# NDDOT Stone Mix Asphalt
# Fargo District


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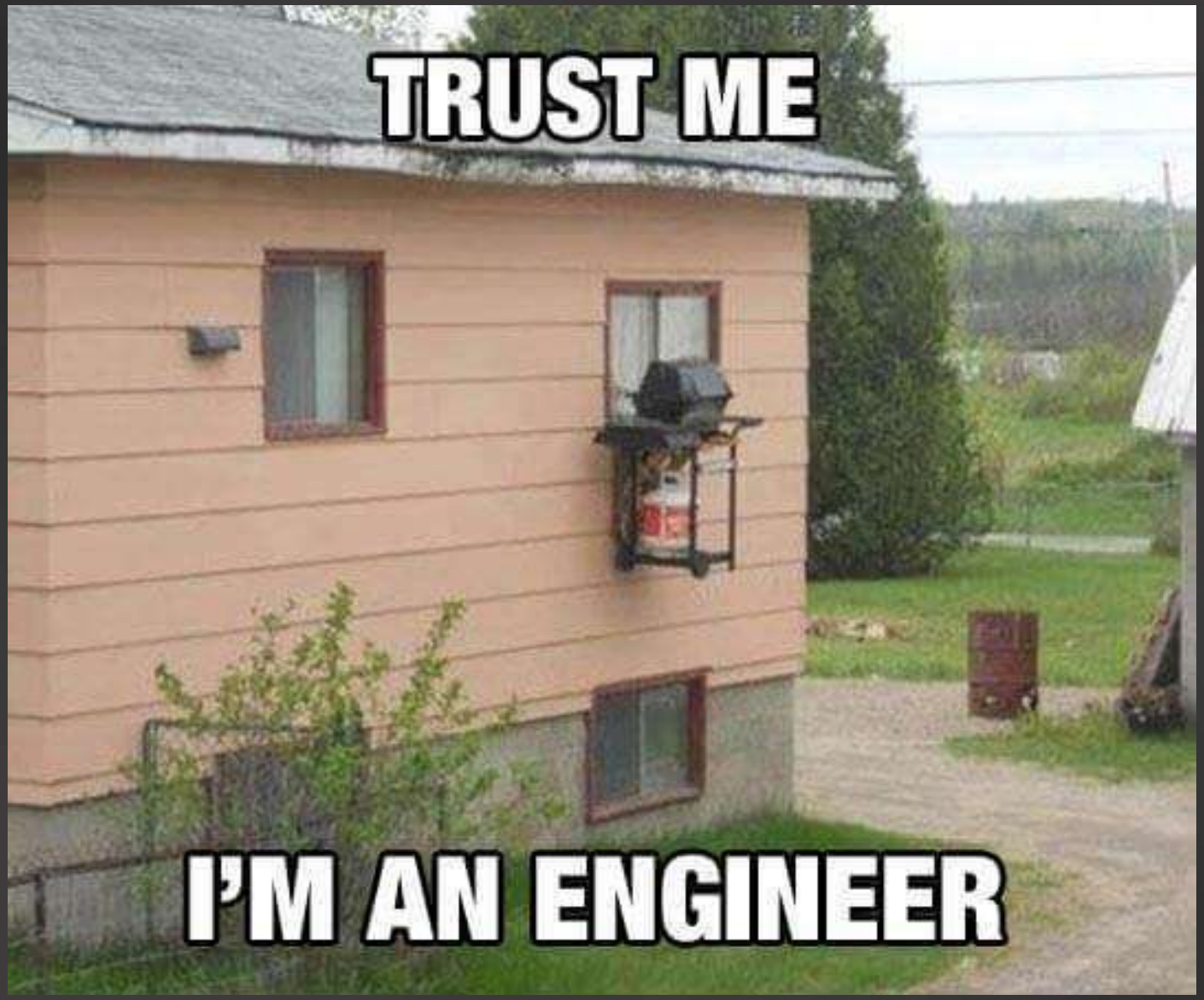
NDDOT


TRUST ME
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

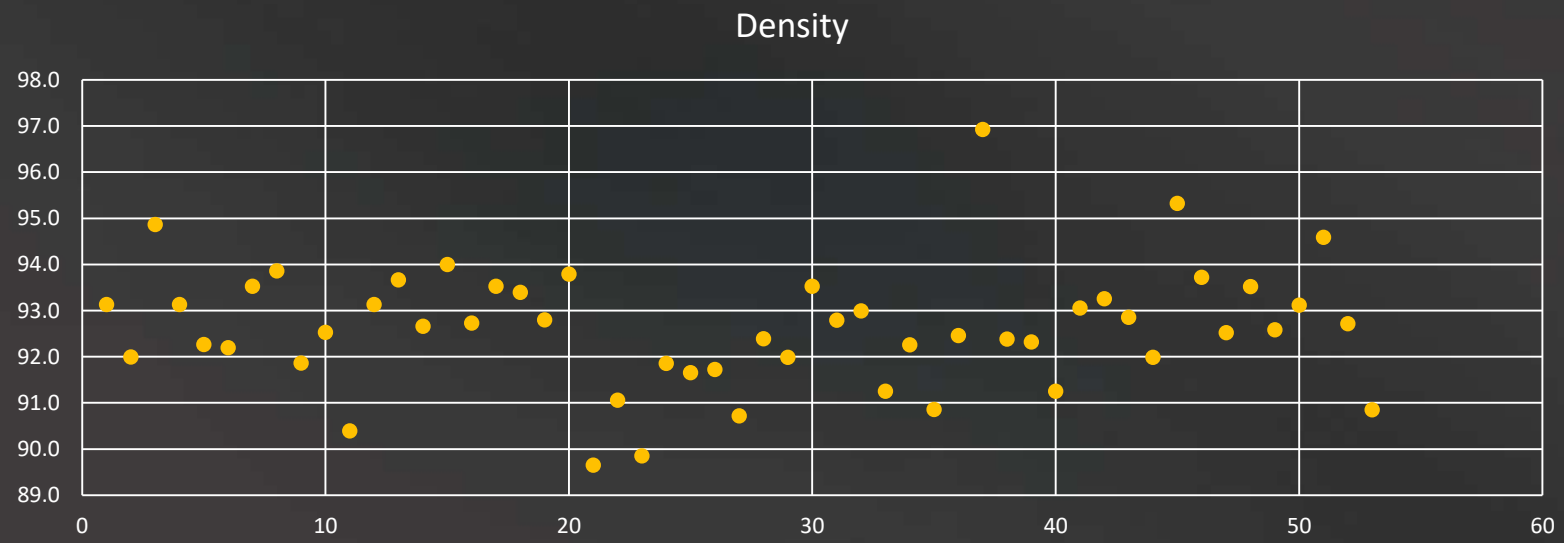
# Project Cost

- 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<br>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

NDDOT
North Dakota
Department of Transportation

# HOT MIX DESIGN DATA - SUPERPAVE

Feb 2 2016

| | | |
|---|---|---|
| Lab. No. | | |
| Location | I-29 | |
| Project | IM-8-029(159)000(PCN-20309) | |
| | IM-8-029(159)000(PCN-20309) | |
| District | FARGO | |
| County | Richland | |
| Date | Feb 2 2016 | |
| Pit Owner(s) | LG Everest | |
| Pit #1 Location | | |
| Pit #2 Location | | |
| Pit #3 Location | | |

| | |
|---|---|
| Project Specification | Section 410 |
| Type of AC (top lift) | 64-34 |
| Type of AC (bot lift) | |
| Letting Date | November 13 2015 |
| Plus #4 (%) | 71.4 |
| Minus #4 (%) | 28.6 |
| Gyratory Compactive Effort | |
| Ninitial | 7 |
| Ndesign | 75 |
| Nmaximum | 115 |

**Mix Properties at Recommended Asphalt Content**

| | Mix Design | Specification |
|---|---|---|
| Optimum AC (%) | 6.4 | |
| Density (pcf) | 142.7 | |
| Air Voids (%) | 4.0 | 4.0 TARGET |
| VMA (%) | 18.6 | 17.0 Min |
| VFA (%) | | |
| %Gmm @ Ninitial | | |
| %Gmm @ Nmaximum | | |
| AC Film Thickness (m) | 13.2 | |
| Dust/Effective AC Ratio | 1.1 | |
| Fine Agg Angularity (%) | 46.0 | |
| Sand Equivalent (%) | 68.0 | |
| Coarse Agg Angularity (%) | 100.0 | |
| Flat/Elongated Pieces (%) | 0.2 | |
| Maximum SpG @ Ndes | 2.382 | |
| Frac. Faces Fine (%) | 100.0 | |
| Frac. Faces Course (%) | 100.0 | |

**Summary of Aggregate Characteristics from Mix Design**

| Gradation (% passing) | |
|---|---|
| 5/8" | 97.3 |
| 1/2" | 89.1 |
| 3/8" | 77.1 |
| #4 | 28.6 |
| #8 | 15.5 |
| #16 | 12.9 |
| #30 | 11.1 |
| #50 | 9.5 |
| #100 | 8.3 |
| #200 | 7.2 |

| | |
|---|---|
| Asphalt Absorption (%) | -0.13 |
| Water Absorption (%) | 0.53 |
| Light Wt Particles (%) | 0.0 |
| Toughness (% Loss) | |

**Final Aggregate Blend (%)**

| | | |
|---|---|---|
| 12 | 3/8 Down | LG Everest |
| 34 | 3/4 x 4 | LG Everest |
| 28 | 1/2 x 4 | LG Everest |
| 20 | 3/8 x 8 | LG Everest |
| 6 | Fly ash | |

**Specific Gravity Information**

| | |
|---|---|
| Bulk (Gsb) | 2.626 |
| Apparent (Gsa) | 2.669 |
| Effective (Gme) | 2.618 |

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 5/18/16 | | DAY3 5/19/16 | | DAY3 5/19/16 | | DAY3 5/19/16 | |
| 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 | |

| | Min. | Max. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1" | | | 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 | | 88 | | 86 | |
| Mov Avg. | 85 | 100 | 88 | | 88 | | 88 | | 87 | |
| Calc. % | | | 89 | | 87 | | 88 | | 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 Design = | Individual | | 6.4 | | 6.4 | | 6.4 | | 6.4 | |
| | Mov. Avg. | | 6.4 | | 6.4 | | 6.4 | | 6.4 | |
| | Calc. %AC | | 6.4 | | 6.4 | | 6.4 | | 6.4 | |
| Gmm - Max.SpG (Rice Test) | Individual | | 2.404 | | 2.403 | | 2.401 | | 2.399 | |
| | Mov. Avg. | | 2.400 | | 2.403 | | 2.401 | | 2.402 | |
| | Calc. Gmm | | 2.404 | | 2.403 | | 2.401 | | 2.399 | |
| Gmb - N-design calc. 100 Gyrations | Individual | | 2.323 | | 2.314 | | 2.317 | | 2.318 | |
| | Calc. Gmb | | 2.323 | | 2.314 | | 2.317 | | 2.318 | |
| % Air Voids Design = 4.0 | Isolated | | 3.4 | | 3.7 | | 3.5 | | 3.4 | |
| | Individual | | 3.2 | | 3.7 | | 3.6 | | 3.6 | |
| | Mov. Avg. | | 3.3 | | 3.4 | | 3.5 | | 3.6 | |
| % VMA Design = 16.6 | Individual | | 17.2 | | 17.5 | | 17.4 | | 17.4 | |
| | Calc. VMA | | 17.2 | | 17.6 | | 17.4 | | 17.4 | |
| | 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 MIX8 | 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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North Dakota
Department of Transportation


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