

# ABRAJ FOR PILE TESTING

جامعة القاهرة  
مكتبة الإسكندرية  
إيادته المحترمة  
الجامعة المصرية  
مكتبة الإسكندرية  
إيادته المحترمة





PILE QUALITY ASSURANCE

JOB REF SLT-2014-KUH09	DATE November 23,2014
PROJECT NAME	KARBALA UNIVERSITY HOSPITAL
PROJECT LOCATION	KARBALA
REPORT FOR	STATIC LOAD TEST

## Working Test Piles

Project:

**Karbala University Hospital (600 Beds)**

Client:

**The Ministry of Higher education and Scientific Research**

Main Contractor:

**M/s. Fourth Dimension for General Contracts**

Consultant:

**M/s. A.M.TECH**

Piling Contractor:

**M/s. Middle East Foundations Group**

Static Compression Load Test Report SLT-2014-KUH09				
Revision No.	Prepared by	Reviewed by	Approved by	Issuing Date
R-0	Eng. Ramson	Eng. Ahmed	M.Sc. Eng. Ali	23 <sup>rd</sup> November,2014



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JOB REF SLT-2014-KUH09	DATE November 23,2014
PROJECT NAME	KARBALA UNIVERSITY HOSPITAL
PROJECT LOCATION	KARBALA
REPORT FOR	STATIC LOAD TEST

## **MAIN CONTENTS:**

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- II. PILE LOADING TEST RECORD & TEST GRAPH
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  - LOAD SETTLEMENT GRAP
  - TIME/LOAD GRAPH
  - TIME/SETTLEMENT GRAPH
- III. APPENDIX
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  - LOAD TEST ARRANGEMENT
  - SITE PHOTOS OF TEST SET-UP

مكتب الابراج الاستشاري لفحص الركائز



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## I. REPORT ON PILE LOAD TEST

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## Contents

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## **1. INTRODUCTION**

Fourth Dimension for General Contracts have been awarded the main contract for the construction of Karbala University Hospital, Karbala, Republic of Iraq .

As per the requirement of the project specifications, static load test has been carried out on working piles by Abraj Consultant for Pile Testing . This report evaluates and recommends the results of the static compression load test carried out on working test pile no. B 79 .

## **2. SITE DETAILS**

The location of the site is next to Karbala University.

## **3. DETAILS OF TEST PILE**

Type of pile : Bored Piles Using Temporary casing Method.

Pile diameter : 80 cm

Pile length : 25.0 m

Concrete Mix : N/mm<sup>2</sup> (Characteristic strength)

### **Reinforcement:-**

Design Capacity : 275 tons (C)

Test Load : 550 tons (C)

The pile was designed as both friction and bearing pile. The design was based on soil report made by National Center for Construction Labs and Research No. 3/1/6/2014 and the recommendation of the Consultant Engineer.

## **4. PILE TESTING**

Working pile no. B 79 (80 cm dia.) load test was carried out on 11<sup>th</sup> November 2014 to a test load of 200 % of the working load :-



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#### **4.1 TEST ARRANGEMENT**

The Pile was tested by using the kentledge system as shown in the sketch and method statement . A hydraulic jack was placed between the pile head and the main beam supporting the load.

Four dial gauges were setup over the pile head to record the settlement of the pile during loading and the release of the load.

#### **4.2 LOADING**

The test loads were applied in one cycle. The Loading was carried out every 60 minutes in 69 tons increments for 80 cm diameter working pile until the test loads were reached. The test load was maintained for 12 hours.

Readings of loadings and settlements were recorded as shown in pile loading test record. The loads were released in 138 tons decrements at every 60 minutes to zero . The zero load was maintained for 1 hour. Readings were recorded as enclosed .

#### **4.3 OFF-LOADING**

550-0 (Ton) The loads were released in steps of 138 tons decrements at every 60 minutes intervals with zero load being maintained for one hour.

In all cases gauge readings were taken at the times shown. These reading are kept by each party.

Gauge readings, time and load were recorded as per the attached field sheets.

#### **4.4 SETTLEMENT**

These were recorded by means of four gauges graduated in mm.

Time/Load , Time/Settlement and Load/Settlement graphs were drawn from the field results and are attached.

#### **ACCEPTANCE CRITERIA**

Pile Loading	100% Design Load	200 % Design Load
Maximum Settlement at Loading	10 mm	25 mm



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## 5. RESULTS

PILE NO.	SETTLEMENT AT 100% DESING LOAD	SETTLEMENT AT 200% DESING LOAD	RESIDUAL SETTLEMENT
WTP B 79	-3.003 mm	-14.763 mm	-7.480 mm

## 6. CONCLUSION

The settlement results are within the acceptable limits for piling works.

We have appreciated the opportunity to be of assistance to you on this project. If you have further need of our services, or if you have any questions regarding the results presented in this report, please feel free to contact our office.

Respectfully Yours,

Ali Kadhim Jassim  
TECHNICAL MANAGER



د. محمد نايف منظر

مكتب الابراج الاستشاري لفحص الركائز



PILE QUALITY ASSURANCE

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## II. PILE LOADING TEST RECORD & TEST GRAPH

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Load - Settlement Log									
Project: Karbala University Hospital (600 Bed)					Pile ID:		WTP B 79		
Main Contractor: Fourth Dimensions for General Contracts					Pile Length:		25.0 m		
Consultant: A.M.TECH					Design Load :		275 tons		
1st. Cycle ( 200%)									
Jack Pressure (bar)	Load (Ton)	% of working load	Loading Time	Reading Time (min)	Settlement Gauge Reading				Average Settlement (mm)
					A (mm)	B (mm)	C (mm)	D (mm)	
0	0	0	-	0	0.00	0.00	0.00	0.00	0.000
50	69	25	1 hr	0	0.55	0.35	0.45	0.60	0.488
				10	0.58	0.37	0.47	0.62	0.510
				20	0.59	0.38	0.48	0.63	0.520
				30	0.59	0.38	0.48	0.64	0.525
				40	0.59	0.39	0.49	0.64	0.530
				50	0.60	0.39	0.50	0.65	0.538
				60	0.61	0.40	0.51	0.66	0.545
99	138	50	1 hr	0	1.26	0.95	1.11	1.33	1.163
				10	1.27	0.97	1.13	1.35	1.180
				20	1.28	0.97	1.14	1.36	1.188
				30	1.29	0.98	1.15	1.36	1.195
				40	1.29	0.99	1.15	1.37	1.200
				50	1.30	1.00	1.16	1.38	1.210
				60	1.31	1.01	1.16	1.38	1.215
149	207	75	1 hr	0	2.27	1.82	2.07	2.35	2.128
				10	2.32	1.86	2.11	2.39	2.170
				20	2.34	1.90	2.14	2.41	2.198
				30	2.34	1.91	2.15	2.42	2.205
				40	2.35	1.92	2.16	2.43	2.215
				50	2.36	1.92	2.16	2.44	2.220
				60	2.36	1.92	2.16	2.45	2.223
198	275	100	1 hr	0	3.04	2.52	2.83	3.12	2.878
				10	3.09	2.57	2.87	3.18	2.928
				20	3.12	2.59	2.89	3.20	2.950
				30	3.14	2.61	2.91	3.22	2.970
				40	3.16	2.64	2.92	3.24	2.990
				50	3.17	2.65	2.93	3.25	3.000
				60	3.18	2.66	2.94	3.25	3.008
248	344	125	1 hr	0	4.16	3.66	4.01	4.29	4.030
				10	4.36	3.85	4.18	4.45	4.210
				20	4.40	3.87	4.21	4.49	4.243
				30	4.42	3.89	4.23	4.51	4.263
				40	4.45	3.92	4.25	4.53	4.288
				50	4.47	3.94	4.27	4.55	4.308
				60	4.49	3.96	4.29	4.57	4.328
298	413	150	1 hr	0	5.95	5.52	5.88	6.05	5.850
				10	6.49	6.02	6.34	6.49	6.335
				20	6.65	6.18	6.49	6.63	6.488
				30	6.74	6.29	6.58	6.73	6.585
				40	6.84	6.38	6.66	6.81	6.673
				50	6.90	6.43	6.70	6.86	6.723
				60	6.94	6.48	6.75	6.91	6.770

ABRAJ Representative

Contractor Representative

Consultant Representative





1st. Cycle (200 %)									
Jack Pressure (bar)	Load (Ton)	% of working load	Loading Time	Reading Time (min)	Settlement Gauge Reading				Average Settlement (mm)
					A (mm)	B (mm)	C (mm)	D (mm)	
347	482	175	1 hr	0	8.35	7.95	8.35	8.50	8.288
				10	9.09	8.62	8.99	9.11	8.953
				20	9.29	8.80	9.17	9.28	9.135
				30	9.44	8.96	9.34	9.43	9.318
				40	9.55	9.07	9.44	9.54	9.443
				50	9.65	9.17	9.51	9.62	9.530
				60	9.72	9.24	9.61	9.70	9.568
397	550	200	12 hr	0	11.20	10.56	11.05	11.25	11.015
				20	12.68	12.03	12.51	12.67	12.473
				40	13.05	12.39	12.88	13.03	12.838
				60	13.29	12.62	13.14	13.29	13.085
				80	13.46	12.71	13.35	13.50	13.255
				100	13.64	12.81	13.51	13.62	13.395
				120	13.75	12.90	13.63	13.74	13.505
				150	13.89	13.03	13.78	13.89	13.675
				180	14.00	13.14	13.89	13.99	13.780
				210	14.10	13.24	14.01	14.11	13.928
				240	14.21	13.34	14.11	14.21	14.033
				300	14.37	13.49	14.28	14.37	14.185
				360	14.49	13.60	14.40	14.49	14.275
				420	14.61	13.72	14.52	14.61	14.388
				480	14.71	13.81	14.61	14.71	14.483
				540	14.81	13.90	14.70	14.81	14.578
				600	14.88	13.99	14.78	14.88	14.633
				660	14.96	14.06	14.86	14.96	14.708
				720	15.03	14.13	14.93	15.03	14.763
298	413	150	1 hr	0	14.62	13.84	14.55	14.64	14.413
				20	14.60	13.81	14.53	14.64	14.395
				40	14.59	13.80	14.52	14.62	14.383
				60	14.59	13.80	14.52	14.62	14.383
198	275	100	1 hr	0	13.28	12.60	13.24	13.31	13.108
				20	13.22	12.56	13.20	13.27	13.063
				40	13.21	12.55	13.19	13.26	13.053
				60	13.20	12.49	13.18	13.25	13.030
99	138	50	1 hr	0	11.22	10.68	11.29	11.26	11.628
				20	11.18	10.64	11.27	11.22	11.588
				40	11.15	10.63	11.27	11.20	11.578
				60	11.15	10.63	11.26	11.20	11.573
0	0	0	1 hr	0	8.33	7.93	8.22	8.17	8.163
				20	7.81	7.50	7.78	7.71	7.700
				40	7.67	7.38	7.68	7.61	7.585
				60	7.58	7.29	7.56	7.49	7.480

ABRAJ Representative

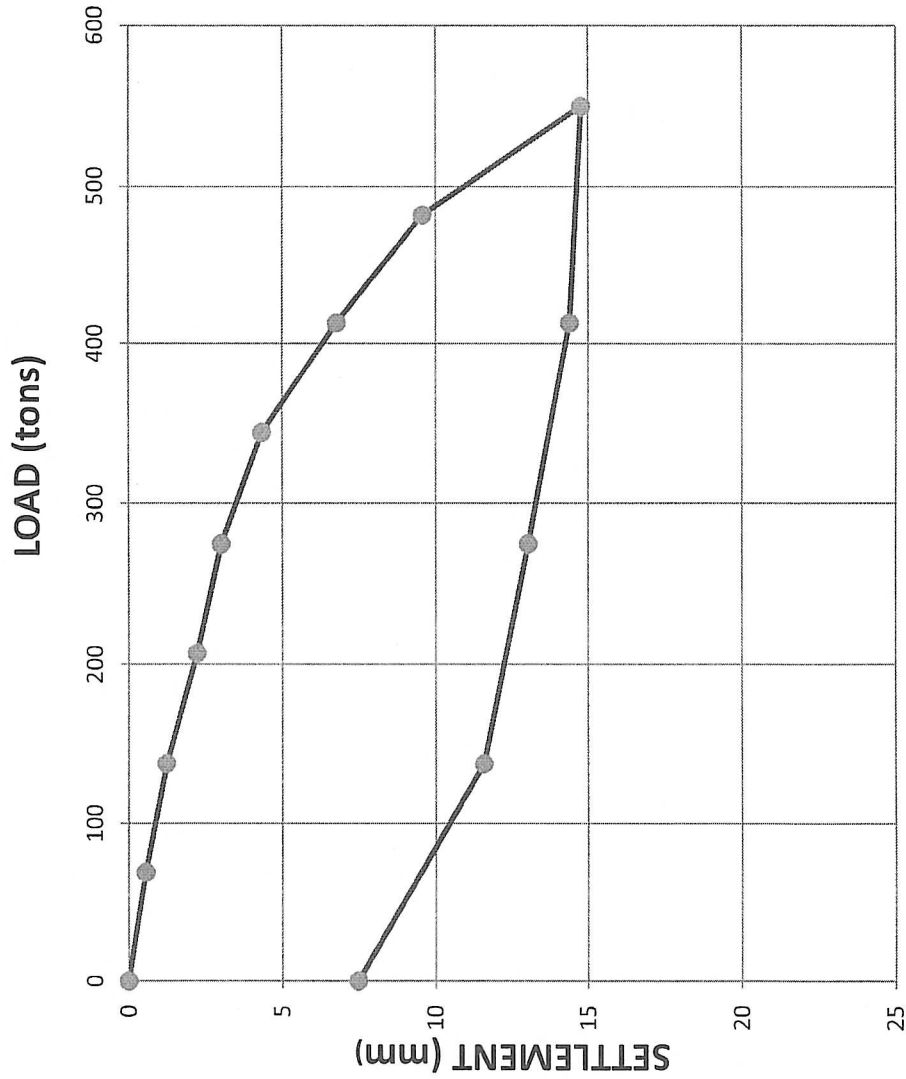
Contractor Representative

Consultant Representative



# PILE LOAD TEST GRAPH (LOAD VS SETTLEMENT CURVE)

Working Test Pile No. B 79



## LOAD VS SETTLEMENT CURVE

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11

Pile No. : WTP B 79  
Pile Type :  
Diameter of Pile : 800 mm  
Pile Toe Elevation : 25.0 M  
System of piling : Cast-in -situ bored piles by rotary drilling method  
Date pile cast : .2014  
Date of testing : 11.11.2014  
Specified working load : 275.00 tons  
Test load on pile : 550.00 tons  
Total settlement under Test load : 14.763 mm  
Net settlement : 7.480 mm

Client : Ministry of High Education and Scientific Research

Project : Karbala University Hospital ,  
Karbala , Republic of Iraq

Main Contractor :M/s. Fourth Dimension  
for General Contracts

Consultant :  
M/s. A.M.TECH.



Pile Testing Agency :  
M/s. Abraj Consultant for Pile Testing

Piling Contractor :  
M/s. Middle East Foundations Group

# PILE LOAD TEST GRAPH (LOAD VS TIME CURVE)

Working Test Pile No. B 79

## LOAD VS TIME CURVE

1

2

3

4

5

6

7

8

9

10

11

Pile No.

Pile Type

Diameter of Pile

Pile Toe Elevation

System of piling

: WTP B 79

:

: 800 mm

: 25.0 M

: Cast-in-situ bored  
piles by rotary drilling  
method

Date pile cast

: .2014

Date of testing

: 11.11.2014

Specified working load

: 275.00 tons

Test load on pile

: 550.00 tons

Total settlement under

Test load

: 14.763 mm

Net settlement

: 7.480 mm

Client : Ministry of High Education and  
Scientific Research

Project : Karbala University Hospital ,  
Karbala , Republic of Iraq

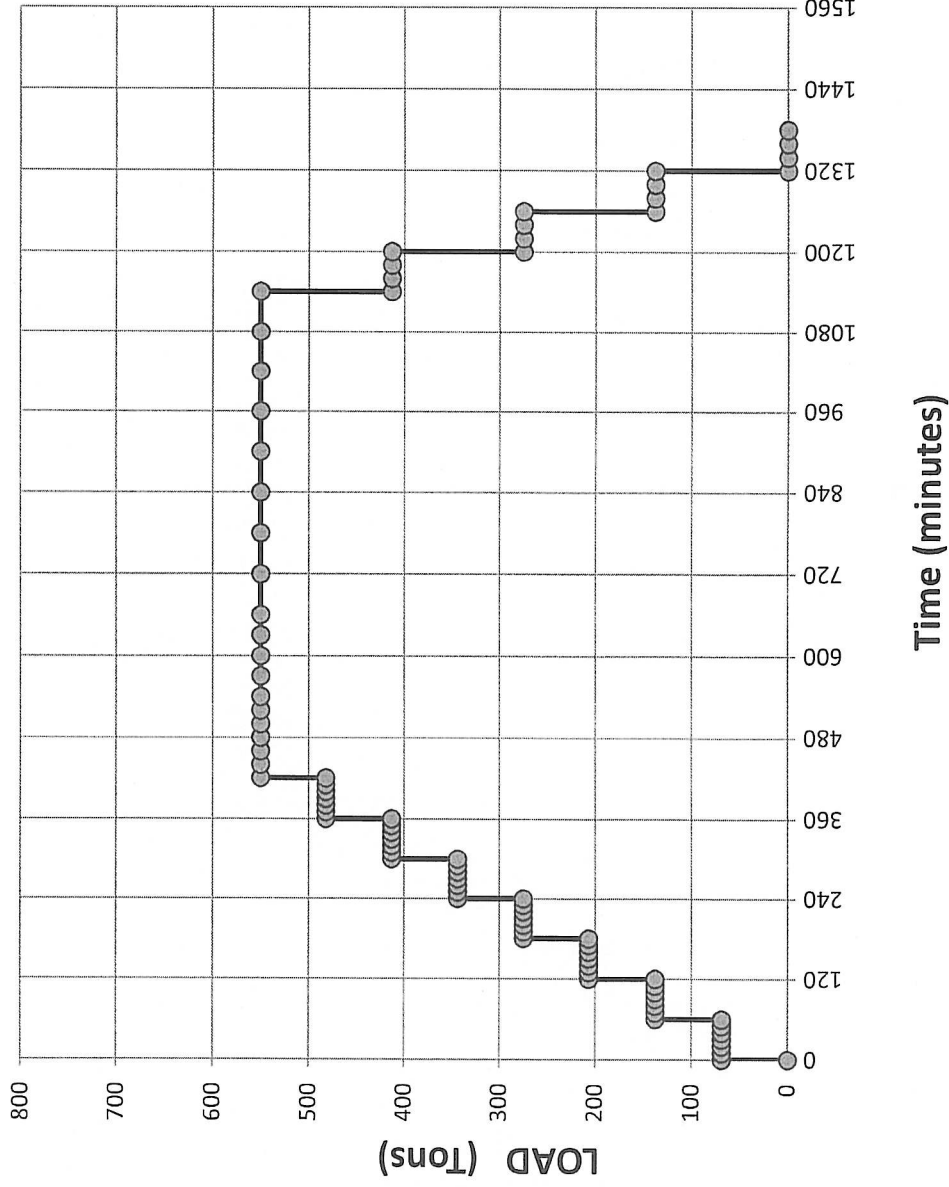
Main Contractor :M/s. Fourth Dimension  
for General Contracts

Consultant :  
M/s. A.M.TECH.



Pile Testing Agency :  
M/s. Abraj Consultant for Pile Testing

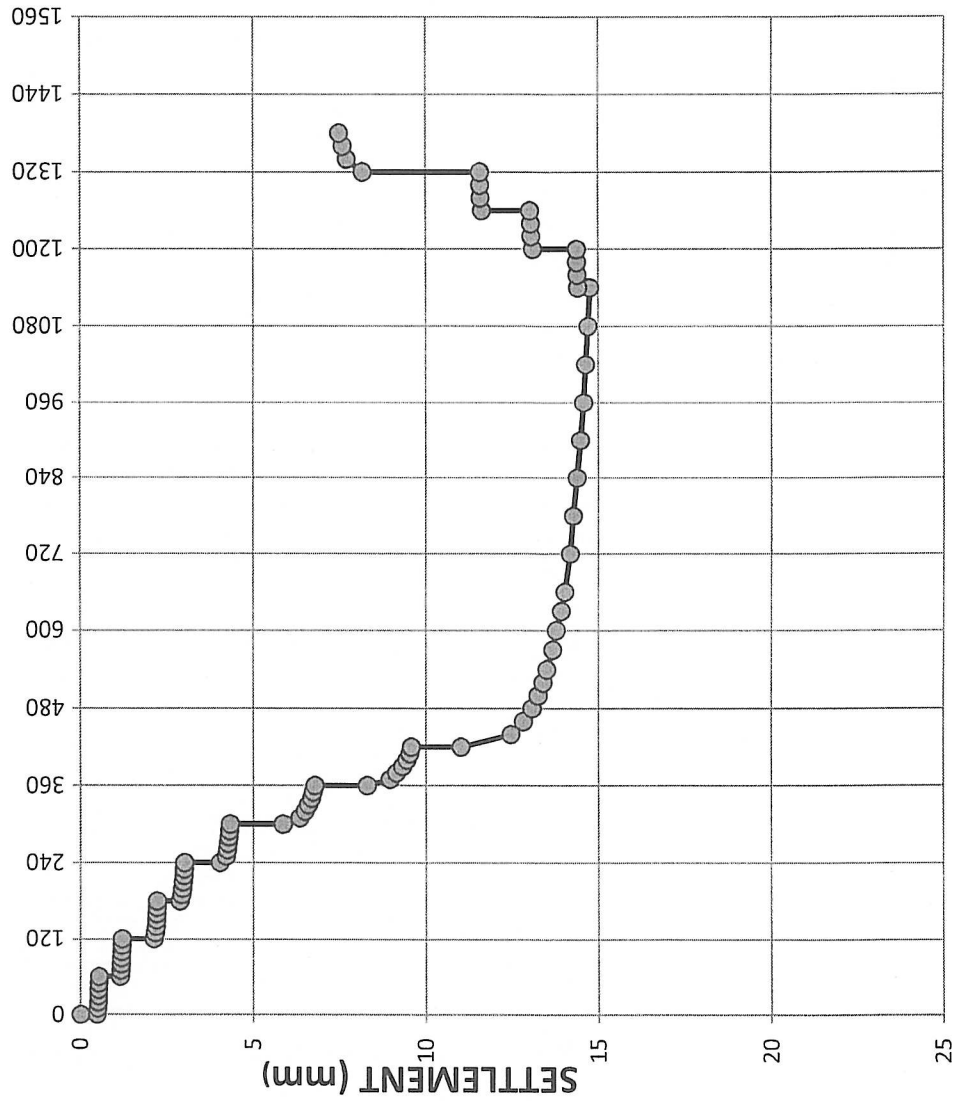
Piling Contractor :  
M/s. Middle East Foundations Group



# PILE LOAD TEST GRAPH (SETTLEMENT VS TIME CURVE)

Working Test Pile No. B 79

Time (minutes)



## SETTLEMENT VS TIME CURVE

1	Pile No.	: WTP B 79
2	Pile Type	:
3	Diameter of Pile	: 800 mm
4	Pile Toe Elevation	: 25.0 M
5	System of piling	: Cast-in -situ bored piles by rotary drilling method
6	Date pile cast	: .2014
7	Date of testing	: 11.11.2014
8	Specified working load	: 275.00 tons
9	Test load on pile	: 550.00 tons
10	Total settlement under	
11	Test load	: 14.763 mm
	Net settlement	: 7.480 mm

Client : Ministry of High Education and Scientific Research

Project : Karbala University Hospital ,  
Karbala , Republic of Iraq

Main Contractor :M/s. Fourth Dimension  
for General Contracts

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REPORT FOR	STATIC LOAD TEST

### III. APPENDIX

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**Central Organization for Standardization and Quality Control**

الجهاز المركزي للتقييس والسيطرة النوعية

P.O. Box13032 Aljadria street,Baghdad ,Tel:7765180

E-Mail [cosqc@yahoo.com](mailto:cosqc@yahoo.com)

**CALIBRATION CERTIFICATE**

شهادة معايرة

Calibration Certificate No.: D2246	رقم شهادة المعايرة: D2246
Client:	العائدية : مكتب الأبراج الاستشاري لفحص الركائز
Address:	العنوان:
Date of object Receipt: 5 /4/2014	تاريخ استلام الطلب: ٢٠١٤/٤/٥
Calibration Object: Dial gauge	اسم الجهاز: مقياس
Type (Model): INSIZE	الموديل أو النوع: INSIZE
Location of Instrument: length Lab	مكان وجود الجهاز : مختبر الطوليه والبعديه
Manufactur:	جهة الصنع :
Instrument Serial No: 2813145	رقم تسلسل الجهاز: 2813145
Range (Max capacity): 50mm	المدى أو السعة القصوى: ٥٠ مم
Division (Resolution): 0.01 mm	قيمة التدرج: ٠,٠١ مم
Calibration Date: 7/5/2014	تاريخ المعايرة: ٢٠١٤/٥/٧
Calibration Condition	ظروف المعايرة
Temp.: 24 °C Humidity: 42 %	الرطوبة ٤٢ % درجة الحرارة ٢٤ °س
Method of Calibration: According to COSQC working instruction(WI-M-05M-1 )	طريقة المعايرة

النتيجة والملاحظة: المبين صالح للاستخدام

-We certify that the above object was calibrated for specific calibration points using certified standards traceable to international standards

نشهد ان الجهاز أعلاه قد تمت معايرته في نقاط محددة باستخدام مراجع قياس معتمدة ذات سلسلة تعود الى المراجع الدولية

-Calibration result ,data and special conditions on the use of the object are stated in the corresponding page(2 )

نتائج المعايرة و البيانات وظروف استخدام الجهاز مبينة في الصفحة المرقمة ( ٢ )

Seal

Head of Length and Dimensional Section  
Hana AL Saeed

19/5/2014



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**Central Organization for Standardization and Quality Control**

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E-Mail [cosqc@yahoo.com](mailto:cosqc@yahoo.com)

**CALIBRATION CERTIFICATE**

شهادة معايرة

Calibration Certificate No.: D2247	رقم شهادة المعايرة: D2247
Client:	العائدية : مكتب الأبراج الاستشاري لفحص الركائز
Address:	العنوان:
Date of object Receipt: 5 /4/2014	تاريخ استلام الطلب: ٢٠١٤/٤/٥
Calibration Object: Dial gauge	اسم الجهاز: مقياس
Type (Model): INSIZE	الموديل أو النوع: INSIZE
Location of Instrument: length Lab	مكان وجود الجهاز : مختبر الطوليه والبعديه
Manufactur:	جهة الصنع :
Instrument Serial No: 2813058	رقم تسلسل الجهاز: 2813058
Range (Max capacity): 50mm	المدى أو السعة القصوى: ٥٠ مم
Division (Resolution): 0.01 mm	قيمة التدرج: ٠,٠١ مم
Calibration Date: 7/5/2014	تاريخ المعايرة: ٢٠١٤/٥/٧
Calibration Condition	ظروف المعايرة
Temp.: 24 °C Humidity: 42 %	الرطوبة ٤٢ % درجة الحرارة ٢٤ °س
Method of Calibration: According to COSQC working instruction(WI-M-05M-1 )	طريقة المعايرة

النتيجة والملاحظة: المبين صالح للاستخدام

-We certify that the above object was calibrated for specific calibration points using certified standards traceable to international standards

نشهد ان الجهاز اعلاه قد تمت معايرته في نقاط محددة باستخدام مراجع قياس معتمدة ذات سلسلة تعود الى المراجع الدولية

-Calibration result ,data and special conditions on the use of the object are stated in the corresponding page(2 )

نتائج المعايرة و البيانات وظروف استخدام الجهاز مبينة في الصفحة المرفقة ( ٢ )

Head of Length and Dimensional Section

Hana AL Saeed

١٩/٥/ ٢٠١٤



Seal

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**Central Organization for Standardization and Quality Control**

**الجهاز المركزي للتقييس والسيطرة النوعية**

P.O. Box13032 Aljadria street,Baghdad ,Tel:7765180

E-Mail [cosqc@yahoo.com](mailto:cosqc@yahoo.com)

**CALIBRATION CERTIFICATE**

**شهادة معايرة**

Calibration Certificate No.: D2248	رقم شهادة المعايرة: D2248
Client:	العائدية : مكتب الأبراج الاستشاري لفحص الركائز
Address:	العنوان:
Date of object Receipt: 5 /4/2014	تاريخ استلام الطلب: ٢٠١٤/٤/٥
Calibration Object: Dial gauge	اسم الجهاز: مقياس
Type (Model): INSIZE	الموديل او النوع: INSIZE
Location of Instrument: length Lab	مكان وجود الجهاز : مختبر الطولية والبعدية
Manufactur:	جهة الصنع :
Instrument Serial No: 2814179	رقم تسلسل الجهاز: 2814179
Range (Max capacity): 50mm	المدى او السعة القصوى: ٥٠ مم
Division (Resolution): 0.01 mm	قيمة التدرج: ٠,٠١ مم
Calibration Date: 7/5/2014	تاريخ المعايرة: ٢٠١٤/٥/٧
Calibration Condition	ظروف المعايرة
Temp.: 24 °C Humidity: 42 %	الرطوبة ٤٢ % درجة الحرارة ٢٤ °س
Method of Calibration: According to COSQC working instruction(WI-M-05M-1 )	طريقة المعايرة
النتيجة والملاحظة: المبين صالح للاستخدام	
-We certify that the above object was calibrated for specific calibration points using certified standards traceable to international standards نشهد ان الجهاز اعلاه قد تمت معايرته في نقاط محددة باستخدام مراجع قياس معتمدة ذات سلسلة تعود الى المراجع الدولية	
-Calibration result ,data and special conditions on the use of the object are stated in the corresponding page(2 ) نتائج المعايرة و البيانات وظروف استخدام الجهاز مبينة في الصفحة المرقمة ( ٢ )	
Head of Length and Dimensional Section Hana AL Saeed 19/5/2014	Seal
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## Central Organization for Standardization and Quality Control

الجهاز المركزي للتقييس والسيطرة النوعية

P.O. Box13032 Aljadria street,Baghdad ,Tel:7765180

E-Mail [cosqc@yahoo.com](mailto:cosqc@yahoo.com)

## CALIBRATION CERTIFICATE

شهادة معايرة

Calibration Certificate No.: D2249	رقم شهادة المعايرة: D2249
Client:	العائدية : مكتب الأبراج الاستشاري لفحص الركائز
Address:	العنوان:
Date of object Receipt: 5 /4/2014	تاريخ استلام الطلب: ٢٠١٤/٤/٥
Calibration Object: Dial gauge	اسم الجهاز: مقياس
Type (Model): INSIZE	الموديل أو النوع: INSIZE
Location of Instrument: length Lab	مكان وجود الجهاز : مختبر الطوليه والبعديه
Manufactur:	جهة الصنع :
Instrument Serial No: 2814396	رقم تسلسل الجهاز : 2814396
Range (Max capacity): 50mm	المدى أو السعة القصوى : ٥٠ مم
Division (Resolution): 0.01 mm	قيمة التدرج : ٠,٠١ مم
Calibration Date: 7/5/2014	تاريخ المعايرة : ٢٠١٤/٥/٧
Calibration Condition	ظروف المعايرة
Temp.: 24 °C Humidity: 42 %	الرطوبة ٤٢ % درجة الحرارة ٢٤ °س
Method of Calibration: According to COSQC working instruction(WI-M-05M-1 )	طريقة المعايرة
النتيجة والملاحظة: المبين صالح للاستخدام	
-We certify that the above object was calibrated for specific calibration points using certified standards traceable to international standards	
نشيد ان الجهاز أعلاه قد تمت معايرته في نقاط محددة باستخدام مراجع قياس معتمدة ذات سلسلة تعود الى المراجع الدولية	
-Calibration result ,data and special conditions on the use of the object are stated in the corresponding page(2 )	
نتائج المعايرة و البيانات وظروف استخدام الجهاز مبينة في الصفحة المرفقة ( ٢ )	
Head of Length and Dimensional Section Hana AL Saeed 19/5/2014	Seal
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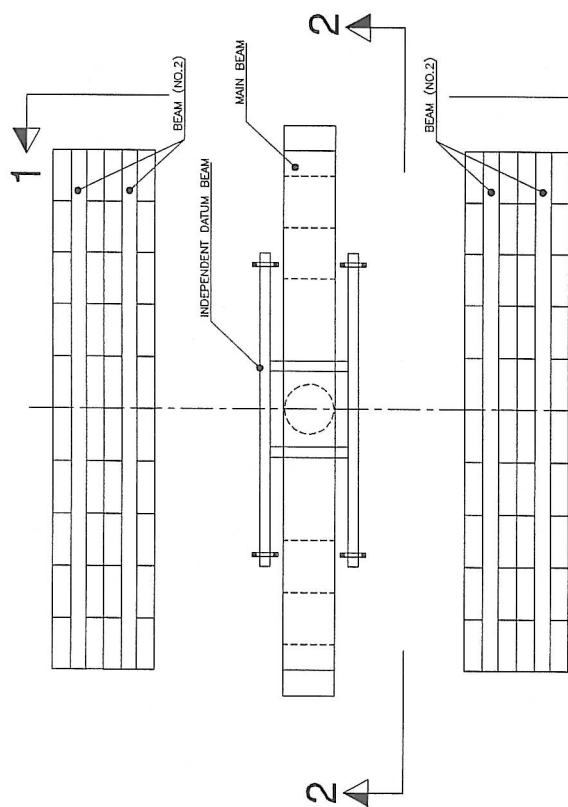
P.O. Box13032 Aljadria street,Baghdad ,Tel:7765180

E-Mail [cosqc@yahoo.com](mailto:cosqc@yahoo.com)

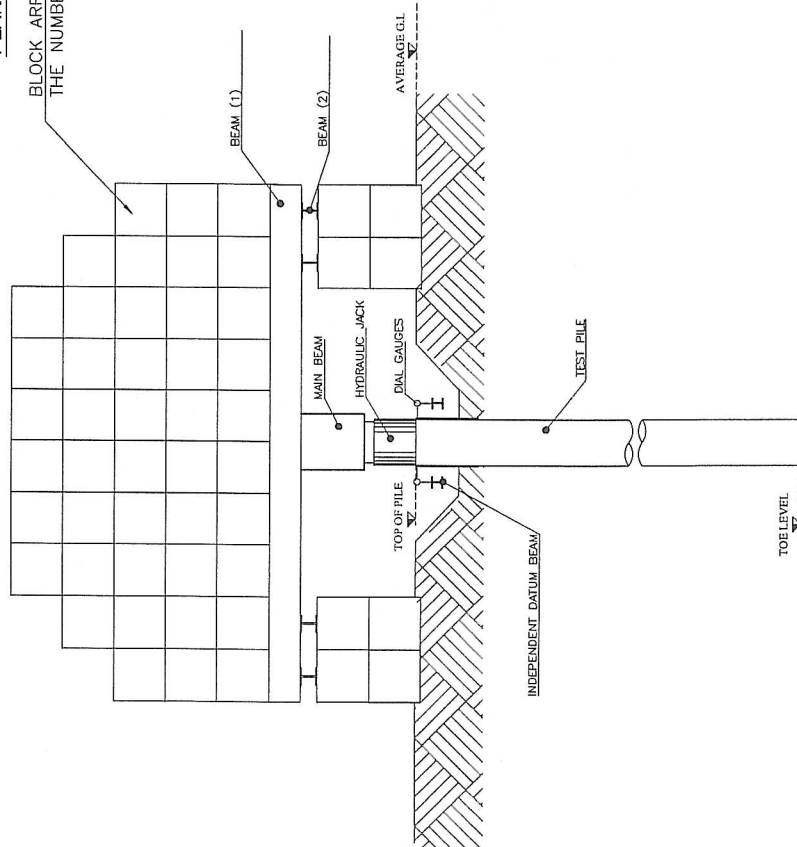
## CALIBRATION CERTIFICATE

شهادة معايرة

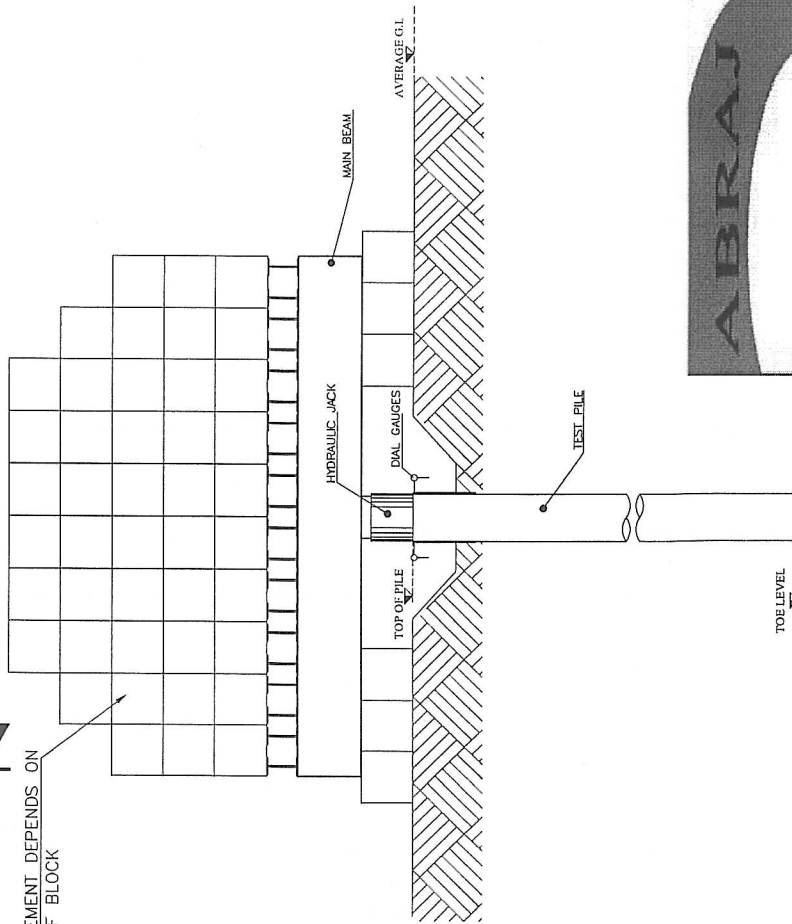
Calibration Certificate No. : 2726P	رقم شهادة المعايرة : 2726P
Client: /	العائدية: : مكتب الابراج الاستشاري لفحص الركائز
Address: /	العنوان: /
Date of object Receipt : 5 / 5 /2014	تاريخ استلام الطلب : ٢٠١٤/ ٥ / ٥
Calibration Object :PRESSURE GAUGE	اسم الجهاز : مقياس ضغط
Type (Model) : BOURDON TUBE	الموديل او النوع : انبوبة بوردين
Location of Instrument: PRESSURE LAB	مكان وجود الجهاز : مختبر قياسات الضغط
Manufacturer: WIKA	جهة الصنع : WIKA
Specifications:	رقم الجهاز:
Range (Max capacity): 680 BAR	لمدى او السعة القصوى : ٦٨٠ بار
Division (Resolution): 20 BAR	قيمة التدريجة : ٢٠ بار
Calibration Date: 7/5/2014	تاريخ المعايرة: ٢٠١٤/٥/٧
Calibration Condition:	ظروف المعايرة:
Temp.: 25 °C Humidity: 45%	الرطوبة ٤٥ % درجة الحرارة ٢٥ °س
نتيجة المعايرة : الجهاز صالح للاستخدام من مرتبة الدقة الاولى لعدم تجاوز نسبة الخطا الحدود المسموح بها 1.5%	
طريقة المعايرة	
Method of Calibration: According to COSQC working instruction(WI-M-04M-1 )	
-We certify that the above object was calibrated for specific calibration points using certified standards traceable to international standards	
نشهد ان الجهاز اعلاه قد تمت معايرته في نقاط محددة باستخدام مراجع قياس معتمدة ذات سلسلة تعود الى المراجع الدولية	
-Calibration result ,data and special conditions on the use of the object are stated in the corresponding page(2 )	
نتائج المعايرة و البيانات وظروف استخدام الجهاز مبينة في الصفحة المرقمة ( ٢ )	
Seal	
Head Of Mass And Pressure Measurement Section Hanan A.J.Al-Moudares	
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BLOCK ARRANGEMENT DEPENDS ON THE NUMBER OF BLOCK



ELEVATION-1



ELEVATION-2



