NDDOT Stone Mix Asphalt
Fargo District

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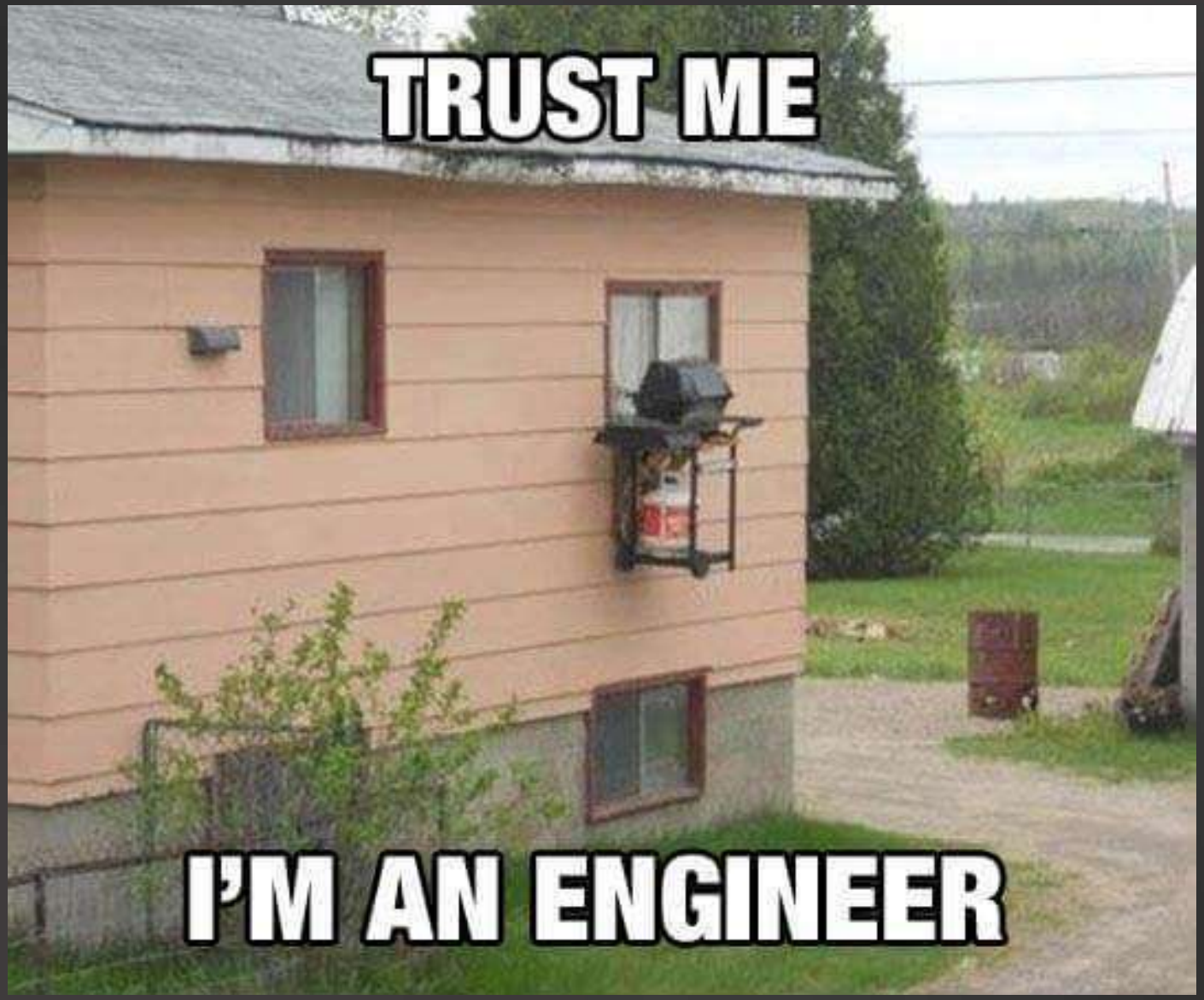
NDDOT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I'M AN ENGINEER

Fargo District Perspective

- I-29 South of Fargo
  - Traffic Volumes in the 6,000 to 9,000 range
  - Built in the 70's
  - South 44 miles is jointed and dowel bar retrofitted
  - 9" of concrete w/ 2" of asphalt base and 2" of aggregate base

History

- Roadway graded in 1975 with base and concrete in 1976
- CPR, Grinding, and DBR in 1998
- CPR and Grinding in 2011
- Options considered
  - Another CPR
  - 4” Overlay
  - Crack and Seat with 4” Overlay
  - Add SMA in the top 2” of the Overlay

Project Location

- Interstate 29 in SE ND
- Starts at the SD border and continues north 11 miles
- Close proximity to ledge rock in NE SD
- State owned pit just west of the project that supplied the aggregate for the FAA 45
- 2016 contractor – Central Specialties
- 2017 contractor – Border State Paving

Project

- Crack and seat entire roadway
- FAA 45 placed on the shoulders and the bottom 2” of driving lanes
- SMA placed on the top 2” of the driving lane
  - PG 58-28 used on shoulders
  - PG 64-28 used on bottom 2”
  - PG 64-34 used in SMA
- QC/QA used on entire project

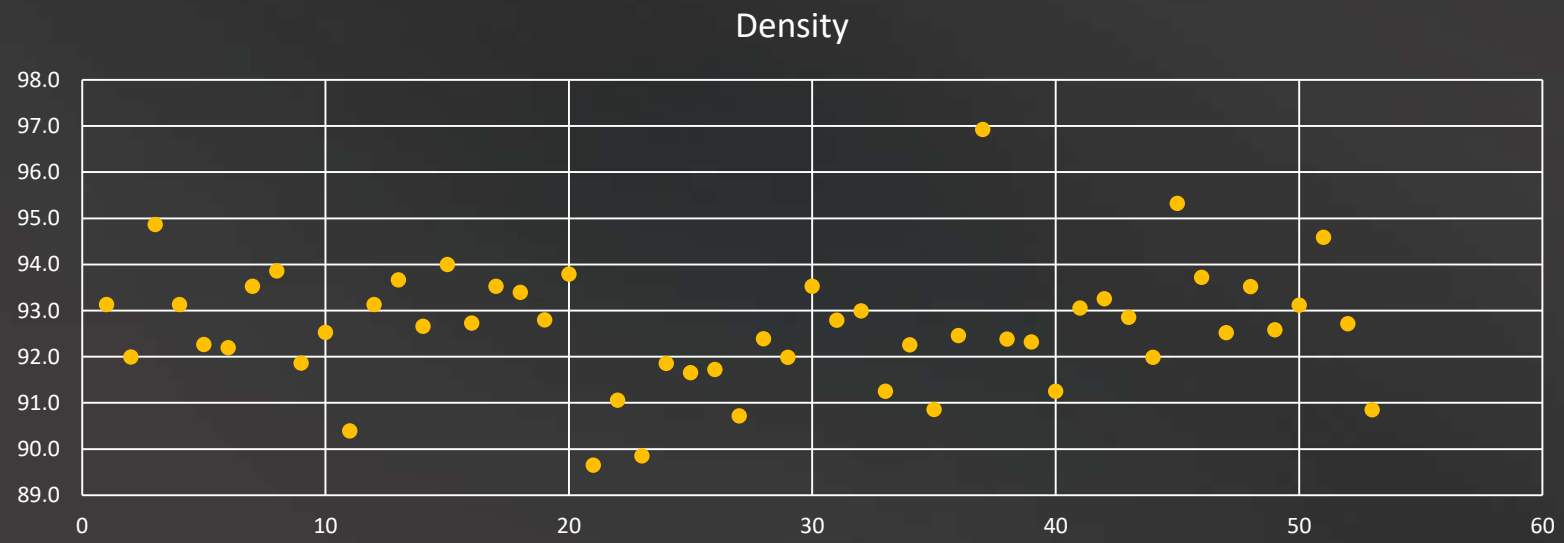
Project Cost

- Full Reconstruct - $2,000,000/mile
- Crack and Seat w/ SMA - $780,000
  - SMA - $48/ton FAA 45 - $33.68/ton
  - PG 58-28 $475/ton PG 64-34 $675/ton
  - Basis of Estimate used 6% oil
- Cost to change top 2” to SMA
  - Approximately $40,000/mile
  - Some thoughts that chip seals are not required
  - Open texture may hold salt residue
- Contractor received $78,600 in ride bonus

Density

- Started with Static Rollers
- Added Vibrations
- Added a Fog Coat at the End

Avg. Pavement Density	Adjustment Factor
≥ 92.0%	1.00
91.0% - 91.9%	0.98
90.5% - 90.9%	0.95
90.0% - 90.4%	0.91
89.5% - 89.9%	0.85
89.0% - 89.4%	0.70



2017 Density

- Changed the full payment slot
- Added an adjustment for too much compaction
- Possibly use intelligent compaction

Table 9 Adjustment Factors	
Avg. Pavement Density	**Adjustment Factor**
≥ 98.1%	Remove & Replace
97.1% - 98.0%	0.85
96.0% - 97.0%	0.95
95.9- 94.0%	1.00
93.0% - 93.9%	0.98
92.5% - 92.9%	0.95
92.0% - 92.4%	0.91
91.5% - 91.9%	0.85
91.0% - 91.4%	0.70

Edge Density between 88.0 and 88.9 on 4 tests

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HOT MIX DESIGN DATA - SUPERPAVE

Feb 2 2016

Lab. No.				
Location	i-29		Project Specification	Section 410
Project	IM-8-029(159)000(PCN-20309)		Type of AC (top lift)	64-34
	IM-8-029(159)000(PCN-20309)		Type of AC (bot lift)	
District	FARGO		Letting Date	November 13 2015
County	Richland		Plus #4 (%)	71.4
Date	Feb 2 2016		Minus #4 (%)	28.6
Pit Owner(s)	LG Everest			
			Gyratory Compactive Effort	
Pit #1 Location			Ninitial	7
Pit #2 Location			Ndesign	75
Pit #3 Location			Nmaximum	115

Mix Properties at Recommended Asphalt Content			**Summary of Aggregate Characteristics from Mix Design**	
	Mix Design	Specification		
Optimum AC (%)	6.4			
Density (pcf)	142.7		Gradation (% passing)	
Air Voids (%)	4.0	4.0 TARGET	5/8"	97.3
VMA (%)	18.6	17.0 Min	1/2"	89.1
VFA (%)			3/8"	77.1
%Gmm @ Ninitial			#4	28.6
%Gmm @ Nmaximum			#8	15.5
AC Film Thickness (m)	13.2		#16	12.9
Dust/Effective AC Ratio	1.1		#30	11.1
Fine Agg Angularity (%)	46.0		#50	9.5
Sand Equivalent (%)	68.0		#100	8.3
Coarse Agg Angularity (%)	100.0		#200	7.2
Flat/Elongated Pieces (%)	0.2			
Maximum SpG @ Ndes	2.382		Asphalt Absorption (%)	-0.13
			Water Absorption (%)	0.53
Frac. Faces Fine (%)	100.0		Light Wt Particles (%)	0.0
Frac. Faces Course (%)	100.0		Toughness (% Loss)	

Final Aggregate Blend (%)			**Specific Gravity Information**	
12	3/8 Down	LG Everest		
34	3/4 x 4	LG Everest	Bulk (Gsb)	2.626
28	1/2 x 4	LG Everest	Apparent (Gsa)	2.669
20	3/8 x 8	LG Everest	Effective (Gme)	2.618
6	Fly ash			

Rev.03Apr2015

AFT Project

TEST SUMMARY SHEET - GYRATORY DESIGN

Project/Plant	IM-8-029(159)000	Mix Designation	SPWEB540
Location	RICHLAND COUNTY	Course	WE (Wear) - 4% Voids

SPEC. YEAR "2013-2015"			Cont'r	Agency	Cont'r	Agency	Cont'r	Agency	Cont'r	Agency
Test#			5		6		7		8	
Date/Day:			DAY2 5/18/15		DAY3 5/19/15		DAY3 5/19/15		DAY3 5/19/15	
MDR #										
- 4 Aggregate Bulk SpG.(Gsb) =			2.635		2.635		2.635		2.635	
Mix Aggregate Bulk SpG.(Gsb) =			2.629		2.629		2.629		2.629	
Project Number =			0		0		0		0	
Ignition Oven Calibration Factor =			0.0000		0.0000		0.0000		0.0000	
Asphalt Binder Grade			F = PG 64-34		F = PG 64-34		F = PG 64-34		F = PG 64-34	
RAP in Mixture?			No		No		No		No	
Shingles (RAS) in Mixture?			No		No		No		No	
ACsg (Asphalt Spec. Grav.)			1.035		1.035		1.035		1.035	
1"	Min.	Max.	100		100		100		100	
Mov Avg.	100	100	100		100		100		100	
Calc. %			100		100		100		100	
3/4 in.			100		100		100		100	
Mov Avg.	100	100	100		100		100		100	
Calc. %			100		100		100		100	
1/2 in.			89		87		86		86	
Mov Avg.	65	100	88		88		86		87	
Calc. %			89		87		86		86	
3/8 in.			77		76		75		75	
Mov Avg.	35	90	77		76		76		76	
Calc. %			77		76		75		75	
#4			33		30		31		33	
Mov Avg.	30	80	32		33		32		32	
Calc. %			33		30		31		33	
#8			17		17		17		17	
Mov Avg.	20	65	17		17		17		17	
Calc. %			17		17		17		17	
# 16			13		13		13		13	
#16 Calc. %			13		13		13		13	
# 30			11		11		11		11	
#30 Calc. %			11		11		11		11	
# 50			9		8		9		9	
#50 Calc. %			9		8		9		9	
# 100			7		7		7		7	
#100 Calc. %			7		7		7		7	
#200			6.5		6.1		6.2		6.1	
Mov Avg.	2.0	7.0	6.3		6.2		6.2		6.1	
#200 Calc. %			6.3		6.1		6.2		6.1	
% Asphalt Content		Individual	6.4		6.4		6.4		6.4	
Design =		Mov. Avg.	6.4		6.4		6.4		6.4	
		Calc. %AC	6.4		6.4		6.4		6.4	
Gmm - Max.SpG		Individual	2.404		2.403		2.401		2.399	
(Rice Test)		Mov. Avg.	2.400		2.403		2.401		2.402	
		Calc. Gmm	2.404		2.403		2.401		2.399	
Gmb - N-design calc.		Individual	2.323		2.314		2.317		2.318	
100 Gyrations		Calc. Gmb	2.323		2.314		2.317		2.318	
		Isolated	3.4		3.7		3.5		3.4	
% Air Voids		Individual	3.2		3.7		3.6		3.6	
Design = 4.0		Mov. Avg.	3.5		3.4		3.5		3.6	
% VMA		Individual	17.2		17.6		17.4		17.4	
		Calc. VMA	17.2		17.6		17.4		17.4	
Design = 18.6		Mov. Avg.	17.2		17.1		17.4		17.4	
Effective Asphalt Content, P_{be}			5.2		5.2		5.2		5.2	
Fines / Effective Asphalt Content			1.0		1.0		1.0		1.0	
Adjusted AFT		Individual	13.8		14.0		13.9		14.0	
		Working AFT	13.8		14.0		13.9		14.0	
		Mov. Avg.	14.0		13.9		13.9		13.9	
% Add AC/Total AC		Individual								
		Mov. Avg.	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Mix Moisture Content										
% Crushing	CAA -1 Face	95			100					
	CAA -2 Face	90								
	FAA	45			47				46	
Sample Ton Number / Tons Represented			1551		563		1748		3089	
Daily Project Total / Cummulative Tons										
NOTES										
Individual Failures Tolerance Note	Quality Control Actions									

Source #	Aggregate Source	Agg. SpG.	% of mix	Agg. SpG.	% of mix	Agg. SpG.	% of mix	Agg. SpG.	% of mix
1	LG EVEREST 3/8 DOWN	2.623	12	2.623	12	2.623	12	2.623	12
2	LG EVEREST 3/4X4	2.636	34	2.636	34	2.636	34	2.636	34
3	LG EVEREST 1/2X4	2.636	28	2.636	28	2.636	28	2.636	28
4	LG EVEREST MIX6	2.620	20	2.620	20	2.620	20	2.620	20
5	FLY ASH	2.700	6	2.700	6	2.700	6	2.700	6
6									
7									
8									
9									
10									
Add AC									
Tested By:									


STONE MATRIX ASPHALT (SMA) PROJECT IM-8-029(159)000 - PCN 20309
LG EVEREST, ORTONVILLE, MN (CRUSHED LEDGE ROCK)
34%
3/4" x 4
20%
3/8" x 8
12%
3/8" Down
6%
Flyash
Cellulose Fibers
drain down)

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THEN THEY STARTED DRIVING A DIFFERENT ROUTE TO AVOID US
SO WE STARTED DOING WORK ON THAT ROAD TOO