DUBAI ACCREDITATION CENTER

REPORT ON 158TH LABORATORY PROFICIENCY TESTING DETERMINATION OF MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT

6 MARCH 2008

1. INTRODUCTION

This document presents the results of the 158th inter-laboratory proficiency-testing program conducted during the month of November involving the **Determination of Maximum Dry Density and Optimum Moisture Content** with twenty two laboratories participating.
This program is part of the Inter-laboratory Comparison Programs organized by the Dubai Accreditation Center (DAC) of Dubai Municipality (DM) for monitoring the validity of test results of laboratories operating in Dubai as a requirement of the Local Order 52/1990 and ISO/IEC 17011: 2004.

2. EXPERIMENTAL DESIGN

2.1 Homogeneity:

DAC ensure the homogeneity of the samples prior to their distribution to the participating laboratories by conducting homogeneity test on six samples (randomly selected). Based on the test results the homogeneity is statistically evaluated as per *ISO 13528:2005 as explained in DAC-G3-03.*

2.2 Participants:

Nineteen private laboratories and three governmental laboratories (eleven of them are accredited by DAC for construction materials testing) participated in this program.

2.3 Samples Tested:

One sample of Cemented Sand approximately 25 KG was distributed to all participating laboratories.

3. CONFIDENTIALITY

Each laboratory is given a code number to maintain confidentiality of results and to protect their identities. Only the concerned laboratory knows its code number.

4. TEST METHOD

Instructions were given to the participants to test the samples for BS 1377 Part 4: 1990 Cl. 3.5.4.2: Amd 13925:2002.

5. TEST RESULTS

The test results submitted by the participating laboratories are presented in Appendix A. In order to protect the identity of the participating laboratories, each one was assigned a code number. The numbers in the column headings, Lab #, of the tables represents the code numbers for the participating laboratories.

6. EVALUATION OF RESULTS

6.1 Method of Analysis

The analysis of the participant's results is based on ***ISO 13528:2005*** (***Statistical Methods for the Use in Proficiency Testing by Inter-laboratory Comparisons)***

6.2 Calculations of Z- scores

Appendix B gives the details of the calculation of the laboratories results and their Z-Scores which are obtained from the raw data. Also Z- Score and participant's results are represented in a bar chart and X-Y scattered plots C. The Z-Score analysis is based on an international Standard (***ISO 13528:2005)***.

6.3 Outlier Results

Test	Labs outside the z-scores ±3
Maximum Dry Density	**Labs Nos. 11; 12;13;22**
Optimum Moisture Content	**Labs Nos. 12; 14**

7. CONCLUSION AND RECOMMENDATIONS

The test results provided by the above mentioned laboratories are outside the Z - score limits of ± 3, the abovementioned laboratories are requested to investigate the root cause of the outlier results, implement corrective action and email a report within 2 weeks to Accreditation Decisions Section of the Dubai Accreditation Center to the following address msrassol@dm.gov.ae.

8. APPENDICES

8.1 Appendix A: Raw Data
8.2 Appendix B: Calculation of z-scores and other statistics
8.3 Appendix C: Charts

Appendix A: Raw Data

Table - 1 Maximum Dry Density

Lab #	Sample No.	Results
Lab 1	15802	1.96
Lab 2	15803	1.96
Lab 3	15804	1.95
Lab 4	15805	1.96
Lab 5	15806	1.96
Lab 6	15807	1.95
Lab 7	15808	1.95
Lab 8	15810	1.95
Lab 9	15811	1.95
Lab 10	15812	1.96
Lab 11	15813	1.92
Lab 12	15815	1.89
Lab 13	15816	1.76
Lab 14	15817	1.94
Lab 15	15818	1.93
Lab 16	15819	1.96
Lab 17	15821	1.96
Lab 18	15822	1.96
Lab 19	15823	1.96
Lab 20	15824	1.95
Lab 21	15826	1.96
Lab 22	15827	2.01

Appendix A: Raw Data

Table - 2 Optimum Moisture Content

Lab #	Sample No.	Results
Lab 1	15802	10
Lab 2	15803	10
Lab 3	15804	9.6
Lab 4	15805	9.6
Lab 5	15806	9.8
Lab 6	15807	10
Lab 7	15808	10
Lab 8	15810	10
Lab 9	15811	10
Lab 10	15812	9.4
Lab 11	15813	9.3
Lab 12	15815	11
Lab 13	15816	10.2
Lab 14	15817	11.7
Lab 15	15818	9.7
Lab 16	15819	10
Lab 17	15821	9.8
Lab 18	15822	9.9
Lab 19	15823	9.1
Lab 20	15824	10
Lab 21	15826	10
Lab 22	15827	9.2

Appendix B: Calculation of z-scores and other statistics

Table -1 Maximum Dry Density

Iteration	0	xi-x*	1	$(xi-x^*)^2$	2	$(xi-x^*)^2$	3	$(xi-x^*)^2$	4	$(xi-x^*)^2$	5	$(xi-x^*)^2$	6	$(xi-x^*)^2$			
$\delta = 1.5\ s^*$	---		0.01		0.01		0.01		0.01		0.01		0.01				
$x^* - \delta$	---		1.94		1.94		1.94		1.94		1.94		1.94				
$x^* + \delta$	---		1.97		1.97		1.97		1.97		1.97		1.97		Z Score		
Lab 1	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 13**	**-23.46**
Lab 2	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 12**	**-7.73**
Lab 3	1.95	0.01	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	-0.47	**Lab 11**	**-4.10**
Lab 4	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 15**	**-2.89**
Lab 5	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 14**	**-1.68**
Lab 6	1.95	0.01	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	-0.47	**Lab 20**	**-0.47**
Lab 7	1.95	0.01	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	-0.47	**Lab 3**	**-0.47**
Lab 8	1.95	0.01	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	-0.47	**Lab 6**	**-0.47**
Lab 9	1.95	0.01	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	-0.47	**Lab 7**	**-0.47**
Lab 10	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 8**	**-0.47**
Lab 11	1.92	0.04	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	-4.10	**Lab 9**	**-0.47**
Lab 12	1.89	0.07	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	-7.73	**Lab 1**	**0.74**
Lab 13	1.76	0.20	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	-23.46	**Lab 10**	**0.74**
Lab 14	1.94	0.02	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	-1.68	**Lab 16**	**0.74**
Lab 15	1.93	0.03	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	1.94	0.00	-2.89	**Lab 17**	**0.74**
Lab 16	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 18**	**0.74**
Lab 17	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 19**	**0.74**
Lab 18	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 2**	**0.74**
Lab 19	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 21**	**0.74**
Lab 20	1.95	0.01	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	-0.47	**Lab 4**	**0.74**
Lab 21	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	1.96	0.00	0.74	**Lab 5**	**0.74**
Lab 22	2.01	0.05	1.97	0.00	1.97	0.00	1.97	0.00	1.97	0.00	1.97	0.00	1.97	0.00	6.79	**Lab 22**	**6.79**
Average	1.94		1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00	1.95	0.00			
SD	0.05		0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00			
New x*	**1.955**	**0.01**	**1.954**	**0.01**	**1.954**	**0.01**	**1.954**	**0.01**	**1.954**	**0.01**	**1.95**	**0.01**	**1.95**	**0.01**			
New s*	**0.01**		**0.008**		**0.008**		**0.008**		**0.008**		**0.01**		**0.01**				
N	**22**																

Target value	**1.95**
Low Acceptable	**1.93**
High Acceptable	**1.98**
Acceptable Range	**1.93 - 1.98**

Appendix B: Calculation of z-scores and other statistics

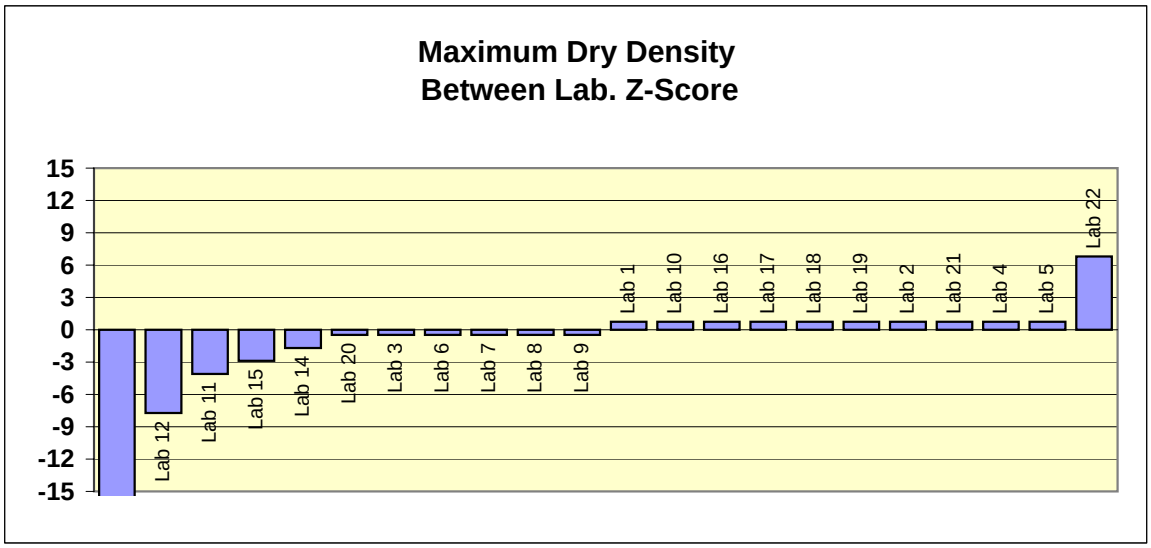
Table - 2 Optimum Moisture Content

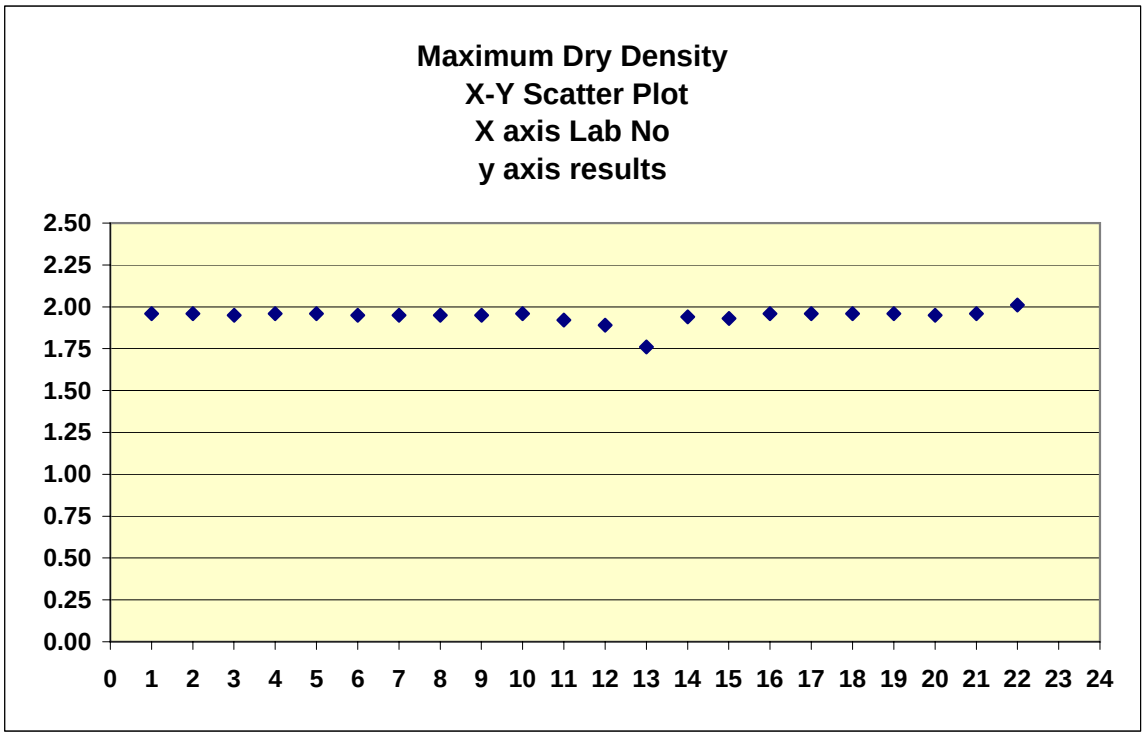
Iteration	0	xi-x*	1	$(xi-x^*)^2$	2	$(xi-x^*)^2$	3	$(xi-x^*)^2$	4	$(xi-x^*)^2$	5	$(xi-x^*)^2$	6	$(xi-x^*)^2$
$\delta = 1.5\ s^*$	---		0.44		0.45		0.42		0.41		0.41		0.41	
$x^* - \delta$	---		9.56		9.44		9.46		9.47		9.48		9.48	
$x^* + \delta$	---		10.44		10.35		10.31		10.29		10.29		10.29	
Lab 1	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 2	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 3	9.6	0.40	9.60	0.09	9.60	0.08	9.60	0.08	9.60	0.08	9.60	0.08	9.60	0.08
Lab 4	9.6	0.40	9.60	0.09	9.60	0.08	9.60	0.08	9.60	0.08	9.60	0.08	9.60	0.08
Lab 5	9.8	0.20	9.80	0.01	9.80	0.01	9.80	0.01	9.80	0.01	9.80	0.01	9.80	0.01
Lab 6	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 7	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 8	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 9	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 10	9.4	0.60	9.56	0.12	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11
Lab 11	9.3	0.70	9.56	0.12	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11
Lab 12	11	1.00	10.44	0.30	10.35	0.21	10.31	0.18	10.29	0.17	10.29	0.17	10.29	0.16
Lab 13	10.2	0.20	10.20	0.09	10.20	0.10	10.20	0.10	10.20	0.10	10.20	0.10	10.20	0.10
Lab 14	11.7	1.70	10.44	0.30	10.35	0.21	10.31	0.18	10.29	0.17	10.29	0.17	10.29	0.16
Lab 15	9.7	0.30	9.70	0.04	9.70	0.04	9.70	0.03	9.70	0.03	9.70	0.03	9.70	0.03
Lab 16	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 17	9.8	0.20	9.80	0.01	9.80	0.01	9.80	0.01	9.80	0.01	9.80	0.01	9.80	0.01
Lab 18	9.9	0.10	9.90	0.00	9.90	0.00	9.90	0.00	9.90	0.00	9.90	0.00	9.90	0.00
Lab 19	9.1	0.90	9.56	0.12	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11
Lab 20	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 21	10	0.00	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01	10.00	0.01
Lab 22	9.2	0.80	9.56	0.12	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11	9.56	0.11
Average	9.92		9.90	1.49	9.89	1.30	9.88	1.23	9.88	1.20	9.88	1.19	9.88	1.19
SD	0.56		0.27	0.07	0.25	0.06	0.24	0.06	0.24	0.06	0.24	0.06	0.24	0.06
New x*	**10**	**0.20**	**9.896**	**0.27**	**9.887**	**0.25**	**9.884**	**0.24**	**9.882**	**0.24**	**9.88**	**0.24**	**9.88**	**0.24**
New s*	**0.30**		**0.302**		**0.282**		**0.274**		**0.271**		**0.27**		**0.27**	
N	**22**													

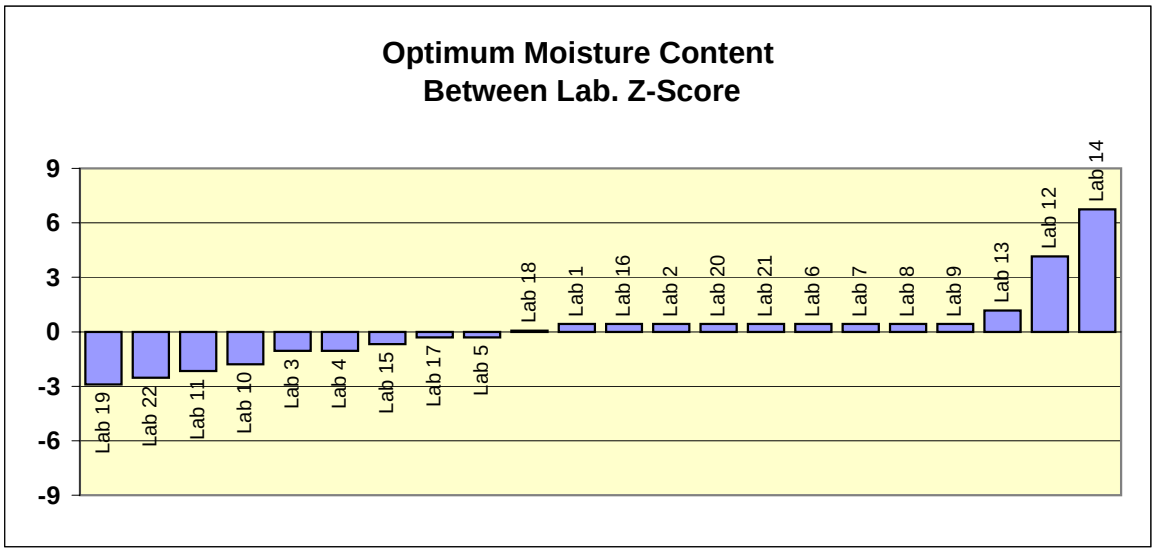
Target value	**9.88**
Low Acceptable	**9.07**
High Acceptable	**10.69**
Acceptable Range	**9.07 - 10.69**

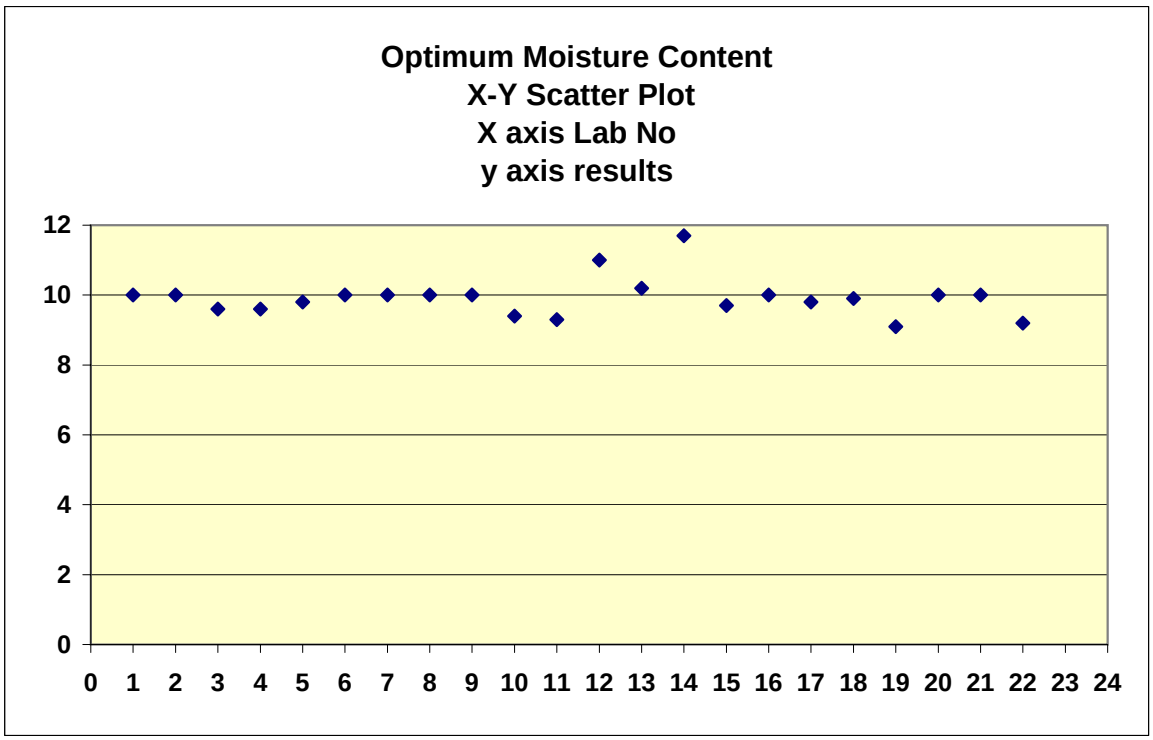
Z-Score			
0.44	**Lab 19**	**-2.90**
0.44	**Lab 22**	**-2.53**
-1.04	**Lab 11**	**-2.16**
-1.04	**Lab 10**	**-1.79**
-0.30	**Lab 3**	**-1.04**
0.44	**Lab 4**	**-1.04**
0.44	**Lab 15**	**-0.67**
0.44	**Lab 17**	**-0.30**
0.44	**Lab 5**	**-0.30**
-1.79	**Lab 18**	**0.07**
-2.16	**Lab 1**	**0.44**
4.15	**Lab 16**	**0.44**
1.18	**Lab 2**	**0.44**
6.74	**Lab 20**	**0.44**
-0.67	**Lab 21**	**0.44**
0.44	**Lab 6**	**0.44**
-0.30	**Lab 7**	**0.44**
0.07	**Lab 8**	**0.44**
-2.90	**Lab 9**	**0.44**
0.44	**Lab 13**	**1.18**
0.44	**Lab 12**	**4.15**
-2.53	**Lab 14**	**6.74**

Appendix C: Charts






Optimum Moisture Content
Between Lab. Z-Score
9
6
3
0
-3
-6
-9
Lab 19
Lab 22
Lab 11
Lab 10
Lab 3
Lab 4
Lab 15
Lab 17
Lab 5
Lab 18
Lab 1
Lab 16
Lab 2
Lab 20
Lab 21
Lab 6
Lab 7
Lab 8
Lab 9
Lab 13
Lab 12
Lab 14


Optimum Moisture Content
X-Y Scatter Plot
X axis Lab No
y axis results
12
10
8
6
4
2
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Dubai Accreditation Center
Tel. No.: (+9714) 3027445
Fax : (+9714) 3362381

Date: 11 March 2008

Invoice No.: INV/PT-LB/16

Participant Name: .....

Fax No. : .....

Attention: .....

Subject: **Invoice for Participation in Inter-Laboratory Proficiency Testing Program (PTP)**

You are hereby requested to pay to Dubai Accreditation Center, Dubai Municipality the participation fee for the Inter-laboratory Proficiency Testing Program having the following details:

PTP No.	158
Details	Determination of Maximum Dry Density and Optimum Moisture Content
Amount	Dhs 850

How to Pay:

EFT

Electronic Funds Transfer

Bank Name: Emirates Bank International PJSC
Branch: Dubai Main Branch, P.O. Box 2923 UAE
Account Name: Dubai Municipality – Revenue A/C
Account Number: 0022 – 107445 – 001
SWIFT Code: EBILAEAD

Credit Card

By visiting Dubai Central Laboratory Department Administration Building- DCLD counter – ground floor

Cheque

Please address the cheque to Dubai Municipality and submit it by hand to DCLD counter.

Note:

- All sending and receiving bank charges must be included in the payment to ensure the full invoice amount is received.
- Please make sure that the payment is referring to DAC Accreditation Fees Alies No. 631 regardless of the payment method used.

Best Regard.

ENG. LINA QUDAH
DIRECTOR OF DUBAI ACCREDITATION CENTER

Cc:
- Quality and Support Unit- DAC