EARTH ENGINEERING CONSULTANTS, LLC

March 19, 2019

Connell Resources, Inc.
7785 Highland Meadows Parkway, Suite 100
Fort Collins, Colorado 80528

Attn: Mr. Ed Wells (ewells@connellresources.com)

Re: Connell Resources, Inc. - 2019 Asphalt Mix Designs
Mix #20150, Grading S 75 (Suncor 64-22) with Lime
EEC Project No. 1195001A-8

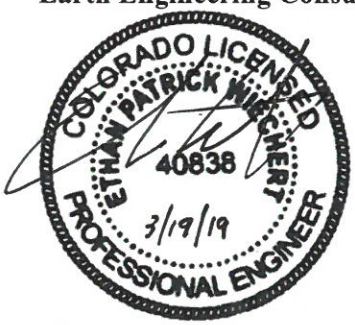
Mr. Wells:

Earth Engineering Consultants, LLC (EEC) personnel have completed the requested laboratory Superpave mix design for the referenced asphaltic concrete mix. The mix design was completed in general accordance with Colorado Department of Transportation and Asphalt Institute Superpave Mix Design No. 2 mix design procedures as well as Larimer County Urban Area Street Standards requirements. The mix design was performed using a Superpave Gyratory Compactor with a compaction angle of 1.25 degrees and 100-mm molds. In addition, specified tests were completed on the component aggregate. Results of the testing completed for this mix and recommendations for the job mix formula are provided in this report.

The asphaltic concrete job mix formula provided with this report is based on testing completed with specific materials, gradations and design procedures. Variation in laboratory test results can occur due to multi-laboratory precision, variation in materials and slight changes in design procedures. These factors should be considered when job mix verification of laboratory mixes is performed. The physical properties of the mix should be retested and re-evaluated for hot plant produced material. It is often necessary to make adjustments to the job mix formula to account for the changed environment between the laboratory and field produced material. Should the source or physical characteristics of the materials change substantially, the development of a new or revised job mix formula is recommended.

We appreciate the opportunity to be of service to you. If you have any questions regarding this report, or if we can be of further service to you in any other way, please do not hesitate to contact us.

Very truly yours,
Earth Engineering Consultants, LLC



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ASPHALTIC CONCRETE MIX DESIGN
Connell Resources, Inc. - Mix No. 20150
Superpave Mix Design: Grading S 75 (Suncor PG 64-22) with Lime

TABLE I - AGGREGATE GRADATIONS

Sieve Size		Connell Carr 3/4"	Connell Carr Crusher Fines	Connell Carr W. Crusher Fines	Bestway Windsor Washed Sand	Connell Timnath RAP AC=5.12%			Pete Lien Lime	Composite	Job Mix Tolerance	Target Master Range
1 1/2"	(37.5 mm)	100	100	100	100	100			100	100	100	
1"	(25.0 mm)	100	100	100	100	100			100	100	100	100
3/4"	(19.0 mm)	100	100	100	100	100			100	100	90 - 100	90 - 100
1/2"	(12.5 mm)	62	100	100	100	99			100	89	83 - 95	
3/8"	(9.5 mm)	37	100	100	100	95			100	81	75 - 87	
No. 4	(4.75 mm)	2	82	85	100	82			100	63	58 - 68	
No. 8	(2.36 mm)	1	55	56	94	66			100	49	44 - 54	23 - 49
No. 16	(1.18 mm)	1	35	35	66	51			100	34		
No. 30	(600 µm)	1	30	21	38	38			100	24	20 - 28	
No. 50	(300 µm)	1	21	13	17	26			100	16		
No. 100	(150 µm)	1	14	6	6	17			98	10		
No. 200	(75 µm)	0.5	9.5	3.2	2.1	10.7			97.0	6.2	4.2 - 8.2	2 - 8
Used		28%	24%	12%	15%	20%			1%	100%		
Combined	Dry Sp. Gr.	2.667	2.595	2.611	2.595	2.641			2.380	2.624		
	Apparent Sp. Gr.	2.721	2.674	2.682	2.659	2.683			2.380	2.684		
	Water Absorption (%)	0.7	1.2	1.0	0.9					0.7		
Coarse	Dry Sp. Gr.	2.667	2.625	2.625		2.641				2.657		
	Apparent Sp. Gr.	2.721	2.694	2.694		2.683				2.713		
	Water Absorption (%)	0.7	1.0	1.0						0.7		
Fine	Dry Sp. Gr.	2.667	2.589	2.609	2.595	2.641			2.380	2.604		
	Apparent Sp. Gr.	2.721	2.670	2.680	2.659	2.683			2.380	2.668		
	Water Absorption (%)	0.7	1.2	1.0	0.9					0.8		
Effective Mix Sp. Gr.										2.670		
LA Abrasion (%)		20								20	45 Max.	
Liquid Limit			NL	NL	NL					NL		
Plasticity Index			NP	NP	NP					NP	NP	

Note: The RAP specific gravity was back-calculated using an assumed aggregate asphalt absorption.

TABLE II - PHYSICAL PROPERTIES OF AGGREGATE

Test Description and Designation	Composite Results	Mix Design Target
Micro-Deval (CP-L 4211) (%)	4.6	18 Max.
Fractured Face Count (Two Faces) (CP 45) (%)	100.0	90 Min.
Fine Aggregate Angularity (AASHTO T 304)	45.0	45.0 Min.
Flat And Elongated Particles (5:1) (ASTM D 4791) (%)	None	10 Max.
Sand Equivalent (AASHTO T 176 / CP 37) (%)	79	45 Min.
Clay Lumps & Friable Particles (AASHTO T 112) (%)	None	--
Adherent Coating (ASTM D 5711) (%)	0.23	--
Sodium Sulfate Soundness (5 cycles) (AASHTO T 104) (%)	Coarse: 1 Fine: 3	--

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FIGURE I: AGGREGATE GRADATION .45 POWER CURVE

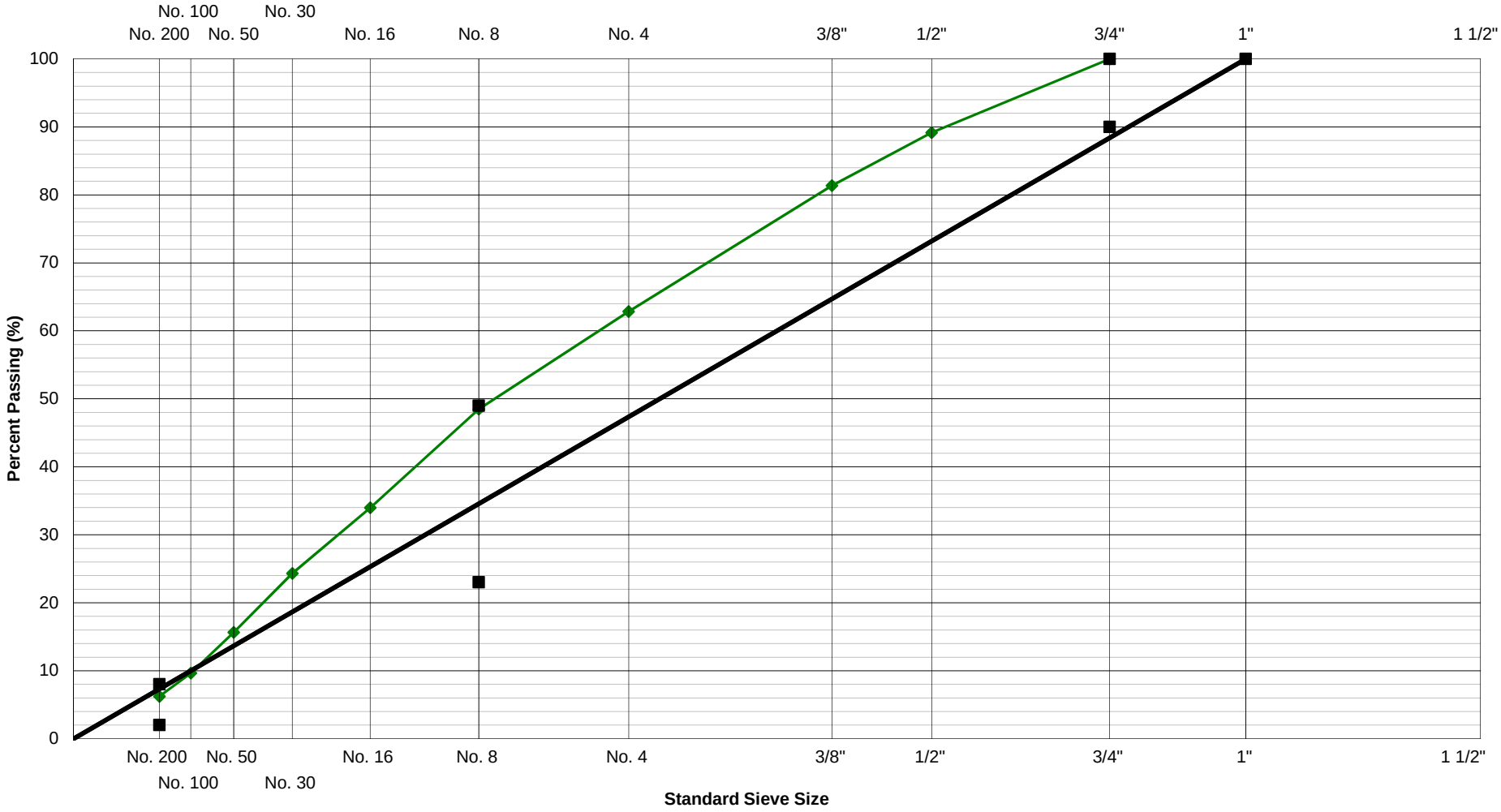

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TABLE III: SHARP SUPERPAVE PROPERTIES

Asphalt Content (%)		4.5	5.0	5.5	6.0
Maximum Specific Gravity		2.493	2.475	2.457	2.439
Maximum Unit Weight (pcf)		155.6	154.4	153.3	152.2
N_{ini}	Bulk Specific Gravity	2.179	2.196	2.215	2.225
	Voids (%)	12.6	11.3	9.9	8.8
N_{des}	Bulk Specific Gravity	2.353	2.372	2.389	2.403
	Unit Weight (pcf)	146.8	148.0	149.1	150.0
	Height (mm)	65.4	64.8	63.7	62.9
	Voids (%)	5.6	4.1	2.8	1.5
	VMA (%)	14.4	14.1	13.9	13.9
	VFA (%)	61	71	80	89
	Hveem Stability	39	39	38	37
Dust to Asphalt Ratio		1.4	1.2	1.1	1.0

TABLE IV: PROPERTIES AT OPTIMUM ASPHALT CONTENT

Test		Design Properties	Mix Design Target
Asphalt Content[1] (%)		5.1	--
Maximum Specific Gravity		2.472	--
Maximum Unit Weight (pcf)		154.2	--
N_{ini}	Bulk Specific Gravity	2.200	--
	Voids (%)	11.0	--
N_{des}	Bulk Specific Gravity	2.376	--
	Unit Weight (pcf)	148.2	--
	Height (mm)	64.6	--
	Voids (%)	3.9	3.5 - 4.5
	VMA (%)	14.1	13.9 Min.
	VFA (%)	72	65 - 80
	Hveem Stability	39	28 Min.
Dust to Asphalt Ratio		1.2	0.6 - 1.2
Mixing Temperature		325 ˚F	325 ±5 ˚F
Compaction Temperature		300 ˚F	300 ±5 ˚F

TABLE V: RESISTANCE TO MOISTURE-INDUCED DAMAGE AT OPTIMUM ASPHALT CONTENT (CP-L 5109)

Tensile Strength Retention (%)	86	80 Min.
Dry Tensile Strength (psi)	78.2	30 Min.
Conditioned Tensile Strength (psi)	67.0	--
Average Specimen Saturation (%)	87	--
Average Specimen Voids (%)	6.5	6.0 - 8.0

[1]Asphalt Specific Gravity (Suncor Performance Grade PG 64-22) = 1.037

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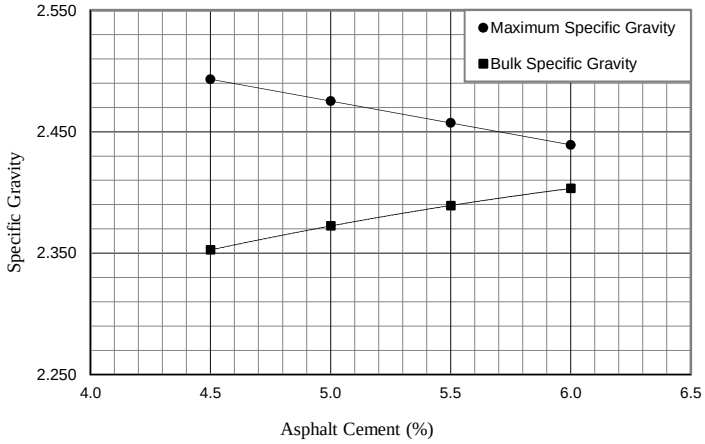
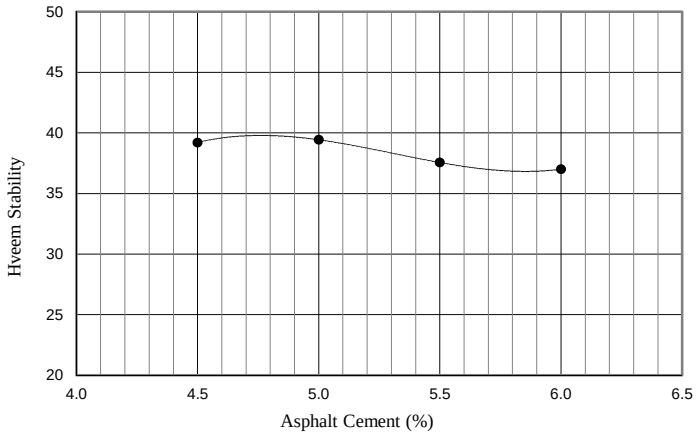
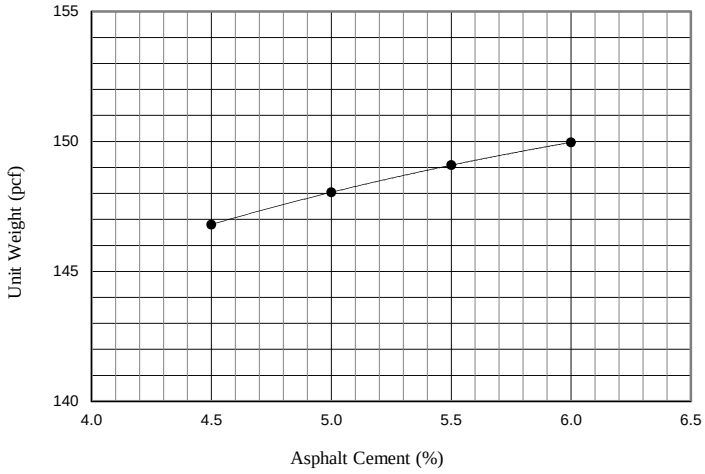
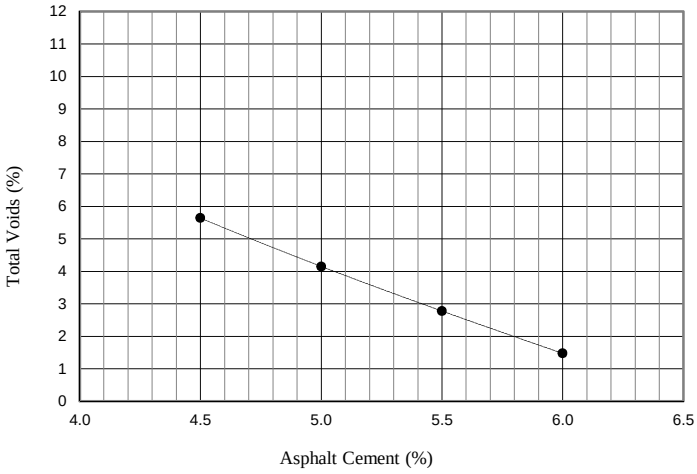
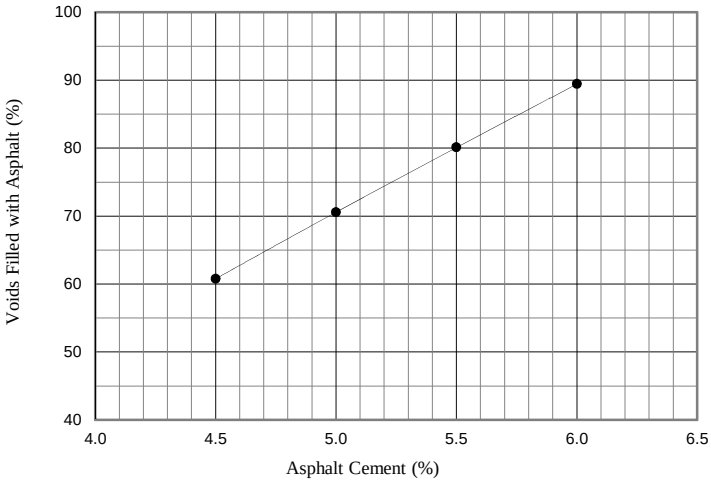
FIGURE II: ASPHALT PROPERTIES VS. ASPHALT CONTENT

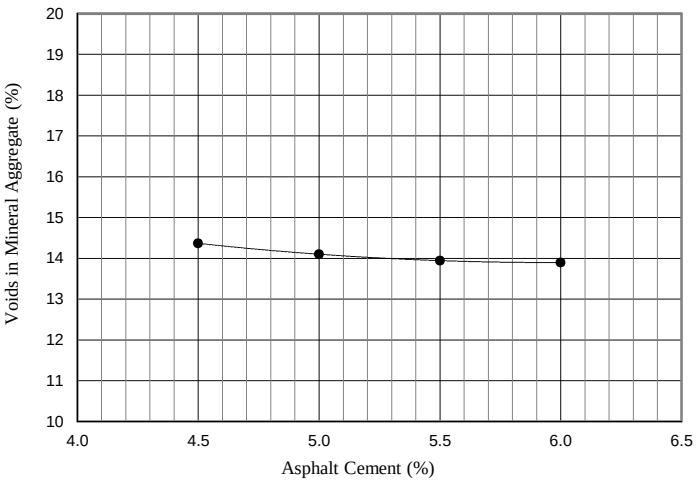












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