Sign Life Expectancy - Retroreflectivity
March 5, 2014
Agenda

- Project Objective
- Project Status
- Data Collection and Analysis
- Data Results and Conclusions
  - ASTM Type I
  - ASTM Type IV
  - ASTM Type IX
  - ASTM Type XI
  - Summary
- The Policy Issue
  - Minnesota Rural County Example
  - Policies in place around US
  - Potential Risk Management Approaches
- What’s Next?
Project Objective

Identify Best Practices for suggested sign life and sign maintenance policies using a combination of engineering and law knowledge, national research and sign retroreflectivity data collected in Minnesota.
**Project Status**

- **Tasks 1-4 complete; Task 5 in progress**
  - Survey of Practice completed
  - Data Collection: initially successful, with some difficulties. More testing of control signs & deck
  - Test Deck installed at MnROAD in July 2013; As of March, 2014:
    - 30 New Type XI Panels
    - 61 (mixed) Salvaged Panels
    - More New & Salvaged Panels will be added (space for 500)
  - Info & Data on Website to be refined
  - Recommendations and Draft Report Next (May 1st)
  - Final TAP Meeting Spring 2014 (at MnROAD?)
Data Collection

- 379 valid Retroreflectivity readings provided by:
  - City of Eagan
  - City of Golden Valley
  - City of Brooklyn Center
  - Dakota County
  - St Louis County
  - Watonwan County
  - MnDOT Research
  - MnDOT Metro District

- Tried to focus on ASTM Type XI and South-facing signs

- Each sign has a single data point; need to track same sheeting over time (Test Deck)
Data Analysis and Review

- Data compiled into Excel format and reviewed
- Modifications to Data (approx. 10% removed)
  - Data was corrected or removed if it was evident Background and Legend had been accidentally misidentified during the data recording process
  - Readings of zero on white sheeting, and high readings on black were removed (instrument may have been improperly placed on sign)
  - Signs more than 7 years old identified as Type XI sheeting were removed (Type XI sheeting was introduced 7 years ago)
- Only background retroreflectivity data was analyzed in colors: Red, Green, Yellow and White
Data Analysis and Review

- A linear trendline was added to the point plots to model (estimate) life expectancy of retroreflectivity based on approach to MNMUTCD specified minimum value
  - Sheeting types and colors remain separate due to their differentiating characteristics and minimum retroreflectivity values
- Separate MnDOT study on color degradation of signs
MnDOT Sign Color Data - Red

Current data is within the color box. Continued study and analysis is required to determine when color is likely to fail.
MNDOT ASTM TYPE I SHEETING DATA
**Data Key**

- **# of Signs:** 17
- **Agency:** Golden Valley
- **Min Retro Value:** 7
- **Signs < Min:** 0
- **Warranty:** 7 Years

Trendline inconclusive

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**Data Key**

- **# of Signs:** 23
- **Agency:** Golden Valley
- **Min Retro Value:** Do Not Use
- **Signs < Min:** N/A
- **Warranty:** 7 Years

**MN MUTCD new table states EG Sheeting should not be used for black on yellow signs**
MNDOT ASTM TYPE IV SHEETING DATA
Type IV Green

\[ y = 0.6521x + 47.843 \]
\[ R^2 = 0.7697 \]

- **# of Signs:** 5
- **Agency:** MnDOT Lab
- **Min Retro Value:** 25, 15
- **Signs < Min:** 0
- **Warranty:** 10 Years

Trendline inconclusive

Type IV Red

\[ y = -0.822x + 74.858 \]
\[ R^2 = 0.0381 \]

- **# of Signs:** 9
- **Agency:** MnDOT Lab, Golden Valley, Eagan
- **Min Retro Value:** 7
- **Signs < Min:** 0
- **Warranty:** 10 Years

Trendline crosses minimum value at 82.5 years
**Type IV White**

Data Key:
- **# of Signs:** 14
- **Agency:** MnDOT Lab, Watonwan, Eagan
- **Min Retro Value:** 250, 120, 50, 35
- **Signs < Min:** 1 (13 Years)
- **Warranty:** 10 Years

Trendline crosses minimum values at:
- 23.0 years (250), 40.2 years (120), 49.5 (50), 51.4 (35)

**Type IV Yellow**

Data Key:
- **# of Signs:** 11
- **Agency:** MnDOT Lab, MnDOT Metro, Watonwan, Eagan
- **Min Retro Value:** 75, 50
- **Signs < Min:** 1 (24 Years)
- **Warranty:** 10 Years

Trendline crosses minimum values at:
- 24.1 years (75), 25.8 years (50)
MNDOT ASTM TYPE IX SHEETING DATA
**Type IX Red**

- Trendline crosses minimum value at 49.6 years

\[ y = -2.4236x + 127.41 \]
\[ R^2 = 0.1688 \]

**Type IX White**

- Trendline inconclusive

\[ y = 12.045x + 325.84 \]
\[ R^2 = 0.1845 \]
Type IX Yellow

Data Key

# of Signs: 11
Agency: MnDOT Lab, MnDOT Metro, Watonwan, Eagan
Min Retro Value: 75, 50
Signs < Min: 0
Warranty: 12 Years

Trendline crosses minimum values at:
26.8 years (75), 28.0 years (50)

\[ y = -21.562x + 653.74 \]
\[ R^2 = 0.4429 \]

Type IX Yellow
Minimum Value Signs Less Than 48 In
Minimum Value Signs 48 In or More
Linear (Type IX Yellow)
MNDOT ASTM TYPE XI SHEETING DATA
**Type XI Green**

- **# of Signs:** 35
- **Agency:** MnDOT Lab, MnDOT Metro, St. Louis Co, Dakota Co, Watonwan Co
- **Min Retro Value:** 25, 15
- **Signs < Min:** 0
- **Warranty:** 12 Years

Trendline inconclusive

\[
y = 7.3874x + 72.563 \\
R^2 = 0.3939
\]

**Type XI Red**

- **# of Signs:** 78
- **Agency:** MnDOT Lab, MnDOT Metro, St. Louis Co, Dakota Co, Watonwan Co, Golden Valley, Brooklyn Center, Eagan
- **Min Retro Value:** 7
- **Signs < Min:** 0

Trendline crosses minimum value at 133.0 years

\[
y = -0.8008x + 113.52 \\
R^2 = 0.0029
\]
Type XI White

- **# of Signs:** 91
- **Agency:** MnDOT Lab, MnDOT Metro, St. Louis Co, Dakota Co, Watonwan Co, Golden Valley, Brooklyn Center, Eagan
- **Min Retro Value:** 250, 120, 50, 35
- **Signs < Min:** 0
- **Warranty:** 12 Years
- **Trendline crosses minimum values at:**
  - 35.6 years (250)
  - 46.0 years (120)
  - 51.6 years (50)
  - 52.8 years (35)

Type XI Yellow

- **# of Signs:** 65
- **Agency:** MnDOT Lab, MnDOT Metro, St. Louis Co, Dakota Co, Watonwan Co, Golden Valley, Eagan
- **Min Retro Value:** 75, 50
- **Signs < Min:** 0
- **Warranty:** 12 Years
- **Trendline crosses minimum values at:**
  - 75.7 years (75)
  - 79.9 years (50)
MN Data Summary

- Not enough Minnesota data to credibly conclude an exact value for sign life
- Different agencies have different experience with sign life (i.e. vandalism, knock downs, etc)
- Data (including national research) suggests a range of 15 to 30 years for prismatic sheeting and 10 to 20 years for beaded sheeting
- Color (especially red) may fall below adopted thresholds prior to retroreflectivity
The Policy Issue

- Highway agencies are required to develop and adopt a traffic sign maintenance policy.
- The best practices for policy development include documenting an agency’s Method of Sign Maintenance (Assessment or Management) and specifying when signs will be replaced.
- There is a financial incentive for agencies to adopt a longer sign life – reduced annual replacement costs.

Are there any risks for agencies if they select a longer (than the warranty) sign life? Are there any best practices approaches to managing the risk?
Example Signing Policy – Rural County

The ________________ County Highway Department will complete a daytime inspection, twice a year, for traffic signs along the county roads, and complete E-911 daytime inspection once a year. In the process of “Maintaining Traffic Retroreflectivity” the County will use the Expected Sign life method and replace the traffic sign as follows:

<table>
<thead>
<tr>
<th>Material Grade</th>
<th>From Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>8 Years</td>
</tr>
<tr>
<td>HI or HIP</td>
<td>10 Years (South Facing)</td>
</tr>
<tr>
<td></td>
<td>11 Years (East/West Facing)</td>
</tr>
<tr>
<td></td>
<td>12 Years (North Facing)</td>
</tr>
<tr>
<td>VIP or DG3</td>
<td>10 Years (South Facing)</td>
</tr>
<tr>
<td></td>
<td>11 Years (East/West Facing)</td>
</tr>
<tr>
<td></td>
<td>12 Years (North Facing)</td>
</tr>
<tr>
<td>E-911 Signing (HIP)</td>
<td>12 Years</td>
</tr>
<tr>
<td>E-911 Signing (DG3)</td>
<td>15 Years</td>
</tr>
</tbody>
</table>

Signs requested to be placed within the right of way, along the county roadway, must meet the requirement of the MNMUTCD and have the ________________ County Highway Engineer’s approval. (See Signing Request Policy)
Approaches to Managing Risk

Bring your decisions under an umbrella of immunity

- Have the highest decision making body (City Council, County Commission, Township Board) adopt a policy or pass a resolution – specifying types of sheeting material you use and expected sign life
- Document the outcome of your actions relative to installing/replacing signs, consistent with the direction provided by your decision making body

 Generated by actions consistent with adopted policies and ordinances

- Conduct an engineering study
- Document the applicable guidelines in the MNMUTCD
- Document the conditions in the field
- Document your decision

 Generated by exercising your engineering judgment as part of an engineering study and then documenting your actions
# Policies in place around US

<table>
<thead>
<tr>
<th>Location</th>
<th>Sheeting Type</th>
<th>Sign Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania DOT</td>
<td>ASTM Type III</td>
<td>15 Years</td>
</tr>
<tr>
<td>Indiana DOT</td>
<td>ASTM Type III</td>
<td>18 years (20 Overhead)</td>
</tr>
<tr>
<td>WisDOT</td>
<td>Not specified</td>
<td>12 Years</td>
</tr>
<tr>
<td>Ohio DOT</td>
<td>Not specified</td>
<td>15 Years</td>
</tr>
<tr>
<td>Vermont DOT</td>
<td>Not specified</td>
<td>15 Years Red, 15-20 for Others</td>
</tr>
<tr>
<td>Wright County, MN</td>
<td>DG3</td>
<td>15 Years</td>
</tr>
<tr>
<td>City of University-Heights, OH</td>
<td>HIP (ASTM Type IV)</td>
<td>12 Years</td>
</tr>
</tbody>
</table>
Policy Discussion Items

• Comments on Policy development?
• Comments on selecting a traffic sign management method?
• Comments on selecting/documenting a package of sheeting material?
• Comments on adopting a specific sign life?
• Comments on approaches to managing risk?

Challenges?
Barriers?
Roadblocks?

Alternative Solutions Include:
• ??
• ??
WHAT’S NEXT?

• Receive Panel Comments (March 12th)
• CH2M HILL prepares summary of comments and sample “Best Practice” statements (April 2nd)
• CH2M HILL prepares Draft Report and circulates for review (May 1st)
• CH2M HILL receives Draft Report comments (May 16th)
• CH2M HILL prepares Final Report (End of June)