## **Aggregate Optimization Chart**

### **Production Gradation Report**

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

Sample Date: 12/13/21 DM Concrete Grade: Dates Test Represents: 12/14/2021 12/20/2021 MDOT No.: through

Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1560	9.54	2.62	53.6
26A	71-47	Presque Isle	200	1.22	2.62	6.9
2NS	75-051	Mid-Michigan	1150	6.93	2.66	39.5
		Total Wt	2910	17.69		100.0

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

	i otai vvt	/t 2910 17.69		100.0	< Verify this number is 100%		
Sieve 6AA		6AA 26A 2		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"	99.0	100.0	100.0	99.5	0.5	0.5	
3/4"	85.6	100.0	100.0	92.3	7.2	7.7	
1/2"	42.5	97.6	100.0	69.0	23.3	31.0	
3/8"	24.8	86.4	100.0	58.8	10.3	41.2	
#4	3.5	16.7	98.9	42.1	16.6	57.9	
#8	1.9	5.3	81.3	33.5	8.6	66.5	
#16	1.7	2.9	64.0	26.4	7.1	73.6	
#30	1.6	2.7	48.6	20.2	6.2	79.8	
#50	1.6	2.5	27.2	11.8	8.5	88.2	
#100	1.5	2.3	9.0	4.5	7.3	95.5	
LBW	1.4	2.0	0.7	1.2	3.4	98.8	
Production Gra	dation O Batch Plant Gradati	ions    Aggregate Supplier G	Gradations	Adjusted WF	Initial Producti	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.

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

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

Coarseness Factor: 62 Workability Factor: 34 36.0 Coarseness Factor:  ### Workability Factor:    Sieve   Cumulative % Passing	Production Gradation	Batch Plant Grada	ations    Aggregate Supplier Gradation	ns	Adjusted WF	Initial Produc	tion Sample (IPS	3)
Sieve   Cumulative % Passing 2"   100.0   1.5"   10	Coarseness Factor:	62	Workability Factor:	34	36.0	Coars	seness Factor:	
Sieve % Passing  2" 100.0  1.5" 100.0  1.5" 100.0  3/4" 95.0  1/2" 70.5  3/8" 60.0  #4 44.4  #8 35.5  #16 28.5  #30 21.5  #50 10.2	45		•			Worl	kability Factor:	
35				JMF Zone	]	Sieve		F
1.5 100.0  1" 100.0  3/4" 95.0  1/2" 70.5  3/8" 60.0  #4 44.4  #8 35.5  #16 28.5  #30 21.5  #50 10.2	1 40				- 11	2"	100.0	
35   60, 38 coduction Gradation   3/4"   95.0   1/2"   70.5   3/8"   60.0   3/8"   60.0   45, 33   45, 33   57, 31   67, 68, 131   75, 28		5		75, 39	- 11	1.5"	100.0	
30 45, 33 52, 34 35, 31 6768,131 3/8" 60.0 #4 44.4 #8 35.5 #16 28.5 #30 21.5 #50 10.2			00, 30	I	- 11	1"	100.0	
30 45, 33 52, 34 35, 31 6768,131 3/8" 60.0 #4 44.4 #8 35.5 #16 28.5 #30 21.5 #50 10.2	5		■ 60.3Broduction Gradation		- 11	3/4"	95.0	
30 45, 33 52, 34 35, 31 6768,131 3/8" 60.0 #4 44.4 #8 35.5 #16 28.5 #30 21.5 #50 10.2	25 -		IPS I		- 11	1/2"	70.5	
57, 31 67 <sub>6</sub> 8,1 <sub>31</sub> #8 35.5 Operating Zone Boundary #30 21.5 #50 10.2		52, 34	<del>-!</del> :		- 11	3/8"	60.0	
#8 35.5 #16 28.5 #30 21.5 #50 10.2	45, 33				- 11	#4	44.4	
Operating Zone Boundary #16 28.5 #30 21.5 #50 10.2	30 -	5	67 <sub>6</sub> 3,1 <sub>31</sub>		- 11	#8	35.5	
Boundary #30 21.5 #50 10.2	Operating Zone				- 11	#16	28.5	
<b> </b>   #50   10.2	Boundary			75, 28	- 11	#30	21.5	
	≥ <sub>25</sub>					#50	10.2	
		50 55	5 60 65 70	75	80	#100	3.1	
40 45 50 55 60 65 70 75 80 LBW 1.3			Coaršeness Factor (%)	. 5	°°	LBW	1.3	

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

**PLANT #:** P-102

Sample Date:

**Production Gradation** 

12/13/21 DM Concrete Grade: 12/14/2021 12/20/2021 through

Contractor:

MDOT No.:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

37.6

Dates Test F	Represents:	12/14/2021	through	12/20/2021		
Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	58-003	Stoneco	1500	8.94	2.69	50.8
26A	58-003	Stoneco	305	1.82	2.69	10.3
2NS	63-114	Highland	1150	6.95	2.65	38.9
		Total Wt	2955	17.71		100.0

leight (SSD)	ft <sup>3</sup>	Gravity	70 Contribution
1500	8.94	2.69	50.8
305	1.82	2.69	10.3
1150	6.95	2.65	38.9
2955	17.71		100.0

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

	Total Wt	2955 17.71		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"	85.8	100.0	100.0	92.8	7.2	7.2
1/2"	48.0	99.6	100.0	73.6	19.2	26.4
3/8"	23.9	88.4	100.0	60.2	13.4	39.8
#4	3.6	7.6	99.6	41.4	18.8	58.6
#8	2.2	3.8	86.4	35.1	6.2	64.9 r
#16	2.0	3.2	64.8	26.6	8.6	73.4
#30	1.8	3.0	42.6	17.8	8.8	82.2 r
#50	1.7	2.8	16.9	7.7	10.1	92.3
#100	1.6	2.7	3.2	2.3	5.4	97.7 a
LBW	1.4	2.4	0.6	1.2	1.1	98.8

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:	61	Workability Factor:	35	
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 34	68, 38 Production Gradation 60,126	JMF Zone 75, 39 75, 28	
25	50 5	5 Coarseness Factor (%)	75	80

Batch Plant Gradations

Work	ability Factor:	36	
Sieve	Cumulative	%	Cumulative
0.010	% 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"	89.2	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

Contractor:

# **Aggregate Optimization Chart**

PLANT #: P-32

Sample Date:

12/13/21 Concrete Grade: 12/14/2021 12/20/2021

DM

38.0

Dates Test F	Represents:	12/14/2021	through	12/20/2021		
Agg. Class	Pit#	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1355	8.29	2.62	46.6
26A	71-47	Presque Isle	400	2.45	2.62	13.8
2NS	95-013	Smelter Bay	1150	6.95	2.65	39.6
		Total Wt	2905	17.69		100.0

MDOT No.:

--- Verify this number is 100%

**Coarseness Factor:** 

SUPERIOR	

#### **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
1.5"	100.0	100.0	100.0	100.0	0.0	0.0
1"	96.2	100.0	100.0	98.2	1.8	1.8
3/4"	73.0	100.0	100.0	87.4	10.8	12.6
1/2"	30.7	96.2	100.0	67.2	20.3	32.8
3/8"	14.5	77.5	100.0	57.0	10.1	43.0
#4	4.6	15.4	96.4	42.4	14.6	57.6
#8	3.1	4.5	84.4	35.5	7.0	64.5
#16	2.7	2.6	69.2	29.0	6.5	71.0
#30	2.6	2.1	49.0	20.9	8.1	79.1
#50	2.4	1.9	23.6	10.7	10.2	89.3
#100	2.2	1.7	6.2	3.7	7.0	96.3
LBW	1.7	1.1	1.0	1.3	2.4	98.7
Production Gra	adation O Batch Plant Grada	tions    Aggregate Supplier Gr	radations	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.

\*% 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:	35	
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 34	6, 40 68, 38 60, 38S 68, 38 roduction	75, 39 n Gradation	
25 40 45  ActionLimits Boundary =	50 59	Coarseness Factor (%) <sup>70</sup>	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

62

**PLANT #:** P-35 Sample Date:

Dates Test Represents:

12/13/21 DM Concrete Grade: 12/14/2021 12/20/2021 through

Contractor:

MDOT No.:

**Coarseness Factor:** 

Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	58-003	Stoneco	1550	9.23	2.69	52.5
26A	58-003	Stoneco	300	1.79	2.69	10.2
2NS	81-093	Burmeister	1100	6.65	2.65	37.3
		Total Wt	2950	17.67		100.0

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

	i otai wt	2950	17.67		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	<b>SA</b>	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"	85.8	100	0.0	100.0	92.5	7.5	7.5
1/2"	48.0	99	0.6	100.0	72.6	19.9	27.4
3/8"	23.9	88	3.4	100.0	58.8	13.8	41.2
#4	3.6	7.	.6	98.0	39.2	19.6	60.8
#8	2.2	3.	.8	86.3	33.7	5.5	66.3
#16	2.0	3.	2	72.8	28.5	5.2	71.5
#30	1.8	3.	.0	53.2	21.1	7.4	78.9
#50	1.7	2.	.8	19.0	8.3	12.8	91.7
#100	1.6	2.	.7	4.0	2.6	5.7	97.4
LBW	1.4	2.	.4	1.2	1.4	1.2	98.6
Production Gra	dation	ions	regate Supplier Gr	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.

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

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

Coarseness Factor:	62	Workability Factor:	34	36.2
45 45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41 <b>56,</b> 52, 34 <b>56,</b>	■ 60 13 Gradation	75, 39 75, 28	
25 40 45  ActionLimits Boundary =	50 55	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"	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

## **Aggregate Optimization Chart**

PLANT #: P-39

Sample Date:

12/13/21 DM Concrete Grade: 12/20/2021

Dates Test F	Represents:	12/14/2021	through	12/20/2021		
Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	71-47	Presque Isle	1605	9.82	2.62	55.2
26A	71-47	Presque Isle	200	1.22	2.62	6.9
2NS	63-92	Grange Hall	1100	6.65	2.65	37.9
		Total Wt	2905	17.69		100.0

MDOT No.:

**Coarseness Factor:** 

Contractor:

### **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 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"	99.0	10	0.0	100.0	99.4	0.6	0.6
3/4"	85.6	10	0.0	100.0	92.0	7.4	8.0
1/2"	42.5	97	7.6	100.0	68.1	24.0	31.9
3/8"	24.8	86	6.4	100.0	57.5	10.6	42.5
#4	3.5	16	6.7	98.2	40.3	17.2	59.7
#8	1.9	5	.3	86.3	34.1	6.2	65.9
#16	1.7	2	.9	71.1	28.1	6.0	71.9
#30	1.6	2	.7	52.3	20.9	7.2	79.1
#50	1.6	2	.5	22.3	9.5	11.4	90.5
#100	1.5	2	.3	3.3	2.2	7.3	97.8
LBW	1.4	2	.0	0.4	1.1	1.2	98.9
	Patch Plant Crad	ations Ago	rogato Supplior Gra	dations		1	

75, 28

80

75

 Batch Plant Gradations Aggregate Supplier Gradations **Production Gradation** Adjusted WF Intial Production Sample (IPS) **Coarseness Factor:** 34 36.6 64 **Workability Factor:** 45 JMF Zone 45, 44 52, 41 Workability Factor (%) ■ 60, 36 Production Gradation

Coarseness Factor (%)<sup>70</sup>

Workability Factor:		36	
Sieve	Cumulative % Passing		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

PREPARED BY: SM, LLC Technical Service

Operating Zone Boundary

45

ActionLimits Boundary = - - -

25

52, 34

50

55

PLANT #: P-O2 Contractor:

Sample Date: 12/13/21 Concrete Grade: DM

Dates Test Represents: 12/14/2021 through 12/20/2021 MDOT No.:

Agg. Class	Pit #	Source	Weight (SSD)	ft <sup>3</sup>	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	63-115	Ray Rd	1100	6.65	2.65	37.9
		Total Wt	2905	17.69		100.0

MDOT No.:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 



<u>S</u>	uperior Materials, LLC
3	0701 W. 10 Mile Rd.
S	uite 500
F	armington Hills, MI 48336

	i Otai Wt	2303 17.03		100.0	C Verily tills if	ullibel is 10076
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"	85.1	100.0	100.0	92.3	7.7	7.7
1/2"	37.5	96.2	100.0	67.2	25.1	32.8
3/8"	22.3	77.5	100.0	57.4	9.8	42.6
#4	2.9	15.4	96.8	39.7	17.7	60.3
#8	1.7	4.5	80.8	31.9	7.8	68.1
#16	1.5	2.6	65.3	25.8	6.2	74.2
#30	1.4	2.1	48.8	19.4	6.4	80.6
#50	1.4	1.9	27.6	11.4	8.0	88.6
#100	1.3	1.7	5.9	3.1	8.3	96.9
LBW	0.8	1.1	0.9	0.9	2.2	99.1

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.

 $\ensuremath{^{*}\%}$  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:	63	Workability Factor:	32	34.4
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41	58, 39 68, 39 68, 38 Production Gradation 58, 31 689, 38	75, 39 75, 28	
40 45  ActionLimits Boundary =	50 5	Coarseness Factor (%)	75	80

Batch Plant Gradations

**Production Gradation** 

Workability Factor:		35	
Sieve	Sieve Cumulative % Passing		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