

DUBAI ACCREDITATION DEPARTMENT

REPORT ON 159TH LABORATORY PROFICIENCY TESTING DETERMINATION OF CALIFORNIA BEARING RATIO

29 APRIL 2008

1. INTRODUCTION

This document presents the results of the 159th Inter-Laboratory Proficiency Testing program conducted during the month of March involving the **Determination of California Bearing Ratio** with eighteen 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:

Fifteen private laboratories and three governmental laboratories (twelve 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. For this particular program participating Laboratories are requested to contact Dr. Yaser Rahaq (Tel No.: 302 7074) to know their code number.

4. TEST METHOD

Instructions were given to the participants to test the samples as per BS 1377 Part 4, T.7: 1990, Amd: 13925:2002.

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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
California Bearing Ratio (Top)	Labs No. 18
California Bearing Ratio (Bottom)	Labs No. 13

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 Department to the following address mrsassol@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

CBR @ 2.5 mm (Top)

Lab #	Results
Lab 1	24.1
Lab 2	23
Lab 3	30
Lab 4	36
Lab 5	30
Lab 6	34
Lab 7	32
Lab 8	29
Lab 9	32
Lab 10	26
Lab 11	33
Lab 12	30
Lab 13	31
Lab 14	31
Lab 15	36
Lab 16	31
Lab 17	30
Lab 18	60

CBR @ 2.5 mm (Bottom)

Lab #	Results
Lab 1	33.2
Lab 2	26
Lab 3	34
Lab 4	34
Lab 5	32
Lab 6	34
Lab 7	33
Lab 8	31
Lab 9	33
Lab 10	29
Lab 11	34
Lab 12	29
Lab 13	28
Lab 14	32
Lab 15	37
Lab 16	32
Lab 17	33
Lab 18	33

Appendix A - Raw Data

CBR @ 5 mm (Top)

Lab #	Results
Lab 1	26.7
Lab 2	25
Lab 3	31
Lab 4	28
Lab 5	30
Lab 6	33
Lab 7	29
Lab 8	30
Lab 9	33
Lab 10	27
Lab 11	30
Lab 12	29
Lab 13	27
Lab 14	32
Lab 15	32
Lab 16	32
Lab 17	25
Lab 18	< 60

CBR @ 5 mm (Bottom)

Lab #	Results
Lab 1	34.3
Lab 2	29
Lab 3	34
Lab 4	31
Lab 5	31
Lab 6	34
Lab 7	30
Lab 8	32
Lab 9	34
Lab 10	31
Lab 11	32
Lab 12	28
Lab 13	27
Lab 14	33
Lab 15	36
Lab 16	34
Lab 17	27
Lab 18	< 33

Appendix A - Raw Data

Computed Values for Z- Scores Calculations (CBR Top Values)

Lab #	Results
Lab 1	26.7
Lab 2	25
Lab 3	31
Lab 4	36
Lab 5	30
Lab 6	34
Lab 7	32
Lab 8	30
Lab 9	33
Lab 10	27
Lab 11	33
Lab 12	30
Lab 13	31
Lab 14	32
Lab 15	36
Lab 16	32
Lab 17	30
Lab 18	60

Computed Values for Z- Scores Calculations (CBR Bottom Values)

Lab #	Results
Lab 1	34.3
Lab 2	29
Lab 3	34
Lab 4	34
Lab 5	32
Lab 6	34
Lab 7	33
Lab 8	32
Lab 9	34
Lab 10	31
Lab 11	34
Lab 12	29
Lab 13	28
Lab 14	33
Lab 15	37
Lab 16	34
Lab 17	33
Lab 18	33

Appendix B: Calculation of z-scoree and other statistics

CBR @ Top

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
$\delta = 1.5 s^*$	---		3.34		3.87		3.87		3.87		3.87		3.87		
$x^* - \delta$	---		28.16		27.63		27.63		27.63		27.63		27.63		
$x^* + \delta$	---		34.84		35.37		35.37		35.37		35.37		35.37		
Lab 1	26.7	4.80	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	-1.86
Lab 2	25	6.50	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	-2.52
Lab 3	31	0.50	31.00	0.25	31.00	0.25	31.00	0.25	31.00	0.25	31.00	0.25	31.00	0.25	-0.19
Lab 4	36	4.50	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	1.75
Lab 5	30	1.50	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	-0.58
Lab 6	34	2.50	34.00	6.25	34.00	6.25	34.00	6.25	34.00	6.25	34.00	6.25	34.00	6.25	0.97
Lab 7	32	0.50	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	0.19
Lab 8	30	1.50	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	-0.58
Lab 9	33	1.50	33.00	2.25	33.00	2.25	33.00	2.25	33.00	2.25	33.00	2.25	33.00	2.25	0.58
Lab 10	27	4.50	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	28.16	11.13	-1.75
Lab 11	33	1.50	33.00	2.25	33.00	2.25	33.00	2.25	33.00	2.25	33.00	2.25	33.00	2.25	0.58
Lab 12	30	1.50	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	-0.58
Lab 13	31	0.50	31.00	0.25	31.00	0.25	31.00	0.25	31.00	0.25	31.00	0.25	31.00	0.25	-0.19
Lab 14	32	0.50	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	0.19
Lab 15	36	4.50	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	1.75
Lab 16	32	0.50	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	32.00	0.25	0.19
Lab 17	30	1.50	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	30.00	2.25	-0.58
Lab 18	60	28.50	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	34.84	11.13	11.06
Average	32.71		31.50	87.80	31.50	87.80	31.50	87.80	31.50	87.80	31.50	87.80	31.50	87.80	
SD	7.41		2.27	5.16	2.27	5.16	2.27	5.16	2.27	5.16	2.27	5.16	2.27	5.16	
New x*	31.5	1.50	31.500	2.27	31.500	2.27	31.500	2.27	31.500	2.27	31.50	2.27	31.50	2.27	
New s*	2.22		2.577		2.577		2.577		2.577		2.58		2.58		

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Target value	32
Low Acceptable	24
High Acceptable	39
Acceptable Range	24 - 39

Appendix B: Calculation of z-score and other statistics

CBR @ Bottom

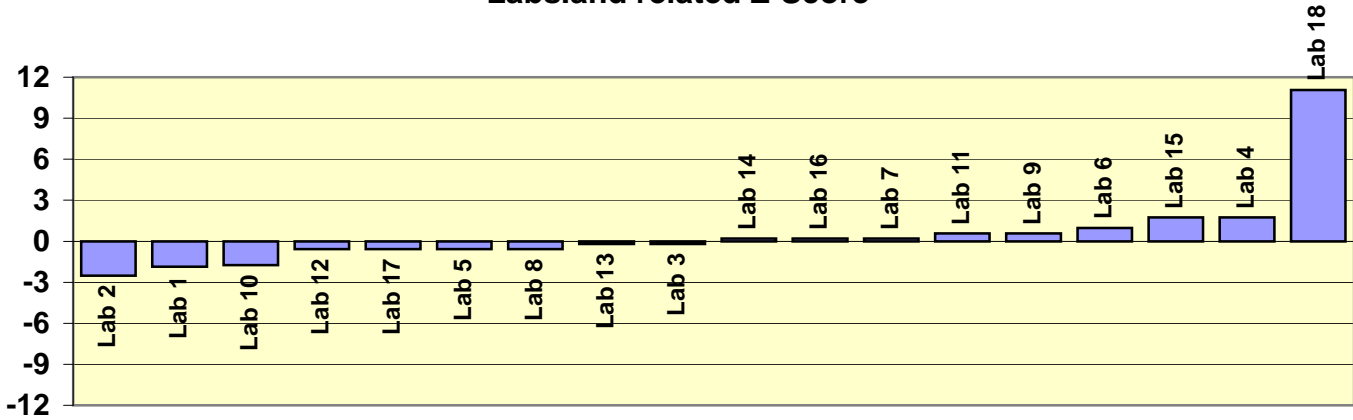
Iteration	0	xi-x*	1	(xi-x*) ²	2	(xi-x*) ²	3	(xi-x*) ²	4	(xi-x*) ²	5	(xi-x*) ²	6	(xi-x*) ²	Z Score
$\delta = 1.5 s^*$	---		2.22		2.38		2.38		2.38		2.38		2.38		
$x^* - \delta$	---		30.78		30.55		30.55		30.55		30.55		30.55		
$x^* + \delta$	---		35.22		35.32		35.32		35.32		35.32		35.32		
Lab 1	34.3	1.30	34.30	1.86	34.30	1.86	34.30	1.86	34.30	1.86	34.30	1.86	34.30	1.86	0.88
Lab 2	29	4.00	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	-2.55
Lab 3	34	1.00	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	0.69
Lab 4	34	1.00	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	0.69
Lab 5	32	1.00	32.00	0.88	32.00	0.88	32.00	0.88	32.00	0.88	32.00	0.88	32.00	0.88	-0.61
Lab 6	34	1.00	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	0.69
Lab 7	33	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	0.04
Lab 8	32	1.00	32.00	0.88	32.00	0.88	32.00	0.88	32.00	0.88	32.00	0.88	32.00	0.88	-0.61
Lab 9	34	1.00	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	0.69
Lab 10	31	2.00	31.00	3.75	31.00	3.75	31.00	3.75	31.00	3.75	31.00	3.75	31.00	3.75	-1.25
Lab 11	34	1.00	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	0.69
Lab 12	29	4.00	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	-2.55
Lab 13	28	5.00	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	-3.20
Lab 14	33	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	0.04
Lab 15	37	4.00	35.22	5.24	35.22	5.24	35.22	5.24	35.22	5.24	35.22	5.24	35.22	5.24	2.63
Lab 16	34	1.00	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	34.00	1.13	0.69
Lab 17	33	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	0.04
Lab 18	33	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	33.00	0.00	0.04
Average	32.68		32.94	33.41	32.94	33.41	32.94	33.41	32.94	33.41	32.94	33.41	32.94	33.41	
SD	2.23		1.40	1.97	1.40	1.97	1.40	1.97	1.40	1.97	1.40	1.97	1.40	1.86	
New x*	33	1.00	32.936	1.40	32.936	1.40	32.936	1.40	32.936	1.40	32.94	1.40	32.94	1.36	
New s*	1.48		1.590		1.590		1.590		1.590		1.59		1.54		

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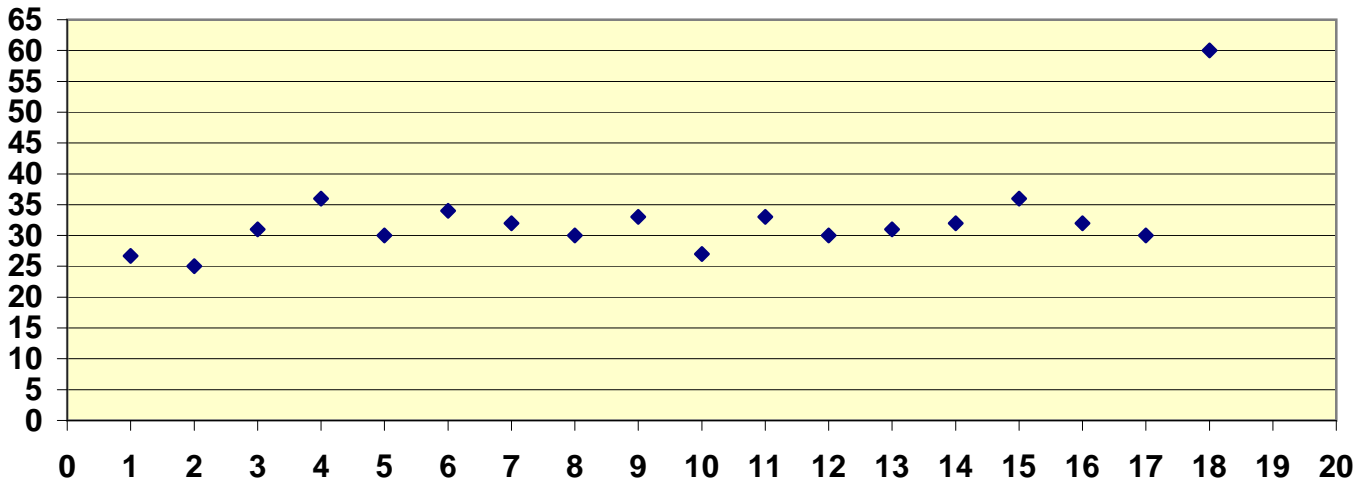
Target value	33
Low Acceptable	28
High Acceptable	38
Acceptable Range	29 - 37

Appendix C: Charts

**CBR @ Top
Labs.and related Z-Score**

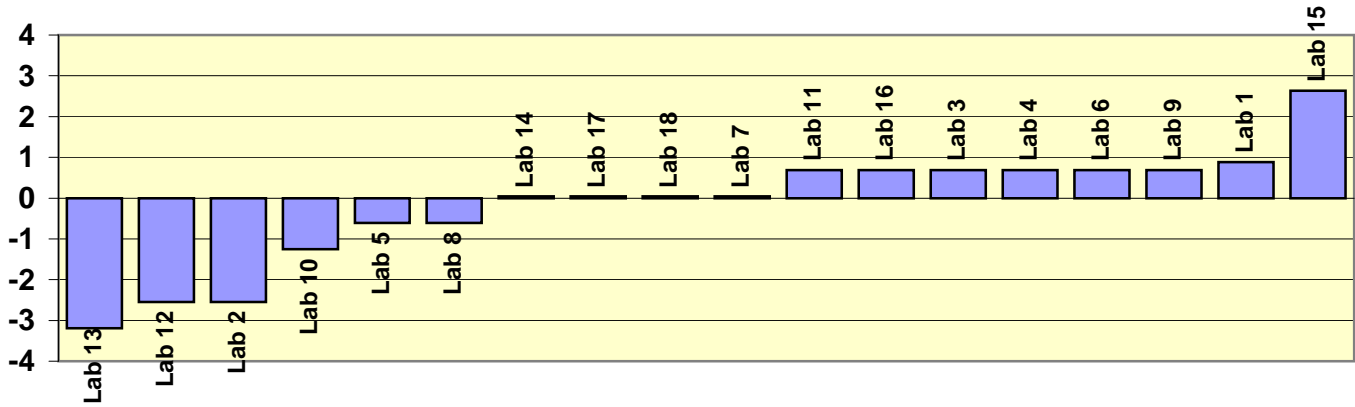


**CBR @ Top
X-Y Scatter Plot between
Labs.and CBR Top values
X axis Lab no. , y axis results**



Appendix C: Charts

**CBR @ Bottom
Between Labs.and related Z-Score**



**CBR @ Bottom
X-Y Scatter Plot between
Labs.and CBR Bottom values
X axis Lab no. , y axis results**

