

Pavement Marking

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Who am I? Why am I here?

- Graduated from UND
- Worked for the NDDOT around 4 years
- At Bismarck District for 2 years
- “Given the opportunity” to present
- Nearly 1.6 miles of pavement marking experience



Why should you listen to me?

- Recent pavement marking research
- Issues that come up during construction



Research

- IM-6-029(075)129 & SNH-6-002(079)337: Evaluation of Wet-Reflective Elements for Pavement Markings
- SIM-6-029(091)136: Evaluation of Grooved Pavement Markings
- IM-1-094(181)162: Retroreflective Optics



Evaluation of Wet-Reflective Elements for Pavement Markings

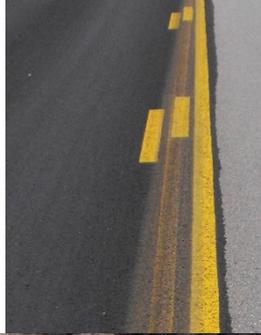
- I-29: standard elements and All Weather elements
- US 2: standard elements and wet reflective elements



Evaluation of Wet-Reflective Elements for Pavement Markings



Evaluation of Wet-Reflective Elements for Pavement Markings



Evaluation of Wet-Reflective Elements for Pavement Markings

| I-29 Northbound White Edge-line Paint RL (mcd/m2/lux) | | | | | | | | | | | |
|---|----------|---------------------|-----|-------------|-----|-------------|-----|-------------|-----|-------------|-----|
| Material Type | Date | Initial (Fall 2010) | | Spring 2011 | | Spring 2012 | | Spring 2013 | | Spring 2014 | |
| | Location | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Standard Paint with Standard Glass (Section 4A) | RP 130 | 495 | 33 | 308 | 5 | 147 | 3 | 136 | 2 | 98 | 6 |
| | RP 131 | 471 | 22 | 295 | 2 | 142 | 2 | 142 | 2 | 79 | 2 |
| | RP 132 | 466 | 36 | 286 | 10 | 143 | 2 | 128 | 2 | 90 | 5 |
| 3M AWP (Section 4B) | RP 134 | 673 | 292 | 437 | 65 | 238 | 24 | 239 | 17 | 178 | 29 |
| | RP 135 | 532 | 276 | 297 | 20 | 179 | 8 | 143 | 14 | 129 | 5 |
| | RP 136 | 468 | 188 | 288 | 14 | 159 | 9 | 131 | 5 | 114 | 6 |

Evaluation of Wet-Reflective Elements for Pavement Markings

I-29 Northbound White Center-line Tape RL (mcd/m²/lux)

| Material Type | Date Location | Initial (Fall 2010) | | Spring 2011 | | Spring 2012 | | Spring 2013 | | Spring 2014 | |
|--|------------------|------------------------|-----|-------------|-----|-------------|-----|-------------|-----|-------------|-----|
| | | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Standard Tape (Control) (Section 6A) | RP 130 | 812 | 22 | 1009 | 89 | 964 | 28 | 964 | 89 | 744 | 47 |
| | RP 131 | 853 | 118 | 1045 | 63 | 926 | 62 | 819 | 71 | 613 | 29 |
| | RP 132 | 832 | 59 | 961 | 52 | 864 | 64 | 829 | 56 | 613 | 58 |
| 3M AWT (Generation 2) (Section 6B) | RP 134 | 870 | 519 | 801 | 505 | 648 | 279 | 569 | 215 | 512 | 139 |
| | RP 135 | 790 | 440 | 848 | 447 | 721 | 194 | 554 | 186 | 498 | 131 |
| | RP 136 | 638 | 260 | 844 | 591 | 770 | 425 | 711 | 305 | 725 | 232 |

Evaluation of Grooved Pavement Markings

- I-29 near Grand Forks
- Three sections tested
 - Epoxy Paint
 - Grooved Epoxy Paint
 - Grooved Water-Based Paint
- All Weather Elements
- Retroreflectivity tested



Evaluation of Grooved Pavement Markings



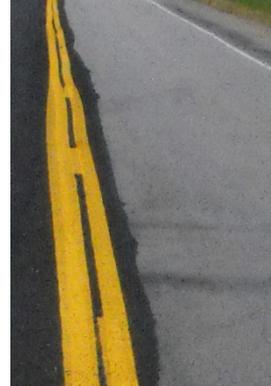
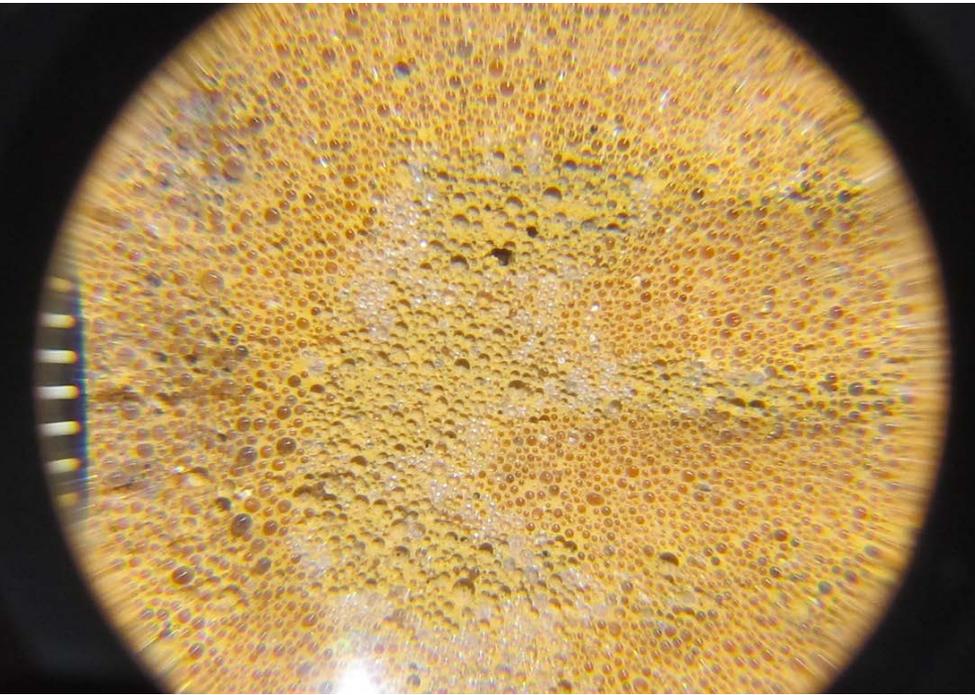
| Average Retroreflectivity with Standard Glass Beads | | | | | | | | | | | | |
|---|---------------------------------|-----|---------------|-----|---------------------------|-----|---------------------------------|-----|---------------|-----|---------------------------|-----|
| Date Tested | White Edge-line | | | | | | Yellow Edge-line | | | | | |
| | Surface Applied Epoxy (Control) | | Grooved Epoxy | | Grooved Water-based Paint | | Surface Applied Epoxy (Control) | | Grooved Epoxy | | Grooved Water-based Paint | |
| | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Initial (Fall 2011) | 331 | 44 | 331 | 23 | 364 | 3 | 203 | 19 | 221 | 29 | 205 | 12 |
| Spring 2012 | 168 | 13 | 178 | 4 | 239 | 2 | 103 | 3 | 188 | 10 | 141 | 3 |
| Spring 2013 | 146 | 8 | 154 | 9 | 196 | 3 | 106 | 3 | 123 | 3 | 143 | 4 |
| Spring 2014 | 152 | 7 | 191 | 4 | * | * | 140 | 7 | 203 | 9 | * | * |



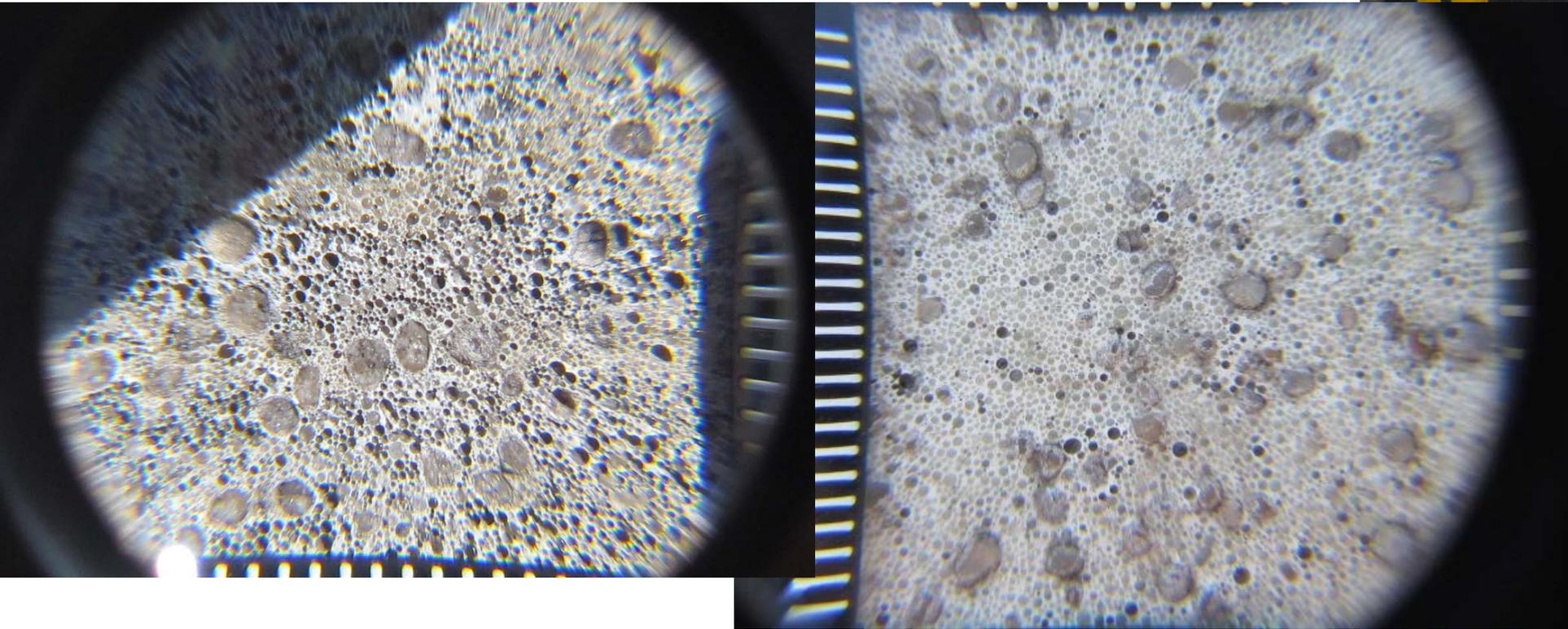
| Average Retroreflectivity with AW Elements | | | | | | | | | | | | |
|--|---------------------------------|-----|---------------|-----|-------------|-----|---------------------------------|-----|---------------|-----|-------------|-----|
| Date Tested | White Edge-line | | | | | | Yellow Edge-line | | | | | |
| | Surface Applied Epoxy (Control) | | Grooved Epoxy | | Grooved AWP | | Surface Applied Epoxy (Control) | | Grooved Epoxy | | Grooved AWP | |
| | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Initial (Fall 2011) | 573 | 212 | 600 | 78 | 544 | 190 | 429 | 261 | 390 | 171 | 208 | 59 |
| Spring 2012 | 230 | 28 | 331 | 8 | 205 | 25 | 221 | 37 | 297 | 40 | 123 | 22 |
| Spring 2013 | 195 | 25 | 211 | 11 | 128 | 6 | 193 | 29 | 272 | 55 | 70 | 7 |
| Spring 2014 | 173 | 11 | 170 | 4 | * | * | 216 | 12 | 278 | 16 | * | * |



Evaluation of Grooved Pavement Markings



Evaluation of Grooved Pavement Markings



IM-1-094(181)162: Retroreflective Optics

- Microsurface
- Wet reflective elements
- Long term testing



Issues During Construction

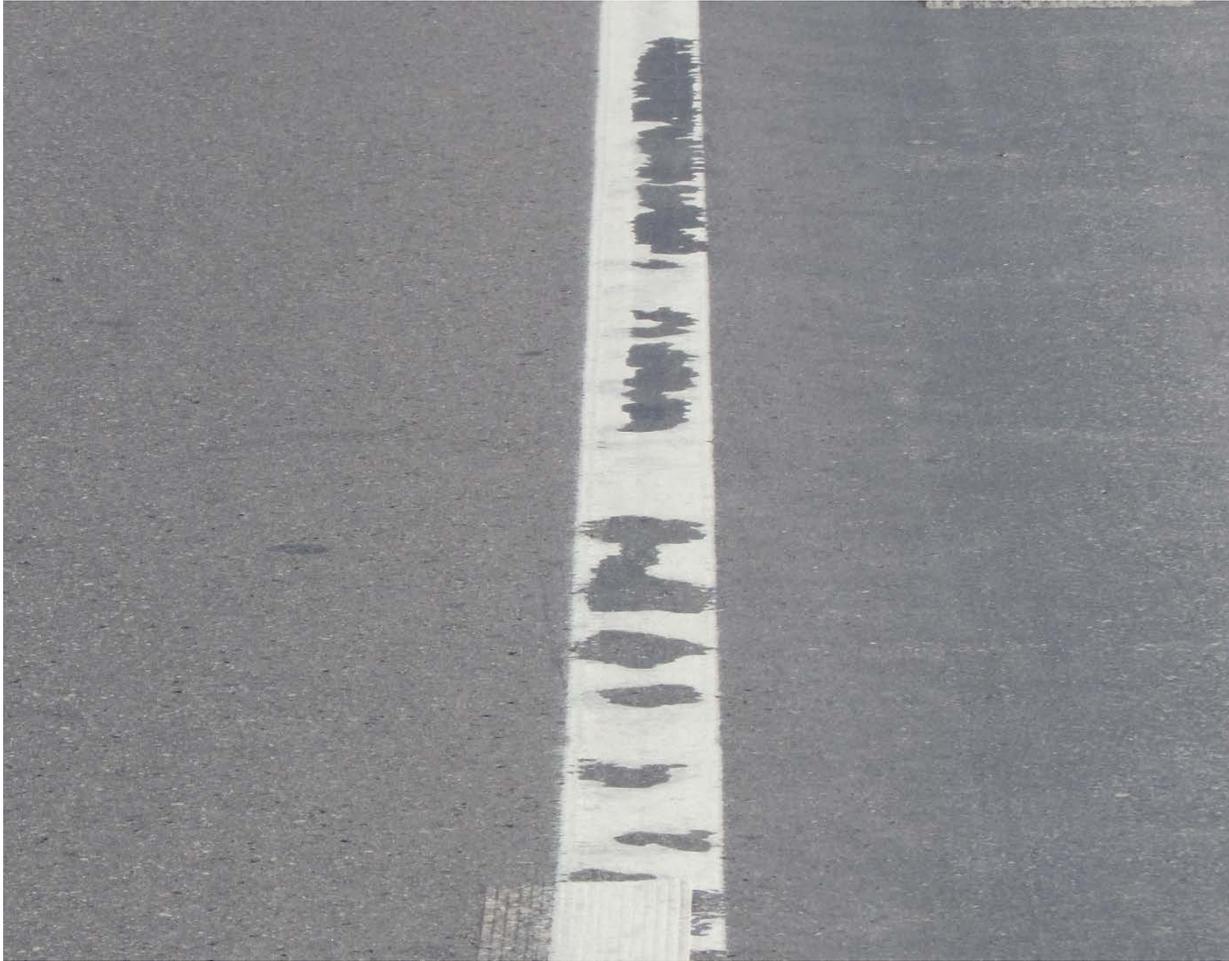
- Snowplow damage
- Adhesion
- Tracking



Snowplow damage



Snowplow damage



Adhesion



Adhesion



Adhesion

Rural Pavement Marking Goals Two Lane Two Way Highways

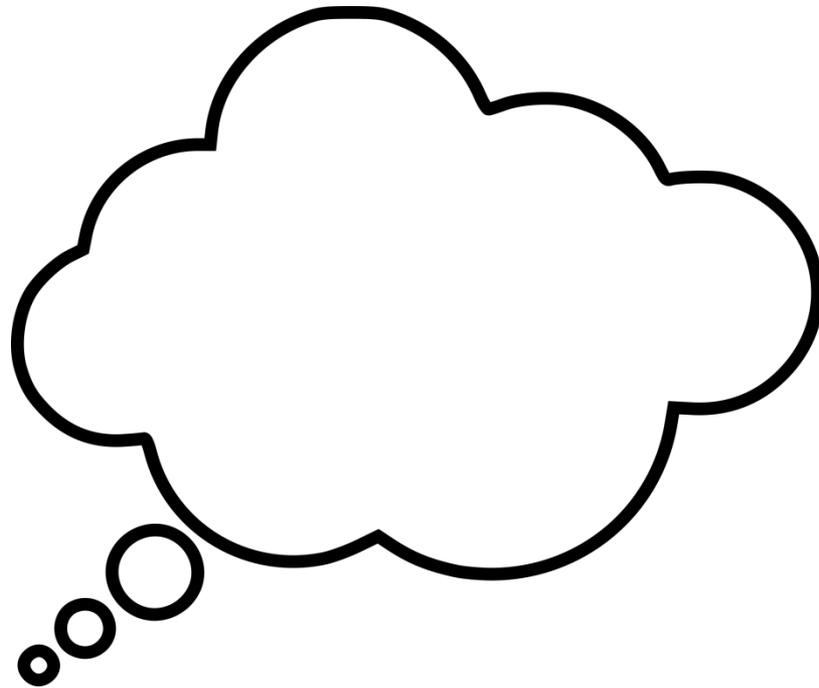
| Anticipated Surface Life ¹ (years) | | ADT | | | | | |
|---|----------|----------|------------|---------------|------------|----------------------|------------|
| | | < 1,500 | | 1,500 - 4,000 | | > 4,000 | |
| | | Edgeline | Centerline | Edgeline | Centerline | Edgeline | Centerline |
| 0 - 2 | | Paint | Paint | Paint | Paint | Paint | Paint |
| 2 - 4 | | Paint | Paint | Paint | Epoxy | Epoxy | Epoxy |
| 4 - 6 | Asphalt | Paint | Paint | Epoxy | Epoxy | Epoxy | Epoxy |
| | Concrete | Paint | Paint | Epoxy | Epoxy | Epoxy | Epoxy |
| 6+ | Asphalt | Paint | Paint | Epoxy | Epoxy | Grooved Epoxy (A) | Epoxy |
| | Concrete | Paint | Paint | Epoxy | Epoxy | Grooved Epoxy (A) | Epoxy |

Adhesion

- Fog seal cure time
- Alternate traffic control during construction



Tracking



Tracking

- Lose marking thickness
- Tracking prevention
 - Contractor: Cones
 - NDDOT: Lane Closures / Pilot Car
 - NDDOT: Fast dry epoxy



Fast Dry Epoxy

- Faster cure/no-track time ...as one would expect
- May eliminate need for cones
- Good for night use

