HOT MIX ASPHALT (HMA) DESIGN CRITERIA

Overview of the HMA Mixture Design Criteria Chart (Table 1)

The HMA Mixture Criteria chart identifies the aggregate, mixture volumetric, and laboratory density requirements for mixtures designed under the gyratory mix design system. The chart is formatted to correspond with the bid item designations. The bid item designations classify each mixture by the maximum 20-year traffic load (ESAL), the intended pavement layer (surface, intermediate, base), the mixture size (based on nominal maximum aggregate size), and the surface layer friction requirement. A designation of "**HMA 3M S ½ L-3**" describes the HMA mixture for up to 3 million ESALs, surface layer, ½-inch mixture size, with level 3 friction aggregate.

The columns to the right of the mixture designations define the required level of compaction (N values) and the maximum or target density (expressed as percent of G_{mm}) associated with each level of compaction. Note that the required density of a given level of compaction varies for different traffic levels and pavement layers. For example, the 1M ESAL surface/intermediate 7-76-117 mixture requires 96 percent of G_{mm} (4.0% air voids) at N-design. The 7-76-117 base mixture for 3M ESALs requires 96.5 percent of G_{mm} (3.5% air voids) at N-design.

The middle columns identify the volumetric properties of the compacted HMA mixture when analyzed at the target air voids at N-design.

The aggregate properties are defined in the right columns. The quality of the aggregate (Type A or B) is further specified in Standard Specifications 4126 and 4127. The crush value specifies the minimum amount of crushed aggregate required. The Fine Aggregate Angularity and Sand Equivalent values are consensus properties of the fine aggregate portion of the mix. The friction columns specify the minimum amounts of friction quality coarse aggregate (Type 4, 3, 2) as defined in Materials IM T203. The details of the friction criteria are specified in Standard Specification 2303. Table Note 4 defines the allowable quantity of flat and elongated aggregate for all mixtures.

For any specified HMA mixture, the mix design criteria are found by reading across the table. The HMA mixtures are grouped by ESAL levels.

Gradation Requirements

The individual aggregate gradation requirements for HMA mix designers are contained on Form 955.

The combined aggregate shall meet the gradation requirements on Table 2.

VMA Requirements

The minimum VMA requirements are shown on Table 3.

Table 1
HMA MIXTURE DESIGN CRITERIA

Mix Designation	Gyratory Density						Friction [2]			Aggregate [3]			
	N_{ini} - N_{des} - N_{max}	Initial % G_{mm} (max)	Design % G_{mm} (target)	Maximum % G_{mm} (max)	VFA	Film Thickness	Filler: Binder	Type 4 (min)	Type 3 (min)	Type 2 (min)	Quality Type	Crush (min)	FAA (min)	Sand Equiv. (min)
HMA 100K S-I-B	7 - 68 - 104	92.5	97.0	98.5	75-85	8.0-13.0	0.6-1.4				B[1]	45[1]	---	40
HMA 300K S-I	7 - 68 - 104	92.0	96.5	98.0	70-80	8.0-13.0	0.6-1.4				B[1]	45[1]	---	40
HMA 300K B	7 - 68 - 104	92.5	97.0	98.5	75-85									
HMA 1M S L-4	7 - 76 - 117	90.5	96.0	98.0	65-78	8.0-15.0	0.6-1.4	50			A[1]	60[1]	40	40
HMA 1M S														
HMA 1M I											B[1]	45[1]		
HMA 1M B	7 - 68 - 104	92.0	96.5	98.0	70-80						B[1]	45[1]	---	
HMA 1M B (shld pav sep)	7 - 68 - 104	92.0	97.0	98.0	75-85						B[1]	45[1]	---	
HMA 3M S L-4	7 - 86 - 134	89.5	96.0	98.0	65-78	8.0-15.0	0.6-1.4	50			A	75	40	40
HMA 3M S L-3								80	45	(30)				
HMA 3M S														
HMA 3M I												60		
HMA 3M B	7 - 76 - 117	90.5	96.5	98.0	65-78						B	45		
HMA 10M S L-3	8 - 96 - 152	89.0	96.0	98.0	65-78	8.0-15.0	0.6-1.4	80	45	(30)	A	75	43	45
HMA 10M I														
HMA 10M B	7 - 86 - 134	89.5	96.0	98.0	65-78						B	75	40	
HMA 30M S L-3	8 - 109 - 174	89.0	96.0	98.0	65-75	8.0-15.0	0.6-1.4	80	45	(30)	A	85	45	45
HMA 30M S L-2								80		25				
HMA 30M I														
HMA 30M B	8 - 96 - 152	89.0	96.0	98.0	65-75						B	75	40	
HMA 100M S L-2	9 - 126 - 204	89.0	96.0	98.0	65-75	8.0-15.0	0.6-1.4	80		25	A	85	45	50
HMA 100M I														
HMA 100M B	8 - 109 - 174	89.0	96.0	98.0	65-75						B	75	43	

Note (1) On local agency projects, the minimum percent crushed and quality type shown above shall be used unless specified in plans.

Note (2) See Iowa DOT Standard Specification 2303.02

Note (3) Flat & Elongated 10% maximum at a 5:1 ratio.

Table 2

Aggregate Gradation Control Points								
	Mix Size - Control Points (% passing)							
	1 inch (25 mm)		3/4 inch (19 mm)		1/2 inch (12.5 mm)		3/8 inch (9.5 mm)	
Sieve Size	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**	**min.**	**max.**
1 1/2 inch (37.5 mm)	100							
1 inch (25 mm)	90	100	100					
3/4 inch (19 mm)		90	90	100	100			
1/2 inch (12.5 mm)				90	90	100	100	
3/8 inch (9.5 mm)						90	90	100
No. 4 (4.75 mm)								90
No. 8 (2.36 mm)	19	45	23	49	28	58	32	67
No. 16 (1.18 mm)(1)				28		32		
No. 30 (600 mm)(2)				24		25		
No. 200 (75 mm)	1	7	2	8	2	10	2	10

(1) Only applies to surface and intermediate mixtures for HMA 30M and above.
(2) Only applies to surface and intermediate mixtures for HMA 10M.

Table 3

Minimum VMA Criteria(1)				
	Mix Size			
Mix Designation	**1 inch (25 mm)**	**3/4 inch (19 mm)**	**1/2 inch (12.5 mm)**	**3/8 inch (9.5 mm)**
HMA 100K	12.0	13.0	14.0	15.0
HMA 300K				
HMA 1M				
HMA 3M				
HMA 10M				
HMA 30M	11.5	12.5	13.5	14.5
HMA 100M				

(1) Applies to all layers in the pavement structure (surface, intermediate and base).