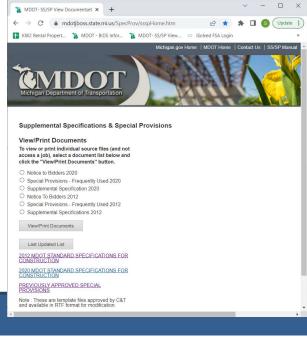


MDOT Concrete Mix Design: Proportioning, Approvals, etc.

Steve Waalkes, P.E., Director of Engineering – W. Mich. Michigan Concrete Association

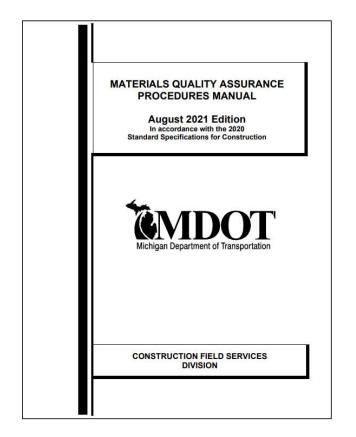
Where are MDOT specs located?

- Standard Specifications for Construction and Frequently Used Special Provisions (2020)
 - <u>https://mdotjboss.state.mi.us/SpecProv/ssspHome.htm</u>
- Previously approved special provisions
- Various other project-specific special provisions





Approved Materials



- Materials Quality Assurance Procedures Manual
 - A contract document
 - Current revision in place at the time of contractor's bid is binding for the project
 - Quarterly updates
 - Available on MDOT website
 - Just Google "MDOT Materials Quality Assurance Procedures Manual"

Approved Materials – Cement, Slag Cement

- Approved manufacturers of portland cement ASTM C150 and/or ASTM C595 (MDOT 901)
- Prior to addition to approved list,
 - MDOT reviews historical mill reports for ASTM compliance
 - Verifies physical properties of lab samples
- Ongoing,
 - Biannual mill report submitted and reviewed
 - Random samples may be taken in the field for QA verification
- Type III cement is permitted only for precast / prestressed (not for ready-mix or paving)

Spec. # and Material Name	Approved Manufacturers	Approved Distribution Facilities (not manufacturer specific)
901 Cement	Argos USA, LLC - Martinsburg, WV	Ash Grove - Detroit, and Dundee, MI; Duluth, MN
	Ash Grove - Mississauga, Ontario, Canada; Joliette, Quebec, Canada	Buzzi Unicem USA - Elmira and Grandville MI; Elkhart, IN; Joliet, IL
	Buzzi Unicem USA - Chattanooga, TN; Festus MO; Greencastle, IN Central Plains Cement - Sugar Creek, MO	Holcim (US), Inc. – Detroit, Essexville, Muskegon, St. Joseph and Zilwaukee, MI; Chicago, Lemont and Summit, IL;
	Continental Cement Company - Hannibal, MO	Toledo, OH; Green Bay, WI
	Fairborn Cement Company - Fairborn, OH	St. Mary's Cement, Inc. (US) -
	Holcim (US), Inc Alpena, MI; Paulding, OH; and Bloomsdale, MO	Cleveland 1, Cleveland 2, Marysville ar Toledo, OH; Ferrysburg, MI;
	Illinois Cement Company - LaSalle, IL	206 / A 12:126 2048 VA
	Kosmos Cement Company - Louisville, KY	
	LeHigh Cement Company, LLC - Logansport and Mitchell, IN; Union Bridge, Maryland; Picton, Ontario, Canada	
	McInnis Cement - Port Daniel-Gascons, Quebec, Canada	
	St. Mary's Cement, Inc. (US) - Detroit and Charlevoix, MI; Bowmanville and St. Mary's, Ontario, Canada	
901.06	Ash Grove - Detroit, MI; Mississauga, Ontario,	Ash Grove - Dundee, MI
Slag Cement	Canada	Holcim (US), Inc. – Detroit, Essexville, Muskegon, St. Joseph and Zilwaukee,
	Holcim (US), Inc South Chicago, IL Skyway Cement Company, LLC - Chicago, IL	MI; Chicago, Lemont and Summit, IL; Toledo, OH; Green Bay, WI
	St. Mary's Cement, Inc. (US) - Detroit, MI; Milwaukee, WI	St. Mary's Cement, Inc. (US) – Cleveland 7 Cleveland 2 and Marysville, OH; Ferrysburg, MI



Approved Materials – SCM's

Required amount: 25%-40% total replacement of portland in high performance mixtures

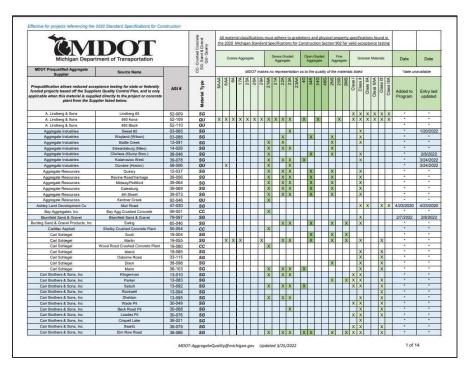
- Could be lower in certain situations (mass concrete placements)
- Approved Manufacturers of supplemental cementitious materials (MDOT 901)
- Prior to addition to list.
 - MDOT reviews historical mill reports for compliance
 - Fly ash C618, Class C and F
 - Slag cement C989, Grade 100, minimum
 - Verifies physical properties of lab samples
- Ongoing,
 - Monthly mill report submitted and reviewed fly ash only^L
 - Random samples may be taken in the field for QA verification



Spec. # and Material Name	Approved Manufacturers	Approved Distribution Facilities (not manufacturer specific)
901.07 Pozzolanic Admixtures (Fly Ash) for Concrete	 Ash Grove - Bell River, St. Clair, MI Boral Resources - Avon Power Plant, Avon Lake, OH; Erickson Power Plant, Lansing, MI; Sammis Power Station, Stratton, OH; Monroe Power Plant, Monroe, Michigan; Schahfer Station, Unit 15, Unit 17 & Unit 18, Wheatfield, IN; Labadie Power Station, Labadie, MO; Rush Island Power Station, Festus, MO; Coal Creek Steam Generating Plant, Underwood, ND Charah, Inc Zimmer Power Station, Moscow, OH; Miami Fort Unit 7 & 8, North Bend, OH Holcim (US), Inc Will Co. Plant, Romeoville, IL; Elm Road Generating Station, Oak Creek, IL; Columbia, Portage, WI; Edgewater Sta. Unit 5, Sheboygan, WI; Pleasant Prairie, Kenosha, WI; Weston #3, Wausau, WI; Separation Technologies, LLC - Clifty Creek Power Station, Madison, IN; Longview Power Plant, Maidsville, WV Waste Mgmt/FlyAsh Direct - Zimmer Power Plant, Moscow, OH; Miami Fort Unit 7 & 8, North Bend, OH; Avon Lake Unit 9, Cleveland, OH; Joppa Generating Station, Joppa, IL 	Ash Grove - Dundee, MI

Approved Materials – Aggregates

- Prequalified aggregate sources (Section 902)
 - Yearly inspection of labs
 - History of a well controlled process
 - History of specification compliance
 - Reduced MDOT QA acceptance of source
 - 1 test per 10,000 tons of material produced
- Non-Prequalified aggregate sources
 - No history of specification or process control
 - Normal MDOT QA acceptance of source
 - 1 test per 1000 tons of material produced

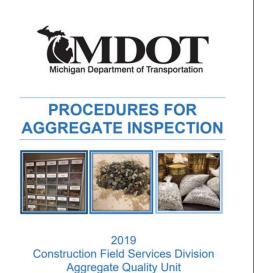




Approved Materials - Aggregates (cont.)

- Aggregate Quality
 - Coarse Agg. Freeze-Thaw
 - Maximum F-T dilation = 0.067 for most concrete applications
 - Maximum F-T dilation = 0.040 for all paving, high performance concrete
 - Specific gravity
 - F-T values are good for all products from that quarry/pit that are within -0.04 of the specific gravity of the product tested
- Aggregate Inspection Manual





ASR Testing (Fine Aggregate only)

- ASTM C 1260
 - Expansion < 0.10% at 14 days
- ASTM C 1293
 - Expansion < 0.040% at 1 year

- Data good for two years
- Need to start test 1 year before product is desired to be used
- Must be run on the class of aggregate to be used
- ASTM C 1567
 - Must use replacement of portland cement with slag cement or fly ash
 - Expansion < 0.10% at 14 days



Approved Materials – Admixtures

- Admixtures (MDOT 903) Qualified Products List (QPL) in Materials Source Guide
 - Accepted for use on MDOT projects based on the trade name, model number, etc., as listed.

903.01

- Manufacturer secures independent lab testing using three locally available cements
 - Air entraining ASTM C260
 - Water reducers, retarders, accelerators ASTM C494
 - Yearly affidavit from manufacturer
- Re-submit every 7 years
- Try to avoid "witches brew" or "chemical soup"
- Dosage rates listed are only manufacturer's <u>recommendations</u>

	Air Entraining - ASTM	C 260; C	CONCRETE chemical - ASTM C 494 g of Admixtures)	
Spec. # and /aterial Name	Manufacturer or Supplier and Trade Name	Туре	Producer and Description	Recommended Dosage min. or range fl oz/cwt
	EUCLID CHEMICAL CO.			
raining Admixtures	Eucon AEA 92	AE	Air-entraining	1.5
aning Admixtures	Accelguard G3	E	Water-reducer accelerator (non-chloride)	16 - 90
Chemical	Accelguard NCA	С	Accelerator (non-chloride)	15
ures	Eucon Air Mix 200	AE	Air-entraining	3
	EUCON Air MAC6	AE	Air-entraining	0.5 - 4
	EUCON MR	A	Water-reducer	4.5
		MR	Mid-range water-reducer	5.5
		F	High-range water-reducer	12
	EUCON MRX	MR	Mid-range water-reducer	3.5
		F	High-range water-reducer	7.5
	EUCON SE	A	Water-reducer	2.5
		D	Water-reducer retarder	4.5
	EUCON WR	A	Water-reducer	2.5 - 10
		D	Water-reducer retarder	2.5 - 10
	EUCON WR-91	A	Water-reducer	3
		MR	Mid-range water-reducer	5
		D	Water-reducer retarder	6
	EUCON A+	А	Water-reducer	3.5
		MR	Mid-range water-reducer	4.5

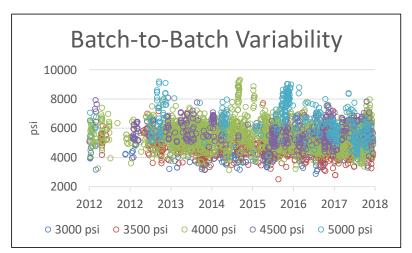
Where do Mixes Originate?

- Contractor provided mixes:
 - Based on ACI 211 procedure
 - The contractor is responsible for submitting the mix documentation to the MDOT project engineer
 - Developed by MCA Level 2 Concrete Technician
- Department (MDDT) provided mixes:
 - Structural patching, mortar, and grout
 - Project-specific mixes, per special provision
 - Bridge deck overlays
 - Latex modified
 - Silica fume



Developing the Mix

- Contractor provided mix designs and mixture proportions (Section 1003)
 - Supporting documentation
 - Methods of verification
 - Method 1 Trial batches: same materials used on project
 - Method 2 Same mix: recent experience with same ingredients
 - Method 3 Similar mix: similar aggregates (of same geologic type), with same cement/additives
 - Method 4 Annual verification: concrete plant verification, same materials



• All materials must meet MDOT specs



MDOT Grades of Concrete

Grade	3000	3500	3500НР	4000	4500	4500HP	P-NC
Old name	P2, S3	P1, S2, T	P1M, S2M	S1	D	DM	P-NC
Use	Shoulders, sidewalk	Pavement, bridge substructure, curb & gutter, driveways, Tremie *	HP conc pavt, HP bridge approaches, HP substructure	Foundations, piles	Bridge decks, railing	HP bridge decks, HP railing	Pavement patching (full-depth repairs)

* Tremie does not require aggregate optimization when pumped



MDOT Spec Book

- Section 1004, "Portland Cement Concrete Mixtures"
- For pavements:
 - 0 to 3 inch slump is typical
 - O to 6 inch slump if mix includes a mid-range water reducer
- Air content spec limits:
 - 5.5% to 8.5%

						1004-1: e Mixtures				
						Concre	ete Grade			
		3000	3500	3500HP(a).(b)	4000	4000HP(a).(b)	4500	4500HP(a).(b)	м	x
Compressive	7 day	2200	2600	2600	3000	3000	3200	3200	Commercial-	Unless otherwise
strength (psi)	28 day	3000	3500	3500	4000	4000	4500	4500	grade concrete	specified, Grade X
	70%	2100	2450	2450	2800	2800	3150	3150	containing 517 lb/cyd.	concrete contains 282 lb/cyd of
Flexural	7 day	500	550	550	600	600	625	625	Portland cement	cement.
strength (psi)	12		10.000	1.		27.0	1992.0	877.5	may be replaced	
9 4 1	28 day	600	650	650	700	700	750	750	with an SCM.	
	70%	420	455	455	490	490	525	525		
Slump (inch)		(c)-(f)	(c)-(k)	(C)-(N)	(I)-(II)	(1)-(11)	(d)-(f)	(a)-(f)		
Cementitious n content (lb/cyd)		489-517	517-611 ^(o)	470-564(0)	517-611	517-611	517-658	517-658		
Class of coarse	e aggregate					0	p)-(r)			
Maximum w/cn	n ratio					(0.45			
Air content ran	ge					5.5	-8.5%			
Section referen	nce	402, 403, 602, 803, 804, 806, 808, 810, 813, 814,	401, 602, 603, 705, 706, 712, 713, 718, 801, 802,	401, 602, 603, 706, 712, 713, 718, 801, 802, 803,	705, 922	705, 922	706, 711, 712	706, 711, 712	N/A	N/A
		810	803 810	810 810						
		819	803, 810, 819	810, 819						10-3
			819	810, 819		(l) 3- to 5-inch	slump without	ut admixtures o	or with Type A or D ad	Section 100
HP = high perforr (a) HP mixtures	mance require optin	tions for Con	819 struction meeting subs	ection 1004.03	.C.	(m) 3- to 6-inch	slump after	the addition of	Type MR admixture.	Section 100
HP = high perform (a) HP mixtures (b) HP mixtures	mance require optin require 25 to	tions for Con nized gradation 9 40% replacem	819 struction meeting subs	ection 1004.03	.C. In SCM.	(m) 3- to 6-inch (n) 3- to 7-inch	slump after slump after	the addition of the addition of	Type MR admixture. Type F or G admixtur	Section 100 Imixture. e.
HP = high perform (a) HP mixtures (b) HP mixtures (c) 0- to 3-inch s	mance require optin require 25 to slump for mix	tions for Con nized gradation 40% replacem tures for paver	819 struction meeting subs rent of portland nents.	ection 1004.03 d cement with a	.C. In SCM.	(m) 3- to 6-inch (n) 3- to 7-inch (o) For concret	slump after slump after te pavement	the addition of the addition of repair mixtures	Type MR admixture. Type F or G admixtur , use 658 lb/cyd of ce	Section 100 Imixture. e. ment when the weather
HP = high perform (a) HP mixtures (b) HP mixtures (c) 0- to 3-inch a (d) 0- to 3-inch a	mance require optin require 25 to slump for mix slump withou	tions for Con nized gradation 40% replacem t admixtures for paver t admixtures or	819 struction meeting subs sent of portlan- nents. with Type A or	ection 1004.03 d coment with a r D admixture.	.C. In SCM.	 (m) 3- to 6-inch (n) 3- to 7-inch (o) For concrete is forecast to or below. 	slump after slump after te pavement to be above	the addition of the addition of repair mixtures 50°F or 752 lb/o	Type MR admixture. Type F or G admixtur , use 658 lb/cyd of ce cyd when the weather	Section 100 Imixture. e. ment when the weath r is forecast to be 50°F
HP = high perform (a) HP mixtures (b) HP mixtures (c) 0- to 3-inch (d) 0- to 3-inch (e) 0- to 6-inch	mance require optin require 25 to slump for mix slump withou slump after th	tions for Con nized gradation 40% replacem tures for paver ta dmixtures or ta addition of T	819 struction meeting subs rent of portland nents. with Type A or ype MR admix	ection 1004.03 d cement with a r D admixture. ture.	.C. In SCM.	 (m) 3- to 6-inch (n) 3- to 7-inch (o) For concrete is forecast or below. (p) Use aggreg 	slump after slump after te pavement to be above	the addition of the addition of repair mixtures 50°F or 752 lb/o om geologically	Type MR admixture. Type F or G admixture, , use 658 lb/cyd of ce cyd when the weather natural sources for pa	Section 100 Imixture. e. ment when the weather is forecast to be 50°F avement, shoulder,
HP = high perform (a) HP mixtures (b) HP mixtures (c) 0- to 3-inch s (d) 0- to 3-inch s (e) 0- to 6-inch s (f) 0- to 7-inch s admixture.	mance require optin require 25 to slump for mix slump for mix slump after th slump after th slump for trer	tions for Con nized gradation 40% replacem tures for paver ta dmixtures or the addition of T ne addition of T mie application	819 struction meeting subs ent of portlan nents. with Type A or ype MR admix ype F or G admix without admit	ection 1004.03 d cement with a r D admixture. ture. nixture. sture or with Ty	.C. in SCM. pe A or D	 (m) 3- to 6-inch (n) 3- to 7-inch (o) For concret is forecast to or below. (p) Use aggreg miscellaned 	slump after slump after te pavement to be above gates only fro ous pavemen lab, structura	the addition of the addition of repair mixtures 50°F or 752 lb/o om geologically at (including ran	Type MR admixture. Type F or G admixtur , use 658 lb/cyd of ce cyd when the weather natural sources for pr nps), concrete pavem	Section 100 Imixture. e. ment when the weath is forecast to be 50°F avement, shoulder, ent overlay, bridge
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(k) 7- to 9-inch slump for wet placed drilled shafts

standard conditions.

MDOT Form 1976 (JMF Form)

- Develop JMF (mix proportions) according to ACI 211
- Aggregate bulk density
 - >65% coarse agg content
- JMF valid for 2 years

Michigan Department of Transportation 1976 (02/16)	This form	JOB MIX F CONCRETE FIE applies only to the project list ORIGINAL – Project Engineer	LD CC	MMUNI and is not tra	CATION ansferable to other proje	Clear Form
CONTROL SECTION JO	B NUMBER	PROJECT LOCATION	net kontre de la		PROJECT ENGINEER	
CONCRETE SUPPLIER		PLANT LO	CATION			PLANT NUMBER
GRADE OF CONCRETE PS	REQUIREMENT	MIX DESIGN NUMBER		INTENDED	USE (S) CON	
PRIME / SUBCONTRACTOR	2(5)				SUB	MITTED? (MDOT use only) N
Traine / Subcontrivior of	((3)	N				111
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Specific Gravity (Bulk Dry) of F-T Sample'		Specific Gravity (Bulk Dry) of F-T sample"				
Date of MDOT Freeze-Thaw Report "If the bulk dry specific gravit be considered to have chang	y is more than 0.04	Date of NDOT Freeze-Thaw Repor less than the bulk dry specifi	ic gravity o	f the most re	ecently tested freeze-tha	w sample, the aggregate will
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Reviewing the Mix

- Contractor submits mix documentation (Form 1976)
 - 10 days prior to anticipated date of placement
- Problems with submitted mix
 - Incomplete packages will be returned without review
- Checklist?

Con	crete Mix Design Approval Checklist
Ceme	association association
	From facility or manufacturer on MDOT Approved Manufacturers List? www.michigaa.gov/mdot/ gickie_foling business" (on left) gickie_foling business" (on left) gickie_foling business" (on left) gickie_Materials Source Guide" Cementitious materials content minimized (s 564 lb/crgkies s 6-sack; max. of 658 lb/crgkie.s 27-sack)? Fly ash content s 25% of total cementitious content? Slag cement (GGBFS) content s 40% of total cementitious content? Total SCM (slag. + fly ash) content s 50% of total cementitious content? Total SCM (slag. + fly ash) content s 50% of total cementitious content? N/cm ratio s 0.50 for fixed form or hand pours; w/cm ratio s 0.45 for slipform? maters:
Aggre	igates:
	From certified pits? (see Approved Manufacturers in Materials Source Guide) Combined, the coarse and fine aggregates make up 60% to 75% of the total concrete volume? Proportion (by weight) of <u>coarse</u> to -fine aggregate is around 60/40; roughly 55% to 65% coarse and 35% to 45% fine? Combined aggregate gradation <u>analyzed;</u> mix design in a good zone on workability chart? Fineness modulus of fine aggregate (sand) analyzed and in higher range (2.7 and above, 3.0 to 3.5 or higher works best)?
Othe	a
	Admixtures from Qualified Products List? (see Materials Source Guide) Admixture dosage within limits? (sheek QPL for specifics) • Air entrainment usually around 1.0 to 3.0 or/cwt to achieve 5-8% • Type A water reducer usually up to 4.0 or/cwt • Mid-range water reducer usually up to 8.0 or/cwt • Mid-range (superplasticiter) not usually recommended except for pumping or very low w/cm ratio
	Air content checked against yield calcs? Fibers in the mik? o Synthetic fiber dosage rate usually 1.5 (b/cost./1 bag per cycl)



Optimized Aggregates

From this:









Goal of Optimized Aggregates

- Reduce permeability
 - Reduce paste
 - Less shrinkage
 - Potential cost savings related to less cementitious
- Better workability for pumping and finishing
 - Need saturated aggs. in the stockpile
- Greater durability
 - Better air system quality
 - Lower w-cm ratio
- Req'd for pumped concrete and HP mixes





Improved Finishing

Less Handwork



Better Barrier Walls





Workability

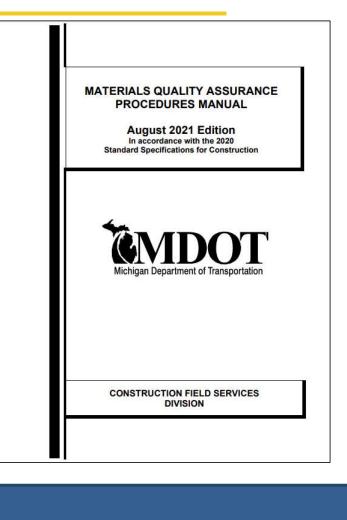


Harsh initial appearance, but very workable once vibrated



MQAP Section 3.09

- Does not specify MDOT gradation series for aggregates
 - CA retained on $\frac{1}{2}$ inch sieve or greater (0.040 F-T dilation)
 - IA retained on No. 4 and passing $\frac{1}{2}$ inch $\,$ (0.067 F-T dilation)
 - FA passing No. 4 sieve (2NS sand)
- Physical Requirements for each aggregate are located in subsection 902.03.C of the 2020 Spec Book
- LBW (P200) 2% CA, 3% IA & FA
- Max of 5% material with F-T >0.040 retained above ½" sieve
- No more than 15% carbonate passing No. 4 sieve



MQAP Section 3.09

- Stockpile Management Plan
 - Process controls for shipping, handling, and storage (see next slides)
- Two different max aggregate sizes

6AA / 6AAA size

- Pavements > 6 inches <2 inch max size
- Pavements ≤ 6 inches = 1½ inch max size
- All other applications = $1\frac{1}{2}$ inch max size



Custom size material (not an

MDOT standard gradation)



Aggregate Stockpile Management

- Truck delivery
- How do we build a stockpile?
- Segregation minimization
- Moisture control
- Mini Stockpile sampling for tests





Aggregate Stockpile Management

- Maintain uniform gradation
 - Restore uniform gradation if necessary
- Minimize contamination
 - Place a pad or aggregate separation layer
 - Or don't utilize bottom layer of stockpile
- Maintain uniform moisture content
 - Keep moist







Basic Stockpiling Concepts

- Create stockpile in lifts
 - Complete each lift before beginning next
- Do not dump material over edge of stockpile
- Minimize free-fall heights
- Only stockpile amount of aggregate which is practical
- Minimize crushing by loader





Optimized Aggregate Gradation Acceptance Criteria

- One test per 5000 tons
- One test per 1000 tons –if not prequalified supplier material
- Use Mini -stockpile sampling protocol – MTM 107
- Use AASHTO method T 248 to
 - Reduce sample size by quartering –CA and IA
 - $\boldsymbol{\diamondsuit}$ Miniature Stockpile sampling for FA





Combined Gradation

7 8			6AA	26A	2NS		Combined	Percent
9		% Blend ⇒	50.0%	10.0%	40.0%	0%	100%	Retained
10		Sieve Size	50.070		ercent Pass		100 /8	Retaineu
11	50 mm	2	100.0	100.0	100.0	0.0	100.0	0.0
12	37.5 mm	1 1/2	100.0	100.0	100.0	0.0	100.0	0.0
13	25 mm	1	98.6	100.0	100.0	0.0	99.3	0.7
14	19 mm	3/4	77.7	100.0	100.0	0.0	88.9	10.5
15	12.5 mm	1/2	41.6	99.5	100.0	0.0	70.8	18.1
16	9.5 mm	3/8	22.7	79.4	100.0	0.0	59.3	11.5
17	4.75 mm	#4	2.7	9.8	99.0	0.0	41.9	17.4
18	2.36 mm	#8	1.4	3.2	84.0	0.0	34.6	7.3
19	1.18 mm	#16	1.4	2.1	66.0	0.0	27.3	7.3
20	600 μm	#30	1.3	1.8	47.0	0.0	19.6	7.7
21	300 µm	#50	1.3	1.7	19.0	0.0	8.4	11.2
22	150 μm	#100	1.2	1.6	4.0	0.0	2.4	6.1
23	75 μm	#200	0.8	1.6	0.3	0.0	0.7	1.7
24								
25		Coarsene	ss Factor	62.3			34.6	Workability
26								

NOTE: Submittal must also include individual gradations of each of the three (or more) aggregates.

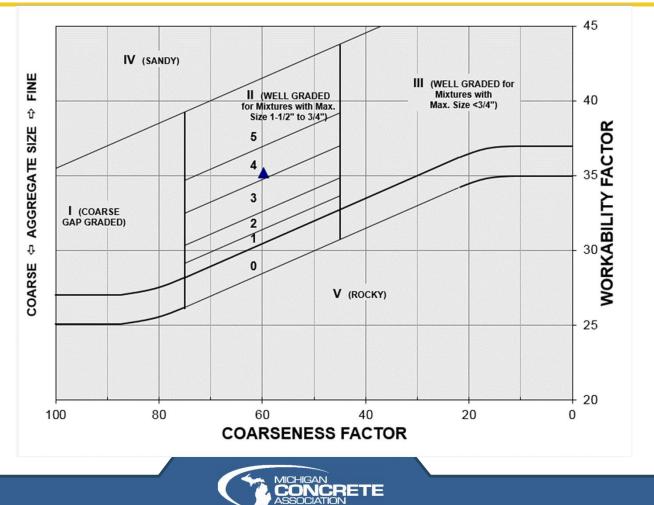


Coarseness vs. Workability Chart

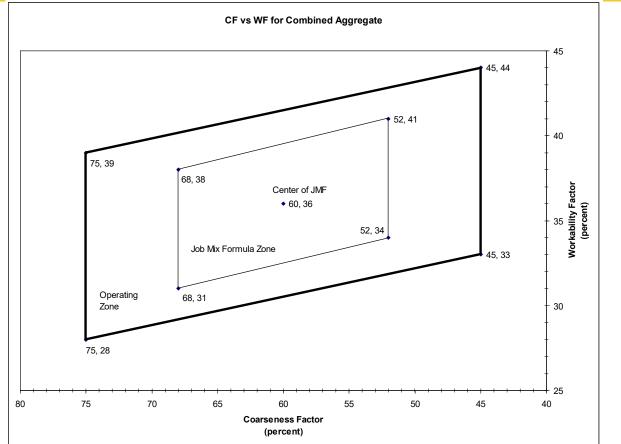
• WF = Combined % Passing No.8 Sieve



Coarseness vs. Workability Chart

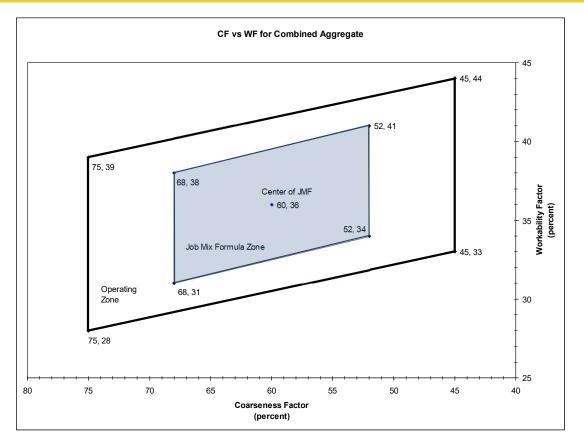








Zones in MDOT Chart



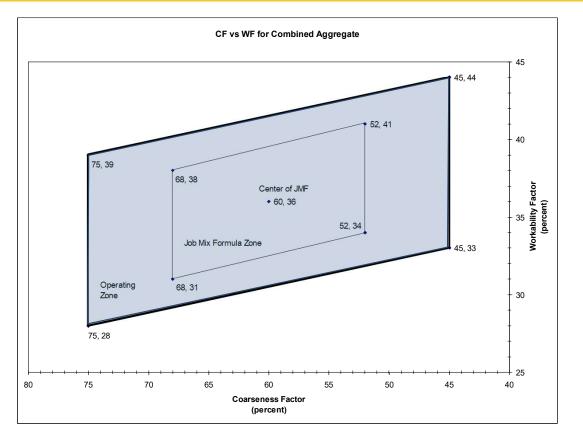
Job Mix Formula (JMF) Zone

 Contractor's proposed optimized gradation for production, as submitted to the Engineer in the Initial Mix Design, <u>must plot within this</u>

<u>zone</u>



Zones in MDOT Chart

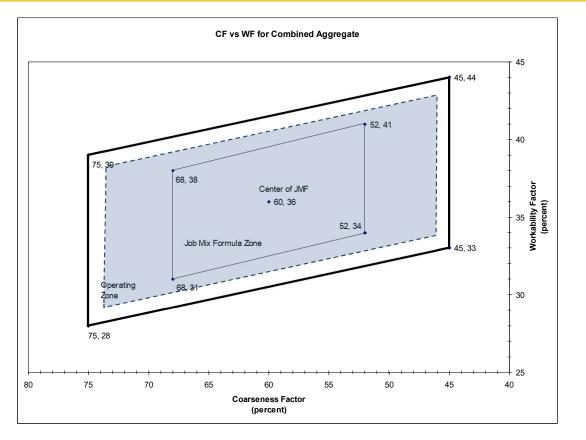


Operating Zone

 Contractor must ensure that the optimized gradation for <u>production</u> plots within this zone



Zones in MDOT Chart



Action Limits

 Contractor's proposed action limits; if <u>production</u> gradation plots outside this zone, steps taken to bring back within this zone. This is NOT a stop production criteria.



MDOT Spreadsheet

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D5 \checkmark : $\times \checkmark f_x$ 2.55									
Opt	timized Ago	gregate Gra	dation						
Aggregate Classification \rightarrow	Coarse Aggregate	Intermediate Aggregate	Fine Aggregate				Project Inf	ormation	
Relative Percent \rightarrow	30.61	27.38	42.01	Theoretical	Theoretical	Control Section	41000	Job Number	131531
$\begin{array}{ccc} \text{Actual Batch Weight (Ibs) (SSD)} & \longrightarrow \end{array}$	950.0	850.0	1350.0	Combined	Combined	Location	Kent	Date	8/21/22
Specific Gravity ->	2.55	2.55	2.64	Gradation		Mix Design Type	3500HP	JMF Number	10347
				%Passing	%Retained	Conc. Producer	Sector Co.	Plant Location	South
Sieve Size		Percent Passin	g			Pounds	of Cement:		490
	100	100	100	100.0			Comm	ients	
! inch	100	100	100	100.0	0.0	-			
1/2 inch inch	91.7	100 100	100	97.5	2.5 15.6	-			
4 inch	40.8	99.4	100	81.9 74.7	7.2	-			
2 inch	9.9	83.8	100	68.0	6.7	-			
2 linch	9.9	57.1	100	60.5	7.5				
0. 4	9.4	13.5	94.2	46.1	14.4				
0.8	9.2	5.1	73.9	35.3	10.8				
lo. 16	9.2	3.7	54.1	26.6	8.7				
lo. 30	9.1	3.3	32.5	17.3	9.2				
lo. 50	9.1	3.2	9.2	7.5	9.8	1	Combined	Gradation	
lo. 100	9.1	3	2	4.4	3.1	1	combined	Gradation	
			-		0	18.0			
		None	•	Key		14.0 in 12.0	15.6	14.4	
Identify Aggregate with a Freeze/ Thav									

QC Testing Requirements for Optimized Aggregates

Ready-Mix Supplier:

- If aggregates from Prequalified Aggregate Supplier
 - Utilize aggregate source's current weekly gradation analysis
 - Must QA these QC results *weekly* to confirm
 - Adjust as necessary to re-optimized and/or move the plot back from Action Limits
- If not from Prequalified Supplier or gradations not supplied by aggregate sources
 - Requirements of On-Site batch plant apply (daily testing)

On-Site Batch Plant for Paving Project:

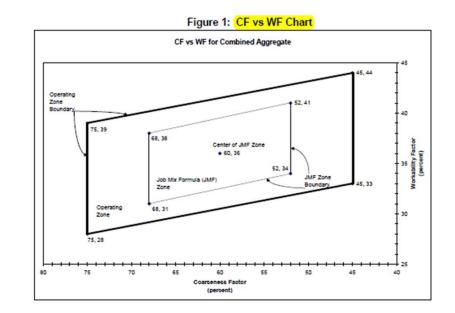
• Daily gradation testing each *day* of production; adjust as necessary



QA Testing Requirements for Optimized Aggregates

Acceptance (3.09.08)

- Acceptance of the combined aggregate gradation will be based on the ability of the combined aggregate gradation to plot within the <u>Operating Zone Boundary</u>
- Loss by Wash < Spec Requirement
- Frequency of testing based on tonnage used (usually coarse agg. tons is trigger; all three sampled at same time)





Summary page

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The Markenian	15361 Dale Street Detroit, MI 48219	Div II Paving
Max Case Description Prior March 2007 STATE Case PT Presented - PT Ninger State 2007 STATE MODIT Case PT Presented + NE + CF Support 2007 STATE 2007 STATE	Re: MDOT 82	121-204003 M-5 from East of the Rouge River to East of M-39
PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE WITCH STATES PATE	We submit herewi	th the following concrete mixture(s) for the above referenced project:
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the project specifications" and in reference to AC 316-60, Chapter 5- (Concrete Quility), and ACI standard' deviation/credelings requirements. These startistical will most the most creation when multicly ploted, cared and testind accordance with current ATM and ACI standards and recommended practices. These refers to the distribution concrete miss characteristic and the concrete start results that prevails and the project from the insetting blothorizer of record for the purposes of quality assurance, the information case be forward to its collections of the framework and activation of the purposes of quality assurance, the information case be forward to its collection of the purposes of quality assurance, the information case be forward to its collection of the purposes of quality assurance, the information case be forward to its collection of the purposes of quality assurance, the information case be required that submittain in the entropy of mound for the purposes of quality assurance, the information case be required to Collencough blue.	P1-FM P2-FM	3500 PSI MDOT Grade P1 Pavement + MR - 6" Slump 3000 PSI MDOT Grade P2 Pavement + MR - 6" Slump
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JMF Form 1976

1976 (06/17)	This fo	CONCI	IOB MIX FOR RETE FIELD (the project listed bail Project Engineer COP	COMMUN	ICATION transferable to c	ther project	File 20
CONTROL SECTION 82121	JOB NUMBER 204003	PROJECT LOC			PROJECT EN Bonnie Yu - D	GINEER	
CONCRETE SUPPLIER McColo Materials		·	PLANT LOCATION Redford, MI / Detroi	, M			PLANT NUMBER M-10, M-40
GRADE OF CONCRETE P1	PSI REQUIREMENT 3500	MIX DESIGN N P1-FW	UMBER	INTENDED MDOT P1		SUBM	RACTOR QC PLAN Y
PRIME / SUBCONTRACTOR(S Major Cement Co. / All Subcont							
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		MATERIAL D	ESIGN SOURCES	AND PROP	ERTIES		
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Source Name MOOT Source No.	Carmeuse - Calcit	Source Name MDOT Source No.	-		Scurce Name		StoneCo - Burmelste 81-093
MOOT Source No. MOOT Series Class	71-003 6AA	MDOT Source No. MDOT Series Class	· · · · ·		MDOT Source I MDOT Series C		81-093 2NS
Specific Gravity (Bulk Dry)*	2.54	Specific Gravity (b)			Specific Gravity		2.62
Specific Gravity (Bulk SSD) options		Specific Gravity (Br			Specific Gravity		
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Percent Crushed	100%	Percent Crushed			1		
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Sample" Date of MDOT Freeze-Thaw Report		Sample* Date of MDOT Free			-		
If the bulk dry specific gravit considered to have changed of	characteristics and be CEMENTITOUS	required to have a	a new treeze-thaw ter	at conducted	ADMIX	on Departme	ent projects
					ADMIX	URES	
Cameral Structure / Plant			Ar Eren	inment	ADMIX		Master Air AE 200-0AE-PR
Camerit Source / Plant		- Alpena, Mi	Ar Entra Water P		ADMIX	BASE	Master Air AE 200-0AE-PR ere - Opt#Fio 50 - OWRA-PR
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Strength Report

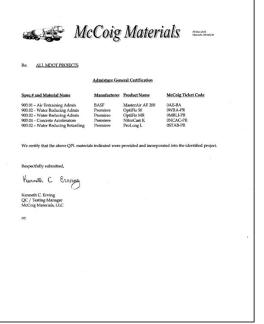
Mix : Period :	P1-FW - 11 May	MDOT P1 F2 2018 To	29 May 20	19				
Number of 1				ified Strengt	1	3500		reasive Tes
Average Str Required St				cled CofV ford Deviatio		0	ACI Running Ave ACI Standard De	Ye
			Concrete Temp deg F		Strength28 Day psi			
	eunt -	6	6	6	5			
	TROP	6.82	75	2.96	5180			
	DEV	0.60	9	0.75	570			
	ovs	8.8	11.6	25.3	11.1			
	go Min	6.00	63	2.00	4590			
Ran	ge Max	7.60	85	4.00	6110			
Date	Sample	Air Conten %	Concrete Temp deg F	Slump	Strength28 Day psi			
5/29/2019	1203883	7.40	66	4.00	4590			
8/17/2018	2176245		85	3.50	5330			
6/19/2018	700	6.80	81	2.00	5470			
6/12/2018	2172032	6.70	79	3.00	4920			
6/5/2018 5/11/2018	2171384		75	3.00	4870 6110			

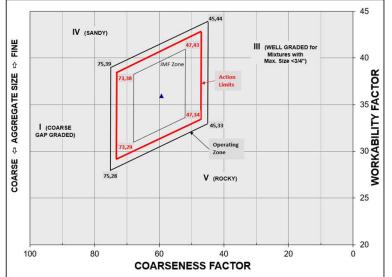


Admixtures Used

Optimized Blend Chart

Sand Gradation

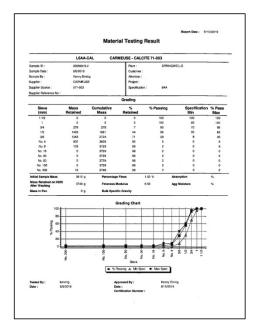




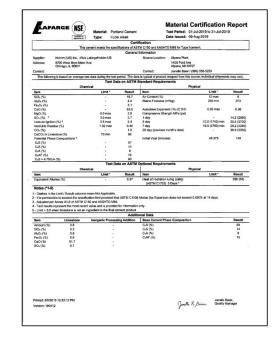
STO	NECO											
				5	SPC A	Analy	sis F	Repor	t			
Plant Product Specification	141_01455-Burmoist 2272-2NS Sand MDOT 2 NS Natural	kor										
		3/8* (9.5mm) (%)	#4 (4.75mm) (%)	#8 (2.36mm) (%)	#16 (1.18mm) (%)	#30 (0.6mm) (%)	#50 (0.3mm) (%)	#100 (0.15mm) (%)	#200 (75µm) (%)	Pan (%)	Wash Loss (# 200/75um) (%)	
	Count	5	5	5	5	5	5	5	5	5	5	
	Min	100.0	95.5	85.8	62.2	41.1	13.3	2.4	0.99	0.00	0.9	
	Max	100.0	96.2	87.8	65.7	45.7	17.4	3.4	1.37	0.00	1.2	
	Rango	0.0	0.7	2.0	3.5	4.6	4.1	1.0	0.38	0.00	0.3	
	Mean	100.0	95.8	86.9	63.6	43.4	15.7	3.0	1.18	0.00	1.1	
	St Dev	0.00	0.33	0.71	1.31	1.90	1.74	0.36	0.144	0.000	0.11	
	Lower Target											
	Upper Target											
	Lower Spec (LSL)	100	95	65	35	20	10	0	0		0	
	Upper Spec (USL)	100	100	95	75	55	30	10	3		3	
	Lower Limit (LCL)		94.6	84.9 88.9	59.8 67.3	38.5 48.3	10.1	1.7	0.65	0.00	0.7	
	Upper Limit (UCL)							4.3	1.71		1.5	
	Limit Mean (CL) 2-Sigma Lower	100.0	95.8 95.0	86.9	63.6 61.1	43.4	15.7	3.0	1.18	0.00	1.1	
	2-Sigma Upper	100.0	96.6	88.2	66.1	46.7	19.5	3.8	1.53	0.00	1.3	
	2-oigma Upper Cp	100.0	2.17	7.48	5.33	3.57	1.77	3.93	2.84	0.00	3.76	
	Cok		0.68	4.04	3.05	2.36	1.01	2.35	2.23		2.66	
	opk		2.53	7.04	5.09	3.07	1.92	4.63	3.47		4.55	
			0.80	3.80	2.91	2.03	1.09	2.77	2.74		3.21	
StonemontQC	06/11/2019				CRH	Americas	Materials (AMAT)				Page: 2 of 3



Coarse Gradation



Cement Mill Report



Slag Cement Mill Report

Orthogone Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2"Colspan="2	8 may vary. Resu 0.9 435 4.8	Limit 1 20 max	South Chicago Plant 2150 East 130th Orean Chicago, B. 40633 Brian Borowski / (630) 243-4 shipped from this source; Individua nents Physical	ate and AASHTO M 3 Information Bource Location: Contact is hysical of product of Standard Requires	tions of ASTM C General R period. The dat	geHolden US eel data during the test	Holoim (US) Inc. ofbia Lafarge 8700 West Bryn Mawr Ave	Buppler:
Basis District (Strict) Distr	Resu 0.9 435	Limit 1 20 max	South Chicago Plant 2150 East 130th Orean Chicago, B. 40633 Brian Borowski / (630) 243-4 shipped from this source; Individua nents Physical	Information Source Location: Contact: a is typical of product : Standard Requires	General speriod. The data	geHolden US eel data during the test	Holoim (US) Inc. ofbia Lafarge 8700 West Bryn Mawr Ave	Supplier:
Materials Bit (Part (Bard) Restar / A and (Bard) (B	Resu 0.9 435	Limit 1 20 max	2150 East 130h Bireet Chicego, E. 60853 Brian Borowski / (600) 243-4 shipped from this source, individua menta Physical	Contact is typical of product Standard Requirer		est data during the test	\$700 West Bryn Mawr Ave	Supplier:
Orage, 6891 Orage, 6891 Orage, 6891 Citit Tech Name, 1000, 100, 100, 100, 100, 100, 100, 1	Resu 0.9 435	Limit 1 20 max	Chicago, IL 60833 Brian Borowski / (630) 243-4 shipped from this source; Intil-Hou nexts Physical	a is typical of product of Standard Requirer			6700 West Bryn Mawr Ave Chicago, IL 60531	
The Making is basic of a samp tile for all addition that super of product regression to super interaction that super interaction to super int	Resu 0.9 435	Limit 1 20 max	shipped from this source, individua menta Physical	a is typical of product of Standard Requirer				ADDRESS:
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Observation Physical Physical Physical Physical Unit? Safeth Safety (Str) 2.3 mm; 6.4 4.6 µm; File; 20(1) (time (Str) 2.7 mm; Safeth Safety (Str) 0.4 4.6 µm; File; 20(1) (time (Str) 1.7 mm; Safeth Safety (Str) 0.4 4.6 4.6 1.0 mm; 1.0 mm; Safeth Safety (Str) 1.8 Backety (Str) 1.8 Backety (Str) 1.0 mm; Controls (Str) .0 4.9 Backety (Str) 1.0 mm; 1.0 mm; Controls (Str) .0 4.9 Backety (Str) 1.0 mm; 1.0 mm; 1.0 mm; Controls (Str) .0 4.0 .00 4.0 for the third month? Hold; 1.0 mm; Controls (Str) .0 .00	0.9 435	20 max	Physical	1	ata on ASTM 3		e following is based on average tes	The B
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كلمان المراب الحري التي التي التي التي التي التي التي الت				+45 µm (No. 325)	0.9	2.5 mex	(\$) (%)	Sulfide Sulfur (S
Austhum Octob (a) (N) 28 目的 pickoly (N) と	4.8		mitta)					
May 7 Cay roles May 7 Cay roles Counter (21) (3) Sale Any 3 Cay roles El anno 1000 (1000) Dauhaint Akkles (%) Sale Counter (1000) El anno 1000 (1000) El anno 1000 (1000) Dauhaint Akkles (%) Sale Counter (1000) Town Town Town Town Town (1000) Town (1000) Town (1000) Town Town		12 max		Air Content (%)	0.0		(an 5O ₃) ² (%)	Sulfate Sulfur (an
May 7 Cay roles May 7 Cay roles Counter (21) (3) Sale Any 3 Cay roles El anno 1000 (1000) Dauhaint Akkles (%) Sale Counter (1000) El anno 1000 (1000) El anno 1000 (1000) Dauhaint Akkles (%) Sale Counter (1000) Town Town Town Town Town (1000) Town (1000) Town (1000) Town Town			(75)	Class Artikity Index	9.0		ide (as ALO.) (%)	Aluminum Oxide
Epholen Alales (%) - 0.55 Companie Story (h.649 (a)) State Adamsa Conet 7 Say - 20 De grankas methi oda) -	93	-					Ford Cost	
Stag + Reformed Commet 7 Day 20 Day (providue month's data)	120	95 min	(previous month's data)	Avg 28 Day Index	0.969		CN)	Chicride (CI) (%)
Stag + Reformed Commet 7 Day 20 Day (providue month's data)				61 T 32 ST				
7 Day - 28 Day (previsos month's data) -					0.50		energy ()	unpervenere Alkali
28 Day (previous month's data)	29.9 (43							
	48.4 (70		month's data)					
Chemical Physical	2	2	and the second second	aference Coment	Test Data on R		Queles	
tem Link' Rosult hem Link'	Resu	Limit '	Physical	Item	Result		Chemical	tem
Equivalent Alkalius (%) 0.60 - 0.90 0.76 7 Day -	32.5 (4)						kalius (%)	Equivalent Alkali
26 Day (previous month's data) 5000 min	40.4 (58	5000 min	month's data)	28 Day (previous				
 F. claim. In labels a lot of long careful, research is accordance with Tark Nethod CIDS/CIDML Stag careful with active active provint module. (2005): 41. 499. Hormston: In Network: Converting tails available upon repaid. Hormston: In Section 2007. Hormston: A special converting tails available upon repaid. This situ my hows four reported or periode Material Cariflation Repaid. This situ my hows four reported or periode Material Cariflation Repaid. 					si.	ys. available upon requesi	nsion exceeding 0.020% at 14 days n on Reference Cement test data an ravity: 2.98	develop expension 3 - Information of 4 - Specific Grav



ASR (ASTM C1293) Data

Delivery Address: 4	518 Taylorsvi	ille Rd • Dayton, Ohio 45	5424 Mailing Address: P.O. Box	51 · Dayton, Ohi	0 45401
	AASH	TO/ISO 17025 Acc	redited • USACE Validated	ACIL	
		LABORATO	ORY REPORT		·
Report To: Stoneco				Report Date:	09/25/18
Attn.: Cync				Job No.:	
7555 White				Report No.:	
Cttawa Lai	ke, MI 49267	7		No. of Pages:	3
Report On: Laboratory	Determinati	ion of Alkali-Silica Rea	clivity (ASR)		
Procedure: Length Cha	ange of Con	crete Due to Alkaii-Sili	ca Reaction (ASTM C 1293)		
		Material and So	surce Information		
Sample Identification:		MDOT 2NS			
Fine Aggregate Source	4	Burmeister; Pit #81-4	93		
Coarse Aggregate Sour	ce:	#57 crLS MMA Phillips	sburg		
Cement Source:		Fairborn Cement Co.			
Date Received: 08/25/17					
		09/25/17	d data sheets.		
	below and d	09/25/17	d data sheets.	%	
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Date Cast: Results are summarized	Average 56 Days: 90 Days: 180 Days:	09/25/17 letailed on the attached b Length Change, % 0.012 0.017 0.018	ASTM C 1293 Specification,	%	
Results are summarized	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1293 Spedification, 	7) 236-8805, ext	329.
Results are summarized	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1293 Specification.	7) 236-8805, ext	329.
Results are summarized	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1203 Specification, 	7) 236-8805, ext submitted, DRNER, INC.	.329.
Results are summarized	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1293 Specification.	7) 236-8805, ext submitted, DRNER, INC.	329.
Results are summarized Should you have any que	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1203 Specification.	7) 236-8805, ext submitted, DRNER, INC.	
Results are summarized Should you have any que SDR/sdr 19814A	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1203 Specification.	7) 236-8805, ext submitted, DRNER, INC. RMBA samp, Supervisor	
Results are summarized	Average 56 Days: 90 Days: 180 Days: 270 Days: 365 Days:	09/25/17 letailed on the attached Length Change, % 0.012 0.017 0.018 0.023 0.025	ASTM C 1293 Specification, 	7) 236-8805, ext submitted, DRNER, INC. RMBA samp, Supervisor	

NRMCA Plant Cert.

(III c	Certificate of Conformance
)))).	For Concrete Production Facilities
NRMCA	Concrete Production Facilities
NKMUA	THIS IS TO CERTIFY THAT
Azteca	Concrete Plant #3, Redford, MI
M	cCoig Materials, LLC
	MDOT Plant No. M-10 McCoig Plant No. 3
requirements of the Check L	dersigned licensed professional engineer for conformance with the data for Ready Mixed Concrete Production Facilities. As of the met the requirements for production by
	with Automatic Batching and Recordings of ials, Aggregate, Water, and Chemical Admixtures
State State	Signature of Licensed Proteinional Engineer March 21, 2018 May 06, 2020
(Seal)	Inspection Date Certification Expiration Date
This company will maintain th correct promptly any deficient	ese facilities in compliance with the Check List requirements and will ies which develop.
Frank Man Signature of Company Office	Al Plant Manager Title of Coopery Official
NOTICE: The Check List indicates only the	at plant facilities are satisfactory for the production of overcrete when properly operated. Conformance of the engit be verified by usual inspection methods in accordance with sales agreements.
This curfficula is insued by the National Earth	Mised Concelle Association on vertication that the production facility conforms to the requirements of the Production Facilities, QC3. Unauthorized reproduction or mises of this sertilicate may studi in legal action.
Plant ID #: 800716	Certification ID #: 22680 © 1965, 1992, 2001, 2002, 2006, 2007, 2012
National Ready Mixed Con	creta Association 900 Spring Street • Silver Spring • Maryland 20910

Scale Calibration

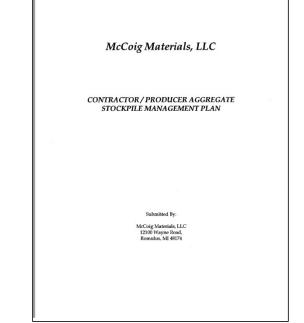
	PJL Calibrat Accreditab	J P	METRO 670 ALLEN HONE: (313 SCALE	ROAD, 3) 382-6	MELVIND	ALE, MI (313) 382	48122 -6194	62004
	TECHNICIA	N: Alex Lala	16m file		DATE: 3-1	9-19	Next D	.00
	SCALE MFO		, and		CUSTOMER	: KOENIG	FUEL & SL	PPLY CO.(SH
	MODEL NO	650			ADDRESS:	24940 P	LYMOUTH	
	SERIAL NO	101115						
	LOCATION	Agg Scal	e Plant #3			REDFOR	RD, MI	
			: 36,000 X	2018				
			ALIBRATION:		EPTABLE	I NEEDS	REPAIR - U	NABLE TO CAL.
	UNITS OF M	EASURE:	POUNDS	C KG		GRAMS	OTHE	R:
1			BOOK 44 TOLE	RANCE:	U YES		LEGAL F	OR TRADE
	APPLIED	BEFORE	AFTER	1	SERIAL N	UMBERS O	WEIGHTS	JSED:
1	0 LB	OLB	01	101	101 8 100	. 18		
	2000LB	1000 18	100010					
	4000LB		102018	Shift T	est: Befo		Bable Redienter	After
J	6000LB	102018	402018				Ceble/Indicator	1
	12.000 LB			Position	1. 1	- 1	2	NA
	18,000 LB	12,020 LB	12,01018	Position				
ł			18,000 18	Position		_		
	30,000 LB	24,02018	24,02018	Position	4:	3	4	
		29,98018	29,910 48				_	
٩	3 6,00 0 LB	36,02018	36,02018					
	COMMENT	S:						
	NOTES:		SCALE AS APPLIED TO P		USE OTYES			
	2. DEVIC THRC 3. CALII NIST 4. RESU 5. THIS 6. ALL C UNDE 7. THE L	ES LISTED ON UGH N.LS.T. CI IRATION COMP HANDBOOK 44 LTS OF THIS CI REPORT IS NOT ALIBRATIONS I R COMMENTS.	THIS SHEET WER ERTIFICATIONS F LIES WITH MSC I WHERE APPLICA ALIBRATION RELL TO BE REPROD	RE CHECKE OR TEST W INSTRUCTIO BLE. ATE ONLY 1 UCED EXCE DER NORMA	D AND CALIBRA EIGHTS ARE AN IN QW 4.11.02, II TO THE ITEMS S IPT IN FULL, WI AL WORKING EF	ATED WITH WI VALIABLE UP SO IEC 17025: PECIFIED ABI THOUT WRITT	ON REQUEST. 2005 AND WITH OVE. EN PERMISSIO AL CONDITIONS	N OF MSC.



Admixture Calibration Water Meter Calibration Stockpile Mgmt. Plan

	Premiere Coontric Admitth PO Box 277 Nonser, Ohio 43554 3800) 503-3418		Premiere Concrete Admixtures			
	Redfred McCaig Redfred 24940 Pyrnouth Redfred, MI 48239 United Status		Date Of Certil		luoc 24, 2019 dike McKowa	
	Nepawer Serial	Digenser Product	Meterol	Masserel	Tel %	
	doCoig ?	Mainer All 200	48	48	6%	
	deCoig 7	OptiFie 50	319	310	0%	
	doCoig 7	OptiFis MR	260	260	0%	
,	doCoig 7	ProLong L	100	100	0%	
	deCoig 7	Citra#1a 2000	100	100	0%	
-	W.	4 A 4	"			

Water Meter Accuracy Verification 55 Gallon Drum Calibration Sheet							
90 Day Requireme	nt for Volumetric Water	Batching Devices per MDOT (se	ct 601.03 A. 1. a.)				
Plant Information							
Plant Name: Plant Number; MDO'T Plant Number; Water Temperature; Ambient Temperature;	Azteca 3 M-10 60F 80F	Meter Type: Meter Brand name; Plant Meter No.: Meter Serial No.: Meter Setting: Pulse Count:	Flow Badger No. 1 123456 0.2445 16 oz				
Date Information Calibration Date: Next Calibration Date:	7/12/2019 10/12/2019	Previous Calibration Date:	3/29/2019				
Test 1							
Metered Quantity Meter Setting	55 gallons 0.2645	Measure Quantity Adjusted Setting	55 gailons Not Required				
Test 2			:				
Metered Quantity Meter Setting	55 gallons 0.2845	Measure Quantity Adjusted Setting	55 gallons Not Required				
Test 3							
Metered Quantity Meter Setting	Not Required Not Required	Measure Quantity Adjusted Setting	Not Required Not Required				
i certify the above in		ults are accurate, no adjustment	to the meter was				
DUAN'E Park	Hor	Just Morsser Test Witnessed By	in				
		Signitive	Con Chilles The line Care				





Summary

- ACI 211 mix proportioning considers:
 - Strength
 - Slump
 - Air content
 - Durability
- MDOT JMF Form 1976 requires backup documentation
 - Approved sources
 - i's dotted, t's crossed

- Other considerations not in ACI 211:
 - Optimized aggregate gradations
 - Placeability / finishability
 - Air system quality
 - Admixture compatibility
 - Ultimate strengths



Questions?

swaalkes@miconcrete.net 616-633-9629

ddegraaf@miconcrete.net 517-862-5632

Thank you!!

