

## DUBAI ACCREDITATION DEPARTMENT

### REPORT ON PTP 180<sup>TH</sup> INTER-LABORATORY PROFICIENCY TESTING PROGRAM DETERMINATION OF FLAKINESS & ELONGATION INDEX IN COARSE CRUSHED ROCK

Date: 30 August 2009

#### 1. INTRODUCTION

This document presents the results of the 180<sup>th</sup> inter-laboratory proficiency-testing program conducted during the month of August involving the determination of **Flakiness and Elongation Index in Coarse Crushed Rock** with twenty nine 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 beach 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 eight private laboratories and one governmental laboratory (sixteen of them are accredited by DAC for construction materials testing) participated in this program. A total of twenty nine laboratories participated in this program.

##### 2.3 Samples Tested:

One (1) Aggregate sample of approximately 1.5 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 $\pm 3$
Elongation Index	Lab EX1 ; Lab EX3; Lab 85; Lab 88

After evaluating the Z-Score, the test results provided by the above mentioned laboratories are outside the Z – score limits  $\pm 3$ , 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 checking by the assessment team during the nearest assessment visit.



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Also other participating laboratories have showed Z-score values higher than **two** which representing **not outlier** but a warring 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 ----

## Flakiness and Elongation Index in Coarse Crushed Rocks

### Elongation Index

Analysis Code	Results
Lab G01	27.00
Lab 3	24.00
Lab 4	23.00
Lab 56	24.00
Lab 21	24.00
Lab 7	25.00
Lab 9	23.00
Lab 28	23.00
Lab 23	23.00
Lab EX4	24.00
Lab 88	19.00
Lab 57	24.00
Lab 58	22.00
Lab 64	25.00
Lab 72	25.00
Lab 71	23.00
Lab 74	22.00
Lab 76	24.00
Lab EX3	18.00
Lab 79	23.00
Lab 78	24.00
Lab 82	24.00
Lab 84	27.00
Lab 85	18.68
Lab 89	24.00
Lab EX1	17.00
Lab EX2	25.00
Lab EX5	24.00
Lab EX6	24.00

### Flakiness Index

Analysis Code	Results
Lab G01	19.00
Lab 3	17.00
Lab 4	17.00
Lab 56	17.00
Lab 21	16.00
Lab 7	15.00
Lab 9	17.00
Lab 28	17.00
Lab 23	17.00
Lab EX4	15.00
Lab 88	16.00
Lab 57	17.00
Lab 58	17.00
Lab 64	17.00
Lab 72	14.00
Lab 71	17.00
Lab 74	17.00
Lab 76	17.00
Lab EX3	21.00
Lab 79	18.00
Lab 78	17.00
Lab 82	17.00
Lab 84	19.00
Lab 85	18.22
Lab 89	17.00
Lab EX1	14.00
Lab EX2	15.00
Lab EX5	16.00
Lab EX6	18.00

Elongation Index

Index in Coarse Crushed Rocks

Iteration	0		1		2		3		4		5		6		Z Score
$\delta = 1.5 s^*$	---	xi-x*	2.22	(xi-x*) <sup>2</sup>	1.75	(xi-x*) <sup>2</sup>	1.90	(xi-x*) <sup>2</sup>	1.90	(xi-x*) <sup>2</sup>	1.90	(xi-x*) <sup>2</sup>	1.90	(xi-x*) <sup>2</sup>	
$x^* - \delta$	---		21.78		21.89		21.70		21.70		21.70		21.70		
$x^* + \delta$	---		26.22		25.39		25.50		25.50		25.50		25.50		
Lab EX1	17.00	7.00	21.78	3.48	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	-5.21
Lab EX3	18.00	6.00	21.78	3.48	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	-4.42
Lab 85	18.68	5.32	21.78	3.48	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	-3.89
Lab 88	19.00	5.00	21.78	3.48	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	21.89	2.90	-3.63
Lab 58	22.00	2.00	22.00	2.69	22.00	2.55	22.00	2.55	22.00	2.55	22.00	2.55	22.00	2.55	-1.26
Lab 74	22.00	2.00	22.00	2.69	22.00	2.55	22.00	2.55	22.00	2.55	22.00	2.55	22.00	2.55	-1.26
Lab 23	23.00	1.00	23.00	0.41	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	-0.47
Lab 28	23.00	1.00	23.00	0.41	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	-0.47
Lab 4	23.00	1.00	23.00	0.41	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	-0.47
Lab 71	23.00	1.00	23.00	0.41	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	-0.47
Lab 79	23.00	1.00	23.00	0.41	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	-0.47
Lab 9	23.00	1.00	23.00	0.41	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	23.00	0.36	-0.47
Lab 21	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab EX6	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 3	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 56	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 57	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab EX5	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 76	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 78	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 82	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 89	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab EX4	24.00	0.00	24.00	0.13	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	24.00	0.16	0.32
Lab 64	25.00	1.00	25.00	1.85	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	1.11
Lab 7	25.00	1.00	25.00	1.85	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	1.11
Lab 72	25.00	1.00	25.00	1.85	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	1.11
Lab EX2	25.00	1.00	25.00	1.85	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	25.00	1.97	1.11
Lab G01	27.00	3.00	26.22	6.68	25.39	3.19	25.39	3.19	25.39	3.19	25.39	3.19	25.39	3.19	2.69
Lab 84	27.00	3.00	26.22	6.68	25.39	3.19	25.39	3.19	25.39	3.19	25.39	3.19	25.39	3.19	2.69
Average	23.20		23.64	23.16	23.60	34.89	23.60	34.89	23.60	34.89	23.60	34.89	23.60	34.89	
SD	2.36		1.25	1.05	1.12	1.25	1.12	1.25	1.12	1.25	1.12	1.25	1.12	1.25	
New x*	24.0	1.00	23.64	1.03	23.60	1.12	23.60	1.12	23.60	1.12	23.60	1.12	23.60	1.12	
New s*	1.48		1.16		1.27		1.27		1.27		1.27		1.27		

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Target value	23.60
Low Acceptable	19.80
High Acceptable	27.40
Acceptable Range	19.80 -27.40

**Flakiness Elongation  
Index in Coarse Crushed Rocks**

**Appendix B: Calculation of Z-score and other statistics**

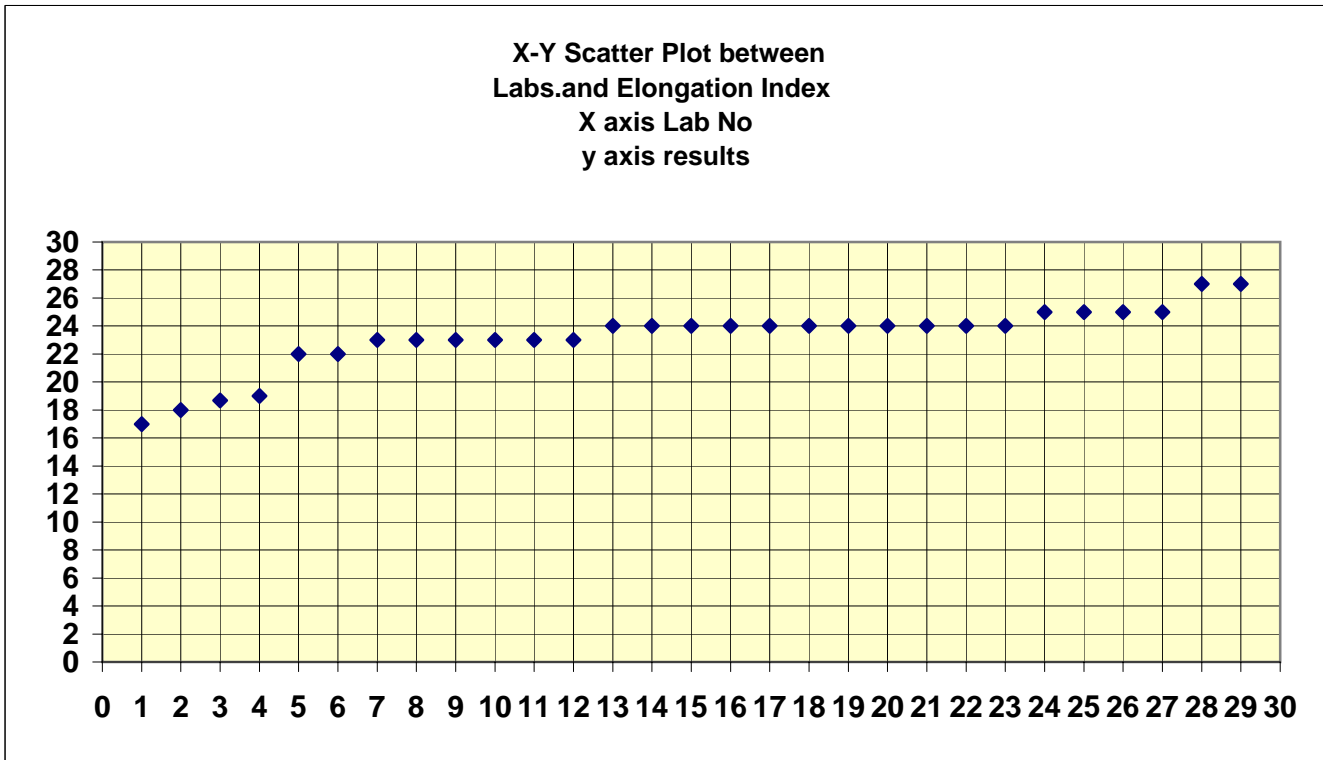
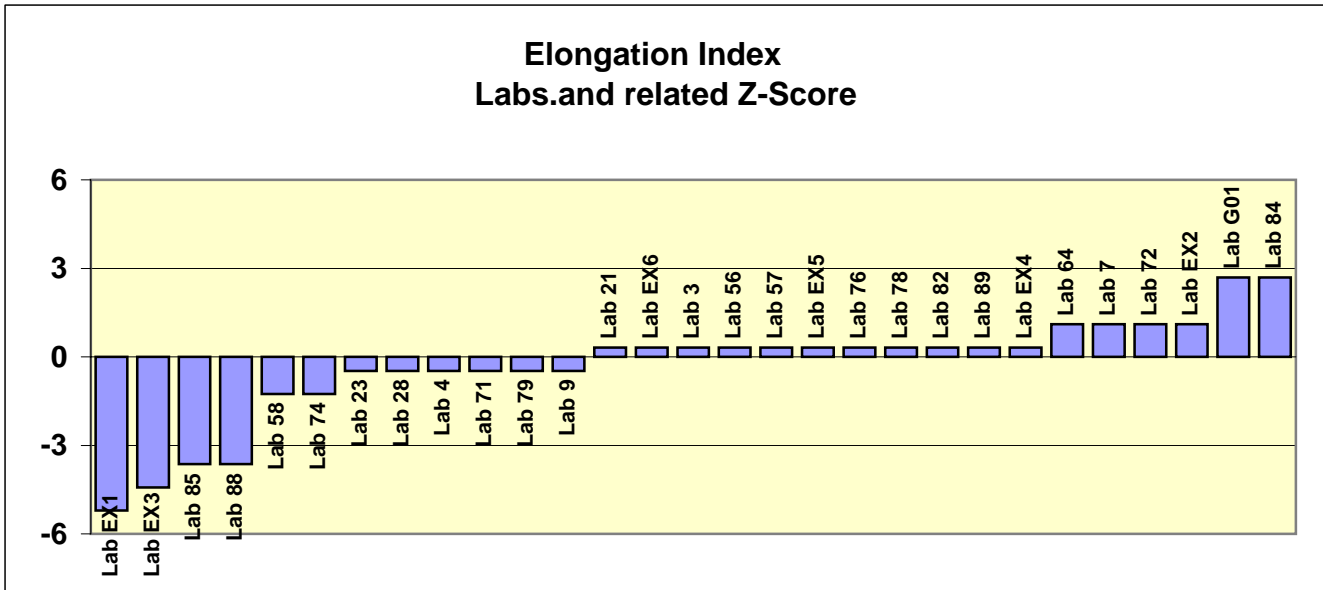
**Flakiness Index**

Iteration	0	xi-x*	1	(xi-x*) <sup>2</sup>	2	(xi-x*) <sup>2</sup>	3	(xi-x*) <sup>2</sup>	4	(xi-x*) <sup>2</sup>	5	(xi-x*) <sup>2</sup>	6	(xi-x*) <sup>2</sup>	Z Score
$\delta = 1.5 s^*$	---		0.00		0.00		0.00		0.00		0.00		0.00		
$x^* - \delta$	---		17.00		17.00		17.00		17.00		17.00		17.00		
$x^* + \delta$	---		17.00		17.00		17.00		17.00		17.00		17.00		
Lab EX1	14.00	3.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-1.96
Lab 72	14.00	3.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-1.96
Lab 7	15.00	2.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-1.28
Lab EX4	15.00	2.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-1.28
Lab EX2	15.00	2.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-1.28
Lab 21	16.00	1.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-0.59
Lab EX5	16.00	1.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-0.59
Lab 88	16.00	1.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	-0.59
Lab 23	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 28	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 3	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 4	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 56	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 57	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 58	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 64	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 71	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 74	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 76	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 78	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 82	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 89	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab 9	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.09
Lab EX6	18.00	1.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.77
Lab 79	18.00	1.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.77
Lab 85	18.22	1.22	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	0.92
Lab G01	19.00	2.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	1.46
Lab 84	19.00	2.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	1.46
Lab EX3	21.00	4.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	17.00	0.00	2.82
<b>Average</b>	<b>16.87</b>		<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	
<b>SD</b>	<b>1.46</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	
<b>New x*</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	<b>17.00</b>	<b>0.00</b>	
<b>New s*</b>	<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		<b>0.00</b>		

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<b>Target value</b>	<b>17.00</b>
<b>Low Acceptable</b>	<b>12.61</b>
<b>High Acceptable</b>	<b>21.39</b>
<b>Acceptable Range</b>	<b>12.61 - 21.39</b>

### Flakiness Elongation Index in Coarse Crushed Rocks



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