



REFERENCE SAMPLE PROGRAM

**METHOD OF TEST FOR
EVALUATING CLEANNES OF
COARSE AGGREGATE**

2016 PROFICIENCY TEST RESULTS

State of California Department of Transportation
Division of Engineering Services
Materials Engineering and Testing Services-MS #5
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TABLE OF CONTENTS

1.0	Overview	2
2.0	Analysis of Test Results	3
2.1	EVALUATION CRITERIA	3
2.2	INITIAL TEST	3
2.3	RETEST	4
2.4	COMBINED RESULTS	5
2.5	OBSERVATIONS.....	6
3.0	Summary.....	6
4.0	References.....	7

LIST OF TABLES

Table 1: Evaluation Criteria	3
Table 2: Labs and Test Results Considered as Outliers for Cleanness Value	3
Table 3: Summary of Initial Test Results	4
Table 4: Summary of Retest Results A (CT 227)	5
Table 4: Summary of Retest Results B (CT 227)	5
Table 4: Summary of Retest Results C (CT 227)	5
Table 5: Summary of Witness Test Results (CT 227)	5
Table 6: Summary of Combined Test Results (CT 227)	6

Appendix A – Test Results from Initial Test

Appendix B – Test Results from Retest

Appendix C – Test Results from Witness Test

REFERENCE SAMPLE PROGRAM

EVALUATING CLEANNES OF COARSE AGGREGATE 2016 PROFICIENCY TEST RESULTS

1.0 OVERVIEW

In early March 2016, Caltrans Reference Sample Program (RSP) sent out an invitation to participate to laboratories. This proficiency test was centered on the California Test (CT) 227 “Method of Test for Determining Cleanness of Coarse Aggregate”. The proficiency samples were prepared in the state References Sample Laboratory located at 5900 Folsom Blvd, Sacramento, CA. A total of 3 sample sets namely A, B, and C were prepared specifically for this round of proficiency testing. Each sample set was designed with a specific standard target value determined prior to sample distribution.

The significance of this test is that it provides an indication of how well asphalt binder will bond with the coarse aggregate. The cleanness value is also used to determine aggregate quality used on treated permeable bases, concrete pavement, and structure concrete. This test assigns an empirical value to the amount of clay-sized material clinging to the coarse aggregate. When necessary, a minimum cleanness value may be specified in order not to exceed a tolerable amount of clay sized material in aggregate. Excessive clay size material will coat the aggregate surface and prevent the asphalt binder from bonding. Improper bonding will impact HMA mix stability, may lead to moisture damage, and stripping in our HMA pavements.

The mass used for the CT 227 samples was 2500 ± 125 grams retained above the #4 sieve. The aggregate used in the proficiency tests originated from a single source to maintain material uniformity.

The purpose of performing this test is to ensure that laboratories performing CT 227 are proficient in conducting this test. This includes using the correct test equipment and providing accurate test results to Caltrans RSP.

Caltrans RSP sent out 637 announcement letters. The initial round of participating labs that responded to the announcement letter was 276 laboratories that include private, local agencies, and state laboratories. During the initial evaluation, 11 laboratories did not submit results. The final count for participants were 265 laboratories.

2.0 ANALYSIS OF TEST RESULTS

2.1 EVALUATION CRITERIA

Results were evaluated using a statistical evaluation system in which the mean (X) and standard deviation (s) were calculated. A rating score was then applied to the test results based on the criteria shown in Table 1. A test result with a score of 3 or greater was considered an acceptable result. 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 265 laboratories participated in the initial test. Laboratories were excluded from the statistical analysis for one of the following reasons. (1) Test results not submitted by the prescribed deadline. However, laboratories that submitted late results were ultimately scored using the initial analysis results as reference. (2) Results were not submitted on the data sheet issued. Analysis for outliers in accordance with ASTM E 178 was conducted for each set of samples. These outliers were summarized in Table 2. The initial statistical analysis is summarized in Table 3.

Table 2: Labs and Test Results Considered as Outliers for Cleanness Value

Sample	Count	Outliers	Lab ID
A	104	2	321, 398
B	99	none	none
C	62	1	639

After excluding the outliers, the average and standard deviation were re-calculated for each sample set to determine the score for each of the remaining 262 laboratories. The analysis results are presented in Table 3. Detailed test results are provided in Appendix A.

Table 3: Summary of Initial Test Results (outliers removed)

CT 227: SAMPLE A

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	102	0.817	0.309	67	25	7	2	1
% of Total				65.6%	24.5%	6.9%	2.0%	1.0%

CT 227: SAMPLE B

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	99	0.724	0.283	68	19	8	4	0
% of Total				68.7%	19.2%	8.1%	4.0%	0.0%

CT 227: SAMPLE C

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	61	0.300	0.122	47	0	13	1	0
% of Total				77.0%	0.0%	21.3%	1.7%	0.0%

2.3 RETEST

Re-test samples were sent to laboratories whose test results were considered as outliers and to laboratories that scored a rating of 2 and below. In the initial analysis, 11 laboratories did not achieve acceptable ratings. These laboratories were: 31, 104, 398, 321, 250, 634, 5, 6, 395, 302 and 639. In May, 2016, these laboratories were provided with an additional sample to conduct retest. The retest results were evaluated based on the initial statistical analysis results. The retest summary is presented in Table 4A – 4C. Detailed retest results and scores are provided in Appendix B. Laboratory #104 did not achieve acceptable rating for the retest. A third sample was sent to laboratory #104 for a 2nd retest which was witnessed by Caltrans (IA) Independence Assurance staff. A Summary of witness test results is provided in Table 5.

Table 4A: Summary of Retest Results (includes outliers)

Sample A

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	4	.817	0.309	4	0	0	1	0
% of Total				80%	0.0%	0.0%	20%	0.0%

Table 4B: Summary of Retest Results

Sample B

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	4	.724	0.283	4	0	0	0	0
% of Total				100%	0.0%	0.0%	0.0%	0.0%

Table 4C: Summary of Retest Results

Sample C

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	2	.300	.122	2	0	0	0	0
% of Total				100%	0.0%	0.0%	0.0%	0.0%

Table 5: Summary of Witness Test Results

Sample A

Item	# of Laboratories	Average Sediment Ht. (in)	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 227	1	.817	0.309	1	0	0	0	0
% of Total				100%	0.0%	0.0%	0.0%	0.0%

2.4 COMBINED RESULTS

A total of 265 laboratories participated in the reference sample program, 11 laboratories participated in both the initial test and the retest with a single laboratory failing to attain an acceptable result. Laboratory #104 failed to achieve acceptable results which was later witnessed by Caltrans IA personnel. The final combined score that includes the initial test, retest, 2nd retest, and witness test are scored in Table 6.

Table 6: Summary of Combined Test Results

Test Method	# of Laboratories	Number of Labs Achieved Score of				
		5	4	3	2	1
CT 227	265	193	44	28	0	0
	% of Total	73%	17%	10.0%	0.0%	0.0%

2.5 OBSERVATIONS

During the initial testing, 11 laboratories failed the cleanness value proficiency test. Consequently, retests for these 11 laboratories were required to ensure that laboratories are correctly following the test methods and using the correct equipment. The retest samples provides these laboratories corrective measures to obtain acceptable results. The corrective measures include determining reasons for failures, aid in resolving any issues related to the equipment, test procedure and sample. Once the retest was completed and results were evaluated, one laboratory failed to meet acceptable results. Laboratory # 104 was provided with a sample to perform a 2nd re-test with Caltrans IA staff present to observe. Caltrans IA staff provided verbal notes and test results for Laboratory #104. The Caltrans IA staff indicated that on the initial test and 1st retest, laboratory #104 sieved the material over the #4 sieve as though it were 1½inch material. This process removed material that would otherwise be part of the final sediment height reading. This error was identified and corrected on site.

3.0 SUMMARY

In the initial round of testing, 265 laboratories participated. Out of the 265 participants 11 laboratories failed the initial test. The failure constitutes laboratories whose results were considered as outliers and those with results below a score rating of 3. Laboratories that failed to submit their references sample results were not considered in the statistical analysis. Samples were provided to the 11 failed laboratories for a retest, and 10 laboratories passed with satisfactory results. The one laboratory that failed the 1st retest was later given a 2nd retest with Caltrans IA staff present the laboratory achieved a passing rating.

During the evaluation process it was discovered that laboratory #302 was issued an acceptable rating in error during the initial test. Laboratory #302 was notified and given a retest. Once completing the retest the laboratory achieved acceptable results.

4.0 REFERENCES

California Test Method 227, “Method of Test for Evaluating Cleanness of Coarse Aggregate”

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

Sample Set A			
Lab ID	Sediment Height (in)	CV	Rating
110	1.1	73	5
31	1.5	66	2
62	0.7	81	5
56	1	75	5
29	0.2	94	3
520	1	75	5
521	1.2	71	4
273	1.2	71	4
49	0.8	79	5
457	1.1	73	5
366	0.5	90	4
593	1.1	73	5
87	1	75	5
74	0.9	77	5
302	1.9	60	1
552	0.8	79	5
63	1.2	73	4
533	0.4	89	4
351	1.1	73	5
612	0.9	77	5
196	0.7	81	5
576	0.6	84	5
550	0.8	79	5
40	0.7	81	5
103	0.8	79	5
104	0.1	97	2

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 Proficiency Test Results
 Office of Roadway Materials Testing

Sample Set A			
Lab ID	Sediment Height (in)	CV	Rating
183	0.9	77	5
264	0.7	81	5
48	0.9	77	5
335	1	75	5
333	1.1	73	5
42	0.3	91	3
52	1.1	73	5
90	0.6	86	5
283	0.9	77	5
432	1.2	71	4
67	1	75	5
198	1.2	71	4
207	1	75	5
145	1	73	5
377	1	75	5
66	1	75	5
543	0.9	77	5
253	0.3	91	3
600	1.2	71	4
30	1	75	5
75	0.9	77	5
372	1	75	5
412	0.9	77	5
516	0.5	86	4
608	1	75	5
98	1.3	69	3
535	0.9	77	5
214	0.6	84	5
92	1	75	5
636	1	75	5
140	1.2	71	4
32	0.5	86	4
93	0.9	77	5
151	1	75	5
346	0.5	86	4
423	1	75	5
614	1.2	71	4
73	1.1	73	5

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 Proficiency Test Results
 Office of Roadway Materials Testing

Sample Set A			
Lab ID	Sediment Height (in)	CV	Rating
193	0.9	77	5
246	1.1	73	5
271	1.1	73	5
483	1	75	5
551	1	75	5
394	1	75	5
400	0.9	77	5
128	1.1	73	5
26	0.9	77	5
309	0.2	94	3
16	0.8	79	5
310	0.4	89	4
131	0.5	86	4
149	0.5	86	4
354	0.5	86	4
1	0.7	81	5
348	0.7	81	5
430	0.7	81	5
603	0.6	84	5
360	0.6	84	5
437	0.4	89	4
317	0.5	86	4
422	0.5	86	4
21	0.6	84	5
201	0.4	89	4
332	0.3	91	3
417	0.3	91	3
187	0.4	89	4
182	0.4	89	4
476	0.7	81	5
7	0.5	86	4
314	0.8	79	5
345	0.7	81	5
419	0.4	89	4
10	0.7	81	5
403	0.6	84	5
11	0.9	77	5
172	0.9	77	5

Sample Set B			
Lab ID	Sediment Height (in)	CV	Rating
469	0.7	81	5
385	0.5	86	5
79	0.4	89	4
83	0.7	81	5
170	0.7	81	5
65	0.5	86	5
449	0.5	86	5
611	0.5	86	5
375	0.4	89	4
176	0.5	86	5
339	0.4	90	4
596	0.7	81	5
249	0.6	84	5
209	0.5	86	5
381	1	75	5
47	0.6	84	5
68	0.5	86	5
303	0.6	84	5
102	0.5	86	5
441	0.2	94	3
265	0.5	86	5
233	1	75	5
482	0.4	89	4
342	0.7	81	5
561	0.4	89	4
448	0.9	77	5
45	0.6	84	5
256	0.6	84	5
364	0.4	89	4
147	0.6	84	5
252	0.6	84	5
234	1.1	73	4
250	1.3	69	2
266	1	75	5
213	0.5	86	5
203	0.6	84	5
420	0.9	77	5

RSP Evaluation Cleanness of Coarse Aggregate
 Proficiency Test Results
 Office of Roadway Materials Testing

Sample Set B			
Lab ID	Sediment Height (in)	CV	Rating
57	0.5	88	5
166	0.5	86	5
173	0.7	81	5
296	0.5	86	5
223	0.7	81	5
293	1	75	5
300	0.4	89	4
96	0.4	89	4
361	0.9	77	5
177	0.3	91	3
451	0.4	89	4
59	0.5	86	5
195	0.5	86	5
387	0.9	77	5
479	1.1	73	4
589	0.5	86	5
316	0.6	84	5
113	0.5	86	5
536	0.5	86	5
634	1.3	69	2
118	0.6	84	5
69	0.6	84	5
160	0.6	84	5
549	0.4	89	4
55	1.1	73	4
99	0.5	86	5
464	0.5	86	5
353	0.6	84	5
100	0.5	86	5
228	0.5	86	5
269	1.2	71	3
301	0.7	81	5
485	0.6	84	5
635	0.7	81	5
388	0.7	81	5
609	0.6	6	5
76	0.7	81	5
461	0.7	81	5

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Sample Set B			
Lab ID	Sediment Height (in)	CV	Rating
20	1.2	71	3
17	1	75	5
46	1.1	73	4
22	1.1	73	4
2	1.2	71	3
349	0.8	79	5
508	0.5	86	5
3	0.8	79	5
382	1.1	73	4
438	1	75	5
318	0.9	77	5
5	1.3	69	2
211	0.5	86	5
334	1	75	5
6	1.4	68	2
515	1.1	73	4
308	1.2	71	3
312	1.1	73	4
319	1	75	5
407	0.7	81	5
445	1.2	71	3
401	1.1	73	4
426	1.2	71	3
12	0.6	84	5

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 Proficiency Test Results
 Office of Roadway Materials Testing

Sample Set C			
Lab ID	Sediment Height (in)	CV	Rating
70	0.2	94	5
569	0.1	97	3
164	0.4	89	5
257	0.2	94	5
413	0.4	89	5
58	0.4	89	5
263	0.2	94	5
286	0.5	86	3
205	0.3	91	5
297	0.4	89	5
587	0.4	89	5
237	0.2	94	5
284	0.2	94	5
340	0.5	86	3
396	0.4	89	5
511	0.3	91	5
590	0.4	89	5
97	0.2	94	5
359	0.3	91	5
219	0.3	91	5
43	0.2	94	5
369	0.2	94	5
135	0.3	91	5
184	0.3	91	5
144	0.1	97	3
86	0.4	89	5
221	0.5	86	3
627	0.2	94	5
395	0.6	84	2
580	0.3	91	5
192	0.1	97	3
245	0.3	91	5
270	0.5	86	3
304	0.4	89	5
534	0.1	97	3
322	0.3	91	5
241	0.2	94	5
615	0.4	89	5

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Sample Set C			
Lab ID	Sediment Height (in)	CV	Rating
158	0.1	97	3
18	0.3	91	5
24	0.3	91	5
19	0.3	91	5
226	0.4	89	5
64	0.3	91	5
416	0.3	91	5
513	0.3	91	5
141	0.4	89	5
480	0.4	89	5
362	0.4	89	5
146	0.1	97	3
330	0.2	94	5
379	0.2	94	5
139	0.5	86	3
313	0.2	94	5
7	0.5	86	3
538	0.4	89	5
418	0.3	91	5
9	0.2	94	5
402	0.5	86	3
509	0.2	94	5
148	0.3	91	5

APPENDIX - B

Test Results from Retest

Lab ID	Sediment Height (in)	CV	Rating
31	0.9	77	5
398	1	75	5
321	0.8	79	5
104	0.2	94	2
250	0.6	84	5
634	0.5	86	5
5	0.6	84	5
6	0.5	86	5
639	0.3	91	5
395	0.2	94	5
302	0.7	81	5

APPENDIX - C

Final Scores from Witness Test

Lab ID	Sediment Height (in)	CV	Rating
104	0.9	77	5