



REFERENCE SAMPLE PROGRAM
**RELATIVE COMPACTION OF
UNTREATED AND TREATED SOILS
AND AGGREGATE**
2010 PROFICIENCY TEST RESULTS

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1.0 OVERVIEW

The 2009 Relative Compaction proficiency test was started in September 2009. The proficiency test utilized California Tests (CT) 216 – “Relative Compaction of Untreated and Treated Soils and Aggregates”.

Approximately 50 pounds of Class II recycled aggregate base proficiency samples were sent to each participating laboratories. The goal of this test determines the proximity of results between Caltrans, Private, and Local Agency laboratories considering the subjective nature of this specific test. One hundred fifty-four (154) laboratories participated in the initial round of testing. Test results were received in January 2010 and analyzed in accordance with Caltrans Independent Assurance Program Manual. Laboratories that failed to achieve an acceptable score in the initial test were provided with an additional sample to conduct a retest. This report presents test results from both the initial test and the retest.

2.0 ANALYSIS OF TEST RESULTS

2.1 EVALUATION CRITERIA

Test results were analyzed using a statistical evaluation system in which the mean (**X**) and standard deviation (**s**) was calculated for each test parameter. A rating score was then given to the test result based on the criteria shown in Table 1. A test result with a score of 3 or greater was considered acceptable. A test result with a score of 2 or less was considered unacceptable and a retest was required.

Table 1: Evaluation Criteria

Test Result	Rating	Interpretation of Results	Acceptance
$X \pm 1.0s$	5	Very Good	Acceptable
$X \pm 1.5s$	4	Good	
$X \pm 2.0s$	3	Fair	
$X \pm 2.5s$	2	Poor	Unacceptable
$X \pm 3.0s$	1	Very Poor	

2.2 INITIAL TEST

A total of 154 laboratories participated in the initial test. An analysis for outliers in accordance with ASTM E 178 indicated that a test result from one of the laboratories was a possible outlier. This outlier is summarized in Table 2.

Table 2: Labs and Test Results Considered as Outliers

CT	# of Outlier	Lab ID
216	1	128

After removing the outlier, the mean value and standard deviation for each test parameter were re-calculated to determine the score for the respective test parameter. The analysis results are presented in Table 3. Detailed test results are provided in Appendix A.

Table 3: Summary of Initial Test Results

CT 216 – Relative Compaction of Untreated and Treated Soils and Aggregates								
Item	# Lab	Average	Standard Deviation	Number of Labs with Rating of				
				5	4	3	2	1
Relative Compaction, %	153	96.8	1.7	109	17	19	7	1
% of Total				71	11	12	5	1*

*Lab #128 was considered as an outlier and was not included in the initial analysis

RETEST

In the initial test, nine laboratories did not receive an acceptable score. Samples for a retest were sent to these laboratories in February 2010. These laboratories were: 29, 31, 110, 128, 151, 174, 178, 234, and 297. Their results were included in the analysis of the retest results.

The outlier analysis was performed following ASTM E-178. It was determined that there were no outlier values on the retest results. The retest score for each laboratory was determined by comparing the retest result with the rating range from the initial test. Table 4 presents the mean value and standard deviation from the retest. Detailed test results and scores are provided in Appendix B.

Table 4: Summary of Retest Results

CT 216 - Relative Compaction of Untreated and Treated Soils and Aggregates								
Item	# Lab	Average	Standard Deviation	Number of Labs with Rating of				
				5	4	3	2	1
Relative Compaction, %	9	97	1.36	7	2	0	0	0
% of Total				78	22			

2.3 COMBINED RESULTS

A total of 154 laboratories participated in the reference sample program. Nine laboratories participated in both the initial test and the retest. Table 5 shows combined scores from both the initial test and the retest. The final combined scores are provided in Appendix C.

Table 5: Summary of Combined Test Results

Test Method	Total # Labs	Number of Labs Achieved Score of				
		5	4	3	2	1
CT 216	154	116	19	19	0	0
	% of Total	75	12.5	12.5		

2.4 OBSERVATIONS

There were nine laboratories that failed in the initial test. A retest was conducted by these laboratories and acceptable results were achieved. No further failures were observed. Possible causes of the initial failure maybe attributed to the following:

- Equipment out of calibration – it was noticed that some tamper weights were over the allowable tolerance.
- Not following proper test procedure/s or best practice, i.e., inaccurate tamper graduation reading, inaccurate moisture computation, inconsistent tamper drop height.

3.0 SUMMARY

- CT 216 – In the initial round of testing, 154 laboratories participated, 9 of which did not achieve an acceptable score. The 9 laboratories with poor scores were given an additional sample to conduct a retest. After the retest was completed, all 9 laboratories submitted satisfactory results and were able to gain acceptable scores.

4.0 REFERENCES

ASTM, “Standard Practice for Dealing with Outlying Observations,” Designation E 178 – 80.

Caltrans, “Independent Assurance Manual,” Sacramento, July 2005.

APPENDIX – A

Test Results from Initial Test

Lab No.	Results, %	Score
9	96	5
12	96	5
15	97	5
17	100	3
18	97	5
19	97	5
20	99	4
21	97	5
22	97	5
23	95	5
24	99	4
26	96	5
27	96	5
29	93	2
31	93	2
42	95	5
48	96	5
49	97	5
53	96	5
56	96	5
57	96	5
64	99	4
65	96	5
66	95	5
67	96	5
70	96	5
76	99	4
79	97	5
80	96	5
84	95	5
87	97	5
88	97	5
89	97	5
91	97	5
92	96	5
95	94	3
96	94	3
101	96	5
102	97	5
104	95	5
110	93	2

Lab No.	Results, %	Score
114	100	3
125	94	3
126	99	4
127	96	5
128	90	0
131	95	5
133	96	5
137	97	5
139	98	5
145	96	5
146	97	5
149	98	5
151	93	2
158	97	5
165	96	5
166	96	5
174	93	2
177	99	4
178	102	1
182	99	4
196	97	5
200	97	5
201	99	4
204	96	5
206	96	5
207	96	5
210	96	5
211	99	4
216	96	5
223	96	5
225	96	5
226	96	5
233	96	5
234	93	2
237	100	3
239	97	5
244	99	4
248	97	5
250	94	3
255	96	5
261	96	5

Lab No.	Results, %	Score
263	97	5
268	95	5
272	96	5
277	99	4
280	98	5
290	97	5
293	96	5
297	93	2
300	95	5
302	97	5
303	96	5
307	99	4
310	97	5
311	97	5
316	97	5
317	100	3
318	99	4
323	97	5
325	97	5
330	97	5
331	97	5
332	96	5
334	97	5
339	99	4
348	100	3
351	97	5
354	94	3
356	94	3
358	96	5
359	98	5
361	96	5
366	96	5
373	96	5
375	97	5
379	97	5
380	96	5
383	97	5
389	97	5
391	97	5
393	97	5
395	97	5
401	98	5
402	98	5
403	96	5
405	96	5
407	97	5
417	99	4

Lab No.	Results, %	Score
418	97	5
422	95	5
437	97	5
438	99	4
444	100	3
449	95	5
455	96	5
458	96	5
459	97	5
461	97	5
462	100	3
464	97	5
470	100	3
471	100	3
472	99	4
473	100	3
474	100	3
560	97	5
568	96	5
573	96	5
595	96	5
598	100	3
599	100	3
601	96	5
602	97	5

Legend:

- 1,2 Unacceptable Score
- O Outlier

APPENDIX - B

Test Results from Retest

Lab No.	Results, %	Score
29	97	5
31	97	5
110	97	5
128	96	5
151	96	5
174	95	5
178	99	4
234	99	4
297	96	5

APPENDIX - C

Combined Final Scores from both Initial Test and Retest

Lab No.	Results, %	Score
9	96	5
12	96	5
15	97	5
17	100	3
18	97	5
19	97	5
20	99	4
21	97	5
22	97	5
23	95	5
24	99	4
26	96	5
27	96	5
29	97	5
31	97	5
42	95	5
48	96	5
49	97	5
53	96	5
56	96	5
57	96	5
64	99	4
65	96	5
66	95	5
67	96	5
70	96	5
76	99	4
79	97	5
80	96	5
84	95	5
87	97	5
88	97	5
89	97	5
91	97	5
92	96	5
95	94	3
96	94	3
101	96	5
102	97	5
104	95	5
110	97	5

Lab No.	Results, %	Score
114	100	3
125	94	3
126	99	4
127	96	5
128	96	5
131	95	5
133	96	5
137	97	5
139	98	5
145	96	5
146	97	5
149	98	5
151	96	5
158	97	5
165	96	5
166	96	5
174	95	5
177	99	4
178	99	4
182	99	4
196	97	5
200	97	5
201	99	4
204	96	5
206	96	5
207	96	5
210	96	5
211	99	4
216	96	5
223	96	5
225	96	5
226	96	5
233	96	5
234	99	4
237	100	3
239	97	5
244	99	4
248	97	5
250	94	3
255	96	5
261	96	5

Lab No.	Results, %	Score
263	97	5
268	95	5
272	96	5
277	99	4
280	98	5
290	97	5
293	96	5
297	96	5
300	95	5
302	97	5
303	96	5
307	99	4
310	97	5
311	97	5
316	97	5
317	100	3
318	99	4
323	97	5
325	97	5
330	97	5
331	97	5
332	96	5
334	97	5
339	99	4
348	100	3
351	97	5
354	94	3
356	94	3
358	96	5
359	98	5
361	96	5
366	96	5
373	96	5
375	97	5
379	97	5
380	96	5
383	97	5

Lab No.	Results, %	Score
389	97	5
391	97	5
393	97	5
395	97	5
401	98	5
402	98	5
403	96	5
405	96	5
407	97	5
417	99	4
418	97	5
422	95	5
437	97	5
438	99	4
444	100	3
449	95	5
455	96	5
458	96	5
459	97	5
461	97	5
462	100	3
464	97	5
470	100	3
471	100	3
472	99	4
473	100	3
474	100	3
560	97	5
568	96	5
573	96	5
595	96	5
598	100	3
599	100	3
601	96	5
602	97	5