# DUBAI ACCREDITATION DEPARTMENT

## REPORT ON 187TH LABORATORY PROFICIENCY TESTING
## DETERMINATION OF IN-SITUE DENSITY BY SAND REPLACEMENT METHOD

**Date: 4 April 2010**

## 1. INTRODUCTION

This document presents the results of the 187th inter-laboratory proficiency-testing program conducted during the month of March involving the **Determination of In – Situ Density by Sand Replacement Method** with twenty six laboratories participating.

This program is part of the Inter-laboratory Comparison Programs organized by the Dubai Accreditation Department (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:

Twenty six laboratories were participated in this program, the participants are registered and accredited laboratories who are operating in the emirate of Dubai. Also the program included one governmental laboratory and other laboratories participated from Abu Dhabi.

### 2.3 Samples Tested:

One sand sample (wet mix) had been taken from the location by all participating laboratories; the site was prepared in advance as per the conditions required for this proficiency testing program.

## 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 as per BS 1377: Part 9: 1990: Cl. 2.2 AMD 8264: 1995.

## 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 statistical calculations of the laboratories results and their Z-Scores which are obtained from the raw data in Appendix A. 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

After evaluating the Z-Score, the test results from all participating laboratories are found within the Z-score limits of ± 3, therefore, all the results are acceptable.

However, the Z-score value for one participating laboratory is **two,** although, this value can not be considered as **outlier** but as a warring limit, this laboratory is advised to investigate the potential root cause of such result.

## 7. APPENDICES

**7.1** Appendix A: Raw Data

**7.2** Appendix B: Calculation of z-scores and other statistics

**7.3** Appendix C: Charts

**---- End of Report ---**

# Determination of In –Situ Density by Sand Replacement Method

**Appendix A: Raw Data**

**Degree of Compaction %**

| Lab # | Results |
|---|---|
| **Lab G01** | 96 |
| **Lab 2** | 96 |
| **Lab 39** | 96 |
| **Lab 4** | 95 |
| **Lab 56** | 96 |
| **Lab 21** | 95 |
| **Lab 7** | 95 |
| **Lab 9** | 97 |
| **Lab 28** | 95 |
| **Lab 23** | 94 |
| **Lab 57** | 95 |
| **Lab 58** | 95 |
| **Lab 64** | 97 |
| **Lab 68** | 96 |
| **Lab 66** | 96 |
| **Lab 72** | 97 |
| **Lab 67** | 97 |
| **Lab 71** | 95 |
| **Lab 74** | 95 |
| **Lab 79** | 96 |
| **Lab 78** | 96 |
| **Lab 82** | 95 |
| **Lab 84** | 96 |
| **Lab 89** | 96 |
| **Lab EX6** | 95 |
| **Lab EX5** | 96 |

# Determination of In –Situ Density by Sand Replacement Method

**Appendix B:Calculation of z-scores and other statistics**

| 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 | $(xi-x^*)^2$ | Z Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| δ = 1.5 s* | --- | | 2.22 | | 1.34 | | 1.29 | | 1.29 | | 1.28 | | 1.28 | | |
| x* - δ | --- | | 93.78 | | 94.35 | | 94.41 | | 94.42 | | 94.42 | | 94.43 | | |
| x* + δ | --- | | 98.22 | | 97.03 | | 97.00 | | 96.99 | | 96.99 | | 96.99 | | |
| **Lab 23** | 94 | 2.00 | 94.00 | 2.86 | 94.35 | 1.83 | 94.41 | 1.68 | 94.42 | 1.65 | 94.42 | 1.65 | 94.43 | 1.64 | -2.00 |
| **Lab 21** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 28** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 4** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 57** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 58** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 7** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 71** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 74** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 82** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab EX6** | 95 | 1.00 | 95.00 | 0.48 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | 95.00 | 0.50 | -0.83 |
| **Lab 2** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 39** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 56** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 66** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 68** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 78** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 79** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 84** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 89** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab EX5** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab G01** | 96 | 0.00 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 96.00 | 0.09 | 0.34 |
| **Lab 64** | 97 | 1.00 | 97.00 | 1.71 | 97.00 | 1.67 | 97.00 | 1.67 | 96.99 | 1.66 | 96.99 | 1.65 | 96.99 | 1.64 | 1.52 |
| **Lab 67** | 97 | 1.00 | 97.00 | 1.71 | 97.00 | 1.67 | 97.00 | 1.67 | 96.99 | 1.66 | 96.99 | 1.65 | 96.99 | 1.64 | 1.52 |
| **Lab 72** | 97 | 1.00 | 97.00 | 1.71 | 97.00 | 1.67 | 97.00 | 1.67 | 96.99 | 1.66 | 96.99 | 1.65 | 96.99 | 1.64 | 1.52 |
| **Lab 9** | 97 | 1.00 | 97.00 | 1.71 | 97.00 | 1.67 | 97.00 | 1.67 | 96.99 | 1.66 | 96.99 | 1.65 | 96.99 | 1.64 | 1.52 |
| Average | 95.69 | | 95.69 | 15.54 | 95.71 | 14.47 | 95.71 | 14.31 | 95.71 | 14.23 | 95.71 | 14.18 | 95.71 | 14.15 | |
| SD | 0.79 | | 0.79 | 0.62 | 0.76 | 0.58 | 0.76 | 0.57 | 0.75 | 0.57 | 0.75 | 0.57 | 0.75 | 0.57 | |
| **New x*** | **96** | **1.00** | **95.69** | **0.79** | **95.71** | **0.76** | **95.71** | **0.76** | **95.71** | **0.75** | **95.71** | **0.75** | **95.71** | **0.75** | |
| **New s*** | **1.48** | | **0.89** | | **0.86** | | **0.86** | | **0.86** | | **0.85** | | **0.85** | | |
| **N** | **26** | | | | | | | | | | | | | | |

| | |
|---|---|
| **Target value** | **96** |
| **Low Acceptable** | **93** |
| **High Acceptable** | **98** |
| **Acceptable Range** | **93 - 98** |

**Appendix C:Charts**