DUBAI ACCREDITATION DEPARTMENT

REPORT ON PTP 189TH INTER-LABORATORY PROFICIENCY TESTING PROGRAM DETERMINATION OF TENSILE TEST OF CARBON STEEL BARS

Date: 3 June 2010

1. INTRODUCTION

This document presents the results of the 189th inter-laboratory proficiency-testing program conducted during the month of April involving the determination of **Tensile Test of Carbon Steel Bars** with twenty six 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 Participants:

Twenty six laboratories were participated in this program; the participants are the registered and accredited laboratories who are operating in the emirate of Dubai, one governmental laboratory, two from Abu Dhabi, three from Qatar and one from Oman.

2.2 Samples Tested:

One (1) Steel sample Comprises of Three (3) specimens of 20 mm Diameter Carbon Steel Bar of approximately one meter long was distributed to all participating laboratories. With each participant being given his sample with a unique identification number provided during the time of collection.

Test certificate was provided by the manufacturer which is including the test results for the dispatch from which the samples were taken.

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 for Determination of Tensile Test of Carbon Steel Bars as per **BS 4449:1997**

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
Tensile Strength	**Lab EX12**
Yield Strength	**Lab EX12; Lab 26; Lab 83; Lab 89**
Elongation at Fracture (A5) %	**Lab EX12; Lab 26; Lab 27**

After evaluating the Z-Score the test results provided by the above mentioned laboratories are outside the Z - score limits of ± 3, the above mentioned laboratories are requested to investigate the root cause of the outlier results, implement corrective action. For accredited laboratories these evidence shall be available for checking by 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 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 ---

Determination of Tesile Test of Steel Bars

Appendix A: Raw Data

Table - 1 : Tensile Strength (R_m) N/mm^2

Lab #	Specimen No.1	Specimen No.2	Specimen No.3	Ave
Lab G01	696	662	659	672
Lab 3	672	667	672	670
Lab 39	637	668	648	651
Lab 4	664	674	675	671
Lab 56	653	665	660	659
Lab 21	678	667	681	675
Lab 26	634	631	632	632
Lab 9	666	664	668	666
Lab 28	681	683	680	681
Lab 23	666	656	657	660
Lab 83	688	703	557	649
Lab EX10	670	672	664	669
Lab 57	672	681	677	677
Lab 58	663	664	674	667
Lab 105	664	665	666	665
Lab 2	676	675	679	677
Lab 27	680	667	666	671
Lab 74	645	643	649	646
Lab 79	688	679	657	675
Lab 82	671	656	675	667
Lab 84	662	668	655	662
Lab 89	702	702	682	695
Lab EX3	670.9	669.6	668.2	670
Lab EX4	652	657	646	652
Lab EX6	691	691	665	682
Lab EX12	595	599	593	596

Determination of Tesile Test of Steel Bars

Appendix A: Raw Data

Table - 2 : Yield Strength (R_e) N/mm^2

Lab #	Specimen No.1	Specimen No.2	Specimen No.3	Ave
Lab G01	588	548	547	561
Lab 3	565	559	560	561
Lab 39	541	561	557	553
Lab 4	554	557	559	557
Lab 56	540	555	547	547
Lab 21	562	549	565	559
Lab 26	525	529	521	525
Lab 9	555	557	556	556
Lab 28	563	563	562	563
Lab 23	552	542	543	546
Lab 83	563	579	433	525
Lab EX10	564	558	556	559
Lab 57	561	560	554	558
Lab 58	550	548	558	552
Lab 105	555	558	553	555
Lab 2	560	554	558	557
Lab 27	574	564	562	567
Lab 74	530	529	533	531
Lab 79	575	559	549	561
Lab 82	539	552	551	547
Lab 84	545	555	551	550
Lab 89	593	586	574	584
Lab EX3	560.4	559	556.7	559
Lab EX4	535	558	548	547
Lab EX6	576	584	558	573
Lab EX12	434	439	430	434

Determination of Tesile Test of Steel Bars

Appendix A: Raw Data

Table - 3 : Elongation at Fracture (A_5) %

Lab #	Specimen No.1	Specimen No.2	Specimen No.3	Ave
Lab G01	22.5	23.5	23.5	23.2
Lab 3	20	21	21	20.7
Lab 39	20.4	21.4	20.4	20.7
Lab 4	20.5	21.5	20.5	20.8
Lab 56	22	21	20	21.0
Lab 21	21	22	22	21.7
Lab 26	16	21	18	18.3
Lab 9	24.5	21.5	22.5	22.8
Lab 28	20	22	20	20.7
Lab 23	21	23	24	22.7
Lab 83	22	19	24	21.7
Lab EX10	21	21.5	21.5	21.3
Lab 57	22	21	22	21.7
Lab 58	21	21	22	21.3
Lab 105	20	21	22	21.0
Lab 2	20.8	21.4	22.5	21.6
Lab 27	26	25	23	24.7
Lab 74	21	21	21	21.0
Lab 79	23.5	23.5	22.5	23.2
Lab 82	23	22	22.5	22.5
Lab 84	21.5	20.5	22	21.3
Lab 89	22	21	21	21.3
Lab EX3	20	20.5	20	20.2
Lab EX4	23	22	21	22.0
Lab EX6	22	20.5	21.5	21.3
Lab EX12	25	27	26	26.0

Determination of Tensile Test of Carbon Steel Bars

Appendex - B Calcualations of Z-Score and Other Statistics

Table - 1 : Tensile Strength (R_m) N/mm^2

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	
δ = 1.5 s*	---		17.43		18.27		18.18		18.16		18.16		18.16		
x* - δ	---		650.57		648.13		648.19		648.20		648.20		648.20		
x* + δ	---		685.43		684.66		684.54		684.52		684.52		684.52		Z Score
Lab EX12	595.7	72.33	650.57	250.31	650.57	249.38	650.57	249.23	650.57	249.21	650.57	249.21	650.57	249.21	-5.84
Lab 26	632.3	35.67	650.57	250.31	650.57	249.38	650.57	249.23	650.57	249.21	650.57	249.21	650.57	249.21	-2.81
Lab 74	645.7	22.33	650.57	250.31	650.57	249.38	650.57	249.23	650.57	249.21	650.57	249.21	650.57	249.21	-1.71
Lab 83	649.3	18.67	650.57	250.31	650.57	249.38	650.57	249.23	650.57	249.21	650.57	249.21	650.57	249.21	-1.41
Lab 39	651.0	17.00	651.00	237.03	651.00	236.13	651.00	235.99	651.00	235.96	651.00	235.96	651.00	235.96	-1.27
Lab EX4	651.7	16.33	651.67	216.95	651.67	216.08	651.67	215.95	651.67	215.93	651.67	215.92	651.67	215.92	-1.21
Lab 56	659.3	8.67	659.33	49.88	659.33	49.46	659.33	49.40	659.33	49.39	659.33	49.39	659.33	49.39	-0.58
Lab 23	659.7	8.33	659.67	45.28	659.67	44.89	659.67	44.83	659.67	44.82	659.67	44.81	659.67	44.81	-0.55
Lab 84	661.7	6.33	661.67	22.36	661.67	22.09	661.67	22.04	661.67	22.04	661.67	22.04	661.67	22.04	-0.39
Lab 105	665.0	3.00	665.00	1.95	665.00	1.87	665.00	1.85	665.00	1.85	665.00	1.85	665.00	1.85	-0.11
Lab 9	666.0	2.00	666.00	0.16	666.00	0.13	666.00	0.13	666.00	0.13	666.00	0.13	666.00	0.13	-0.03
Lab 58	667.0	1.00	667.00	0.37	667.00	0.40	667.00	0.41	667.00	0.41	667.00	0.41	667.00	0.41	0.05
Lab 82	667.3	0.67	667.33	0.88	667.33	0.93	667.33	0.94	667.33	0.95	667.33	0.95	667.33	0.95	0.08
Lab EX10	668.7	0.67	668.67	5.16	668.67	5.29	668.67	5.31	668.67	5.32	668.67	5.32	668.67	5.32	0.19
Lab EX3	669.6	1.57	669.57	10.05	669.57	10.24	669.57	10.27	669.57	10.28	669.57	10.28	669.57	10.28	0.26
Lab 3	670.3	2.33	670.33	15.50	670.33	15.74	670.33	15.77	670.33	15.78	670.33	15.78	670.33	15.78	0.33
Lab 27	671.0	3.00	671.00	21.20	671.00	21.47	671.00	21.51	671.00	21.52	671.00	21.52	671.00	21.52	0.38
Lab 4	671.0	3.00	671.00	21.20	671.00	21.47	671.00	21.51	671.00	21.52	671.00	21.52	671.00	21.52	0.38
Lab G01	672.3	4.33	672.33	35.25	672.33	35.60	672.33	35.66	672.33	35.67	672.33	35.67	672.33	35.67	0.49
Lab 79	674.7	6.67	674.67	68.41	674.67	68.89	674.67	68.97	674.67	68.98	674.67	68.98	674.67	68.98	0.69
Lab 21	675.3	7.33	675.33	79.88	675.33	80.40	675.33	80.49	675.33	80.50	675.33	80.50	675.33	80.50	0.74
Lab 2	676.7	8.67	676.67	105.49	676.67	106.09	676.67	106.19	676.67	106.20	676.67	106.21	676.67	106.21	0.85
Lab 57	676.7	8.67	676.67	105.49	676.67	106.09	676.67	106.19	676.67	106.20	676.67	106.21	676.67	106.21	0.85
Lab 28	681.3	13.33	681.33	223.13	681.33	224.01	681.33	224.15	681.33	224.17	681.33	224.17	681.33	224.17	1.24
Lab EX6	682.3	14.33	682.33	254.00	682.33	254.94	682.33	255.09	682.33	255.11	682.33	255.11	682.33	255.12	1.32
Lab 89	695.3	27.33	685.43	362.12	684.66	334.74	684.54	330.53	684.52	329.89	684.52	329.79	684.52	329.77	2.39
Average	663.7		666.40	2882.96	666.37	2854.48	666.36	2850.11	666.36	2849.44	666.36	2849.34	666.36	2849.32	
SD	19.03		10.74	115.32	10.69	114.18	10.68	114.00	10.68	113.98	10.68	113.97	10.68	113.97	
New x*	668.00	7.83	666.40	10.74	666.37	10.69	666.36	10.68	666.36	10.68	666.36	10.68	666.36	10.68	
New s*	11.62		12.18		12.12		12.11		12.11		12.11		12.11		

N 26

Target value	666.36
Low Acceptable	630.04
High Acceptable	702.68
Acceptable Range	630.04 -702.68

Determination of Tensile Test of Carbon Steel Bars

Appendex - B Calcualations of Z-Score and Other Statistics

Table - 2 : Yield Strength (R_e) N/mm^2

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	
δ = 1.5 s *	---		12.23		13.26		13.19		13.16		13.15		13.15		
x* - δ	---		544.10		541.71		541.76		541.77		541.78		541.78		
x* + δ	---		568.57		568.24		568.13		568.10		568.09		568.09		Z Score
Lab EX12	434	122	544	118	544	118	544	117	544	117	544	117	544	117	-14
Lab 26	525	31	544	118	544	118	544	117	544	117	544	117	544	117	-3
Lab 83	525	31	544	118	544	118	544	117	544	117	544	117	544	117	-3
Lab 74	531	26	544	118	544	118	544	117	544	117	544	117	544	117	-3
Lab 23	546	11	546	87	546	86	546	86	546	86	546	86	546	86	-1
Lab EX4	547	9	547	64	547	63	547	63	547	63	547	63	547	63	-1
Lab 56	547	9	547	58	547	58	547	58	547	58	547	58	547	58	-1
Lab 82	547	9	547	58	547	58	547	58	547	58	547	58	547	58	-1
Lab 84	550	6	550	22	550	21	550	21	550	21	550	21	550	21	-1
Lab 58	552	4	552	9	552	9	552	9	552	9	552	9	552	9	0
Lab 39	553	3	553	4	553	4	553	4	553	4	553	4	553	4	0
Lab 105	555	1	555	0	555	0	555	0	555	0	555	0	555	0	0
Lab 9	556	0	556	1	556	1	556	1	556	1	556	1	556	1	0
Lab 4	557	0	557	3	557	3	557	3	557	3	557	3	557	3	0
Lab 2	557	1	557	6	557	6	557	6	557	6	557	6	557	6	0
Lab 57	558	2	558	11	558	11	558	12	558	12	558	12	558	12	0
Lab 21	559	2	559	14	559	14	559	14	559	14	559	14	559	14	0
Lab EX3	559	2	559	14	559	14	559	14	559	14	559	14	559	14	0
Lab EX10	559	3	559	19	559	19	559	19	559	19	559	19	559	19	1
Lab 79	561	5	561	36	561	37	561	37	561	37	561	37	561	37	1
Lab G01	561	5	561	36	561	37	561	37	561	37	561	37	561	37	1
Lab 3	561	5	561	40	561	41	561	41	561	41	561	41	561	41	1
Lab 28	563	6	563	59	563	60	563	60	563	60	563	60	563	60	1
Lab 27	567	10	567	137	567	137	567	138	567	138	567	138	567	138	1
Lab EX6	573	16	569	185	568	177	568	174	568	173	568	173	568	173	2
Lab 89	584	28	569	185	568	177	568	174	568	173	568	173	568	173	3
Average	550		555	1520	555	1502	555	1497	555	1495	555	1495	555	1495	
SD	27		8	61	8	60	8	60	8	60	8	60	8	60	
New x*	556	6	555	8	555	8	555	8	555	8	555	8	555	8	
New s*	8		9		9		9		9		9		9		

N 26

Target value	555
Low Acceptable	529
High Acceptable	581
Acceptable Range	529 - 581

Determination of Tensile Test of Carbon Steel Bars

Appendex - B Calcualations of Z-Score and Other Statistics

Table - 3 : Elongation at Fracture (A_5) %

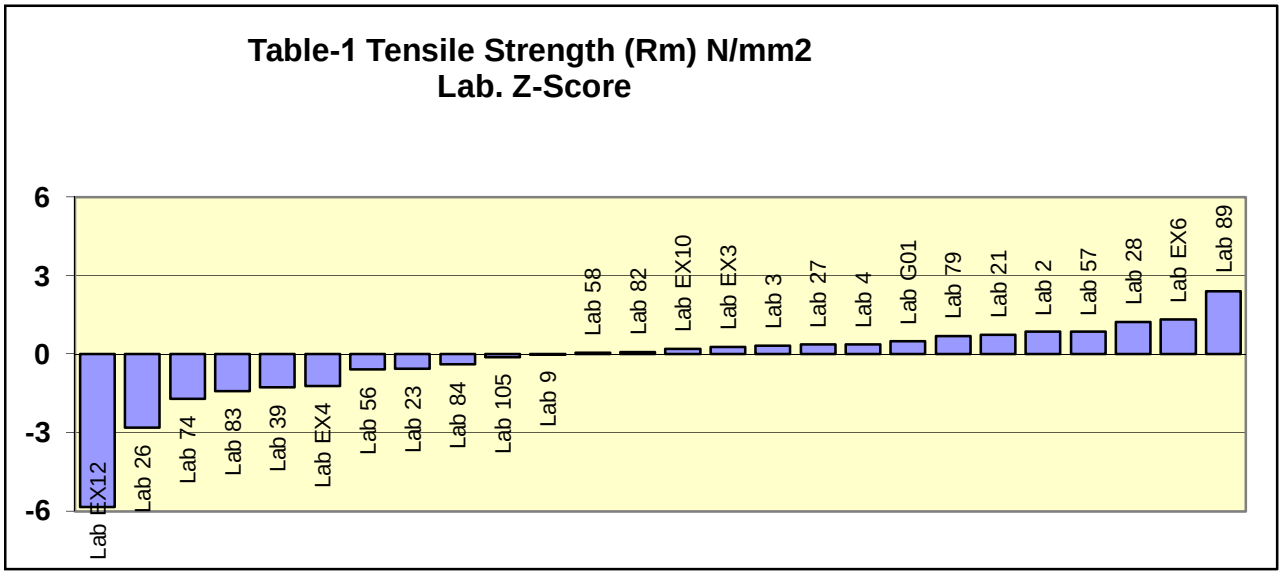
Iteration	0	xi-x*	1	$(xi-x^*)^2$	2	$(xi-x^*)^2$	3	$(xi-x^*)^2$	4	$(xi-x^*)^2$	5	$(xi-x^*)^2$	6	$(xi-x^*)^2$	
δ = 1.5 s *	---		1		1.32		1.31		1.30		1.30		1.30		
x* - δ	---		20		20.19		20.21		20.21		20.21		20.21		
x* + δ	---		23		22.83		22.82		22.82		22.82		22.82		Z Score
Lab 26	18.3	3.00	20.11	1.96	20.19	1.75	20.21	1.71	20.21	1.70	20.21	1.70	20.21	1.70	-3.66
Lab EX3	20.2	1.17	20.17	1.80	20.19	1.75	20.21	1.71	20.21	1.70	20.21	1.70	20.21	1.70	-1.55
Lab 28	20.7	0.67	20.67	0.71	20.67	0.72	20.67	0.72	20.67	0.72	20.67	0.72	20.67	0.72	-0.98
Lab 3	20.7	0.67	20.67	0.71	20.67	0.72	20.67	0.72	20.67	0.72	20.67	0.72	20.67	0.72	-0.98
Lab 39	20.7	0.60	20.73	0.60	20.73	0.61	20.73	0.61	20.73	0.61	20.73	0.61	20.73	0.61	-0.90
Lab 4	20.8	0.50	20.83	0.46	20.83	0.46	20.83	0.46	20.83	0.46	20.83	0.47	20.83	0.47	-0.79
Lab 105	21.0	0.33	21.00	0.26	21.00	0.26	21.00	0.27	21.00	0.27	21.00	0.27	21.00	0.27	-0.59
Lab 56	21.0	0.33	21.00	0.26	21.00	0.26	21.00	0.27	21.00	0.27	21.00	0.27	21.00	0.27	-0.59
Lab 74	21.0	0.33	21.00	0.26	21.00	0.26	21.00	0.27	21.00	0.27	21.00	0.27	21.00	0.27	-0.59
Lab 58	21.3	0.00	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	-0.21
Lab 84	21.3	0.00	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	-0.21
Lab 89	21.3	0.00	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	-0.21
Lab EX10	21.3	0.00	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	-0.21
Lab EX6	21.3	0.00	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	21.33	0.03	-0.21
Lab 2	21.6	0.23	21.57	0.00	21.57	0.00	21.57	0.00	21.57	0.00	21.57	0.00	21.57	0.00	0.06
Lab 21	21.7	0.33	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	0.17
Lab 57	21.7	0.33	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	0.17
Lab 83	21.7	0.33	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	21.67	0.02	0.17
Lab EX4	22.0	0.67	22.00	0.24	22.00	0.24	22.00	0.24	22.00	0.24	22.00	0.23	22.00	0.23	0.56
Lab 82	22.5	1.17	22.50	0.98	22.50	0.97	22.50	0.97	22.50	0.97	22.50	0.97	22.50	0.97	1.13
Lab 23	22.7	1.33	22.56	1.10	22.56	1.09	22.56	1.09	22.56	1.08	22.56	1.08	22.56	1.08	1.33
Lab 9	22.8	1.50	22.56	1.10	22.56	1.09	22.56	1.09	22.56	1.08	22.56	1.08	22.56	1.08	1.52
Lab 79	23.2	1.83	22.56	1.10	22.56	1.09	22.56	1.09	22.56	1.08	22.56	1.08	22.56	1.08	1.90
Lab G01	23.2	1.83	22.56	1.10	22.56	1.09	22.56	1.09	22.56	1.08	22.56	1.08	22.56	1.08	1.90
Lab 27	24.7	3.33	22.56	1.10	22.56	1.09	22.56	1.09	22.56	1.08	22.56	1.08	22.56	1.08	3.63
Lab EX12	26.0	4.67	22.56	1.10	22.56	1.09	22.56	1.09	22.56	1.08	22.56	1.08	22.56	1.08	5.16
Average	21.7		21.51	15.06	21.51	14.78	21.51	14.69	21.52	14.67	21.52	14.66	21.52	14.66	
SD	1.47		0.78	0.60	0.77	0.59	0.77	0.59	0.77	0.59	0.77	0.59	0.77	0.59	
New x*	21.33	0.55	21.51	0.78	21.51	0.77	21.51	0.77	21.52	0.77	21.52	0.77	21.52	0.77	
New s*	0.82		0.88		0.87		0.87		0.87		0.87		0.87		

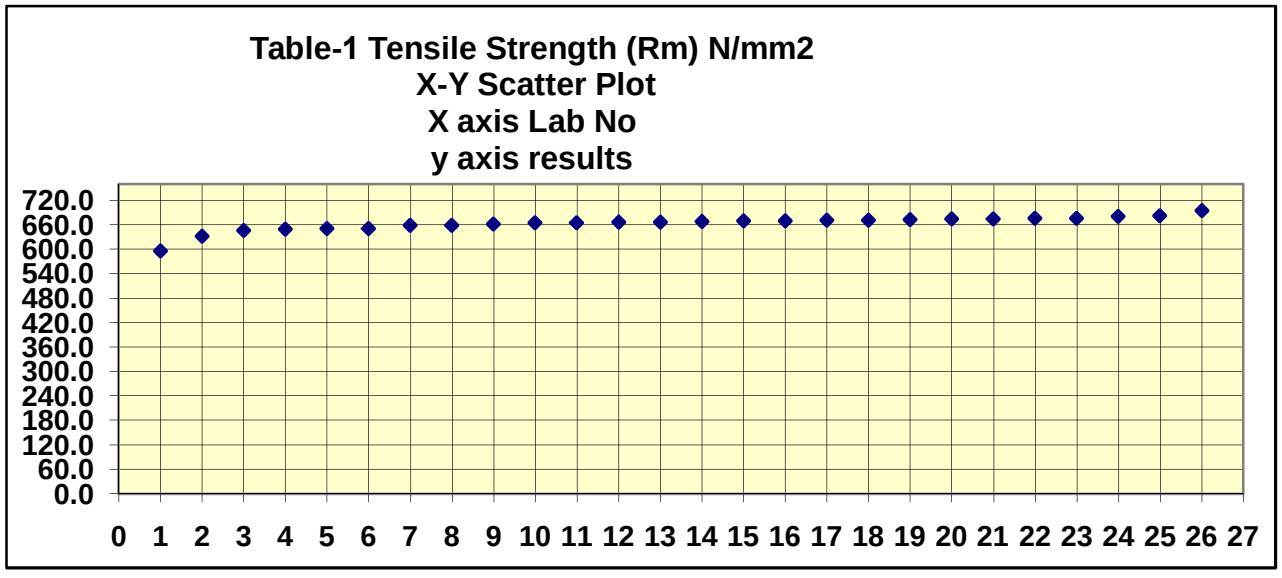
N 26

Target value	21.52
Low Acceptable	18.91
High Acceptable	24.12
Acceptable Range	18.91 - 24.12

Determination of Tensile Test of Carbon Steel Bars

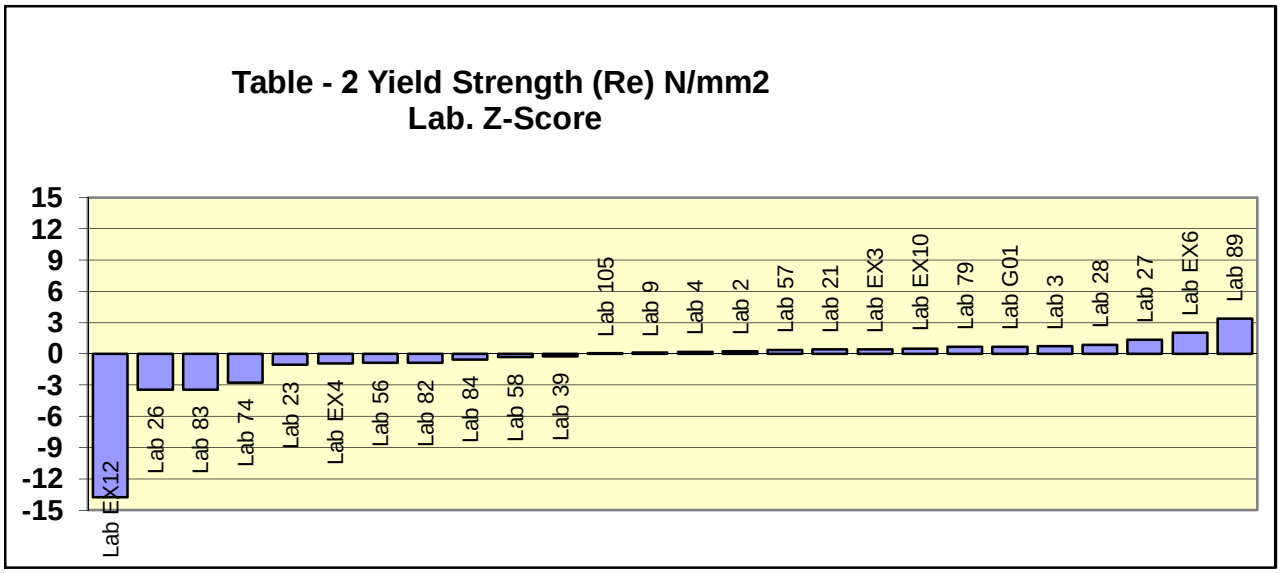
Appendex - C Charts Tensile Test of Steel Bars

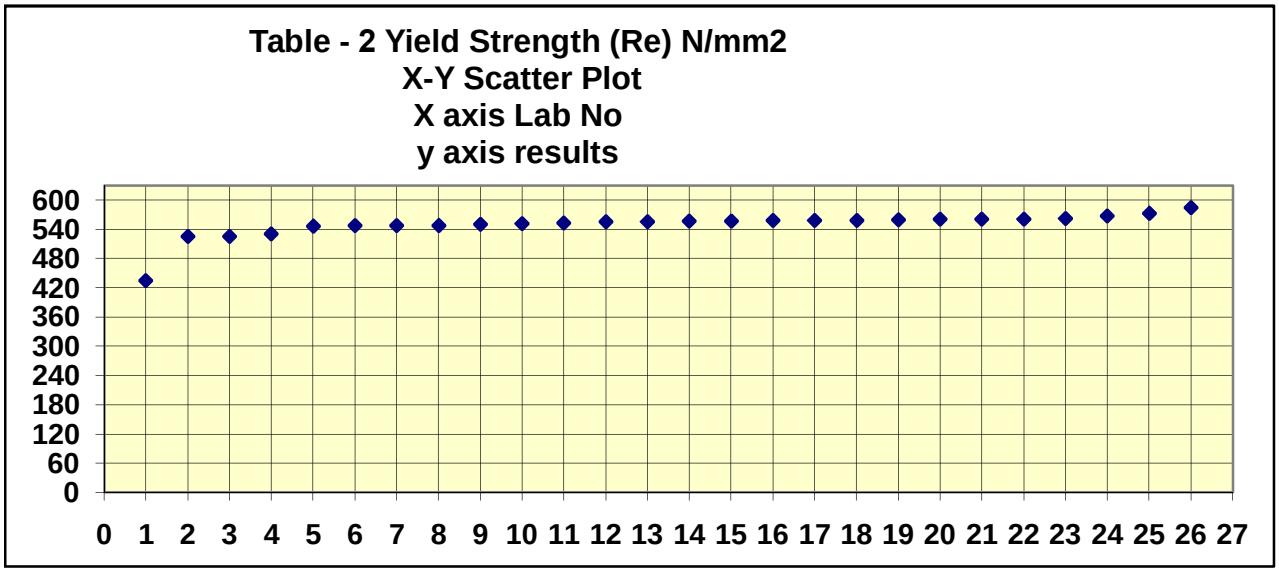




Determination of Tensile Test of Carbon Steel Bars

Appendex - C Charts Tensile Test of Steel Bars





Determination of Tensile Test of Carbon Steel Bars

Appendex - C Charts Tensile Test of Steel Bars