

CMT ENGINEERING **LABORATORIES**

Geotechnical • Materials Testing • Special Inspections • Chemical Analysis

MARSHALL METHOD

BITUMINOUS MIX DESIGN

ASTM D-1559 AND ASPHALT INSTITUTE MS-2

Prepared for: Asphalt Materials Inc

Mix Design: 1/2" Custom PG 58-28

non apwa spec 35% Rap

Date Prepared: February 24, 2020

Blows: 50



Bulk Unit Weight	Max Unit Weight (Voidless / Rice)
143.2	148.5

MARSHALL METHOD BITUMINOUS MIX DESIGN ASTM D-1559 AND ASPHALT INSTITUTE MS-2

Prepared for: Asphalt Materials

Lab #: 817196

Project: Various Projects

Date: February 24, 2020

Product: Custom No Spec 35% Rap

Max Size: 1/2

Project #: 5648

Gentlemen:

CMT Engineering Labs performed an Asphalt Mix Design in accordance with ASTM D-1559 and Asphalt Institute MS-2, to determine the optimum binder content for the Job Mix Target listed below.

The aggregate physical properties were determined and are listed on page 2, the asphalt physical properties were measured and are provided on page 3.

RECOMMENDED DESIGN CRITERIA

Stability:	3041	Recommended Oil Content:	5.85
Flow:	13.8	Virgin Oil Content:	4.05
Air Voids:	3.5	Lottman (TSR):	96.8%
VMA:	15.1	Binder Supplier:	Sinclair
Anti-Strip:		Virgin Binder Grade: PG	58 -28
Voids Filled VFA:	76.6	Final Binder Grade: PG	0 0
Dust Asphalt Ratio:	1.38	No. of Blows:	50
Effective Asphalt Content:	4.97	Max. Unit Weight (Rice):	148.5
		Bulk Unit Weight:	143.2

Job Mix Formula

<u>(inch)</u>	<u>(mm)</u>	<u>Percent Passing</u>	<u>No Spec</u>
1	25	100	
3/4"	19	100	
1/2"	12.5	100	100 - 100
3/8"	9.5	97	
#4	4.75	69	60 - 80
#8	2.36	45	
#16	1.18	32	28 - 42
#30	0.6	25	
#50	0.3	20	11 - 23
#100	0.15	14	
#200	0.075	6.8	3 - 7

Aggregate Source Proportions

Aggregate Source	Product Name	Proportions (%)
Parleys	3/4"	0
Point of Mountain	1/2"	10
Point of Mountain	1/4"	25
Point of Mountain	Sand	30
0	0.00	0
WJ Pit	Course Rap	25
WJ Pit	Fine Rap	10
None	Lime	0
Total		100

Aggregate Blend Physical Properties

Test Method	Results	Specification
MgSo4 Soundness (coarse) ASTM C-88	0.50	16 % Max.
MgSo4 Soundness (fine) ASTM C-88	1.50	16 % Max.
Dry Rodded Unit Weight ASTM C29	120.1	75 Min.
Fracture Face Count - Two Face's	91.8	50% Min.
Los Angeles Wear ASTM C-131	22	40% Max.
Sand Equivelent ASTM D-2419	81	45 MIN
Clay Lumps and Friable Particles ASTM C-142	0.0	2 max
Flat or Elongated Particles ASTM D-4791	0.0	20%Max
Plastic Index ASTM D-4318	Non-Plastic	6 Max.
Liquid Limit ASTM D-4316	Non-Plastic	25 Max

Specific Gravity of Aggregates

Product Name	Bulk Specific Gravities	Apparent Specific Gravities	Water Absorption	Proportion
3/4"	2.671	2.717	0.63	0
1/2"	2.477	2.592	1.80	10
1/4"	2.473	2.573	1.59	25
Sand	2.550	2.657	1.58	30
0	0.000	0.000	0.00	0
Course Rap	2.623	2.715	1.29	25
Fine Rap	2.658	2.658	1.29	10
None	2.723	2.723	5.16	0
Blend Totals	2.551	2.650	1.50	100

Summary of Paving Mixture Properties

Asphalt Content	Bulk Specific Gravity	Bulk Unit Weight	Stability	Flow	Air Voids	VMA	VFA	Max Specific Gravity	Max Unit Wt. (Rice)
5.30	2.274	141.6	2723	9	5.4	15.6	65.16	2.405	149.7
5.60	2.288	142.4	3025	11	4.4	15.3	71.01	2.394	149.0
5.90	2.304	143.4	3044	14	3.3	15.0	77.69	2.383	148.4
6.20	2.345	146.0	2976	16	1.2	13.7	91.51	2.373	147.7

Summary of Paving Mixture Properties @ Recommended Oil Content

Asphalt Content	Bulk Specific Gravity	Bulk Unit Weight	Stability	Flow	Air Voids	VMA	VFA	Max Specific Gravity	Max Unit Wt. (Rice)
5.85	2.301	143.2	3041	14	3.5	15.1	76.6	2.385	148.5

RAP, M323 Properties

Asphalt contribution from RAP	1.80
Total Binder Recommendation	5.85
Percent Binder from RAP	30.83
Max. Allowable Binder Contribution M323	-168.67
AASHTO M323 Compliant	No

Paving Mixture Properties

Mixing Temp	307
Compaction Temp	273
Dust to Asphalt Ratio	1.38
Hamburg Loaded Wheel Tes	N/A

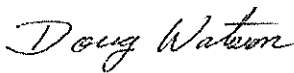
Asphalt Water Susceptibility

Lottman AASHTO T-283-89:

Immersion Compression

ASTM C-1074,1075

Test Specimen	Tensile Strength (PSI)	Retained Strength %	Stripping Index	Dry Strength (PSI)	Retained Strength %
Dry Controls	121.0				
Wet Controls	117.1	96.8%			
1/4% Liquid Anti-Strip					
1% Lime					
1.5% Lime					



 Douglas Watson

