CONSTRUCTION STANDARD SPECIFICATION

SECTION 02510

ASPHALT CONCRETE

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ASPHALT CONCRETE

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: Work provided under this specification shall include the furnishing, placement, and compaction of asphalt concrete pavement.

B. Asphalt concrete shall consist of a mixture of asphalt binder, aggregates, mineral filler and admixtures, proportioned as required, batched and delivered as specified herein. All materials and job mix formulas used in asphalt concrete, either batched at or delivered to a project, shall be certified in accordance with the requirements of these specifications. The CONTRACTOR shall be solely responsible for asphalt concrete job mix formula supplied under this specification, its proportions and manufacture. Each job mix formula submitted and authorized for use under this specification shall be identified by a number unique to that job mix formula. If either a change in material(s) or material supplier(s) from that specified in the job mix formula occurs during a project, authorized use of the job mix formula on the project may be cancelled as directed by the Sandia Delegated Representative (SDR). A job mix formula shall not be used on a project without written approval of the SDR.

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM):

C88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C117	Method for Material Finer than 0.75μm (No. 200) Sieve in Mineral Aggregates by Washing
C131	Test Method for Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in a Los Angeles Machine
C136	Method for Sieve Analysis of Fine and Coarse Aggregate
D242	Specifications for Mineral Filler for Bituminous Paving Mixtures
D692	Specification for Coarse Aggregate for Bituminous Paving Mixtures
D979	Methods of Sampling Bituminous Paving Mixtures
D995	Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
D1073	Specification for Fine Aggregate for Bituminous Paving Mixtures
D1074	Test Method for Compressive Strength of Bituminous Mixtures
D1559	Resistance to Plastic Flow of Bituminous Mixtures using Marshall

Apparatus
D2041 Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
D2493 Viscosity-Temperature Chart for Asphalts
D2726 Bulk Specific Gravity and Density of Compacted Bituminous Mixtures using Saturated Surface-Dry Specimens
D2851 Test for Determining the Percentage of Fractured Particles in Coarse Aggregate
D2950 Density of Bituminous Concrete in Place by Nuclear Methods
D3203 Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
D3515 Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
D4791 Test for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

B. American Association of State Highway and Transportation Officials, AASHTO:

MP2 Specification for Superpave™ Volumetric Mix Design
PP-28 Superpave™ Volumetric Design for HMA
TP 4 Preparation of Compacted Specimens of Modified and Unmodified Hot Mix Asphalt by Means of SHRP Gyratory Compactor
PP 2 Short and Long-term Aging of Bituminous Mixes
T53 Quantitative Analysis of Bitumen from Bituminous Paving Mixtures, Ignition Oven Method A
T245 Resistance to Plastic Flow of Bituminous Mixture using Marshall Apparatus
T283 Resistance of Bituminous Mixture to Moisture Induced Damage
T304 Uncompacted Void Content of Fine Aggregate

C. Asphalt Institute:

MS-2 Mix Design Methods, Sixth Edition
MS-2 Mix Design Methods, Sixth Edition, Section 5.16, Modified Marshall Method for Large Aggregate

D. SNL Standard Specifications:

1. 02511 ASPHALT CONCRETE PAVEMENT
2. 02512 PAVING ASPHALT BINDER

E. City of Albuquerque “Standard Specifications for Public Works Construction”, latest edition.

1. Section 113 EMULSIFIED ASPHALTS
2. Section 117 ASPHALT REJUVENATING AGENTS
3. Section 118 HYDRATED LIME FILLER

4. Section 333 FOG SEAL COATS

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asphalt binder shall comply with the requirements of SECTION 02512 – PAVING ASPHALT BINDER

B. Aggregates shall be crushed stone, crushed gravel, crushed asphalt concrete pavement, crushed Portland cement concrete, and natural or manufactured sand conforming to the quality and crushed particle requirements of this Specification. Coarse aggregates shall comply with the requirements of ASTM D692, Coarse Aggregate for Bituminous Paving Mixtures. Fine aggregates shall comply with the requirements of ASTM D1073, Fine Aggregate for Bituminous Paving Mixtures. The combined aggregates, proportioned as defined by the target gradation, shall comply with the requirements of TABLE 02510-116.A. Aggregates shall be certified to comply with the requirements of this Specification and authorized for use by the SDR before the materials may be incorporated in the construction. Prior to delivery of the aggregates or material containing the aggregates, the CONTRACTOR may be required to furnish samples of the aggregates to the SDR for testing. Daily production aggregates gradations shall be submitted to the SDR upon request.

C. Mineral filler shall comply with the requirements of ASTM D242, Mineral Filler for Bituminous Paving Mixtures and as specified herein. Mineral filler shall be certified to comply with the requirements of this Specification and approved for use by SDR before the materials may be incorporated in the construction. Prior to either delivery of the mineral filler or material containing the mineral filler, The CONTRACTOR may be required to furnish samples of the mineral filler to The SDR for testing.

D. Asphalt concrete shall comply with the minimum requirements of TABLE 02510-116.C.1.H, moisture susceptibility, percent retained strength at 7 % air voids, AASHTO T283 with freeze cycle. Admixtures to reduce moisture susceptibility in an asphalt concrete mix shall be either hydrated lime, Portland cement, liquid admixture, or a modified asphalt binder authorized by the SDR.

2.02 PROPORTIONING

A. The CONTRACTOR shall be solely responsible for the asphalt concrete job mix formula (jmf) proportions and asphalt concrete either batched at and/or delivered to the site. Asphalt concrete shall be proportioned in accordance with the requirements of this Specification.

B. Asphalt concrete material proportioned with “performance grade binders” shall be proportioned to comply with the requirements of TABLE 02510-116.C.1 of this specification, AASHTO MP2, Specification for Superpave™ Volumetric Mix Design, and PP-28, Superpave™ Volumetric Design for HMA. The job mix

formulas shall be designed under the direct supervision of a New Mexico Registered Professional Engineer who has completed a certified "SUPERPAVE Mixture Design & Analysis" Short Course.

C. Asphalt concrete for construction of classifications of Primary Streets, Secondary Streets, and Parking Lots shall be proportioned with performance grade (PG) binders.

D. Asphalt concrete for construction of street classification of Secondary Street with design equivalent single axle loads (Esals) less than 3.0 mil, may be proportioned with a PG70-22 performance grade (PG) binders.

E. Asphalt concrete proportioned with either penetration or viscosity grade binders shall be proportioned to comply with the requirements TABLE -02510-116.C.2. A JMF shall be prepared in a laboratory under the direct supervision of a New Mexico Registered Professional Engineer.

F. Asphalt concrete design and analysis shall be performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition.

G. An asphalt concrete job mix formula shall be proportioned to comply with the requirements of TABLE 02510-116.B AGGREGATE GRADATION PROPERTIES and either TABLE 02510-116.C.1 ASPHALT CONCRETE DESIGN SPECIFICATIONS PERFORMANCE GRADE BINDERS, or TABLE 02510-116.C.2 ASPHALT CONCRETE DESIGN SPECIFICATIONS PENETRATION AND VISCOSITY GRADED BINDERS.

H. Aggregates, mineral filler, and anti-strip admixture if required, shall be proportioned to provide a combined gradation that complies with the requirements specified in TABLE 02510-116.B, and have the same or similar shaped characteristic gradation curve as the specification limits specified therein when graphically plotted on a standard "0.45 POWER" gradation chart. The gradation shall be reported to the nearest whole percent for material passing sieves above the 0.075 mm (No. 200) sieve, and to the nearest 0.1 percent for material passing the 0.075 mm (No. 200) sieve. The theoretical maximum density gradation curve shall be the curve represented by a straight line drawn from the intersection of the ordinate and abscissa of the graph to the one hundred percent passing point for the nominal maximum size aggregate.

I. The design characteristic shape gradation curve for SP-II asphalt concrete shall be similar to an "S" shape curve, with a convex curve above the maximum density line for aggregate greater than 4.75 mm (No. 4) sieve and a concave curve below the maximum density line for aggregate finer than the 4.75 mm (No. 4) sieve.

J. The design characteristic shape gradation curve for Type SP-III and SP-IV asphalt concretes shall be similar to an "S" shape curve, with a convex curve above the maximum density line for aggregate greater than 2.36 mm (No. 8) sieve and a concave curve below the maximum density line for aggregate finer than the 2.36 mm (No. 8) sieve.

K. The design characteristic shape gradation curves for Types B, C, and D, asphalt concretes

shall be similar to two convex curves above the maximum density line, one for aggregate greater than the 2.36 mm (No. 8) sieve, and one for the aggregate finer than the 2.36 (No. 8) sieve. The two curves shall intersect each other at the 2.36 mm (No. 8) sieve.

L. The design characteristic gradation curve shape for Type A asphalt concrete shall be similar to two convex curves above the maximum density line, one for aggregate greater than the 4.75 mm (N. 4) sieve, and one for aggregate finer than the 4.75 mm (No. 4) sieve. The two curves shall intersect each other at the 4.75 mm (No. 4) sieve.

M. The job mix formula asphalt binder content shall be proportioned to provide a job mix formula that complies with the requirements defined either in TABLE 02510-116.C.1 when proportioned with PG binders, or in TABLE 02510-116.C.2, when proportioned with either penetration or viscosity graded binders. The design asphalt binder content shall be selected, based on laboratory testing, aged binder/mix required. The binder content shall include a minimum of 75% virgin binder when a job mix formula is designed with recycled asphalt concrete pavement, RAP. The design percent binder content, ± 0.3%, shall not exceed the binder content at minimum VMA.

TABLE 02510-116.A – COMBINED AGGREGATE DESIGN PROPERTIES				
	AGGREGATE TYPE			
CHARACTERISTIC	Coarse		Fine	PROCEDURE
1. Coarse aggregate angularity, material > 4.75 mm	[1]	[2]	-	ASTM D 5821
ESALs < 3.0 mil	85	80		
3.0 ≤ ESALs < 30.0 mil	95	90		
30.0 mil ≤ ESALs	100	100		
2. Fine aggregate angularity as air voids, %, min	-		45	AASHTO TP 33
3. Flat and elongated particles, 3:1 or greater dimension, material > 4.75 mm, %	20 max			ASTM D 4791
4. Clay content, min %	-		45	ASTM D 2419
5. Deleterious material, max %	1		1	ASTM C 142
6. LA Abrasion, material > 2.36 mm, max loss, %	40		40	ASTM C 131
7. Soundness, max loss after 5 cycles, %	15		15	ASTM C 88
[1] coarse aggregate has one or more fractured faces				
[2] coarse aggregate has two or more fractured faces				

TABLE 02510-116.B - AGGREGATE GRADATION [3]

SIEVE SIZE, in	% PASSING TYPE, Nominal Maximum Size Aggregate [1]												PRODUCTION TOLERANCE
	SP-II/A,1		SP-III, 3/4		SP-IV, 1/2		SP-V/D, 3/8		B, 3/4		C, 1/2		
	min	max	min	max	min	max	min	max	min	max	min	max	
1-1/2	100	100	-	-	-	-	-	-	-	-	-	-	
1.00	86	96	100	100	-	-	-	-	100	100-	-	-	8
¾	-	90-	89	96	100	100	-	-	88	96	100	100	8
½	62	83	-	90	88	96	100	-	-	90	88	96	8
3/8	-	-	64	85	-	90	91	97	70	85	73	90	8
No. 4	31	40	37	47	52	70	-	90	51	69	57	75	7 [2]
8	19	27	23	32	28	39	47	67	35	49	39	58	6
16	10	18	12	22	14	26	38	55	28	40	32	48	6
30	6	14	8	17	8	19	28	43	21	31	24	38	5
50	4	11	5	14	5	16	19	30	14	23	16	27	5
200	3.0	7.0	3.0	8.0	2.0	10.0	3.0	10.0	2.0	8.0	3.0	10.0	3.0

NOTES:

[1] SP-II and Type A gradation materials may not be used for the surface course

[2] If recycled asphalt concrete aggregate (RAP) is used, ± 8%

[3] A JMF aggregate gradation may pass through the restricted zone if all JMF volumetric design criteria is in compliance. The restricted zone is defined by the material passing the No. 8 to No. 30 sieves for SP-II and Type A asphalt concretes. The restricted zoned is defined by material passing the No. 4 to No. 30 sieves for all other asphalt concrete.

TABLE 02510-116.C.1 – ASPHALT CONCRETE SUPERPAVE DESIGN SPECIFICATIONS							
DESCRIPTION		Local, Major Local, Residential, Intersection [1]		Collector, Minor and Major Arterial, Controlled Access Roadway, And Intersections [1]			
A.	Binder	PG70-22		PG76-28		PG76-28	
B.	Equiv. Single Axle Load, ESALs (millions)	<3		3 ≤ ESALs <30		30 ≤ ESALs [2]	
C.	Voids, %	3.5 – 4.5		3.5 – 4.5		3.5 – 4.5	
D.	Voids in Mineral Aggregate, VMA, %	min	max	min	max	min	max
	Type SP-II [3], (1 in.)	12	14	12	14	12	14
	Type SP-III, (3/4 in.)	-	-	13	15	13	15
	Type SP-IV, (1/2 in.)	-	-	14	16	14	16
	Type SP-V, (3/8 in.)	-	-	16	18	16	18
	Type A, (1 in.) [3]	12	14	-	-	-	-
	Type B, (3/4 in.)	13	15	-	-	-	-
	Type C, (1/2 in.)	14	16	-	-	-	-
	Type D, (3/8 in.)	16	18	-	-	-	-
E.	Voids filled with binder, %						
	Type SP-II [3], (1 in.)	-	-	65	75	65	75
	Type SP-III, (3/4 in.)	-	-	65	75	65	75
	Type SP-IV, (1/2 in.)	-	-	65	75	65	75
	Type SP-V, (3/8 in.)	-	-	65	75	65	75
	Type A, (1 in.) [3]	68	78	-	-	-	-
	Type B, (3/4 in.)	68	78	-	-	-	-
	Type C, (1/2 in.)	68	78	-	-	-	-
	Type D, (3/8 in.)	68	78	-	-	-	-
F.	Dust Ratio, -No. 200 (0.075 mm): $\%P_{be}$	0.6	1.6	0.6	1.6	0.6	1.6
G.	Gyratory compaction [4] At binder compaction temp, ± 5°F	N	% CMPTN	N	% CMPTN	N	% CMPTN
	Gyrations						
	N_i (initial)	7	91.0	8	89.0	9	89.0
	N_d (design)	75	96.0	100	96.0	125	96.0
	N_m (max)	115	98.0	160	98.0	205	98.0
H.	Moisture susceptibility, % retained strength @ 7% air voids, AASHTO T283, with freeze cycle	80 min		80 min		80 min	

NOTES:	
[1]	The intersection area shall be the core area common to all intersecting streets, and include the distance to the curb return of the approach and departure of the intersecting streets.
[2]	Level II Design Complying with NMSHTD Procedures at Date of Bid, as directed by the SDR.
[3]	SP-II and Type A gradations asphalt concrete shall not be used for surface course
[4]	% of maximum theoretical specific gravity / density, G_{mm}

TABLE 02510-116.C.2 – ASPHALT CONCRETE DESIGN SPECIFICATIONS PENETRATION & VISCOSITY GRADE BINDERS		
DESCRIPTION		Residential, Local, Major Local, And Intersection
A.	Binder Grade	60 – 70 Pen,
		AC-20 Viscosity
B.	Equiv. Single Axle Load, ESALs (million)	ESALs < 3.0
C.	Voids, %	3.5 – 4.5
D.	Voids in Mineral Aggregate, VMA, %	
	Type A, (1 in.)	12 – 14
	Type B, (3/4 in.)	13 – 15
	Type C, (1/2 in.)	14 – 16
	Type D, (3/8 in.)	15 – 17
E.	Voids filled with binder, %	68 – 78
F.	Dust Ratio, -No. 200 (0.075 mm): % P_{be}	0.6 – 1.6
G.	Marshall Stability Design, Blow counts/each face	50
	Stability, lbs, min	1500
	Flow, 0.01 in.	10 – 18
H.	Stability to Flow Ratio, minimum @target binder ± 0.5%	200
I.	Moisture Susceptibility, % retained strength,	80 min
	@ 7% air voids, AASHTO T283, with freeze cycle	
NOTES:		
[1]	The intersection area shall be the core area common to all intersecting streets and includes the distance to the curb return of the approach and departure of the intersecting street.	

PART 3 – EXECUTION

3.01 JOB MIX FORMULA SUBMITTALS

A. A design job mix formula submitted shall be included but not be limited to the information specified in TABLE 02510-116.D-SUBMITTAL INFORMATION, as directed by the SDR.

B. The materials specified in an authorized job mix formula shall be the same source and type for all asphalt concrete batched, delivered, placed and compacted, under the identification code defined for the authorized job mix formula.

C. A submittal shall be rejected if it does not include the specified information and samples. A job mix formula submittal shall be accepted or rejected within ten (10) working days of receipt by the SDR.

TABLE 02510-116.D – SUBMITTAL INFORMATION			
I.	Identification		
	A.	Asphalt concrete supplier	
	B.	Laboratory that performed design/development tests	
	C.	Date of Submittal	
	D.	Unique mix code identification number	
	E.	Aggregate sample date	
II.	Job Mix Formula (jmf)		
	A.	Type/application of asphalt concrete	
	B.	Component material target proportions to include combined aggregate gradation and asphalt content, specifications, and production tolerances	
	C.	0.45 power gradation plot of combined aggregate gradation with specification and production limits	
	D.	Temperature viscosity relationship of binder	
	E.	Recommended mixing, compaction, and release to traffic maximum temperatures	
	F.	Tabulation of job mix formula performance characteristics defined in either TABLE 02510-116.C.1 or TABLE 02510-116.C.2 as applicable, at the proposed design proportions, with reference specification limits and production limits (if specified), maximum theoretical specific gravity/density (as pcf), and bulk specific gravity/density (pcf).	
	G.	Reference daily production gradation, see 02510-116.3.2	
III.	Certifications of Compliance		
	A.	Compliance of job mix formula by NM Registered Professional Engineer in direct charge of design/development;	
	B.	Design Laboratory Certification, projects bid after June 30, 2000.	
	C.	Component materials testing and certification by supplier/manufacturer with supporting test data for materials used in design development	
	D.	Certification and laboratory test results of asphalt binder used in job mix formula design development, see Section 02511 PAVING ASPHALT BINDER	
IV.	Design Development (tables and graphs, with specifications limits of the following):		
	A.	Marshall Design & Modified Marshall Designs (design development with a minimum of 4 asphalt binder contents required, and the recommended design characteristic bracketed by a minimum of two test points for the design binder content ± 0.5%)	
		1.	Design hammer blow counts, mold diameter, hammer mass and drop
		2.	Stability (lbs.) vs. % asphalt content
		3.	Flow (0.01 in.) vs. % asphalt content
		4.	Briquette bulk Specific Gravity and Bulk Density (as pcf) vs. % asphalt content
		5.	% Voids in Mineral Aggregate (% VMA) vs. % Asphalt content
		6.	% Voids (Pa) in asphalt concrete vs. % asphalt content
		7.	% Voids filled in asphalt concrete vs. % asphalt content
		8.	Dust ratio vs. % asphalt content
	B.	SUPERPAVE Design (Tables and graphs, with specifications limits of the following)	
		1.	Trial Designs: Aggregate gradations, 3 minimum required, and trial asphalt binder content (%)
			a) Table of Aggregate Gradations and 0.45 power plot, with specification limits b) Trial design % asphalt content c) Trial designs volumetric analysis for each gradation, VMA, Va, VFA, graph not required d) Trial designs compaction analysis @ N_i, N_d, and N_m, for each gradation e) Dust ratio for each trial design, graph not required

TABLE 02510-116.D – SUBMITTAL INFORMATION (Cont.)			
	2.	Job Mix Formula Design, (design development with a minimum of 4 asphalt binder contents required, and the recommended design characteristic bracketed by a minimum of two test points for the design binder content ± 0.5%)	
		a)	Table of design aggregate gradation and 0.45 power plat, with specification limits and production targets
		b)	Compaction analysis G_{mb} as % $G_{m,}$ at N_i, N_d, and N_m, for each gradation vs. asphalt content (separate graphs for N_i, N_d, and N_m)
		c)	Volumetric analysis of VMA, Va, VFA, and dust ratio at design gyration, @ N_d, vs. % asphalt content
		d)	Gyratory compaction tables as height of sample versus gyration, for each asphalt content, Gmb @ NM, and bulk specific gravity/density correction factor(s) (graphs not required)
		e)	Maximum theoretical specific gravity/density (as pcf), $G_{mm,}$ vs % asphalt content @ N_d
		f)	Corrected bulk specific gravity/density (as pcf), $G_{mb,}$ vs. % asphalt content
		g)	Dust ratio vs. % asphalt content
		h)	Recommended gyratory sample mass(g) for 115 mm sample height at Nm
	C. Ignition Correction Factor: Correction for material losses during asphalt content ignition oven analysis		
	The correction factor shall be determined as the average value for three samples, design % asphalt content, design – 1.0%, and design + 1.0%, developed in an ignition oven complying with the requirements of AASHTO T53, Method A		

3.02 PRODUCTION

A. Asphalt concrete shall be produced in accordance with the requirements of ASTM D3515, the requirements of this Specification, or as authorized by the SDR. Production facilities shall comply with the requirements of ASTM D995, and this Specification. A plant shall be certified annually, by a New Mexico Registered Professional Engineer, to comply with the requirements of this Specification and Section 13. The production plant shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Certification shall be completed within 12 months prior to production of an authorized job mix formula at the plant. Certificates of calibration and production certifications shall be maintained at the plant for review by the SDR. A copy of the certifications shall be submitted to the SDR upon request.

B. Asphalt concrete shall be placed at the design proportions specified in the authorized job mix formula within the specified production tolerances for combined aggregate gradation and asphalt binder content. Asphalt concrete placed at a project, sampled and tested in accordance with this specification, shall have a gradation that complies with the authorized design gradation ± the production tolerance(s) specified in the authorized job mix formula. Asphalt concrete placed at a project, sampled and tested in accordance with this specification, shall have an asphalt content that complies with the design asphalt content ± 0.5% (laboratory analysis),

T53-Quantitative Analysis of Bitumen From Bituminous Paving Mixtures, Ignition Oven Method, Method A (Modified: reference temperature for constant mass, 149 ± 3° C / 300 ± 7° F).

3.03 DELIVERY

A. Asphalt concrete shall be delivered in trucks free of fluid leaks. Trucks detected to have leaks shall not be allowed on the project. Subgrade, base course, and asphalt concrete surfaces contaminated by uncontrolled equipment fluids shall be removed and replaced with complying material. Contaminated material shall be disposed of as specified. When hauling time from the mixing plant to the job site exceeds two hours or when inclement weather prevails, bituminous mixtures shall be covered with tarpaulins while being hauled. The tarpaulins shall completely cover the load and be firmly tied down. Mixtures shall be delivered to site of the work and placed without segregation of the ingredients and within the temperature range specified in the authorized job mix formula. Diesel fuel or other petroleum based solvents shall not be used in the bed of transport vehicles as a release agent to prevent buildup of the asphalt material. Material contaminated with diesel fuel or other petroleum based solvents shall be removed and replaced with complying material by the CONTRACTOR, as directed by the SDR, at no cost to the OWNER (SNL/NM).

B. The CONTRACTOR shall provide with each load of asphalt concrete batched and/or delivered to the job site, before unloading at the site, a delivery ticket on which is printed, stamped or written, the information defined in TABLE 02510-116.E. One copy of the ticket shall be available for each of the SDR and the quality assurance testing program.

TABLE 02510-116.E – DELIVER TICKET INFORMATION
Name of Asphalt Concrete Supplier
Date of Delivery
Delivery Ticket Number Contractor
Project Name (optional)
Job Mix Formula Number
Weight of Load (tons)
Time Loaded

3.04 PLACEMENT

A. Asphalt concrete shall be placed in uniform layers/lifts in accordance with the requirements of 02512 ASPHALT CONCRETE PAVEMENT. The thickness of a layer/lift shall be not less than two (2) times the maximum size aggregate and/or not greater than 4 inches for SP-II aggregate gradations. The thickness of a layer/lift shall be not less than two (2) times the maximum size aggregate of the job mix formula used but not greater than 3 inches, as directed by the SDR. A pavement lift thickness shall be selected to use the maximum size aggregate, as authorized by the

SDR. Lift thickness(es) and asphalt concrete type, designating the maximum size aggregate, shall be either specified in the CONTRACT documents, or as directed by the SDR. SP-II asphalt concrete shall not be used for a surface course.

3.05 COMPACTION

A. Asphalt concrete compaction shall begin when the asphalt concrete temperature is in the compaction temperature range specified in the authorized job mix formula. Compaction shall be completed before the temperature of the materials cools to less that 200° F. Compaction may be allowed on material with a temperature less than 200°F and greater than 185°F, as directed by the SDR. The material shall be compacted to a density of at least 93% but not greater than 97% of the theoretical maximum density as determined by ASTM D2041.

B. The CONTRACTOR shall be responsible for the development and implementation of the compaction program. The program shall be defined by the CONTRACTOR, to include equipment type and description, and procedures, reported in writing to the SDR for each job mix formula/lift thickness used on a project. Changes in the compaction program shall be reported to the SDR as they may occur.

C. A CONTRACTOR may construct a test strip, a minimum of 10 feet wide and 250 feet long, to establish the rolling pattern for an asphalt mix and lift thickness to be placed on a project, as directed by the SDR. The test strip shall be paid for in accordance with the requirements of the CONTRACT, as authorized by the SDR.

D. Compaction equipment shall be steel wheeled, pneumatic wheeled, and hand plate tampers, free of fluid leaks, selected by the CONTRACTOR, and authorized by the SDR. Compaction equipment detected to have leaks shall not be allowed on the project.

E. Compaction may be either static or dynamic (vibratory). All equipment shall be ballasted and operated as recommended by the manufacturer. Motorized wheeled dynamic (vibratory) compaction equipment shall have the frequency rate and amplitude setting readily available for review by the SDR. Frequency rate and amplitude adjustability shall be operable on so equipped motorized wheeled dynamic (vibratory) compaction equipment. Motorized compaction equipment with inoperable frequency rate and amplitude adjustment features shall not be used on the project.

F. Motorized compaction equipment shall be equipped with automatic wheel spray systems to apply release agents to prevent tracking of asphalt concrete. Diesel fuel or other petroleum based solvents shall not be used as a release agent to prevent buildup of the asphalt material. Material contaminated with diesel fuel or other petroleum based solvents shall be removed and replaced with complying material by the CONTRACTOR, as directed by the SDR, at no cost to SNL/NM.

G. Repair and replacement of damaged adjacent property and structures, resulting from the use of vibratory rolling equipment, shall be the responsibility of the CONTRACTOR, at no cost to SNL/NM.

3.06 SAMPLING AND TESTING

A. QUALITY ASSURANCE:

1. Asphalt concrete quality assurance sampling and testing shall be performed in accordance with the requirements of this specification, the Supplemental Technical Specifications, or as directed by the SDR.

2. Quality assurance asphalt concrete analysis shall be (1) performed in a laboratory accredited in accordance with the requirements of the New Mexico State Highway and Transportation Department "Procedure for Approval of Testing Laboratories to Perform Inspection, Testing, and Mix Design Services", April 13, 1998 Edition, and (2) under the direct supervision of a New Mexico Registered Professional Engineer.

3. Testing equipment shall be calibrated annually with calibration standards traceable to the National Bureau of Standards. Calibration records and certifications shall be maintained at the laboratory for review by the SDR. A copy of the certifications shall be submitted to the SDR upon request.

4. Quality assurance sampling and testing shall be performed by a technician certified under the New Mexico State Highway and Transportation Department/Associated Contractors of New Mexico Technical Training and Certification Program for ASPHALT and SUPERPAVE™.

B. FIELD SAMPLING:

1. A quality assurance asphalt concrete material field sample shall be taken in accordance with the requirements of ASTM D979 for each job mix delivered. The materials shall be sampled at the greater rate of either one sample for each 250 tons, or one sample per day, for each type of material placed on a project, as directed by the SDR. The sample shall be of such size to provide material for all tests specified and a split sample to perform verification/referee tests for gradation and binder content, if required.

C. MATERIAL TESTING:

1. Asphalt concrete quality assurance sampling and testing shall be performed in accordance with the requirements of this Specification, the Supplemental Technical Specifications, or as directed by the SDR.

2. The asphalt concrete quality assurance sample shall be tested and the properties reported, with authorized job mix formula production limits, as specified in TABLE 02510-116.F – FIELD SAMPLE LABORATORY TESTS.

TABLE 02510-116.F – FIELD SAMPLE LABORATORY TESTS		
I.	Marshall Design Analysis	
	A.	Energy Reference:
		1. Briquette mass / mold size;

3.		2. Hammer size and drop; and 3. Number of blow counts per face;
	B.	Volume characteristics of compacted briquettes, with production specifications, average of three:
		1. VMA, voids in mineral aggregate; 2. Va, voids in asphalt concrete; 3. VFA, voids filled with asphalt binder; and, 4. G_{mb}, bulk specific gravity and density, with authorized jmf target, average of three;
	C.	G_{mm}, maximum theoretical specific gravity/density with authorized jmf target, one test;
	D.	Strength Characteristics:
		1. Stability; 2. Flow; and, 3. Stability : flow ratio.
III.	SUPERPAVE analysis (sample aging is not required) Analysis at authorized jmf gyrations, N_i (initial), N_d (design), and N_m (max). (1) Two briquettes required. (2) Report average of test results of two briquette tests	
	A.	Compaction analysis with authorized design, and specifications (if applicable)
		1. Bulk specific gravity/density, G_{mb}, @ N_i, N_d, and N_m 2. Maximum theoretical specific gravity/density, G_{mm} 3. Compaction: G_{mb} as % G_{mm} at N_i, N_d, and N_m 4. Sample height, mm, at N_d
	B.	Volume characteristics of compacted briquettes @ N_d, with design value and specifications
		1. VMA, voids in mineral aggregate 2. Va, voids in asphalt concrete 3. VFA, voids filled with asphalt binder
IV.	Asphalt binder content, with design value and authorized production range, T53 – Quantitative Analysis of Bitumen From Bituminous Paving Mixtures, Ignition Oven Method A (Modified: reference temperature for constant mass, 149 ± 3°C / 300 ± 7°F)	
V.	Dust ratio, $\%P_{be}$	
VI.	Extracted Combined Aggregate, with design value(s) and authorized production range	
	A.	Gradation
	B.	Coarse aggregate angularity, material > 4.75 mm, coarse aggregate has two or more fractured faces
	C.	Flat and elongated particles, 3:1 or greater dimension, material > 4.75 mm, %

3. A CONTRACTOR may challenge production material test results, binder content and aggregate gradation, and request that the retained split asphalt concrete sample of record be released to his assigned laboratory and tested for compliance, as authorized by the SDR. Notification of challenge shall be

made in writing to the SDR by the CONTRACTOR within 28 calendar days from date of sampling. Challenge test results shall be submitted to the SDR for evaluation no later than 42 calendar days from date of sampling. Challenge test results will be evaluated in accordance with "multi laboratory" precision tolerances specified, T53 for binder content, ASTM C117 and C136 for aggregate gradation. Challenge and record test results that comply with precision tolerances will be averaged with the companion test results of record and the material pay factor, PFM, recalculated, as directed by the SDR. Challenge and record test results that do not comply with the precision tolerances will direct the disqualification of the challenged sample, as directed by the SDR. Cut/core sample(s) will be taken from the area(s) represented by the disqualified challenge sample(s) and evaluated by the lab of record under the observation of the CONTRACTOR, in accordance with the requirements of this specification and replace the disqualified sample test results. Analysis of the replacement cut/core sample(s) may not be challenged. The CONTRACTOR will submit challenge test results in writing to the SDR for each split sample released to his assigned laboratory of record. Challenges filed after the time limitations will not be considered. The OWNER (SNL/NM) shall pay for all complying tests.

D. FIELD TESTING:

1. Asphalt concrete quality assurance sampling and testing shall be performed in accordance with the requirements of this Specification, the Supplemental Technical Specifications, or as directed by the SDR.

2. Quality assurance of in-place field compaction tests shall be conducted in accordance with the requirements of this specification, as directed by the SDR. A test shall determine the density of a constructed asphalt concrete roadway lift. Compaction shall be calculated as the measured in-place density, divided by the average maximum theoretical density (Gmm) of the samples taken for that day's placement, reported to one tenth of a percent, xxx.x%. Maximum theoretical density (Gmm) shall be determined in accordance with ASTM D2041.

   a. Field density for SP-II and Type A materials shall be measured from field core samples. A minimum of one core sample shall be taken for each lift of 250 tons of a material type, or fraction thereof, placed each day, but not less than 3 cores per day, as directed by the SDR. The bulk density (G_{mb}) of each core shall be measured in accordance with the requirements of D2726 and reported to the nearest one-tenth pound per cubic foot, (one kilogram per cubic meter). The compaction for the asphalt concrete shall be calculated as the average measured density of the cores for a lift of a type of material placed in a day, divided by the average of the maximum theoretical density (G_{mm}) of the samples of the same or similar materials taken for that day's placement, reported to the nearest one tenth of a percent, xxx.x%. The maximum theoretical density (G_{mm}) shall be determined in accordance

with ASTM D2041, and reported to the nearest one-tenth pound per cubic foot, (one kilogram per cubic meter). The core barrel shall be 6 inches (150mm) outer diameter or greater, taken full depth. A lift sample shall be trimmed from the core at the lamination lines between lifts. The CONTRACTOR shall be responsible for material replacement at no cost to the OWNER (SNL/NM) where samples are removed.

i. The field density for Types B, C, D, SP-III, SP-IV, and SP-V materials shall be measured in accordance with the requirements of ASTM D2950, at the minimum rate of three tests per lift, per 500 sy of each type of asphalt material placed in a day, as directed by the SDR.

ii. A reference density test of the support material, for the asphalt concrete roadway lift to be constructed, shall be taken prior to the placement of the fresh asphalt concrete lift, or defined from previous test results. The density of the support material shall be used as reference in performing the density test of a fresh asphalt concrete lift in accordance with the requirements ASTM D2950, placed over the support material. A density test of the support material shall be taken at the rate of one (1) test for each 500 sy of surface or less to be paved over in a day, as directed by the SDR. The density of the support material shall be reported as "reference support material density" in the compaction test report of the constructed asphalt concrete pavement over the area represented by the support material compaction test.

b. Compaction Tests

i. Compaction tests shall be taken at random locations on the asphalt being placed, as directed by the SDR. The three (3) general areas in which tests are to be taken are the free edge of the mat, mat interior, and the joints. The number of tests taken in each area will vary but the total number of tests taken on any project shall be in the following approximate proportions.

TABLE 02510-116.G
FIELD IN PLACE DENSITY PROPORTIONS

Location	% of Total Tests
Free Edge of Mat[1]	20 to 33
Mat Interior	33 to 60
Joints[2]	20 to 33

Notes:	
1	The free Edge of Mat test shall be taken in the area between one (1) foot and two (2) feet in from a free edge of a lift.
2	Joints shall include the longitudinal and transverse butt joints between adjacent lifts of asphalt having the same finish elevation. Tests may be taken on material placed against a cold joint edge of formed surface.

ii. Samples of the compacted Types S-III, S-IV, B, C, and D asphalt concretes may be taken and tested to determine compaction conformance of the finished pavement with the specified requirements either as requested by the CONTRACTOR, or as directed by the SDR. Cores shall be sampled and tested in accordance with 3.06 subpart D. – Field Testing.

E. TEST REPORTS

1. Test reports shall include but not be limited to the information specified in TABLE 02510-116.H – TEST REPORT.

TABLE 02510-116.H – TEST REPORT	
A.	Field Data and Test Results:
	1. Date of Sampling/Test 2. SNL Project Number or Permit Number 3. Project Title 4. Asphalt Concrete Supplier 5. Delivery Ticket Number (asphalt concrete sample – only) 6. Job Mix Formula Number 7. Location of Sample/Test as defined by Contract Documents 8. Time of Sampling/Testing 9. Material temperature at time of sampling, °F 10. Ambient temperature at time of sampling, °F 11. Field test results with reference specification limits (compaction test)
B.	Laboratory Test Results
	1. Laboratory results as defined in TABLE 02510-116.F 2. Field Test Data, per 3.06 subpart D. Field Testing.
C.	Recommended Pay Adjustment Factor for a LOT
	1. C_{LM}, material factor, see TABLE 02510-116.J 2. C_{LC}, placement/compaction factor, see TABLE 02510-116.K

2. Test results shall be reported to the SDR, CONTRACTOR, and the Supplier in writing, within 7 working days of completion of the sampling of the asphalt and/or the field testing. Non-complying tests shall be reported to the

SDR, CONTRACTOR, and the Supplier within 1 working day of completion of the test.

3. The New Mexico Registered Professional Engineer in direct charge of the laboratory shall certify on a quality assurance test report that the test procedures used to generate the report complied with the specifications.

3.07 PERFORMANCE AND ACCEPTANCE

A. If there are failing tests on the asphalt concrete for material properties, placement, compaction or thickness, the SDR may, at his discretion, direct the LOT to be removed and replaced with materials complying with the specifications at no cost to the OWNER (SNL/NM), or may make reductions in the amount paid to the CONTRACTOR for asphalt concrete paving as defined in 3.07 Subpart B. below. A LOT shall be defined as the total tonnage placed in a day, for each type of material placed.

B. Each LOT of asphalt concrete material shall be paid at an adjusted price, as determined by the schedule of values, for asphalt concrete calculated in accordance with the equation below and adjusted by a material factor, PFm, specified in TABLE 02510-116.J, as authorized by the SDR. Acceptance samples shall be sampled and tested in accordance with the requirements of 3.06 subpart D. Field Testing, and tested for compliance with the specifications. A material pay factor, PFm, shall be determined in accordance with TABLE 02510-116.J, as defined for test results for combined aggregate gradation and asphalt content, as compared to the authorized job mix formula's production specifications. All complying acceptance samples taken in a day for a material type shall represent a LOT in the computation specified in TABLE 02510-116.J. Non complying acceptance samples shall be evaluated in accordance with these specifications as directed by the SDR. The material factor, PFM, for a LOT shall be determined based on the deviation of the average value, arithmetic mean, M, of the acceptance samples' test results from the job mix formula targets, T, adjusted for the range of the test results, maximum value minus the minimum value. If the absolute value of the deviation of the daily mean from the target is greater than the maximum allowable deviation, the LOT will be removed and replaced with materials complying with the specifications at no cost to the OWNER (SNL/NM), as directed by the SDR. If it is determined by the SDR to be more practical to accept the material under a specific project condition, the LOT may be accepted under written agreement between the OWNER (SNL/NM) and the CONTRACTOR at an assigned pay factor PFM=0.70, for a LOT having a compaction pay factor PFc, equal or greater than 0.85, as authorized by the SDR.

$$UP' = PF_M \times UP$$

UP', Adjusted Unit Price/Ton
UP, Unit Price/Ton
PF_M, Material Adjustment Factor

TABLE 02510-116.J – MATERIAL FACTOR, PF_M, FOR GRADATION & BINDER CONTENT			
NUMBER OF DAILY SAMPLES	For [T-M] equal or greater than D', [1, 2] D', MAXIMUM ALLOWABLE DEVIATION [3]		
1	1.40D	1.20D	D
2	D + R	D + 0.37R	D – 0.10R
3	D + 0.30R	D + 0.07R	D – 0.14R
4	D + 0.16R	D – 0.01R	D – 0.17R
5	D +0.11R	D – 0.03R	D – 0.20R
6	D + 0.09R	D – 0.05R	D – 0.22R
7	D + 0.07R	D – 0.07R	D – 0.24R
8	D + 0.06R	D – 0.08R	D – 0.25R
9	D + 0.05R	D – 0.09R	D – 0.26R
10 OR MORE	D + 0.04R	D – 0.10R	D – 0.27R
MATERIAL FACTOR PF_M [3]	0.85	0.95	1.00

[1]	D, production tolerance +/- %, see TABLE 02510-116.B and Section 2.02 PROPORTIONING, and authorized job mix formula, R, range of test values, maximum – minimum values, M, average test value of a LOT's samples test results, T, target value specified in the authorized job mix formula.
[2]	If the deviation of the daily mean from the target exceeds the maximum allowable deviation for a LOT, [T-M]>D', the LOT will be removed and replaced with material complying with this specification, at no cost to the OWNER (SNL/NM), as directed by the SDR. If determined by the SDR to be more practical to accept the material, the LOT may be accepted under written agreement between the OWNER (SNL/NM) and the CONTRACTOR at an assigned pay factor $PF_M = 0.70$, for compaction LOT(s) having a compaction factor, PF_C, equal or greater than 0.85, as directed by the SDR.
[3]	The material factor PF_m, shall be the lowest of the factors calculated for either the combined aggregate gradation of material passing the nominal maximum size aggregate screen, 3/8 inch, and smaller screens, or, the binder content.

C. The placement and compaction factor, PF_c, for a LOT shall be determined based on the average value of the compaction tests for the LOT, with any single test neither less than 90.0% nor greater than 98%, and TABLE 02510-116.K. If a test for a LOT is either less than 90.0% or greater than 98%, the LOT will be evaluated as directed by the SDR.

$$UP' = PF_c \times UP$$

UP', Adjusted Unit Price

PF_c, see TABLE 02510-116.K

UP, Unit Price

TABLE 02510-116.K – PAY FACTOR (PF_C) FOR COMPACTION	
Average of Acceptance Test Results	Pay Factor, PF_c
98.0% and greater	[1]
97.1 to 97.9	0.85
93.0 to 97.0	1.00
92.0 to 92.9	0.95
91.0 to 91.9	0.90 [2]
90.0 to 90.9	0.85 [2]
Less than 90%	[1], [2]

[1]	The material defined for the LOT shall be removed and replaced with asphalt concrete material complying with this Specification at no cost to the OWNER (SNL/NM), as directed by the SDR. Upon written agreement, the CONTRACTOR and SDR may determine that for practical purposes the LOT shall not be removed. If determined by the SDR to be more practical to accept a LOT, a LOT may be accepted under written agreement between the OWNER (SNL/NM) and the CONTRACTOR at an assigned compaction pay factor PF c = 0.50 [2], for a LOT having a material pay factor equal or greater than 0.85, as directed by the SDR.
[2]	When the lift is the surface course, and is accepted at this pay factor, the CONTRACTOR shall apply a sanded fog seal to the LOT complying with the applicable requirements of City of Albuquerque "Standard Specifications for Public Works Construction" SECTION 333 FOG SEAL, latest edition as directed by the SDR, at no cost to the OWNER (SNL/NM).

- END OF SECTION -