1/24/2016

HMA Materials

Session 3



What are HMA pavements made out of?

- Aggregates (~95% by weight or ~85% by volume)
- Asphalt Cement (~5% by weight or ~15% by volume)



What is HMA made of

- Aggregates (93-96% by weight) Load bearing components of the mix Skid resistance, stability, workability
- PG binder (4-7% by weight)
 Glue or muscle that holds everything together Flexibility, durability
- ► Air

Allows proper compaction for the pavement to remain flexible



Aggregates



Aggregate Properties

- Aggregates have several physical properties that are of importance to the asphalt pavement designer:
 - Gradation & Size
 - Particle Shape
 - Toughness
 - Durability / Soundness
 - Cleanliness (deleterious materials)
 - Absorption
 - Specific Gravity
 - Adhesion
 - Surface Texture



Aggregate Properties



- Toughness:
 - Resist crushing, degradation and disintegration
- Durability / Soundness:
 - Resistance to breakdown from wetting and drying
- Freeze Thaw
 - Resistance to breakdown from freeze thaw cycles



Aggregate Properties

- Absorption:
 - Capacity to absorb water or Asphalt

Specific Gravity

- Ratio between the weight of a given volume of the aggregate and the weight of an equal volume of water (@23°C).
- Means of expressing a weight volume relationship



Aggregate Production

Crushing Operation Overview

- Stripping overburden
- Drilling and blasting
- Primary Crushing
- Scalping off larger size intermediate sizes to second and tertiary crushers for further reduction (when necessary)
- Washing to remove silt, clay and other tenacious coatings (when necessary)
- Stockpiling



Aggregate Production



Aggregate Production Simplified Crusher Set-up





Aggregate Production

Potential sources of Segregation

- Aggregate falling great distances from the conveyor belt to stockpile
- Travelling long distances on conveyor belts
- Dozers pushing/working stockpiles
- Improper loading of trucks/bins by loader operator



WisDOT Standard Specification 460

- Aggregates
 - Department-approved source
 - Gradation Master Range
 - Consensus/Volumetric Properties
 - Design limits may differ from production tolerances
 - Additives, antistrip, rejuvenators and stabilizing agents
 - Recycled Asphaltic Material
 - Production testing

Field Inspection: contact Materials personnel to verify source compliance



WisDOT Standard Specification 460

- RAM (Recycled Asphaltic Materials)
 - RAP-Reclaimed Asphaltic Pavements
 - May be fractionated into different sizes, then identified as FRAP
 - RAS-Recycled Asphalt Shingles (tear offs or manufacturer waste-limited to 5% total weight
 - Stockpile sampling/testing same as any other aggregate source
 - Extractions required to adjust asphalt contents
 - Controlled by binder replacement percentage and not by weight









WisDOT Standard Specification 460

Max. Allowable Lower Layer	%Binder Replacement Upper Layer
25	20
40	25
AP 35	25
	Max. Allowable Lower Layer 25 40 AP 35





Asphalt Binder



Asphalt

- Sweet vs. Sour
 - Amount of Sulfur
- Light vs. Heavy
 - Light-Middle East & North America
 - Heavy-Venezuela & Canada



Background

Refinery Operation



Asphalt

- Asphalt cement is a viscoelastic material (viscous properties at high temperatures and elastic properties at low temperatures
- Asphalt is a *thermoplastic* material that softens as it is heated and hardens when cooled



Asphalt Binder Grading System

 Performance Graded Binders uses measured physical properties that can be directly related to field performance by engineering principles



PG Binder Grading Spec

CEC													
Avg 7-day Max, °C	PG 46	PG 52	PG 58	PG 64	PG 70	PG 76	PG 82						
1-day Min, °C	-34 -40 -46	-10 -16 -22 -28 -34 -40 -46 -	16 -22 -28 -34 -40 -10	-16 -22 -28 -34	-40 -10 -16 -22 -28 -34	-40 -10 -16 -22	2 -28 -34 -10 -16 -22	-28 -34					
		ORIGINAL											
<u><⊃</u> ≥ 230 °C		(Flash Point) FP Safety											
<u> </u>		(Rotational Viscosi	ty) RV	Hig	gh Ten	np Handl	ing					
	(Dynamic Shear Rheometer) DSR G*/sin 8 Workability												
<u> </u>	46	52	58	64	70	76	82						
(ROLLING THIN FILM OVEN) RTFO Mass loss ≤ 1.00 %													
> 2 20 kPa		(Dynamic Shear Rheometer) DSR G'/sin 8 Rutting Resistance											
<u> </u>	46	52	58	64	70	76	82						
		(PRESSURE AGIN	g vessel) F	PAV									
20 Hours, 2.07 MPa	90	90	100	100	100 (110)	100 (110) 110 (110)						
		(Dynamic Shear Rheometer) DSR G* sin 8 Fatigue Cracking											
	10 7 4 3	25 22 19 16 13 10 7 2	5 22 19 16 13 31	28 25 22 19 1	6 34 31 28 25 22	19 37 34 31	28 25 40 37 34	31 28					
S <u><</u> 300 MPa 🛛 🐺 m <u>></u> 0.300		(Bending	g Beam Rheomete	r) BBR "s	" Stiffness & "m	'- value	Thermal (Cracking					
n n	-24 -30 -36	0 •6 •12 •18 •24 •30 •36 •	6 -12 -18 -24 -30 0	6 -12 -18 -24 -	30 0 -6 -12 -18 -24	30 0 -6 -12	2 -18 -24 0 -6 -12	-18 -24					
Report Value		(Bendin	g Beam Rheomete	r) BBR P	hysical Hardening	9							
<u>≥</u> 1.00 %			(Direct Tensi	ion) DT	Th	ermal	Cracking	1					
	-24 -30 -36	0 •6 •12 •18 •24 •30 •36 •	6 -12 -18 -24 -30 0	6 . 2 . 18 . 24 .	30 0 -6 -12 -18 -24	30 0 6 -12	2 -18 -24 0 -6 -12	-18 -24					



PG Binder Grading

Common Grades:

- PG 58-28
- PG 58-34
- PG 64-22**
- PG 64-28
- PG 70-28

6°C Increments



New MSCR Binder Protocols

Current Grade	New Grade Comparison
58-28	58-28 S
64-28P	58-28 H
70-28P	58-28 V
58-34	58-34 S
64-34P	58-34 H
70-34	58-34 V
The TRAINED	

WisDOT Standard Specification 455

General

- Furnish (and sample) asphaltic material conforming to the department's "Combined State Binder Group Certification Method of Acceptance for Asphalt Binders."
 - Field Inspection Sample Accordingly (Get copy of BOL)
- Do not change the grade of PG materials
 - Field Inspection Visual (Document Findings)
- Use only clean, dry sample containers free from cleaning oil or other contamination. Tightly seal, identify and submit. The Bureau of Technical Services tests the material.
 - Field Inspection Sample Accordingly (Get copy of BOL)



1/24/2016

HMA Mix Design



Superpave

Superpave Design Looks at Pavement Performance:

- Asphalt Binder Grades related to temperature
- Aggregates are looked at more closely
- Mix Designs better simulate field conditions
- All aspects are based on traffic loading (ESALs)
 - Equivalent Single Axle Loads
 - Based off of 20 years



HMA Mix Design

- The amount of air voids measured in the HMA mixture is the most important factor in predicting HMA pavement performance
 - 3-5% air voids has historically proven to provide the best pavement performance
 - Compaction specifications require ~10% air voids (or min. 89.5% density)
 - After 3 years of traffic loading, the pavement air voids reduce to ~4%



Air Voids Relationships



WisDOT Mix Designation

- ► E-0.3
- ►-1 ►-3
- E-10
- E-10
- E-30
- E-30X
- SMA

- Nominal Aggregate Size
 - 9.5 mm
 - 12.5 mm (upper layer)
 - 19.0 mm (lower layer)
 - 25.0 mm
 - 37.5 mm



New WisDOT Mix Designations

- LT <2 Million ESALs</p>
- MT 2-8 Million ESALs
- HT >8 Million ESALs
- SMA >5 Million ESALs
 - Applies to surface mixes only











Superpave Mix Sizes

19.0 mm

25.0 mm

37.5 mm





9.5 mm (#5)



12.5 mm (#4)

New Mix Designations

19.0 mm (#3)

25.0 mm (#2)

37.5 mm (#1)



WisDOT Specification

Aggregate Specs are based on ESALS

	IADLE 4	00-2 MIAI	JRE REGUI	REMENTS				
Mixture type	E - 0.3	E - 1	E - 3	E - 10	E - 30	E - 30x	SMA	
ESALs x 10 ⁶ (20 yr design life)	< 0.3	0.3 - < 1	1-<3	3 - < 10	10 - < 30	≥ 30		
LA Wear (AASHTO T 96) 100 revolutions(max % loss) 500 revolutions(max % loss)	13 50	13 50	13 45	13 45	13 45	13 45	13 45	LA Wear
Soundness (AASHTO T 104) (sodium sulfate, max % loss)	12	12	12	12	12	12	12	
Freeze/Thaw (AASHTO T 103) (specified counties, max % loss)	18	18	18	18	18	18	18	
Fractured Faces (ASTM 5821) (one face/2 face, % by count)	60/_	65/_	75/60	85 / 80	98 / 90	100/100	100/90	Crush Count
Thin or Elongated (ASTM D4791) (max %, by weight)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	5 (5:1 ratio)	20 (3:1ratio)	
Fine Aggregate Angularity (AASHTO T304, method A, min)	40	40	43	45	45	45	45	FAA
Sand Equivalency (AASHTO T 176, min)	40	40	40	45	45	50	50	Sand Equivalency
Gyratory Compaction								
Gyrations for Nini	6	7	7	8	8	9	8	Or most in a large state
Gyrations for N _{des}	40	60	75	100	100	125	100	Gyration Level
Gyrations for Nmax	60	75	115	160	160	205	160	
Air Volds, %Va (%Gmm @ Ndes)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	4.0 (96.0)	
% G _{mm} @ N _{ini}	< 91.5 ⁽¹⁾	< 90.5 ⁽¹⁾	< 89.0 ^{/1/}	< 89.0	< 89.0	< 89.0		
% G _{mm} @ N _{max}	≤ 98.0	≤ 98.0	≤ 98.0	≤ 98.0	≤ 98.0	≤ 98.0	_	
Dust to Binder Ratio ⁽²⁾ (% passing 0.075/Phe)	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	0.6 - 1.2	1.2 - 2.0	
Voids filled with Binder (VFB or VFA, %)	70 - 80 [4] [5]	65 - 78 [4]	65 - 75 [4]	65 - 75 [3] [4]	65 - 75 <i>[3]</i> [4]	65 - 75 (3) [4]	70 - 80	
Tensile Strength Ratio (TSR) (ASTM 4867) no antistripping additive with antistripping additive	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
Draindown at Production Temperature (%)	_	_	_	_	_	_	0.30	



Figure 3 Mix Design submittal form 249





Project D	notional	STH 25	STADK	
It the Do	bo	August 15, 2013	JIANK ASPHA	NT.
Project II	DW NC	1390-04-81	Korth	
Specifica	peditorition Type WikDOT 12.5-mm E-0.3		50 10	
Derign IC	0	NI/0 13D9	117.10 Ste at Hampton A.w.	
MILEOT	MIC IDW		MIW sukee, VA153225	
			Phone: (414) 465-0644 Fax: (414) 465-3505	
Aggregat	e Source	Bituminous N	∕l× Design Report	
	Percent	Material	Source	GtD
AGG#1	12.0	5.6° C 10 (H)	HalquistSussex NOU S35 T8N R 19 E	2.724
AGG#2	23.0	3.8° C 10 (H)	Halquist Sussex NOU S35 T8N R 19E	2.729
AGGER	25.0	Mitt d San d (LC)	Latarde Colgate NW S36 TSN R 19 E	2,684
0000	22.0	Top Cred 4Ch	Lations Colomba Million 26 TRN 8 50 F	0.000

0000	2010	Mill a Salia (DS)	Training contain	1000 300 10101	196	2.004	
AGGEN	25.0	Top Said (LC)	Lataige Colgate	NUU S 36 T8N F	R19E	2.660	
AGGIN							
AGG#6	3 K	- 2				5	
AGGIR	2.2	1				1	
AGGIR							Percent of Total life
RAM#1	12.6	RAP (NIN)	Northwest	PD-43%		2,681	1251
RAM#2	2.4	RAS	Northwest	PD=21.5%		2.650	2.89
TOTAL	100.0	1	3		Comb he d G 🖕	2.692	S
					CombliedG_	2.747	
Aggregat	e Gradation						
0	Siette	3				1	Spec. Lh

(510)	(finition)	7656/1	7656 #2	800#3	200 14	X66#5	20.040	2056#1	20.040	(SAMP)	85082	JWC	Lower	Upper
2	50	100.0	100.0	100.0	100.0					100.0	100.0	100.0		_
1.5*	37.5	100.0	100.0	100.0	100.0	3 3	3		8	100.0	100.0	100.0		
r	25	100.0	100.0	100.0	100.0	8 1	4		li	100.0	100.0	100.0	. <u>\$</u>	
34*	19	100.0	100.0	100.0	100.0					100.0	100.0	100.0	100	
1/2*	12.5	80.5	100.0	100.0	100.0	8 - 6			8	98.7	100.0	97.5	90	100
36.	9.5	16.5	770	100.0	100.0	8 - 3	8 <u>8</u>		8	94.3	99.9	84.1	And the second second	90
No 4	4.75	3.6	2.5	99.1	99.9					75.3	96.7	62.9		
No 8	2.36	2.8	17	69 D	87.8	1			8	56.4	92.6	49.8	28	58
No 16	1.18	2.5	1.7	42.1	72.1	S - 3	4		8	42.5	73.1	37.0	1.000	
No 30	0.600	2.4	1.6	27.2	51.9					32.2	47.7	26.4		
No SD	0.300	2.3	15	16.6	17.4	1				21.0	38.6	13.6	1	
No 100	0.150	2.2	15	8.5	4.1					14.4	31.4	7.3		
No 200	0.075	2.0	1.4	4.5	20	g			19	11.1	24.5	5.1	2	10
Absorp	tbi [8]	1.4	1.4	1.8	19					1.1	1.4	15	0.00	
Fractured	1-Face [6]	100.0	100.0									100	28	60
Fractured	2-Fax [%]	98.0	967	3		3			13			97		
ThhorE	or gated [%]	1.8	2.1									20	5	5
Debterious	Material (%)	0.0	0.0	0.0	00	2			8		1	0.0	6	
LA Vilea	100.500	4.3/22.0	43/22.0	5.8/29.1	58/29.1							1.44	\$ 13	950
Soud	iess [%]	3.7	37	2.5	25	8 - 3	1 3		8		1	30	5	12
Freeze/	Tiaw [%]	1.6	1.4	1.7	17	S	1 8		15		8	1.6	S	18
Flie Agg	Aigitany		10 B	46.2	41.0	19 - 3	3				8	43.6	2 1	40
Sand Ed	t hubben ce		6 8	35.4	89.1	÷			1		ŝ.	87.8	21	40



Verified Aggregate Halquis I Sussex Latinge Colgaie 0-225-007-9-2013 0-225-007-3-2011





Carl Johnson HMA-MD, HMA-TPC





ONST	RUCTIO	AN CO	MA	THE	CC GENE	RAL CO	RU	CII TORS	on (<u>co.</u>		
			920 10 TH	AVE N	POST	OFFICE B	IOX 189	ONA	LASKA.	WI 54650		
MA	\mathbf{ATE}	\mathbf{IY}	520 10									
		77		PHONE	608-781-4	1683	FAX 608	-781-469	4			
ONA	LASKA	.W	R	eport of	Bitumi	nous Mi	ix Desig	In				
Project N	lame	Necedah	- Coloma	STH 21								
Date		July 3, 20)14							\sim		
Project #		6160-03-	82							<u> </u>		
Test#		15-14-59	6-E1-12.5	i(R)					-	AABHTO RI		
County		Adams										
Specifica	tions	12.5mm	E1 Mix									
Course/L	.ayer											
Aggrega	te Sourc	es										
	Percent	Material				Location	/ Source				Gas	
1	25	3/4" X 3/	8" Bit Gra	uel/5214)		Monthey	Fast Dit/2	6/35 17 1	7E Adam		2 746	
2	15	3/8* Bit G	sravel (52)	25)		Manthey	East Pit/2	6/35 17	7E Adam	8	2.740	
	15	1/8" Was	hed Man	Sand(340	4)	Tork/1 22	2.5E Wood	1		-	2,719	
4	25	5/8" Scre	ened San	d(5501)	.,	Manthey	East Pit/2	6/35.17 7	7E Adam	5	2.665	
5	20	RAP(5.7	%AC)(720	16)		Manthey	Stockpile				2.733	
6						Ĺ (
7												
8												
Total	100.0	1	2	3	4	5	6	7	8	Comb G _{sb}	2.718	
Virgin A	gg Blend	31.25	18.75	18.75	31.25					Comb G _{at}	2.756	
Aggrega	ite Grada	tions			Mat	tarial					Sr	
(Std)	(mm)	1	2	3	4	5	6	7	8	Job Mix	High	Low
2"	50	100.0	100.0	100.0	100.0	100.0	-		1	100.0		
1.5"	37.5	100.0	100.0	100.0	100.0	100.0				100.0		
1"	25	100.0	100.0	100.0	100.0	100.0				100.0		
3/4"	19	100.0	100.0	100.0	100.0	100.0			1	100.0		
1/2"	12.5	83.0	100.0	100.0	98.0	99.0				95.1		
3/8"	9.5	41.0	100.0	100.0	94.0	94.0				82.6		
#4	4.75	5.2	76.0	99.0	84.0	79.0				64.4		
#8	2.36	3.0	52.0	84.0	76.0	60.0				52.2		
#16	1.18	2.7	37.0	55.0	71.0	46.0				41.4		
#30	0.6	2.6	29.0	37.0	55.0	36.0				31.5		
#50	0.3	2.4	22.0	21.0	22.0	23.0				1/.2		
#100	0.075	2.0	15.0	1.6	0.0	14.0				0.2		
#200	0.075	1.0	10.4	1.0	2.0	5.0				4./	42	
5000	uness (E00 Rev	225-215	225-215	225-20	225-215						12	XBM
Crush 1	Face (%)	2011	100.0	2014	2011	91.0				89.7	13 8 5	Min
Crush 2	Face (%)	96.0	100.0	100.0	33.0	89.0			-	88.5		
Sand	Equiv.	00.0	100.0						<u> </u>	80	40	Min
Flat & E	long (%)	1.8	4.0	1.0	0.4	1.6				1.8	51	Max.
Fine A	gg Ang									42.8	40	Min
Wate	r Abs.	1.1	1.0	0.1	0.6	1.0				0.8		
							10040010					









Signature <u>ff 5. Jugar</u> Cert. No._ Date: 7/3/2014 361



Mathy Construction Co. -- MTE





M Sec.		1 A A	
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ROCE ROAD COMPANIES INC.			Rock	Road C		nies Mix	C Design	44 •		6	
Project:	STH 26 Jan	wille-Fort Atkinson	1	Spec.	WisDOT	1	RR Plant &	4068-07		Date:	4/28/2014
Project #	15	90-04-80	j	RR Mix #	RR0288]	MD Tech Signature :	Array -		-	
Mix Type:	12.5	mm E-0.3R	j	WisDOT #	0	j	MD Tech Print :	Jon Wixom	i		
4	2g #	1		2			3	4	6	ASPHALT	1
Aggregate	Description	1/2" RAP		5/8" STONE			WMS	BS	Dust	PG 58-28	1
Source D	resignation	Rock Road Co.		Bjoin Querry ; SW 1/4 SS8 T3N R11E; Rock County			Townline Pit ; NE 1/4 S1 T1N R12E; Rock County	Townline Pit; NE 1/4 81 T1N R12E; Rock County	Rock Road	BP Products North America, Bartlett IL]
Sou	irce #	4068-07		NIA			52400-28	52400-28	4068-07	8220-01	4
	Test#			225-0048-2012			225-0041-2013	225-0041-2013	a	1.031	1
Source Quality Data	Sound	TRUE.		10.4			22	22			
	Freeze	NA		0.2735.0 N/A			NIA	N/A			
SiAn	regate	41.0		15.0			7.0	36.0	10		Webot
100	a c parc	41.4		10.0			1.00	30.0	1.4	JMF Blend	12.5 mm E-0.3
1 1/2*	37.5mm	100.0		100.0			100.0	100.0	100.0	100.0	
r	25.4mm	100.0		100.0			100.0	100.0	100.0	100.0	
3/4"	19.0mm	100.0		100.0			100.0	100.0	100.0	100.0	100
1/2*	12.5mm	100.0		88.0			100.0	99.8	100.0	97.7	90 - 100
3/8	9.5mm	95.4		35.0			100.0	90.0	100.0	87.0	SO max.
	2.26mm	74.1		20			70.0	78.5	100.0	60.0	28.58
#16	1.18mm	43.9		1.0			40.0	60.5	100.0	43.8	20100
#30	0.6um	33.3		1.0			24.0	45.8	100.0	89.0	
#50	0.3um	19.7		1.0			14.0	11.0	100.0	14.1	
#100	0.15um	11.8		1.0			7.0	2.1	90.5	7.1	
#200	0.075um	7.9		0.7			3.4	1.3	78.0	4.8	2.0 - 10.0
0	AA.	95.5		100			100	38.5	100	83.4/81.3	60/
	AA	43.9					48.9	40.1		42.7	40 MIN
Ag	g Abs	1.7		24			1	0.8	1	1.2%	Agg Abs
BAN	and and	2.000		2.630			2/18	2.045	2.700	2.656	Gab
1998	14.60	4.4%								1.0%	Plat & Elong.
	% Gmr	n @ Optimum		1	HMA Mixture Li	guid AC Properties	1	[Volumetric Pro	perties at Ndes	
N Level	Nini	Ndes	Nmax	1	Total Pb	5.3%		%AC	%Air Voids	%VMA	%VFA
Reva	8	40	80	1	Virgin Pb	3.5%	1	5.0%	5.0%	15.3%	67.6%
% Gmm	91.1%	95.8%	98.6%		Pba	0.5%	1	5.5%	3.4%	15.0%	77.1%
					Pbe	4.8%		6.0%	2.4%	15.2%	84.0%
	HMA Mixing and C	ompaction Temperatures			RAM Pb	1.8%	1				
Mixing Temp.	300F	Compection Temp.	275F				Optimum	5.3%	4.0%	15.1%	73.5%
MIX TYPE-	12.5mm E-0	3R SUPERPAV	E MIX DESIG	N	Ontimum D	esion Data		MIX#	RR0288		
# of G	rations	% A	C	% Binder R	eplacement	961	Voids	V	AA	Gn	000
#010	10	53	6	34 (1%**	4	0%	15	1%	24	81
		0.0	-								
6	mb	VE	<u>م</u>	6	CO		Sch	Due	t/AC	т	R
6		VF	1		se		050	Dus	040	ISR	
2.	382	73.5	%0	2.0	592	2	.606	1.	00	92.	2%
2.302 13.		-		** Add. Binder	Testing Passed			*(0.6-1.2)	Based on Pbe	21	Reva

CRM				82	PORT OF SU	PERPAVE	OLUMETRIC	MIX DESIGN Issued Date: 8/8/2014					/2014
W234 N798	Busse Road				(AASHTO N	IP-2, PP-28	T312 & ASTN	1 D 4867)	7) Amended Date: 8/8/2014				
Waukesha,V	VI 53072												
(262) 524-17	21												
De	sign Number:	506514				300:	1300-13-70						
	Plant	waukesh	a Planc			міх туре:	5.5		Mix ten	operature: 130-1	49°C		
	Mix Size:	1/2" (12.)	Smm)	De	sign ESAL Re	inge (mil):	1 to <3						
	Effort:		Nic	7	Nd	5 75		Nm	c 115				
Rinda	- Data:		GRADE	84 88-38	1011		CRAMING AND			(D) 1 030	Ebs:		
-						AGGREGAT	E SOURCE DA	TA				-	
AGG	AGG	REGATE			SOURCE		TESTE		LOCATION				Psb
477 81	1/8"	Chins			Waukesha		1010		526 T7N 819F W	Autority County			
477 27	3/8"	Chips			Waukesha				\$26 T7N 819F W	Aukesha County			
Arr #3	MEG	D Sand			Waukecha				\$26 T7N 819E W	aukesha County			
477.84	Netto	nal Sand			labosan				SETEN BIRE W	whethe County			
Are #1	Dec				40002				40002				
444.86	5040				40002				40002				4.75
						AGGREGA	TE GRADATIC	NN.					
		Acetti	Acc #2	Acc #3	Acc 24	Acc #5	Acc 25				IME	SPECIE	CATIONS
%0	lend	11.0	9.0	16.0	36.0	1.0	27.0					MIN	MAX
											-		
2	50.0 mm	100.0	100.0	100.0	100.0	100.0	100.0				100.0		
1 1/2	37.5 mm	100.0	100.0	100.0	100.0	100.0	100.0				100.0		
1	25.0 mm	100.0	100.0	100.0	100.0	100.0	100.0				100.0		
3/4	19.0 mm	100.0	100.0	100.0	100.0	100.0	100.0				100.0	100	100
1/2	12.5 mm	84.9	100.0	100.0	100.0	100.0	100.0				98.3	90	100
3/8	9.5 mm	16.0	92.6	100.0	100.0	100.0	96.3				89.1		90
#4	4.75 mm	2.1	5.8	88.3	96.5	100.0	72.6				70.2		
#8	2.36 mm	1.5	1.8	30.4	86.3	100.0	53.6				54.9	28	58
#16	1.18 mm	1.3	1.6	32.0	73.8	100.0	41.3				44.3		
#30	0.6 mm	1.2	1.4	15.7	61.7	100.0	29.2				33.9		
=30	0.3 mm	1.2	1.3	9.5	22.1	100.0	20.1				16.2		
#100	0.15 mm	1.1	1.2	5.4	3.9	100.0	14.9				7.5		
=200	0.075 mm	1.0	11	3.3	1.8	100.0	12.4				5.7	2.0	10.0
	FAA			46.6	42.0						43	43	
	Gsb	2.777	2.764	2.733	2.668		2.697				2.707		
					AGGREG	ATE DATA P	OR BLENDED	DESIGN J	MF				
	CRUSH 1F/2F:	100/100		Gsb:	2.707	Moist.	Absorption:	0.9	LA	WEAR:	ELONG	ATED:	0.6(3/1)
	FAA:	43		Gsa:	2.775	Dust	Proportion:	1.2					
	SE:	94		Gse:	2.759		Soundness:		Freez	e-Thew:			
						VOLUN	METRIC DATA						
Point	Added Pb	то	tal Pb	Gmm	Gmb	Va	VMA	VFB	Unit Weight	% Gmm Ni	% Gmm N	łm	TSR
A	3.6		4.8	2.553	2,405	5.8	15.4	62.3	2399				
	4.1		5.3	2.534	2.433	4.0	14.9	73.2	2426				
c	4.6		5.8	2.514	2.454	2.4	14.6	\$3.6	2447				
JMF	4.1		5.3	2.534	2.433	4.0	14.9	73.2	2426	90.3	96	.5	100
			Corr Factor:									TSR N =	18
SPECIFICATI	ON						>14.5	70-76		<89.0	<91	8.0	
Comments													



-2017 Under produi A change in b ste Deg., .

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sign tory t



