

DUBAI ACCREDITATION DEPARTMENT

REPORT ON PTP 210TH INTER-LABORATORY PROFICIENCY TESTING PROGRAM DETERMINATION OF FLAKINESS & ELONGATION INDEX IN COARSE CRUSHED ROCK

Date: 11 July 2011

1. INTRODUCTION

This document presents the results of the 210th inter-laboratory proficiency-testing program conducted during the month of June involving the Determination of **Flakiness and Elongation Index in Coarse Crushed Rock in Aggregate** with twenty eight laboratories participating.

This program is part of the Inter-laboratory Comparison Programs organized by 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 had ensured the homogeneity of the samples prior to their distribution to the participating laboratories by conducting homogeneity test on six samples (randomly selected), two portions A & B from each sample were tested. 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 seven laboratories were participated in this PTP including:

- One governmental laboratory.
- Thirteen are private laboratories operating in Dubai including accredited and registered laboratories.
- Six private laboratories are from other Emirates.
- Four laboratories are from Qatar.
- Two laboratories are from Oman
- One laboratory is from Bahrain.

2.3 Samples Tested:

One (1) Aggregate sample of approximately 2 kg consists of coarse crushed rock specimen has been distributed to all participating laboratories. With each participant being given one sample with a unique identification number provided during the time of collection.

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.

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4. TEST METHOD

Instructions were given to the participants to test the samples for Determination of flakiness and elongation index in coarse crushed rock *as per (BS 812: 1989 P105 S105.1, BS 812: 1990 P105 S105.2).*

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
Elongation Index	Lab 2;
Flakiness Index	Lab EX14

After evaluating the Z-Score, the test results provided by the above mentioned laboratories are outside the Z – score limits ± 3 , the above mentioned laboratories are requested to investigate the root cause of the outlier results, implement a corrective action and a report shall be available for reviewing/checking by the assessment team during the nearest assessment visit.

Also other participating laboratories have showed Z-score values higher than **two** which representing **not outlier** but a warning limit, these laboratories are advised to investigate the potential root cause of such results.

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 ----

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Determination of Flakiness and Elongation Index in Coarse Crushed Rock in Aggregate

Appendix A: Raw Data

Elongation Index Flakiness Index

Lab Code #	Results	Results
Lab G01	20.00	18.00
Lab 2	26.00	16.00
Lab EX12	21.00	18.00
Lab EX7	20.00	18.00
Lab EX25	20.00	15.00
Lab 4	23.00	17.00
Lab EX9	20.00	20.00
Lab EX27	20.00	17.00
Lab 21	21.00	19.00
Lab 84	22.00	15.00
Lab EX2	19.00	16.00
Lab 9	21.00	18.00
Lab 28	21.00	17.00
Lab 23	22.00	17.00
Lab EX6	21.00	16.00
Lab EX16	16.50	18.20
Lab 58	20.00	21.00
Lab EX14	21.00	22.00
Lab 66	22.00	17.00
Lab EX4	17.00	16.00
Lab 76	23.00	17.00
Lab 79	21.00	18.00
Lab 82	18.00	15.00
Lab EX10	22.00	15.00
Lab 89	21.00	18.00
Lab EX11	23.00	17.00
Lab EX18	20.00	19.00

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Appendix B: Calculation of Z-score and other statistics

Elongation Index

Iteration	0		1		2		3		4		5		6		Z Score
$\delta = 1.5 s^*$	---		2.22		2.27		2.26		2.26		2.26		2.26		
$x^* - \delta$	---	$xi-x^*$	18.78	$(xi-x^*)^2$	18.60	$(xi-x^*)^2$	18.61	$(xi-x^*)^2$	18.61	$(xi-x^*)^2$	18.61	$(xi-x^*)^2$	18.61	$(xi-x^*)^2$	
$x^* + \delta$	---		23.22		23.14		23.13		23.13		23.13		23.13		
Lab EX16	16.50	4.50	18.78	4.40	18.78	4.38	18.78	4.38	18.78	4.38	18.78	4.38	18.78	4.38	-2.90
Lab EX4	17.00	4.00	18.78	4.40	18.78	4.38	18.78	4.38	18.78	4.38	18.78	4.38	18.78	4.38	-2.57
Lab 82	18.00	3.00	18.78	4.40	18.78	4.38	18.78	4.38	18.78	4.38	18.78	4.38	18.78	4.38	-1.90
Lab EX2	19.00	2.00	19.00	3.51	19.00	3.49	19.00	3.49	19.00	3.49	19.00	3.49	19.00	3.49	-1.24
Lab 58	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab EX18	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab EX25	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab EX27	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab EX7	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab EX9	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab G01	20.00	1.00	20.00	0.76	20.00	0.76	20.00	0.75	20.00	0.75	20.00	0.75	20.00	0.75	-0.58
Lab 21	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab 28	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab 79	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab 89	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab 9	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab EX12	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab EX14	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab EX6	21.00	0.00	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	21.00	0.02	0.09
Lab 23	22.00	1.00	22.00	1.27	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	0.75
Lab 66	22.00	1.00	22.00	1.27	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	0.75
Lab 84	22.00	1.00	22.00	1.27	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	0.75
Lab EX10	22.00	1.00	22.00	1.27	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	22.00	1.28	0.75
Lab 4	23.00	2.00	23.00	4.53	23.00	4.54	23.00	4.54	23.00	4.54	23.00	4.54	23.00	4.54	1.41
Lab 76	23.00	2.00	23.00	4.53	23.00	4.54	23.00	4.54	23.00	4.54	23.00	4.54	23.00	4.54	1.41
Lab EX11	23.00	2.00	23.00	4.53	23.00	4.54	23.00	4.54	23.00	4.54	23.00	4.54	23.00	4.54	1.41
Lab 2	26.00	5.00	23.22	5.53	23.14	5.17	23.13	5.12	23.13	5.11	23.13	5.11	23.13	5.11	3.41
Average	20.80		20.87	46.35	20.87	45.98	20.87	45.92	20.87	45.91	20.87	45.91	20.87	45.91	
SD	1.92		1.34	1.78	1.33	1.77	1.33	1.77	1.33	1.77	1.33	1.77	1.33	1.77	
New x^*	21.0	1.00	20.87	1.34	20.87	1.33	20.87	1.33	20.87	1.33	20.87	1.33	20.87	1.33	
New s^*	1.48		1.51		1.51		1.51		1.51		1.51		1.51		

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Target value= 20.87

Low Acceptable value:16.35

High Acceptable value:25.39

Acceptable Range: 16.35 - 25.39

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Appendix B: Calculation of Z-score and other statistics

Flakiness Index

Iteration	0		1		2		3		4		5		6		Z Score
$\delta = 1.5 s^*$	---		2.22		2.34		2.34		2.34		2.34		2.34		
$x^* - \delta$	---	$xi-x^*$	14.78	$(xi-x^*)^2$	14.88	$(xi-x^*)^2$	14.88	$(xi-x^*)^2$	14.88	$(xi-x^*)^2$	14.88	$(xi-x^*)^2$	14.88	$(xi-x^*)^2$	
$x^* + \delta$	---		19.22		19.55		19.55		19.55		19.55		19.55		
Lab 82	15.00	2.00	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	-1.42
Lab 84	15.00	2.00	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	-1.42
Lab EX10	15.00	2.00	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	-1.42
Lab EX25	15.00	2.00	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	15.00	4.92	-1.42
Lab 2	16.00	1.00	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	-0.78
Lab EX2	16.00	1.00	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	-0.78
Lab EX4	16.00	1.00	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	-0.78
Lab EX6	16.00	1.00	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	16.00	1.48	-0.78
Lab 23	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab 28	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab 4	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab 66	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab 76	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab EX11	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab EX27	17.00	0.00	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	17.00	0.05	-0.14
Lab 79	18.00	1.00	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	0.50
Lab 89	18.00	1.00	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	0.50
Lab 9	18.00	1.00	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	0.50
Lab EX12	18.00	1.00	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	0.50
Lab EX7	18.00	1.00	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	0.50
Lab G01	18.00	1.00	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	18.00	0.61	0.50
Lab EX16	18.20	1.20	18.20	0.97	18.20	0.97	18.20	0.97	18.20	0.97	18.20	0.97	18.20	0.97	0.63
Lab 21	19.00	2.00	19.00	3.18	19.00	3.18	19.00	3.18	19.00	3.18	19.00	3.18	19.00	3.18	1.14
Lab EX18	19.00	2.00	19.00	3.18	19.00	3.18	19.00	3.18	19.00	3.18	19.00	3.18	19.00	3.18	1.14
Lab EX9	20.00	3.00	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	1.79
Lab 58	21.00	4.00	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	2.43
Lab EX14	22.00	5.00	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	19.22	4.03	3.07
Average	17.41		17.22	49.01	17.22	49.01	17.22	49.01	17.22	49.01	17.22	49.01	17.22	49.01	
SD	1.76		1.37	1.88	1.37	1.88	1.37	1.88	1.37	1.88	1.37	1.88	1.37	1.88	
New x^*	17.00	1.00	17.22	1.37	17.22	1.37	17.22	1.37	17.22	1.37	17.22	1.37	17.22	1.37	
New s^*	1.48		1.56		1.56		1.56		1.56		1.56		1.56		

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Target value= 17.22

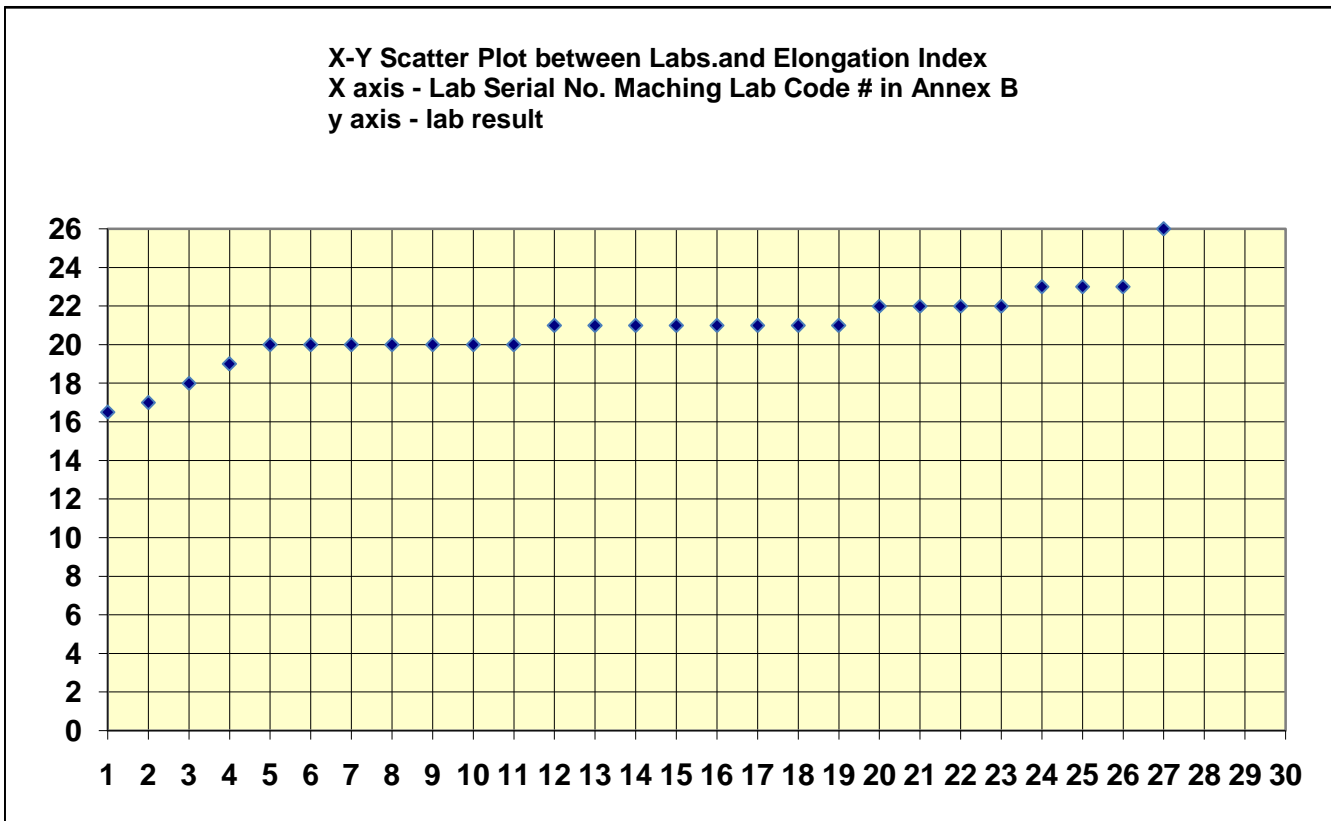
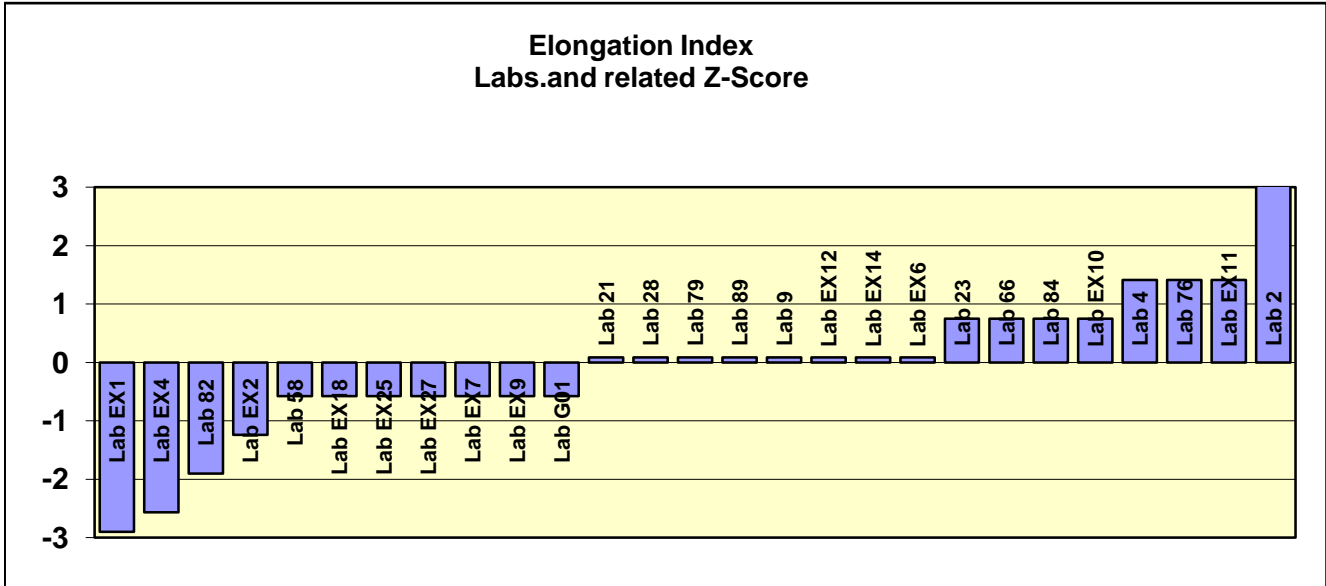
Low Acceptable value: 12.55

High Acceptable value: 21.89

Acceptable Range: 12.55 - 21.89

Determination of Flakiness and Elongation Index in Coarse Crushed Rock in Aggregate

Appendix C: Charts



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