



# AUTOMATED CRACK LENGTH ESTIMATION

TRENT ROUSE, MONTANA DOT  
ENGINEERING DATA ANALYST





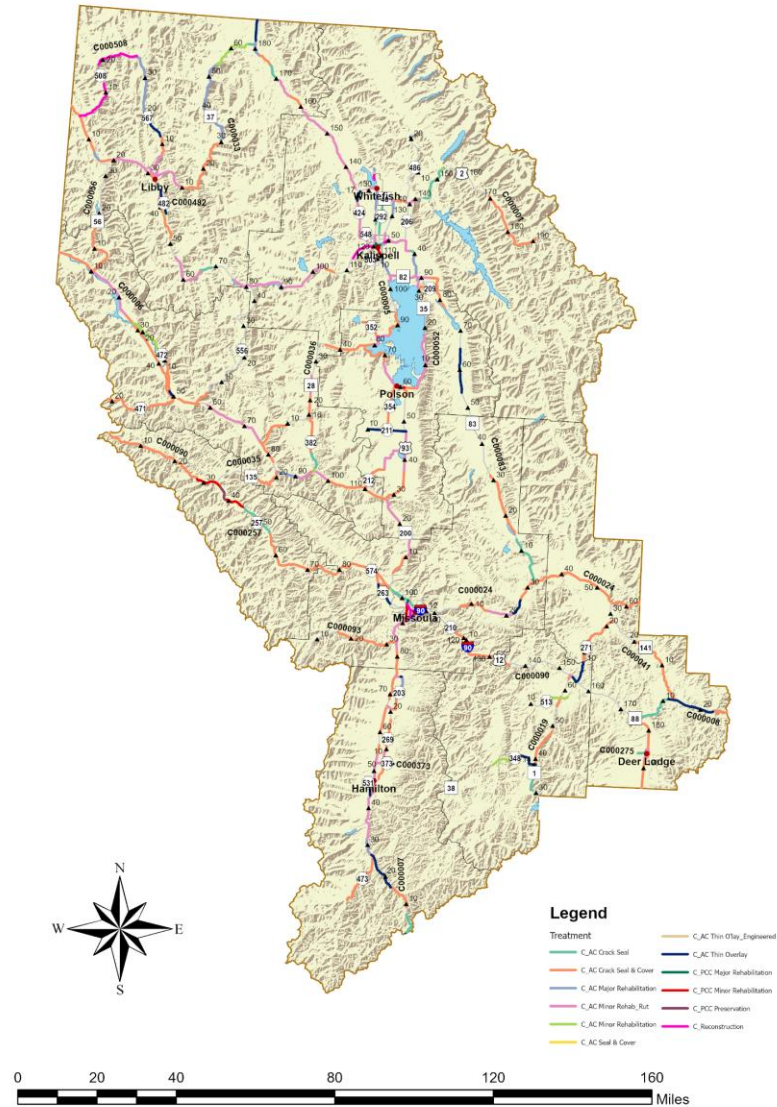
## The Challenge of Crack Estimation

- Crack seal estimation has historically been inconsistent and inaccurate at MDT. Projects have both overran and underrun by over 50% in the past.
- Survey methods vary from windshield surveys to manual counts via online roadway image viewer.
- No standardized, repeatable approach statewide.

# Project Goals



# District 1 Treatment Recommendations 2025



## Leverage Existing Data

- Pavement Management collects 3D surface imagery on all state-maintained roads annually (~24,000 miles).
- Includes laser profiles, distress imagery, and georeferenced data.
- Processed using vendor software from Pathway Services.

# Key Data Sources

- Utilize our distress rating output file (Distress Data Grid) in conjunction with our ALTIS database (Advanced Linear Transportation Information System) to begin estimation

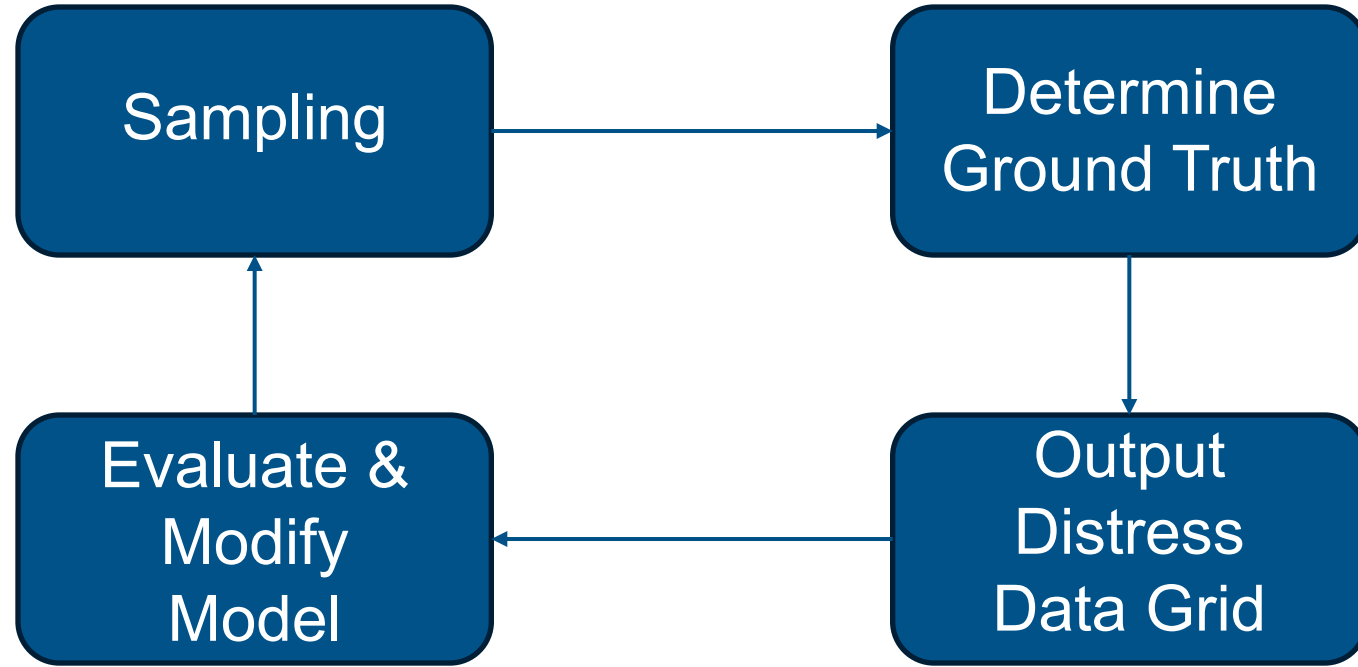
Surface Image  
Display

Transverse Profile    Longitudinal Profile

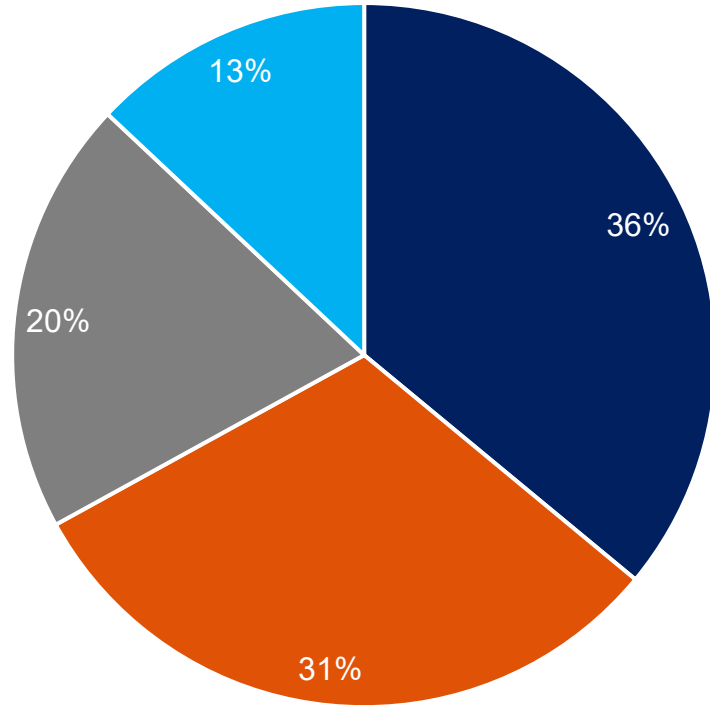
Distress Data Grid. C11: C:\Pathway\MontanaDOT\_3D\_Rev\_06\_06\_2024.c11

Distress Type	Severity	Lane Location	Seal Type	Width Inches	Length Inches	Set Number	Begin Image Frame	Begin Calculate...
8061	0	right wheel path	Sealed	29.5	279.4	263	01:20:21:15	01:20:21:16
8062	0	Left Edge	Sealed	13.7	815.8	263	01:20:20:22	01:20:21:10
8063	0	Right Wheel Path	Unsealed	43	5.3	263	01:20:21:15	01:20:22:06
8064	0	Center	Sealed	132.8	14.7	263	01:20:22:07	01:20:22:11
8065	0	Center	Sealed	126.6	6.3	263	01:20:23:00	01:20:23:12

Count=9961



## Project Methodology



■ Interstate ■ Primaries ■ Secondaries ■ Urban

## Sampling

- 100 random tenth-mile sections selected via stratified random sampling (Interstate, Primary, Secondary, Urban).

# Ground Truth Measurements



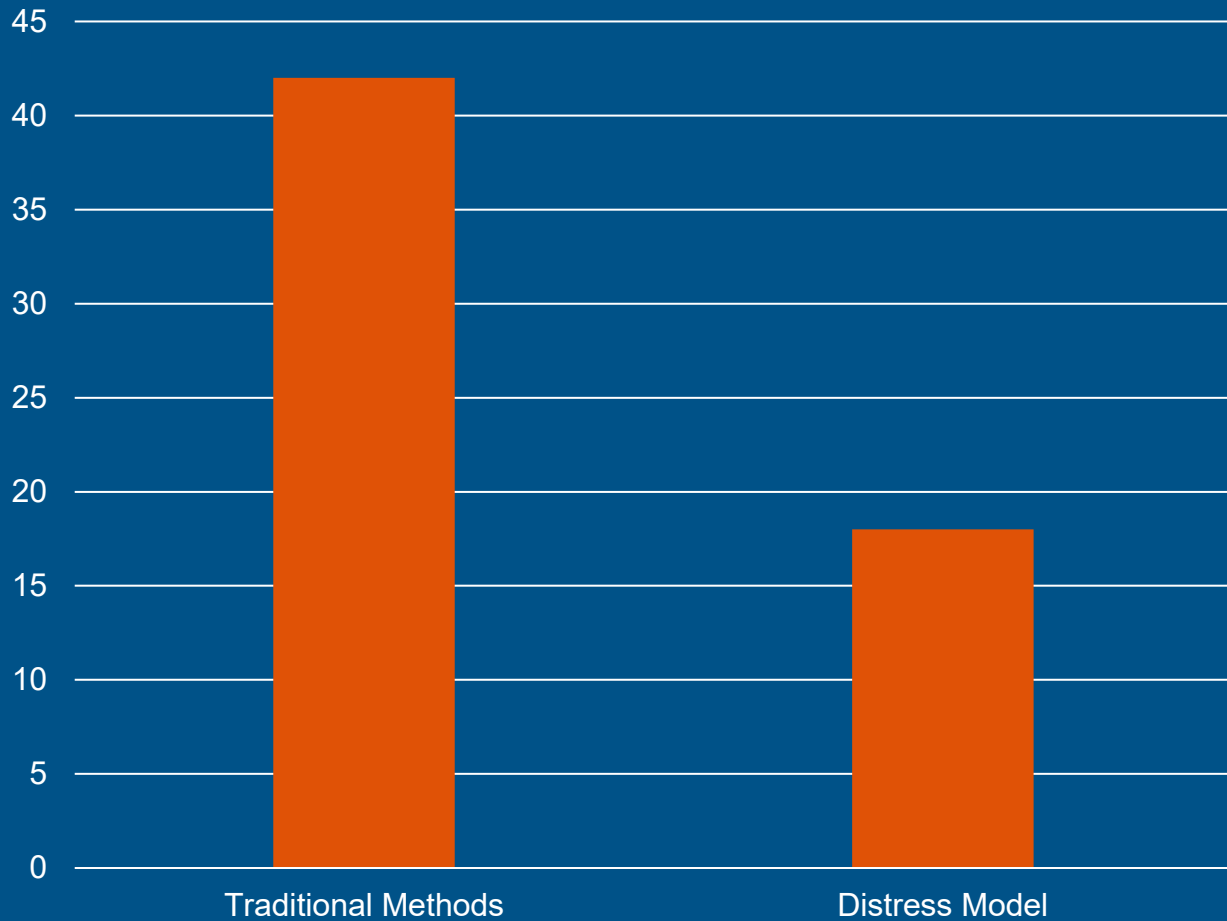
- Ground truth measured manually in PathView, using ROW imagery to identify cracks extending into shoulders.
- Shoulder lengths added using LiDAR or ALTIS measurements.
- Distress Data Grid outputs adjusted using model parameters for likely full-lane or shoulder-spanning cracks.

Metric	Value	Notes
<b>Crack Identification Accuracy</b>	92%	<p><b>Definition:</b> The percentage of cracks correctly identified compared to ground truth (number of correct detections ÷ total cracks).</p> <p><b>Purpose:</b> It measures AutoCrack's ability to detect the presence of cracks, regardless of length. High identification accuracy ensures that cracks are not being systematically missed.</p>
<b>Total Crack Length Accuracy</b>	94%	<p><b>Definition:</b> The ratio of AutoCrack's total measured crack length to the total ground truth length across all sections.</p> <p><b>Purpose:</b> While total length accuracy shows aggregate performance, it can mask section-level variability, which is why we also use per-section metrics.</p>
<b>Unsealed Total Accuracy</b>	92%	<p><b>Definition:</b> Similar to total crack length accuracy but restricted to unsealed cracks only.</p> <p><b>Purpose:</b> Sealed cracks present unique detection challenges, so separating them helps isolate the performance on untreated surfaces, where accuracy is generally expected to be higher.</p>
<b>Mean Average Percent Error (w/o outliers)</b>	17.9%	<p><b>Definition:</b> The average of the absolute percentage errors between AutoCrack and ground truth, calculated per section.</p> <p><b>Purpose:</b> MAPE is sensitive to section-level deviations, making it a better indicator of real-world reliability. A 17.9% MAPE shows AutoCrack is typically close to ground truth, with room for calibration improvements.</p>
<b>Mean Average Percent Error (with outliers)</b>	36.6%	<p><b>Definition:</b> Same as above, but includes sections where input errors or extreme misclassifications occurred.</p> <p><b>Purpose:</b> Including outliers shows worst-case scenarios and emphasizes the need for improving data inputs and thresholds.</p>

## Model Performance

- Accuracy within ~18% of manual ground truth.
- Significant improvement over previous manual estimation methods.
- This estimate will likely improve with consistent use from project managers.

Average Percent Error



## Results

The results indicate an estimation technique that is an improvement on traditional methods.

However, there is still room for improvement.



**“Don’t let perfect be the enemy of good”  
-Voltaire**



# Q&A

## Contact

Trent Rouse – Engineering Data Analyst

Email: [trouse@mt.gov](mailto:trouse@mt.gov)

Phone Number: (406) 439-0425