



A Proactive Approach to Tribal Roadway Safety

Presented By:



RDV Systems
Natan Elsberg
Founder & CEO



KLJ Engineering
Craig Genzlinger
Project Engineer





Barriers to Safer Tribal Roads

Challenges in Tribal Roadway Safety

- Lack of reliable crash history
- Limited funding & resources
- Vast roadway networks to monitor

Why Current Crash-Based Methods Fall Short

- Delays in data availability
- Reactive, not proactive
- Misses emerging risks



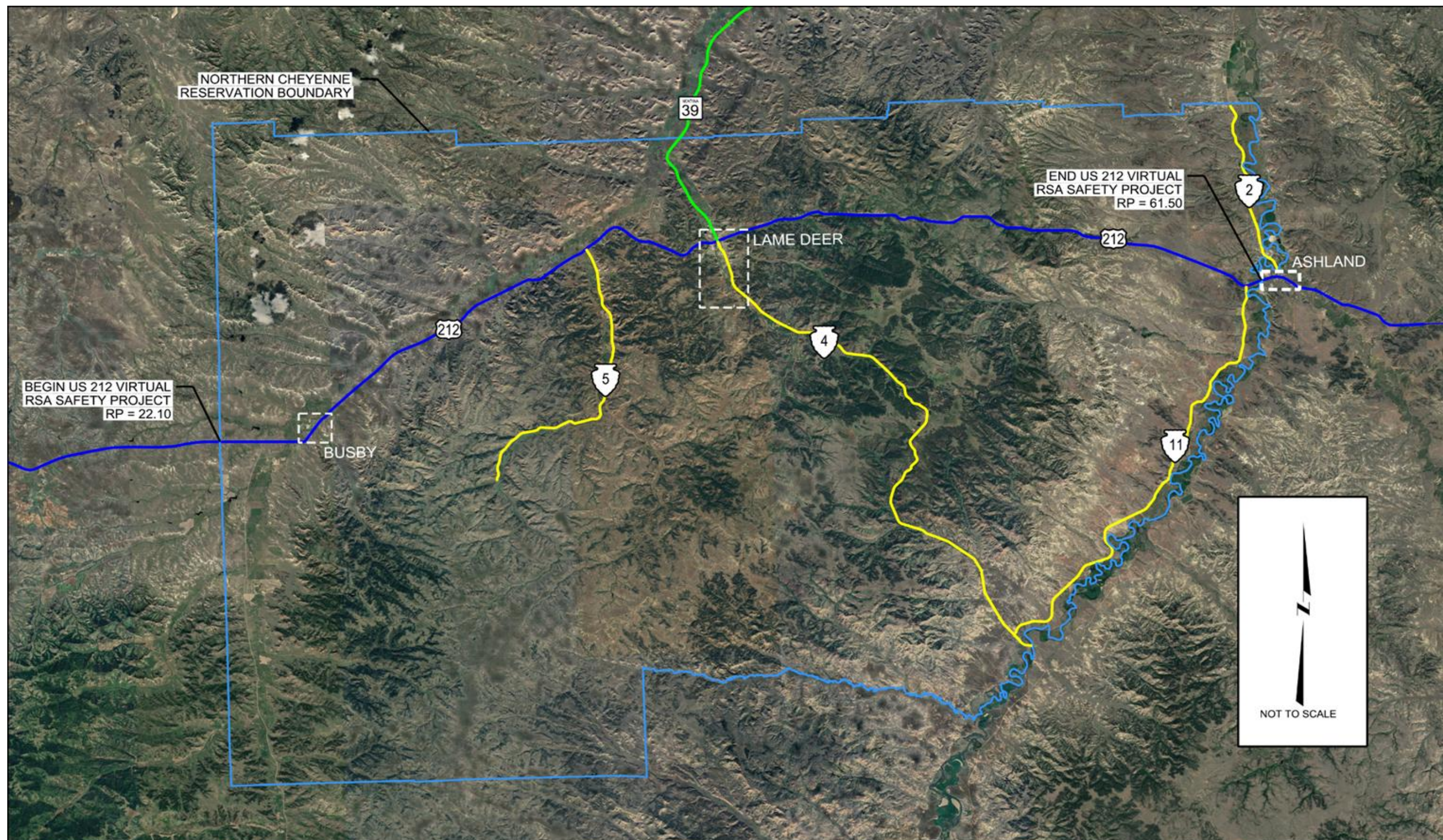
Northern Cheyenne Reservation Case Study

US 212



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Study Area



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US Highway 212

SAFETY ACTION PLAN

CROW AGENCY — ALZADA

212 212 212



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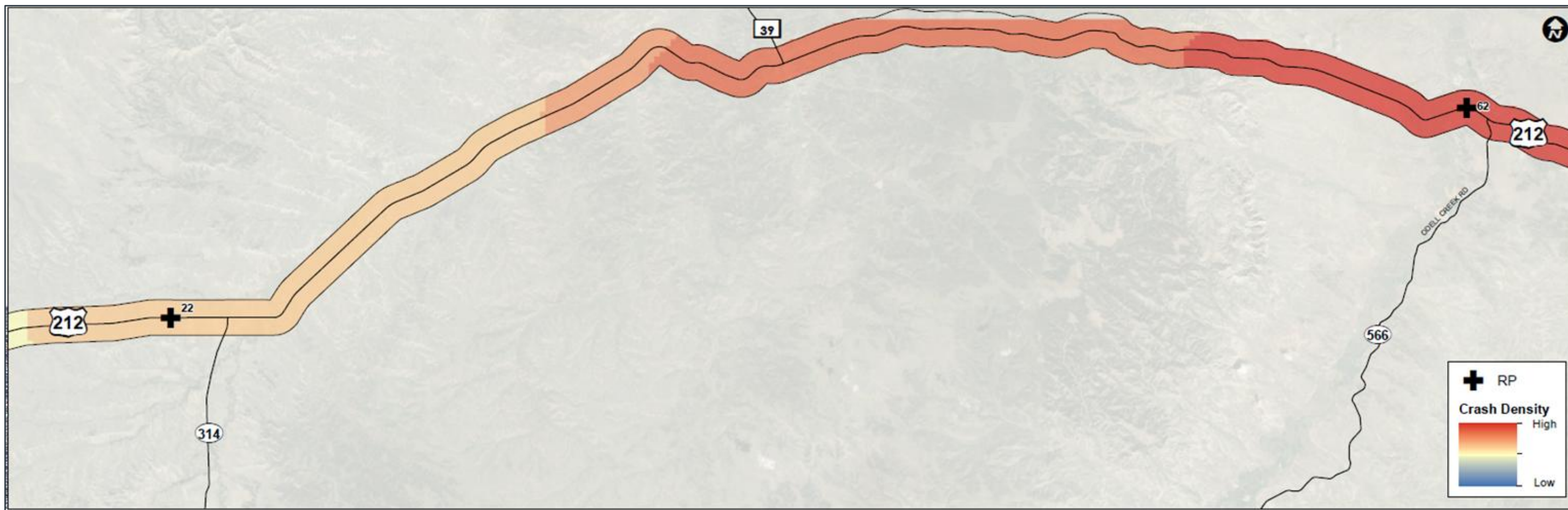
Historical Crash Data (2013-2022)

- Crash data was only available from the MDT Traffic and Safety Bureau
- There were a reported 184 crash or approximately 18.4 crashes per year
- These included the following injury severities
 - 29 fatal crashes
 - More recent Crashes including 3 fatalities that involved a school bus and county sheriff
 - 15 serious injury crashes
 - 36 minor injury crashes
 - 6 possible injury crashes
 - 94 property damage-only crashes
 - 4 crashes with unknown severity



Historical Crash Data (2013-2022)

- The highest crash density is generally concentrated east of RP 54.0, with moderate to high density observed between RP 33.5 and RP 54.0.
- A heat map was developed using ArcGIS tool to identify the high-density crash areas within the study segment.



RDV's RSA 3D Overview

- RDV's RSA 3-D is a cutting-edge Road Safety Audit tool that uses 3D simulations to assess roadway safety
- It identifies deficiencies related to sight distance, geometry, and terrain, providing a proactive approach to addressing safety issues
- The tool is particularly valuable for evaluating complex roadways and identifying potential hazards before they lead to accidents.

Methodology

- **Stopping Sight Distance (SSD)**

- Determine maximum safe speeds at various points along the corridor
- Identify challenges related to terrain, vegetation, vertical curves, guardrails, and signs

- **Passing Sight Distance (PSD)**

- Evaluates the safety of passing zones under existing design speeds

- **Flat Spot Detection**

- Uses a 0.5% elevation change threshold to identify potential flat spots, which can cause water pooling and hydroplaning risks

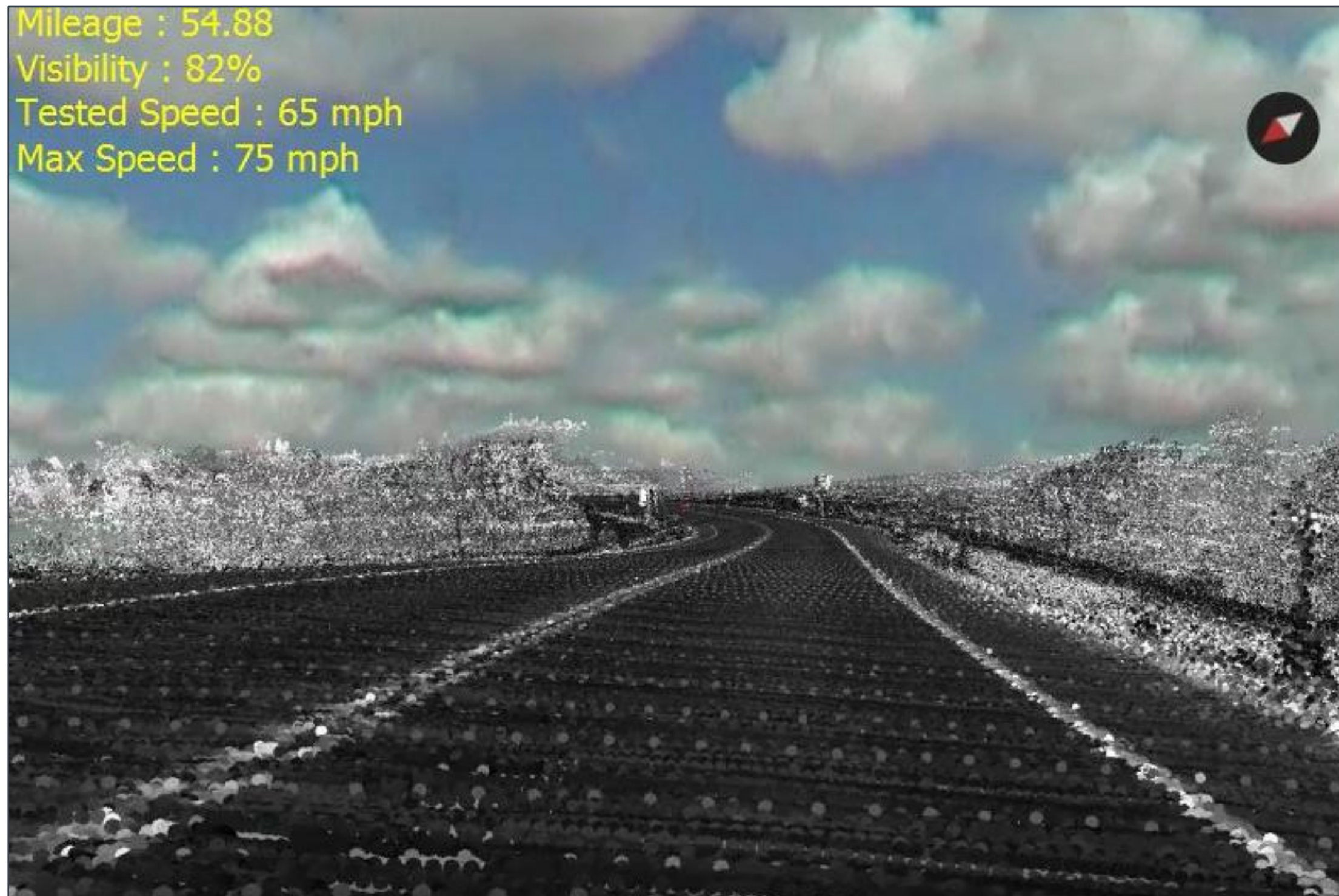
- **Roadside Safety Analysis**



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RDV's RSA 3D - Summary

- Example photo of the video provided by RSA 3D



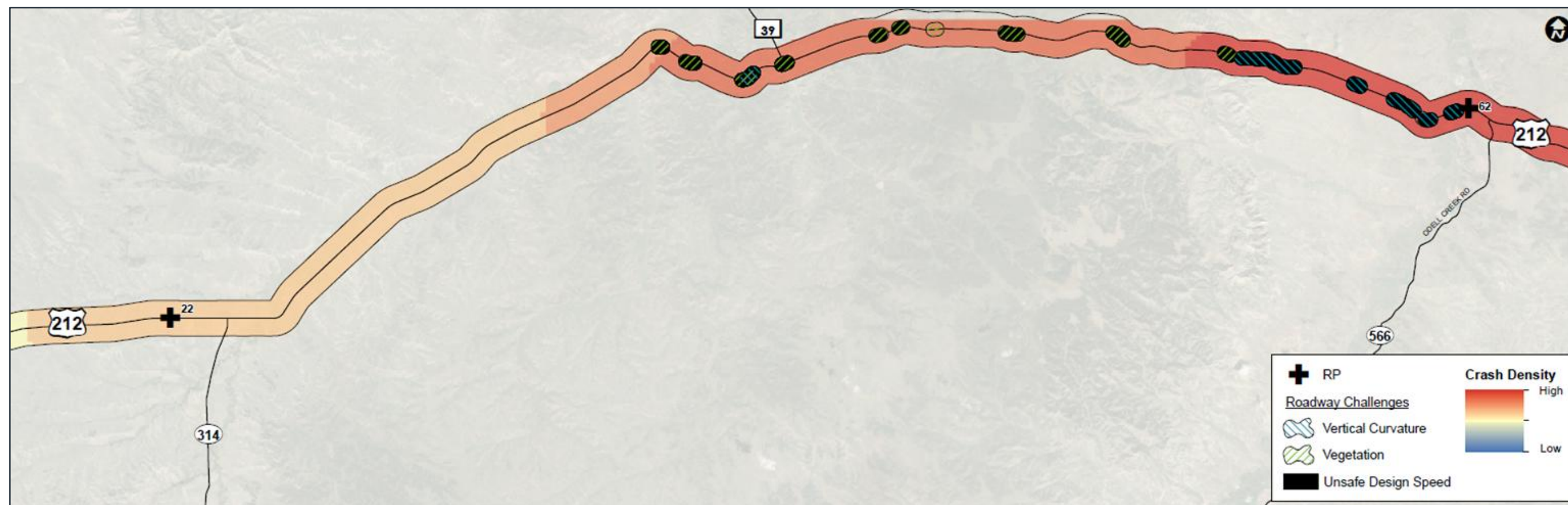
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RDV's RSA 3D - Findings

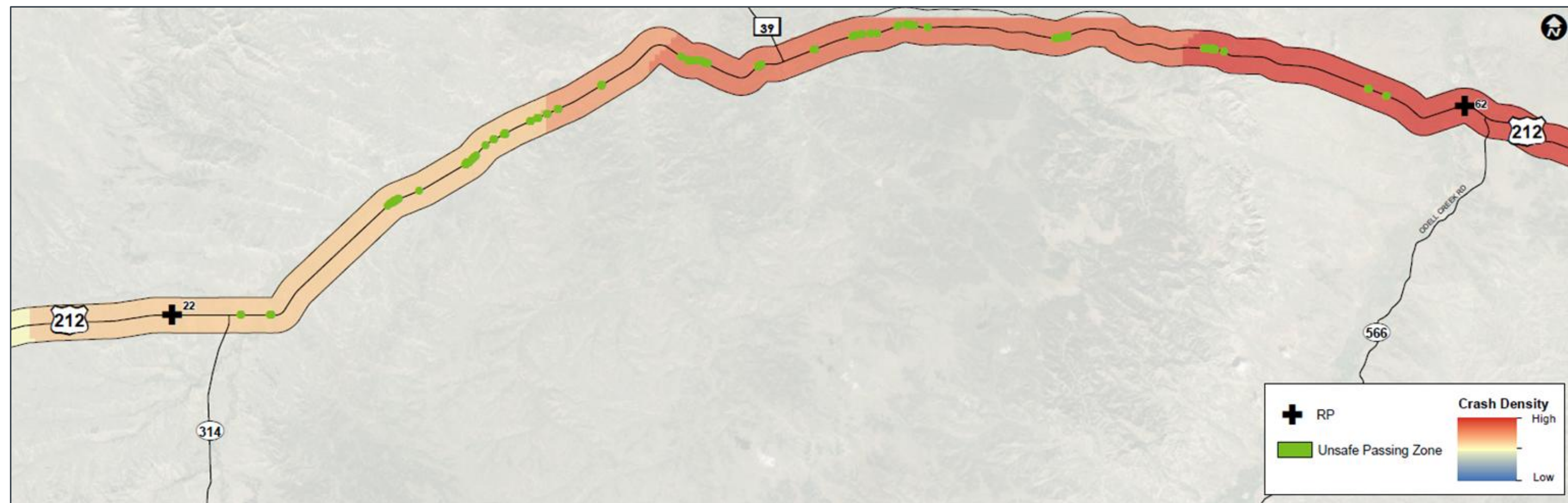
- Vegetation and Vertical Curve Challenges
 - Safe speeds were 10-15 mph lower than design speeds in areas with significant vegetation and vertical curvature. These areas coincided with high crash density locations



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RDV's RSA 3D - Findings

- Unsafe Passing Zones
 - Several passing zones were identified as unsafe under existing design speeds



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RDV's RSA 3D - Summary

- RSA-3D is a powerful tool that enhances road safety analysis by providing detailed 3D visualizations
- It allows engineers to assess roadways with unprecedented clarity
- Has the ability to create real-world simulations supports a proactive approach to road safety
- It enables the identification of potential deficiencies before crashes occur
- By integrating LiDAR data, RSA-3D offers highly accurate terrain and geometric assessments, making it a valuable resource for infrastructure planning and improvement
- It has a global recognition as an industry leader in road safety audits highlights its effectiveness in enhancing roadway design and reducing long-term costs through early detection of safety concerns.



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RDV's RSA 3D - Summary

- The videos provided by RSA 3D provide a dynamic, real-world simulations of roadway conditions, offering a level of insight that static reports or 2D diagrams cannot match
- The videos provide a realistic, 3D representation of the roadway, including terrain, vegetation, and infrastructure.
- This helps reviewers visualize the environment as drivers experience it
- Unlike static images, videos allow reviewers to "drive" through the corridor, observing how sight distances, curves, and other features change in real-time. By leveraging these videos, reviewers can make more informed decisions, prioritize interventions, and ultimately improve road safety for all users
- While RSA-3D serves as an effective screening and visualization tool, it should be supplemented with traditional safety audits, crash data analysis, and engineering expertise to develop well-rounded and effective safety solutions.





About RDV Systems



-  RDV = **Rapid** Design Visualization
-  Pioneers in **3D Modeling for visualization** of infrastructure
-  Pioneers in 3D model-based **Roadway Safety Simulations**
-  Expertise in:
 - 3D modeling technology and services
 - Artificial intelligence (AI) for Automation
 - LiDAR analytics
 - Road Safety



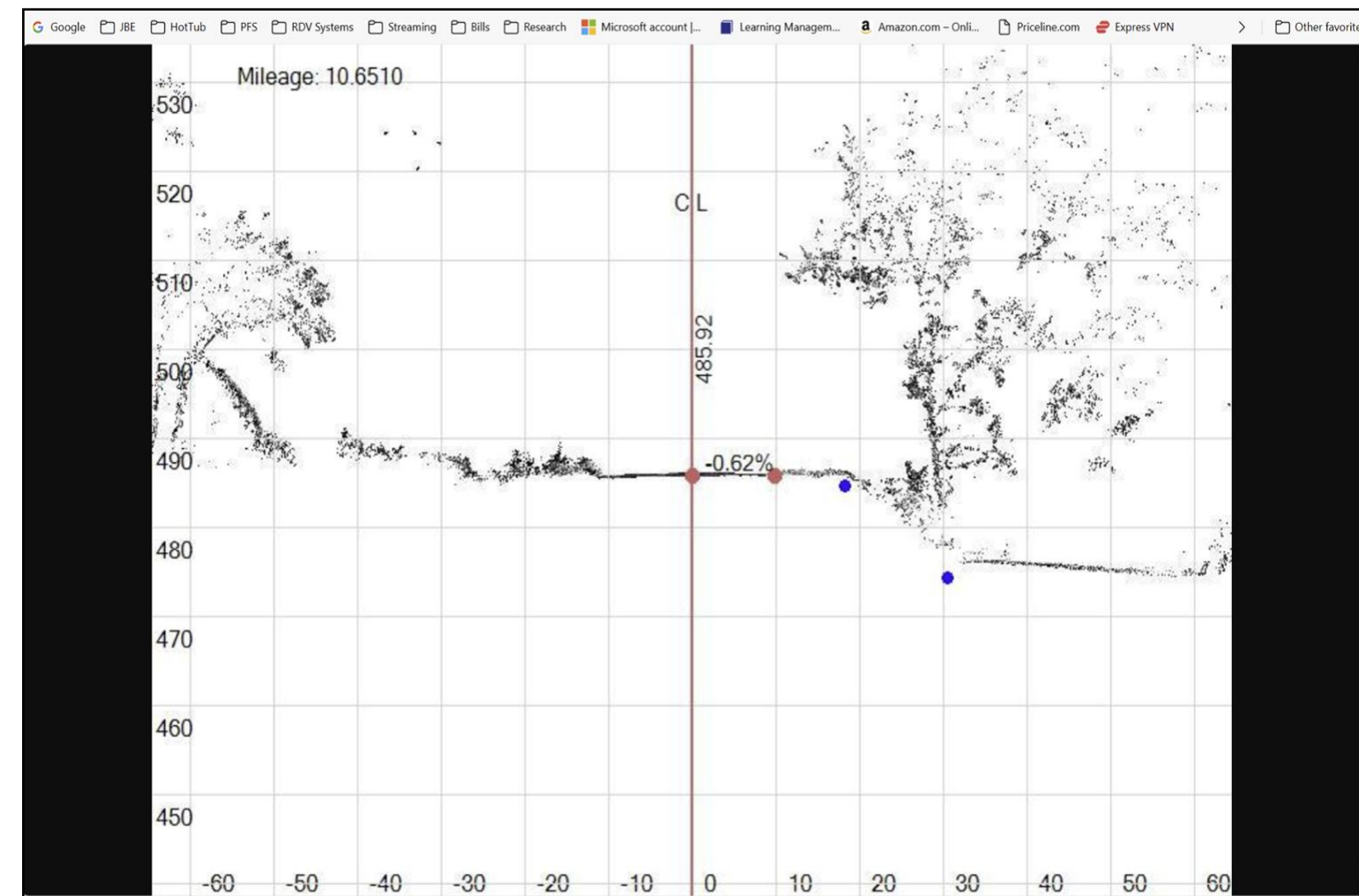
Embankments/Clear Zones/ Guardrails



- **Roadway & Embankment Measurements**

- (Clear Zone)**

- Roadway & shoulder width
 - Height & width
 - Slope & back slope
 - Vegetation density
 - Guardrail presence
 - Guardrail warrants





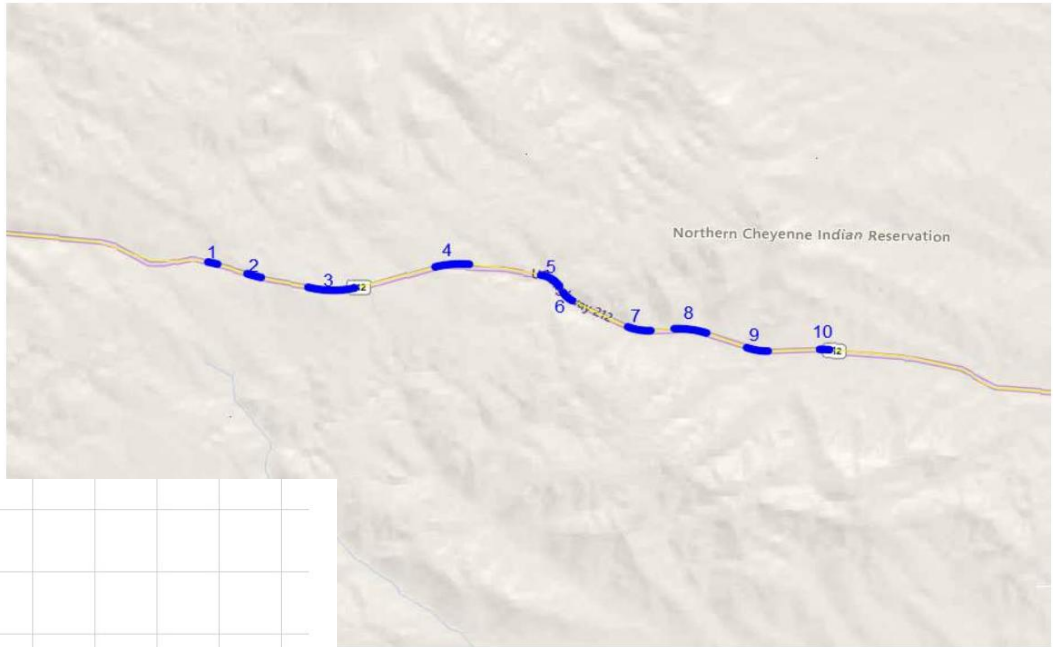
Horizontal Curves



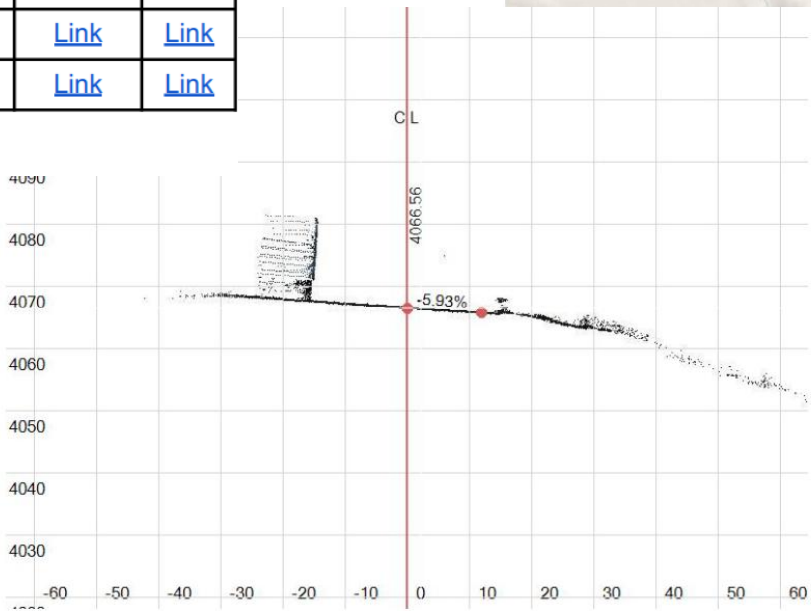
Automated application to analyze horizontal curvature and superelevation as it relates to design speed. Outputs recommended advisory speed for curves with deficiencies

Curve ID	Start Mile	End Mile	Turn Direction	Speed Limit (MPH)	f (Side Friction Factor)	Existing Radius (feet)	Minimum required radius (feet)	Existing Superelevation	Required Superelevation	Safety Score	Required Speed (MPH)	Link (middle point of curve)	SV
1	49.0015	49.0716	Right	65	0.11	3830	1480	-4.33	-4.60	85%	55	Link	Link
2	49.3044	49.4067	Left	65	0.11	5453	1480	4.75	3.30			Link	Link
3	49.7645	50.1072	Left	65	0.11	3727	1480	5.41	4.70			Link	Link
4	50.7263	50.9743	Right	65	0.11	3808	1480	-4.30	-4.60	85%	55	Link	Link
5	51.512	51.6786	Right	65	0.11	1019	1480	-6.30	-8.00	46%	30	Link	Link
6	51.7372	51.8243	Left	65	0.11	995	1480	8.21	8.00			Link	Link
7	52.2863	52.4548	Left	65	0.11	2000	1480	7.80	7.30			Link	Link
8	52.6328	52.8694	Right	65	0.11	3721	1480	-4.62	-4.70	85%	55	Link	Link
9	53.1913	53.3465	Left	65	0.11	2277	1480	8.69	6.80			Link	Link
10	53.7308	53.799	Right	65	0.11	3381	1480	-4.61	-5.00	77%	50	Link	Link

Curves Table

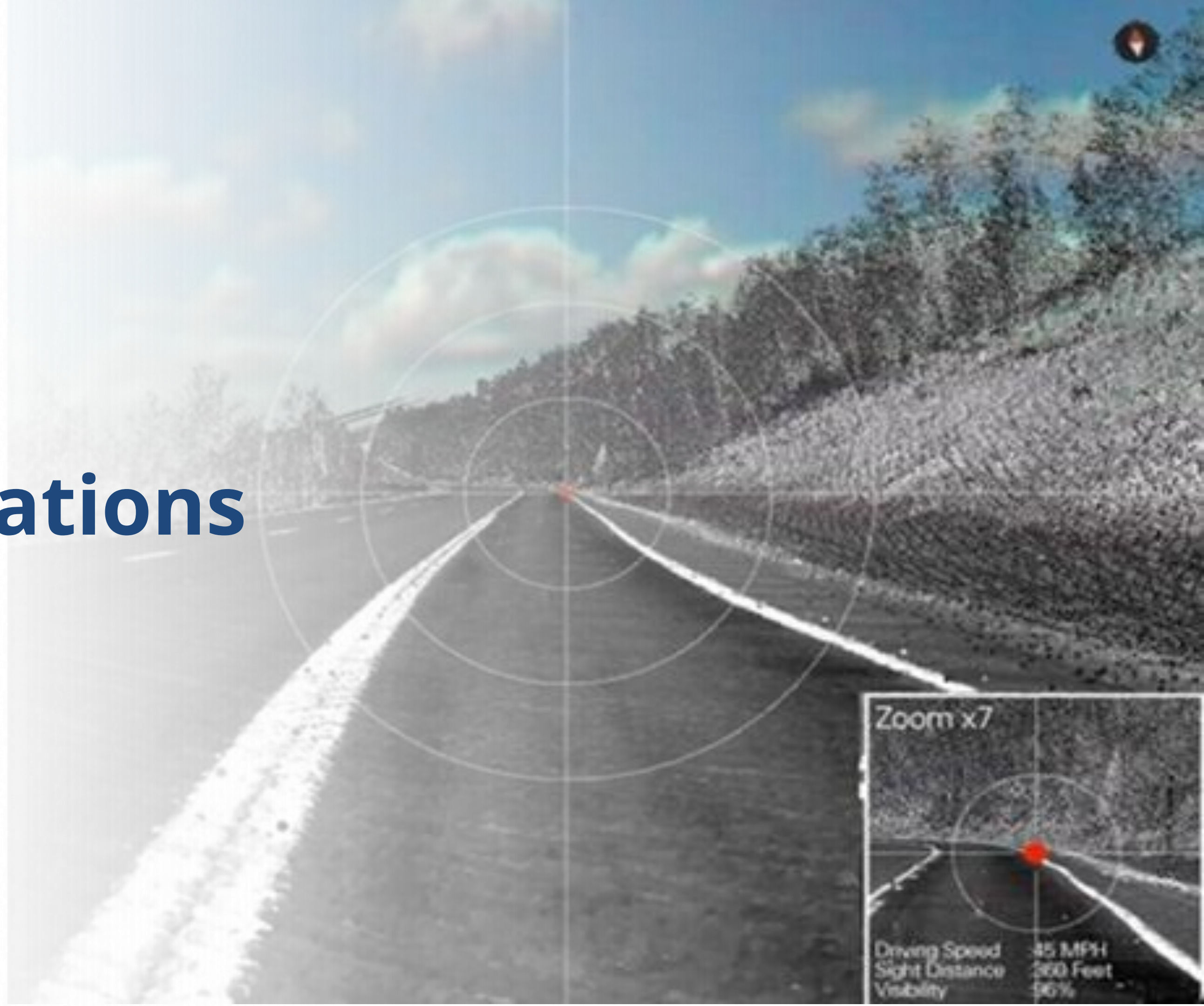


horizontal curves Map





Other Applications

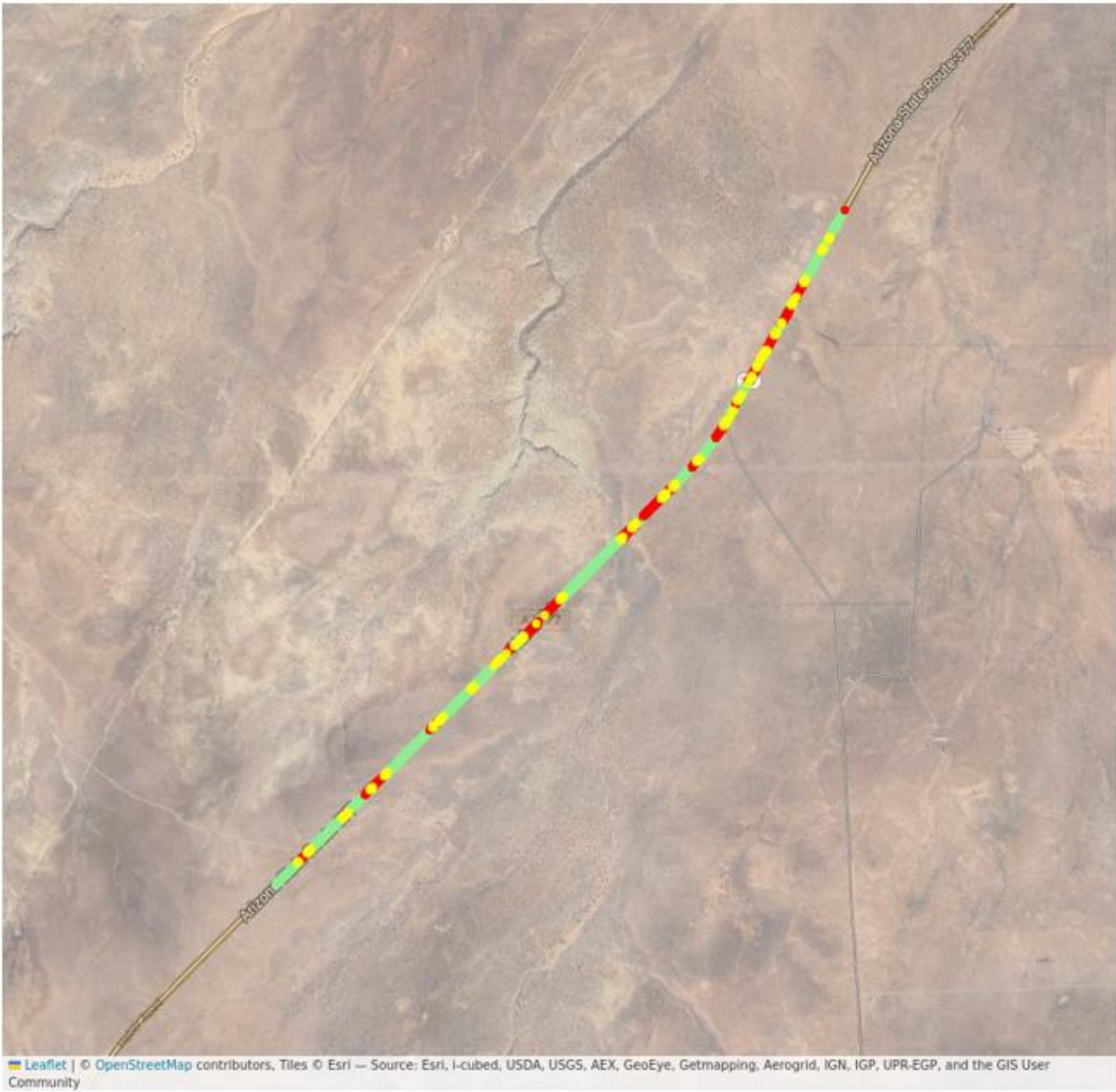




Stopping Sight Distance



[On Line Report](#)



- speed difference ≤ -10
- $-10 < \text{speed difference} \leq -5$
- speed difference > -5

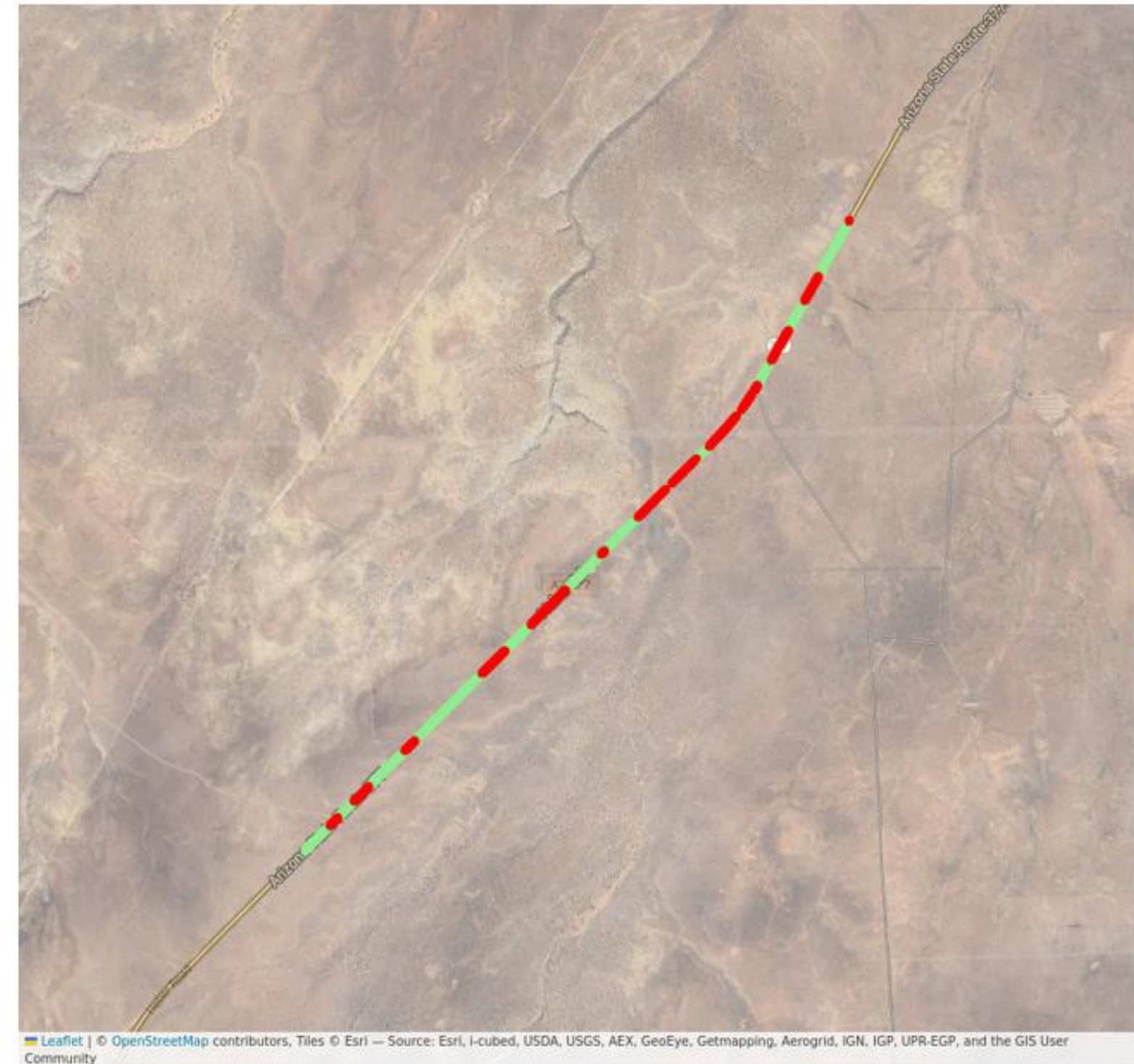


Passing Sight Distance



[On Line Report](#)

[Video Simulation](#)

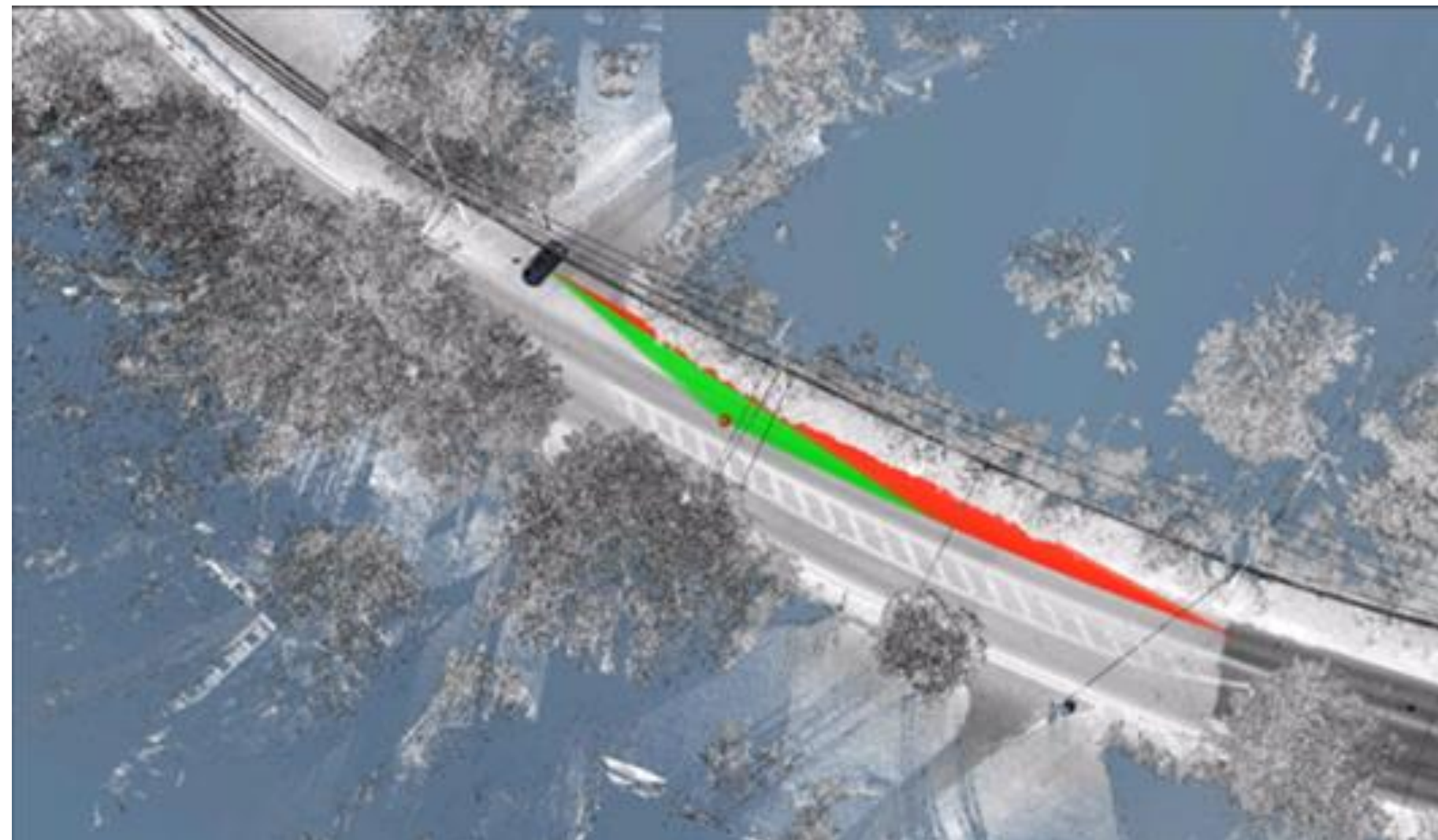




Intersection Sight Distance



- **Intersection Sight Distance**
 - **Sight triangles** for turning maneuvers
 - Evaluate for **PED and bike**
 - Evaluate **left turn opposing queue**





Vulnerable Road Users





Solar Glare

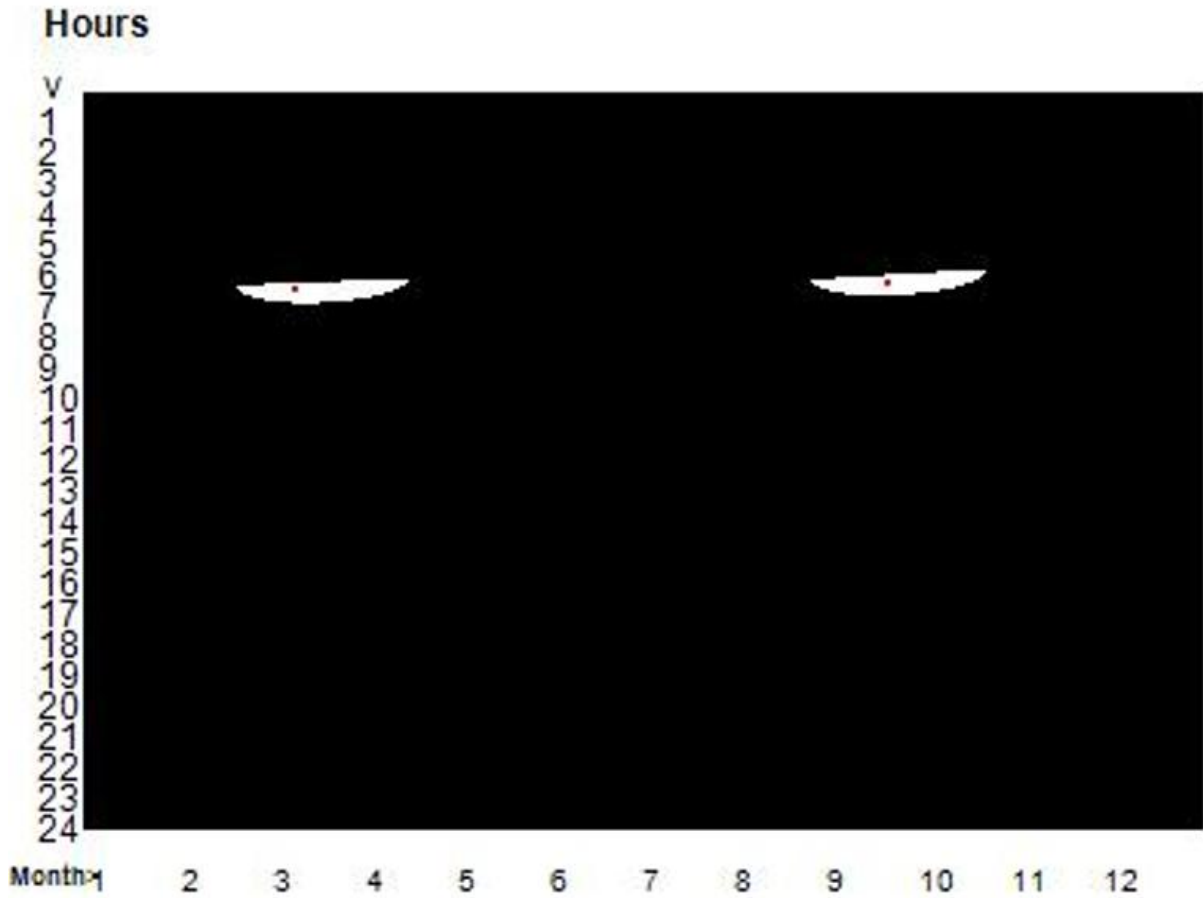


Feature	Value
UTAH_R3-0132-5-LL-P_GLR.shp	
RName	0132
(Derived)	
(Actions)	
Mileage	34.3579
Distance	2206.20
FrameURL	https://devus.123k
Units	FEET
glareMinut	10410
positionLa	[Latitude: 39.711...
ID	12/24/2023 8:33...
RName	0132
Direction	Positive
PathCode	LL
PathID	R3-0132-5-LL-P
ConfType	GLR
Cycle	2020.00



ROAD SAFETY AUDIT 3D

Glare: 19 Feb - 15 Apr, 06:06 - 06:48
Glare peak: 09 Mar, 06:18
Glare: 25 Aug - 20 Oct, 05:48 - 06:30
Glare peak: 18 Sep, 06:06





Design Kingman Bypass



Original RSA Model



Revised RSA Model



Wrap Up & Summary



- **Overcoming limited crash data:** LiDAR based predictive analysis provides insights without relying on incomplete records
- **Maximizing limited resources:** Prioritization tools help focus efforts where they matter most
- **Managing vast roadway networks:** Scalable, network-wide assessments identify risks before crashes occur

Why a Proactive Approach Matters

- Shifts from reactive crash-based studies to predictive safety analysis
- Enables earlier interventions that save lives and reduce costs
- Empowers tribes with data-driven tools to strengthen roadway safety



Questions & Answers



Natan Elsberg
CEO and Founder

✉ natan.elsberg@rdvsystems.com

☎ 914-469-5362

🌐 www.rdvsystems.com



Craig Genzlinger
Project Engineer

✉ craig.genzlinger@kljeng.com

☎ 406-461-2222

🌐 www.kljeng.com

