

usRAP Tribal Roadway Safety Experience: Northern Cheyenne and Crow Tribes

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How It All started

- Background
- Initial goal: Leveraging the usRAP
- Early collaboration

usRAP: UGPTI Perspective

- Understanding the Project Scope
- Workflow development
- Technology and Tools
- Collaboration & Iteration
- Outcome-Oriented Focus

Tribe Expectation from usRAP

Risk Mapping

Identification of high-risk zones

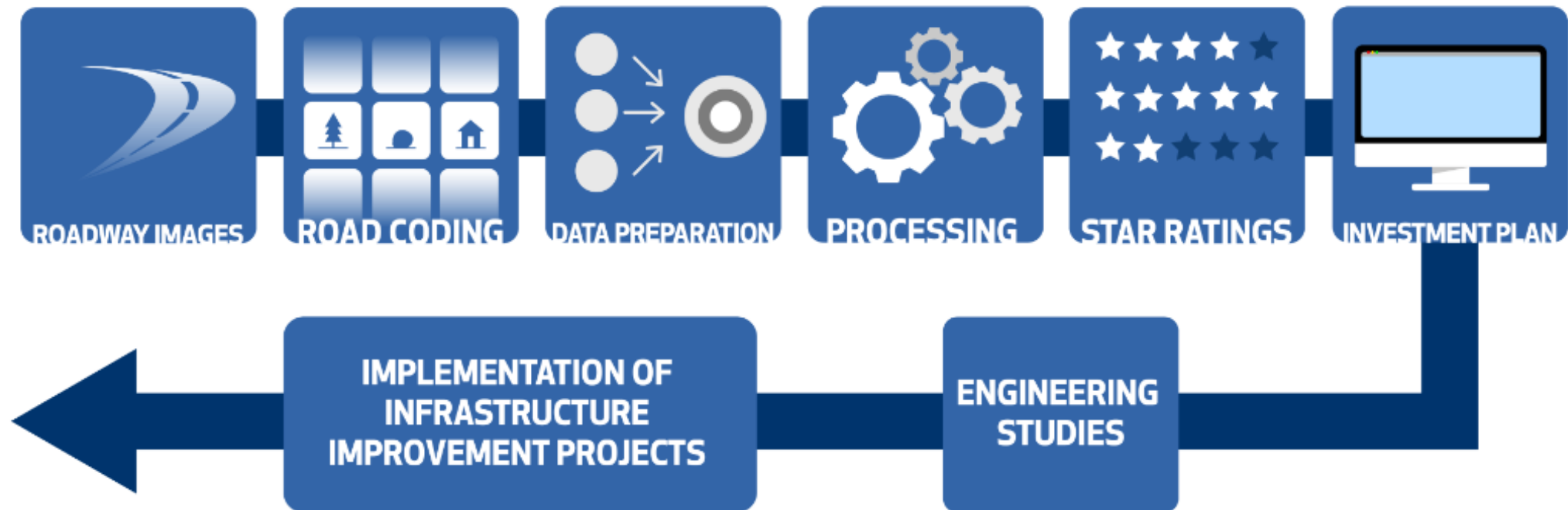
- Roadway Departure (RwD) Crashes
- Limited infrastructure, poor road conditions, and lack of clear signage

Road Inventory Tool

Low cost alternative

- Defined matrices related to roadway safety.
- Performance tracking over time with limited training.

usRAP in Action: Risk-based Safety Planning Steps



Source: usRAP Analysis Process Training Manual

Turning Data into Safer Roads

Data collection:
Equipment and Procedure

Image Processing

Coding of Roads

Network Calibration with
crash information



Data Collection Equipment



Source: Image created by AI chatbot;

Disclaimer: FHWA/NDSU/UGPTI does not endorse any product as part of this presentation

Data Collection: GoPro 360 Installation

- 360 Camera has two lenses and captures spherical photos/videos.
- Mounts on top of the vehicle.
- View the photos/videos in all directions as if standing at the camera location.



Source: Sara Yockey permitted use of her photos, per FHWA Office of Tribal Transportation

Data Collection Equipment: Other



Powerextra 3 Pack Rapid 3-Channel USB Charger Compatible with GoPro MAX 360 Battery and ACBBD-001 ACBAT-001

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Data Collection: Network Identification



Source: Northern Cheyenne Tribe

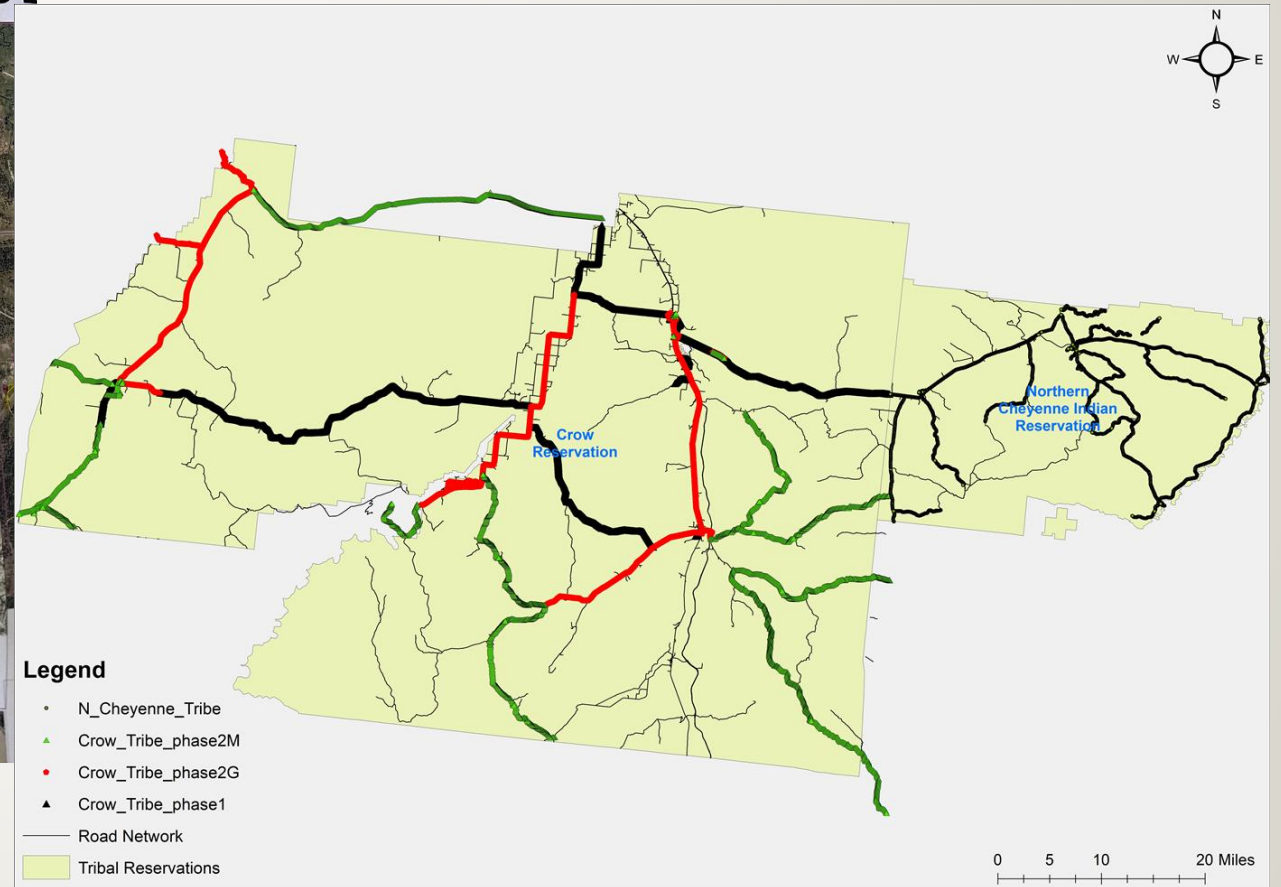
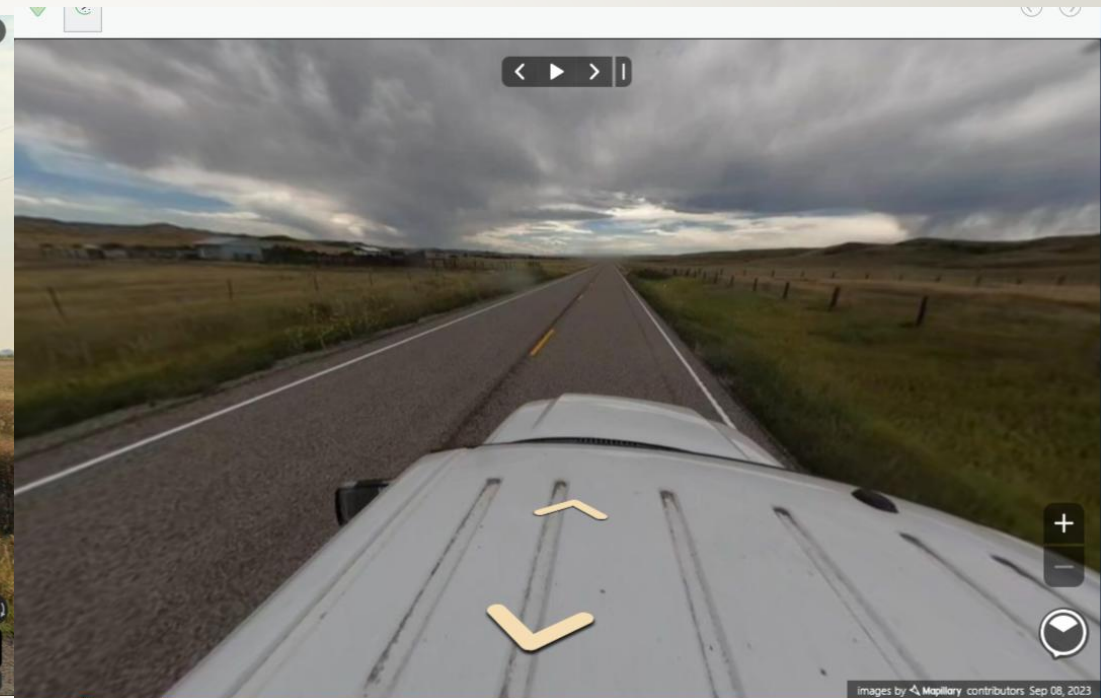


Image Processing



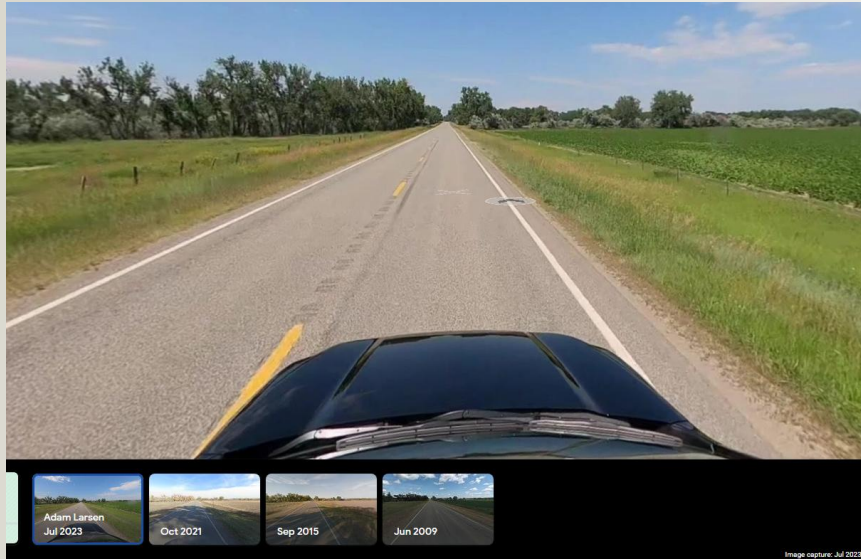
From Google



From Mapillary

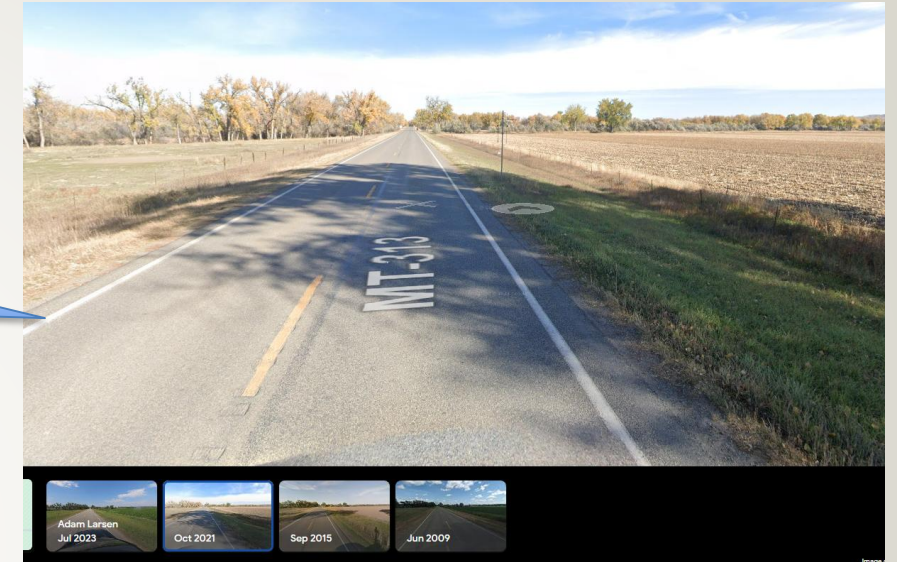
Image source: Google Street View and Mapillary

Recent Images for Inventory



July 2023

October 2021



September 2015

June 2009

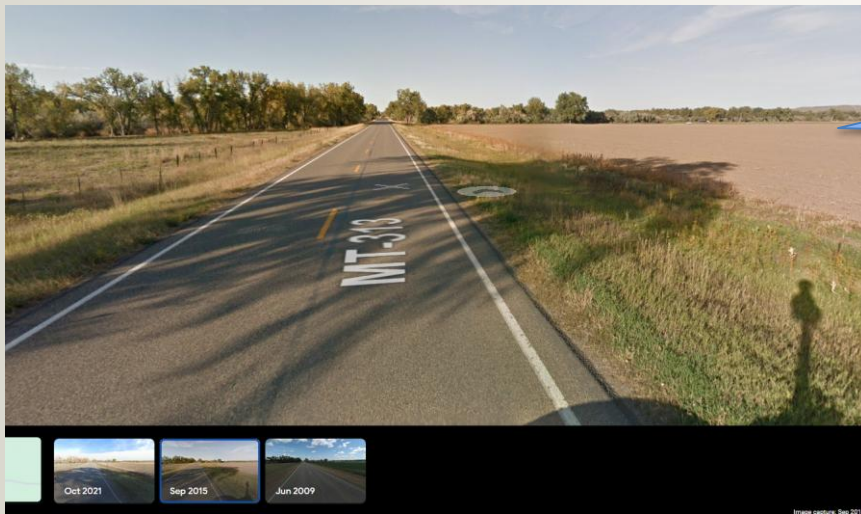
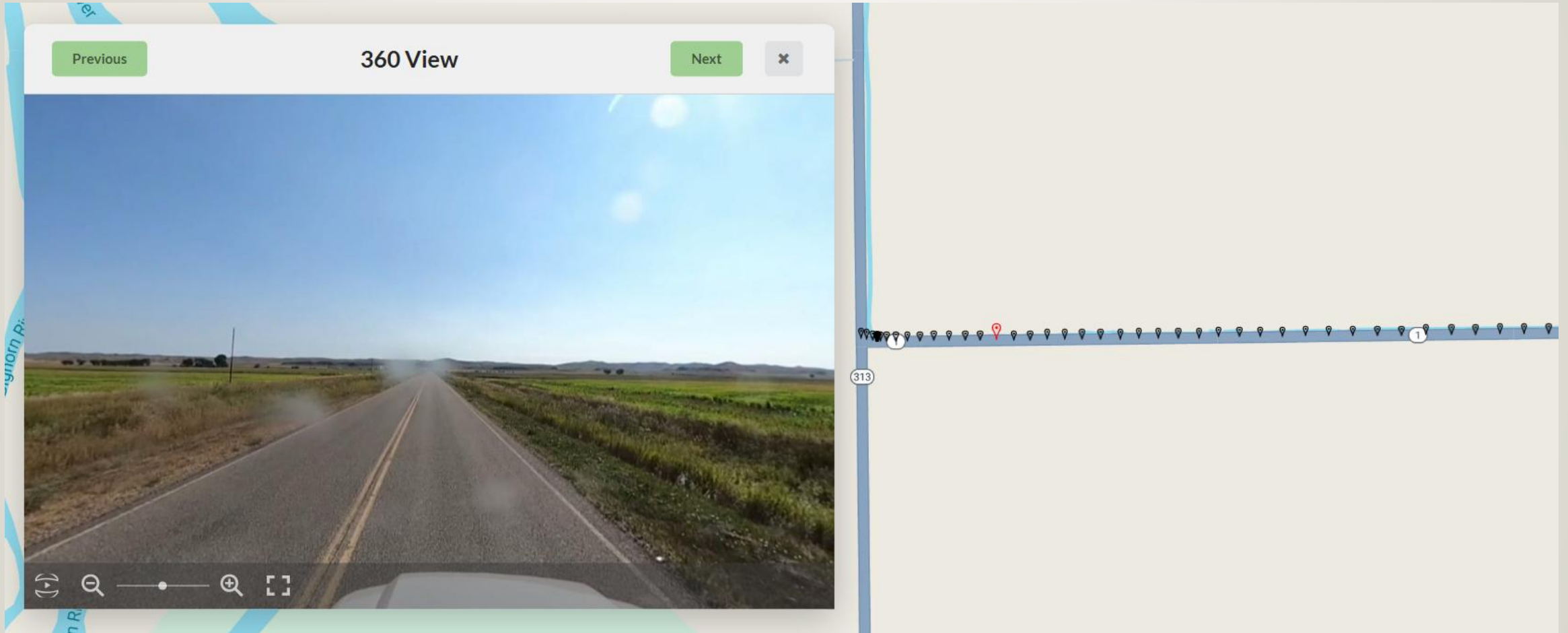


Image Processing in GRIT



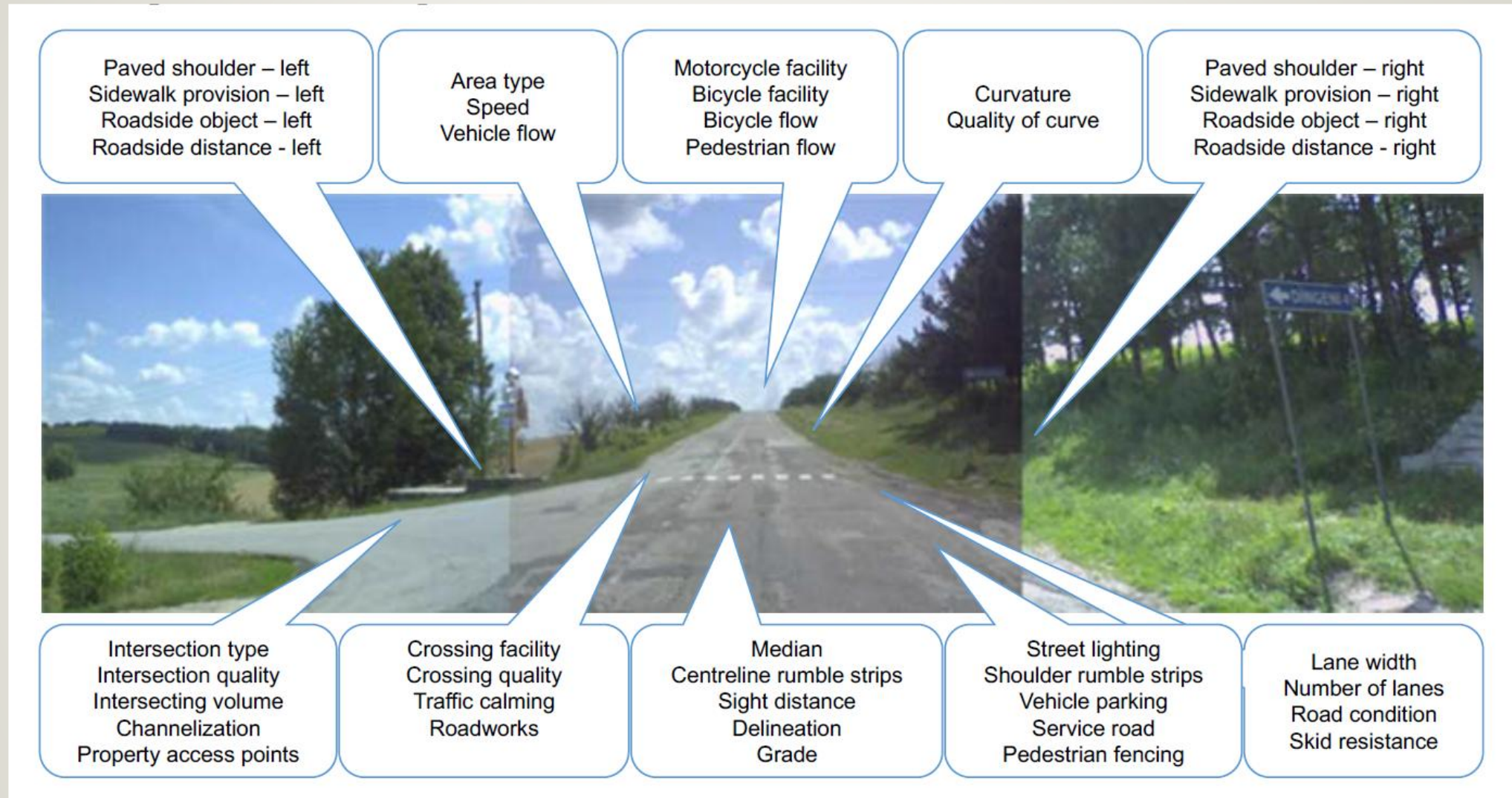
Demonstration: Sample of Road Segment



Coding/Logging Attributes

- Pre-coding (14 attributes): Road Identification
- Coding (47 attributes):
 - Roadside Object/ Obstacles
 - Curvature and Grade
 - Intersection and Road Crossing
 - On-road and Roadside Safety Measures
 - Pavement and Shoulder Condition
 - Multimodal Facility and Demographic Data
- Post-coding (19 attributes): Vehicular Flow

usRAP Matrices



Source: usRAP Analysis Process Training Manual

Coding/Logging Attributes

iRAP Star Rating Input Review

Road Name	Pryor Gap Rd	Length	0.1	Landmark	
Section	GS018362	Latitude	45.412579973	Vehicle flow (AADT)	50
Distance	3.6	Longitude	-108.555496468	Image reference	37

Item	Category	Hold	Item	Category	Hold	Item	Category	Hold
Carriageway-Roadway Type	Undivided road	☐	Roadside severity - right side object	Downwards slope (> -15°)	☐	Delineation	Poor	☐
Upgrade cost	Low	☐	Shoulder rumble strips	Not present	☐	Street lighting	Not present	☐
Bicycle observed flow	None	☐	Paved shoulder - left side	None	☐	Pedestrian crossing - inspected road	No facility	☐
Pedestrian observed flow across the	None	☐	Paved shoulder - right side	None	☐	Pedestrian crossing quality	Not applicable	☐
Pedestrian observed flow along the	None	☐	Intersection type	None	☐	Pedestrian crossing facilities - side	No facility	☐
Pedestrian observed flow along the	None	☐	Intersection channelization	Not present	☐	Pedestrian fencing	Not present	☐
Land use - right side	Undeveloped areas	☐	Intersecting road volume	Not applicable	☐	Speed management / traffic calming	Not present	☐
Land use - left side	Farming and agricultural	☐	Intersection quality	Not applicable	☐	Vehicle parking	No parking	☐
Area type	Rural	☐	Property access points	None	☐	Sidewalk - left side	None	☐
Speed limit	45	☐	Number of lanes in one direction	One	☐	Sidewalk - right side	None	☐
Truck speed limit	40	☐	Lane width	Wide (≥ 10.6ft)	☐	Service road	Not present	☐
Median type	Centerline	☐	Curvature	Straight or gently curving	☐	Bicycle facility	None	☐
Centerline rumble strips	Not present	☐	Quality of curve	Not applicable	☐	Roadworks - Work zone	No road works (work zone)	☐
Roadside severity - left side distance	3 to <15ft	☐	Grade	≥ 0% to <7.5%	☐	Sight distance	Adequate	☐
Roadside severity - left side object	Downwards slope (> -15°)	☐	Road condition	Medium	☐	School zone warning	Not applicable (no school at th	☐
Roadside severity - right side distance	0 to <3ft	☐	Road surface type - Skid resistance	Paved - medium	☐	School zone crossing guard	Not applicable (no school at th	☐

Coder name	Sharijad	Coding date	1/23/2024	Road survey date	8/1/2023
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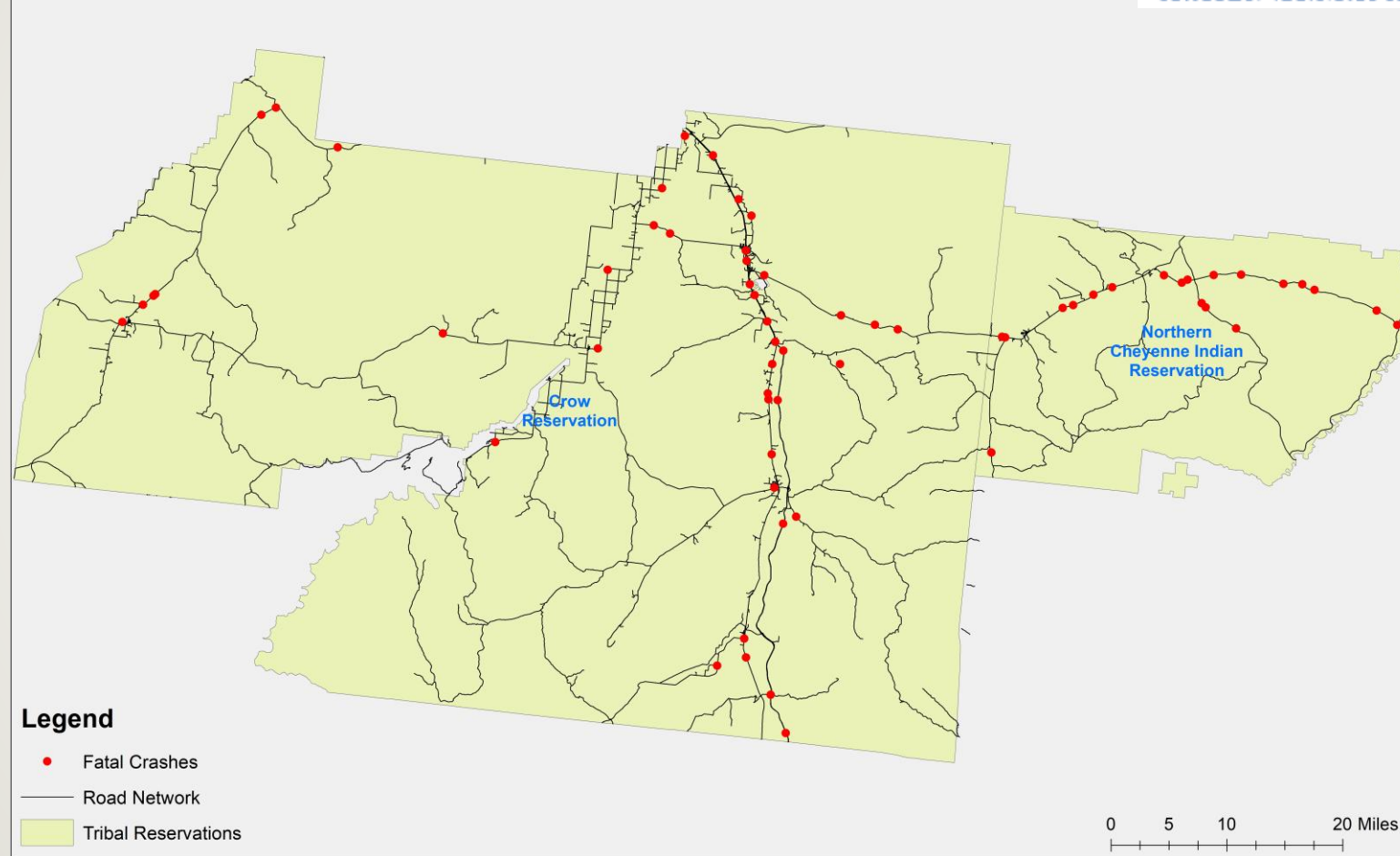
Comments This is close to the intersection of Pryor Gap Rd and Loop Rod. Pryor Gap Rd is consid

Sheet Name	coding	Previous Row	Write changes	Show StreetView	Save Input File
Row Number	38	Next Row	Hold all - on/off		Close
Mode	Review				

Network Calibration



Fatal Crashes 2018-2022



The Road Ahead: What usRAP Shows Us

- usRAP/ ViDA
- Star Rating
- Risk Map
- FSI (Fatality and Serious Injury) Estimation



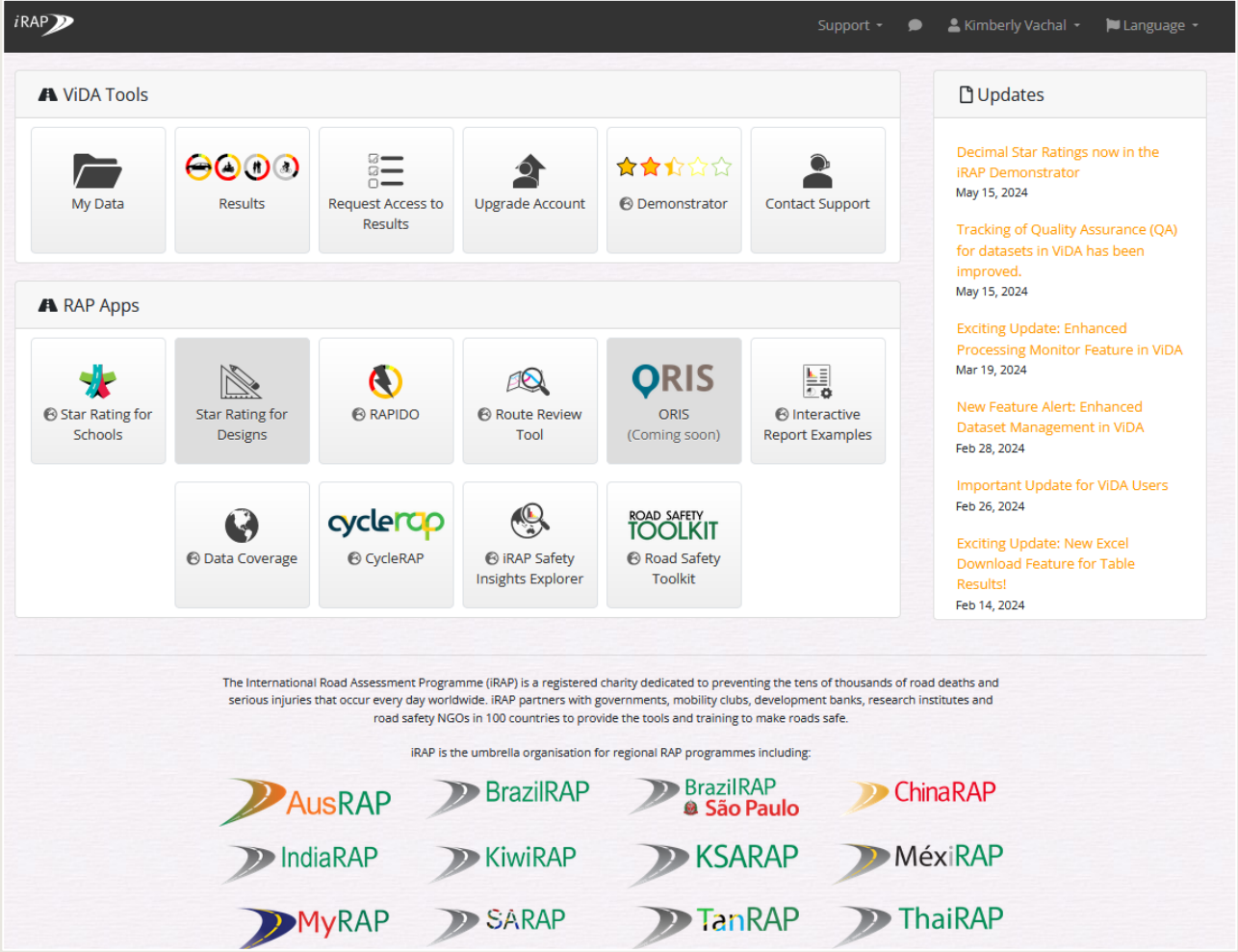
ViDA Features

- Safer Roads Investment Plan – detailed recommendations on countermeasures and their estimated cost and benefits.

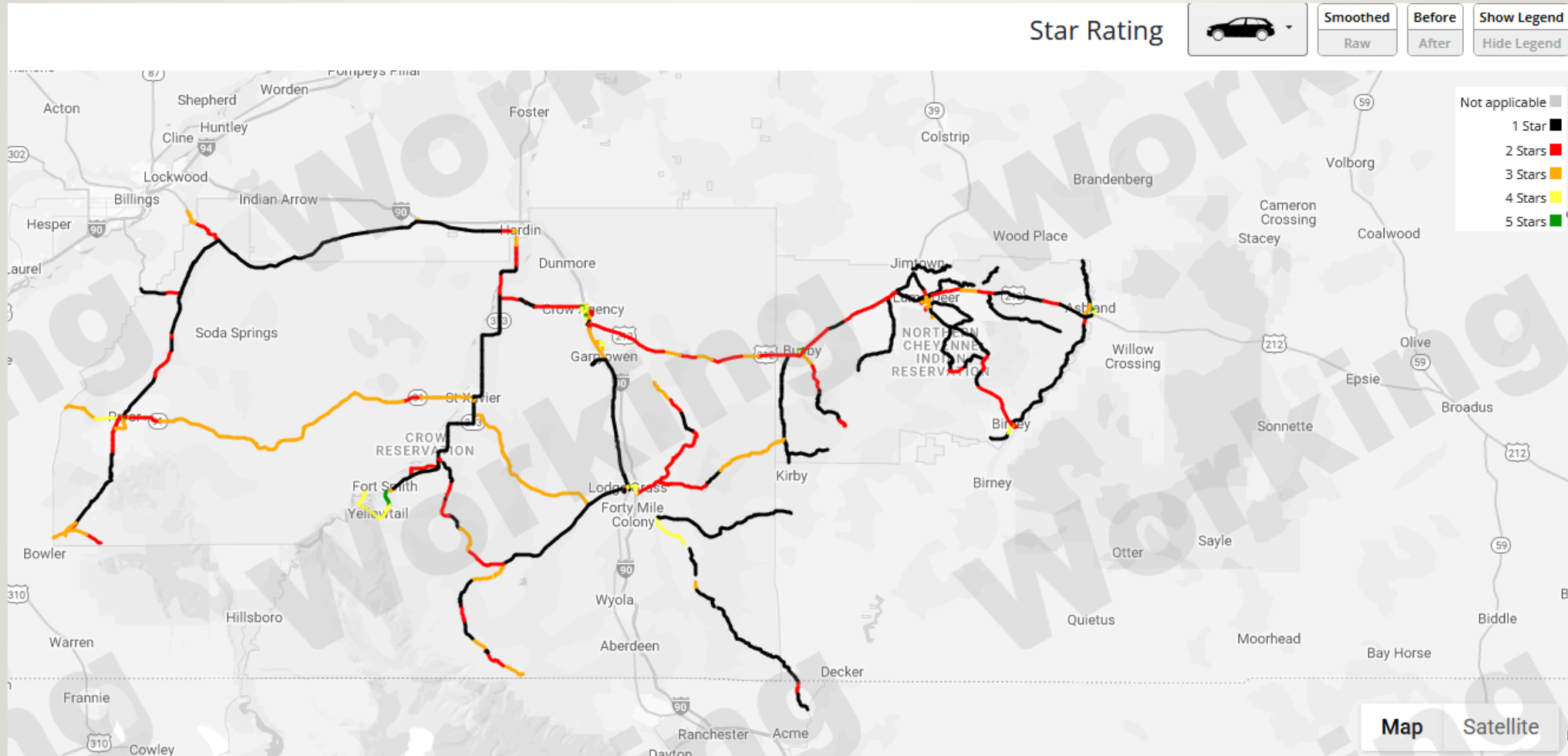
Tribal Community Road Safety Plan

- Strip Plans – Detail of countermeasure application on roadway section.
- Performance Tracking – Tools to review and download the coded attribute data, risk results, and recommended countermeasures.

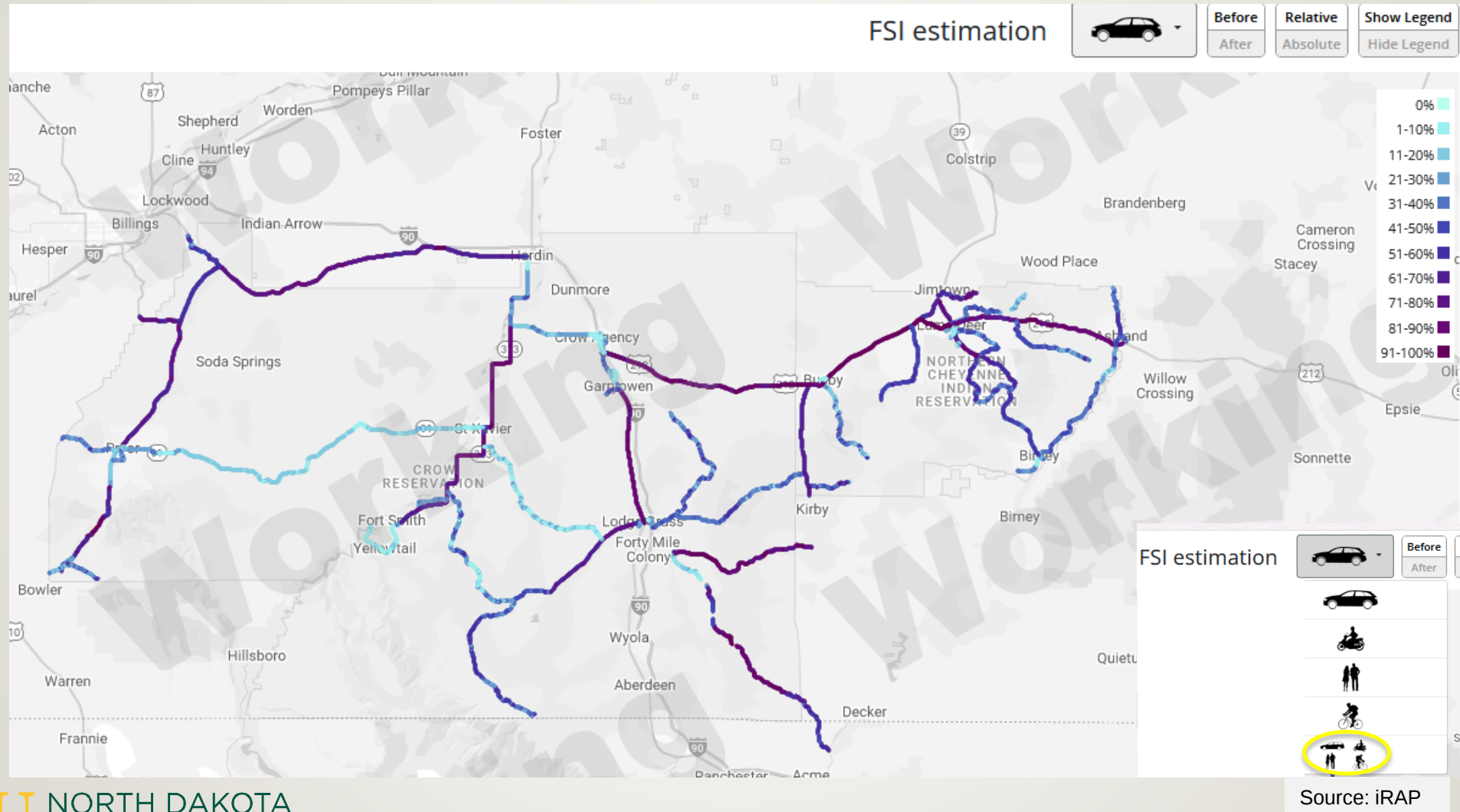
ViDA Road Safety Assessment Dashboard



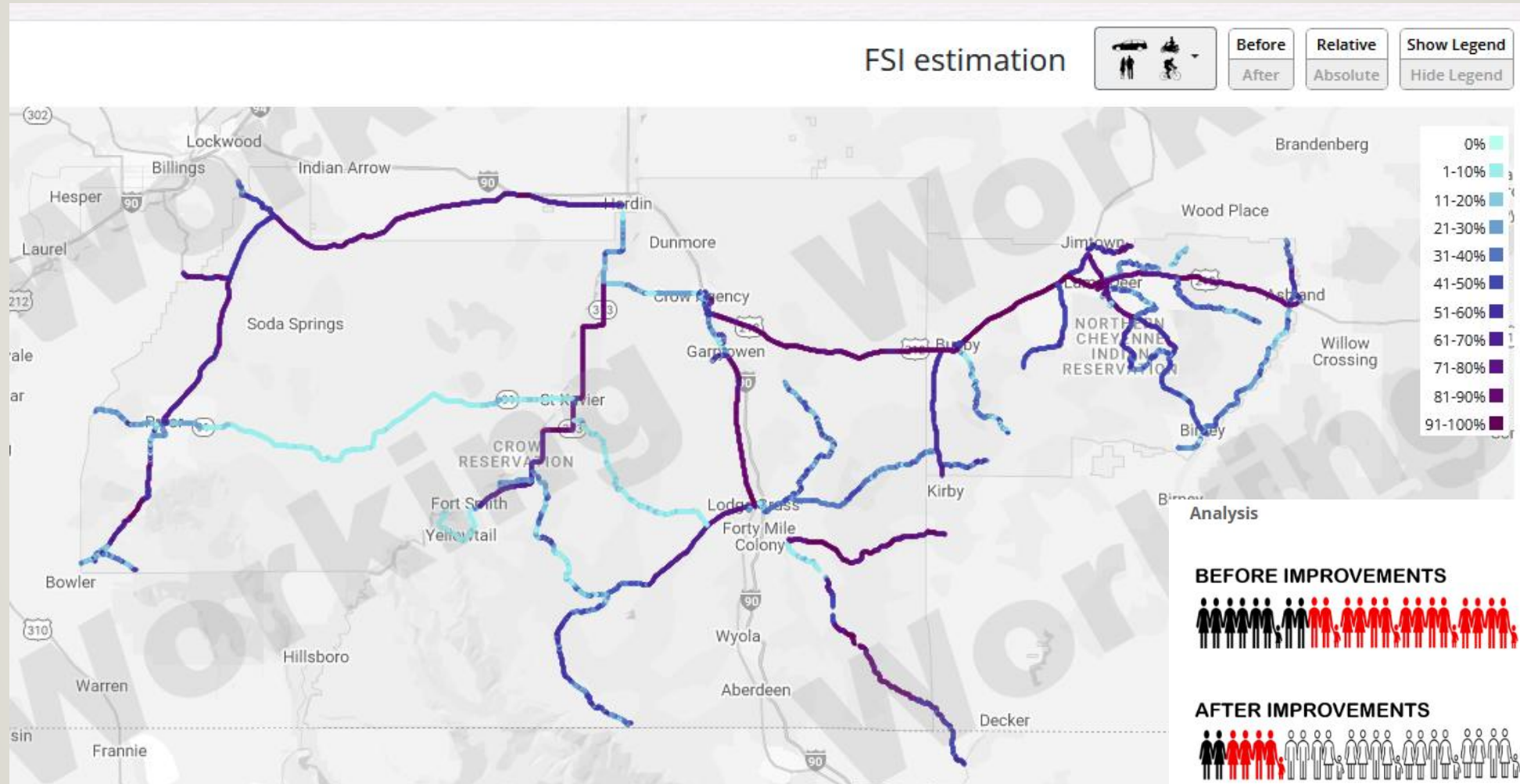
usRAP Montana Star Rating



usRAP Montana FSI Estimates



usRAP Montana FSI Likelihood



ViDA & Road to SRIP

Sample: usRAP Output

(download image, pdf, or csv)

Dashboard / Results / Investment Plans / SRIP Table

Filter 1 - usRAP > Montana > Northern Cheyenne

Safer Roads Investment Plan
Analysis Period: 20 years

Beta United States dollar USD 2024-11

Total FSI's Saved	Total PV of Safety Benefits	Estimated Cost	Cost per FSI saved	Program BCR
159	477,000,000	74,300,000	468,000	6.42

Countermeasure	Length / Sites	FSI's saved	PV of safety benefit	Estimated Cost	Cost per FSI saved	Program BCR
Central median barrier (1+1)	10.4 km	5.69	17,100,000	2,060,000	362,000	8.3
Clear roadside hazards - driver side	26.1 km	2.33	6,980,000	275,000	118,000	25.4
Clear roadside hazards - passenger side	23.0 km	1.83	5,480,000	237,000	130,000	23.1
Delineation and signing (intersection)	19 sites	0.302	906,000	516,000	1,710,000	1.76
Footpath provision driver side (adjacent to road)	9.2 km	5.68	17,000,000	8,570,000	1,510,000	1.99
Footpath provision driver side (informal path >1m)	3.3 km	0.518	1,560,000	564,000	1,090,000	2.76
Footpath provision passenger side (adjacent to road)	9.0 km	5.57	16,700,000	8,420,000	1,510,000	1.99
Footpath provision passenger side (informal path >1m)	3.1 km	0.494	1,480,000	535,000	1,080,000	2.77
Improve curve delineation	12.8 km	1.87	5,610,000	212,000	113,000	26.5
Improve Delineation	94.6 km	5.18	15,500,000	3,300,000	637,000	4.71
Lane widening (>0.5m)	3.3 km	1.25	3,750,000	774,000	621,000	4.84

ViDA & Road to SRIP

Sample: usRAP Output

Filter 1 - usRAP > Montana > Crow

Safer Roads Investment Plan

Analysis Period: 20 years

Beta

United States dollar USD

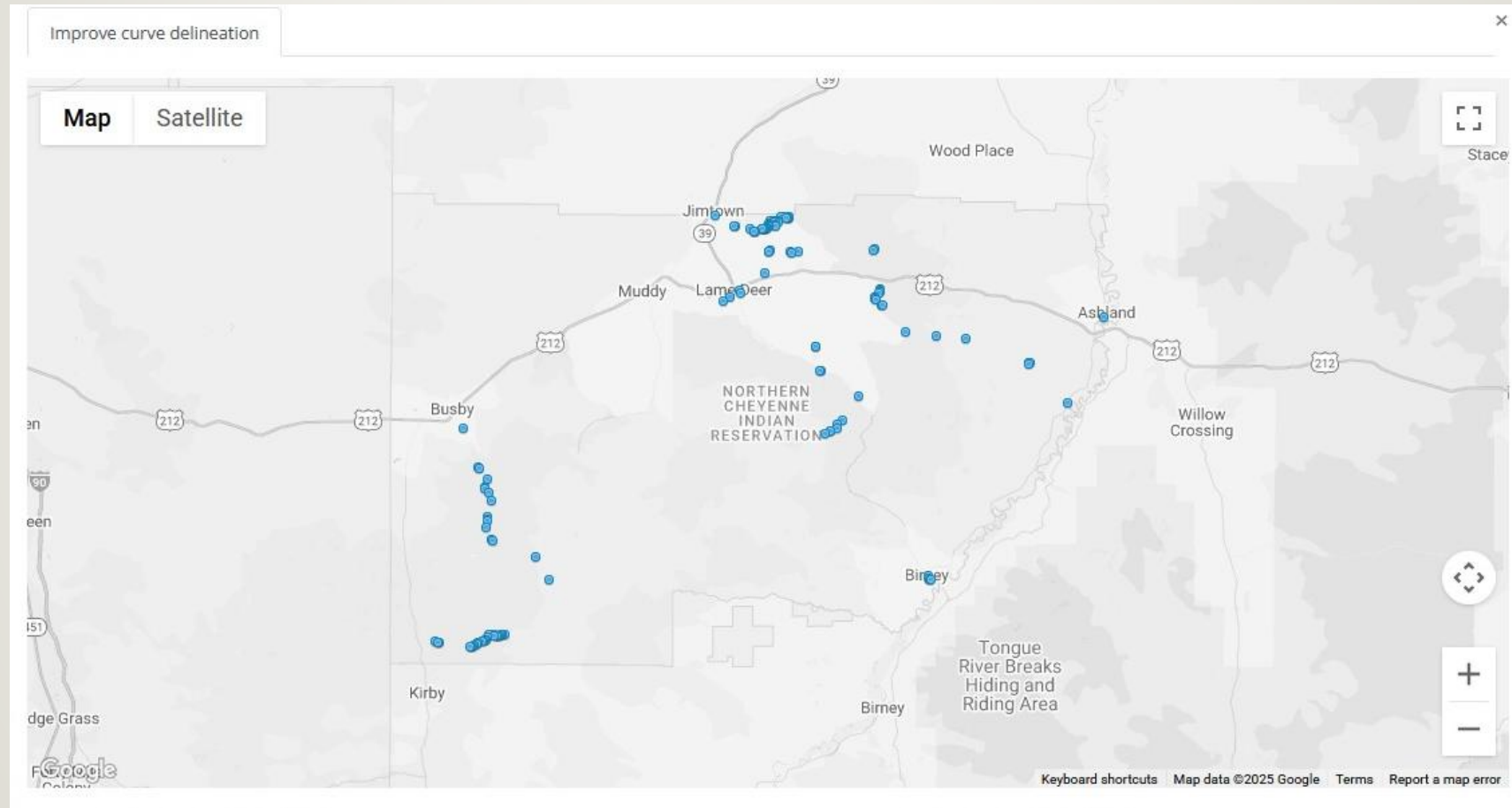
Beta

2024-11

Total FSIs Saved		Total PV of Safety Benefits		Estimated Cost		Cost per FSI saved		Program BCR	
289		710,000,000		87,800,000		304,000		8.08	
Countermeasure	↑↓ Length / Sites	↑↓ FSIs saved	↑↓ PV of safety benefit	↑↓ Estimated Cost	↑↓ Cost per FSI saved	↑↓ Program BCR		↑	
Pave road surface	110.6 km	74.8	184,000,000	18,600,000	249,000	9.86			
Shoulder rumble strips	180.9 km	34.6	85,000,000	14,300,000	413,000	5.96			
Roadside barriers - driver side	33.5 km	30.5	74,900,000	6,700,000	220,000	11.2			
Roadside barriers - passenger side	36.5 km	29.9	73,600,000	7,630,000	255,000	9.64			
Skid Resistance (paved road)	31.4 km	20.9	51,200,000	6,090,000	292,000	8.42			
Improve Delineation	134.9 km	16.6	40,800,000	4,810,000	290,000	8.48			
Sideslope improvement - driver side	26.0 km	9.03	22,200,000	1,520,000	168,000	14.6			
Clear roadside hazards - driver side	20.1 km	8.15	20,000,000	220,000	27,000	90.9			
Central median barrier (1+1)	28.8 km	7.72	19,000,000	5,990,000	776,000	3.17			
Shoulder sealing driver side (<1m)	74.5 km	7.57	18,600,000	3,100,000	409,000	6			
Lane widening (>0.5m)	10.4 km	7.55	18,500,000	2,450,000	324,000	7.57			

ViDA & Road to SRIP

Sample: usRAP Output



ViDA & Road to Strip Plan

Sample: usRAP Output



ViDA Downloads

Dashboard / Results / Downloads

Core Data

Core Data - Before (zip)

Core Data - Before - inc End-GPS (zip)

Core Data - After (zip)

Core Data - After - inc End-GPS (zip)

Chainages

Chainages (zip)

Fatality Estimations

Fatality Estimations - Before (zip)

Fatality Estimations - After (zip)
Please note: this file does not include the outcome of multiple-countermeasure adjustments.

Countermeasures

Countermeasures - Including Overridden (zip)
Countermeasure details including overridden

Countermeasures - Excluding Overridden (zip)
Countermeasure details with overridden excluded

Upload Only

Upload Only (zip)

Montana > Crow > Crow Tribe Network v2

Star Ratings - Before

Vehicle Occupant Star Rating Smoothed (kml)

Pedestrian Star Rating Smoothed (kml)

Motorcyclist Star Rating Smoothed (kml)

Bicyclist Star Rating Smoothed (kml)

Star Ratings - After

Vehicle Occupant Star Rating Smoothed - After (kml)

Pedestrian Star Rating Smoothed - After (kml)

Motorcyclist Star Rating Smoothed - After (kml)

Bicyclist Star Rating Smoothed - After (kml)

Montana > Northern Cheyenne > Northern Cheyenne Network v2

Star Ratings - Before

Vehicle Occupant Star Rating Smoothed (kml)

Pedestrian Star Rating Smoothed (kml)

Motorcyclist Star Rating Smoothed (kml)

Bicyclist Star Rating Smoothed (kml)

Star Ratings - After

Vehicle Occupant Star Rating Smoothed - After (kml)

Pedestrian Star Rating Smoothed - After (kml)

Motorcyclist Star Rating Smoothed - After (kml)

Bicyclist Star Rating Smoothed - After (kml)

Safety Plan Adoption

- Development of a Comprehensive Roadway Departure Safety Plan
 - Targeted identification of critical segments for effective safety interventions
- Assessment of challenges and potential obstacles
- Alignment of policies with proposed countermeasures

Questions/Comments



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Thank You!