Aggregate Optimization Chart

Mid-Michigan

Batch Plant Gradations

Production Gradation Report

PLANT #: P-101

75-051

2NS

Production Gradation

Concrete Grade: DM, 4500HP Sample Date: 2/28/22

Dates Test Represents: 3/1/2022 3/7/2022 through Specific % ft³ Agg. Class Pit# Weight (SSD) Source Gravity Contribution 6AA 71-47 Presque Isle 1500 9.17 2.62 51.5 26A 71-47 Presque Isle 260 1.59 2.62 8.9

1150

MDOT No.:

Contractor:

Adjusted WF Initial Production Sample (IPS)

Coarseness Factor:



lative ained	<u>Superior Materials, LLC</u> 30701 W. 10 Mile Rd.
.0	Suite 500
.0	Farmington Hills, MI 48336

	Total Wt	2910	17.69		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	6A	2NS	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	10	0.0	100.0	100.0	0.0	0.0
1.5"	100.0	10	0.0	100.0	100.0	0.0	0.0
1"	97.4	10	0.0	100.0	98.7	1.3	1.3
3/4"	83.4	10	0.0	100.0	91.4	7.2	8.6
1/2"	38.1	95	5.7	100.0	67.7	23.7	32.3
3/8"	19.3	81	.5	100.0	56.7	11.0	43.3
#4	2.8	13	3.4	98.5	41.6	15.2	58.4
#8	1.7	3	.1	83.3	34.1	7.5	65.9
#16	1.5	1.	.7	68.3	27.9	6.2	72.1
#30	1.5	1.	.4	53.3	22.0	6.0	78.0
#50	1.4	1.	.4	29.2	12.4	9.6	87.6
#100	1.4	1.	.3	7.3	3.7	8.7	96.3
LBW	1.3	1.	.2	0.6	1.0	2.7	99.0

Aggregate Supplier Gradations

6.93

2.66

39.5

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

62

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

Coarseness Factor:	66	Workability Factor:	34	36.6
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41	57, 39 60, 36 60, 36 67, 38 Production Gra	JMF Zone 75, 39 dation 75, 28	
40 45 ActionLimits Boundary =	50	Coarseness Factor (%)	75	80

Work	ability Factor:	35	
Sieve	Cumulative	%	Cumulative
Sieve	% Passing	Retained	% Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	100.0	0.0	0.0
3/4"	95.0	5.0	5.0
1/2"	70.5	24.5	29.5
3/8"	60.0	10.5	40.0
#4	44.4	15.6	55.6
#8	35.5	9.0	64.5
#16	28.5	7.0	71.5
#30	21.5	7.0	78.5
#50	10.2	11.3	89.8
#100	3.1	7.1	96.9
LBW	1.3	1.8	98.7

PLANT #: P-102

Sample Date:

2/28/22 Concrete Grade: DM, 4500HP

MDOT No.:

Contractor:

Dates Test F	Represents:	3/1/2022	through	3/7/2022		
Agg. Class	Pit#	Source	Weight (SSD)	ft ³	Specific Gravity	% Contribution
6AA	58-003	Stoneco	1400	8.34	2.69	47.4
26A	58-003	Stoneco	405	2.41	2.69	13.7
2NS	63-114	Highland	1150	6.95	2.65	38.9
		Total Wt	2955	17 71		100.0

Coarseness Factor:

Superior Materials, LLC 30701 W. 10 Mile Rd. Suite 500 Farmington Hills, MI 48336

61

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

	Total Wt	2955	17.71		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	6 A	2NS	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	10	0.0	100.0	100.0	0.0	0.0
1.5"	100.0	10	0.0	100.0	100.0	0.0	0.0
1"	100.0	10	0.0	100.0	100.0	0.0	0.0
3/4"	81.4	10	0.0	100.0	91.2	8.8	8.8
1/2"	44.3	98	3.9	100.0	73.5	17.7	26.5
3/8"	19.2	70).9	100.0	57.7	15.7	42.3
#4	1.8	9.	.3	99.6	40.9	16.8	59.1
#8	1.0	3	.4	87.2	34.9	6.0	65.1
#16	0.8	2	.1	67.0	26.7	8.1	73.3
#30	0.6	1.	.8	47.0	18.8	7.9	81.2
#50	0.5	1.	.7	20.7	8.5	10.3	91.5
#100	0.4	1.	.5	4.1	2.0	6.5	98.0
LBW	0.3	1.	.4	0.6	0.6	1.4	99.4
Production Grad	dation O Batch Plant Grada	itions () Agg	regate Supplier Gr	adations	Adjusted WF	Intial Production	on Sample (IPS

Adjusted WF Intial Production Sample (IPS) **Coarseness Factor: Workability Factor:** 35 37.4 65 45 45, 44 JMF Zone Workability Factor (%) Production Gradation ■ 60µ36 45, 33 Operating Zone Boundary 75, 28 25 45 50 55 Coarseness Factor (%)⁷⁰ 75 80

Work	ability Factor:	36	
Sieve	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	99.3	0.7	0.7
3/4"	89.2	10.1	10.8
1/2"	70.7	18.5	29.3
3/8"	60.7	10.0	39.3
#4	44.4	16.3	55.6
#8	35.9	8.5	64.1
#16	27.3	8.6	72.7
#30	19.1	8.2	80.9
#50	7.4	11.7	92.6
#100	1.9	5.6	98.1
LBW	0.7	1.2	99.3

PREPARED BY: SM, LLC Technical Service

ActionLimits Boundary = - - - - -

3/1/2022

PLANT #: P-32

Sample Date:

Dates Test Represents:

2/28/22

Contractor:

Concrete Grade: DM, 4500HP 3/7/2022

MDOT No.:

Agg. Class	Pit#	Source	Weight (SSD)	ft ³	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1455	8.90	2.62	50.1
26A	71-47	Presque Isle	300	1.83	2.62	10.3
2NS	95-013	Smelter Bay	1150	6.95	2.65	39.6
		Total Wt	2905	17.69		100.0

through

- Verify this number is 100%

Adjusted WF Intial Production Sample (IPS)

Coarseness Factor:

37.7

Superior Materials, LLC
30701 W. 10 Mile Rd.
Suite 500
Farmington Hills, MI 48336

	i Otai Wt	2903	17.09		100.0	< verily trils if	uniber is 100%
Sieve	6AA	26/	1	2NS	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	100	.0	100.0	100.0	0.0	0.0
1.5"	100.0	100	.0	100.0	100.0	0.0	0.0
1"	97.8	100	.0	100.0	98.9	1.1	1.1
3/4"	87.5	100	.0	100.0	93.7	5.2	6.3
1/2"	45.5	97.	3	100.0	72.5	21.3	27.5
3/8"	25.7	89.)	100.0	61.7	10.8	38.3
#4	5.4	28.	4	95.8	43.6	18.1	56.4
#8	3.1	7.8	1	83.0	35.2	8.3	64.8
#16	2.4	5.0)	67.6	28.5	6.7	71.5
#30	2.2	3.4		49.3	21.0	7.5	79.0
#50	2.0	3.0)	24.4	11.0	10.0	89.0
#100	1.9	2.7	,	7.4	4.2	6.8	95.8
LBW	1.3	2.0		1.3	1.4	2.8	98.6
Production Grada	tion Batch Plant Grada	ations	gate Supplier Gra	adations	Adjusted WF	Intial Production	on Sample (IPS

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

62

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

Coarseness Facto	r: 59	Workability Factor:	35	
45 45, 44 45, 44 45, 33 Operating Zo Boundary	52, 34	67, 40 68, 38 Production Gradation 60, 38S 7, 32 68, 31	75, 28	
25 + 40 45 ActionLimits Boundary = -	50 5	Coarseness Factor (%) ⁷⁰	75	80

Work	ability Factor:	36	
Sieve	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	100.0	0.0	0.0
3/4"	95.0	5.0	5.0
1/2"	72.3	22.8	27.7
3/8"	60.4	11.8	39.6
#4	42.6	17.8	57.4
#8	36.0	6.6	64.0
#16	29.5	6.5	70.5
#30	20.3	9.2	79.7
#50	9.5	10.8	90.5
#100	3.4	6.1	96.6
LBW	1.3	2.1	98.7

PLANT #: P-35

81-019

Sample Date: Dates Test Re

2NS

Production Gradation

2/28/22 Concrete Grade: **DM**, **4500HP**

Dates Test Represents:		3/1/2022	through	3/7/2022			
	Agg. Class	Pit #	Source	Weight (SSD)	ft ³	Specific Gravity	% Contribution
	6AA	58-003	Stoneco	1450	8.64	2.69	49.1
	26A	58-003	Stoneco	405	2.41	2.69	13.7

Adjusted WF Intial Production Sample (IPS)

Coarseness Factor:

35.5

Contractor:

MDOT No.:

 Stoneco
 1450
 8.64
 2.69
 49.1

 Stoneco
 405
 2.41
 2.69
 13.7

 Pleasant Lake
 1100
 6.65
 2.65
 37.2

 Total Wt
 2955
 17.70
 100.0

this number is 100%

SUPERIOR MATERIALS

Superior Materials, LLC 30701 W. 10 Mile Rd. Suite 500 Farmington Hills, MI 48336

	i otai wt	2955 17.	70	100.0	< Verify this n	umber is 100%
Sieve	6AA	26A	2NS	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	100.0	100.0	100.0	0.0	0.0
1.5"	100.0	100.0	100.0	100.0	0.0	0.0
1"	100.0	100.0	100.0	100.0	0.0	0.0
3/4"	81.4	100.0	100.0	90.9	9.1	9.1
1/2"	44.3	98.9	100.0	72.5	18.4	27.5
3/8"	19.2	70.9	100.0	56.4	16.2	43.6
#4	1.8	9.3	97.7	38.5	17.8	61.5
#8	1.0	3.4	86.0	33.0	5.6	67.0
#16	0.8	2.1	70.7	27.0	6.0	73.0
#30	0.6	1.8	52.4	20.0	7.0	80.0
#50	0.5	1.7	22.0	8.7	11.4	91.3
#100	0.4	1.5	4.5	2.1	6.6	97.9
LBW	0.3	1.4	1.7	1.0	1.1	99.0

Aggregate Supplier Gradations

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

Coarseness Factor:	65	Workability Factor:	33	
45 45,44			JMF Zone	
(%)	52, 41	68, 38	75, 39	
Morkability Factor (%) 35 45, 33 Operating Zone Boundary	52, 34	■ 60 ₁ β ■ Production Grad	ation	
30 Operating Zone Boundary	56	31 67 , 39 , 31	75.00	
25 40 45	50 5	5 Coarseness Factor (%)	75, 28 75	80
ActionLimits Boundary =				

Batch Plant Gradations

Work	ability Factor:	36	
Sieve	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	99.3	0.7	0.7
3/4"	89.1	10.2	10.9
1/2"	70.5	18.6	29.5
3/8"	60.5	10.0	39.5
#4	44.1	16.4	55.9
#8	35.6	8.5	64.4
#16	27.7	7.9	72.3
#30	20.6	7.1	79.4
#50	8.7	11.8	91.3
#100	1.6	7.1	98.4
LBW	1.1	0.6	98.9

PREPARED BY: SM, LLC Technical Service Approved by

PLANT #: P-36

Sample Date:

Production Gradation

2/28/22 Concrete Grade: DM, 4500HP 3/7/2022

Dates Test Represents:		3/1/2022	through	3/7/2022		
Agg. Class	Pit #	Source	Weight (SSD)	ft ³	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1400	8.56	2.62	48.2
26A	71-47	Presque Isle	405	2.48	2.62	13.9
2NS	63-92	Grange Hall	1100	6.65	2.65	37.9
		Total Wt	2005	17.60		100.0

MDOT No.:

Contractor:

Adjusted WF Intial Production Sample (IPS)

Coarseness Factor:

36.0

Superior Materials, LLC
30701 W. 10 Mile Rd.
Suite 500
Farmington Hills, MI 48336

	Total Wt	Total Wt 2905 17.			100.0	< Verify this number is 100%		
Sieve	6AA	26/	4	2NS	Cumulative % Passing	% Retained	Cumulative % Retained	
2"	100.0	100	.0	100.0	100.0	0.0	0.0	
1.5"	100.0	100	.0	100.0	100.0	0.0	0.0	
1"	98.3	100	.0	100.0	99.2	0.8	0.8	
3/4"	79.6	100	.0	100.0	90.2	9.0	9.8	
1/2"	32.1	97.	6	100.0	66.9	23.2	33.1	
3/8"	10.9	89.	0	100.0	55.5	11.4	44.5	
#4	1.9	28.	4	97.7	41.9	13.7	58.1	
#8	1.5	7.8	3	83.8	33.5	8.3	66.5	
#16	1.3	5.0)	67.3	26.8	6.7	73.2	
#30	1.2	3.4	ļ	49.1	19.6	7.2	80.4	
#50	1.2	3.0)	21.8	9.3	10.4	90.7	
#100	1.1	2.7	7	3.9	2.4	6.9	97.6	
LBW	0.6	2.0)	0.6	0.8	1.6	99.2	

Aggregate Supplier Gradations

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

Coarseness Factor:	67	Workability Factor:	34	
45 45, 44			JMF Zone	$\overline{\mathbb{n}}$
% ⁴⁰	52, 41	58, 39 68, 38	75, 39	
Morkability Factor (%) 35 45, 33 Operating Zone Boundary	52, 34	■ 60, 36 IPS	Gradation	
Operating Zone Boundary		58, 31 68, 31	75, 28	
25 40 45 ActionLimits Boundary =	50 5	Coarseness Factor (%)	75	80

Batch Plant Gradations

Work	ability Factor:	35	
Sieve	Cumulative	%	Cumulative
Sieve	% Passing	Retained	% Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	99.1	0.9	0.9
3/4"	90.3	8.8	9.7
1/2"	69.2	21.1	30.8
3/8"	59.1	10.1	40.9
#4	41.8	17.3	58.2
#8	35.1	6.6	64.9
#16	28.5	6.6	71.5
#30	21.2	7.3	78.8
#50	8.7	12.5	91.3
#100	1.8	7.0	98.2
LBW	0.7	1.0	99.3

PLANT #: P-39

Sample Date:

Concrete Grade: DM, 4500HP 2/28/22

3/1/2022 3/7/2022 through

Dates Test Represents:		3/1/2022	through	3/7/2022		
Agg. Class	Pit#	Source	Weight (SSD)	ft ³	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1505	9.21	2.62	51.8
26A	71-47	Presque Isle	300	1.83	2.62	10.3
2NS	63-92	Grange Hall	1100	6.65	2.65	37.9
		Total Wt	2905	17.69		100.0

MDOT No.:

Contractor:

Coarseness Factor:

35.4

SUPERIOR	

Superior Materials, LLC 30701 W. 10 Mile Rd. Suite 500

Farmington Hills, MI 48336

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

*% Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

63

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

Total W			17.69		100.0	< Verify this number is 100%		
Sieve	6AA	26	A	2NS	Cumulative % Passing	% Retained	Cumulative % Retained	
2"	100.0	100	0.0	100.0	100.0	0.0	0.0	
1.5"	100.0	100	0.0	100.0	100.0	0.0	0.0	
1"	97.4	100	0.0	100.0	98.7	1.3	1.3	
3/4"	83.4	100	0.0	100.0	91.4	7.3	8.6	
1/2"	38.1	95	.7	100.0	67.5	23.9	32.5	
3/8"	19.3	81	.5	100.0	56.3	11.2	43.7	
#4	2.8	13	.4	97.7	39.8	16.5	60.2	
#8	1.7	3.	1	83.8	32.9	6.9	67.1	
#16	1.5	1.	7	67.3	26.4	6.5	73.6	
#30	1.5	1.	4	49.1	19.5	6.9	80.5	
#50	1.4	1.	4	21.8	9.1	10.4	90.9	
#100	1.4	1.	3	3.9	2.3	6.8	97.7	
LBW	1.3	1.	2	0.6	1.0	1.3	99.0	
Production Gradation							on Sample (IPS	

Coarsen	ess Factor:	65	Workability Factor:	33	
Workability Factor (%) 08 29 10 10 10 10 10 10 10 10 10 1	45, 44 45, 33 Operating Zone Boundary	52, 41	58, 40 68, 38 68, 838 Froduction Grad	JMF Zone 75, 39 ation 75, 28	
25 40 ActionLimits	45 Boundary =	50 5	Coarseness Factor (%)	75	80

Work	ability Factor:	36	
Sieve	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	100.0	0.0	0.0
3/4"	89.7	10.3	10.3
1/2"	70.3	19.4	29.7
3/8"	59.1	11.2	40.9
#4	42.8	16.3	57.2
#8	35.5	7.3	64.5
#16	29.0	6.5	71.0
#30	21.2	7.7	78.8
#50	9.8	11.5	90.2
#100	3.7	6.1	96.3
LBW	1.2	2.5	98.8

Ray Rd

Batch Plant Gradations

PLANT #: P-O2

63-115

Sample Date:

2NS

Production Gradation

2/28/22 Concrete Grade: **DM**, **4500HP**

6.65

17.60

2.65

Dates Test Represents:		3/1/2022	through	3/7/2022			
	Agg. Class	Pit #	Source	Weight (SSD)	ft ³	Specific Gravity	% Contribution
I	6AA	71-47	Presque Isle	1455	8.90	2.62	50.1
I	26A	71-47	Presque Isle	350	2.14	2.62	12.0

1100

2005

Contractor:

Adjusted WF Intial Production Sample (IPS)

Coarseness Factor:

34.1

MDOT No.:

%	
tribution	
50.1	
12.0	
37.9	

---- Verify this number is 100%

Superior Materials, LLC
30701 W. 10 Mile Rd.
Suite 500
Farmington Hills, MI 48336

	i otai wt	2905	17.69		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	6A	2NS	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	10	0.0	100.0	100.0	0.0	0.0
1.5"	100.0	10	0.0	100.0	100.0	0.0	0.0
1"	98.3	10	0.0	100.0	99.1	0.9	0.9
3/4"	79.6	10	0.0	100.0	89.8	9.4	10.2
1/2"	32.1	97	7.6	100.0	65.7	24.1	34.3
3/8"	10.9	89	0.0	100.0	54.0	11.7	46.0
#4	1.9	28	3.4	97.7	41.4	12.7	58.6
#8	1.5	7.	.8	79.0	31.6	9.8	68.4
#16	1.3	5	.0	62.6	25.0	6.6	75.0
#30	1.2	3.	.4	46.2	18.5	6.5	81.5
#50	1.2	3	.0	23.0	9.7	8.8	90.3
#100	1.1	2	.7	4.7	2.7	7.0	97.3
LBW	0.6	2	.0	0.7	0.8	1.8	99.2

Aggregate SupplierGradations

*Maximum % Retained must be above the 3/8" sieve.

*Any two adjacent sieves must equal 10% except max.,

nom. max., #100 and #200 sieves.

 $^{*}\%$ Retained must be at least 4% for each sieve except max.,

nom. max., #100 and #200 sieves.

63

*% Retained must be at least 8% for the 1" sieve when

a 2" max. size (nom. Max. 1.5") aggregate is used.

Coarseness Factor	: 67	Workability Factor:	32	
45 45, 44 45, 44 45, 33 Operating Zon Boundary	52, 41 52, 34	68, 39 68, 38 Production 58, 31	75, 39 Gradation 75, 28	
40 45 ActionLimits Boundary =	50 5	Coarseness Factor (%)	75	80

Work	ability Factor:	35	
Sieve	Cumulative % Passing	% Retained	Cumulative % Retained
2"	100.0	0.0	0.0
1.5"	100.0	0.0	0.0
1"	100.0	0.0	0.0
3/4"	95.1	4.9	4.9
1/2"	74.6	20.5	25.4
3/8"	59.3	15.3	40.7
#4	42.1	17.2	57.9
#8	35.1	7.1	64.9
#16	29.2	5.9	70.8
#30	21.9	7.3	78.1
#50	9.6	12.4	90.4
#100	2.4	7.2	97.6
LBW	0.9	1.5	99.1

PREPARED BY: SM, LLC Technical Service Approved By