# **STANDARD SPECIFICATIONS**

STATE OF CALIFORNIA BUSINESS, TRANSPORTATION AND HOUSING AGENCY DEPARTMENT OF TRANSPORTATION

# 2010

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## 39 HOT MIX ASPHALT 39-1 GENERAL

39-1.01 GENERAL

39-1.01A Summary

### 39-1.04 CONTRACTOR QUALITY CONTROL

#### 39-1.04A General

#### 39-1.04F Density Cores

To determine density for Standard and QC/QA construction process projects, take 4- or 6-inch diameter density cores{ XE "Density cores" } at least once every 5 business days. Take 1 density core for every 250 tons of HMA from random locations the Engineer designates. Take density cores in the Engineer's presence and backfill and compact holes with authorized material. Before submitting a density core, mark it with the density core's location and place it in a protective container.

If a density core is damaged, replace it with a density core taken within 1 foot longitudinally from the original density core. Relocate any density core located within 1 foot of a rumble strip to 1 foot transversely away from the rumble strip.

#### 39-1.04G Briquettes

Prepare 3 briquettes{ XE "Briquettes" } for each stability and air void content determination. Report the average of 3 tests. Prepare new briquettes and test again when the range of stability for the 3 briquettes is more than 8 points.

You may use the same briquettes used for stability testing to determine bulk specific gravity under California Test 308. If you use these briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity.

#### **39-1.05 ACCEPTANCE CRITERIA**

HMA acceptance is specified in the sections for each HMA construction process.

The Department samples materials for testing under California Test 125 and the applicable test method, except samples may be taken:

- 1. At the plant from a truck or an automatic sampling device
- 2. From the mat behind the paver

Sampling must be independent of Contractor quality control, statistically based, and random.

If you request, the Department splits samples and provides you with a part.

HMA acceptance is based on:

- 1. Authorized JMF
- 2. Accepted QC plan for Standard and QC/QA construction process projects
- 3. Compliance with the HMA acceptance tables
- 4. Lot acceptance for QC/QA construction process projects
- 5. Visual inspection

The Department prepares 3 briquettes for each stability and air void content determination. The average of 3 tests is reported. If the range of stability for the 3 briquettes is more than 8 points, new briquettes are prepared and tested.

The Department may use the briquettes used for stability testing to determine bulk specific gravity under California Test 308. If the Engineer uses the same briquettes and the tests using that bulk specific gravity fail, the Engineer prepares 3 new briquettes and determines a new bulk specific gravity.

#### **39-1.06 DISPUTE RESOLUTION**

#### Replace "5 days" in the 1st paragraph of section 39-1.06 with:

01-20-12

Work with the Engineer to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer within 5-days-5 business days of receiving a test result if you dispute the test result.

If you or the Engineer dispute each other's test results, submit quality control test results and copies of paperwork including worksheets used to determine the disputed test results. An independent third party performs referee testing. Before the independent third party participates in a dispute resolution, the party must be accredited under the Department's Independent Assurance Program. The independent third party must be independent of the project. By mutual agreement, the independent third party is chosen from:

- 1. Department laboratory
- 2. Department laboratory in a district or region not in the district or region the project is located
- 3. Transportation Laboratory
- 4. Laboratory not currently employed by you or your HMA producer

If split quality control or acceptance samples are not available, the independent third party uses any available material representing the disputed HMA for evaluation.

#### **39-2 STANDARD CONSTRUCTION PROCESS**

#### 39-2.01 GENERAL

Section 39-2 includes specifications for HMA produced and constructed under the Standard construction process.

#### 39-2.02 CONTRACTOR QUALITY CONTROL

#### 39-2.02A Quality Control Plan

Establish, implement, and maintain a QC plan for HMA. The QC plan must describe the organization and procedures you will use to:

- 1. Control the quality characteristics
- 2. Determine when corrective actions are needed (action limits)
- 3. Implement corrective actions

When you submit the proposed JMF, submit the proposed QC plan. You and the Engineer must discuss the QC plan during the prepaving conference.

The QC plan must address the elements affecting HMA quality including:

- 1. Aggregate
- 2. Asphalt binder
- 3. Additives
- 4. Production
- 5. Paving

The Engineer reviews each QC plan within 5 business days from the submittal. Do not produce HMA until the Engineer authorizes the QC plan.

#### 39-2.02B Quality Control Testing

Perform sampling and testing at the specified frequency for the quality characteristics shown in the following table:

Quality	Test	Minimum	um HMA type				
characteristic	method	sampling and testing frequency	А	В	RHMA-G	OGFC	
Aggregate gradation <sup>a</sup>	California Test 202	1 per 750 tons and	JMF ± Tolerance <sup>b</sup>	JMF ± Tolerance <sup>b</sup>	JMF ± Tolerance <sup>b</sup>	JMF ± Tolerance <sup>b</sup>	
Sand equivalent	California	any	47	42	47		
Asphalt binder content (%)	California Test 379 or 382	part at the end of the project	JMF±0.40	JMF±0.40	JMF ± 0.40	JMF ± 0.40	
HMA moisture content (%, max)	California Test 226 or 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	1.0	
Field compaction (% max. theoretical density) <sup>d,e</sup>	QC plan	2 per business day (min.)	91–97	91–97	91–97		
Stabilometer	California	1 per 4,000					
No. 4 and 3/8"	1651 500	per 5	30	30			
1/2" and 3/4" gradings		days, whichever	37	35	23		
Air void content (%) <sup>c, f</sup>	California Test 367	is greater	4 ± 2	4 ± 2	$TV \pm 2$		
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants <sup>9</sup>	California Test 226 or 370	2 per day during production					
Percent of crushed particles coarse aggregate (%, min) One fractured face Two fractured faces Fine aggregate (%, min) (Passing no. 4 sieve and retained on no. 8 sieve.)	California Test 205	As designated in the QC plan. At least once per project	90 75	25 	 90	90 75	

# Minimum Quality Control—Standard Construction Process

One fractured			70	20	70	90
face						
Los Angeles	California					
Rattler (%, max)	Test 211					
Loss at 100			12		12	12
rev.						
Loss at 500			45	50	40	40
rev.						
Flat and	California		Report only	Report only	Report only	Report only
elongated	Test 235					
particles (%, max						
by weight @ 5:1)	Oplifamia		45	45	45	
Fine aggregate	California		45	45	45	
min <sup>h</sup>	1651 254					
Voids filled with	California					
asphalt (%) <sup>i</sup>	Test 367					
No. 4 grading	1001001		65.0-75.0	65.0-75.0		
3/8" grading			65.0-75.0	65.0-75.0	Report only	
1/2" grading			65.0-75.0	65.0-75.0		
3/4" grading			65.0-75.0	65.0-75.0		
Voids in mineral	California					
aggregate (%	Test 367					
min) <sup>i</sup>						
No. 4 grading			17.0	17.0		
3/8" grading			15.0	15.0		
1/2 grading			14.0	14.0	18.0-23.0	
Dust proportion <sup>i</sup>	California		15.0	15.0	10.0-23.0	
No. 4 and 3/8"	Test 367		0.6-1.2	0.6-1.2		
gradings					Report only	
1/2" and 3/4"			0.6-1.2	0.6-1.2		
gradings						
Hamburg wheel	AASHTO					
track	T 324	1 per				
(minimum number	(Modified)	10,000				
of passes at 0.5		tons or 1				
Inch average rut		per project				
PG-58		is more	10,000	10,000		
PG-64		13 11016	15,000	15,000		
PG-70			20,000	20,000		
PG-76 or higher			25,000	25,000		
Hamburg wheel	AASHTO		, í	, í		
track	T 324	1 per				
(inflection point	(Modified)	10,000				
minimum number		tons or 1				
of passes) j		per project				
PG-58		whichever	10,000	10,000		
PG-64		is more	10,000	10,000		
PG-70 PG-76 or bighor			12,500	12,500		
Moisture	California		15000	15000		
susceptibility	Test 371	≥15%	120	120		

(minimum dry strength, psi) <sup>j</sup>		1 per 10,000 tons or 1 per project whichever is greater				
Moisture susceptibility (tensile strength ration, %) <sup>i</sup>	California Test 371	For RAP ≥15% 1 per 10,000 tons or 1 per project whichever is greater	70	70		
Smoothness	Section 39-1.12		12-foot straight- edge, must grind, and Pl₀	12-foot straight- edge, must grind, and Pl₀	12-foot straight- edge, must grind, and Pl₀	12-foot straight- edge, must grind, and Pl₀
Asphalt rubber binder viscosity @ 375 °F, centipoises	Section 39-1.02D	Section 39-1.04C			1,500– 4,000	1,500– 4,000
Asphalt modifier	Section 39-1.02D	Section 39-1.04C			Section 39-1.02D	Section 39-1.02D
CRM	Section 39-1.02D	Section 39-1.04C			Section 39-1.02D	Section 39-1.02D

<sup>a</sup> Determine combined aggregate gradation containing RAP under California Test 367.

<sup>b</sup> The tolerances must comply with the allowable tolerances in section 39-1.02E.

<sup>c</sup> Report the average of 3 tests from a single split sample.

<sup>d</sup> Determine field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.

2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

<sup>e</sup> To determine field compaction use:

1. In-place density measurements using the method specified in your QC plan.

2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

<sup>f</sup> Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>9</sup> For adjusting the plant controller at the HMA plant.

<sup>h</sup> The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

<sup>i</sup> Report only.

Applies to RAP substitution rate greater than 15 percent.

For any single quality characteristic except smoothness, if 2 consecutive quality control test results do not comply with the action limits or specifications:

- 1. Stop production.
- 2. Notify the Engineer.
- 3. Take corrective action.
- 4. Demonstrate compliance with the specifications before resuming production and placement.

39-2.03 ACCEPTANCE CRITERIA 39-2.03A Testing

02-22-13 The Department samples for acceptance testing and tests for the quality characteristics shown in the following table:

## HMA Acceptance—Standard Construction Process

Qua	alitv cha	racteris	stic	Test		HM	A type	
	,			method	Α	В	RHMA-G	OGFC
Aaa	regate o	aradatio	on <sup>a</sup>	California	.IME +	.IME +	.IME +	.IMF +
Sieve	3/4"	1/2"	3/8"	Test 202	tolerance °	tolerance °	tolerance °	tolerance °
1/2"	Xb							
3/8"		X						
No. 4			Х					
No. 8	X	X	X					
No	X	X	X					
200	~	~	~					
Sand equ	uivalent	(min)		California	47	42	47	
ound oq.	arraioni	. ()		Test 217				
Asphalt b	oinder o	ontent	(%)	California	.IME+0.40	.IME+0.40	.IME + 0.40	.IME + 0.40
			(,,,,)	Test 379				
				or 382				
HMA mo	isture c	ontent		California	1.0	1.0	1.0	1.0
(%, max)	)			Test 226				
(,				or 370				
Field con	npactio	n (% m	ax.	California	91–97	91–97	91–97	
theoretic	oretical density) <sup>e, f</sup>			Test 375				
Stabilom	eter val	lue (mir	ר) <sup>d,</sup>	California				
No. 4 and 3/8" gradings				Test 366	30	30		
1/2" :	1/2" and 3/4" gradings				37	35	23	
Air void o	content	(%) <sup>d, g</sup>		California	4 ± 2	4 ± 2	TV ± 2	
				Test 367				
Percent	of crush	ned par	ticles	California				
Coarse aggregate (%, min)			Test 205					
One fractured face			90	25		90		
Two	fracture	ed face	S		75		90	75
Fine agg	regate	(%, mir	n) .					
(Pas	sing no	. 4 siev	e and					
retai	ned on	no. 8 si	ieve.)					
One	tracture	ed face		0.111	/0	20	/0	90
Los Ange	eles Ra	ttler (%	, max)	California	10		10	10
LOSS	at 100	rev.		Test 211	12		12	12
LOSS	at 500	rev.	it. (0/	California	45	50	40	40
Fine agg	regate	angulai	nty (%,	California	45	45	45	
Flot ond	alangat	od port	iolog	Colifornia	40 Beport	40	40	
riat anu	by weight	bt @ 5		Test 235	oply	Report only	Report only	Report only
Voids fille	ed with	asnhal	t (%) i	California	Only			
No 4	1 aradin	aspilai	( /0)	Test 367	65 0-75 0	65.0-75.0		
3/8"	aradina	'9 '		1001007	65.0-75.0	65.0-75.0	Report only	
1/2"	arading				65 0-75 0	65.0-75.0	report only	
3/4"	aradina				65.0-75.0	65.0-75.0		
Voids in	mineral	aggree	nate	California	2010 1010			
(% min) <sup>i</sup>		-35.0		Test 367				
No. 4	1 gradin	ng			17.0	17.0		
3/8"	grading				15.0	15.0		
1/2"	grading				14.0	14.0	18.0-23.0	
3/4"	grading				13.0	13.0	18.0-23.0	
Dust pro	portion	i		California				
No. 4	4 and 3/	/8" grad	dings	Test 367	0.6-1.2	0.6-1.2	Report only	
1/2" ;	and 3/4	" gradii	ngs		0.6-1.2	0.6-1.2		

Hamburg wheel track	AASHTO				
(minimum number of passes at	T 324				
0.5 inch average rut depth) <sup>j</sup>	(Modified)				
PG-58		10,000	10,000		
PG-64		15,000	15,000		
PG-70		20,000	20,000		
PG-76 or higher		25,000	25,000		
Hamburg wheel track	AASHTO				
(inflection point minimum	T 324				
number of passes) <sup>j</sup>	(Modified)				
PG-58		10,000	10,000		
PG-64		10,000	10,000		
PG-70		12,500	12,500		
PG-76 or higher		15000	15000		
Moisture susceptibility	California	120	120		
(minimum dry strength, psi) <sup>j</sup>	Test 371	120	120		
Moisture susceptibility	California	70	70		
(tensile strength ration, %) <sup>j</sup>	Test 371	70	70		
Smoothness	Section	12-foot	12-foot	12-foot	12-foot
	39-1.12	straight-	straight-	straight-	straight-
		edge,	edge, must	edge, must	edge and
		must	grind, and	grind, and	must grind
		grind, and	Plo	Plo	
		Pl <sub>0</sub>			
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various			Section	Section
				92-	92-1.01D(2)
				1.01D(2)	and section
				and section	39-1.02D
				39-1.02D	
Asphalt modifier	Various			Section	Section
				39-1.02D	39-1.02D
CRM	Various			Section	Section
				39-1.02D	39-1.02D

<sup>a</sup> The Engineer determines combined aggregate gradations containing RAP under California Test 367.

<sup>b</sup> "X" denotes the sieves the Engineer tests for the specified aggregate gradation.

<sup>c</sup> The tolerances must comply with the allowable tolerances in section 39-1.02E.

<sup>d</sup> The Engineer reports the average of 3 tests from a single split sample.

<sup>e</sup> The Engineer determines field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.

2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

<sup>f</sup>To determine field compaction, the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core.

2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

<sup>9</sup>The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>h</sup> The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

<sup>i</sup>Report only.

Applies to RAP substitution rate greater than 15 percent.

No single test result may represent more than 750 tons or 1 day's production, whichever is less.

For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

- 1. Stop production.
- 2. Take corrective action.
- 3. Take samples and split each sample into 4 parts in the Engineer's presence. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Department tests 1 part for compliance with the specifications and reserves and stores 2 parts.
- 4. Demonstrate compliance with the specifications before resuming production and placement.

The Department tests the density core you take from each 250 tons of HMA production. The Department determines the percent of maximum theoretical density for each density core by determining the density core's density and dividing by the maximum theoretical density.

For percent of maximum theoretical density, the Engineer determines a deduction for each test result outside the specifications using the reduced payment factors shown in the following table:

HMA Type A and B	Reduced payment	HMA Type A and B	Reduced payment
and RHIVIA-G	lacion	and RHMA-G	Tactor
percent or		percent of	
maximum		maximum	
theoretical density		theoretical density	
91.0	0.0000	97.0	0.0000
90.9	0.0125	97.1	0.0125
90.8	0.0250	97.2	0.0250
90.7	0.0375	97.3	0.0375
90.6	0.0500	97.4	0.0500
90.5	0.0625	97.5	0.0625
90.4	0.0750	97.6	0.0750
90.3	0.0875	97.7	0.0875
90.2	0.1000	97.8	0.1000
90.1	0.1125	97.9	0.1125
90.0	0.1250	98.0	0.1250
89.9	0.1375	98.1	0.1375
89.8	0.1500	98.2	0.1500
89.7	0.1625	98.3	0.1625
89.6	0.1750	98.4	0.1750
89.5	0.1875	98.5	0.1875
89.4	0.2000	98.6	0.2000
89.3	0.2125	98.7	0.2125
89.2	0.2250	98.8	0.2250
89.1	0.2375	98.9	0.2375
89.0	0.2500	99.0	0.2500
- 90.0	Remove and	> 00.0	Remove and
< 09.0	replace	> 99.0	replace

#### Reduced Payment Factors for Percent of Maximum Theoretical Density

#### **39-3 METHOD CONSTRUCTION PROCESS**

#### 39-3.01 GENERAL

Section 39-3 includes specifications for HMA produced and constructed under the Method construction process.

# 39-3.02 ACCEPTANCE CRITERIA 39-3.02A Testing

02-22-13 The Department samples for acceptance testing and tests for the quality characteristics shown in the following table:

Quality characteristic	Test		HMA type			
	method	Α	В	RHMA-G	OGFC	
Aggregate gradation a	California	JMF +	JMF +	JMF +	JMF +	
	Test 202	tolerance <sup>b</sup>	tolerance <sup>b</sup>	tolerance <sup>b</sup>	tolerance <sup>b</sup>	
Sand equivalent (min) °	California	47	42	47		
	Test 217					
Asphalt binder content (%)	California	JMF±0.40	JMF±0.40	JMF ± 0.40	JMF ± 0.40	
	Test 379					
	or 382					
HMA moisture content (%, max)	California	1.0	1.0	1.0	1.0	
	Test 226					
	or 370					
Stabilometer value (min) <sup>c</sup>	California					
No. 4 and 3/8" gradings	Test 366	30	30			
1/2" and 3/4" gradings		37	35	23		
Percent of crushed particles	California					
Coarse aggregate (% min)	Test 205					
One fractured face		90	25		90	
I wo fractured faces		75		90	75	
Fine aggregate (% min)						
(Passing no. 4 sieve and						
One fractured face		70	20	70	00	
Los Angeles Rattler (% max)	California	70	20	70	30	
Loss at 100 rev	Test 211	12		12	12	
Loss at 500 rev	103(21)	45	50	40	40	
Air void content (%) <sup>c, d</sup>	California	-10	00			
	Test 367	4 ± 2	4 ± 2	TV ± 2		
Fine aggregate angularity	California	1-	17			
(% min) <sup>e</sup>	Test 234	45	45	45		
Flat and elongated particles	California	Report	Dement ender	Dement and	Dement and	
(% max by weight @ 5:1)	Test 235	only	Report only	Report only	Report only	
Voids filled with asphalt	California					
(%) <sup>f</sup>	Test 367					
No. 4 grading		65.0-75.0	65.0-75.0	Report only		
3/8" grading		65.0–75.0	65.0–75.0	report only		
1/2" grading		65.0-75.0	65.0-75.0			
3/4" grading		65.0-75.0	65.0–75.0			
Voids in mineral aggregate	California					
(% min) '	Test 367	17.0	47.0			
No. 4 grading		17.0	17.0			
1/2" grading		13.0	15.0	18 0-23 0		
3/4" grading		13.0	13.0	18.0-23.0		
Dust proportion <sup>f</sup>	California	10.0	10.0	10.0-23.0		
No. 4 and 3/8" gradings	Test 367	0.6-1.2	0.6-1.2	Report only		
1/2" and $3/4"$ gradings	1001007	0.6-1.2	0.6-1.2	report only		
Hamburg wheel track	AASHTO	0.0 1.2	0.0 1.2			
(minimum number of passes at	T 324					
0.5 inch average rut depth) <sup>g</sup>	(Modified)					
PG-58	x = -7	10,000	10,000			
PG-64		15,000	15,000			
PG-70		20,000	20,000			
PG-76 or higher		25.000	25.000			

HMA Acceptance—Method Construction Process

Hamburg wheel track	AASHTO					
(inflection point minimum	T 324					
number of passes) <sup>g</sup>	(Modified)					
PG-58		10,000	10,000			
PG-64		10,000	10,000			
PG-70		12,500	12,500			
PG-76 or higher		15000	15000			
Moisture susceptibility	California	120	120			
(minimum dry strength, psi) <sup>g</sup>	Test 371	120	120			
Moisture susceptibility	California	70	70			
(tensile strength ration, %) <sup>g</sup>	Test 371	70	70			
Smoothness	Section	12-foot	12-foot	12-foot	12-foot	
	39-1.12	straight-	straight-	straight-	straight-	
		edge and	edge and	edge and	edge and	
		must-grind	must-grind	must-grind	must-grind	
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92	
Asphalt rubber binder	Various			Section	Section	
				92-	92-	
				1.01D(2)	1.01D(2)	
				and section	and section	
				39-1.02D	39-1.02D	
Asphalt modifier	Various			Section	Section	
				39-1.02D	39-1.02D	
CRM	Various			Section	Section	
				39-1.02D	39-1.02D	

<sup>a</sup> The Engineer determines combined aggregate gradations containing RAP under California Test 367.

<sup>b</sup> The tolerances must comply with the allowable tolerances in section 39-1.02E.

° The Engineer reports the average of 3 tests from a single split sample.

<sup>d</sup> The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>e</sup> The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

<sup>f</sup>Report only.

<sup>9</sup> Applies to RAP substitution rate greater than 15 percent.

No single test result may represent more than 750 tons or 1 day's production, whichever is less.

For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

- 1. Stop production.
- 2. Take corrective action.
- Take samples and split each sample into 4 parts in the Engineer's presence. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Department tests 1 part for compliance with the specifications and reserves and stores 2 parts.
- 4. Demonstrate compliance with the specifications before resuming production and placement.

#### 39-4 QUALITY CONTROL/QUALITY ASSURANCE CONSTRUCTION PROCESS

39-4.01 GENERAL

39-4.02 CONTRACTOR QUALITY CONTROL

39-4.02A General

#### Replace the 8th paragraph of section 39-4.02C with:

02-22-13

Comply with the values for the HMA quality characteristics and minimum random sampling and testing for quality control shown in the following table:

# Minimum Quality Control—QC/QA Construction Process

Quality characteristic	Test method	Minimum sampling	НМА Туре			Location of	Maxi- mum
		and testing frequency	A	В	RHMA-G	sampling	-ing time allow- ance
Aggregate gradation <sup>a</sup>	California		JMF ±	JMF ±	JMF ±	California	
Asphalt binder content (%)	California Test 379 or 382	1 per 750 tons	JMF±0.40	JMF±0.40	JMF ±0.40	Loose mix behind paver See California Test 125	24 hours
Field compaction (% max. theoretical density) <sup>c,d</sup>	QC plan		92–96	92–96	91–96	QC plan	
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants <sup>e</sup>	California Test 226 or 370	2 per day during production				Stock- piles or cold feed belts	
Sand equivalent (min) <sup>f</sup>	California Test 217	1 per 750 tons	47	42	47	California Test 125	24 hours
HMA moisture content (%,max)	California Test 226 or 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	Loose Mix	24 hours
Stabilometer value (min) <sup>f</sup> No. 4 and 3/8" gradings 1/2" and 3/4" gradings	California Test 366	1 per 4,000 tons or 2 per 5 business days, whichever is greater	30 37	30 35	 23	Paver See California Test 125	48 hours
content (%) <sup>f,g</sup>	Test 367	io groutor	4 ± 2	4 ± 2	$TV \pm 2$		

Percent of crushed particles coarse aggregate (% min.): One fractured face Two fractured faces	California Test 205		90 75	25 	 90	California Test 125	
aggregate (% min) (Passing no. 4 sieve and retained on no. 8 sieve): One fractured face			70	20	70		
Los Angeles Rattler (% max): Loss at 100 rev. Loss at 500 rev.	California Test 211	As desig- nated in QC plan.	12 45	 50	12 40	California Test 125	48
Fine aggregate angularity (% min) <sup>h</sup>	California Test 234	At least once per project.	45	45	45	California Test 125	nours
Flat and elongated particle (% max by weight @ 5:1)	California Test 235		Report only	Report only	Report only	California Test 125	
Voids filled with asphalt (%) <sup>i</sup> No. 4 grading 3/8" grading 1/2" grading 3/4" grading	California Test 367		65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0	65.0–75.0 65.0–75.0 65.0–75.0 65.0–75.0	Report only		
Voids in mineral aggregate (% min.) <sup>i</sup>	California Test 367						
No. 4 grading 3/8" grading 1/2" grading 3/4" grading			17.0 15.0 14.0 13.0	17.0 15.0 14.0 13.0	  18.0–23.0 18.0–23.0		

Dust	California						
proportion <sup>i</sup>	Test 367						
No. 4 and					Report		
3/8" gradings			0.6–1.2	0.6–1.2	only		
1/2" and 3/4"							
gradings			0.6–1.2	0.6–1.2			
Hamburg	AASHTO	1					
wheel track	I 324 (Modified)	1 per					
number of	(Modified)	tons or 1					
passes at 0.5		per project					
inch average		whichever					
rut depth) <sup>ji</sup>		is greater					
PG-58			10,000	10,000			
PG-64 PG-70			15,000	15,000			
PG-76 or			20,000	20,000			
higher			25,000	25,000			
Hamburg	AASHTO						
wheel track	T 324	1 per					
(inflection	(Modified)	10,000					
minimum		ner project					
number of		whichever					
passes) <sup>j</sup>		is greater					
PG-58			10,000	10,000			
PG-64			10,000	10,000			
PG-70 PG-76 or			12,500	12,500			
higher			15000	15000			
Moisture	California						
susceptibility	Test 371	1 per					
(minimum		10,000	100	100			
ary strength,		tons or 1	120	120			
p31)?		whichever					
		is greater					
Moisture	California	1 per					
susceptibility	Test 371	10,000					
(tensile		tons or 1	70	70	70		
strengtn		per project					
ratio, 70) <sup>2</sup>		is greater					
Smoothness			12-foot	12-foot	12-foot		
			straight-	straight-	straight-		
	Section		edge,	edge,	edge,		
	39-1.12		must-	must-	must-		
			Pl <sub>0</sub>	Pl <sub>0</sub>	Pl <sub>0</sub>		
Asphalt							
rubber binder	Section				1,500-	Section	24
375 °F	39-1.02D				4,000	39-1.02D	hours
centipoises							
CRM	Section				Section	Section	48
	39-1.02D				39-1.02D	39-1.02D	hours

<sup>a</sup> Determine combined aggregate gradation containing RAP under California Test 367.

<sup>b</sup> The tolerances must comply with the allowable tolerances in section 39-1.02E.

<sup>c</sup> Determines field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot.

2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

<sup>d</sup> To determine field compaction use:

1. In-place density measurements using the method specified in your QC plan.

2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

<sup>e</sup> For adjusting the plant controller at the HMA plant.

<sup>f</sup> Report the average of 3 tests from a single split sample.

<sup>9</sup> Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>h</sup> The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

<sup>i</sup>Report only.

Applies to RAP substitution rate greater than 15 percent.

#### 02-22-13

The Engineer samples for acceptance testing and tests for the following quality characteristics:

			HMA	A Accep	tance—Q	C/QA Constr	uction Proce	ess		
Index	Qua	ality cha	aracteri	stic	Weight	Test		HMA type		
(i)					-ing factor (w)	method	А	В	RHMA-G	
		A g	Aggrega radatio	ate n <sup>a</sup>						
	Sieve	3/4"	1/2"	3/8"	0.05					
1	1/2"	XD			0.05	California	J	MF ± Tolerand	ce c	
1	3/8"		X		0.05	Test 202				
1	No. 4	 V	 V	X	0.05					
2	NO. 8	×			0.10					
3	200	^	^	^	0.15			1		
4	Asphal	t binde	r conter	nt (%)	0.30	California	JMF±0.40	JMF±0.40	JMF ± 0.40	
						Test 379				
-	Field or		ion (0/		0.40	Of 382	02.00	02.00	01.00	
Э	theoretical density) <sup>d, e</sup>			0.40	Test 375	92-90	92-90	91-90		
	Sand e	quivale	ent (min	) f		California	47	42	47	
		4	(	/		Test 217				
	Stabilo	meter v	value (n	nin) <sup>f</sup>		California				
	No. 4 and 3/8" gradings					Test 366	30	30		
	1/2	" and 3	6/4" gra	dings			37	35	23	
	Air void content (%) <sup>f, g</sup>				California Test 367	4 ± 2	4 ± 2	TV ± 2		
	Percen	t of cru	shed pa	articles		California				
	coarse	aggreg	gate (%	min)		Test 205				
	On	e fractu	ured fac	e			90			
	Tw	o fractu	ured fac	es			75		90	
	Fine ag	gregat	e (% m	in)						
	(Pa	assing r	10. 4 SI							
	sio		eu on i	NU. 0						
	On	e fracti	ired fac	e			70	20	70	
	HMA m	oisture	conter	nt		California	1.0	1.0	1.0	
	(%, ma	x)				Test 226	_			
	·					or 370				
	Los An	geles F	Rattler (	%		California				
	max)					Test 211				
	Los	ss at 10	)0 rev.				12		12	
	LOS	ss at 50	JU rev.			Colifornia	45	50	40	
	(% min	) <sup>h</sup>	e angu	larity		Test 234	40	45	45	
	Flat an	d elong	ated pa	article		California	Report	Report only	Report only	
				0.1)		Test 235	oniy			
	VOIOS II	n miner \i	a aggr	egate		Tost 267				
	No	/ 4 arac	dina			1051 307	17.0	17.0		
	3/8	" gradi	na				15.0	15.0	18.0-23.0	
	1/2	" gradi	ng				14.0	14.0	18.0–23.0	
	3/4	" gradii	ng				13.0	13.0		

Voids filled with asphalt (%)	California			
No. 4 grading	Test 367			Depart only
NO. 4 grading		65.0-75.0	65.0-75.0	Report only
1/2" grading		65.0 <u>-</u> 75.0	65 0 <u>-</u> 75 0	
3/4" grading		65 0 <del>-</del> 75 0	65 0 <u></u> 75 0	
Dust proportion <sup>1</sup>	California	00.0 70.0	00.0 70.0	
No. 4 and 3/8" gradings	Test 367	0.6-1.2	0.6-1.2	Report only
1/2" and 3/4" gradings		0.6–1.2	0.6–1.2	
Hamburg Wheel Tracker	AASHTO			
(minimum number of	T 324			
passes at 0.5 inch average	(Modified)			
rut depth) <sup>j</sup>				
PG-58		10,000	10,000	
PG-64		15,000	15,000	
PG-70		20,000	20,000	
 PG-76 or higher		25,000	25,000	
Hamburg Wheel Tracker	AASHIO			
(inflection point minimum	1 324			
number of passes)	(ivioaifiea)	10,000	10,000	
PG-56		10,000	10,000	
PG-04 PC 70		15,000	15,000	
PG-76 or higher		20,000	20,000	
Moisture susceptibility	California	20,000	20,000	
(minimum dry strength, psi) <sup>j</sup>	Test 371	120	120	
Moisture susceptibility	California			
(tensile strength ratio %) <sup>j</sup>	Test 371	70	70	70
Smoothness	Section	12-foot	12-foot	12-foot
	39-1.12	straight-	straight-	straight-
		edge,	edge, must	edge, must
		must	grind, and	grind, and
		grind, and	$\mathbf{PI}_{0}$	PIo
 Asphalt hinder	 Various	PI0 Section 02	Section 02	Section 02
 Aspital bilder	various	Section 92	Section 92	Section
				92-1 01D(2)
Asphalt rubber binder	Various			and section
				39-1.02D
				Section
Asphalt modifier	Various			39-1.02D
CRM	Various			Section
UT WI	vanous			39-1.02D

<sup>a</sup> The Engineer determines combined aggregate gradations containing RAP under California Test 367.

<sup>b</sup> "X" denotes the sieves the Engineer tests for the specified aggregate gradation.

° The tolerances must comply with the allowable tolerances in section 39-1.02E.

<sup>d</sup> The Engineer determines field compaction for any of the following conditions:

1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot and less than 0.20 foot.

2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 foot.

<sup>e</sup> To determine field compaction, the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each density core.

2. California Test 309 to determine the maximum theoretical density at the frequency specified in California Test 375, Part 5C.

<sup>f</sup> The Engineer reports the average of 3 tests from a single split sample.

<sup>9</sup> The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.

<sup>h</sup> The Engineer waives this specification if HMA contains 10 percent or less of nonmanufactured sand by weight of total aggregate. Manufactured sand is fine aggregate produced by crushing rock or gravel.

<sup>i</sup>Report only.

Applies to RAP substitution rate greater than 15 percent.

The Department determines the percent of maximum theoretical density from the average density of 3 density cores you take from every 750 tons of production or part thereof divided by the maximum theoretical density.

The Department determines the percent of maximum theoretical density from density cores taken from the final layer measured the full depth of the total paved HMA thickness if any of the following applies:

- 1. 1/2-inch, 3/8-inch, or no. 4 aggregate grading is used and the specified total paved thickness is at least 0.15 foot and any lager is less than 0.15 foot.
- 2. 3/4-inch aggregate grading is used and the specified total paved thickness is at least 0.20 and any layer is less than 0.20 foot.