

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.

DUBAI ACCREDITATION DEPARTMENT

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. 22
California Bearing Ratio (Bottom)	Labs No. 1

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 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

CBR @ 2.5 mm (Top)

Lab #	Sample No.	Results
Lab 1	15922	31
Lab 2	15904	30
Lab 3	15919	33
Lab 4	15903	23
Lab 5	15923	31
Lab 7	15905	36
Lab 8	15909	32
Lab 9	15906	30
Lab 10	15927	30
Lab 11	15924	36
Lab 12	15911	32
Lab 15	15920	30
Lab 17	15908	34
Lab 18	15926	31
Lab 19	15910	29
Lab 20	15901	24.1
Lab 21	15914	26
Lab 22	15929	60

CBR @ 2.5 mm (Bottom)

Lab #	Sample No.	Results
Lab 1	15922	28
Lab 2	15904	34
Lab 3	15919	34
Lab 4	15903	26
Lab 5	15923	32
Lab 7	15905	34
Lab 8	15909	33
Lab 9	15906	32
Lab 10	15927	33
Lab 11	15924	37
Lab 12	15911	33
Lab 15	15920	29
Lab 17	15908	34
Lab 18	15926	32
Lab 19	15910	31
Lab 20	15901	33.2
Lab 21	15914	29
Lab 22	15929	33

Appendix A - Raw Data

CBR @ 5 mm (Top)

Lab #	Sample No.	Results
Lab 1	15922	27
Lab 2	15904	31
Lab 3	15919	30
Lab 4	15903	25
Lab 5	15923	32
Lab 7	15905	28
Lab 8	15909	29
Lab 9	15906	30
Lab 10	15927	25
Lab 11	15924	32
Lab 12	15911	33
Lab 15	15920	29
Lab 17	15908	33
Lab 18	15926	32
Lab 19	15910	30
Lab 20	15901	26.7
Lab 21	15914	27
Lab 22	15929	< 60

CBR @ 5 mm (Bottom)

Lab #	Sample No.	Results
Lab 1	15922	27
Lab 2	15904	34
Lab 3	15919	32
Lab 4	15903	29
Lab 5	15923	33
Lab 7	15905	31
Lab 8	15909	30
Lab 9	15906	31
Lab 10	15927	27
Lab 11	15924	36
Lab 12	15911	34
Lab 15	15920	28
Lab 17	15908	34
Lab 18	15926	34
Lab 19	15910	32
Lab 20	15901	34.3
Lab 21	15914	31
Lab 22	15929	< 33

Appendix A - Raw Data

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

Lab #	Sample No.	Results
Lab 1	15922	31
Lab 2	15904	31
Lab 3	15919	33
Lab 4	15903	25
Lab 5	15923	32
Lab 7	15905	36
Lab 8	15909	32
Lab 9	15906	30
Lab 10	15927	30
Lab 11	15924	36
Lab 12	15911	33
Lab 15	15920	30
Lab 17	15908	34
Lab 18	15926	32
Lab 19	15910	30
Lab 20	15901	26.7
Lab 21	15914	27
Lab 22	15929	60

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

Lab #	Sample No.	Results
Lab 1	15922	28
Lab 2	15904	34
Lab 3	15919	34
Lab 4	15903	29
Lab 5	15923	33
Lab 7	15905	34
Lab 8	15909	33
Lab 9	15906	32
Lab 10	15927	33
Lab 11	15924	37
Lab 12	15911	34
Lab 15	15920	29
Lab 17	15908	34
Lab 18	15926	34
Lab 19	15910	32
Lab 20	15901	34.3
Lab 21	15914	31
Lab 22	15929	33

Appendix B: Calculation of z-score 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	
$\delta = 1.5 s^*$	---		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		Z Score
Lab 1	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 2	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 3	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 4	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 5	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 7	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 8	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 9	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 10	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 11	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 12	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 15	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 17	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 18	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 19	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 20	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 21	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 22	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		

N 18

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

Appendix B: Calculation of z-score and other statistics

CBR @ Bottom

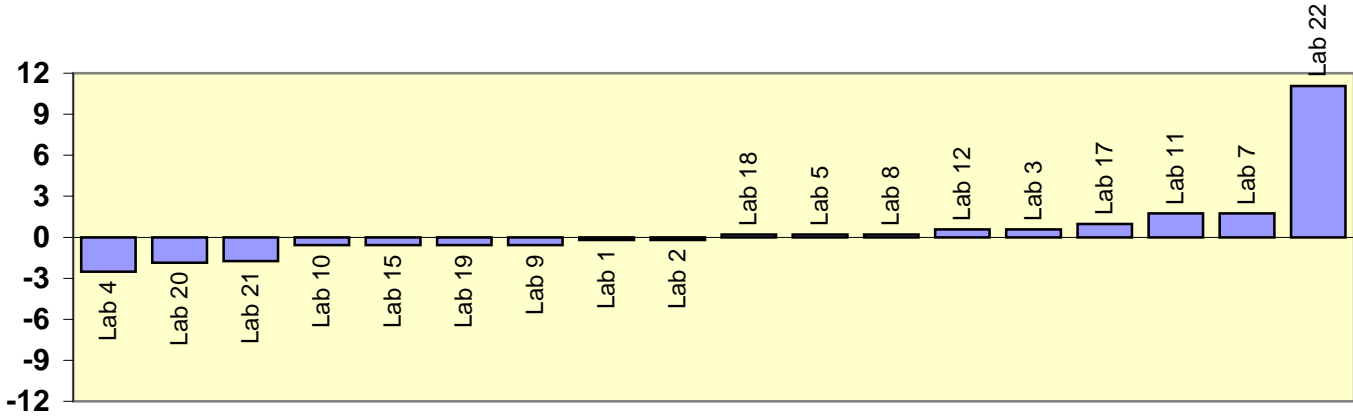
Iteration	0	xi-x*	1	(xi-x*) ²	2	(xi-x*) ²	3	(xi-x*) ²	4	(xi-x*) ²	5	(xi-x*) ²	6	(xi-x*) ²	
$\delta = 1.5 s^*$	---		2.22		2.38		2.38		2.38		2.38		2.38		
$x^* - \delta$	---		30.78		30.55		30.55		30.55		30.55		30.55		
$x^* + \delta$	---		35.22		35.32		35.32		35.32		35.32		35.32		Z Score
Lab 1	28	5.00	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	30.78	4.67	-3.53
Lab 2	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	0.76
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	0.76
Lab 4	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	-2.82
Lab 5	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	0.05
Lab 7	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	0.76
Lab 8	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	0.05
Lab 9	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	-0.67
Lab 10	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	0.05
Lab 11	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	2.91
Lab 12	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	0.76
Lab 15	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	-2.82
Lab 17	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	0.76
Lab 18	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	0.76
Lab 19	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	-0.67
Lab 20	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	0.98
Lab 21	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	-1.39
Lab 22	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	0.05
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	1.52	
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	1.23	
New s*	1.48		1.590		1.590		1.590		1.590		1.59		1.40		

N 18

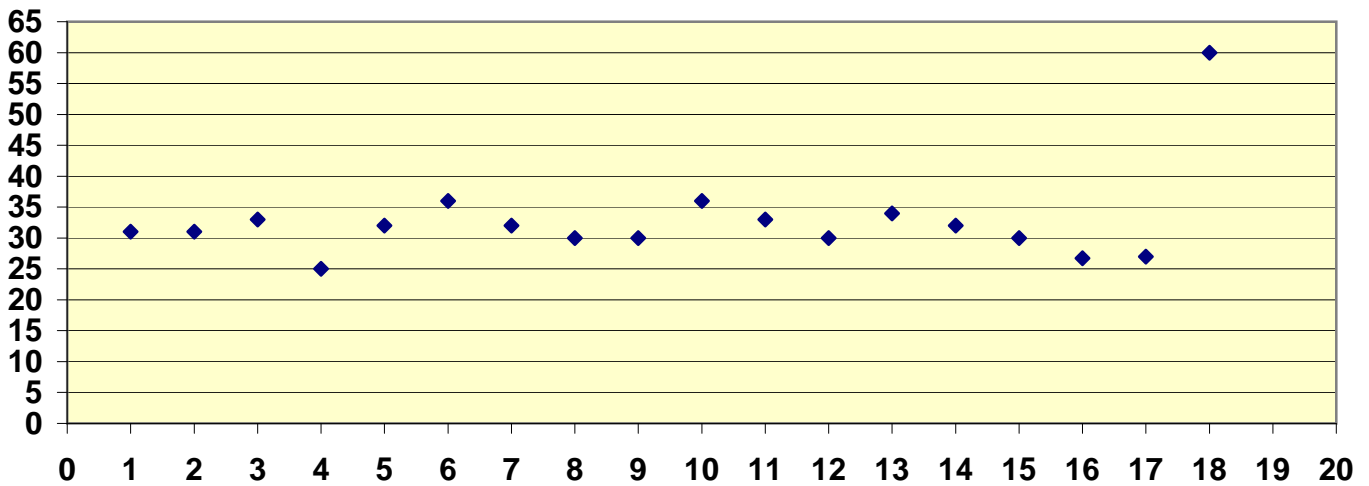
Target value	33
Low Acceptable	29
High Acceptable	37
Acceptable Range	29 - 37

Appendix C: Charts

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

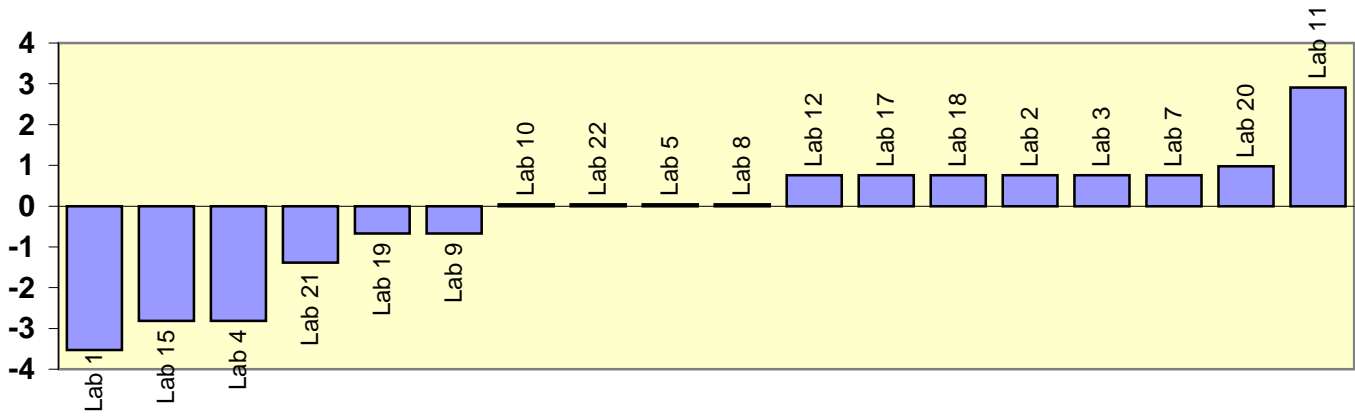


**CBR @ Top
X-Y Scatter Plot between
Labs.and CBR Top values
X axis Lab no. , y axis results**



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**

