

Quality Control of Warm Mix Asphalt Mixtures

Presented by:

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CV Urban Fishery: Getting Started



- **Our first warm mix asphalt experience**
- **Project was an old sand plant; City wanted to transform into a recreational area**



CV Urban Fishery: Quality Control Issues

Batches designed as recommended

- Preliminary testing at the lab
- PG 64-22
- Batches produced at 260°F (3.2 & 3.6 air voids)



CV Urban Fishery: Quality Control Issues



- **GMB compaction “hurdle”**
- **Aggregate absorption must be considered**

Tip: You may want to start with a lower binder content than designed



CV Urban Fishery: Warm Mix Production



Mix was very workable



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CV Urban Fishery: Warm Mix Production

Onsite temps. of 220-240°F



CV Urban Fishery: Base Layer



Compacted like regular HMA



CV Urban Fishery: Surface Layer



CV Urban Fishery: Conclusion



Project Overview: Capitol Street

- **First time used in Iowa City Streets was a successful pilot project**
- **First time used in USA**
- **First experience for Iowa City plant & crews**



Capitol Street: Material Introduction - Plant

- **LEADCAP – Low Energy and Low Carbon Dioxide Asphalt Pavement**
- **Organic additive of a waxed based composition including:**
 - **Crystal controller**
 - **Synthetic materials**
- **Can be added as a dry or wet process**
- **Improves crack resistance of asphalt at lower temps**



Capitol Street: Job Mix and Test Results

- **Material Introduction**
- **Oil Tanks**



Capitol Street: Job Mix and Test Results

800241 - 1008 ver. 3.5

Project No.: I.C. Streets
Contract ID: _____
Mix Design No.: ABD8-6008R2

DAILY HMA PLANT REPORT

Contractor: L.L.Pelling
County: Johnson
Recycle Source: 1-80 shoulders

JMF VMA: 15.7
Size: 1/2"
Mix Type: 1M No Friction

Report No.: 4
Lab Voids Target: 4.0
Design Gyration: 76

Hot Box I.D. No.:	Su8-16a	Su8-16b	Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Date Sampled:	08/16/11	08/16/11	Air Temp. °F		65					
Gradation ID:	Specs	Su8-16a	Binder Temp. °F		270					
1 in. (25mm) Sieve	100	100	Mix Temp. °F		260					
3/4 in. (19mm) Sieve	100	100	Mat Temp. °F		230					
1/2 in. (12.5mm) Sieve	88-100(95)	96	From Station	To Station	Lane	Placement And Density Record		Date Placed:	08/16/11	
3/8 in. (9.5mm) Sieve	83-97(90)	89				Course Placed:		Surface		
* #4 (4.75mm) Sieve	59-73(68)	69				Intended Lift Thickness:				
* Moving Average						Tested By:				
* #8 (2.38mm) Sieve	45-55(50)	49								
* Moving Average										
#16 (1.18mm) Sieve		36								
* #30 (600um) Sieve	21-29(25)	25								
* Moving Average										
#50 (300um) Sieve		11								
#100 (150um) Sieve		5.1								
* #200 (75um) Sieve	1.8-5.8(3.8)	4.1								
* Moving Average										
Compliance (Y/N)		y								
Intended Added, % Binder	4.60									
Actual Added, % Binder		4.56								
Intended Total, % Binder	5.20									
Actual Total, % Binder	4.90-5.50	5.12								
Gmb:		2.363								
Gmm:		2.461								
Pa:		4.0								
Moving Average	3.5-5.0									
Time	8:30 AM	4:00 PM								
Station										
Side										
Sample Tons	97.00	300.00								
Sublot Tons	331.46									
Tons to Date	682.73									
Fines / Bitumen Ratio	0.6-1.4	0.86								

Core No.:	1	2	3	4	5	6	7
Station							
Cl. Reference							
W 1 Dry							
W 2 in H2O							
W 3 Wet							
Difference							
Field Density							
% Density							
% Voids							
Thickness (in.)							

Gmb (Lot Avg.): 2.369 Avg. Field Density: _____
 Gmm (Lot Avg.): 2.467 Avg. % Density: _____
 Pa (Lot Avg.): 4.0 Avg. % Field Voids: _____
 Target % RAP: 10.0 Specified % Density: _____

Q.I. = _____ - (_____ x 2.369) = _____

Low Outlier: _____ High Outlier: _____ New Q.I. = _____

Film Thickness (FT): 9.4 VMA: 14.8 D.O.T. Results Used:
 8.0-15.0 14.7-16.7

Remarks: Added Lead Cap to mix to create a warm mix.
35.02 T of patch base (mix design 3/4" ABD8-6008A) laid on Prentiss St

Gsb: 2.637 Gb: 1.0430 Effective % Binder (Pbe): 4.75
 Tons of Mix for Pay: 331.46 Tons of Binder for Pay: 16.99

Mix Change Information: _____

Certified Tech: Dave McDowell EC898 Cert. No. _____
 Certified Tech: Megan Finnegan EC740 Cert. No. _____

Distribution: _____ Central Materials _____ Dist. Materials _____ Proj. Engineer _____ Contractor _____ Plant _____



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Capitol Street: Job Mix and Test Results

Form 956 ver. 9.05

Iowa Department of Transportation Highway Division - Office of Materials WMA Gyrotory Mix Design

County :	Johnson	Project :	City of Iowa City	Letting Date :	1/18/2012
Mix Size (in.) :	1/2	Contractor :	L.L.Pelling Co.	Mix No. :	ABD12-6008
Mix Type :	HMA 1M	Design Life ESAL's :		Contract # :	
Intended Use :	Surface	Location :	Capitol Street	Date :	05/20/12

Aggregate	% in Mix	Source ID	Source Location	Bed	Gsb	%Abs	FAA
Sand	25.0%	A52508	Williams/S&G Materials Inc		2.634	0.47	41.3
TA Mansand	22.0%	A58002	Columbus Junction/River Products Co	16-19	2.590	3.47	48.4
1/4" chips	15.0%	A52004	Conklin/River Products Co	2-10	2.641	0.88	46.5
3/8" Chips	14.0%	A58002	Columbus Junction/River Products Co	16-19	2.583	3.23	48.8
5/8" clean	14.0%	A52006	Klein/River Products Co	21-22	2.640	1.08	47.1
RAP	10.0%	1A 06 milling	10% ABC12-0056 (4.63 % AC)		2.591	1.58	41.1

Job Mix Formula - Combined Gradation (Sieve Size in.)

1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
100	100	100	97	81	54	28				
100	100	95	90	74	49	35	24	10	5.1	5.9
100	100	88	83	67	44	20				1.9

Asphalt Binder Source and Grade:	Flint Hills @ Dav				PG 64-22 (AI = 1.8)	WMA Technology & Rate:
	Gyrotory Data					(Other Chemical Additive) @ 0.3
% Asphalt Binder	5.30	5.70	6.02	6.30		Number of Gyrotorys
Gmb @ N-Des.	2.292	2.311	2.320	2.328		N-Initial
Max Sp.Gr. (Gmm)	2.445	2.429	2.417	2.406		7
% Gmm @ N-Initial	87.9	89.1	89.9	90.3		N-Design
% Gmm @ N-Max	93.7	95.1	97.0	96.8		76
% Air Voids	6.3	4.9	4.0	3.2		N-Max
% VMA	17.0	16.7	16.6	16.6		117
% VFA	63.2	70.8	75.9	80.5		Gsb for Angularity
Film Thickness	9.97	10.88	11.58	12.19		Method A
Filler Bit. Ratio	0.80	0.74	0.69	0.66		2.619
Gsb	2.615	2.615	2.615	2.615		Pba / %Abs Ratio
Gse	2.644	2.641	2.641	2.638		0.22
Pbc	4.89	5.33	5.67	5.97		%Gmm @
Pbs	0.44	0.39	0.39	0.35		N-Max
% New Asphalt Binder	91.7	92.3	92.7	93.1		Mix Check
Asphalt Binder Sp.Gr. @ 25c	1.043	1.043	1.043	1.043		Good
% Water Abs	1.77	1.77	1.77	1.77		Pb Range Check
S.A. m ² /Kg	4.90	4.90	4.90	4.90		1.00
% + 4 Type 4 Agg. Or Better	54.5	54.5	54.5	54.5		RAM Check
% + 4 Type 2 or 3 Agg.	0.0	0.0	0.0	0.0		OK
% + 4 Type 2	0.0	0.0	0.0	0.0		Specification Check
Fineness Modulus of Type 2	0.0	0.0	0.0	0.0		Comply
Angularity-method A	42	42	42	42		ISR Check
% Flat & Elongated	0.3	0.3	0.3	0.3		Not Required
Sand Equivalent	94	94	94	94		
Aggregate Type	A	A	A	A		
% Crushed	73	73	73	73		

Disposition: An asphalt content of 6.02% is recommended to start this project. Target plant temp is 266°F
Data shown in 6.02% column is interpolated from test data.

Form 955 ver. 9.05

Iowa Department of Transportation Highway Division-Office of Materials Proportion & Production Limits For Aggregates

County :	Johnson	Project No.:	City of Iowa City	Date:	05/20/12
Project Location:	Capitol Street	Mix Design No.:	ABD12-6008		
Contract Mix Tonnage:		Mix Size (in.):	1/2		
Contractor:	L.L.Pelling Co.	Course:	Surface	Design Life ESAL's	
		Mix Type:	HMA 1M		

Material	Ident #	% in Mix	Producer & Location	Type (A or B)	Friction Type	Bed	Gsb	%Abs
Sand	A52508	25.0%	Williams/S&G Materials Inc	A	4		2.634	0.47
TA Mansand	A58002	22.0%	Columbus Junction/River Products Co	A	4	16-19	2.590	3.47
1/4" chips	A52004	15.0%	Conklin/River Products Co	A	4	2-10	2.641	0.88
3/8" Chips	A58002	14.0%	Columbus Junction/River Products Co	A	4	16-19	2.583	3.23
5/8" clean	A52006	14.0%	Klein/River Products Co	A	5	21-22	2.640	1.08
RAP	A 06 milling	10.0%	10% ABC12-0056 (4.63 % AC)	A	4		2.591	1.58

Type and Source of Asphalt Binder: PG 64-22 Flint Hills @ Dav

Material	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
Sand	100	100	100	100	95	90	79	53	16	2.0	1.0
TA Mansand	100	100	100	99	97	60	35	25	15	9.4	6.5
1/4" chips	100	100	100	99	86	40	16	9.0	3.0	2.8	2.5
3/8" Chips	100	100	100	95	43	12	4.0	2.7	2.6	2.5	2.3
5/8" clean	100	100	69	41	15	1.2	1.1	1.0	1.0	1.0	1.0
RAP	100	100	97	91	75	58	45	33	22	17	15

Preliminary Job Mix Formula Target Gradation

	100	100	100	97	81	54	28	10	5.1	5.9	
Upper Tolerance	100	100	100	97	81	54	28	10	5.1	5.9	
Comb Grading	100	100	95	90	74	49	35	24	10	5.1	
Lower Tolerance	100	100	88	83	67	44	20	20	10	3.9	
S.A.sq. m/kg	Total	4.90		+0.41	0.30	0.40	0.57	0.69	0.64	0.63	1.29

Production Limits for Aggregates Approved by the Contractor & Producer.

Sieve Size in.	25.0% of mix Sand		22.0% of mix TA Mansand		15.0% of mix 1/4" chips		14.0% of mix 3/8" Chips		14.0% of mix 5/8" clean		10.0% of mix RAP	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1"	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
3/4"	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
1/2"	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	62.0	76.0		
3/8"	100.0	100.0	93.0	100.0	92.0	100.0	88.0	100.0	34.0	48.0		
#4	88.0	100.0	90.0	100.0	79.0	93.0	36.0	50.0	8.0	22.0		
#8	85.0	95.0	55.0	65.0	35.0	45.0	7.0	17.0	0.0	6.0		
#30	49.0	57.0	21.0	29.0	5.0	13.0	0.0	6.7	0.0	5.0		
#200	0.0	3.0	4.5	8.5	0.5	4.5	0.3	4.3	0.0	3.0		



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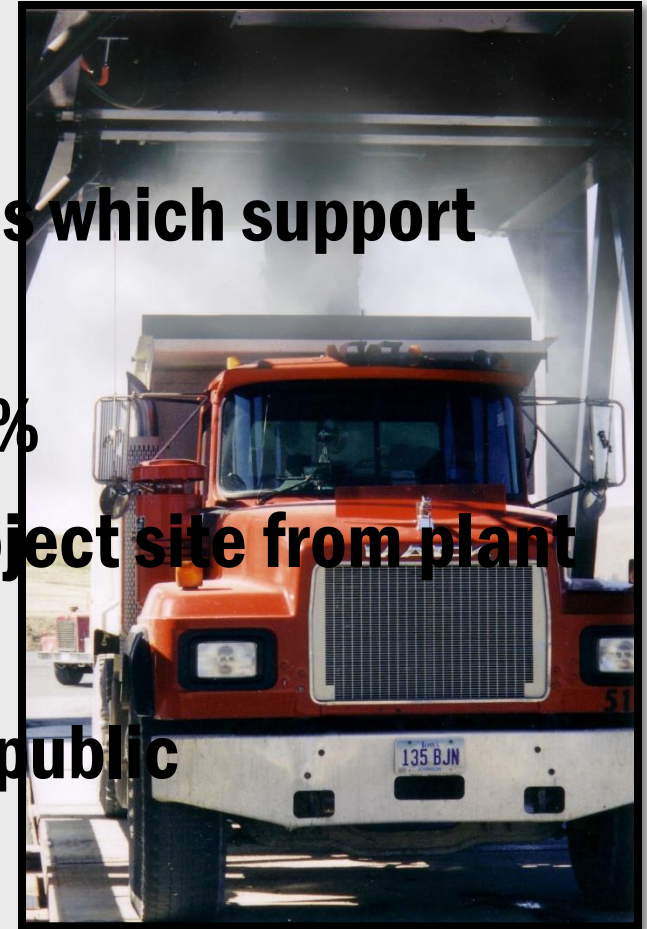
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Capitol Street: WMA Advantages

- WMA offers several advantages which support sustainable development
- Reduces CO2 emissions by 40% **VS.**
- Longer hauling distance to project site from plant productions
- Early site opening to traveling public



Warm Mix



Hot Mix



Capitol Street: Placement & Compaction

Need to place more difficult to place seal/grout/MS



Capitol Street: Placement & Compaction

Asphalt Plant to be completed by 5/15/15. 100% of the asphalt to be placed by 5/15/15.



Capitol Street: Placement & Compaction

Less than 1000 lbs of weight per square foot of pavement
Final road surface is 1 1/2" thick and 100% compacted for traffic



Capitol Street: Project Overview



After



Capitol Street: Conclusion



WMA is better for the environment:
Better compaction → Increased pavement density
LEED Credits: recycling & RAP program credits under the
→ Improved performance
- Re materials & resources, headings



Highway 6: High Rap Warm Mix Research



Warm Mix Asphalt Conclusions



“An Air-voWMA additive also combats the dreaded
“Going Green” at a time when you can’t afford to
store a large amount of material. With WMA’s
stiff and hard to traffic, it’s a real
THANK YOU”



LL Pelling Co.

Iowa Rides on Us