Road Surface Fatigue Observations in Aerial Imagery

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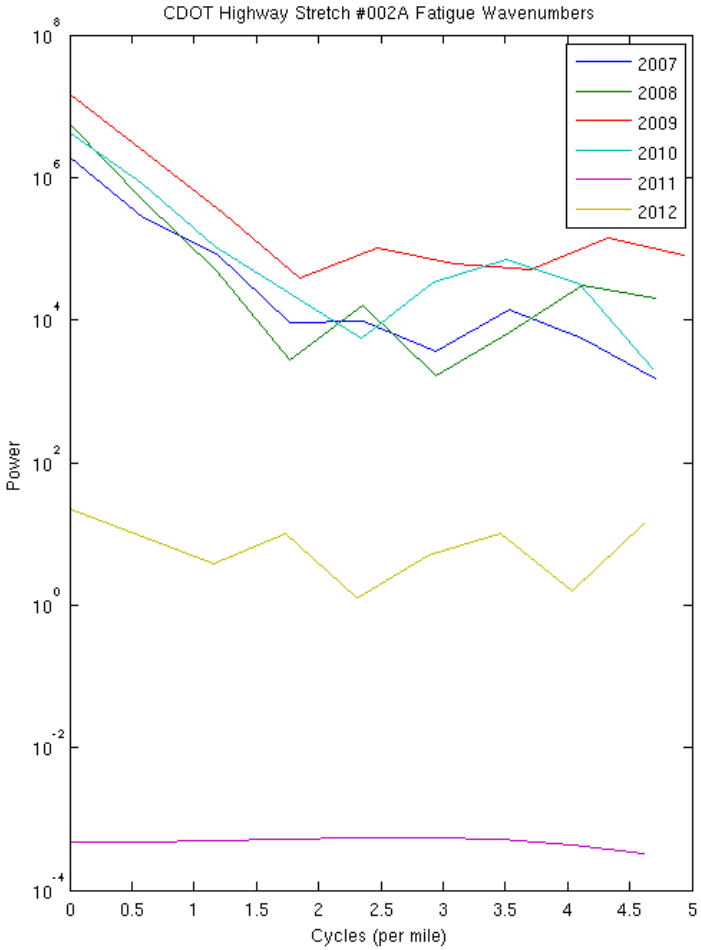
Fatigue

- Fatigue, AKA cracking, is a road quality parameter measured by CDOT
- Values range from 0-7000 square feet
- Quite responsive to repaving
- Potentially measurable via aerial remote sensing imagery

Power Spectra of CDOT Data



- Segment 3 of Highway Stretch #002A was repaved in 2010
- Fatigue power drops to nearly nothing in 2011
- Fatigue power begins to increase in 2012

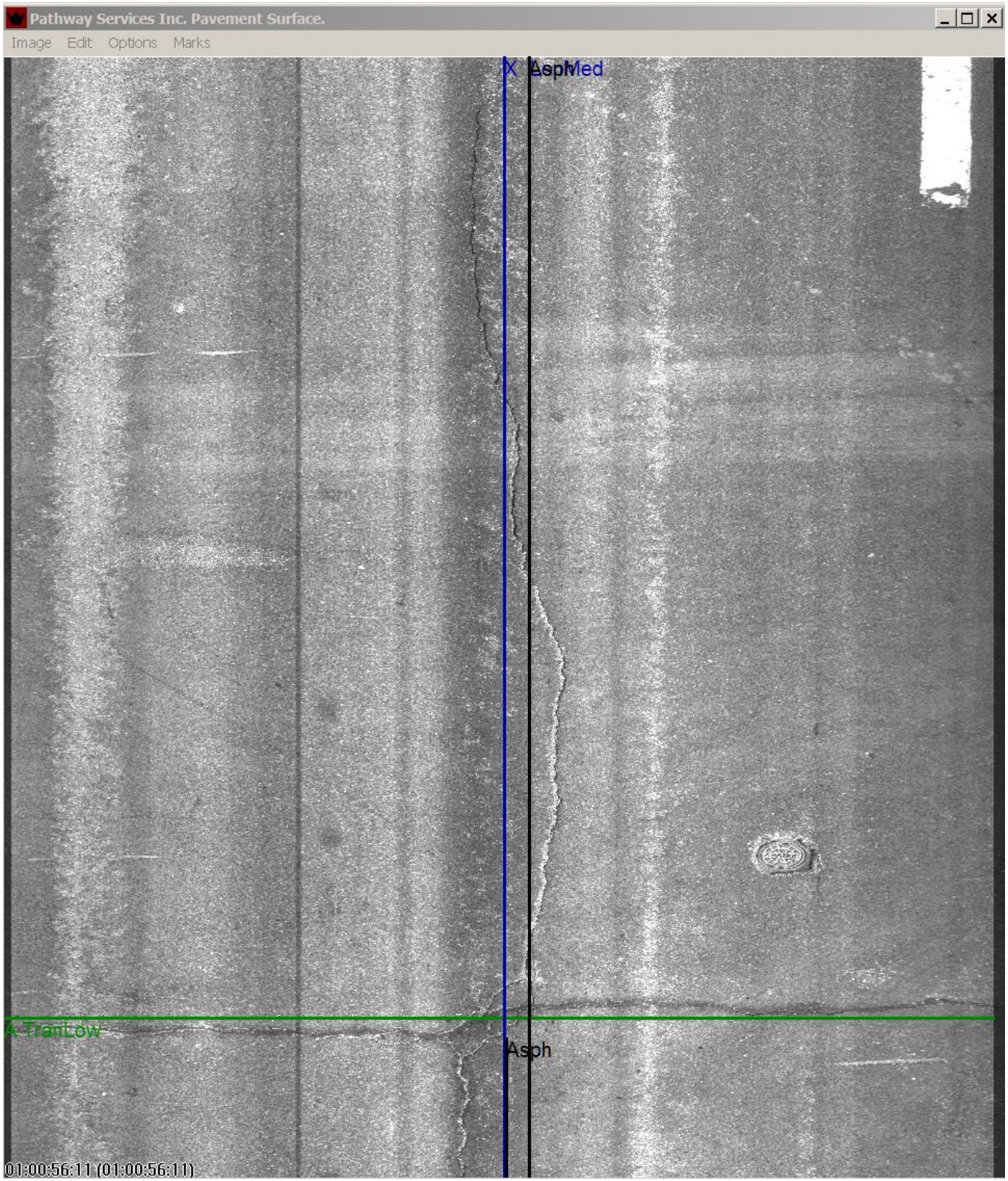
Examples of CDOT In Situ Data

- The next two slides are examples of the data collected by CDOT that are analyzed to produce the fatigue values that went into these wavenumber spectra.

- The data are collected from a van driving at highway speeds carrying high-resolution video cameras viewing the highway.

- The video imagery and analyzed manually to identify the cracks as show by the colored lines.

- These lines are then counted to give a value of fatigue (cracking) that covers a certain area of the highway surface



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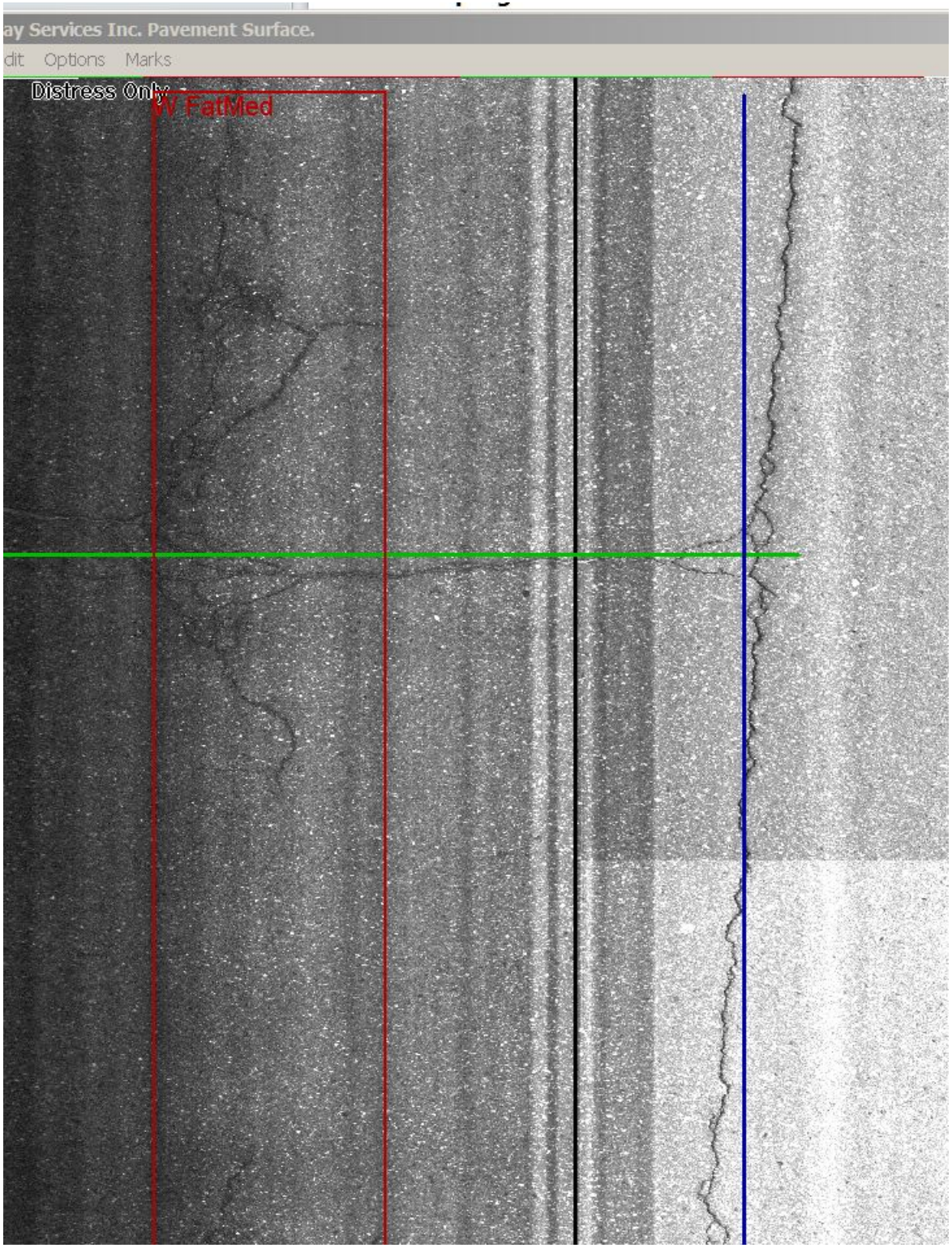

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Region of Interest

- Eastern Greeley, CO
- Highway Stretch #034A
  - Begin Mile Pt 114.0
  - End Mile Pt 115.2
- *In situ* CDOT data collected 2/18/2011
- Aerial imagery collected 4/22/2011

Visible Cracking vs Fatigue Values

Mile 114.0-114.1 (between red dots), Fatigue 586 square meters

Cases of low fatigue values; road is dark and cracks are not apparent.

Mile 114.1-114.2, Fatigue 414 square meters

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Increasing Fatigue Values

Mile 114.2-114.3, Fatigue 3250 square meters

Case where half of the segment has been paved and shows no cracks while the other half is lighter and shows cracks. The fatigue value is intermediate.

Mile 114.3-114.4, Fatigue 6578 square meters

Fatigue value is high consistent with the light colored road that clearly shows the cracks in the surface.

Low and High Fatigue Values

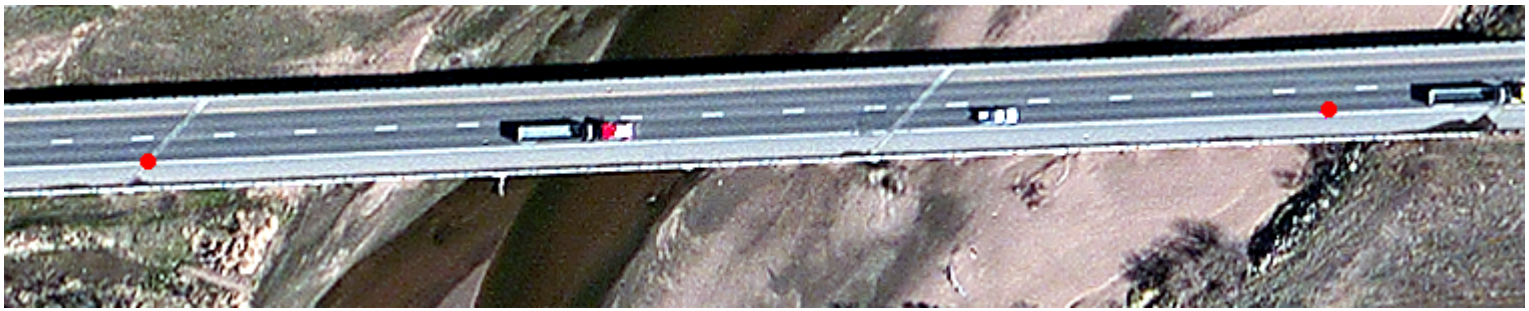
Mile 114.4-114.5, Fatigue 6578 square meters

Most of this road segment is light and shows cracks consistent with the high fatigue value.

Mile 114.5-114.6, Fatigue 527 square meters

Large drop in fatigue value consistent with a dark road showing no cracks.

Very Low and Intermediate Fatigue Values



Mile 114.6-114.7, Fatigue 171 square meters

The lowest fatigue values are consistent with this dark road showing no cracks.

Mile 114.7-114.8, Fatigue 1239 square meters

A mixture of smoothed and cracked road surfaces leads to an intermediate value of fatigue.

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High Fatigue Values

Mile 114.8-114.9, Fatigue 6567 square meters

Both of these roads clearly exhibit cracks and have relatively high fatigue values.

Mile 114.9-115.0, Fatigue 6225 square meters

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Moderate Fatigue Values

Mile 115.0-115.1, Fatigue 5760 square meters

This road indicates that we can optically quantify the cracks to properly estimate the moderate fatigue value.

Mile 115.1-115.2, Fatigue 5014 square meters

Moderate fatigue values here reflect the combination of surfaces. The cracks in the intersection area have been filled with tar so appear slightly different than the other cracks.

Conclusions

- Fatiguing is quite visible from aerial imagery.
  - Lighter color roads with thin perpendicular stripes.
  - Cracks are large enough they will appear in WV2 satellite imagery.
- There are changes in the appearance of cracks consistent with changes in fatigue values.
- We are working to develop automated techniques to quantify the crack condition directly from the imagery.