

**SECTION 02504**  
**ASPHALT CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This is a material specification for hot mix and cold mix bituminous paving mixtures.

1.02 REFERENCES

- A. AASHTO T-27: Standard Method for Sieve Analysis of Fine and Coarse Aggregate.
- B. AASHTO M-17: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
- C. AASHTO T-165: Standard Test Method for Effect of Water on Cohesion of Compacted Bituminous Mixtures.
- D. AASHTO T-245: Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- E. AASHTO T-246: Standard Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
- F. AASHTO T-182: Standard Test Method for Coating and Stripping of Bitumen-Aggregate Mixtures.
- G. AASHTO M-156: Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- H. ASTM D 4215: Standard Specification for Cold-Mixed, Cold-Laid Bituminous Paving Mixture.

1.03 DEFINITIONS

- A. Traffic Classifications:
  - 1. Class I: Parking lots, driveways, light traffic residential streets, light traffic farm roads.
  - 2. Class II: Residential streets, rural farm and residential roads.
  - 3. Class III: Urban minor collector streets, rural minor collector roads.
  - 4. Class IV: Urban minor arterial and light industrial and light industrial streets, rural major collector and minor arterial highways.
  - 5. Class V: Urban freeways, expressways and principal arterial highways, rural interstate and other principal arterial highways.

1.04 SUBMITTALS

- A. Mix Design: Submit each proposed mix design 14 days prior to use in the Work. Include in the report the following information.

1. Mix design method: A Marshal Mix Design or Superpave Mix Design shall be used for Class I and Class II roads. Superpave Mix Design shall be used for Class III, Class IV, and Class V roads.
    - a. For Marshall: use a five (5) point design using a four (4) point binder series with a one (1) point verification at the optimum binder content.
    - b. For Superpave Mix Design: follow the 2017 Utah Department of Transportation (UDOT) Standard Specification section 02741 Hot Mix Asphalt (HMA) requirements for aggregates and volumetric mix design. All designs gyrations and compaction parameters shall meet the 20 year design ESALS 0.3 to < 3 Million. ( $N_{\text{design}}/\% \text{ of } G_{\text{mm}} = 75/97$ ), 3% Air Voids. Super Pave Mix shall be ½” Fine Mix with 15% maximum Reclaimed Asphalt Pavement (RAP) content.
  2. Job control target data for aggregate ideal grading.
  3. Permissible range limits of bitumen content in mixture.
  4. Mixture's index of retained strength, AASHTO T-165
  5. Additives. If none, state none are required.
  6. Percent voids.
- B. Source Aggregate Sample Report. Indicate rodded weight of aggregate, percentage of wear, weight loss, sand equivalent value, percent of fractured faces, amount of organic matter, plasticity of fines, and percentage of fines retained on the aggregate.
- C. Pre-Approved Mix Design Data: If supplier has on record, a City approved mix design, submit name and address of supplier for each mix design 3 days prior to using asphalt concrete mix.

#### 1.05 QUALITY ASSURANCE

- A. Bitumen weights shall be determined by the mix design.
- B. Use asphalt cement when recycled asphalt mixtures are indicated.
- C. Do not change source of supply of paving asphalt or aggregate without Engineer's written approval.
- D. Each shipment of bituminous material shall be uniform in appearance and consistency with no foaming when heated to the specified mixing temperature.
- E. Do not use storage containers contaminated with other asphalt types or grades.
- F. Gradation, density, and maximum density shall be determined by extraction tests, ASTM D 5444. Asphalt binder content shall be determined by using a burn-off oven, ASTM D 6307.
- G. Validate binder grade received from the supplier.

### PART 2 PRODUCTS

#### 2.01 ASPHALT BINDER

- A. Class I and II Streets, Trails and patches: Performance Grade (PG) of virgin asphalt binder shall be PG 58-28.
- B. Class III, IV, & V Streets: Performance Grade (PG) of virgin asphalt binder shall be PG 64-34.

## 2.02 AGGREGATES - MATERIALS

- A. Clean, hard, tough, durable and sound mineral aggregates that consist of crushed stone, crushed gravel, crushed RAP or RAP blend, or crushed slag conforming to the following requirements:
  - 1. Rodded Weight density; not less than 75 pounds per cubic foot.
  - 2. Percentage of wear of coarse aggregate retained on the No. 8 sieve; not exceeding 40 unless specific aggregates having higher values are known to be satisfactory.
  - 3. Weight loss; not exceeding 16 percent by weight when subject to 5 cycles of sodium sulfate.
  - 4. The combined aggregate after going through the dryer shall have a sand equivalent value of not less than 60 percent.
- B. Coarse Aggregate: Use an aggregate that the portion retained on the No. 4 sieve has not less than 50 percent of particles by weight with at least two mechanically fractured faces or clean angular faces.
- C. Fine Aggregate: Fine Aggregate Angularity per AASHTO T304 shall be 40% minimum.
- D. Fine aggregate passing the No. 4 sieve may be either a natural or manufactured product containing not more than 2 percent by weight of organic matter or other deleterious substances.
  - 1. Aggregate passing the No. 40 sieve is nonplastic.
  - 2. Natural sand shall be a maximum of 15%.
  - 3. Mineral Filler: When mix design indicates need, add as separate ingredient; AASHTO M-17.

## 2.03 AGGREGATES - MASTER GRADING BAND LIMITS FOR MARSHAL MIX DESIGN

- A. Maximum particle size of  $\frac{1}{2}$  compacted lift thickness. DM-1/2" mix shall be used unless otherwise specified on the plans and/or standard drawings.
- B. The following gradations describe the total percent passing by weight, AASHTO T-27, and is based on fine and coarse aggregate having approximately the same bulk specific gravities.
- C. Target Grading Curve must lie within one of the Master Grading Bands in the following table.

MASTER GRADING BAND LIMITS FOR MARSHALL MIX DESIGN				
Sieve Size	DENSE MIXTURES			
	Type DM-3/4		Type DM-1/2	
	Min	Max	Min	Max
1"				
3/4"	100	----		
1/2"	----	----	100	----
3/8"	75	91	----	----
# 4	46	62	60	80
# 8	----	----	----	----
# 16	22	34	28	42
# 50	11	23	11	23
# 200	5	7	5	7

#### 2.04 AGGREGATES - JOB-CONTROL GRADING BAND LIMITS

- A. The job control formula shall produce a smooth curve approximately paralleling the master grading band limits for the designated mix. If application of the tolerances results in a job control grading band outside the master grading band, the full job control tolerances shall apply. The following describes the job control grading bands.

JOB-CONTROL GRADING BAND LIMITS					
Sieve Size	Amount Passing Sieve, weight %				
	1 Test	2 Tests	3 Tests	4 Tests	5 Tests
$\geq \frac{1}{2}$	$\pm 10$	$\pm 7.3$	$\pm 6.3$	$\pm 5.6$	$\pm 5.2$
$\frac{3}{8}$	$\pm 9$	$\pm 6.9$	$\pm 5.9$	$\pm 5.3$	$\pm 4.9$
No. 4	$\pm 9$	$\pm 6.7$	$\pm 5.7$	$\pm 5.2$	$\pm 4.8$
No. 8	$\pm 7$	$\pm 5.6$	$\pm 4.8$	$\pm 4.3$	$\pm 4.0$
No. 16	$\pm 7$	$\pm 5.2$	$\pm 4.6$	$\pm 4.2$	$\pm 3.9$
No. 50	$\pm 6$	$\pm 4.3$	$\pm 3.8$	$\pm 3.4$	$\pm 3.2$
No. 200	$\pm 3$	$\pm 2.4$	$\pm 2.0$	$\pm 1.8$	$\pm 1.7$

#### 2.05 MARSHALL MIX DESIGN

- A. The Marshall mix design shall be based upon AASHTO T-245, traffic classifications, and the following:

MARSHALL MIX DESIGN REQUIREMENTS						
	CLASS I		CLASS II		CLASS III to V	
	Min	Max	Min	Max	Min	Max
Number of Compaction Blows (each end of specimen)	35	34	50	50	NA	NA
Stability, lb (ASTM D 6927)	1500	-----	1500	-----	NA	-----
Flow, in 0.01 in. units	8	20	8	18	NA	NA
% Voids in Mineral Aggregate (VMA), (ASTM D 3203)						
1/2" nominal maximum particle size	15		15		NA	
3/4" nominal maximum particle size	14		14		NA	
% Air Voids,	3	3.5	3	3.5	NA	NA
Unconfined Compression Strength Retention, % (AASHTO T-165)	80	-----	80	-----	NA	-----

- B. Compensate for specific gravity and absorption of aggregate to determine bitumen content by laboratory testing.
- C. Recycled Asphalt Pavement (RAP) for Marshall Mix and Superpave Mixes: A maximum 15% Reclaimed Asphalt Pavement (RAP) by total weight of the mix is allowed in asphalt concrete mix, and a maximum 15% of the total binder content of the mix may be RAP asphalt binder.
- D. Dust to Binder ratio should not be more than 1.4.
- E. The mix design air voids shall be between 3% and 3.5%, where mix shall not exceed 3.5% air voids per ASTM D 3203. However, the percent asphalt or fines may need to be adjusted to achieve optimal strength.
- F. If mix design is older than 365 days from date of submission, mix shall be recertified.
- G. Voids in the Mineral Aggregate (VMA) shall be calculated using Gsb dry for both virgin and rap aggregates.

## 2.06 MIXING PLANT

- A. Hot-mixed, hot-laid paving mixtures; AASHTO M-156.

## 2.07 SOURCE QUALITY CONTROL

- A. Unconfined Compression Strength Retention: When crushed mineral aggregate which is thoroughly coated with bitumen has an index of retained strength less than 80 percent bring the strength into compliance by adding any of the following additives to the mix.
  1. Anti-stripping agent.
  2. Hydrated lime.
  3. Portland cement.
- B. Coating and Stripping of Bitumen-Aggregate Mixture: Immediately after mixing, the mixing shall meet the requirements of AASHTO T-182, whereby not more than 5 percent of the aggregate particles shall remain uncoated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Plant Mix Bituminous Paving: In accordance with Section 02510.

END OF SECTION