

Quality is our Business

مركز الفحوصات الجيوتقنية والمواد
Geotechnical & Material Testing Center

Date:22/06/2013

Site Investigation Report

Req. No. SI 13/0637 تقرير فحص رقم

Description	البيان
Client Name: International Building Systems Factory Co.	**اسم الزبون:** شركة المصنع العالمي لأنظمة المباني المحدودة
Project Name: JAIPCO Project	**اسم المشروع:** مدينة أريحا الصناعية
Address: Industrial Zone - Jericho	العنوان: المدينة الصناعية – أريحا
Req. Date: 10/06/2013	تاريخ الطلب 10/06/2013
Contractor: International Building Systems Factory Co.	المقاول: شركة المصنع العالمي لأنظمة المباني المحدودة
Engineer:	المهندس:
Sample Taken by: GMT Center Drill	أخذت العينات بواسطة: حفار مركز الفحوصات
Sample Received by: Lab Technician	استلمت العينات بواسطة: فني المختبر

اسم الفحص:	حسب المواصفة:
Site Investigation.	ASTM D 2216-92, ASTM D 2113-83, ASTM D 2938-95, ASTM D 2488-93

تفصيل الفحص:

Allowable Bearing Capacity, Foundation Depth, Side Slope, Earth Pressure, Backfill Materials….

Number of Pages: 17 + Content + **Appendix A+B**	عدد الصفحات: 17 + الفهرس + **Appendix A+B**
No scratching or changes is allowed	لا يسمح بأي قشط أو تغيير في هذه الشهادة

نتائج الفحص مبينة في صفحة :
Test results shown in Page/s: 1 & 17 Appendix A+B

Checked by:	Approved by:	G. Manager:

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SUMMARY OF RECOMMENDATIONS

The purpose of this report is to investiagte and provide reliable, specific and detailed information about the physical, mechanical properties, thickness of the foundation ground, as well as to provide the designer with the necessary information which will be required for a safe and economic design and excavation of the engineering works, such as the soil bearing capacity, recommended foundation depth and type, expected foundation settlement, side slope stability, hydorlogical conditions at the site and other special recommendation which depends on the site nature Please See Table 1.

Table 1: Summary of the conclusions and the Recomendations

Article No.	Item	Description	Illustration Pages
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1. INTRODUCTION

This report is prepared upon the request of ***International Building Systems Factory Co.*** It includes the final results of the geotechnical site investigation, laboratory tests, ***conclusions & recommendations*** for the proposed ***JAIPCO project*** located in Industrial Zone, Zone 1 - Jericho - Palestine.

2. ABOUT THE STUDY

2.1 Scope Of Investigation:

The scope of work included the following:

1. Review of available data pertinent to the site.
2. Making visits to the site in order to collect information about site nature, topography of the site, geological features and other properties concerning the project site.
3. Drilling of ***eight*** boreholes and sampling of disturbed and undisturbed samples.
4. Performing the necessary field and laboratory tests, and carrying out the geological description of the obtained materials.
5. Applying engineering analysis of field findings and laboratory results.
6. Developing conclusions and recommendations concerning design and construction of the most safe and economical foundations.

3. STANDARD OF CARE

The services performed by GMT were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession practicing contemporaneously under similar conditions in the locality of the project. No other warranty, expressed or implied, is made.

4. PROJECT DESCRIPTION

The proposed project will be composed of ***two steel hangers.*** The area of each hanger is about (3235m^2). The plot survey is shown in **Appendix A.**

5. ABOUT THE SITE

5.1 Site Description

The site is approximetly horizontal level. A site plan is enclosed in Appendix A. The site is located in a Jericho Argo - Industrial Development zone nominated for ne industry.

5.2 Site Geology

Referring to the available geologic map of Israel (former Palestine), scale **(1:50,000),** printed by the Geological Survey of Israel in **1989**, the following geological properties can be summarized:

1) The project site lies within *Judea Group.*
2) *Formation*: **Lisan** formnation.
3) *Composition of the formation*: **sandstone, gravel, conglomerate, mud stone and gypsum .**
4) *Geological Age*: **Quaternary.**.
5) ***Surface faults*: There is no surface fault within the tested plot, but the area is close to jordan rift valley.**

A geologic map of the site, which is extracted from the geological map of Jericho, is shown in Figure1.

Figure 1: Site Geology

6. INVESTIGATION AND TESTING

6.1 Subsurface Investigation

The field investigation to determine the engineering characteristics of the subsurface materials included a investigation of the project site, drilling of boreholes,and perform SPT tests, and auger samples. The drilling consisted of eight test borings at the locations depicted on the Site Plan (**Appendix A**).

The drilling was carried out on 10-11/06/2013 using a mobile rig (B-31) by applying rotary drilling and auto percussion method.

6.2 Laboratory Testing:

After carrying out the geological description on the obtained samples, a laboratory tests program was issued; this program contained the required tests on selected samples in order to determine the physical and mechanical properties of the ground materials. The following standards and specifications of the **American Society for Testing and Materials** (**ASTM**) were used when applicable to the foundation soil type.

Table 2: Common Soil Laboratory Tests Used in Geotechnical Engineering

Type of condition (1)	Soil Properties (2)	Specification (3)
Index Tests	Classification	ASTM D 2487-93
	Particle size	ASTM D 422-90
	Atterberg limits	ASTM D 4318-95
	Water (or moisture) content	ASTM D 2216-92
	Wet density	Block samples or sampling tubes
	Specific gravity	ASTM D 854-92
	Sand equivalent (SE)	ASTM D 2419-95*
Settlement	Consolidation	ASTM D 2435-96
	Collapse	ASTM D 5333-96
	Organic content	ASTM D 2974-95
	Fill compaction: Modified Proctor	ASTM D 1557-91
Expansive Soil	Swell	ASTM D 4546-96
	Expansion index test	ASTM D4829-95or UBC 18-2
Shear strength for slope movement	Unconfined compressive strength	ASTM D 2166-91
	Unconsolidated undrained	ASTM D 2850-95
	Consolidated undrained.	ASTM D 4767-95
	Direct shear	ASTM D 3080-90
Erosion	Dispersive clay	ASTM D 4647-93
	Erosion potential	Day, 1990b
Pavements and deterioration	Pavements: CBR	ASTM D 1883-94
	Pavement: R-value	ASTM D 2844-94
	Sulfate	Chemical analysis
Permeability	Constant head	ASTM D 2434-94
	Falling head	ASTM D 5084-97+

6.3 Laboratory Tests Results:

The results of the laboratory tests are summarized in **Appendix (B),** in the logs of boring charts.

7. SURFACE AND SUBSURFACE CONDITIONS

7.1 Properties of Ground Materials:

According to the exploration, our findings, and the geological description for the obtained samples, there are general similarities and continuities of the subsurface materials, however some local variations were noticed along the drilled depths as illustrated by the general section through the boreholes in each building site.

For the ***eight boreholes***, a longitudinal generalized subsurface section is constructed from west to east, as presented in **Figures No. 2**. This section links the eight boreholes. The profile is constructed by direct interpolation between the materials encountered in the boreholes. The lines connecting the various ground strata are made for illustration purposes only and are not to be considered as actual field conditions.

The encountered layers are described as follow:

Layer one (top - 0.7m) Compacted wadi material.
Layer two (0.7-6.5m) Very pale brown chalky material and mudstone.
Layer three (6.5-11m) Brownish silty material.

7.1.1 *Ground Water and Cavities:*

During our investigation, neither ground water nor cavities were incountered.The samples were obtained continously without any interruption in sampling.

7.1.2 *Expansive Soil and Swell Properties*

In our case eight samples were tested to determine the modified free swell index (Sd).
These results showed that the value of Sd (8.3 – 25),which indicate that the soil has low to moderate swelling potential.

8. CONCLUSIONS AND RECOMMENDATIONS

According to the field exploration, laboratory testing, subsurface conditions and engineering analysis, it can be concluded that the existing ground at the site can not support the expected building loads without special modifications and the following recommendations as follow:

8.1 ***Foundation Ground,Depth & Type:***

- ***Foundation Ground:***

Based on our findings and analyses of the encountered material, it is recommended that the foundations of the proposed building will be laid on ***"Artificial layer of aggregate base coarse of thickness (2.0)m, spread in layers of (25)cm thick and compacted to (98)% modified proctor".***

8.2 ***Foundation Depth:***

- **General**

Foundation must be located properly so as not to be adversely affected by outside influence (adjancent structures, water, frost action, significant soil volume change, underground defects). Thus the depth and location of foundations depend on:

(a) Depth of the bearing stratum.
(b) Frost action.
(c) Ground water location.
(d) Existence of soil which exhibit volume change.
(e) Adjacent structures.
(f) Underground defects (caves, utility pipes).

- **Recommended Depth of Foundation**

1. The recommended foundation layers should be (2.5)m below the existing basecourse (wadi material) layer.
2. The R.C footing should be laid on the top of the recommended artificial foundation and about (0.5)m below the existing level.
3. In any case, the top of footings should be designed to be not less (50) cm below the surrounding streets levels.

8.3 ***Foundation Type:***

- ***General:***

Foundation can be defined as that part of the structure, which transmit the building load to the foundation soil in a way so that the supporting soil is not over stressed and does not undergo excessive settlement.

Foundation generally can be divided into two major groups:

(a) **Shallow foundations:** which is located at shallow depth (usually depth of the footing is less than two times the footing width) below the ground surface.

This type of footing is suitable for good bearing stratum is located at shallow depth.

Example of these footing are: ***spread footing, combined footing, wall footing & mat foundation.***

(b) **Deep foundations:** used when the upper layer is weak and there is a good bearing layer or bed rock at a greater depths.

Example of these footings are: piles and piers foundation.
Any how, the foundation type should be defined by the A/E designer depending on many factores, of which the main importants are the following:

1. The foundation material type and bearing capacity.
2. Type of structure and structural system.
3. The value of imposed loads on footings.
4. The siesmic charactersitics of the location.

- ***Recommended Type of Footing***

It is up to the engineer to decide his best alternative regarding the above mentioned factors from the following types:

- **Pile foundation** is recommended, or
- **Spread footings with strip beams could be utilized.**

8.4 *Allowable Bearing Capacity*

8.4.1 Standard Penetration Test (SPT):

Six SPT tests were performed on BH.8 between depth 1.25m to 3.9m. Results are shown below:

Borehole No.	Depth (m)	N30(Blows)
BH.08	1.25-1.65	13
BH.08	1.65-2.10	10
BH.08	2.10-2.55	12
BH.08	2.55-3.00	12
BH.08	3.00-3.45	12
BH.08	3.45-3.90	11

Based on the results of SPT, the soil can be classified as **soft soil.**

8.4.2 Bearing Capacity:

In our case:

The allowable bearing capacity for the artificial compacted base coarse layer is recommended to be taken as (2.0) Kg/cm^2.

This value of bearing pressure is valid, provided that the foundation ground, depth and type conform to that given above. ***(Section 7.1).***

Note:

- ***It is recommended to compact the excavated natural subgrade material before laying the aggregate base coarse up to (95)% of modified proctor.***
- ***It is recommended to conduct the plate bearing test after the aggregate base coarse layer is compacted.***

8.5 ***Foundation Settlement:***

Settlement is of concern same as the bearing capacity and most test effor is undertaken to determine the in-situ deformation modulus E and Poisson's ratio so that some type of settlement analysis can be made.
Different sources of settlement include:

a) Settlement caused by the structural loads (foundation settlement).
b) Settelement due to the weight of recently placed fill.
c) Settelment due to falling ground water table.
d) Settlements caused by underground mining or tunneling.
e) Settlements caused by the formation of sinkholes.
f) Lateral movements resulting from nearby excavations that indeirectly cause settlement.

In this report the estimated settelement will be that one resulting from the structural loads which are a combination of:

- Immediate settlement (Elastic).
- Consolidation settelement.

8.5.1 Elastic Settlement (S_i):

$$S_i = (q_{fn} B' \frac{1 - \mu^2}{E_d} C_d)$$

Where:

S_i: Immediate , or elastic foundation settlement.
q_{fm}: specified maximum net foundation pressure.
B': Characteristic Dimension of the foundation.
μ: Poissons Ration, for the encountered material.
E_d : Deformation Modulus obtained from unconfined compression tests results.
C_d : Shape & rigidity Correction Factor given in Table 3

Table 3: **Shape and rigidity factores C_d for calculating settlements of points on loaded areas at the surface of an elastic half space (after Winterkorn and Fang. 1975).**

Shape	Centre	Corner	Middle of short side	Middle of long side	Average
Cirlce	1.00	0.64	0.64	0.64	0.85
Circle (rigid)	0.79	0.79	0.79	0.79	0.79
Square	1.12	0.56	0.79	0.79	0.95
Square (rigid)	0.99	0.99	0.99	0.99	0.99
Rectangle					
Length/Width					
1.5	1.36	0.67	0.89	0.97	1.15
2	1.52	0.76	0.98	1.12	1.30
3	1.78	0.88	1.11	1.35	1.52
5	2.10	1.05	1.27	1.68	1.83
10	21.53	1.26	1.49	2.12	2.25
100	4.00	2.00	2.20	3.60	3.70
1000	5.47	2.75	2.94	5.03	5.15
10000	6.90	3.50	3.70	6.50	6.60

In our specific case, the following loads were considered in our analysis.

An analysis was carried out, the following assumptions are applied:-

a) The foundation material is composed of homogenous, isotropic rock **(Figure No. 3)**
b) Loads on the footing are given by the IBSFCO as follow:
   a. For perimeter footings = 250KN
   b. For middle footing= 500KN

c) If square rigid footing with B = 1.6 x 1.6m for middle footings and B = 1.1 x 1.1m for perimeter footings are used.
d) Estimated moduls of elasticity of the encountered material is ($E_s = 250q_a = 5 \times 10^4$ KN/m^2).

For Middle Footings $S_i = \dfrac{200(1.6)(1-0.3^2)(1.15)(1000)}{5*10^4} = 7.3$ mm.

For Perimeter Footings $S_i = \dfrac{200(1.1)(1-0.3^2)(1.15)(1000)}{5*10^4} = 5.0$ mm.

Analysis was carried out and showed that the expected elastic settlement is very small and acceptable.

8.5.2 Consolidation Settlement (S_c)

This type of settlement is time dependent settlement, and it is occur if the footing is located on a compressible layer or if this layer is located within the significant depth below the footing.

In our case, the footing are recommended to be on a layer of compacted aggregate base coarse were the consolidation settlement will be small and negligable and the stress reached to the bottom layer will cuase a settlement that would be withen the tolerable limits .

8.6 *Excavation Methods:*

It is expected that the foundation excavations will be through ***a layers of chalky and mudstone material.*** Therefore, medium, track mounted rock breakers will be needed for the foundation excavation. In addition to the conventional excavation equipment such as loaders and dozers, will be needed for the excavation works.

8.7 *Surface & Subsurface Drainage:*

It is recommended to protect the foundation ground and excavation from surface water both during and after construction by providing proper drainage and protection system. Surface water, if existed, should be diverted away from the edges of the excavations.

- **There is no groundwater encountered at the site, even through a proper drainage system is required and the foundation system shall be isolated using a proper isolation material. The supervisor engineer according to the required specifications shall select and specify this material. The extent of isolation should be up to the finished ground floor level.**

- A special drainage system for surface and storm water should be maintained for the service life of the building.

- In addition to water proofing and isolation, the storm water should be carted away from the building foundation.
- It is desired to note thate the natural ground of the construction area is very sensitive to water content and should be protected from any propable saturation. This will loosen the soil stability even below compacted layers.

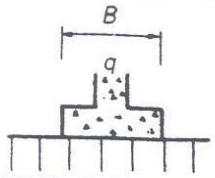
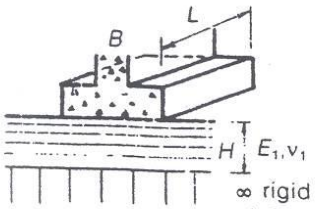
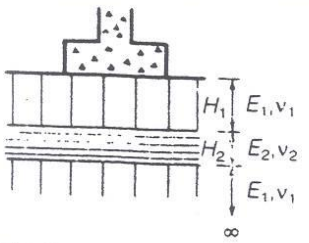
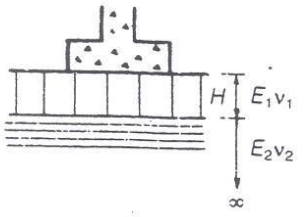
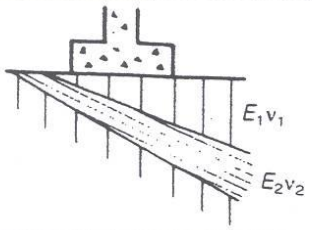
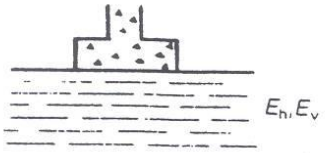
	Geological condition	Settlement calculation
	(a) Homogenous, isotropic, half space.	(a) Determine shape factor C_d from Table 5.4; (b) calculate settlement using equation (5.18).
	(b) Compressible layer on rigid base.	(a) determine ratios H/B, L/B; (b) determine shape factor C'_d from Table 5.5; (c) calculate settlement using equation (5.18).
	(c) Compressible bed within stiffer formation $E_1 > E_2$.	(a) Determine ratios $(H_1 + H_2)/B$, L/B; (b) calculate weighted modulus E for upper two beds $E = (E_1H_1 + E_2H_2)/(H_1 + H_2)$; (c) determine shape factor C'_d for ratio $(H_1 + H_2)/B$ from Table 5.5; (d) calculate settlement using equation (5.18).
	(d) Stiff bed overlying compressible formation $E_1 > E_2$.	(a) Determine ratios H/B, E_1/E_2; (b) determine correction factor a from Table 5.6; (c) determine shape factor C_d from Table 5.4; (d) calculate approximate settlement from equation (5.18) using elastic parameters E_2, ν_2 for overall foundation; (e) calculate actual settlement using equation (5.19).
	(e) Inclined, non-uniform bed of compressible rock.	Use numerical analysis to accurately model foundation geometry.
	(f) Transversly isotropic rock.	Use equations (5.20), (5.21) and (5.22).

Figure No. 2

Settlement calculation for foundation on isotropic, layered and transversely isotropic rock

8.8 ***Excavation Side Slopes:***

Excavations can be divided into two category.

a) Shallow Excavation

When the depth of excavation is less than (6m) in this case the side can be protected by provided a suitable slope sides which depend on the type of the cut material, but if a vertical cut is made, a suitable type of side support should be used.

b) Deep Excavation

When the depth of cut is more than (6m) the sides should be supported, by proper means of supports.

In our case the excavation will be mainly through a layer of sandy silty clay material. The temporary side excavation during construction should be sloped at a face inclination not steeper than **one horizontal to two vertical (1H:2V). This is valid if the excavation will last only few days, while the natural ground still keeping its water content.**

The reocmmended slope depend on the nature of the encountered material.

8.9 ***Backfill Material and Compaction Criteria:***

The encountered chalky and mudstone material resulted from the excavation works could not be used for backfilling purposes. However, the materials used for backfilling purposes should have the following properties:

1. The materials to be used for backfilling purposes shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances. It shall not contain rocks or lumps over 15 cm in greatest dimension, and not more than 15 percent larger than 7 cm. The plasticity index for the backfill material shall not be more than 15 percent. Wadi material is suitable for this purpose.

2. It shall be spread in lifts not exceeding 25 cm in uncompacted thickness, moisture conditioned to its optimum moisture content, and compacted to a dry density not less than 95 percent of the maximum dry density as obtained by standard proctor compaction test **(ASTM D 698).**

8.10 ***Earth Pressure:***

The underground structures, if existed, shall be designed for an equivalent fluid pressure of (800 kg/m^3), however, the uniform lateral pressure that corresponds to the maximum expected surface loads, should be added to the earth pressure.

The backfill material is recommended to be granular material, good drainage, so that no hydrostatic pressure will be developed behined the wall.
Angle of internal friction for this type of fill is about (30°).
Using Rankine's theory for active and passive pressure, so the coefficients can be callculated as:

1. Coefficient for lateral active pressure (Ka) is:

$$Ka = \frac{1 - \sin\phi}{1 + \sin\phi} = 0.33$$

2. Coefficient for lateral passive pressure (Kp) is:

$$Kp = \frac{1 + \sin\phi}{1 - \sin\phi} = 3.0$$

If the wall will be constrained (at rest) So (Ka) in this case is known as coefficient of lateral earth pressure at rest (Ko):

$$Ko = 1 - \sin\phi = 0.5$$

Table No. 4: Values of the angle δ for different interfaces (after NAVFAC)

Interface material	**Friction factor** tg(δ)	**Friction angle** δ°
Mass concrete on the following foundation materials:		
Clean sound rock	0.70	35
Clean gravel, gravel-sand mixtures, coarse sand	0.55 – 0.6	29 - 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	0.45 – 0.55	
Clean fine sand, silty or clayey fine to medium sand	0.35 – 0.45	19 - 24
Fine sandy silt, nonplastic silt	0.30 – 0.35	17 - 19
Very stiff and hard residual or preconsolidated clay	0.40 – 0.50	22 - 26
Medium stiff and stiff clay and silty clay	0.30 – 0.35	17 - 19

- **Effect of surcharge:**

Load imposed on the soil behind the wall should be allowed for in design. Uniform surcharge loads may be converted to an equivalent height of fill and the earth pressures calculated for the correspondingly greater height. The buildings with shallow foundation may be taken as a uniform surcharge of 10 Kpa per story. For rural main road use equivalent surcharge of 5 Kpa and for roads used by heavy traffic use 15 Kpa.

If the walls are designed to resist earthquake forces in this case an additional lateral force (PE) should be added.

$$P_E = \frac{3}{8} \frac{a_{max}}{g} \gamma_t H^2$$

Where:

amax : maximum ground acceleration (in our case amax = 0.15g).
γt : unit weight of the back fill material, can be taken as (18 KN/m3).
H : height of retaining wall.

Point of application of this force is at (0.6H) above the base of the wall.

8.11 ***Slab-on-Grade Foundation:***

- If the existing level will be the bearing layer for the slab on grade, so it is suitable to be used.
- If the level will be increased with the same existing top material compacted to (98) % of modified proctor.
- To isolate the SOG, at the top of compacted aggregate base coarse layer, two folds of polyethylene plastic are recommended to protect the slab from migrated water.
- For industrial use, the indoor slab is recommended to be (15) cm thick reinforced with a two meshes of (10) mm bars at (20) cm in both direction.
- If the area of the slab is large it is recommended to provide an expantion joint every (5) m, or every 25m^2 area.
- For the outdoor slab the thickness will be at least (12)cm and a mesh of (10)mm bars at (20)cm in both direction is used. Top and bottom mesh reinfocement is recommended for the trafic pathways and parking lot slabs.

*8.12 **Site Seismisity*:**

- **Background**

Earthquake can be defined as a sudden vibration felt on the earth surface, due to the sliding of rock slabs beneath the earth surface, this sliding occur when the energy stored in the rock overcome the frictional resistance between the rock masses causing the rock slab to slide past each other and releasing the stored energed as a waves radiate in all direction.

Earthquake is defined by it's intensity and it's magnitude. Intensity scales depend on human perceptibility and destructivity of the earthquakes (qualitative concept) several earthquake intensity scales have been proposed, the widely used one is shown in **(Table 3-a)** is the Mercalli scale.

While the magnitude of the earthquake is instrumentally measured quantity related to the total energy released during an earthquake. In1935 Richter devised a logarithmic scale for comparing the magnitudes of earthquakes.
Earthquakes of magnitude (5) or greater usually cause damage to the structures, **the amount of damage depend on**:

1- Mangitue of the earthquake.
2- Type and design of the structure.
3- Type of the foundation material
4- Duration of the earthquake.
5- Distance from the center (focus) of the earthquake.

An earthquake does not impart simple motion to a building but in general there are elastic impacts followed by forced and free vibrations of the structure, shallow foundations are sensitive to the vertical displacement component while deep foundations generally are not hazardous in an earthquake.

In order to take the effect of earthquake on the building the seismic factor concept (factor of intensity) or peak ground acceleration (PGA) had been introduced into building design . This concept means that the building should be strong enough to resist a horizontal force equal to a certain proportion of the weight of the building.

- **Our refference is:**

The ***Seismic Risk Map*** shown in **Figure No. (4)**,, which divides the region into six zones dependin on th expected horizontal ground acceleration coefficient (0.075g– 0.3g).

The site of the project lies in zone 3 with an accelration coefficient (GPA) of **(0.3g)**,is usually used for analyses.

8.13 *Inspection of the foundation grounds:*

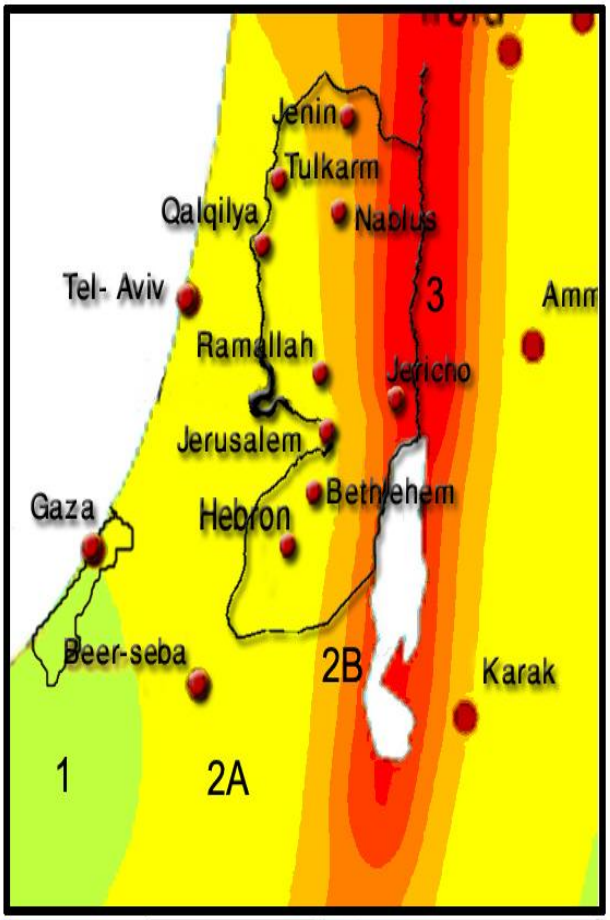
After the foundation excavation and before the construction, we should be notified in order to inspect the foundation ground. This inspection is very important to confirm that the required ground is reached and all the undesirable and loose materials are removed.

Additional fees will be requested and shall be paid by the client or the contractor.

8.14 Modulus of Subgrade Reaction (MSR):

For the encountered material, the modulus of subgrade reaction could be only estimated at this stage. Accurate MSR if requested, could be obtained from the plate bearing test to be implemented after the excavation up to the foundation ground level.
Becuase the scale and height of the designated building are comparatively small and low height.The estimated MSR is **50000 KN/m^3.**

Seismic Zone Factor,Z



Zone	1	2A	2B	3
Z	0.075	0.15	0.20	0.3

SEISMIC RISK MAP

Table 4**:** Richter and Mercalli Earthquake Scale

Richter Magnitude	Mercalli Intensity	Description
2	**I**	Usually not felt, but detected by instruments.
	II	Felt by very few people.
3	**III**	Felt by many, often mistaken for a passing vehicle.
	IV	Felt by many indoors, dishes and doors disturbed.
4	**V**	Felt by nearly everyone. People awakened. Cracked walls, trees disturbed.
5	**VI**	Felt by all. Many run outdoors. Furniture moves. Slight damage occurs.
	VII	Everyone runs outdoors. Poorly built buildings suffer severe damage. Slight damage everywhere else.
6	**VIII**	Everyone runs outdoors. Moderate to major damage. Minor damage to specially designed buildings. Chimneys and walls collapse.
7	**IX**	All buildings suffer major damage. Ground cracks, pipes break, foundations shift.
	X	Major damage. Structures destroyed. Ground is badly cracked. Landslides occur.
8	**XI**	Almost all structures fall. Bridges wrecked. Very wide cracks in ground.
	XII	Total destruction. Ground surface waves seen. Objects thrown into the air. All construction destroyed.

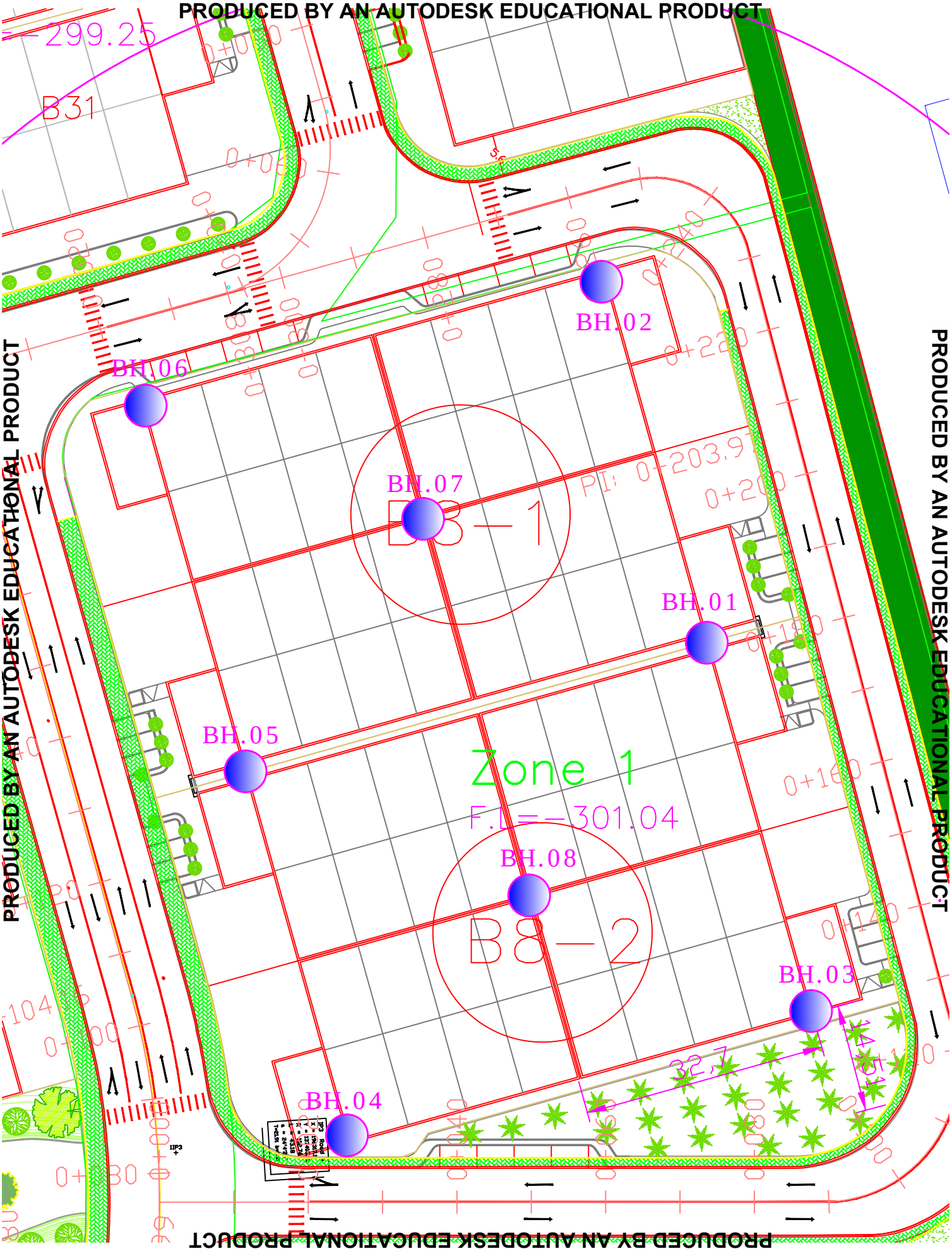
End of Report

Approved by: _____

General Manager: _____

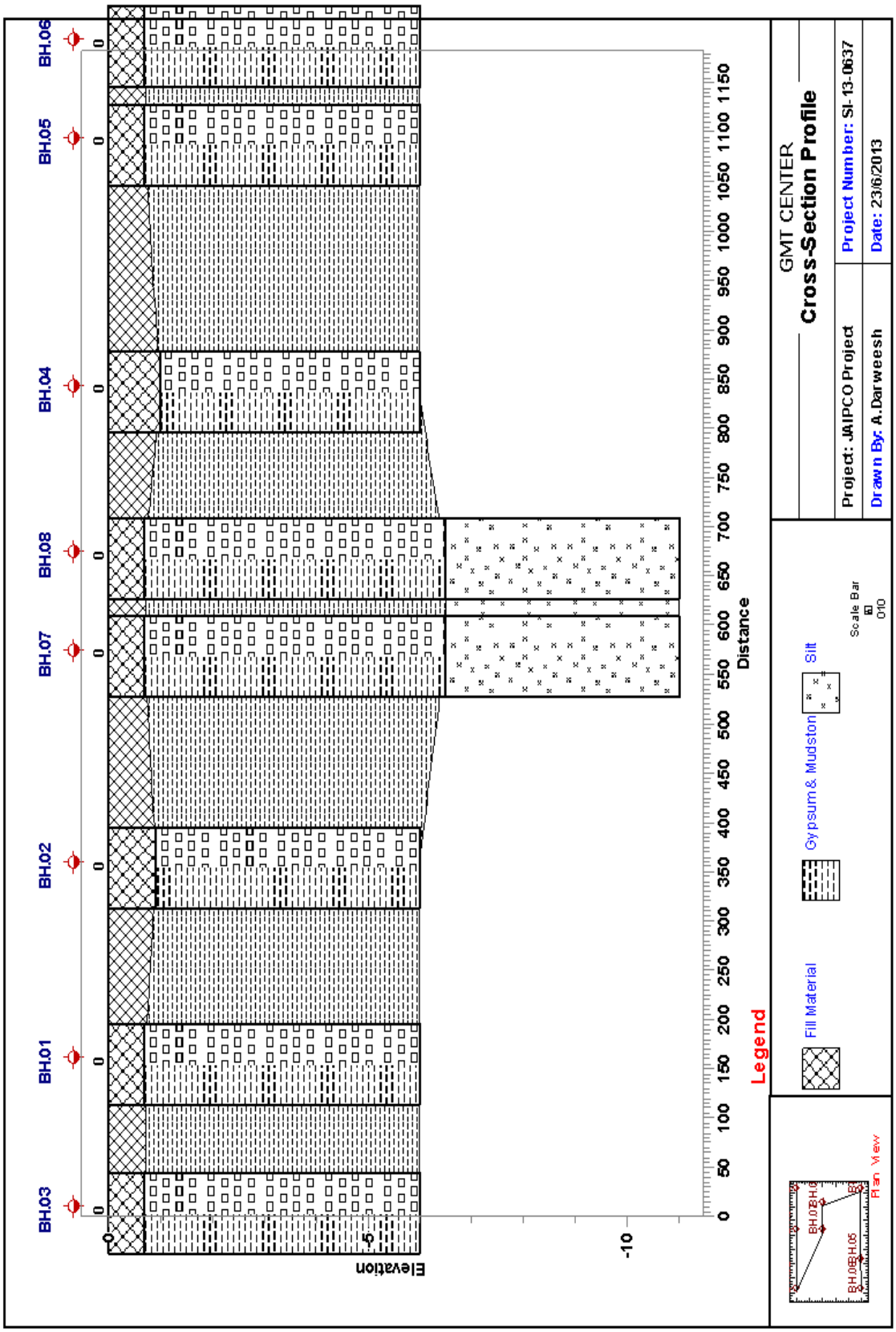
APPENDIX A

SITE PLAN & BOREHOLE LOCATIONS



APPENDIX B

LOG OF BORINGS


GMT CENTER
Cross-Section Profile
Project: JAIPCO Project
Project Number: SI-13-0637
Drawn By: A.Darweesh
Date: 23/6/2013
Legend
Fill Material
Gypsum & Mudston
Silt
Scale Bar
0 10
Plan View
BH.01
BH.02
BH.03
BH.04
BH.05
BH.06
BH.07
BH.08
Distance
Elevation
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150
-10
0

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.01

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center
GMT

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
		Fill Material Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-1.0	2	Dist.				0.5						
2			-2.0												
				3	Dist.				0.5						
3			-3.0												
4			-4.0												
				4	Dist.				0.5						
5			-5.0												
6		End of Borehole	-6.0												
7			-7.0												
8			-8.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.02

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
		Fill Material Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-1.0	2	Dist.				0.5						
2			-2.0	3	Dist.				0.5						
3			-3.0												
4			-4.0	4	Dist.				0.5						
5			-5.0												
6		End of Borehole	-6.0												
7			-7.0												
8			-8.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.03

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

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GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
		Fill Material Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-1.0	2	Dist.				0.5						
2			-2.0	3	Dist.				0.5						
3			-3.0												
4			-4.0	4	Dist.				0.5						
5			-5.0												
6		End of Borehole	-6.0												
7			-7.0												
8			-8.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.04

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

GMT

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
		Fill Material Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1			-1.0	2	Dist.				0.5						
		Gypsum _Mudstone Very pale brown chalky and mudstone material													
2			-2.0												
				3	Dist.				0.5						
3			-3.0												
4			-4.0												
				4	Dist.				0.5						
5			-5.0												
6		End of Borehole	-6.0												
7			-7.0												
8			-8.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.05

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
		Fill Material Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-1.0	2	Dist.				0.5						
2			-2.0	3	Dist.				0.5						
3			-3.0												
4			-4.0	4	Dist.				0.5						
5			-5.0												
6		End of Borehole	-6.0												
7			-7.0												
8			-8.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.06

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
		Fill Material Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-1.0	2	Dist.				0.5						
2			-2.0	3	Dist.				0.5						
3			-3.0												
4			-4.0	4	Dist.				0.5						
5			-5.0												
6		End of Borehole	-6.0												
7			-7.0												
8			-8.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.07

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
0		***Fill Material*** Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1			-1.0												
2		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-2.0	2	Dist.				0.5						
3			-3.0												
4			-4.0												
5			-5.0	3	Dist.				0.5						
6			-6.0												
7		***Silt*** Brownish silty material	-7.0												
8			-8.0	4	Dist.				1.0						
9			-9.0												
10			-10.0	5	Dist.				1.0						
11		End of Borehole	-11.0												
12			-12.0												
13			-13.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1

Project No: *SI-13-0637*

Project: *JAIPCO*

Client: *IBSFCO*

Coordinate:

Borehole Number: BH.08

Consultant: *MADAR Eng. Office*

Geot. Eng.: *SAHEEM*

Geo. Eng.: *AHMED*

Geotechnical & Material Testing Center

GMT CENTER
Al Ersal - Beit Assia Bldg

SUBSURFACE PROFILE				SAMPLE						Atterberg Limits			Particles Size Distrbution		
Depth	Symbol	Description	Depth/Elev.	Number	Type	Symbol	w %	N value	qu Kg/cm2	LL	PL	PI	Gravel	Sand	Silt and Clay
0		Ground Surface	0.0												
0		***Fill Material*** Fill material with granule peices and flient (Wadi material)		1	Dist.				2.0						
1			-1.0	2	Dist.				0.5						
					SPT			13							
2		***Gypsum _Mudstone*** Very pale brown chalky and mudstone material	-2.0		SPT			10							
					SPT			12							
3			-3.0		SPT			12							
					SPT			12							
4			-4.0		SPT			11							
5			-5.0	3	Dist.				0.5						
6			-6.0												
7		***Silt*** Brownish silty material	-7.0												
8			-8.0	4	Dist.				1.0						
9			-9.0												
10			-10.0	5	Dist.				1.0						
11			-11.0												
		End of Borehole													
12			-12.0												
13			-13.0												

Drilled By: SHAREEF

Drill Method: A/P

Drill Date: 10+11/6/2013

Hole Size: 100 mm

Station: N.A

Sheet: 1 of 1