## Aggregate Optimization Chart

## **Production Gradation Report**

**PLANT #:** P-101 Contractor:

Sample Date: Concrete Grade: DM, 4500HP 2/21/22 Dates Test Represents: 2/22/2022 2/28/2022 MDOT No.: through

Agg. Class	Pit#	Source	Weight (SSD)	ft <sup>3</sup>	Specific 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
2NS	75-051	Mid-Michigan	1150	6.93	2.66	39.5
		Total Wt	2910	17.69		100.0

**Coarseness Factor:** 

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

	i otai wt	2910 17.69		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"	96.7	100.0	100.0	98.3	1.7	1.7
3/4"	81.6	100.0	100.0	90.5	7.8	9.5
1/2"	38.4	96.1	100.0	67.9	22.6	32.1
3/8"	17.5	83.4	100.0	56.0	11.9	44.0
#4	2.1	14.7	98.5	41.3	14.7	58.7
#8	1.4	3.7	83.3	34.0	7.4	66.0
#16	1.2	1.8	68.3	27.8	6.2	72.2
#30	1.2	1.4	53.3	21.8	6.0	78.2
#50	1.1	1.3	29.2	12.2	9.6	87.8
#100	1.1	1.2	7.3	3.6	8.7	96.4
LBW	1.0	1.1	0.6	0.9	2.7	99.1
Production Gra	dation	ons	radations	Adjusted WF	Initial Producti	ion 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.

\*% 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	36.5
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41	57, 39  60, 36S  67, 35  68, 38  Production  57, 31	JMF Zone 75, 39 Gradation 75, 28	
40 45  ActionLimits Boundary =	50	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"	95.0	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

62

Highland

Batch Plant Gradations

**PLANT #:** P-102

63-114

Sample Date:

Agg. Class 6AA 26A 2NS

**Production Gradation** 

2/21/22 Concrete Grade: DM, 4500HP

2.65

Dates Test F	Represents:	2/22/2022	through	2/28/2022		
Agg. Class	Pit#	Source	Weight (SSD)	ft <sup>3</sup>	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

Contractor:

MDOT No.:

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	2955	17.71		100.0	< Verify this n	umber 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"	100.0	100	0.0	100.0	100.0	0.0	0.0
3/4"	81.4	100	0.0	100.0	91.2	8.8	8.8
1/2"	44.3	98	5.9	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	99.7	40.9	16.8	59.1
#8	1.0	3.	4	88.0	35.2	5.7	64.8
#16	0.8	2.	1	71.3	28.4	6.8	71.6
#30	0.6	1.	8	49.1	19.6	8.8	80.4
#50	0.5	1.	7	20.6	8.5	11.2	91.5
#100	0.4	1.	5	3.1	1.6	6.9	98.4
LBW	0.3	1.	4	0.3	0.5	1.2	99.5

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 Facto	or: 65	Workability Factor:	35	
45 45, 44 45, 44 45, 33 Operating Z Boundary	52, 34 56	68, 38 Production G 60µ86	75, 39 radation 75, 28	
25 40 45  ActionLimits Boundary = -	50 5	Coarseness Factor (%)	75	80 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

**PLANT #:** 

Sample Date:

**Production Gradation** 

Concrete Grade: DM, 4500HP

Dates Test F	Represents:	2/22/2022	through	2/28/2022		
Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1455	8.90	2.62	50.1
267	71 /7	Processo Iclo	200	1 02	2.62	10.2

MDOT No.:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

38.0

Contractor:

Agg. Class	Pit#	Source	Weight (SSD)	ft <sup>3</sup>	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

-- Verify this number is 100%

SUPERIO	OR LS

**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	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"	95.8	100.0	100.0	97.9	2.1	2.1
3/4"	79.7	100.0	100.0	89.8	8.1	10.2
1/2"	34.1	97.9	100.0	66.8	23.1	33.2
3/8"	16.9	89.3	100.0	57.3	9.5	42.7
#4	4.0	28.8	96.3	43.1	14.2	56.9
#8	3.0	10.7	83.1	35.5	7.6	64.5
#16	2.5	4.1	67.4	28.4	7.1	71.6
#30	2.1	3.7	48.7	20.7	7.6	79.3
#50	1.7	3.4	24.5	10.9	9.8	89.1
#100	1.3	3.0	7.4	3.9	7.0	96.1
LBW	0.9	2.4	1.4	1.3	2.6	98.7

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:	66	Workability Factor:	36	
45 45,44			JMF Zone	$\overline{\mathbb{1}}$
Morkability Factor (%) 35 45, 33 Operating Zone Boundary	52, 34	6, 40 67, 40 68, 38 68, 38 60, 38S	75, 39 adation	
No Operating Zone Boundary	. ,	67 <sub>68</sub> , 31	75, 28	
40 45 ActionLimits Boundary =	50 5	<sup>5</sup> Coarseness Factor (%) <sup>70</sup>	75	80

Batch Plant Gradations

Work	ability Factor:	36	
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"	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

62

PLANT #:

Sample Date:

Dates Test Represents:

. DM. 4500HP

121122			Concrete Grade:	DIVI, 4500F
22/2022	through	2/28/2022		

1							
Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	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	
2NS	81-019	Pleasant Lake	1100	6.65	2.65	37.2	
		Total Wt	2955	17.70		100.0	

Contractor:

MDOT No.:

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

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.,

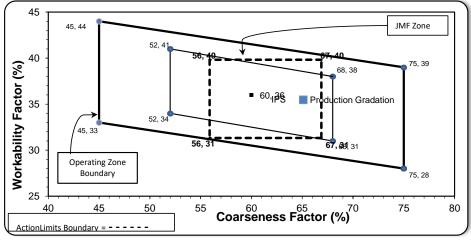
nom. max., #100 and #200 sieves.

\*% 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	17.70		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	6 <b>A</b>	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	100.0		100.0	0.0	0.0
3/4"	81.4	10	0.0	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

 Batch Plant Gradations Aggregate Supplier Gradations **Production Gradation** Adjusted WF Intial Production Sample (IPS) **Coarseness Factor:** 65 **Workability Factor:** 33 35.5 **Coarseness Factor:** Workability Factor:



Workability I actor.		3	
Sieve	Cumulative	%	Cumulative
Sieve	% Passing	Retained	% 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

61

Grange Hall

**Total Wt** 

Batch Plant Gradations

PLANT #: P-36

63-92

Sample Date:

2NS

**Production Gradation** 

/21/22 Concrete Grade: **DM**, **4500HP** 

6.65

17.69

2.65

37.9

100.0

36.6

Dates Test F	Represents:	2/22/2022	through	2/28/2022		
Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1455	8.90	2.62	50.1
26A	71-47	Presque Isle	350	2.14	2.62	12.0

1100

2905

MDOT No.:

<---- Verify this number is 100%

Contractor:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

SUPERIOR MATERIALS

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

Sieve	6AA	26A	2NS	Cumulative % Passing	% Retained	Cumulative % Retained	
2"	100.0	100.0	100.0	100.0	0.0	0.0	ĺ
1.5"	100.0	100.0	100.0	100.0	0.0	0.0	i
1"	98.6	100.0	100.0	99.3	0.7	0.7	ĺ
3/4"	85.6	100.0	100.0	92.8	6.5	7.2	ĺ
1/2"	45.0	97.9	100.0	72.2	20.6	27.8	i
3/8"	23.0	89.3	100.0	60.1	12.1	39.9	*
#4	5.1	28.8	98.1	43.2	17.0	56.8	,
#8	3.0	10.7	82.8	34.1	9.0	65.9	nc
#16	2.5	4.1	67.7	27.4	6.8	72.6	,
#30	2.3	3.7	49.2	20.2	7.2	79.8	nc
#50	2.2	3.4	22.5	10.0	10.2	90.0	*
#100	2.1	3.0	3.8	2.9	7.2	97.1	а
LBW	1.5	2.4	0.6	1.3	1.6	98.7	ĺ

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.

 $\ensuremath{^{*}\%}$  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: 61	Workability Factor:	34	
45 45, 4			JMF Zone	
(%) L	52, 41	58, 39 68, 38	75, 39	
th Facto	52, 34	Production Gradation 60, 36 IPS		
1 <del>-</del> 11 '	rating Zone Soundary	58, 31	75, 28	
25 40 ActionLimits Bound	45 50	55 Coarseness Factor (%)	75	80

Workability Factor:		35	
Sieve	Cumulative % Passing	% Retained	Cumulative % 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

PREPARED BY: SM, LLC Technical Service Approved By:

2/22/2022

Source

Presque Isle

Presque Isle

Grange Hall

Batch Plant Gradations

PLANT #: P-39

Pit#

71-47

71-47

63-92

Sample Date:

Agg. Class

6AA

26A

2NS

Dates Test Represents:

**Production Gradation** 

2/21/22 Concrete Grade: DM, 4500HP

through	2/28/2022		
Weight (SSD)	ft <sup>3</sup>	Specific	%
weight (SSD)	11	Gravity	Contribution
1505	9.21	2.62	51.8
300	1.83	2.62	10.3
1100	6.65	2.65	37.9
2905	17.69		100.0

Contractor:

MDOT No.:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

35.0



**Superior Materials, LLC** 

30701 W. 10 Mile Rd. Suite 500

Farmington Hills, MI 48336

•	Total Wt	2905	17.69		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	6 <b>A</b>	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"	96.7	10	0.0	100.0	98.3	1.7	1.7
3/4"	81.6	10	0.0	100.0	90.5	7.8	9.5
1/2"	38.4	96	6.1	100.0	67.7	22.8	32.3
3/8"	17.5	83	3.4	100.0	55.5	12.1	44.5
#4	2.1	14	1.7	98.1	39.8	15.8	60.2
#8	1.4	3	.7	82.8	32.5	7.3	67.5
#16	1.2	1	.8	67.7	26.4	6.0	73.6
#30	1.2	1	.4	49.2	19.4	7.0	80.6
#50	1.1	1	.3	22.5	9.2	10.2	90.8
#100	1.1	1	.2	3.8	2.1	7.1	97.9
LBW	1.0	1	.1	0.6	0.9	1.3	99.1

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:	66	Workability Factor:	32	
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41	58, 40 60, 36 IPS Production 6 68,88		
25 40 45  ActionLimits Boundary =	50 55	Coarseness Factor (%)	75	 80 

Workability Factor:		36	
Sieve	Cumulative	%	Cumulative
	% 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"	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

PLANT #: P-02

71-47

71-47

63-115

Sample Date:

6AA

26A

2NS

**Production Gradation** 

Concrete Grade: DM, 4500HP

Dates Test Represents: 2/22/2022 2/28/2022 through Agg. Class Pit#

2/21/22

LILLILOLL	tillough	2/20/2022		
Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
Presque Isle	1555	9.51	2.62	53.5
Presque Isle	250	1.53	2.62	8.6
Ray Rd	1100	6.65	2.65	37.9

MDOT No.:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

35.5

Contractor:

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

	Total Wt	2905	17.69		100.0	< Verify this n	umbor ic 100%
	TOTAL VVI	2303	17.09		100.0	< verily trils it	uniber 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"	98.6	10	0.0	100.0	99.3	0.7	0.7
3/4"	85.6	10	0.0	100.0	92.3	7.0	7.7
1/2"	45.0	97	7.9	100.0	70.4	21.9	29.6
3/8"	23.0	89	9.3	100.0	57.9	12.5	42.1
#4	5.1	28	3.8	96.5	41.7	16.1	58.3
#8	3.0	10	).7	80.6	33.0	8.7	67.0
#16	2.5	4	.1	67.6	27.3	5.8	72.7
#30	2.3	3	.7	48.2	19.8	7.5	80.2
#50	2.2	3	.4	27.0	11.7	8.1	88.3
#100	2.1	3	.0	5.2	3.4	8.3	96.6
LBW	1.5	2	.4	0.9	1.4	2.0	98.6

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.

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

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

Coarseness Factor:	63	Workability Factor:	33	
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41	58, 39 68, 39 68, 38 68, 38 68, 38	75, 28	
40 45  ActionLimits Boundary =	50 5	Coarseness Factor (%) <sup>70</sup>	75	80

Batch Plant Gradations

Workability 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

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