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Suite 250
Englewood, CO 80112
Office: (303) 770-7878
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LETTER OF TRANSMITTAL

TO: Steamboat Structures
96 Perry Park Ave #464
Larkspur, CO 80118

DATE: 8/18/2021

FILE NO. 010-01

ATTN: Heather Reed

RE: Forest Lakes Bridges

WE ARE SENDING YOU:

- | | | |
|---|---|----------------------------------|
| <input type="checkbox"/> Shop Drawings | <input type="checkbox"/> Copy of Letter | <input type="checkbox"/> Samples |
| <input type="checkbox"/> Specifications | <input type="checkbox"/> Reports | <input type="checkbox"/> _____ |
| <input type="checkbox"/> Plans | <input checked="" type="checkbox"/> Submittal Information | |

SUBMITTED BY: Structures

COPIES	DESCRIPTION	CONTRACTOR
1	Caisson Concrete Mix Design	Structures

THESE ARE TRANSMITTED:

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> For Approval | <input type="checkbox"/> For Review and Comment | <input type="checkbox"/> Returned for Corrections |
| <input type="checkbox"/> For Your Use | <input type="checkbox"/> Approved As Submitted | <input type="checkbox"/> _____ |
| <input type="checkbox"/> As Requested | <input type="checkbox"/> Approved As Noted | |

REMARKS:

cc: File

SHOP DRAWING REVIEW

- ☒ NO EXCEPTIONS ☐ REVISE AS NOTED
☐ REVISE AND RESUBMIT ☐ REJECTED

This review is for general conformance with the design intent of the project and general compliance with the information provided in the contract documents. Review, corrections, or comments made concerning the shop drawings during this review do not relieve the contractor from compliance with the requirements of the drawings and specifications, nor relieve the contractor of contractual responsibility for any error or deviation from the contract documents.

The contractor is responsible for, but not limited to: confirming all quantities, dimensions, and structural capabilities, selecting fabrication and construction techniques, coordinating work with that of all other trades, and performing work in a safe and satisfactory manner.

STEAMBOAT STRUCTURES, LLC

By: H. Reed

DATE: 08/24/21



1910 Rand Ave.
Colorado Springs, Colorado 80905
Office: (719) 473-3100
Dispatch: (719) 638-8000

CONCRETE MIXTURE DESIGN REPORT

MM Mixture ID#: XBZ4705
Class / Use: 4500 PSI Caisson Mix

Material	Amount / Cubic Yard	Source / Type	ASTM Std.
Cement	528 lbs	Type I-II	C 150
Fly Ash	132 lbs	Class F Fly Ash	C 618
Coarse Aggregate*	1700 lbs	Martin Marietta 57/67	C 33
Fine Aggregate*	1340 lbs	Martin Marietta WCS	C 33
Water (35.7 gal.)	297 lbs	Municipal	C 94
Water Reducer**	** oz	Water Reducer - Type A	C 494
Water Reducer**	** oz	High Range Water Reducer - Type F	C 494
Hydration Stabilizer**	** oz	Hydration Controlling Admix - Type B	C 494

*Aggregate masses determined in SSD condition.

** AEA adjustments at plant and on site may be required to achieve proper air entrainment.

Air adjustments may be made with either liquid or Fritz air entrainment and Air Minus.

Mix proportions may be adjusted in accordance with ACI 301-16 section 4.2.3.6.

**Admixture dosages may be adjusted based on varying environmental and/or jobsite conditions.

Specified Physical Properties

Compressive Strength: **4500** psi (Min)
Air Content: **1.0-3.0** % (Range)
Slump: **5.00-8.00** in. (Max)
W/CM Ratio: **0.45** (Max)

Matt McCombs

Prepared by Martin Marietta
Quality Control Manager

STRENGTH PERFORMANCE REPORT

Mix Design: XBZ4705
Batch Date Range: 01 Dec 2020 to 19 Jul 2021

Specified Strength @ 28 days: 4500 psi
Required Strength @ 28 days: 5090 psi

		Air	Slump/Flow	7 Day	28 Day
Count:		30	30	19	30
Lot Average:		2.5	6.80	4730	5800
Minimum Value:		1.7	4.00	4000	5100
Maximum Value:		5.0	8.50	5660	6420
Standard Deviation:		0.6	1.03	510	445
Sample					
Ticket #	Date Sampled	Air %	Slump/Flow (in)	7 Day (psi)	28 Day (psi)
35092964	01 Dec 2020	1.7	6.75	4390	5340
35092979	01 Dec 2020	2.2	7.50	5000	5400
35092986	01 Dec 2020	2.1	7.50	4500	5510
35093186	10 Dec 2020	2.5	5.75		5740
35093192	10 Dec 2020	2.3	6.50		5320
35093201	10 Dec 2020	2.1	6.00		5140
35093329	17 Dec 2020	3.0	6.75		6330
46365120	17 Dec 2020	1.9	7.25		6080
46365163	18 Dec 2020	2.1	7.25		6290
35093356	21 Dec 2020	2.6	6.75	4640	5600
35093361	21 Dec 2020	2.1	7.00	4540	5420
35093370	21 Dec 2020	2.5	6.50	4960	5740
35093517	29 Dec 2020	2.5	6.50	4540	5300
46365584	05 Jan 2021	2.0	6.50		6160
46365702	06 Jan 2021	2.3	5.50		6310
35093712	11 Jan 2021	2.5	6.00	4820	6050
21102469	25 Jan 2021	1.7	8.25	4360	5600
22073679	05 Feb 2021	2.8	7.75	5320	6360
22073855	11 Feb 2021	1.9	8.50	4160	5260
43284860	16 Feb 2021	2.8	4.00	5660	6420
43284869	16 Feb 2021	5.0	7.00	5500	6350
35096525	24 May 2021	2.9	7.75		5880
35097174	10 Jun 2021	3.0	7.50	4470	6330
35097750	23 Jun 2021	2.4	7.00	4080	5240
35097881	24 Jun 2021	2.9	5.00		6160
35098282	01 Jul 2021	2.9	6.00	5540	6020
35098308	01 Jul 2021	2.7	6.00	4000	5100
45120250	06 Jul 2021	2.3	8.25		6370
45120409	08 Jul 2021	2.6	8.50	5110	5890
35099303	19 Jul 2021	2.8	6.50	4350	5400



GCC of America

600 S. Cherry Street, Suite 1000, Glendale, CO 80246
Sales (303) 739-5900, Customer Service (800) 225-5422

MATERIAL CERTIFICATION REPORT

Plant: Pueblo
Address: 3372 Lime Road
Pueblo, CO 81004
Contact: Urs Fuchs
Phone: (719) 647-6821

Cement Type: I/II, GU
Date Issued: 14-Jul-21
Production Period: 1-Jun-21
To: 30-Jun-21

STANDARD REQUIREMENTS ASTM C150/AASHTO M85/ASTM C1157

CHEMICAL			
Item	ASTM Test Method	ASTM C150 Spec. Limit	Test Result
SiO ₂ (%)	C114	-	20.1
Al ₂ O ₃ (%)	C114	6.0 max	4.4
Fe ₂ O ₃ (%)	C114	6.0 max	3.8
CaO (%)	C114	-	63.5
MgO (%)	C114	6.0 max	0.9
SO ₃ (%)	C114	3.0 max ^A	3.4
Loss On Ignition (%) ^B	C114	3.5 max ^C	2.9
Na ₂ O (%)	C114	-	0.16
K ₂ O (%)	C114	-	0.59
Insoluble Residue (%)	C114	1.5 max	0.9
CO ₂ (%) ^B	C114	-	1.6
Limestone (%)	C150	5.0 max	4.1
CaCO ₃ in Limestone (%)	C150	70 min	87
Inorganic Processing Addition	C150	5.0 max	-
Potential Phase Composition			
C ₃ S (%)	C150	-	56
C ₂ S (%)	C150	-	14
C ₃ A (%)	C150	8 max	5
C ₄ AF (%)	C150	-	11

PHYSICAL				
Item	ASTM Test Method	ASTM C150 Spec. Limit	ASTM C1157 Spec. Limit	Test Result
Air Content (% vol)	C185	12 max	12 max	8
Blaine Fineness (m ² /kg)	C204	260 min	-	403
Residue 45 µm (No.325) Sieve (%)	C430	-	-	3.5
Autoclave Expansion (%)	C151	0.80 max	0.80 max	-0.01
Compressive Strength				
3 days, MPa (psi)	C109	12.0 (1740) min	13.0 (1890) min	28.9 (4200)
7 days, MPa (psi)	C109	19.0 (2760) min	20.0 (2900) min	34.6 (5020)
28 days, MPa (psi) ^D	C109	-	28.0 (4060) min	43.1 (6250)
Time of Setting, Initial Vicat (min)	C191	45 min / 375 max	45 min / 420 max	118
Mortar Bar Expansion (%)	C1038	0.020 max	0.020 max	0.007

ADDITIONAL DATA					
Type	Limestone	Test Method	Base Phase Composition	ASTM Test Method	Test Result
SiO ₂ (%)	7.0	Internal	C ₃ S (%)	C150	59
Al ₂ O ₃ (%)	1.8	Internal	C ₂ S (%)	C150	15
Fe ₂ O ₃ (%)	1.1	Internal	C ₃ A (%)	C150	5
CaO (%)	47.6	Internal	C ₄ AF (%)	C150	12
SO ₃ (%)	0.3	Internal			

OPTIONAL REQUIREMENTS ASTM C150/AASHTO M85/ASTM C1157

CHEMICAL			
Item	ASTM Test Method	ASTM C150 Spec. Limit	Test Result
Equivalent Alkalies (%)	C114	-	0.55

PHYSICAL				
Item	ASTM Test Method	ASTM C150 Spec. Limit	ASTM C1157 Spec. Limit	Test Result
False Set (%)	C451	50 min	50 min	73

^A It is permissible to exceed the specification limit provided that ASTM C1038 Mortar Bar Expansion does not exceed 0.020 % at 14 days.

^B This alternative analysis has been qualified in accordance with ASTM C114 and meets requirements of Table 1.

^C Loss on ignition, max: 3.0 % when limestone is not an ingredient; Loss on ignition, max: 3.5 % when limestone is an ingredient

^D Test result of prior month

GCC of America Cement is warranted to conform at the time of shipment with current ASTM C150/AASHTO M85/ASTM C1157. No other warranty is made or implied. Having no control over the use of its cements, GCC of America does not guarantee finished work.

ASTM C618-19 - Chemical and Physical Analyses - Fly Ash/Pozzolans

CTL Ticket: 21059	Plant of Origin: CR Minerals (Comanche) RFA	Sample Date Range: 04/08/2021
CTL Project: CT16959	Sample ID: Tephra RFA - April #1	to:
Report Date: 05/20/2021	Supplier: CR Minerals, Pueblo	Date Received: 04/09/2021

Chemical Composition (%)

(by Wyoming Analytical Laboratories, Inc.)

ASTM C618-19
Class N
Class F
Class C

Silicon Dioxide:	57.1			
Aluminum Oxide:	14.1			
Iron Oxide:	2.0			
Total Silica, Aluminum, Iron:	73.2	≥70.0%	≥50.0%	≥50.0%
Sulfur Trioxide:	4.3	≤4.0%	≤5.0%	≤5.0%
Calcium Oxide:	9.8	N/A	≤18.0%	>18.0%

Product Class: Class F

Conforms to Class: Yes

Volatile Composition (Mass%)

Moisture Content:	1.2	≤3.0%	≤3.0%	≤3.0%
Loss on Ignition:	4.1	≤10.0%	≤6.0%	≤6.0%

Physical Test Results

Fineness, Retained on #325 Sieve (%):	7.3	≤34%	≤34%	≤34%
Strength Activity Index (%) *		* No 7-day limit if 28-day meets		
Percent of Control @ 7 Days:	87	≥75%	≥75%	≥75%
Percent of Control @ 28 Days:	99	≥75%	≥75%	≥75%
Water Requirement, % of Control:	100	≤115%	≤105%	≤105%
Soundness, Autoclave Expansion (%):	-0.03	≤0.8%	≤0.8%	≤0.8%
Density (g/cm ³):	2.41	N/A	N/A	N/A

Uniformity Established from 10 previous tests

Average Fineness:	6.3	Difference 1(%)	±5(%)	±5(%)	±5(%)
Average Density:	2.41	Difference 0%	±5%	±5%	±5%

Supplementary Requirements

Available Alkalis, as Na ₂ O	1.13%		
Sodium Oxide:	0.71%	Drying Shrinkage %: 0.02	Max 0.03%
Potassium Oxide:	0.64%		

Comments: AA tested by CTL in Skokie - Meets ASTM and AASHTO

CTL | Thompson Materials Engineers, Inc.

Orville R. Werner, P.E.

05/20/2021



West Division
Southern Area Aggregate District
1910 Rand Avenue
Colorado Springs, CO 80905

Attention: Mr. David Chelgren

Re: Aggregate Physical Property Test Results
#57/67 Rock
Parkdale Quarry
Cañon City, CO

October 27, 2020

Mr. Chelgren:

Enclosed are the results of the physical properties tests performed on the #57/67 Rock sampled from the Parkdale Quarry in September 2020. Testing was performed in accordance with the procedures and specifications contained herein. Below is a summary of the results. Detailed test information is contained in the attachments.

Procedure	Description	#57/67 Rock
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregate	Att. #1-1
ASTM C 117	Materials Finer than 75µm (No. 200) Sieve by Washing	Att. #1-1
ASTM C 29	Bulk Density (Unit Weight) and Voids by Rodding	103 / 38
ASTM C 127	Specific Gravity (SSD) and Absorption of Coarse Aggregate	2.67 / 0.6
ASTM C 131	Degradation of Coarse Aggregate in the LA Abrasion Machine	33
CDOT CP-1.4211	Degradation of Coarse Aggregate in the Micro Deval Apparatus	10.5
ASTM C 88	Soundness by Use of Magnesium Sulfate	1
ASTM C 142	Clay Lumps and Friable Particles	0.1
ASTM C 123	Lightweight Particles	0.0

The materials selected for testing do not constitute the constituents of any specific mix design or blend. The materials named above represent products sold from the aforementioned site. Please contact us if you have any questions regarding these results.

Respectfully submitted,
Martin Marietta Materials, Inc.
Central Laboratory

Erik Biggers
Testing Lab Manager



Todd Genovese, P.E.
Division QA/QC Manager



Sieve Analysis of Fine and Coarse Aggregate

ASTM C 136 & C 117

Sieve Size		Percent Passing (%)	Specification ASTM (No. 57/67)
1"	25.0 mm	100	100
3/4"	19.0 mm	92	90 to 100
1/2"	12.5 mm	45	25 to 60
3/8"	9.5 mm	25	20 to 55
No. 4	4.75 mm	4	0 to 10
No. 8	2.36 mm	1	0 to 5
No. 16	1.18 mm	1	
No. 30	600 µm	1	
No. 50	300 µm	1	
No. 100	150 µm	1	
No. 200	75 µm	0.7	1.5 max.*

* Denotes limit for material that is essentially free of clay or shale.

Bulk Density (Unit Weight) and Voids by Rodding

ASTM C 29

Sample Weight (lbs)	Measure Volume (ft³)	Unit Weight (lbs/ft³)	Unit Weight (tons/cy)	Voids by Rodding (%)
34.55	0.3340	103.4	1.40	37.5
34.44	0.3340	103.1	1.39	37.7
34.62	0.3340	103.7	1.40	37.4
Average		103	1.40	38

Bulk Specific Gravity (DRY) = 2.653

Specific Gravity and Absorption of Coarse Aggregate

ASTM C 127

Oven Dried Mass in Air (grams)	SSD Mass in Air (grams)	Mass in Water (grams)	$G_{sb}(SSD)$	Absorption (%)
3299.1	3317.8	2074.4	2.67	0.6

Degradation of Coarse Aggregate in the LA Abrasion Machine

ASTM C 131

Grading	Sample Mass Before Test (grams)	Sample Mass After Test (grams)	Percent Loss (%)	Specification ASTM C 33
B	5003.3	3334.0	33	50% max.

Degradation of Coarse Aggregate in the Micro Deval Apparatus

CDOT CP-L 4211

Grading	Sample Mass Before Test (grams)	Sample Mass After Test (grams)	Percent Loss (%)	Specification CDOT
A (7.2)	1502.0	1344.2	10.5	18% max.

Soundness by Use of Magnesium Sulfate

ASTM C 88

Sieve Size	Original Sample Individual % Retained		Mass of Individual Test Fraction (grams)	Mass of Combined Test Fraction (grams)		Percent Passing Designated Sieve After Test	Weighted Percent Loss (%)
				Before	After		
1-1/2" to 1"	0	8	-	501.3	500.0	0.3	0.0
1" to 3/4"	8		501.3				
3/4" to 1/2"	47	67	671.3	1001.3	986.8	1.4	1.0
1/2" to 3/8"	20		330				
3/8" to No. 4	21	21	300.2	300.2	295.4	1.6	0.3
Minus No. 4	4	4	-	-	-		
Total	100	100%	coarse aggregate fraction				1
Specification - ASTM C 33							18% max.

Sieve Size	Splitting		Crumbling		Cracking		Flaking		Total No. of Pieces Before Test
	No.	%	No.	%	No.	%	No.	%	
1-1/2" to 3/4"	0	0	0	0	0	0	0	0	36

Clay Lumps and Friable Particles

ASTM C 142

Sieve Size	Original Sample Individual % Retained		Mass of Combined Test Fraction (grams)		Percent Passing Designated Sieve After Test	Weighted Percent Loss (%)
			Before	After		
1-1/2" to 1"	0	8	3003.4	2998.7	0.2	0.0
1" to 3/4"	8					
3/4" to 1/2"	47	67	2000.9	1997.5	0.2	0.1
1/2" to 3/8"	20					
3/8" to No. 4	21	21	1000.3	998.2	0.2	0.0
Total	96%					0.1
Specification - ASTM C 33 (Class 5S)						2.0% max.

Lightweight Particles

ASTM C 123

Sieve Size	Specific Gravity of Heavy Liquid	Mass of Test Sample (grams)	Mass of Floating Particles (grams)	Percent of Lightweight Pieces (%)	Specification ASTM C 33
Plus No. 4	2.0	3001.2	0.0	0.0	0.5% max.



West Division
Southern Area Aggregate District
1910 Rand Avenue
Colorado Springs, CO 80905

Attention: Mr. David Chelgren

Re: Potential Alkali Reactivity Test Results
#57/67 Rock
Parkdale Quarry
Cañon City, CO

October 27, 2020

Mr. Chelgren:

Enclosed are the results of potential alkali reactivity tests performed on the #57/67 Rock sampled from the Parkdale Quarry in September 2020. Testing was performed in accordance with the procedures and specifications contained herein. Below is a summary of the results. Detailed test information is contained in the attachments.

		14-Day Expansion Results (%)
Procedure	Description	#57/67 Rock
ASTM C 1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)	0.02

Below is a summary description of the ASTM interpretation of results for this test procedure.

14-Day Expansion (%) (16 Days After Casting)	ASTM Interpretation	Typical Actions
Less than 0.10%	Indicative of innocuous behavior in most cases.	Generally acceptable for use.
Between 0.10 and 0.20%	Includes both aggregates that are known to be innocuous and deleterious in field performance.	Develop supplemental information to conclude a potentially deleterious reaction.
More than 0.20%	Indicative of potentially deleterious expansion.	Evaluate the use of mitigative measures.

The materials selected for testing do not constitute the constituents of any specific mix design or blend. The materials named above represent products sold from the aforementioned site. Please contact us if you have any questions regarding these results.

Respectfully submitted,
Martin Marietta Materials, Inc.
Central Laboratory

Erik Biggers
Testing Lab Manager



Todd Genovese, P.E.
Division QA/QC Manager



Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

ASTM C 1260

Cement: GCC Type I/II LA

Cast Date: 9/26/2020

Cement Alkali Content (%):

Cement Expansion (Autoclave):

Water / Cement Ratio:

% K₂O:

0.030

0.47

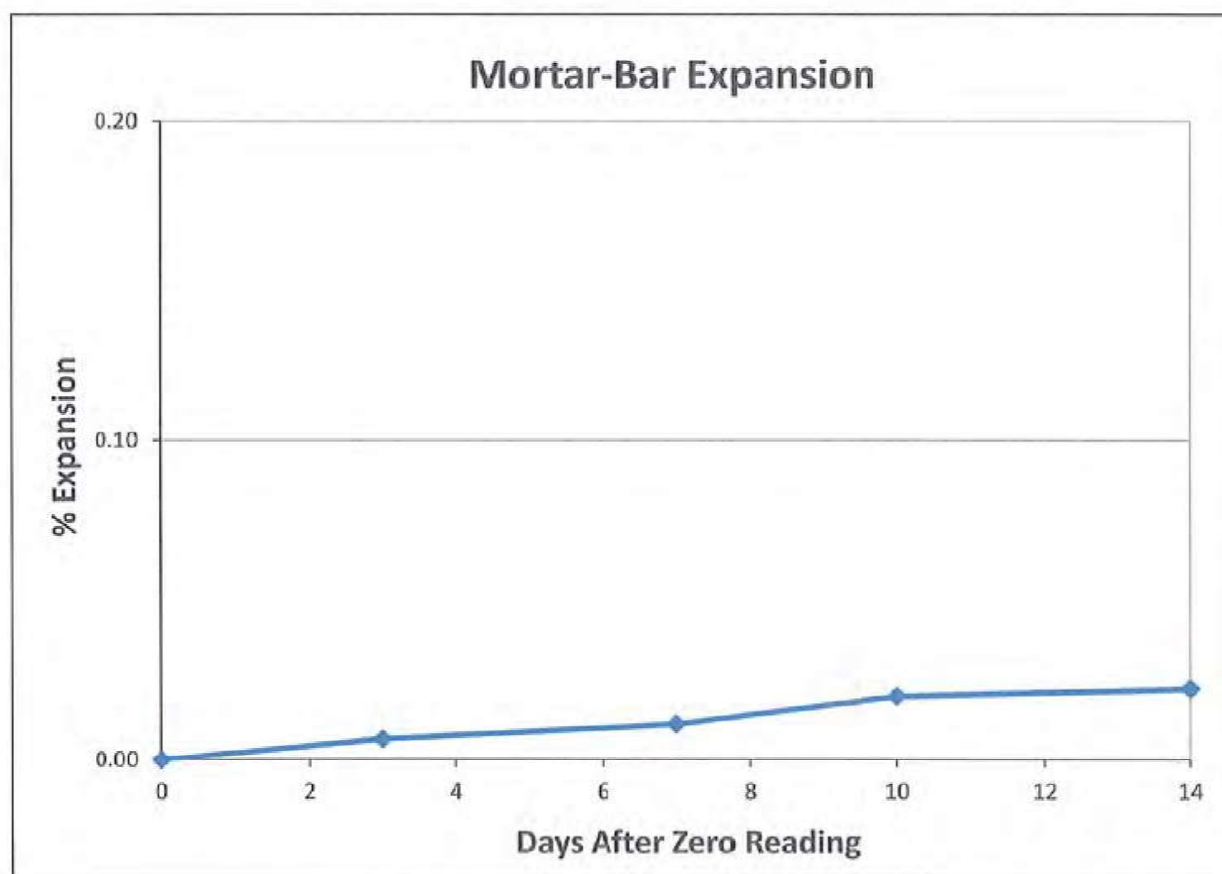
% Na₂O:

Aggregate / Cement Ratio:

% Na₂O_{eq}: 0.57

990g / 440g

Sample ID	Initial (24 hr)	Zero (48 hr)	3 Day Reading	% Change	7 Day Reading	% Change	10 Day Reading	% Change	14 Day Reading	% Change
Date	9/27/2020	9/28/2020	10/1/2020		10/5/2020		10/8/2020		10/12/2020	
A	0.2062	0.2127	0.2132	0.005	0.2137	0.010	0.2145	0.018	0.2149	0.022
B	0.1948	0.2014	0.2020	0.006	0.2025	0.011	0.2035	0.021	0.2036	0.022
C	0.1960	0.2024	0.2033	0.009	0.2037	0.013	0.2045	0.021	0.2047	0.023
Average				0.007		0.011		0.020		0.022





West Division
Southern Area Aggregate District
1910 Rand Avenue
Colorado Springs, CO 80905

Attention: Mr. David Chelgren

Re: Aggregate Physical Property Test Results
Washed Concrete Sand
Penrose Pit
Florence, CO

October 26, 2020

Mr. Chelgren:

Enclosed are the results of the physical properties tests performed on the materials sampled from the Penrose Pit in September 2020. Testing was performed in accordance with the procedures and specifications contained herein. Below is a summary of the results. Detailed test information is contained in the attachments.

Procedure	Description	Washed Concrete Sand
ASTM C 136	Sieve Analysis of Fine and Coarse Aggregate	Att. #1-1
ASTM C 117	Materials Finer than 75µm (No. 200) Sieve by Washing	Att. #1-1
ASTM C 29	Bulk Density (Unit Weight) and Voids by Rodding	103 / 37
ASTM C 128	Specific Gravity (SSD) and Absorption of Fine Aggregate	2.62 / 1.2
ASTM D 7428	Degradation of Fine Aggregate in the Micro Deval Apparatus	9.6
ASTM C 88	Soundness by Use of Magnesium Sulfate	8
ASTM C 142	Clay Lumps and Friable Particles	0.3
ASTM C 123	Lightweight Particles	0.0
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate	80
ASTM C 40	Organic Impurities in Fine Aggregate	Plate 1

The materials selected for testing do not constitute the constituents of any specific mix design or blend. The materials named above represent products sold from the aforementioned site. Please contact us if you have any questions regarding these results.

Respectfully submitted,
Martin Marietta Materials, Inc.
Central Laboratory

Erik Biggers
Testing Lab Manager



Todd Genovese, P.E.
Division QA/QC Manager



Penrose Pit

Washed Concrete Sand

Sieve Analysis of Fine and Coarse Aggregate

ASTM C 136 & C 117

Sieve Size		Percent Passing (%)	Specification ASTM C 33
3/8"	9.5 mm	100	100
No. 4	4.75 mm	99	95 to 100
No. 8	2.36 mm	86	80 to 100
No. 16	1.18 mm	65	50 to 85
No. 30	600 μ m	45	25 to 60
No. 50	300 μ m	19	5 to 30
No. 100	150 μ m	5	0 to 10
No. 200	75 μ m	1.5	0 to 3.0
Fineness Modulus		2.81	2.3 to 3.1

Bulk Density (Unit Weight) and Voids by Rodding

ASTM C 29

Sample Weight (lbs)	Measure Volume (ft ³)	Unit Weight (lbs/ft ³)	Unit Weight (tons/cy)	Voids by Rodding (%)
10.26	0.1000	102.6	1.39	36.5
10.26	0.1000	102.6	1.39	36.5
10.25	0.1000	102.5	1.38	36.6
Average		103	1.38	37

Bulk Specific Gravity (DRY) = 2.591

Specific Gravity and Absorption of Fine Aggregate

ASTM C 128

Oven Dried Mass in Air (grams)	Mass of Pycnometer Filled with Water (grams)	SSD Mass in Air (grams)	Mass of Pycnometer w/ Sample and Water (grams)	G_{sb} (SSD)	Absorption (%)
494.1	1242.2	500.0	1551.5	2.62	1.2

Degradation of Fine Aggregate in the Micro Deval Apparatus

ASTM D 7428

Grading	Sample Mass Before Test (grams)	Sample Mass After Test (grams)	Percent Loss (%)	Specification CDOT
Fine Agg	500.0	452.1	9.6	18% max.

Penrose Pit

Washed Concrete Sand

Soundness by Use of Magnesium Sulfate

ASTM C 88

Sieve Size	Original Sample Individual % Retained		Mass of Individual Test Fraction (grams)	Mass of Combined Test Fraction (grams)		Percent Passing Designated Sieve After Test	Weighted Percent Loss (%)
				Before	After		
3/8" to No. 4	1	1	-	-	-	0.0	0.0
No. 4 to No. 8	13	13	100.0	100.0	87.2	12.8	1.7
No. 8 to No. 16	21	21	100.0	100.0	89.5	10.5	2.2
No. 16 to No. 30	20	20	100.0	100.0	89.2	10.8	2.2
No. 30 to No. 50	26	26	100.0	100.0	91.9	8.1	2.1
Minus No. 50	19	19	-	-	-	-	0.0
Total	100	100%	of fine aggregate fraction				8
Specification - ASTM C 33							15% max.

Clay Lumps and Friable Particles

ASTM C 142

Sieve Size	Original Sample Individual % Retained		Mass of Combined Test Fraction (grams)		Percent Passing Designated Sieve After Test	Weighted Percent Loss (%)
			Before	After		
No. 4 to No. 16	34	34	100.0	99.8	0.2	0.1
Total	34%					0.3
Specification - ASTM C 33 (Class 5S)						2.0% max.

Lightweight Particles

ASTM C 123

Sieve Size	Specific Gravity of Heavy Liquid	Mass of Test Sample (grams)	Mass of Floating Particles (grams)	Percent of Lightweight Pieces (%)	Specification ASTM C 33
Plus No. 4	2.0	200	0.0	0.0	0.5% max.

Sand Equivalent Value of Soils and Fine Aggregate

ASTM D 2419

	Specimen 1	Specimen 2	Specimen 3
Sand Reading	3.5	3.5	3.4
Clay Reading	4.4	4.3	4.4
Sand Equivalent	80	82	78

Average SE Value	80
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Organic Impurities in Fine Aggregate

ASTM C 40

Organic Plate Number
Plate Number 1



West Division
Southern Area Aggregate District
1910 Rand Avenue
Colorado Springs, CO 80905

Attention: Mr. David Chelgren

Re: Potential Alkali Reactivity Test Results
Washed Concrete Sand
Penrose Pit
Florence, CO

October 26, 2020

Mr. Chelgren:

Enclosed are the results of potential alkali reactivity tests performed on the Washed Concrete Sand sampled from the Penrose Pit in September 2020. Testing was performed in accordance with the procedures and specifications contained herein. Below is a summary of the results. Detailed test information is contained in the attachments.

		14-Day Expansion Results (%)
Procedure	Description	Washed Concrete Sand
ASTM C 1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)	0.08

Below is a summary description of the ASTM interpretation of results for this test procedure.

14-Day Expansion (%) (16 Days After Casting)	ASTM Interpretation	Typical Actions
Less than 0.10%	Indicative of innocuous behavior in most cases.	Generally acceptable for use.
Between 0.10 and 0.20%	Includes both aggregates that are known to be innocuous and deleterious in field performance.	Develop supplemental information to conclude a potentially deleterious reaction.
More than 0.20%	Indicative of potentially deleterious expansion.	Evaluate the use of mitigative measures.

The materials selected for testing do not constitute the constituents of any specific mix design or blend. The materials named above represent products sold from the aforementioned site. Please contact us if you have any questions regarding these results.

Respectfully submitted,
Martin Marietta Materials, Inc.
Central Laboratory

Erik Biggers
Testing Lab Manager



Todd Genovese, P.E.
Division QA/QC Manager



Penrose Pit

Washed Concrete Sand

Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)

ASTM C 1260

Cement: GCC Type I/II LA

Cast Date: 9/19/2020

Cement Alkali Content (%):

Cement Expansion (Autoclave):

Water / Cement Ratio:

% K₂O:

0.030

0.47

% Na₂O:

Aggregate / Cement Ratio:

% Na₂O_{eq}: 0.57

990g / 440g

Sample ID	Initial (24 hr)	Zero (48 hr)	3 Day Reading	% Change	7 Day Reading	% Change	10 Day Reading	% Change	14 Day Reading	% Change
Date	9/20/2020	9/21/2020	9/24/2020		9/28/2020		10/1/2020		10/5/2020	
A	0.2062	0.2119	0.2130	0.011	0.2150	0.031	0.2169	0.050	0.2198	0.079
B	0.1869	0.1930	0.1944	0.014	0.1960	0.030	0.1985	0.055	0.2013	0.083
C	0.1962	0.2022	0.2038	0.016	0.2053	0.031	0.2075	0.053	0.2101	0.079
Average				0.014		0.031		0.053		0.080



CHRYSO® Quad 842



Uniformity Enhancer - Rheology Modifier – Water Reducer

■ Overview

CHRYSO® Quad 842 is a breakthrough in chemical admixtures, utilizing the latest molecular synthesis technology from the CHRYSO® Synthesis Lab, combining patented CHRYSO® technologies into one, user focused solution.

CHRYSO® Quad 842 is engineered to address the challenges of today's more variable concrete materials, enabling consistent desired concrete properties while providing maximum performance across a broad range of dosage rates and workability demands.

CHRYSO® Quad 842 greatly enhances paste quality and lubricity when using coarsely graded sand thanks to the CHRYSO® Quad component of the formulation,

Engineered for water reduction, slump retention and ultimate strength, CHRYSO® Quad 842 utilizes patented CHRYSO® synthesized molecules to provide a true full range water reducer for maximum versatility, performance and economy.

■ Features & Benefits

- Excellent slump retention reducing risk of jobsite water addition
- World class air control, reducing QC time, expense, lost loads
- Enables the use of high proportions of manufactured sand
- Proprietary finishing aid provides superior workability and finishability, improved lubricity (pumpability, consolidation, finishability)
- Faster placements, improved jobsite and equipment efficiency
- More robust when using sand containing a high amount of fines
- Early strength = project acceleration
- Reduced potential for shrinkage cracks
- Higher early and ultimate strengths
- Wide range of water reduction at same set time, offering maximum versatility with one product, one tank, fewer variables

CHRYSO® Quad 842 is recommended for use in Ready Mixed Concrete where improved efficiency (more psi/pound) of cement and SCM is desired for quality, economy and environmental responsibility.

CHRYSO® Quad 842 is recommended for all Ready Mixed Concrete to improve rheology and paste quality & lubricity, especially where more harsh aggregates are used.

CHRYSO® Quad 842 is recommended for all Ready Mixed Concrete where superior robustness is desired, offering less sensitivity to variations of aggregate gradations, clay content, aggregate moisture, cement variability, etc.

CHRYSO® Quad 842 is recommended for use in Ready Mixed Concrete mixes to improve uniformity and control of air content, set time and slump retention.



CHRYSO

CHRYSO® Quad 842

■ Description:

Characteristics:

Physical state: Liquid

Color: Brown

Density: Approx. 1.05

pH: Approx. 4.0

Cl⁻ ion content: Nil

CHRYSO® Quad 842 does not contain any purposely added calcium chloride or other chloride based components. It will not promote or contribute to corrosion of reinforcing steel in concrete.

Packaging:

- 55 gallon (210 L) drums
- 264 gallon (1000 L) totes
- bulk deliveries

Standard specifications:

Conforms to ASTM C 494 Type A & F

AASHTO M 194 Type A & F

■ Directions for use:

Dosage

CHRYSO® Quad 842 is recommended for use at a dosage rate of 2 to 10 fluid ounces per 100 pounds (130 to 652 ml per 100 kg) of cement for a Type A and 6 to 20 fluid ounces per 100 pounds (391 to 1304 ml per 100 kg) of cement for a Type F.

CHRYSO® Quad 842 can be added at the concrete plant with either the initial or tail water and allowed to mix 3 - 5 minutes. If **CHRYSO® Quad 842** is added at the job site the concrete should be mixed a minimum of 3 minutes before discharge.

Because local job conditions vary, please contact your local Chryso sales representative for further assistance if using outside recommended dosage ranges.

CHRYSO Inc. Tel: (800) 936-7553 – Fax: 972-772-6010

Southern Division	P.O. Box 190	Rockwall, TX	75032
Midwest Division	P.O. Box 129	Charlestown, IN	47111
Western Division	5090 Nome St	Denver, CO	80239
Southeast Division	4590 Draine Field Rd	Lakeland, FL	33811

Compatibility

CHRYSO® Quad 842 is compatible with all types of Portland cement, class C and F fly ash, slag, microsilica, calcium chloride, fibers and approved air entraining admixtures.

CHRYSO® Quad 842 is compatible with most admixtures and can be used with other **CHRYSO®** admixtures, unless stated otherwise. For best results, each admixture must be dispensed separately into the concrete mix.

CHRYSO® Quad 842 can be used in all white, colored, and architectural concrete. For best results, each admixture must be dispensed separately into the concrete mix.

Precaution:

CHRYSO® Quad 842 may freeze at temperatures below 32°F (0°C). Freezing will damage **CHRYSO® Quad 842** and precautions should be taken to protect it from freezing.

If **CHRYSO® Quad 842** should happen to freeze the product can be reconstituted with mechanical agitation. Do not store the product at temperatures above 100°F (38°C) or under 33°F (1°C) for long periods.

Do Not Use Pressurized Air For Agitation

Shelf life: 9 months.

■ Safety:

CHRYSO® Quad 842 is not considered dangerous to handle. Please refer to the material safety data sheet for additional information.

About CHRYSO:

CHRYSO® is a worldwide leader for Concrete and Cement additives, **CHRYSO®** has been servicing the construction Industry for over half a century with outstanding innovation and service. As a result, **CHRYSO®**'s name and products have been associated with the most prestigious and demanding construction projects worldwide.

CHRYSO

www.chrysoinc.com

The information contained in this document is given to the best of our knowledge and is the result of extensive and controlled testing. However, it cannot under any circumstances be considered as a warranty involving our liability in the case of misuse. Tests should be conducted before the product is used to ensure that the methods and conditions of use of the product are satisfactory. Our specialists remain at the disposal of customers if they require help with the application of the product for their specific needs.

CHRYSO® Fluid Optima 258



HRWR - extended slump retention and high early strengths capabilities

■ Features

CHRYSO®Fluid Optima 258 is a new generation high range water reducing admixture based on patented **CHRYSO®** technology.

CHRYSO®Fluid Optima 258 is formulated specifically to retain workability in extreme conditions while allowing for very high early strengths.

CHRYSO®Fluid Optima 258 is formulated specifically to enhance rheology and strengths characteristics of High and Ultra-High Performance Concrete (HPC & UHPC).

CHRYSO®Fluid Optima 258 exclusive formulation allows for extreme easiness of use and robustness.

CHRYSO®Fluid Optima 258 is manufactured under rigid quality control standards to provide uniform, reliable results.

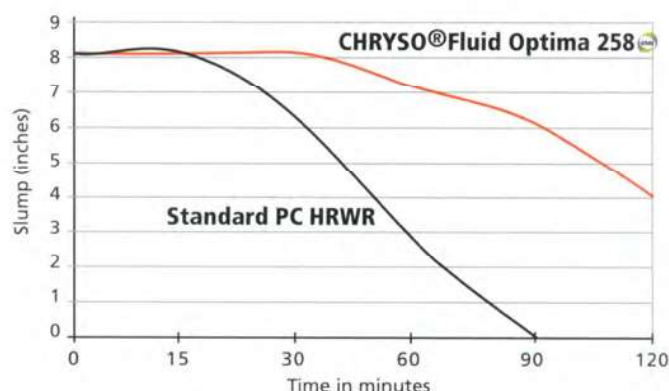
■ Benefits

- Provides enhanced workability retention
- Allows for high early strengths performances
- Provides increased slump and flowability without increased water content
- Improves finish, placement and pumpability of concrete
- Improves concrete quality by reducing the water-cement ratio for a given degree of workability
- Proprietary molecule reduces concrete viscosity (stickiness) allowing for easier placement, better finish and enhanced pumpability
- Reduces cracking and shrinkage
- Improves concrete chemical resistance and durability
- Improves cementitious material performance (more psi/lb)

■ Areas of Application

CHRYSO®Fluid Optima 258 is recommended for all concrete mixes where significant water reduction, improved cementitious material performance (more psi/lb), improved finishing and enhanced slump retention characteristics are desirable.

CHRYSO®Fluid Optima 258 is especially recommended for use in ready mixed concrete applications where very good slump or flow (SCC) retention characteristics along with very high early strengths are required.



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CHRYSO® NutraSet® TC

Hydration stabilizer

■ Features

CHRYSO®NutraSet®TC is a ready-to-use liquid solution manufactured to control the hydration process in Portland cement concrete and concrete wash water.

CHRYSO®NutraSet®TC coats the hydrating cement particles in the concrete and wash water, resulting in the suspension of the hydration chemical reaction.

CHRYSO®NutraSet®TC is manufactured under rigid quality control measures to provide uniform reliable results.

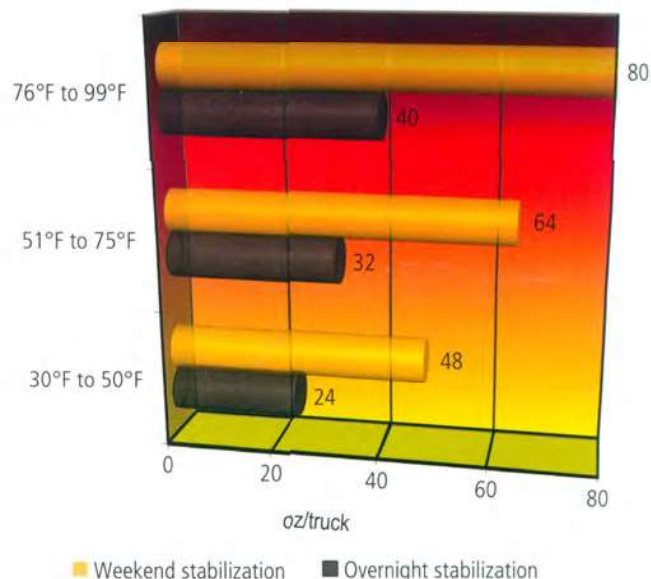
■ Benefits

- Improves ultimate compressive strength performance over conventional concrete
- Controls concrete temperature rise during times of elevated ambient temperatures and long transit times
- Little effect on initial slump when used in conjunction with a water reducer allowing the producer to extend the hydration control with little impact on initial slump
- Reduces disposal costs associated with returned concrete
- Allows reuse of concrete wash water overnight or over a weekend in many situations
- Reduces concrete wash water disposal
- Reduces amount of concrete wash water needed and truck mixer washout
- Reduces expensive disposal costs associated with concrete wash water

■ Areas of Application

CHRYSO®NutraSet®TC is recommended for all concrete mixes where lower hydration temperature, increased ultimate strengths or retarded setting time characteristics are recommended.

Ambient temperature vs. typical dosage rate in oz / truck
for treatment of concrete wash water



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CHRYSO® NeutralSet® TC

■ Description:

Characteristics:

- Physical state: liquid
- Color: Blue
- Density: $1.13 \pm 0.02\text{g/cc}$
- pH: 4.0 ± 2.0
- Cl^- ion content Nil
- Na_2O equiv.: $<1.0\%$

CHRYSO® NeutralSet® TC does not contain any purposely added calcium chloride or other chloride based components.

Packaging:

- 55 gallon (210 L) drums
- 264 gallon (1000 L) totes
- bulk deliveries

Standard Specifications:

Conforms to ASTM C 494 Type B
AASHTO M 194 Type B
CRD C 87 Type B

■ Directions for use:

Dosage:

There is no standard dosage rate for **CHRYSO® NeutralSet® TC** as it will depend on ambient temperature, desired stabilization period or concrete mix design.

For treatment of concrete wash water **CHRYSO® NeutralSet® TC** is typically used at a dosage rate of 24 to 80 fluid ounces (710 to 2366 ml) per truck.

For concrete setting time retardation **CHRYSO® NeutralSet® TC** is typically used at a dosage rate of 1 to 12 fluid ounces per 100 lbs. (65 to 783 ml per 100kg) of Portland cement.

Because local job conditions vary, please contact your local **CHRYSO®** sales representative for recommended dosages when using **CHRYSO® NeutralSet® TC** to stabilize returned concrete or to retard concrete.

CHRYSO Inc. Tel: 800-936-7553 - 972-772-6010

Southern Division:	P.O. Box 190	Rockwall, TX	75087
Midwest Division:	P.O. Box 129	Charlestown, IN	47111
Western Division:	5090 Nome St	Denver, CO	80239
Eastern Division:	200 C Leonard Rd	Lexington, NC	27295

■ Compatibility:

CHRYSO® NeutralSet® TC is compatible with all types of Portland cement, class C and F fly ash, slag, microsilica, calcium chloride, fibers and approved air entraining admixtures.

CHRYSO® NeutralSet® TC can be used in all white, colored, and architectural concrete. For best results, each admixture must be dispensed separately into the concrete mix.

■ Precaution:

CHRYSO® NeutralSet® TC may freeze at temperatures below 35°F (2°C). Although freezing will does not harm **CHRYSO® NeutralSet® TC**, precautions should be taken to protect it from freezing. If **CHRYSO® NeutralSet® TC** should happen to freeze, thaw and reconstitute with mechanical agitation.

■ Safety:

CHRYSO® NeutralSet® TC is not considered dangerous to handle. Please refer to the material safety data sheet for additional information.

About CHRYSO:

CHRYSO is a subsidiary of the multi-billion dollar specialty construction chemicals Group, Materis.

Worldwide leader for Concrete and Cement additives, **CHRYSO** has been servicing the construction Industry for over half a century with outstanding innovation and service.

As a result, **CHRYSO's** name and products have been associated with the most prestigious and demanding construction projects worldwide.

Respectful of the environment, **CHRYSO** continually develops and produces innovative and effective solutions for the cement and concrete industries.

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CHRYSO® Fluid Optima 258



■ Description:

Characteristics:

- Physical state: liquid
- Color: green
- Density: $1.090 \pm 0.020 \text{ g/cc}$
- pH: 5.5 ± 2.0
- Cl^- ion content Nil

CHRYSO®Fluid Optima 258 does not contain any purposely added calcium chloride or other chloride based components. It will not promote or contribute to corrosion of reinforcing steel in concrete.

Packaging:

- 55 gallon (210 L) drums
- 264 gallon (1000 L) totes
- bulk deliveries

Standard specifications:

CHRYSO®Fluid Optima 258 meets the requirements of ASTM C494, Types A & F for a high range water reducing admixture.

■ Directions for use:

Dosage:

CHRYSO®Fluid Optima 258 is recommended for use at a dosage rate of 2 to 7 fluid ounces per 100 pounds (130 to 456 ml per 100 kg) of cement for a Type A and 7 to 16 fluid ounces per 100 pounds (456 to 1045 ml per 100 kg) of cement for a Type F.

CHRYSO®Fluid Optima 258 can be added at the concrete plant with the initial or tail water or on the job site. In case of addition in a mixing truck, it is recommended that the concrete be mixed at high speed for 70 to 100 revolutions (approximately 5-6 minutes).

Because local job conditions vary, please contact your local **CHRYSO®** sales representative for further assistance if using outside recommended dosage ranges.

CHRYSO Inc. Tel: 800-936-7553 - 972-772-6010

Southern Division:	P.O. Box 190	Rockwall, TX	75087
Midwest Division:	P.O. Box 129	Charlestown, IN	47111
Western Division:	5090 Nome St	Denver, CO	80239
Eastern Division:	200 C Leonard Rd	Lexington, NC	27295

Compatibility:

CHRYSO®Fluid Optima 258 is compatible with all types of Portland cement, class C and F fly ash, slag, microsilica, calcium chloride, fibers and approved air entraining admixtures.

CHRYSO®Fluid Optima 258 can be used in all white, colored, and architectural concrete. For best results, each admixture must be dispensed separately into the concrete mix.

Precaution:

CHRYSO®Fluid Optima 258 may freeze at temperatures below 35°F (2°C). Although freezing does not harm **CHRYSO®Fluid Optima 258**, precautions should be taken to protect it from freezing.

If **CHRYSO®Fluid Optima 258** should happen to freeze, thaw and reconstitute with mechanical agitation.

Do not store the product at temperatures above 100°F (38°C) or under 40°F (5°C) for long periods.

Shelf life: 9 months.

■ Safety:

CHRYSO®Fluid Optima 258 is not considered dangerous to handle. Please refer to the material safety data sheet for additional information.

About CHRYSO:

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