## Aggregate Optimization Chart

### **Production Gradation Report**

PLANT #: P-101 Contractor:

Sample Date: 10/18/21 DM Concrete Grade: Dates Test Represents: 10/19/2021 10/25/2021 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

--- Verify this number is 100%

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
1.5"	100.0	100.0	100.0	100.0	0.0	0.0
1"	98.1	100.0	100.0	99.0	1.0	1.0
3/4"	82.8	100.0	100.0	90.8	8.2	9.2
1/2"	38.7	96.8	100.0	66.9	23.9	33.1
3/8"	22.7	87.6	100.0	57.7	9.2	42.3
#4	3.9	12.2	99.2	42.1	15.6	57.9
#8	2.0	3.0	82.6	33.9	8.2	66.1
#16	1.7	1.7	66.3	27.2	6.7	72.8
#30	1.6	1.5	51.1	21.2	6.1	78.8
#50	1.6	1.4	28.6	12.3	8.9	87.7
#100	1.4	1.2	8.2	4.1	8.2	95.9
LBW	1.3	1.1	1.1	1.2	2.9	98.8
Production G	Gradation O Batch Plant Grad	ations    Aggregate Supplier Gra	adations	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.

62

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

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

Production Gradation	Batch Plant Gra	dations        Aggregate Supplier Gradations	Adjusted WF	Initial Product	tion Sample (IPS)
Coarseness Factor:	64	Workability Factor: 34	36.4	Coars	seness Factor:
45				Work	cability Factor:
45, 44		IMF	Zone	Sieve	Cumulative
				Sieve	% Passing
1 40 1	52, 41		- 11	2"	100.0
<b>3</b> 40 1		57, 39 68, 38	75, 39	1.5"	100.0
				1"	100.0
		■ 60, 3βS Prodution Gradation		3/4"	95.0
Factor 35		117, 1PS		1/2"	70.5
1 /	52, 34	<del>-!</del>		3/8"	60.0
45, 33				#4	44.4
30 ]		<b>57</b> , <b>3</b> 1 <b>67</b> <sub>6</sub> <b>3</b> ,1 <sub>31</sub>		#8	35.5
Available 30 Avail				#16	28.5
Boundary			75, 28	#30	21.5
≥ <sub>25</sub>				#50	10.2
40 45	50	55 60 65 70 7	5 80	#100	3.1
		Coarseness Factor (%)	0	LBW	1.3
ActionLimits Boundary =					

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:

LBW

**Production Gradation** 

10/18/21 DM Concrete Grade: 10/19/2021 10/25/2021

Contractor:

MDOT No.:

Dates Test F	Represents:	10/19/2021	through	10/25/2021		
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	255	1.52	2.69	8.6
2NS	63-114	Highland	1150	6.95	2.65	38.9
		Total Wt	2955	17.71		100.0

%	
ntribution	
52.5	
8.6	
38.9	

0.6

36.4

99.4

**Coarseness Factor:** 

Adjusted WF Intial Production Sample (IPS)

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

	l otal 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"	81.1	100.0	100.0	90.1	9.9	9.9
1/2"	36.6	99.7	100.0	66.7	23.4	33.3
3/8"	18.3	89.5	100.0	56.2	10.5	43.8
#4	2.7	8.4	99.3	40.8	15.5	59.2
#8	1.3	1.4	85.1	33.9	6.9	66.1 r
#16	1.3	0.8	65.5	26.2	7.7	73.8
#30	1.0	0.8	44.5	17.9	8.3	82.1 r
#50	0.7	0.6	19.3	7.9	10.0	92.1
#100	0.7	0.5	3.9	1.9	6.0	98.1

Aggregate Supplier Gradations

0.6

0.4

\*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:	34	
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 34	68, 38 60µ86 Production	JMF Zone 75, 39 Gradation 75, 28	
25 40 45  ActionLimits 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"	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

61

PREPARED BY: SM, LLC Technical Service

0.7

Batch Plant Gradations

## Aggregate Optimization Chart

PLANT #: P-32

Sample Date:

Dates Test Represents:

**Production Gradation** 

10/18/21 DM Concrete Grade:

Contractor:

10/19/2021 10/25/2021 through

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

MDOT No.:

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

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\*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	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"	99.4	10	0.0	100.0	99.7	0.3	0.3
3/4"	85.0	10	0.0	100.0	92.5	7.2	7.5
1/2"	42.8	97	7.3	100.0	71.1	21.4	28.9
3/8"	24.6	85	5.8	100.0	60.8	10.3	39.2
#4	4.3	19	9.4	96.3	42.3	18.5	57.7
#8	2.3	5	.3	83.3	34.7	7.6	65.3
#16	2.0	2	.6	68.0	28.2	6.5	71.8
#30	1.8	2	.0	48.7	20.4	7.8	79.6
#50	1.8	1	.9	24.7	10.9	9.5	89.1
#100	1.7	1	.7	7.8	4.1	6.8	95.9
LBW	1.2	1	.4	1.8	1.5	2.7	98.5
Production Gra	adation O Batch Plant Grada	tions   Agg	regate Supplier Gr	adations	Adjusted WF	Intial Production	on Sample (IPS

Coarseness Factor:	60	Workability Factor:	35	37.2
45, 44 (%) 40 (%) 45, 33 Operating Zong Boundary	52, 34	6. 40 67, 40 68, 38 Production Gradation 60, 38S 68, 31	75, 39	
25 40 45 ActionLimits Boundary =	50 55	Coarseness Factor (%)	75	80

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

PLANT #: P-35

Sample Date:

10/18/21 Concrete Grade: 10/19/2021 10/25/2021 through

Contractor:		
	· ·	

MDOT No.:

**Coarseness Factor:** 

DM

34.7

Dates Test F	Represents:	10/19/2021	through	10/25/2021		
Agg. Class	Pit#	Source	Weight (SSD)	ft <sup>3</sup>	Specific Gravity	% Contribution
6AA	58-003	Stoneco	1555	9.26	2.69	52.6
26A	58-003	Stoneco	300	1.79	2.69	10.2
2NS	81-093	Burmeister	1100	6.65	2.65	37.2
		Total Wt	2955	17.70		100.0

Source	Weight (SSD)	ft³	Gravity	Contribution
Stoneco	1555	9.26	2.69	52.6
Stoneco	300	1.79	2.69	10.2
Burmeister	1100	6.65	2.65	37.2
Total Wt	2955	17.70		100.0

SUPER	IOR

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

Farmington Hills, MI 48336

	i otai vvt	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"	81.1	100.0	100.0	90.1	9.9	9.9	
1/2"	36.6	99.7	100.0	66.6	23.4	33.4	
3/8"	18.3	89.5	100.0	55.9	10.7	44.1	*
#4	2.7	8.4	98.7	39.0	16.9	61.0	*,
#8	1.3	1.4	84.2	32.2	6.8	67.8	no
#16	1.3	0.8	66.7	25.6	6.6	74.4	*(
#30	1.0	0.8	46.8	18.0	7.6	82.0	no
#50	0.7	0.6	16.5	6.6	11.5	93.4	*(
#100	0.7	0.5	2.8	1.5	5.1	98.5	a 2
LBW	0.7	0.4	0.9	0.7	0.7	99.3	
Production Gradation	Batch Plant Gradation	ons	Gradations	Adjusted WF	Intial Production	on Sample (IPS	3)

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

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

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

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

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

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

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

Coarseness Factor:	65	Workability Factor:	32	
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41 56, 52, 34	68, 38 ■ 60 <sub>1</sub> β§ ■ Production Gr	75, 39 radation	
40 45  ActionLimits Boundary =	50 55	Coarseness Factor (%)	75	80

Workability 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

35.4

# Aggregate Optimization Chart

10/19/2021

PLANT #: P-36 Sample Date: 10/18/21 DM Concrete Grade: Dates Test Represents:

through	10/25/2021		
Veight (SSD)	ft <sup>3</sup>	Specific	%

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
2NS	63-92	Grange Hall	1100	6.65	2.65	37.9
		Total Wt	2905	17.69		100.0

Contractor:

MDOT No.:

Coarseness Factor:

SUPERIOR

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

0	
.0	
.2	
.2	*Maximum % Re

63

etained 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	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"	98.0	100.0	100.0	99.0	1.0	1.0
3/4"	78.0	100.0	100.0	89.0	10.0	11.0
1/2"	36.3	97.3	100.0	67.8	21.2	32.2
3/8"	19.2	85.8	100.0	57.8	10.0	42.2
#4	3.8	19.4	97.6	41.2	16.6	58.8
#8	2.2	5.3	82.2	32.9	8.3	67.1
#16	1.9	2.6	67.2	26.7	6.2	73.3
#30	1.8	2.0	49.3	19.8	6.9	80.2
#50	1.7	1.9	23.1	9.8	10.0	90.2
#100	1.6	1.7	3.3	2.3	7.6	97.7
LBW	1.1	1.4	0.2	0.8	1.5	99.2
roduction Grad	lation O Batch Plant Gradati	ons	Gradations	Adjusted WF	Intial Producti	on Sample (IPS

Coarseness Fa	ctor: 63	Workability Factor:	33	
45 45, 44 45, 44 45, 33 Operating Bound	ng Zone	58, 39 60, 36 pegduction 6radation 688, 31	75, 28	
25 +	5 50 55	Coarseness Factor (%) <sup>70</sup>	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"	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

Total Wt

Batch Plant Gradations

**Production Gradation** 

PLANT #: P-39 Contractor: \_\_\_\_\_\_\_
Sample Date: 10/18/21 Concrete Grade: DM

Dates Test Represents: 10/19/2021 10/25/2021 through Specific % ft<sup>3</sup> Agg. Class Pit# Source Weight (SSD) Gravity Contribution 6AA 71-47 Presque Isle 1605 9.82 55.2 2.62 26A 71-47 Presque Isle 200 1.22 2.62 6.9 2NS 44-051 Krake Willis Rd 1100 6.65 2.65 37.9

2905

MDOT No.:



<---- Verify this number is 100%

Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

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"	98.1	100.0	100.0	99.0	1.0	1.0
3/4"	82.8	100.0	100.0	90.5	8.5	9.5
1/2"	38.7	96.8	100.0	65.9	24.6	34.1
3/8"	22.7	87.6	100.0	56.4	9.5	43.6
#4	3.9	12.2	97.1	39.8	16.7	60.2
#8	2.0	3.0	81.2	32.1	7.7	67.9
#16	1.7	1.7	65.8	26.0	6.1	74.0
#30	1.6	1.5	49.4	19.7	6.3	80.3
#50	1.6	1.4	25.4	10.6	9.1	89.4
#100	1.4	1.2	8.4	4.0	6.6	96.0
LBW	1.3	1.1	1.6	1.4	2.6	98.6

Aggregate Supplier Gradations

17.69

\*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:	64	Workability Factor:	32	34.6
45 45, 44 45, 44 45, 33 Operating Zone Boundary	52, 41	56, 40 60, 36 IPS Production Grada 56, 832	75, 39 tion	
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"	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 Approved By

PLANT #: P-02 Contractor: Sample Date: 10/18/21 DM Concrete Grade:

Dates Test Represents: 10/19/2021 10/25/2021 through Specific % ft<sup>3</sup> Agg. Class Pit# Source Weight (SSD) 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

MDOT No.:



Adjusted WF Intial Production Sample (IPS)

**Coarseness Factor:** 

35.1

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

	Ťotal Wt	2905	17.69		100.0	< Verify this n	umber is 100%
Sieve	6AA	26	5A	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"	98.0	10	0.0	100.0	99.0	1.0	1.0
3/4"	78.0	10	0.0	100.0	88.6	10.4	11.4
1/2"	36.3	97	7.3	100.0	66.7	21.9	33.3
3/8"	19.2	85	5.8	100.0	56.7	10.0	43.3
#4	3.8	19	9.4	96.4	40.5	16.2	59.5
#8	2.2	5	.3	81.6	32.6	7.9	67.4
#16	1.9	2	.6	67.6	26.9	5.7	73.1
#30	1.8	2	.0	52.3	20.9	5.9	79.1
#50	1.7	1	.9	28.6	11.9	9.0	88.1
#100	1.6	1	.7	6.6	3.5	8.4	96.5
LBW	1.1	1	.4	1.0	1.1	2.4	98.9

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 F	actor: 64	Workability Factor:	33	
1 - 11 '	ting Zone	68, 39 68, 38 68, 38 1PS Production Gradation		
25 +	45 50 55	<sup>5</sup> Coarseness Factor (%)	75, 28 75	80

Batch Plant Gradations

**Production Gradation** 

Wor	kability 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"	95.1	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