MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SUPERPAVE HMA MIXTURES

a. Description. This work shall consist of furnishing a HMA mixture using Superpave Mixture Design Methods. The HMA mixture will be provided according to the requirements of the standard specifications except where modified herein.

b. Mix Design. The HMA mixture design will be provided by the Contractor. The design will be submitted and evaluated according to the HMA Production Manual, Procedures for HMA Mix Design Processing.

c. Recycled Mixtures. The Contractor may substitute Reclaimed Asphalt Pavement (RAP) for a portion of the new materials required to produce HMA mixture. The mixture will be designed and produced to meet all of the criteria herein.

d. Materials. The mixture will consist of aggregates of the highest quality available to meet the minimum specifications herein. Tables 1-6 and 10 provide the required aggregate properties, Tables 7-8 provide the Mix Design Criteria and Volumetric Properties and Table 9 provides the Superpave Gyratory Compactor (SGC) compaction criteria. Criteria specified below apply to the combined aggregate blend. For mixture design purposes, top and leveling courses are defined as the mixture layers within 4 inches of the surface; the base course is defined as all layers below 4 inches of the surface. For mixture layers which fall within the 4 inch threshold, the following rule should apply: If less than 25 percent of a mixture layer is within 4 inches of the surface, the mixture layer should be considered to be a base course. For projects that specify a mix type E03, the Contractor may choose to use a mix type LVSP according to the requirements specified herein.

e. Measurement and Payment.

Contract Items (Pay Item)	**Pay Unit**
HMA, 5 E _	Ton
HMA, 4 E _	Ton
HMA, 3 E _	Ton
HMA, 2 E _	Ton
HMA, LVSP	Ton

The mixture designation, E _, is determined by the ESALs (million) on the design lane over the design life. This number is to be used when determining Mix Design Properties from Tables 1 thru 6, and Tables 8 and 9.

Table 1: Crush Minimum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	55/-	-
< 0.3	E03	55/-	-
< 1.0	E1	65/-	-
< 3.0	E3	75/-	50/-
< 10	E10	85/80	60/-
< 30	E30	95/90	80/75
<100	E50	100/100	95/90

Note: "85/80" denotes that 85 percent of the coarse aggregate has one fractured face and 80 percent has two fractured faces.

Table 2: Fine Aggregate Angularity Minimum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	-	-
< 0.3	E03	-	-
< 1.0	E1	40	-
< 3.0	E3	40(a)	40(a)
< 10	E10	45	40
< 30	E30	45	40
<100	E50	45	45

a. For an E3 mixture type that enters the restricted zone as defined in Table 10, the minimum criteria shall be 43.

Table 3: Sand Equivalent Minimum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	40	40
< 0.3	E03	40	40
< 1.0	E1	40	40
< 3.0	E3	40	40
< 10	E10	45	45
< 30	E30	45	45
<100	E50	50	50

Table 4: L.A. Abrasion Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	45	45
< 0.3	E03	45	45
< 1.0	E1	40	45
<3.0	E3	35	40
< 10	E10	35	40
< 30	E30	35	35
<100	E50	35	35

Table 5: Soft Particles Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	10	10
< 0.3	E03	10	10
< 1.0	E1	10	10
< 3.0	E3	5	5
< 10	E10	5	5
< 30	E30	3	4.5
<100	E50	3	4.5
Note: "Soft Particles Maximum" is the sum of the shale, siltstone, ochre, coal, clay-ironstone and particles which are structurally weak or are found to be non-durable in service.			

Table 6: Flat and Elongated Particles Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	-	-
< 0.3	E03	-	-
< 1.0	E1	-	-
< 3.0	E3	10	10
< 10	E10	10	10
< 30	E30	10	10
<100	E50	10	10
Note: Maximum 10 percent by weight with a 1 to 5 aspect ratio.			

Table 7: Superpave Mix Design Criteria

Design Parameter	Mixture Number				
	5	4	3	2	LVSP
Percent of Maximum Specific Gravity (%G_{mm}) at the design number of gyrations, (N_d) (See Note)	96.0 % (a)				96.0% (a)
%G_{mm} at the initial number of gyrations, (N_i)	See Table 9				
%G_{mm} at the maximum number of gyrations, (N_m)	98.0%				
VMA min % at N_d (based on aggregate bulk specific gravity, (G_{sb}))	15.00	14.00	13.00	12.00	14.00
VFA at N_d	See Table 8 (b)				
Fines to effective asphalt binder ratio (P_{No200}/P_{be})	0.6 - 1.2				
Tensile strength ratio (TSR)	80 % min				

a. For mixtures meeting the definition for base course: Mixtures shall be designed to 96.0% of Maximum Specific Gravity (%G_{mm}) at the design number of gyrations, (N_d). During field production Percent of Maximum Specific Gravity (%G_{mm}) at the design number of gyrations, (N_d) may be increased to 97.0%.

b. For base course or regressed shoulder mixtures the maximum criteria limits do not apply.

Note: Target Air Voids will be lowered by 1.0 percent if used in a separate shoulder paving operation unless noted otherwise on the plans.

Table 8: VFA Minimum and Maximum Criteria

Estimated Traffic (million ESAL)	Mix Type	Top & Leveling Courses	Base Course
< 0.3	LVSP	70-80	70-80
< 0.3	E03	70-80	70-80
< 1.0	E1	65-78	65-78
< 3.0	E3	65-78	65-78
< 10	E10	65-78(a)	65-75
< 30	E30	65-78(a)	65-75
<100	E50	65-78(a)	65-75

a. For mixture Number 5, the specified VFA range shall be 73% - 76%.

Table 9: Superpave Gyratory Compactor (SGC) Compaction Criteria

Estimated Traffic (million ESAL)	Mix Type	%G_{mm} at (N_i)	Number of Gyrations		
			N_i	N_d	N_m
< 0.3	LVSP	91.5%	6	45	70
< 0.3	E03	91.5%	7	50	75
< 1.0	E1	90.5%	7	76	117
< 3.0	E3	90.5%	7	86	134
< 10	E10	89.0%	8	96	152
< 30	E30	89.0%	8	109	174

<100	E50	89.0%	9	126	204
Note: Compact all mixture specimens fabricated in the SGC to N_d. Use height data provided by the SGC to calculate volumetric properties at N_i. Compact specimens at optimum P_b to verify N_m.					

Table 10: Aggregate Gradation Requirements

Standard Sieve	Percent Passing Criteria (control points)				
	Mixture Number				
	5	**4**	**3**	**2**	**LVSP**
1 1/2 inch				100	
1 inch			100	90 - 100	
3/4 inch		100	90 - 100	90 max	100
1/2 inch	100	90 - 100	90 max		75 - 95
3/8 inch	90 - 100	90 max			60 - 90
No. 4	90 max				45 - 80
No. 8	32 - 67	28 - 58	23 - 49	19 - 45	30 - 65
No. 16					20 - 50
No. 30					15 - 40
No. 50					10 - 25
No. 100					5 - 15
No. 200	2.0 - 10.0	2.0 - 10.0	2.0 - 8.0	1.0 - 7.0	3 - 6
Sieve	**Restricted Zone** (see notes)				
No. 4				39.5	-
No. 8	47.2	39.1	34.6	26.8 - 30.8	-
No. 16	31.6 - 37.6	25.6 - 31.6	22.3 - 28.3	18.1 - 24.1	-
No. 30	23.5 - 27.5	19.1 - 23.1	16.7 - 20.7	13.6 - 17.6	-
No. 50	18.7	15.5	13.7	11.4	-

Note: The final gradation blend must pass between the control points established. The following conditions must be satisfied in order for the final gradation blend to enter the restricted zone (restricted zone does not apply to LVSP):

1. Mixture types E03, E1, E10, E30 and E50 may enter the restricted zone provided the final gradation blend enters from above the maximum density line.

2. Mixture type E3 may enter the restricted zone provided the final gradation blend enters from above the maximum density line and the fine aggregate angularity of the final blend is a minimum of 43.

If these criteria are satisfied, acceptance criteria and associated incentive/disincentive or pay adjustment tied to this gradation restricted zone requirement which may be included in other contract documents, do not apply. Otherwise, final gradation blend has to be outside of the area bounded by the limits set for the restricted zone.

Note: Sand Ratio for LVSP – no more than 50 percent of the material passing the No. 4 sieve shall pass the No. 30 sieve.