Mandli Communications, Inc.

Automated Pavement Analysis Past, Present, and Future

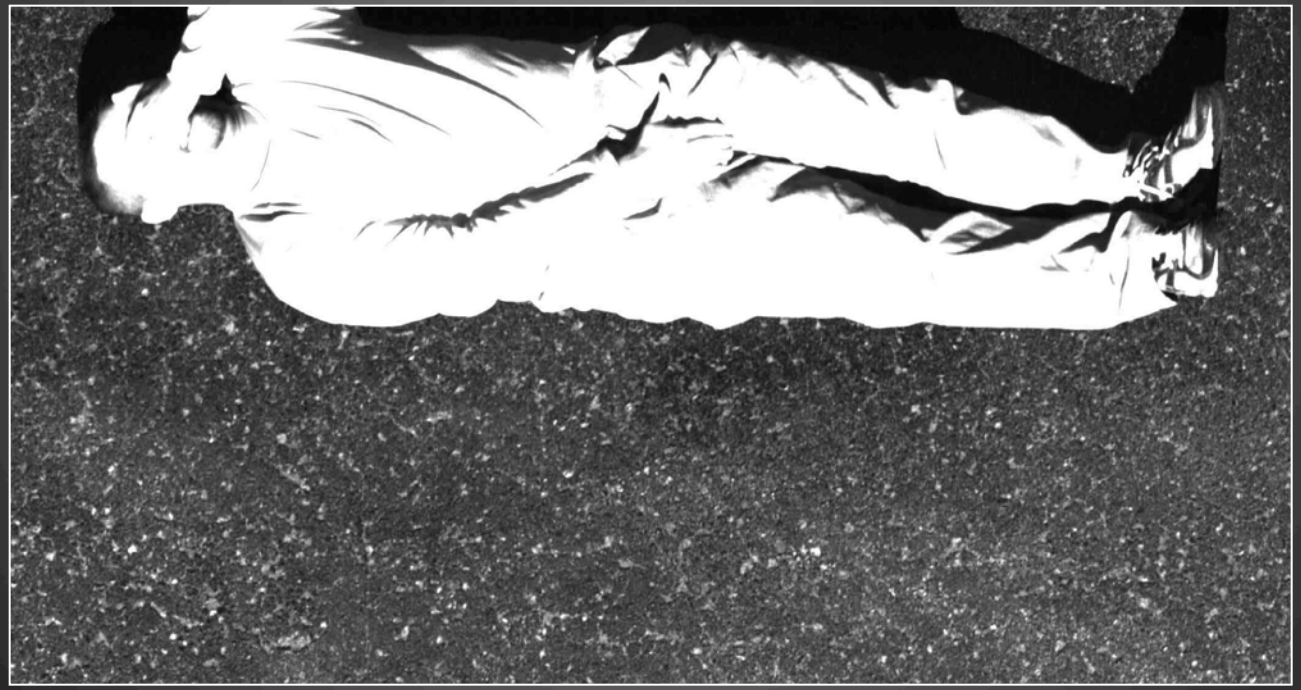
Mandli’s Past Distress

Technology

Technology

- Area Scan Cameras – Visual Assessment
  - Pros:
    - Already collecting imagery for other uses
    - Very cost effective
    - Safer than speed required for windshield survey
  - Cons:
    - Limited to what can be seen in image
    - Hard to identify distress type and extent of damage
    - Inconsistency between manual rating assessments

Technology



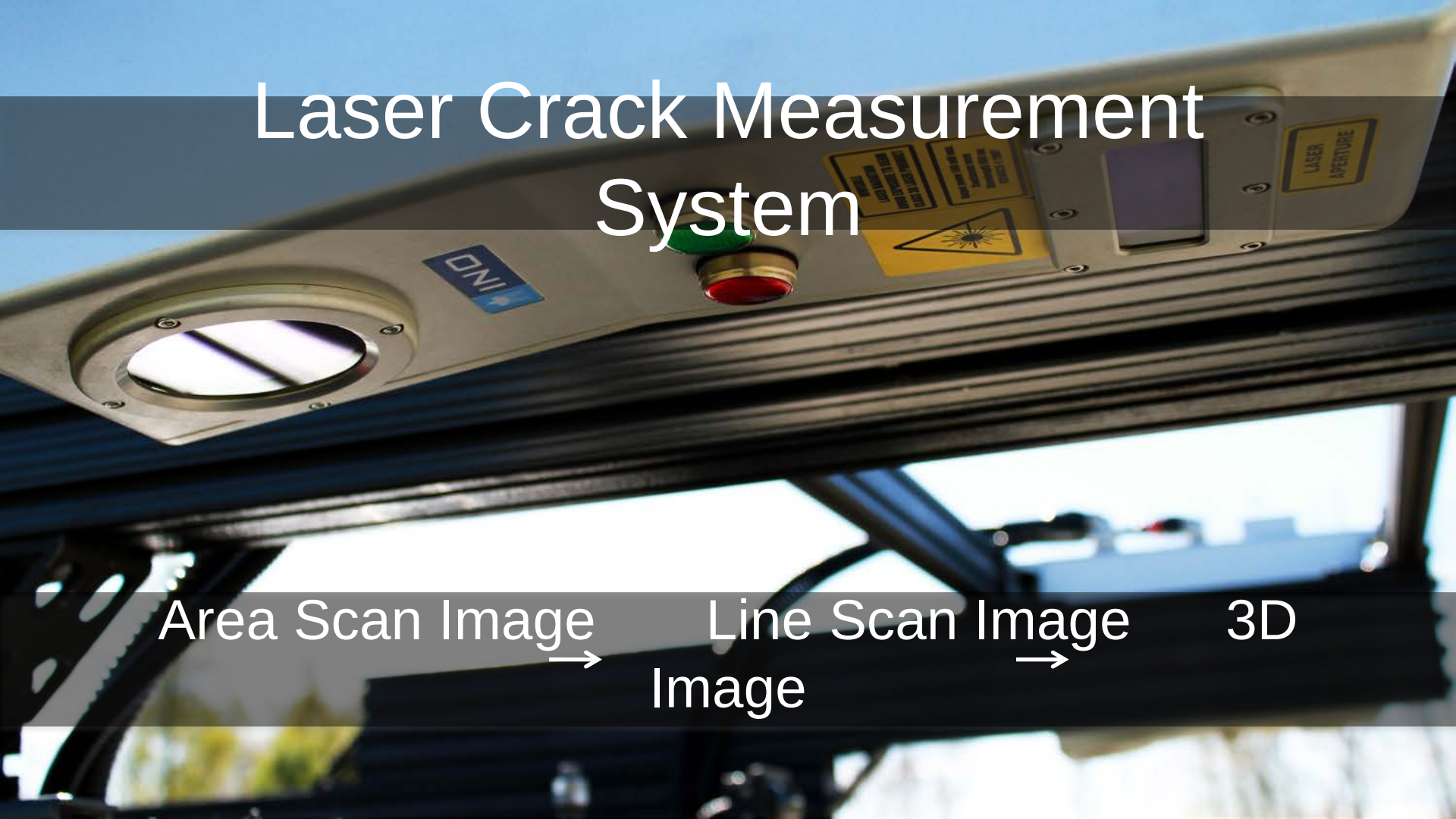
Technology

- Line Scan Cameras – Automated Assessment
  - Pros:
    - Very high-resolution 2D image provided great detail
    - More data to be used to automatically detect cracks
  - Cons:
    - Too many false positives, black does not always equal crack
    - Unable to handle differences in pavement types across the country

Software Limitations

Black ≠ Crack

Mandli’s Current Distress

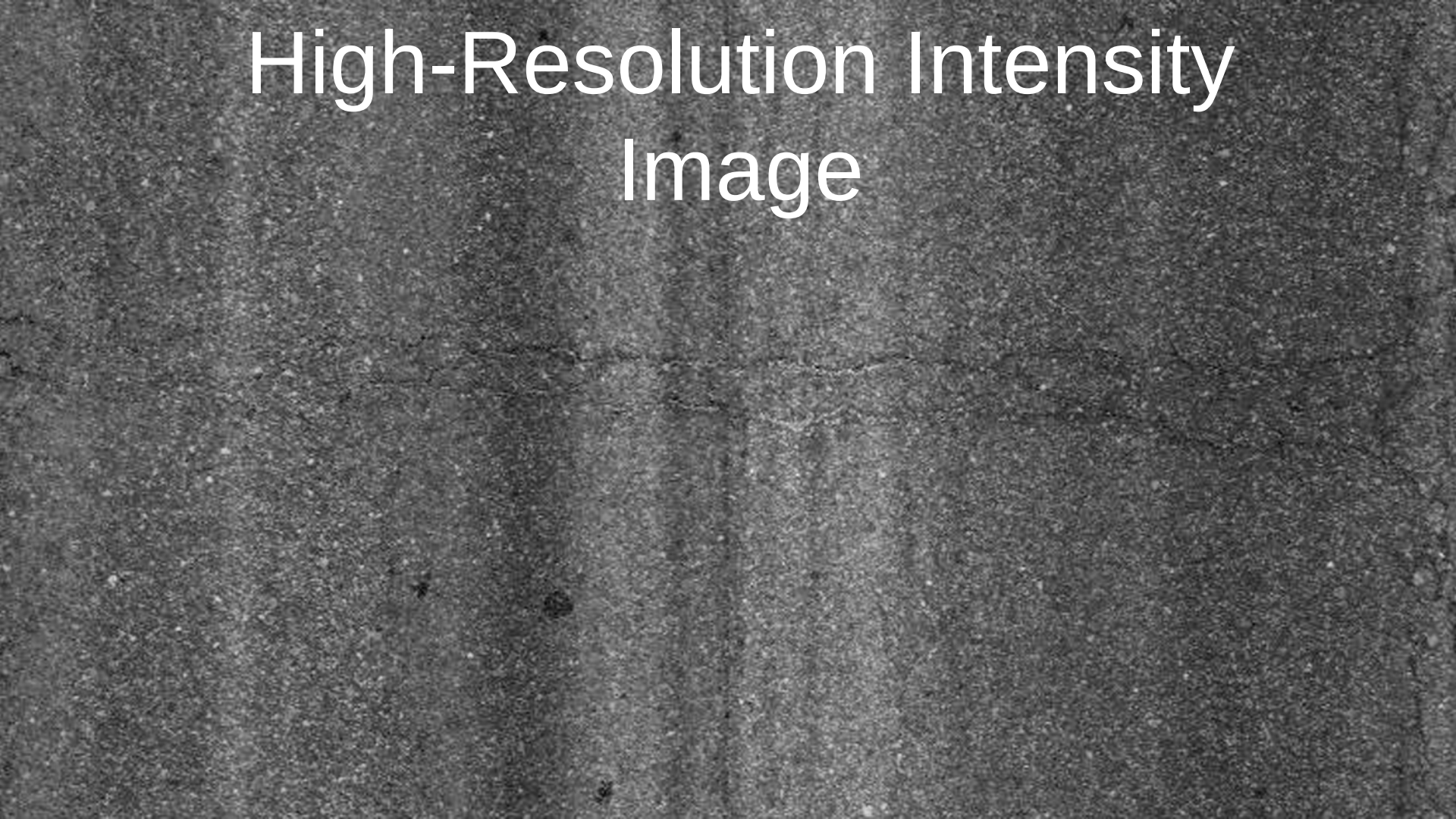


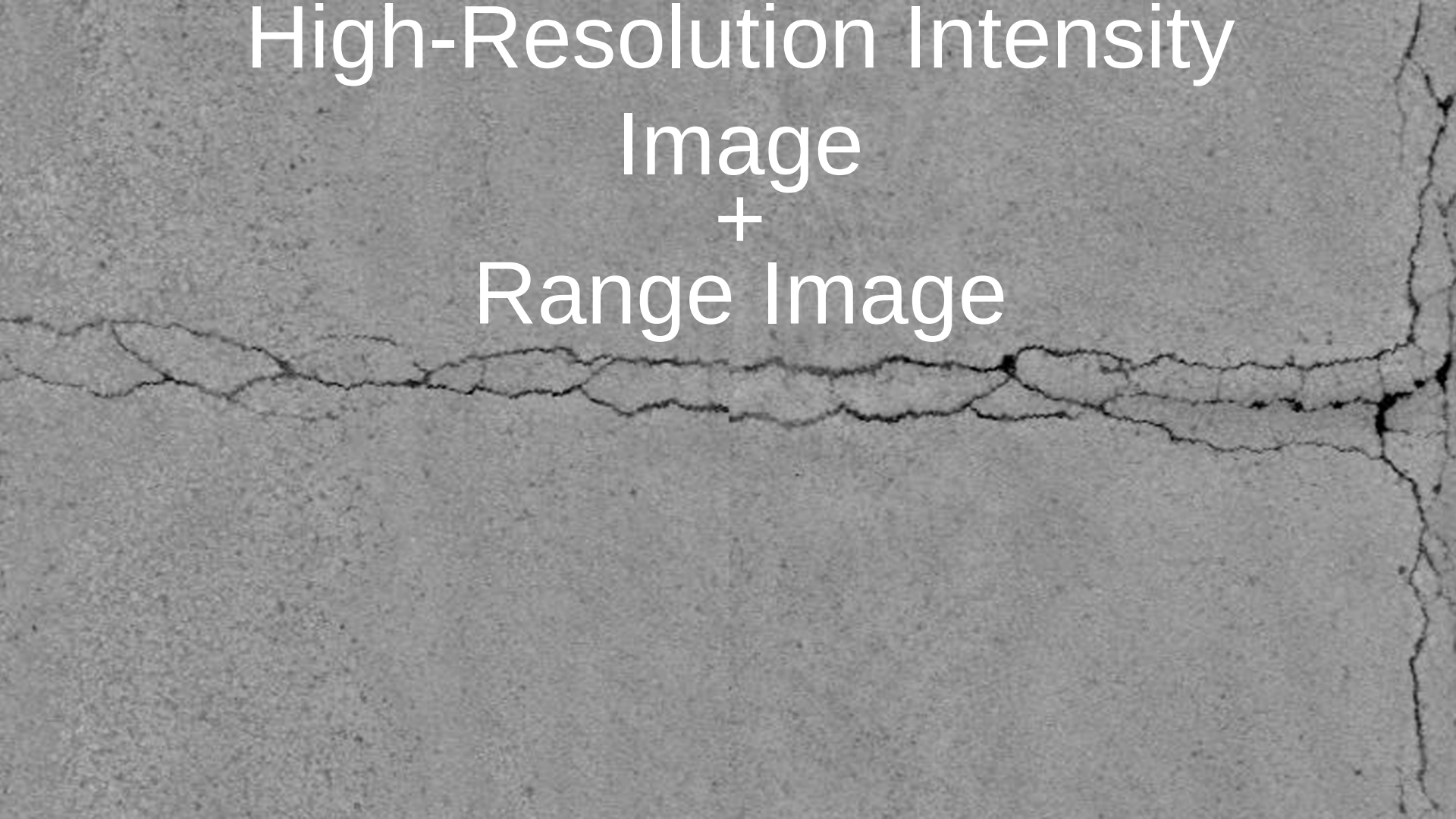
Laser Crack Measurement System

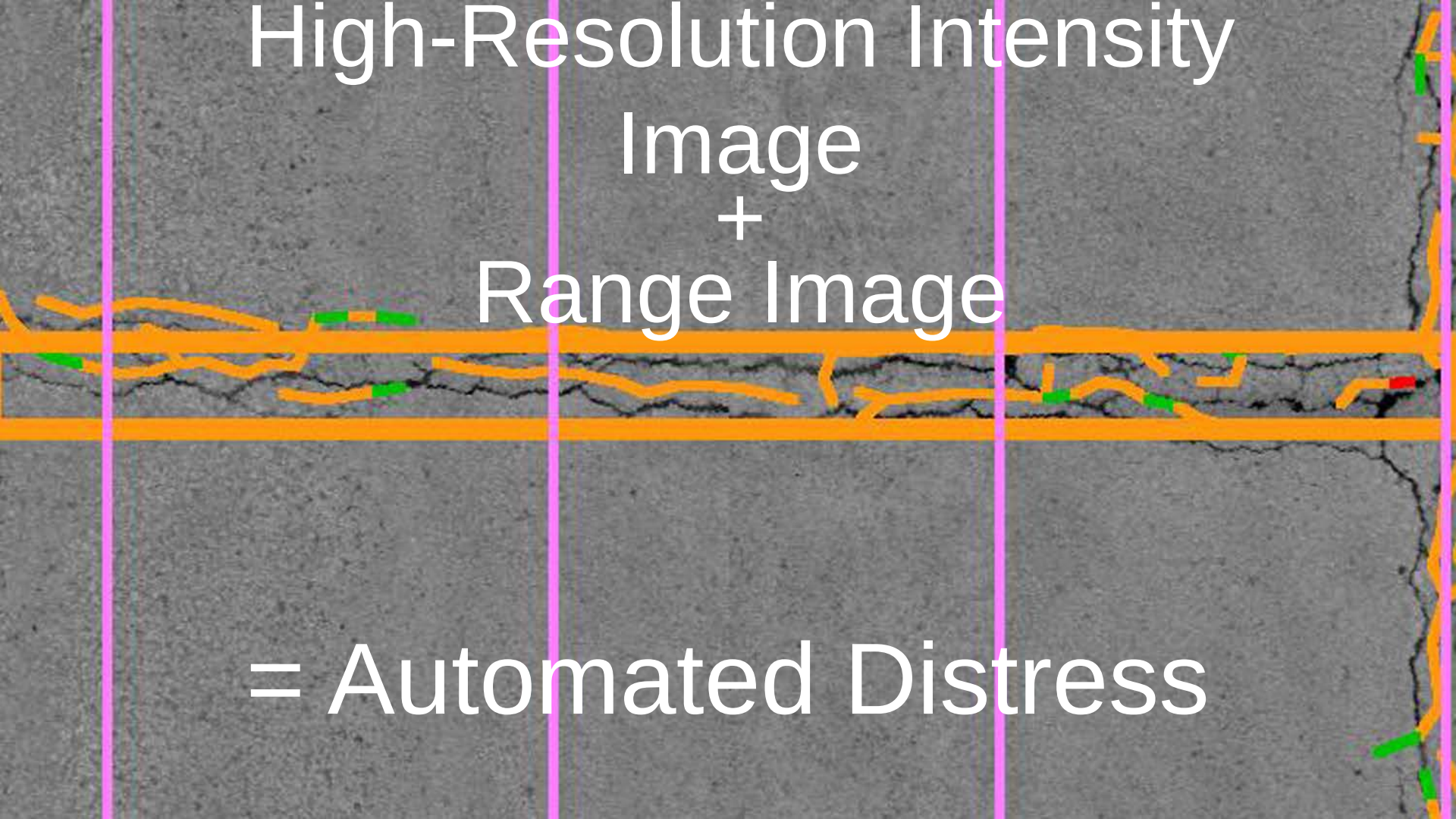
Area Scan Image → Line Scan Image → 3D Image


Dynatest

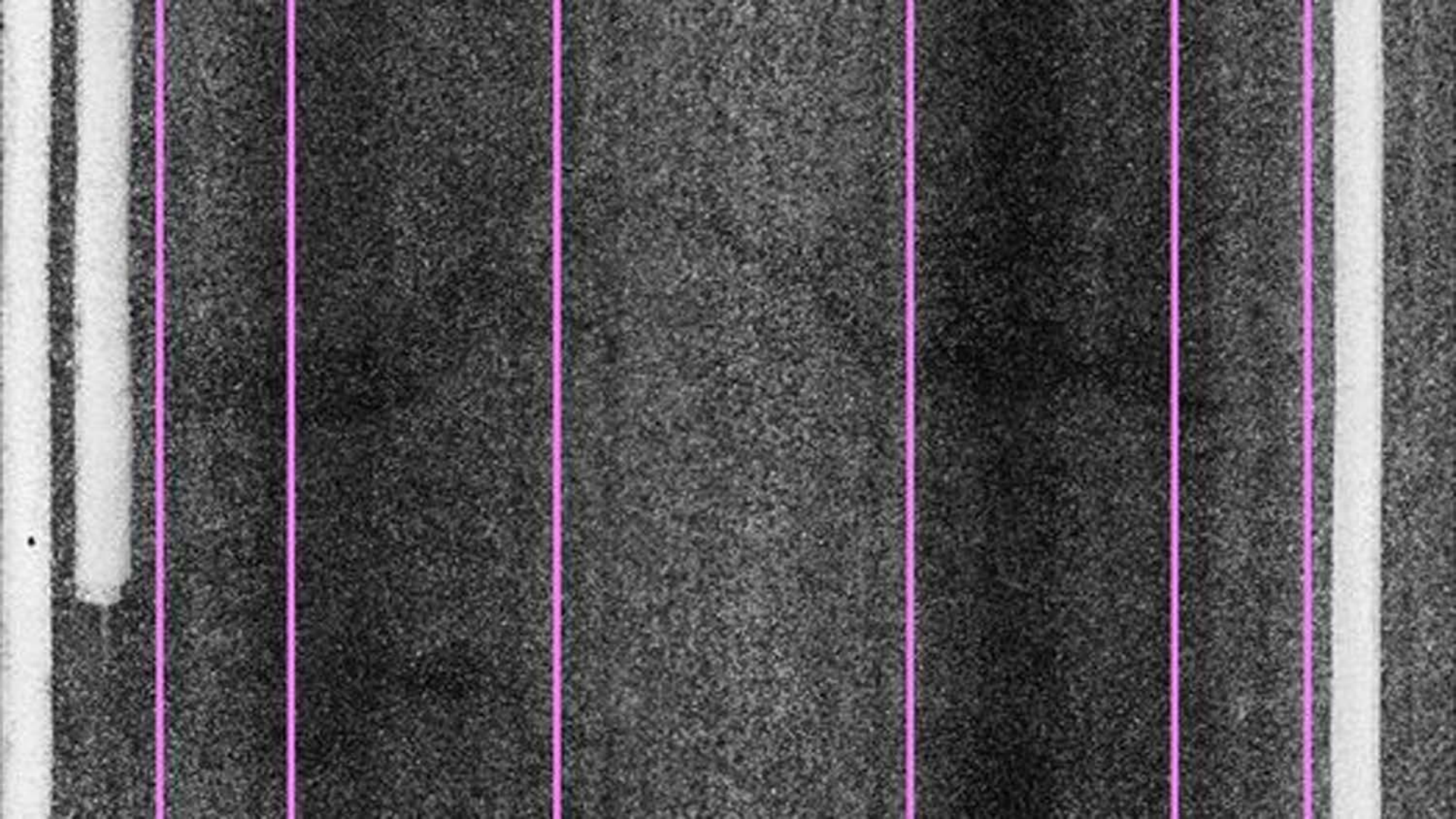
High-Resolution Intensity Image

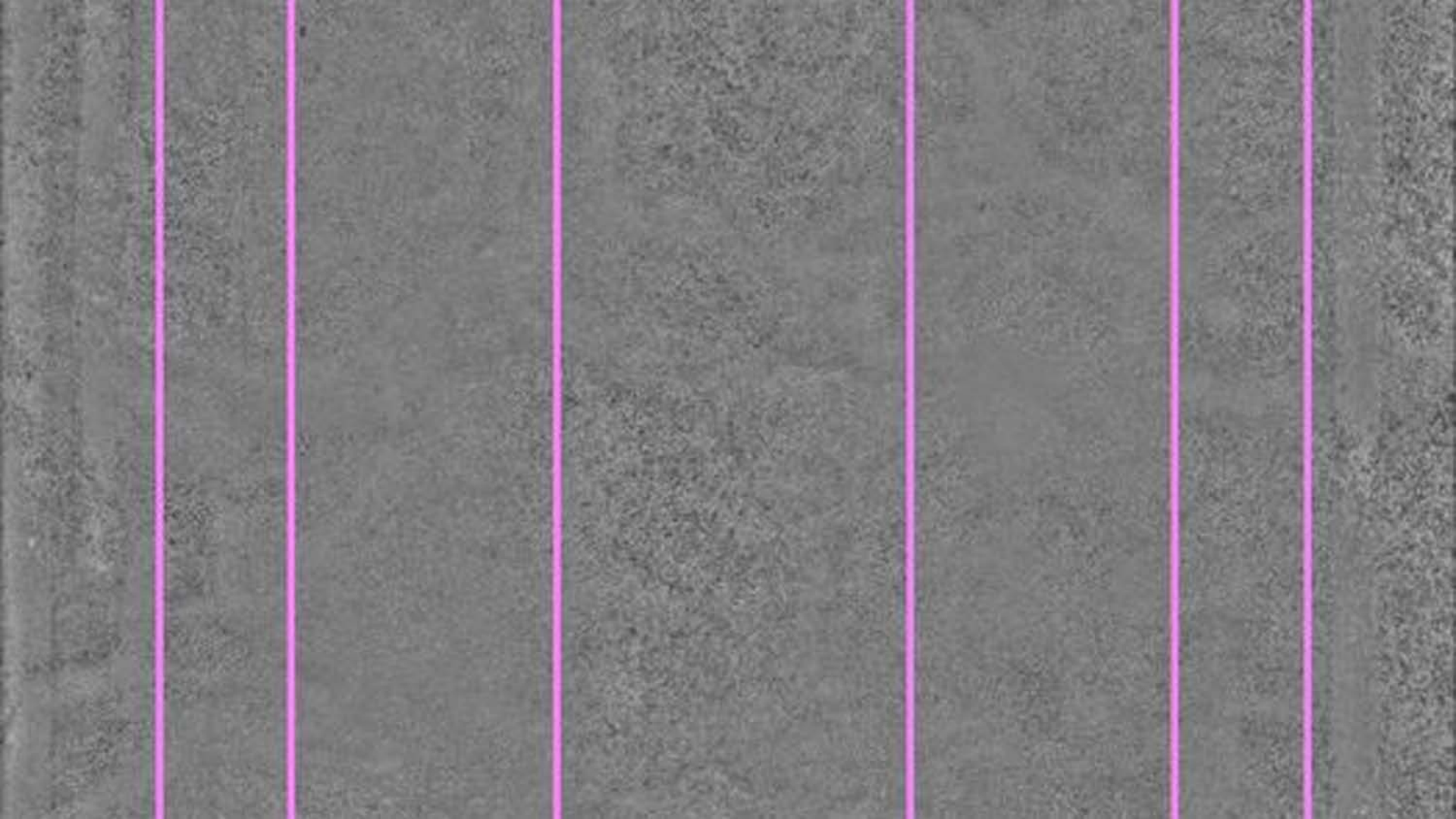



High-Resolution Intensity
Image
+
Range Image

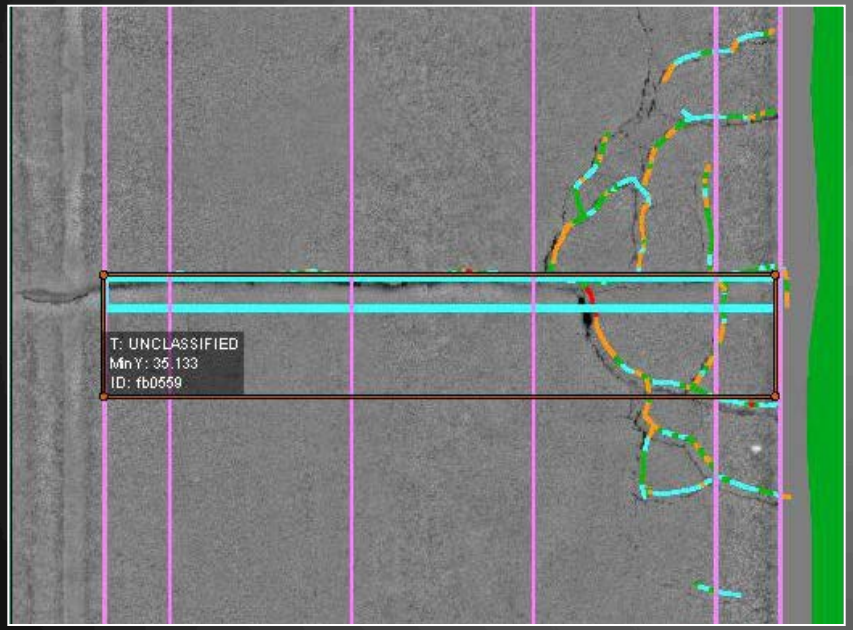

High-Resolution Intensity
Image
+
Range Image
= Automated Distress

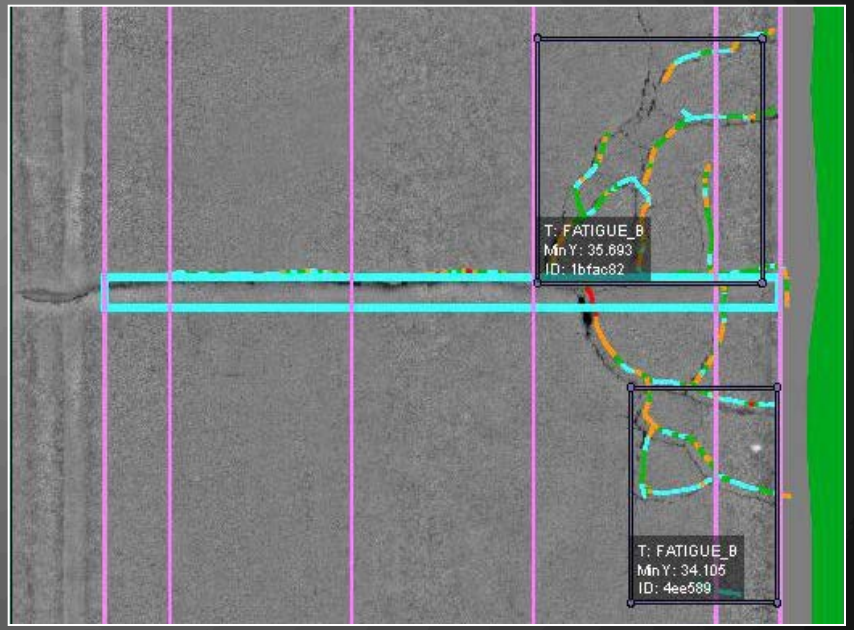

EAST
56



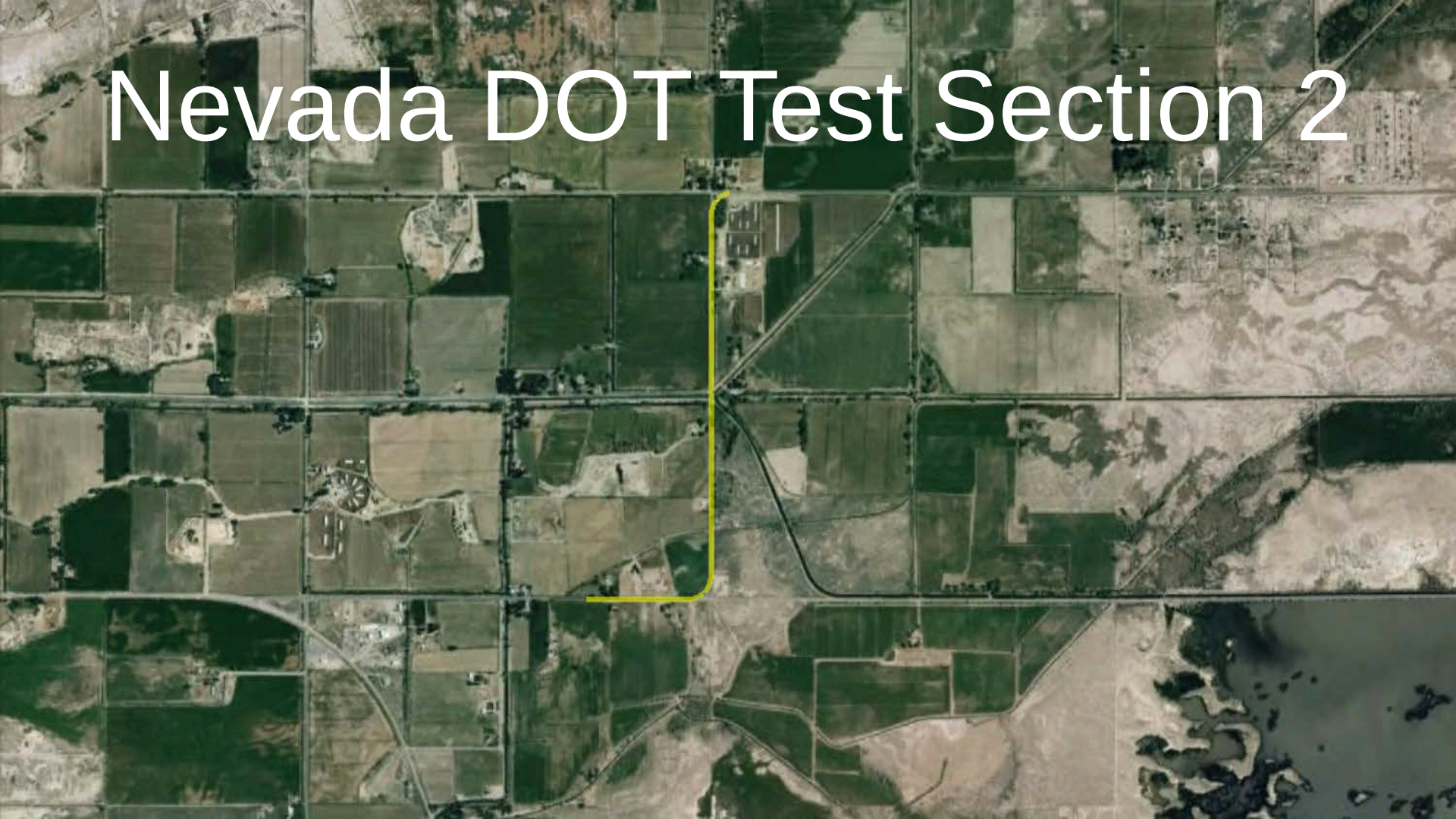


Software Training

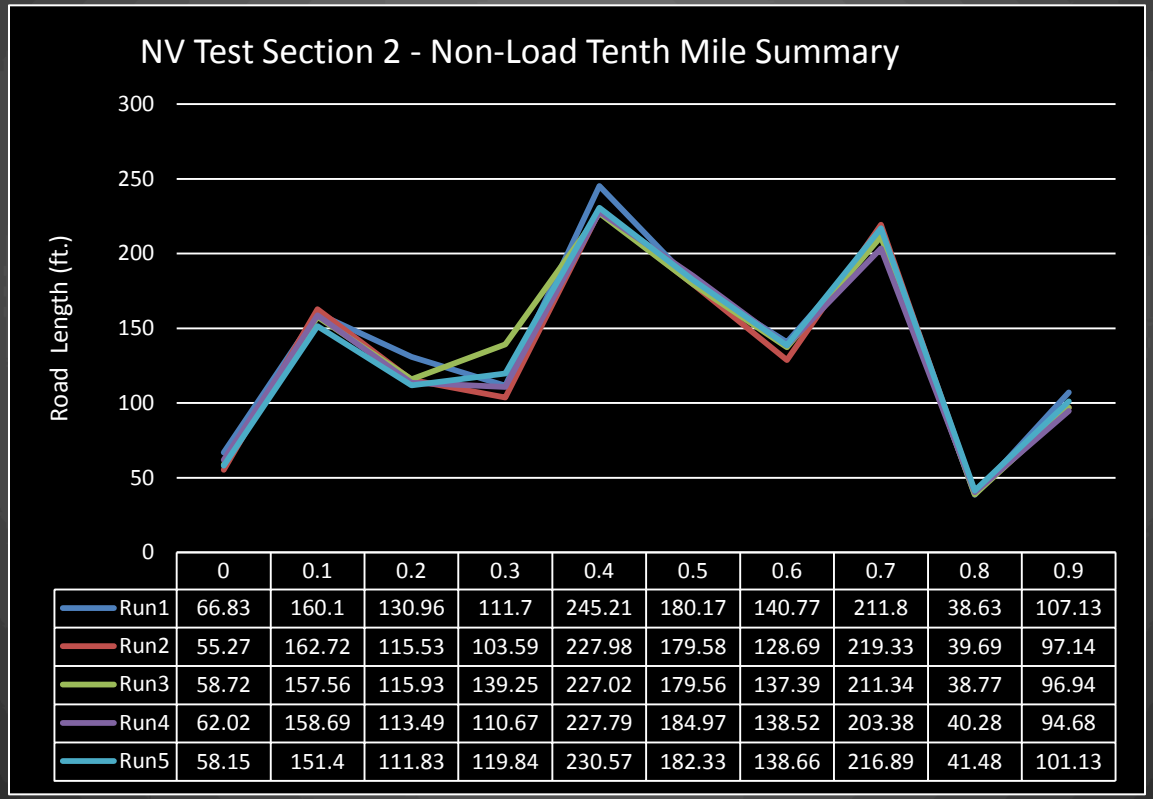




Nevada DOT Test Section 2

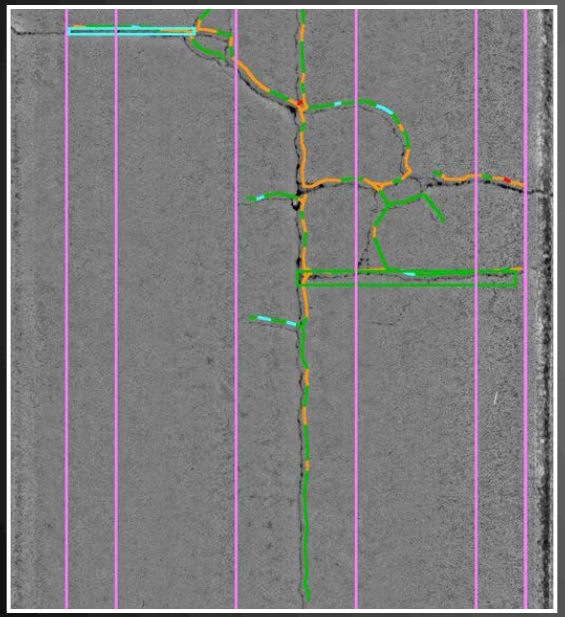


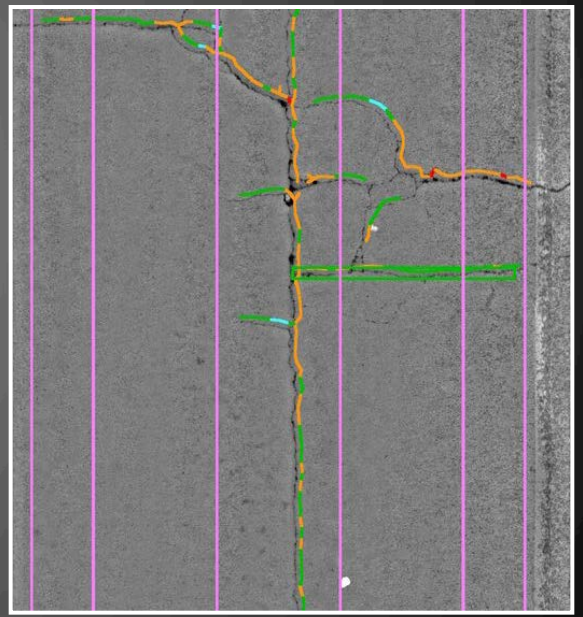
Nevada DOT QC/QA



	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Run1	66.83	160.1	130.96	111.7	245.21	180.17	140.77	211.8	38.63	107.13
Run2	55.27	162.72	115.53	103.59	227.98	179.58	128.69	219.33	39.69	97.14
Run3	58.72	157.56	115.93	139.25	227.02	179.56	137.39	211.34	38.77	96.94
Run4	62.02	158.69	113.49	110.67	227.79	184.97	138.52	203.38	40.28	94.68
Run5	58.15	151.4	111.83	119.84	230.57	182.33	138.66	216.89	41.48	101.13

Nevada DOT QC/QA

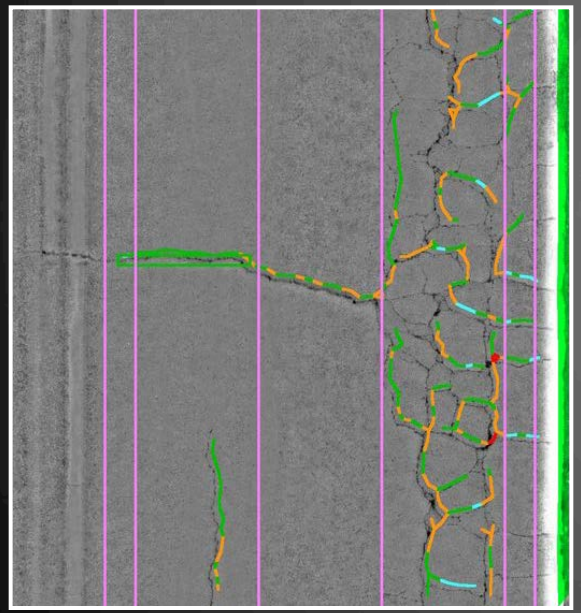


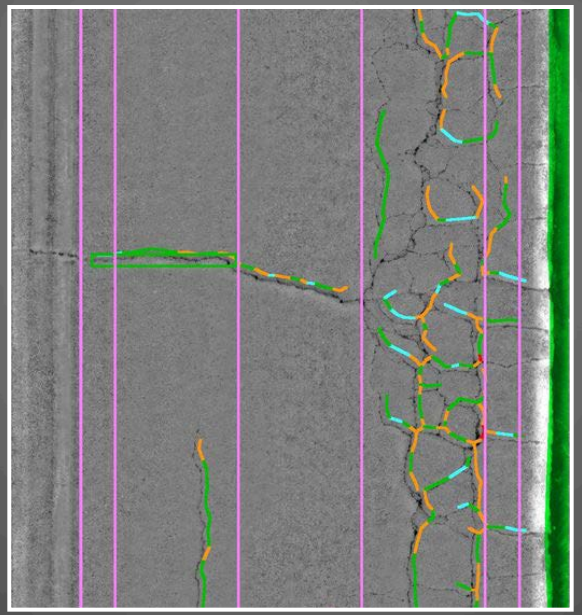


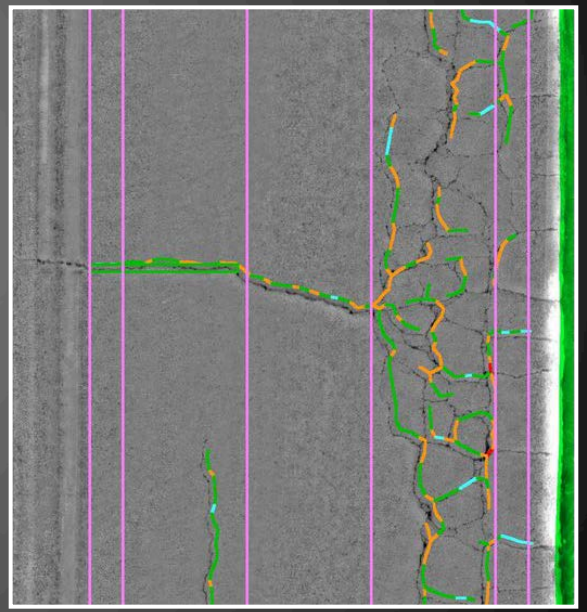
Nevada DOT QC/QA

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Run1	121.21	199.88	226.89	163.84	212.35	116.25	135.78	174.69	45.17	126.5
Run2	118.45	181.17	228.07	173.91	197.12	119.33	113.55	165.5	53.18	126.15
Run3	117.97	187.31	237.25	137.75	195.19	122.55	115.07	171.31	48.07	118.45
Run4	115.44	185.89	229.44	161.42	188.77	125.05	112.48	182.11	47.46	116.87
Run5	117.82	193	240.19	148.07	178.92	118.84	105.41	176.76	47.6	116.35

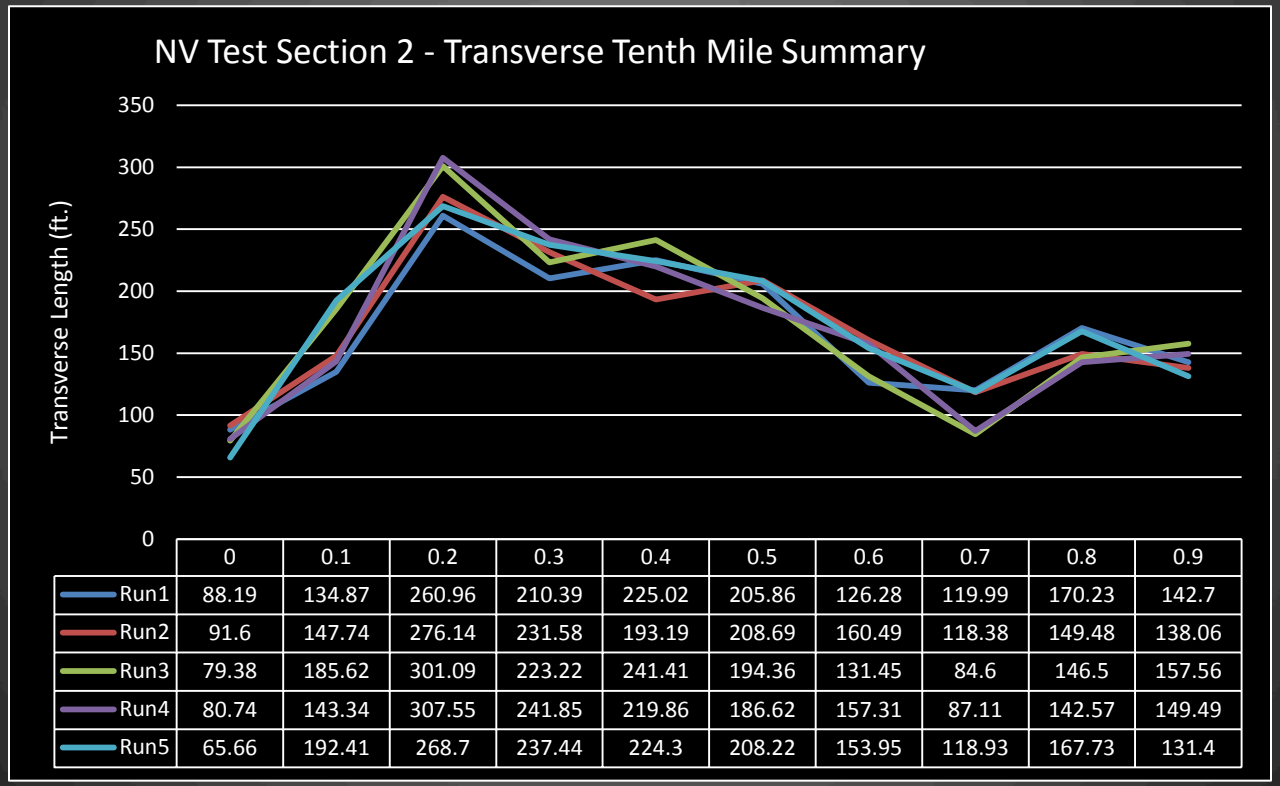
Nevada DOT QC/QA





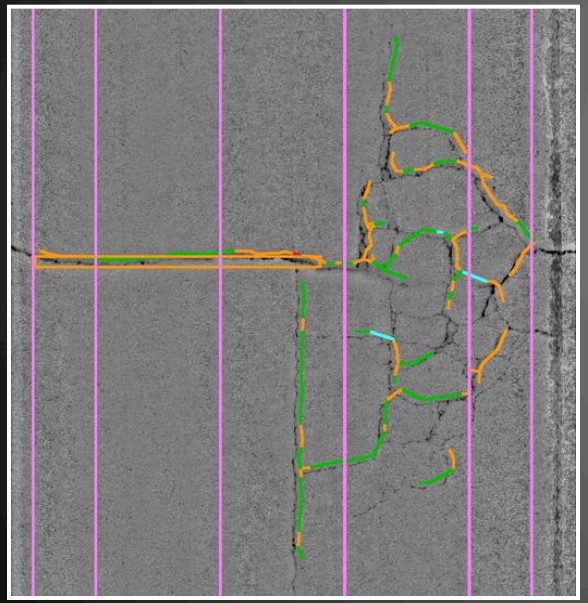


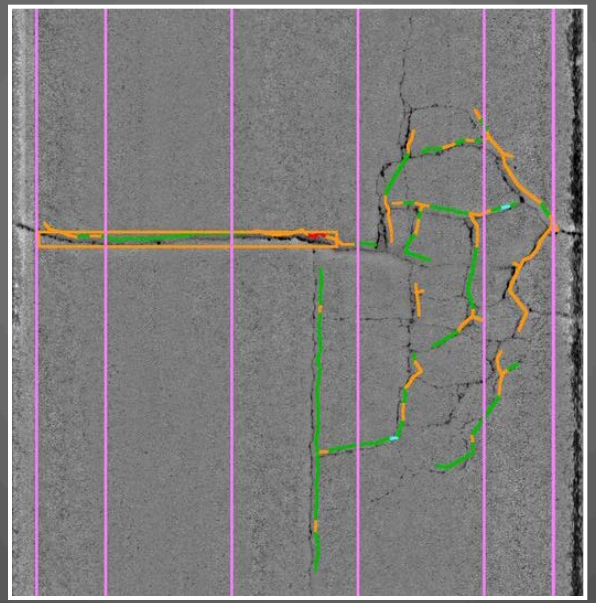
Nevada DOT QC/QA

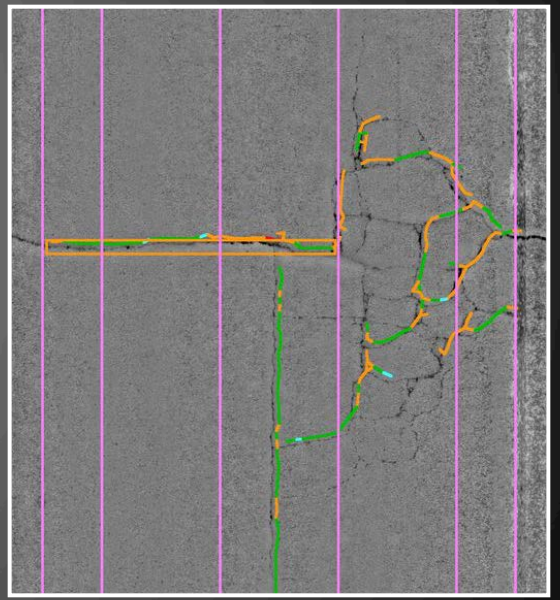


	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Run1	88.19	134.87	260.96	210.39	225.02	205.86	126.28	119.99	170.23	142.7
Run2	91.6	147.74	276.14	231.58	193.19	208.69	160.49	118.38	149.48	138.06
Run3	79.38	185.62	301.09	223.22	241.41	194.36	131.45	84.6	146.5	157.56
Run4	80.74	143.34	307.55	241.85	219.86	186.62	157.31	87.11	142.57	149.49
Run5	65.66	192.41	268.7	237.44	224.3	208.22	153.95	118.93	167.73	131.4

Nevada DOT QC/QA







AUTOMATED	MANUAL
Longitudinal	Maintenance Patching
Transverse	Edge Condition
Alligator	Weathering
Potholes	Depressions
Rutting	
Raveling	
Flushing/Bleeding	

Statewide Projects

Utah
Tennessee
New Mexico
Nevada
Hawaii
Alaska

Illinois
California
Rhode Island
Oklahoma
Kentucky
Kansas

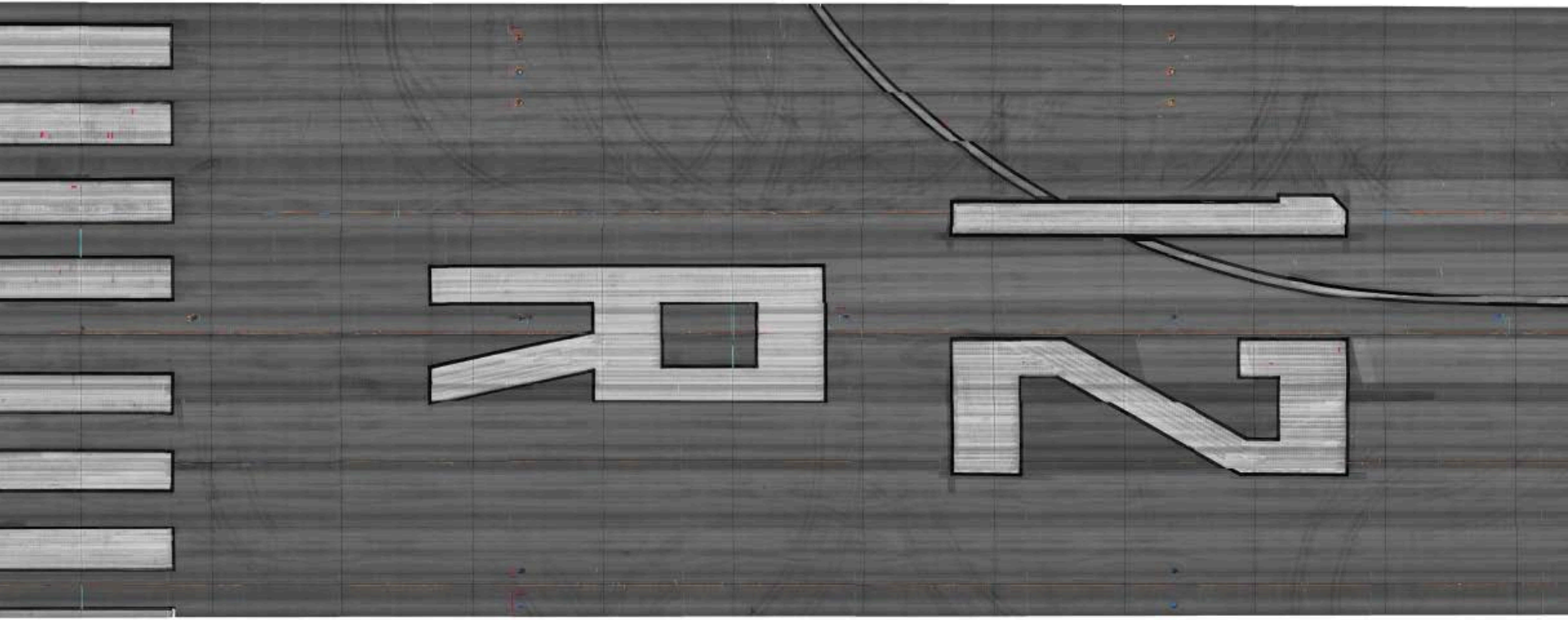
Mandli’s Future Distress

Increased Resolution

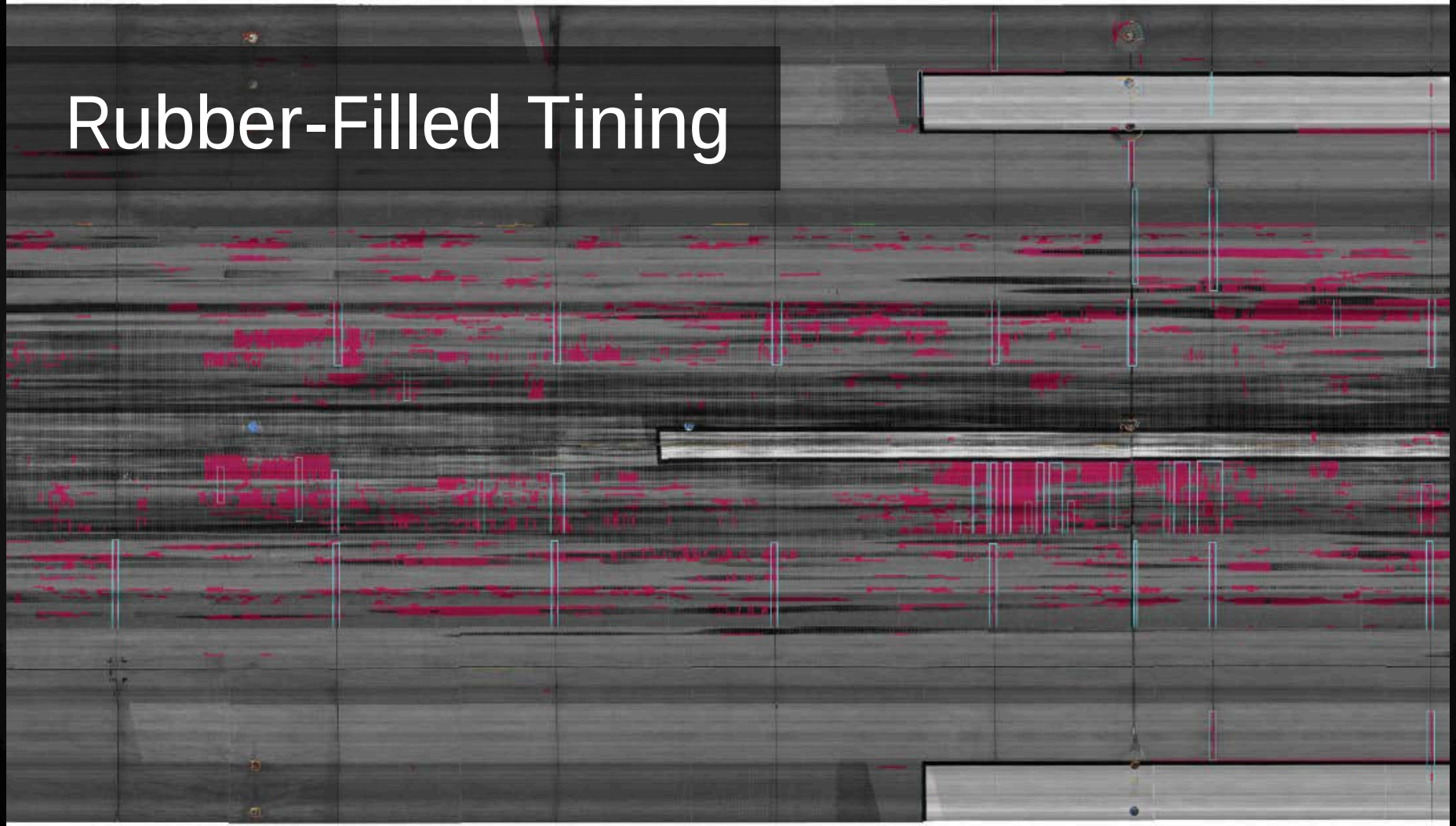
Improved Detection Algorithms

Additional Applications

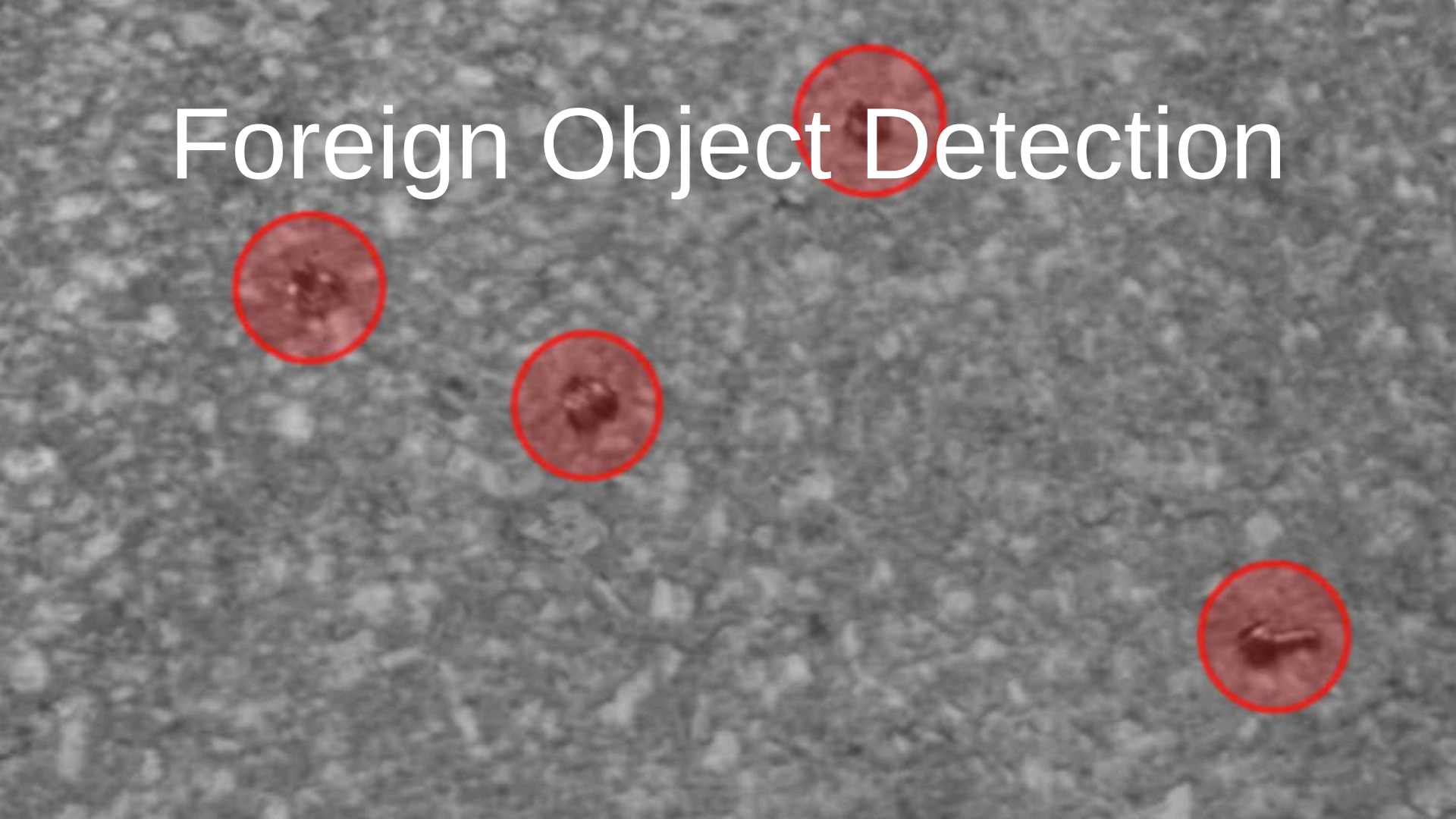
Airport Evaluation



Rubber-Filled Tining



Foreign Object Detection



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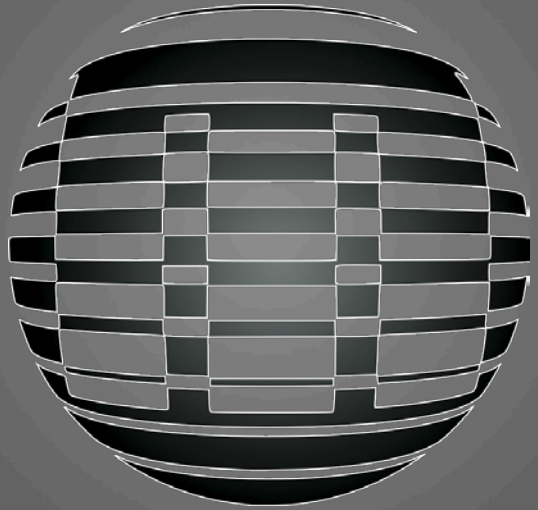

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