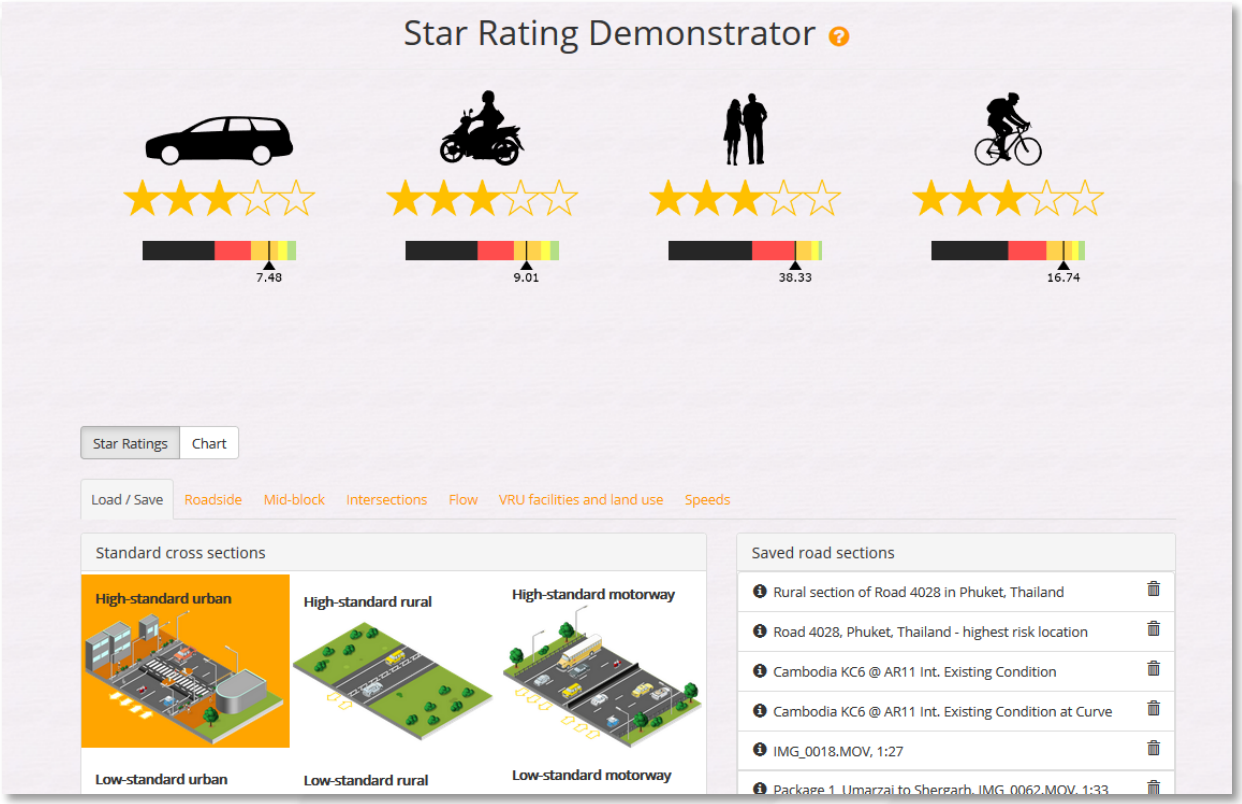
Star Rating Roads for Safety

Greg Smith, iRAP

Asian Development Bank Transport Knowledge Sharing Event

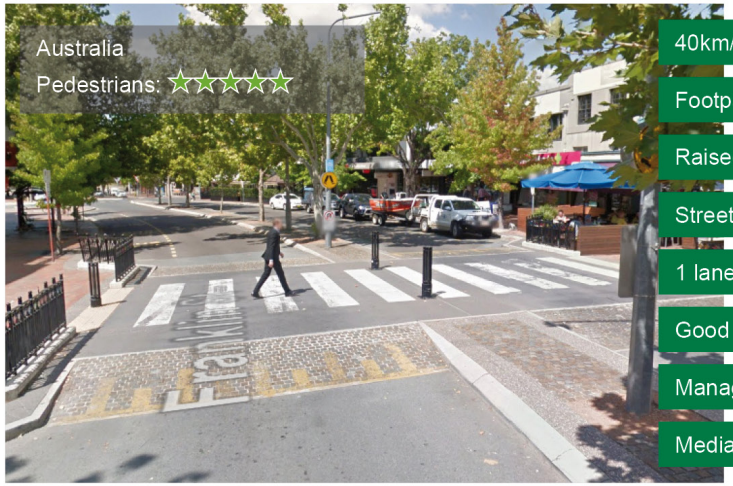
11 September 2017

Risk
5 x
higher



https://demonstrator.vida.irap.org

- One lane each direction
- Good sight distance
- 80km/h
- Narrow paved shoulder
- No formal footpath
- No pedestrian crossing
- No school zone
- No street lighting

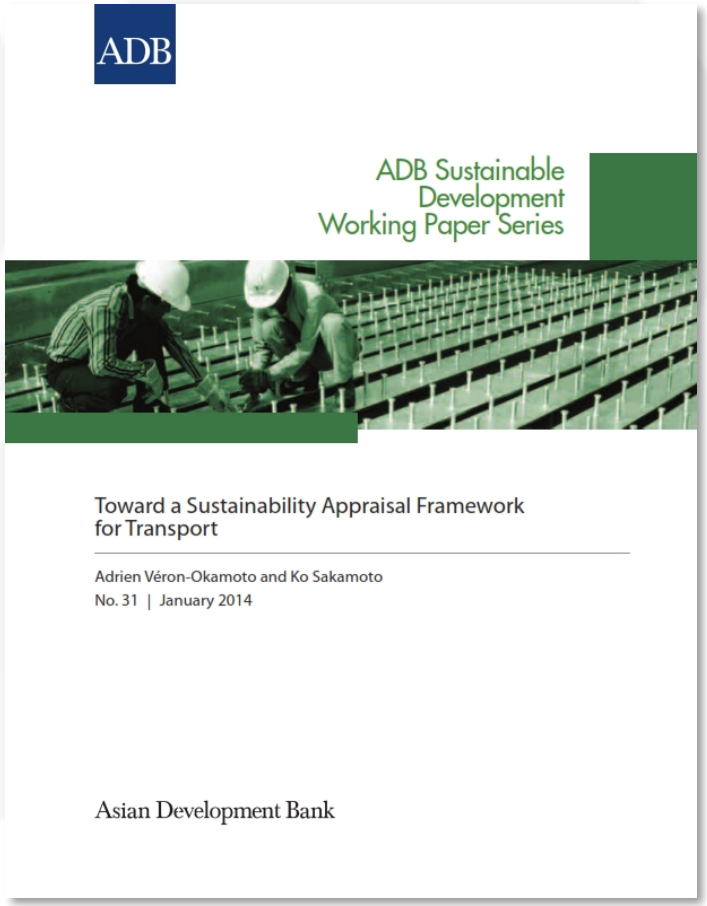


- 40km/h
- Footpaths
- Raised pedestrian crossing
- Street lighting
- 1 lane in each direction
- Good sight distance
- Managed parking
- Median island


Finland
Iceland
Sweden
Norway
Russia
Canada
Kazakhstan
Mongolia
France
Turkey
China
Japan
South Korea
Afghanist
Iraq
Iran
Algeria
Libya
Egypt
Saudi Arabia
México
Thaila
Sudan
Nigeria
Tanzania
Papua New Guinea
Indonesia
Madagascar
Indian
Ocean
South Africa
New Zealand
About iRAP:
Registered charity
Vision: a world free of high risk roads
Inspect high-risk roads and develop Star Ratings and Safer Roads Investment Plans
80+ countries, 700,000km

Toward a Sustainability Appraisal Framework for Transport

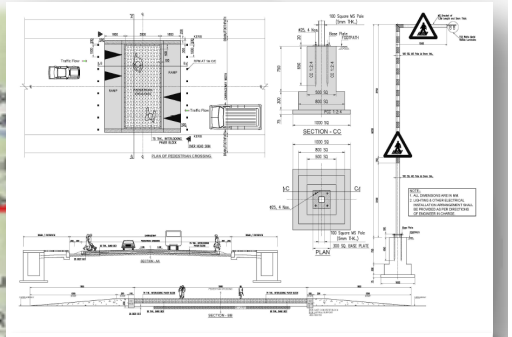
- All new or rehab designs: higher safety rating than existing road and >= 3-stars.
- Roads with > 50,000 AADT >= 4-stars.
- Sections passing through linear settlements >= 4-stars for pedestrians and cyclists.



Star Rating and Investment Plan Process

Road Survey

SAVE LIVES!!



Implementation

Road Coding

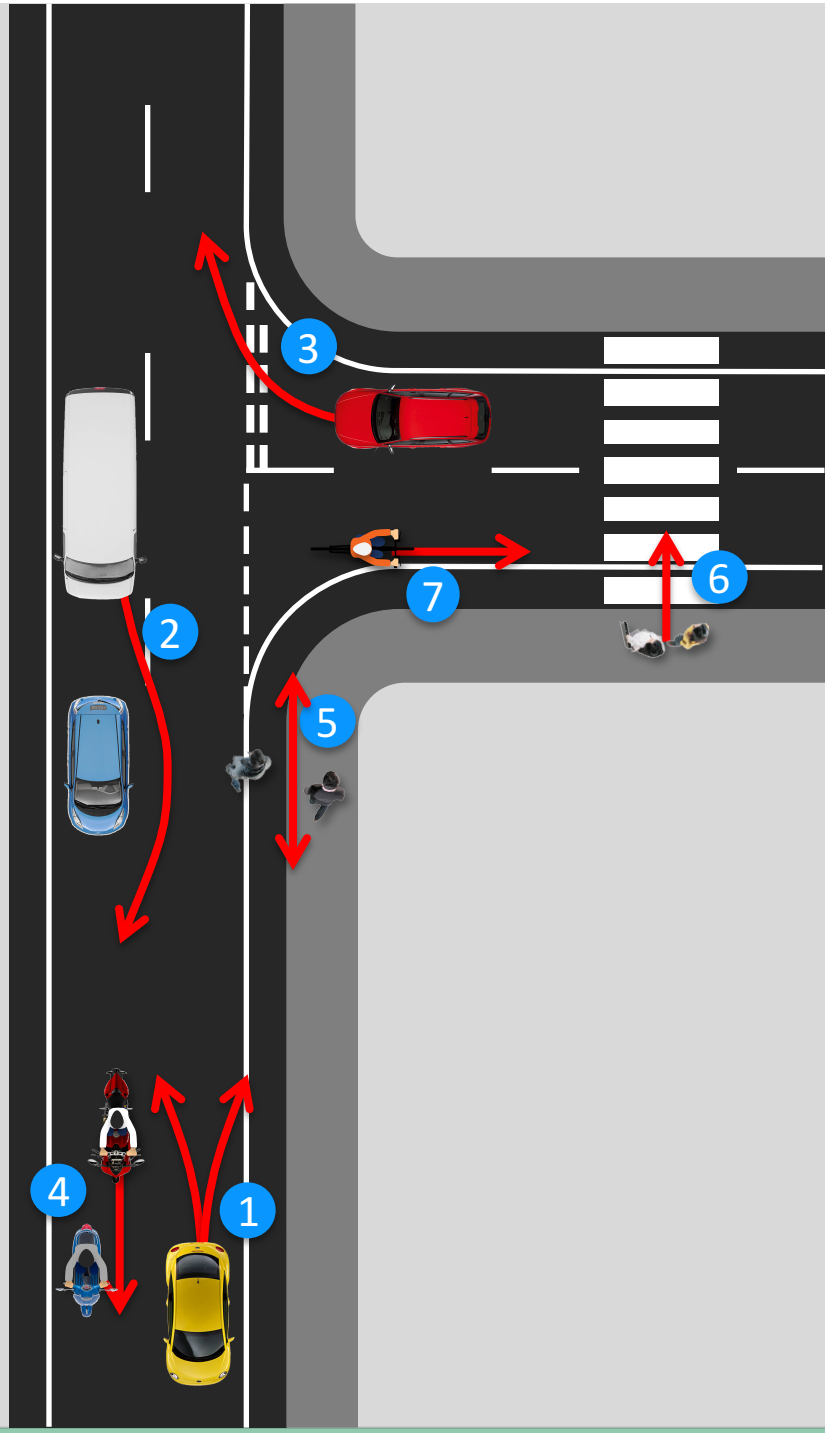
Star Ratings

Life-Saving Countermeasures

Training

Initial Crash Types

1.	Vehicle loss of control 车辆失控
2.	Vehicle overtaking 车辆超车
3.	Vehicle turning manoeuvre 车辆转弯机动
4.	Motorcycle travelling along 摩托车行驶
5.	Pedestrian walking along road 行人沿道路行走
6.	Pedestrian crossing the road 行人横过马路
7.	Bicycle travelling along the road 沿公路行驶的自行车



SNAPSHOT: MEASURING RISK

iRAP inspections involve surveys to collect digital, panoramic images or videos of roads and GPS location information. These data are then used to record (or 'code') 50 types of road attributes that are known to influence the likelihood of a crash and its severity.[23] The road attributes, which are recorded for each 100 metre segment of road, include those that are known to effect risk for vehicle occupants, motorcyclists, pedestrians and bicyclists.[24] The inspections create a permanent image, location and road attribute database that can easily be reviewed by local engineers and planners.

Speed

The risk of death and serious injury increases significantly with speed. If a pedestrian is struck by a car travelling at 60km/h, they face a 90% chance of being killed.

Lighting

Visibility is an important factor in creating a safe environment, particularly at intersections and where vulnerable road users are present.

Roadsides

Roadside hazards (like this pole) increase the risk of death and serious injury when a vehicle runs off the road.

Intersections

Intersection crashes are one of the most common types of crash problem, particularly in urban areas. In rural areas, or where vehicle speeds are high, the consequence of collisions at intersections can be particularly severe.

Bicyclists

Bicyclists (and people using non-motorised vehicles) are amongst the most vulnerable of all road users. Bicyclists are safest when they have paths or lanes and do not need to mix with fast-moving traffic.

Pavement

Poor road surfaces, such as those with holes, standing water and debris, mean it is more likely that vehicles will swerve out of their lane. Furthermore, in an emergency, vehicles can stop faster on skid-resistant pavements.

Delineation

Centre and edge delineation treatments (not present here) help drivers judge their position on the road, and provide advice about conditions ahead.

Median

Medians physically separate opposing traffic streams and help stop vehicles travelling into opposing traffic lanes. They can also help pedestrians cross the road or restrict their access at unsafe places.

Geometry

The number of lanes, width of lanes, curves, dips, crests and slopes all effect crash risk.

Footpaths

Obstructed footpaths (as is the case here) mean it is more likely that pedestrians will walk on the road, especially when it is raining or when visibility is poor.

Crossings

Most pedestrian deaths occur while the pedestrian is attempting to cross the road. Pedestrian crossings (present here, but poorly designed), including signalised crossings, refuge islands, bridges, and traffic calming treatments, have the potential to reduce risk.

Shoulders

When a driver accidentally travels onto the road shoulder (not present here) the risk of crashing will be less if the vehicle can either stop on the shoulder or safely travel back into the traffic lane. Shoulders can also provide space for slower-moving non-motorised vehicles.

Traffic mix

Mixing fast moving cars, trucks and buses and slow moving auto-rickshaws and tractors increases the risk of crashes, especially head-on and rear-end crashes.

A World Free of High Risk Roads

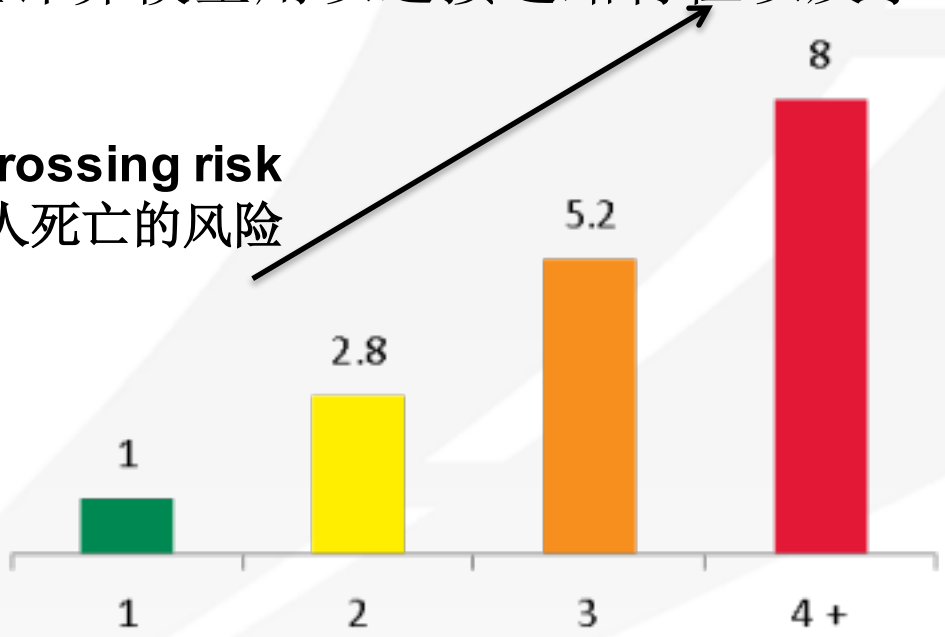
iRAP

Risk factor example
风险因素范例

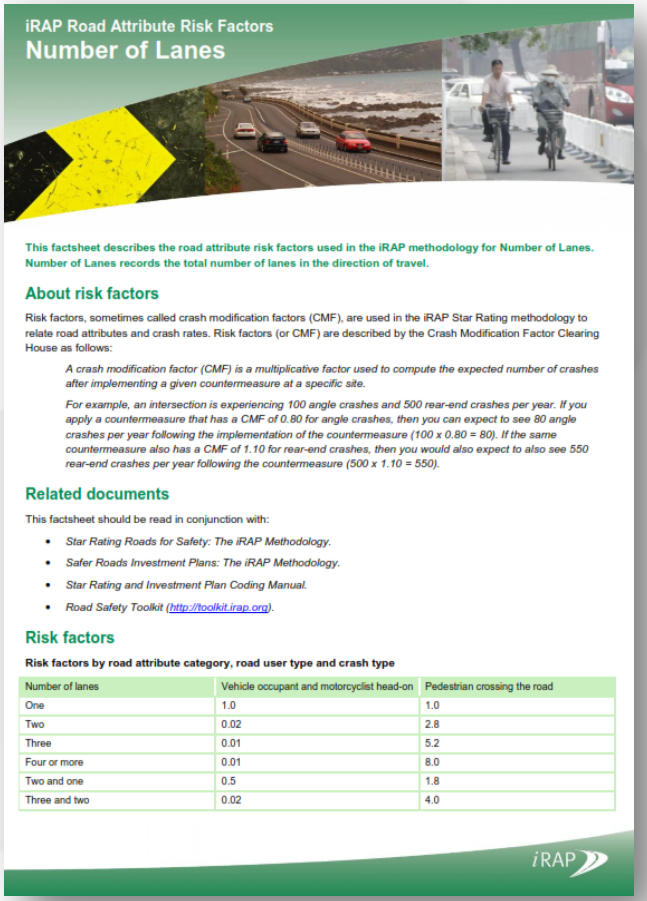
Risk factors, sometimes called crash modification factors (CMF), are used in the iRAP Star Rating methodology to relate road attributes and risk

风险因素，通常被称为事故修正因子，在iRAP风险计算模型用以连接道路特征以及事故风险

Pedestrian crossing risk
增加行人死亡的风险



Lanes 车道数



iRAP Road Attribute Risk Factors

Number of Lanes

This factsheet describes the road attribute risk factors used in the iRAP methodology for Number of Lanes. Number of Lanes records the total number of lanes in the direction of travel.

About risk factors

Risk factors, sometimes called crash modification factors (CMF), are used in the iRAP Star Rating methodology to relate road attributes and crash rates. Risk factors (or CMF) are described by the Crash Modification Factor Clearing House as follows:

> *A crash modification factor (CMF) is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site.*
>
> *For example, an intersection is experiencing 100 angle crashes and 500 rear-end crashes per year. If you apply a countermeasure that has a CMF of 0.80 for angle crashes, then you can expect to see 80 angle crashes per year following the implementation of the countermeasure (100 x 0.80 = 80). If the same countermeasure also has a CMF of 1.10 for rear-end crashes, then you would also expect to also see 550 rear-end crashes per year following the countermeasure (500 x 1.10 = 550).*

Related documents

This factsheet should be read in conjunction with:

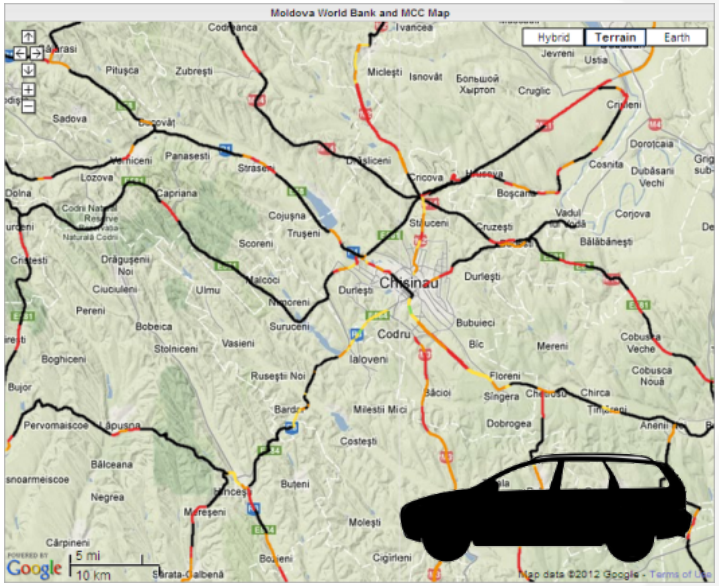
- *Star Rating Roads for Safety: The iRAP Methodology.*
- *Safer Roads Investment Plans: The iRAP Methodology.*
- *Star Rating and Investment Plan Coding Manual.*
- *Road Safety Toolkit (http://toolkit.irap.org).*

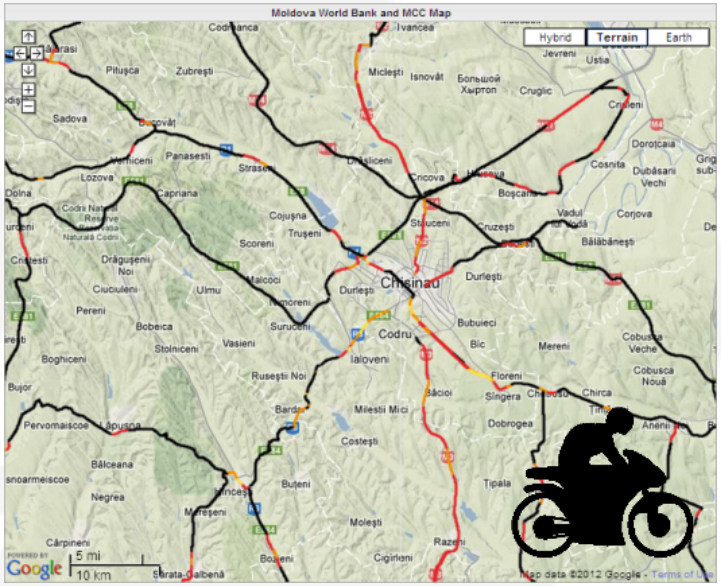
Risk factors

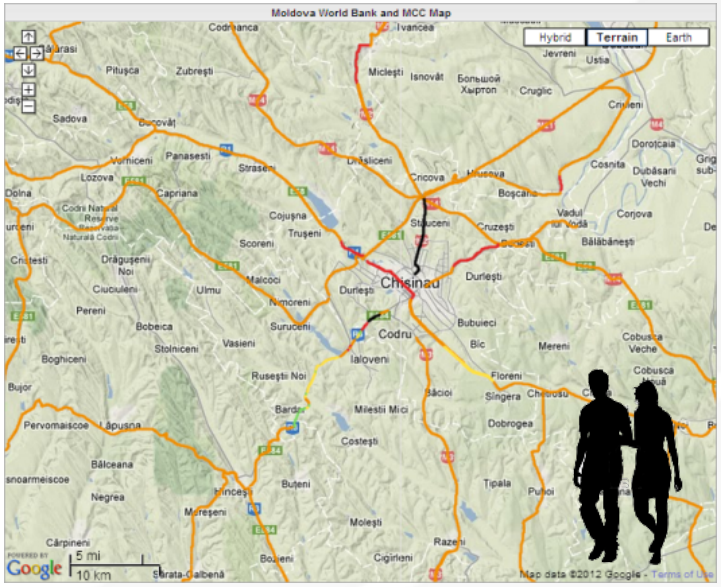
Risk factors by road attribute category, road user type and crash type

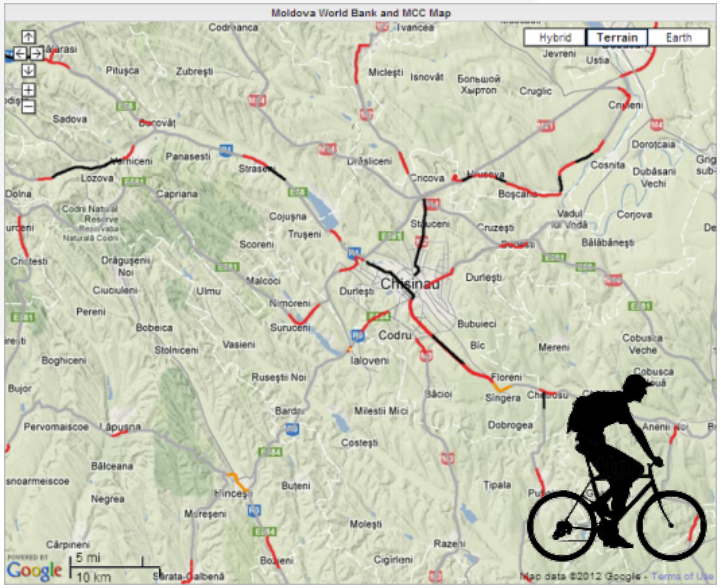
Number of lanes	Vehicle occupant and motorcyclist head-on	Pedestrian crossing the road
One	1.0	1.0
Two	0.02	2.8
Three	0.01	5.2
Four or more	0.01	8.0
Two and one	0.5	1.8
Three and two	0.02	4.0

Star Ratings

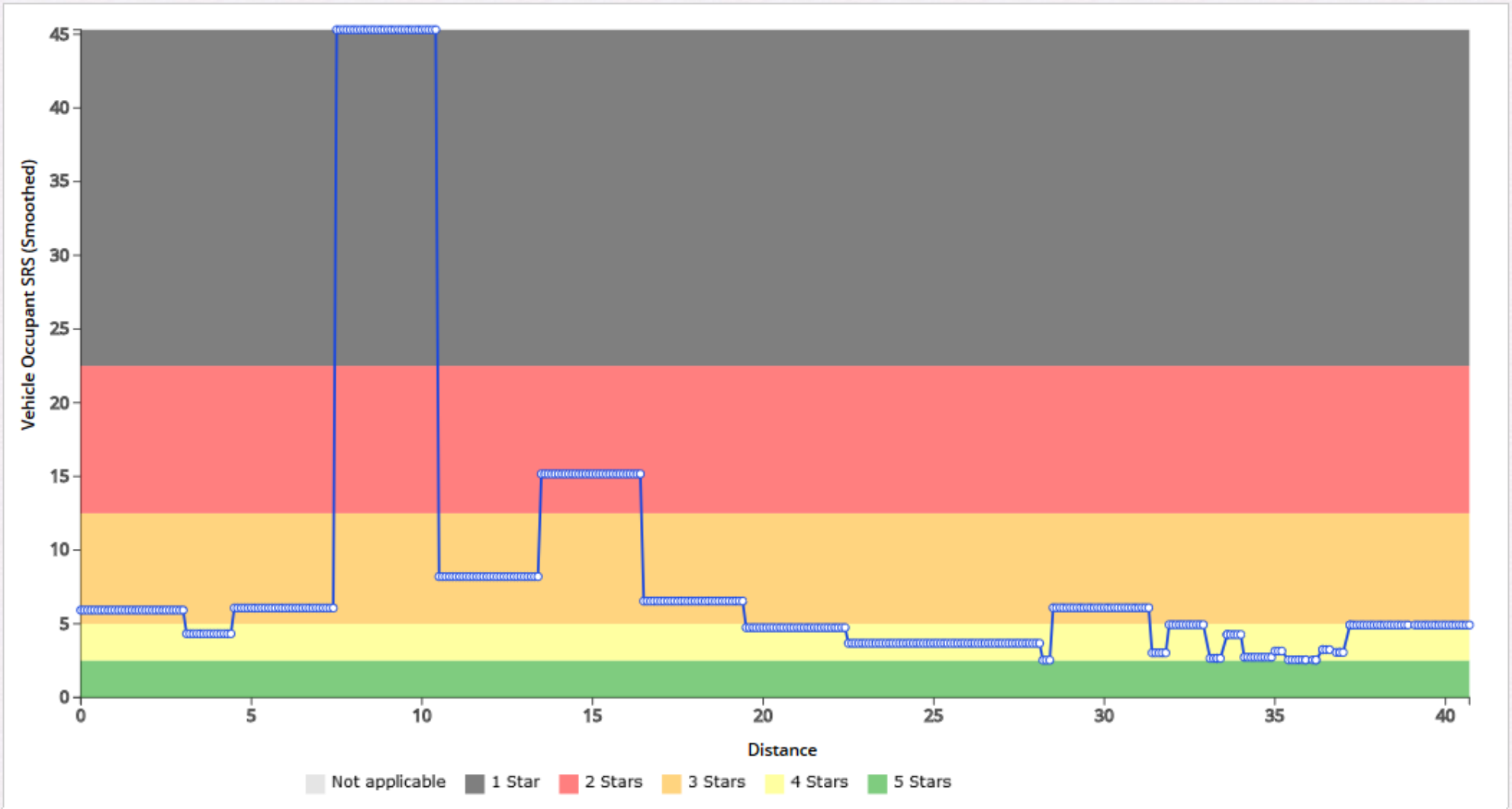


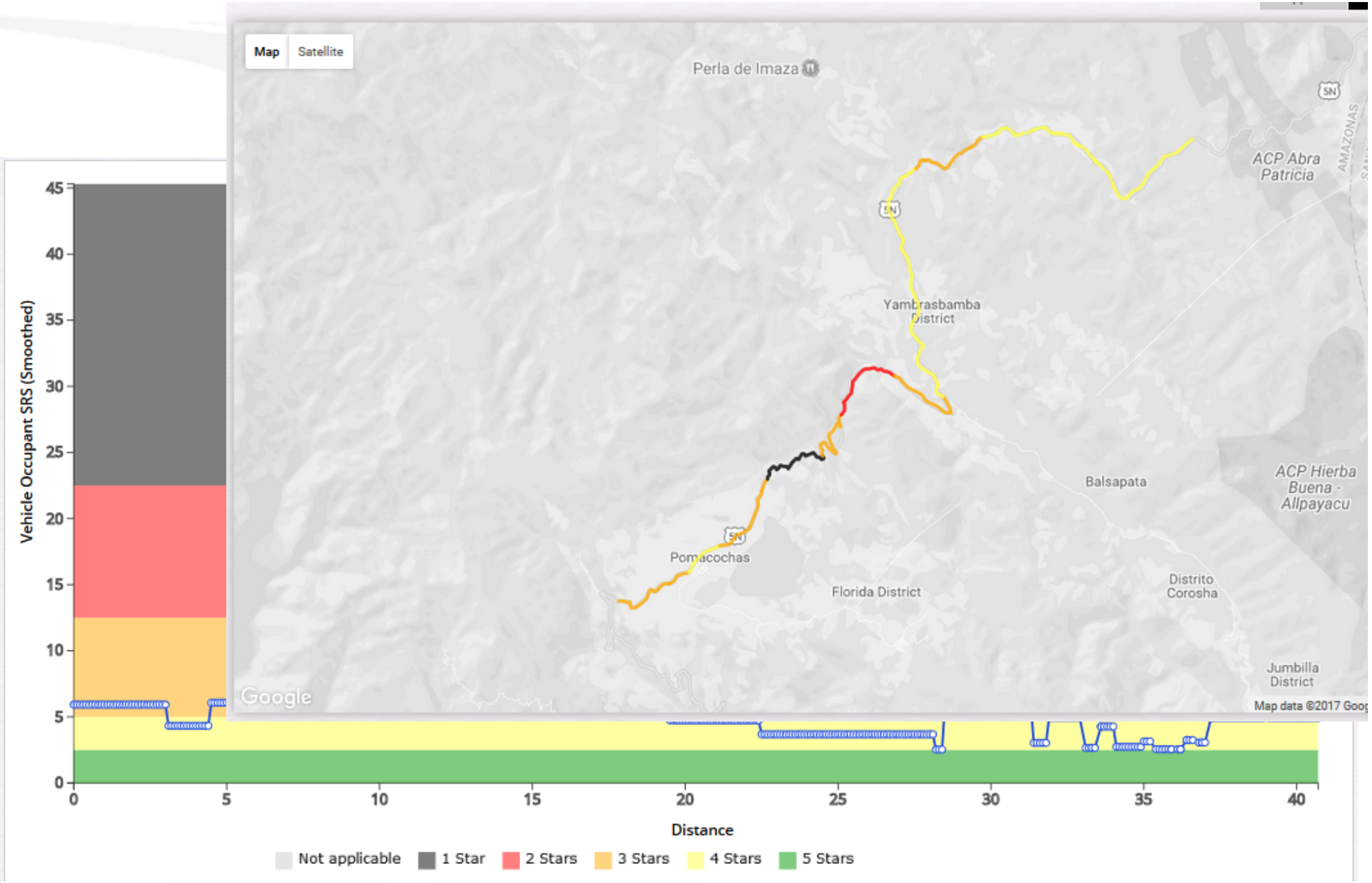






Star Rating Scores

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Distrito Corosha
Jumbilla District
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Map data ©2017 Goog
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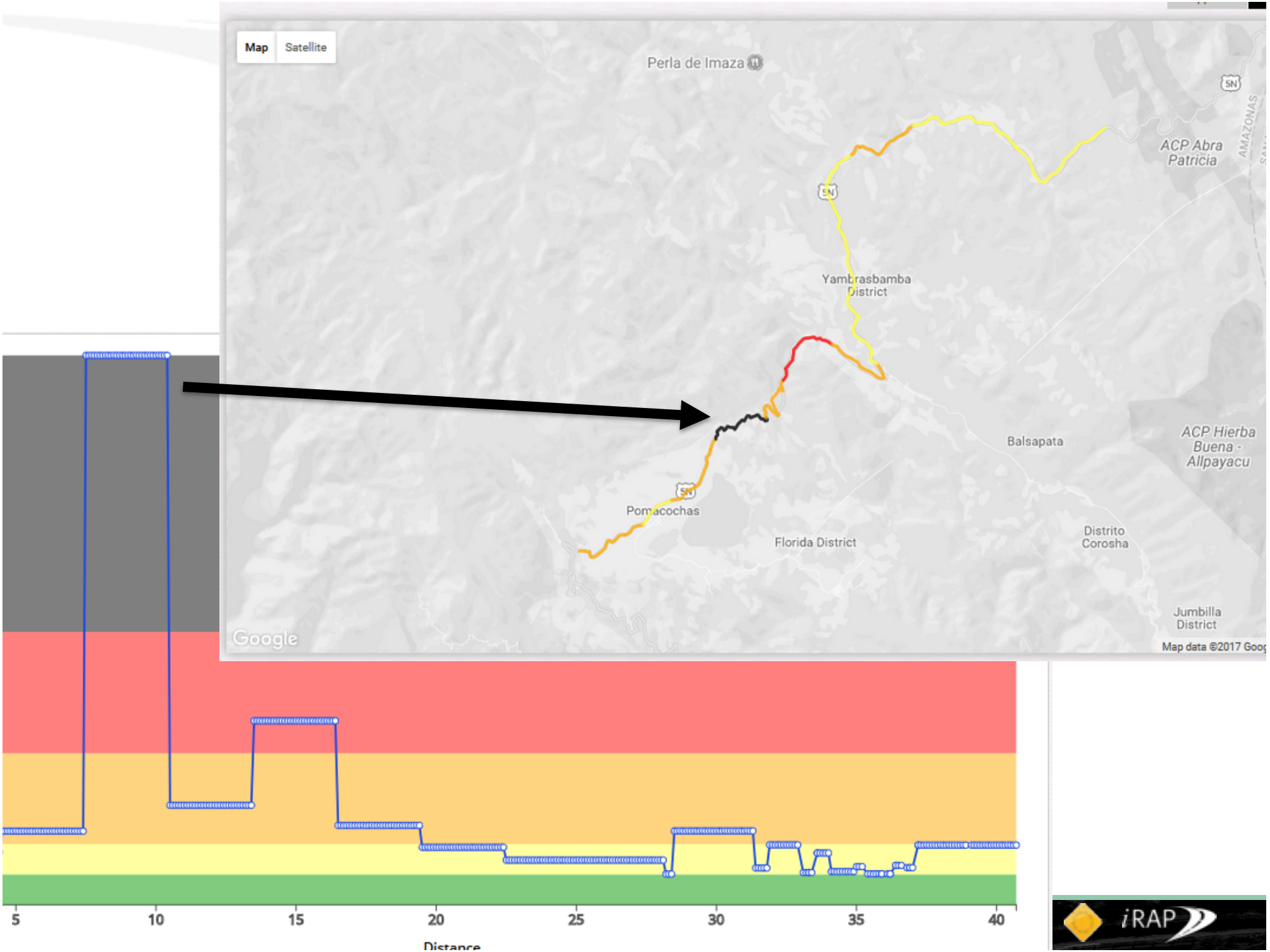
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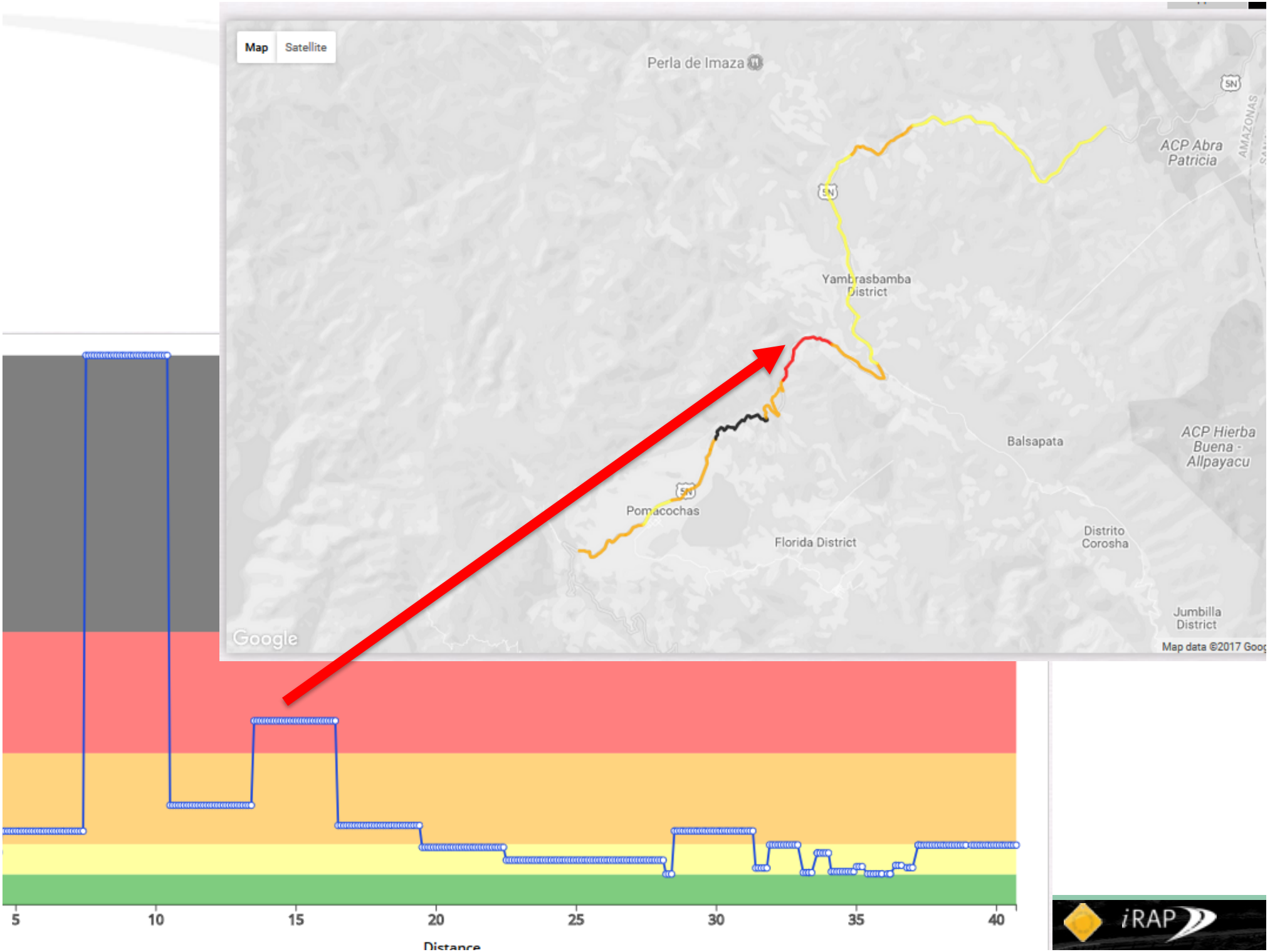
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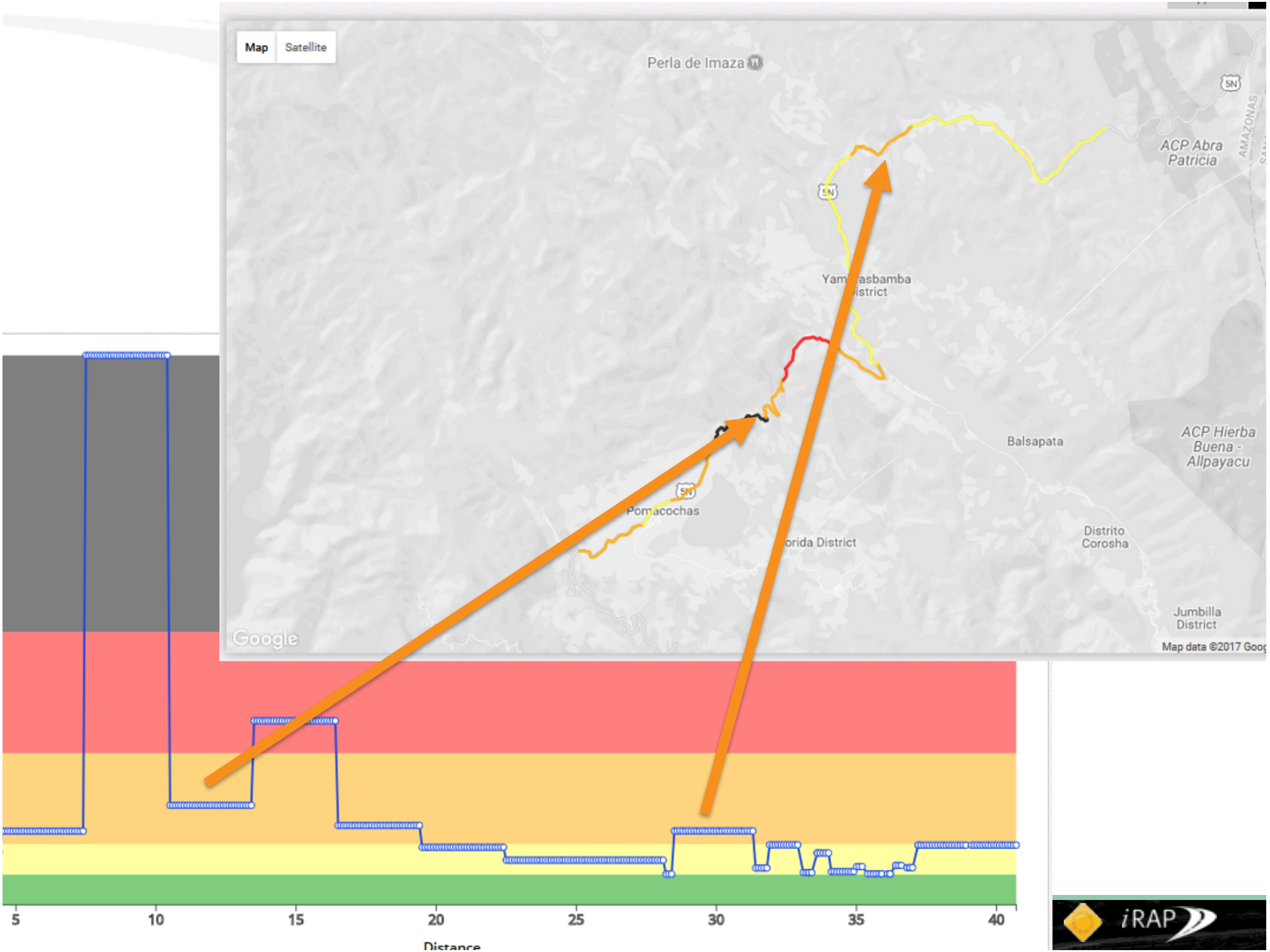
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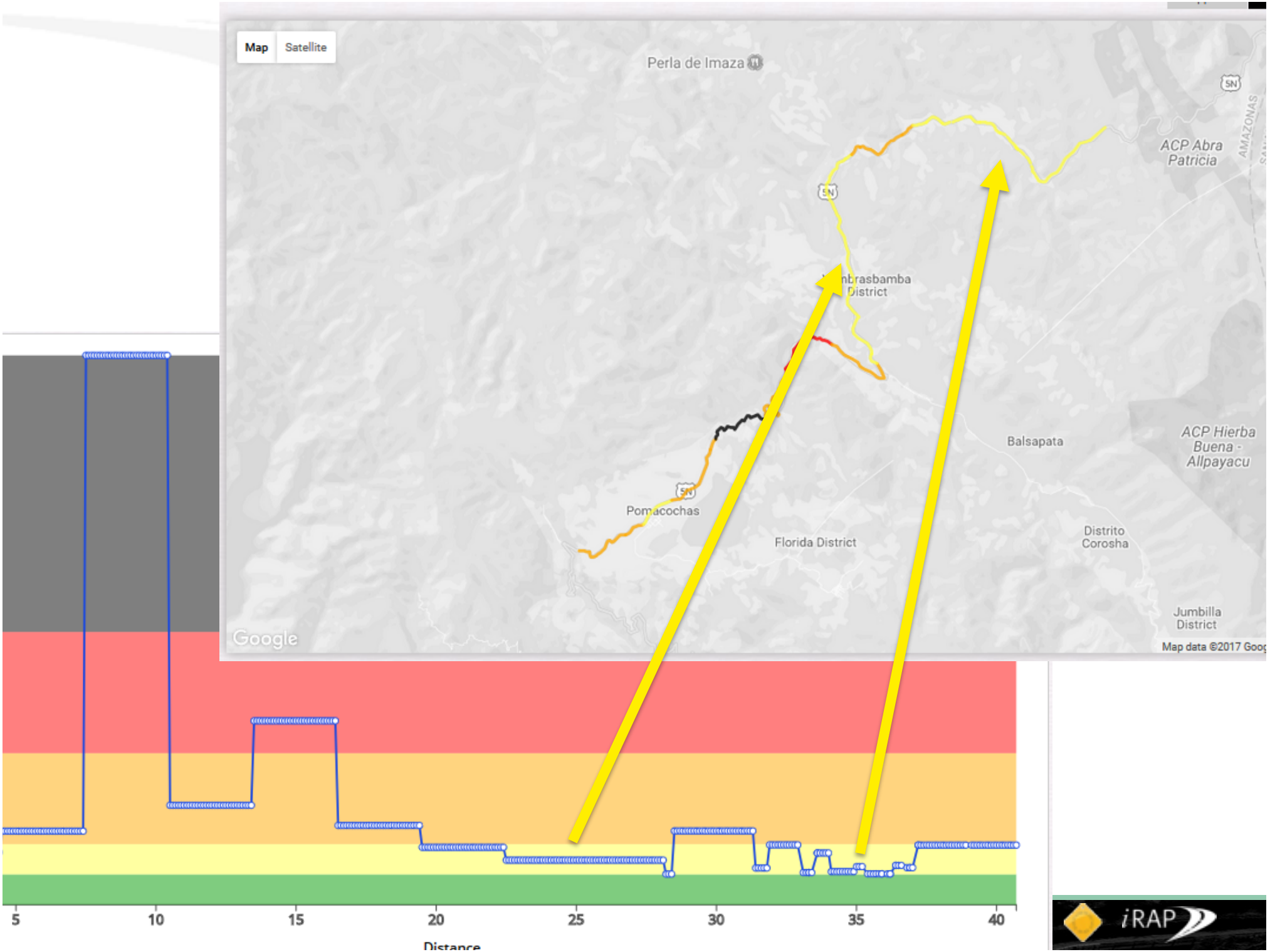
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Map data ©2017 Goog
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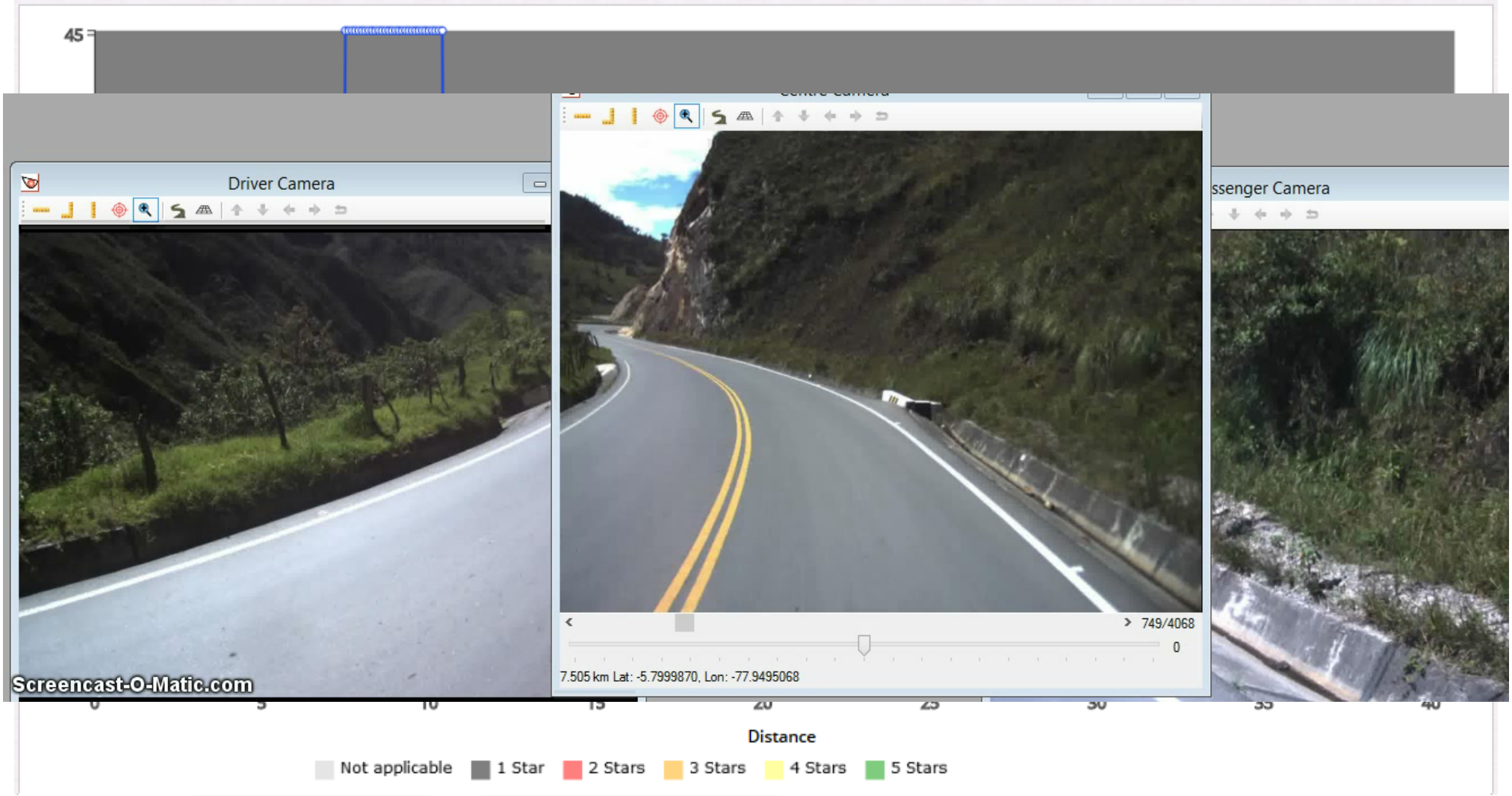
Distance
iRAP

Risk Worm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Driver Camera
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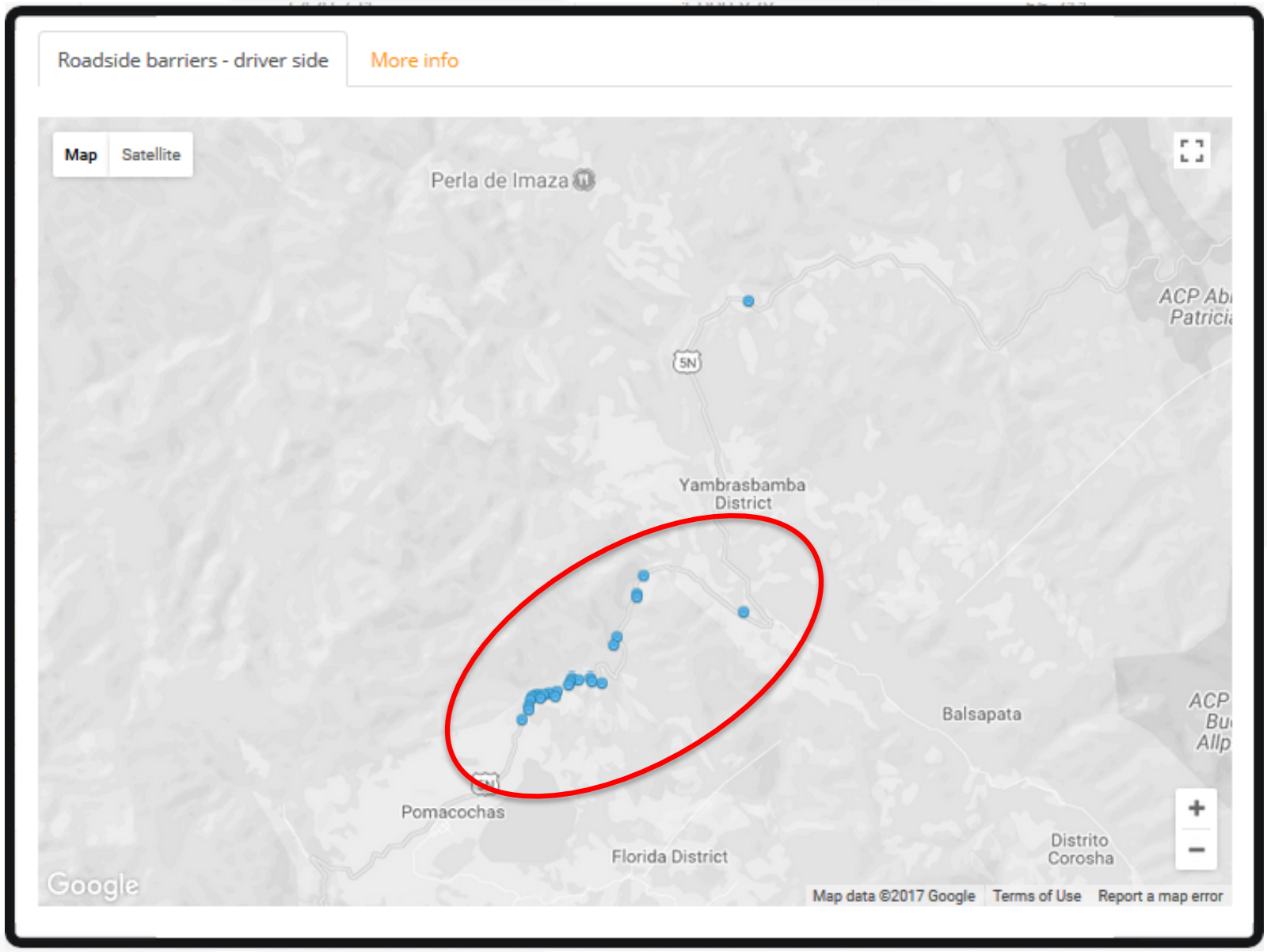
7.505 km Lat: -5.7999870, Lon: -77.9495068
Distance
Not applicable
1 Star
2 Stars
3 Stars
4 Stars
5 Stars

Safer Roads Investment Plan

- 90 safety countermeasures
- 300+ triggers
- Estimation of life-saving potential
- Economic analysis including benefit cost ratio calculation

Safer Roads Investment Plan (20 Years)

Countermeasure	Length / Sites	FSIs saved ▲	PV of safety benefit	Estimated Cost	Cost per FSI saved	Program BCR
Roadside barriers - driver side	2.60 km	13	1,748,534	622,800	48,893	3
Improve Delineation	1.90 km	1	128,988	62,992	67,035	2
Improve curve delineation	0.60 km	1	148,056	77,289	71,658	2
Roadside barriers - passenger side	0.10 km	1	78,260	24,000	42,096	3
Shoulder sealing driver side (>1m)	6.70 km	1	205,020	111,000	74,318	2
Clear roadside hazards - passenger side	0.10 km	0	9,652	2,900	41,244	3
Clear roadside hazards - driver side	0.20 km	0	8,918	5,800	89,273	2
Parking improvements	0.80 km	0	41,730	18,900	62,171	2
Footpath provision passenger side (informal path >1m)	0.10 km	0	5,999	8,857	202,654	1
Footpath provision driver side (adjacent to road)	0.70 km	0	57,058	59,500	143,144	1
Footpath provision driver side (>3m from road)	0.10 km	0	7,507	6,800	124,346	1
		18	2,439,721	1,000,838	56,311	2


Roadside barriers - driver side
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Map
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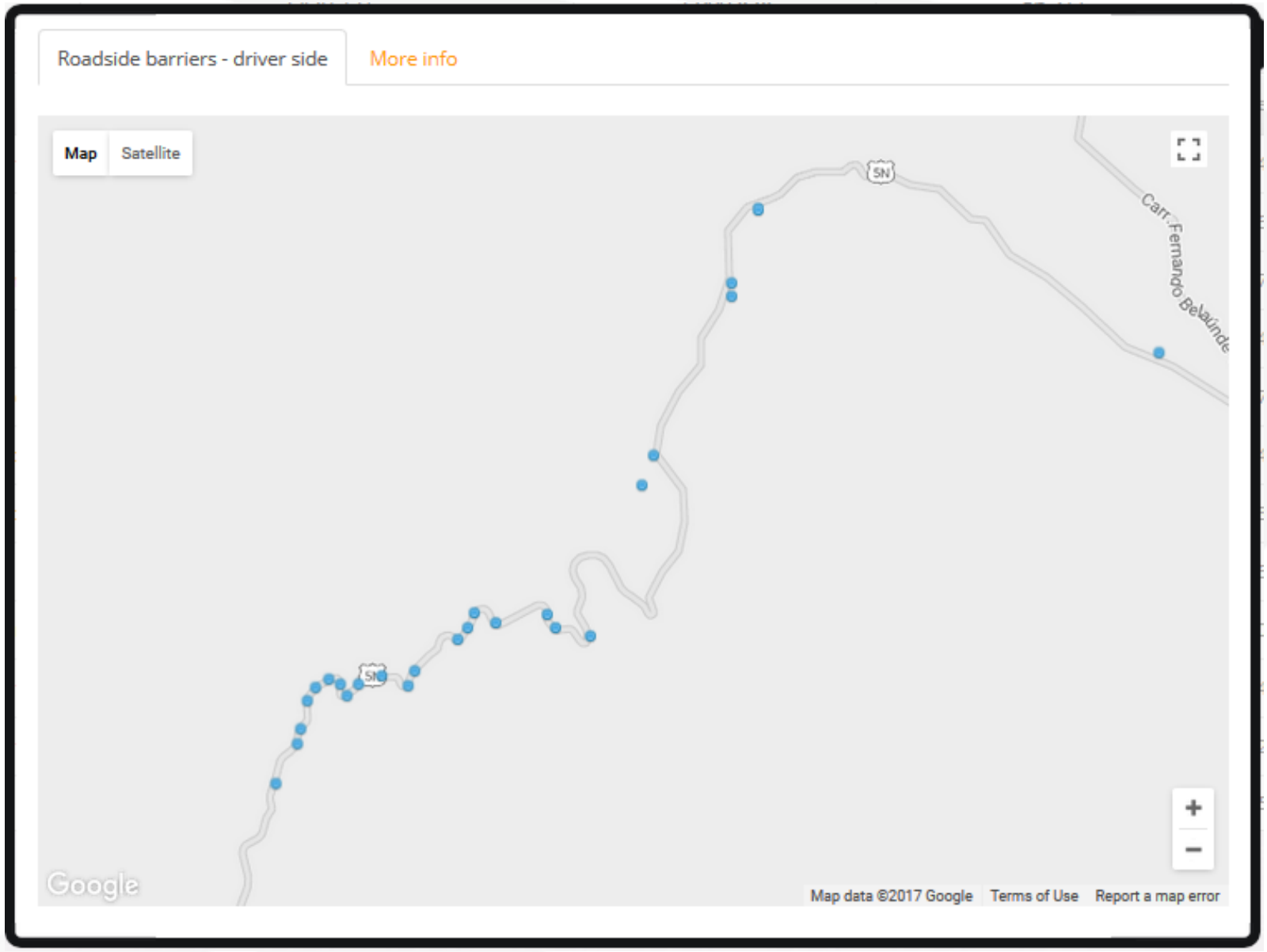
Roadside barriers - driver side
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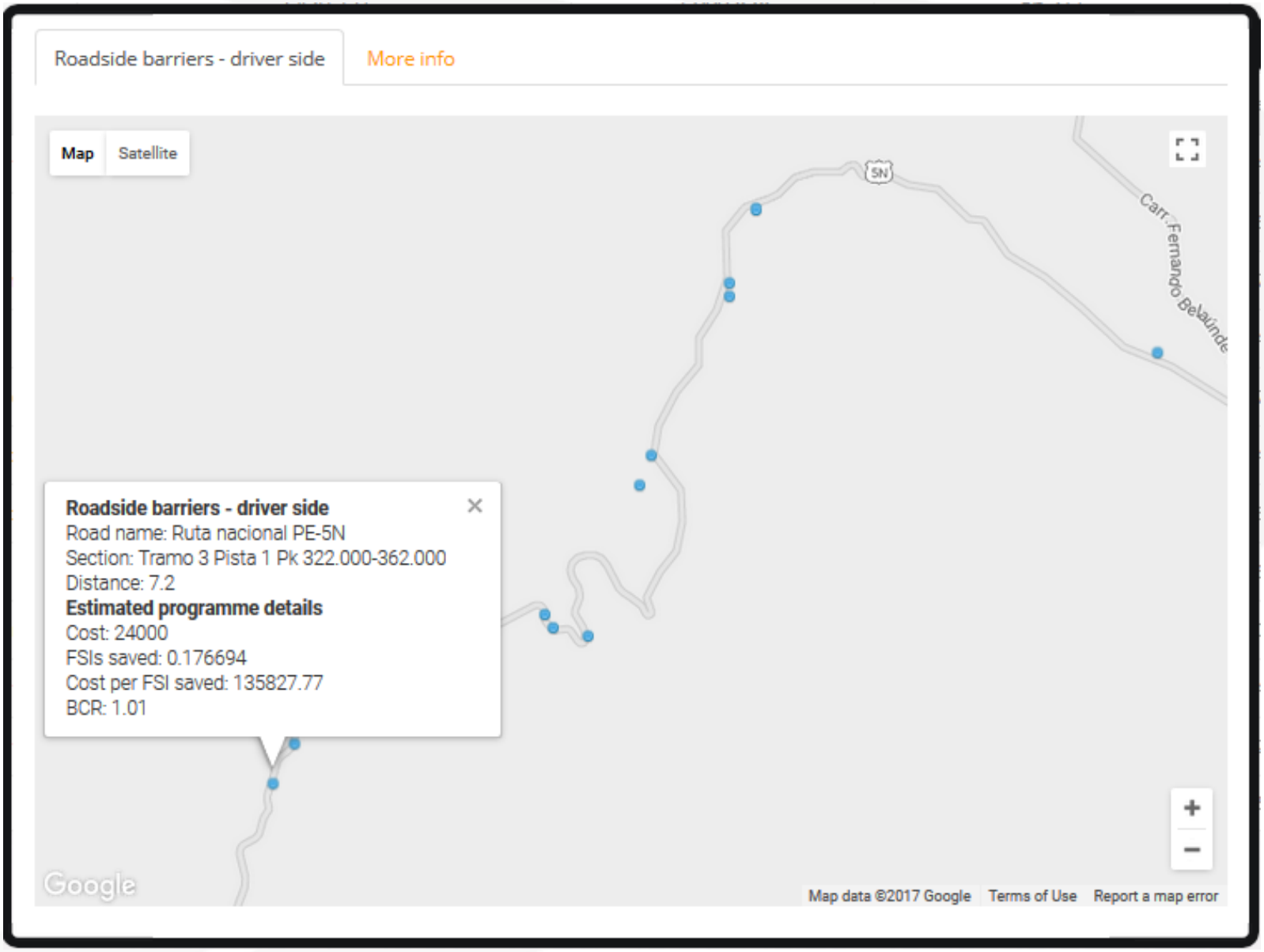
Roadside barriers - driver side
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Roadside barriers - driver side
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Distance: 7.2
Estimated programme details
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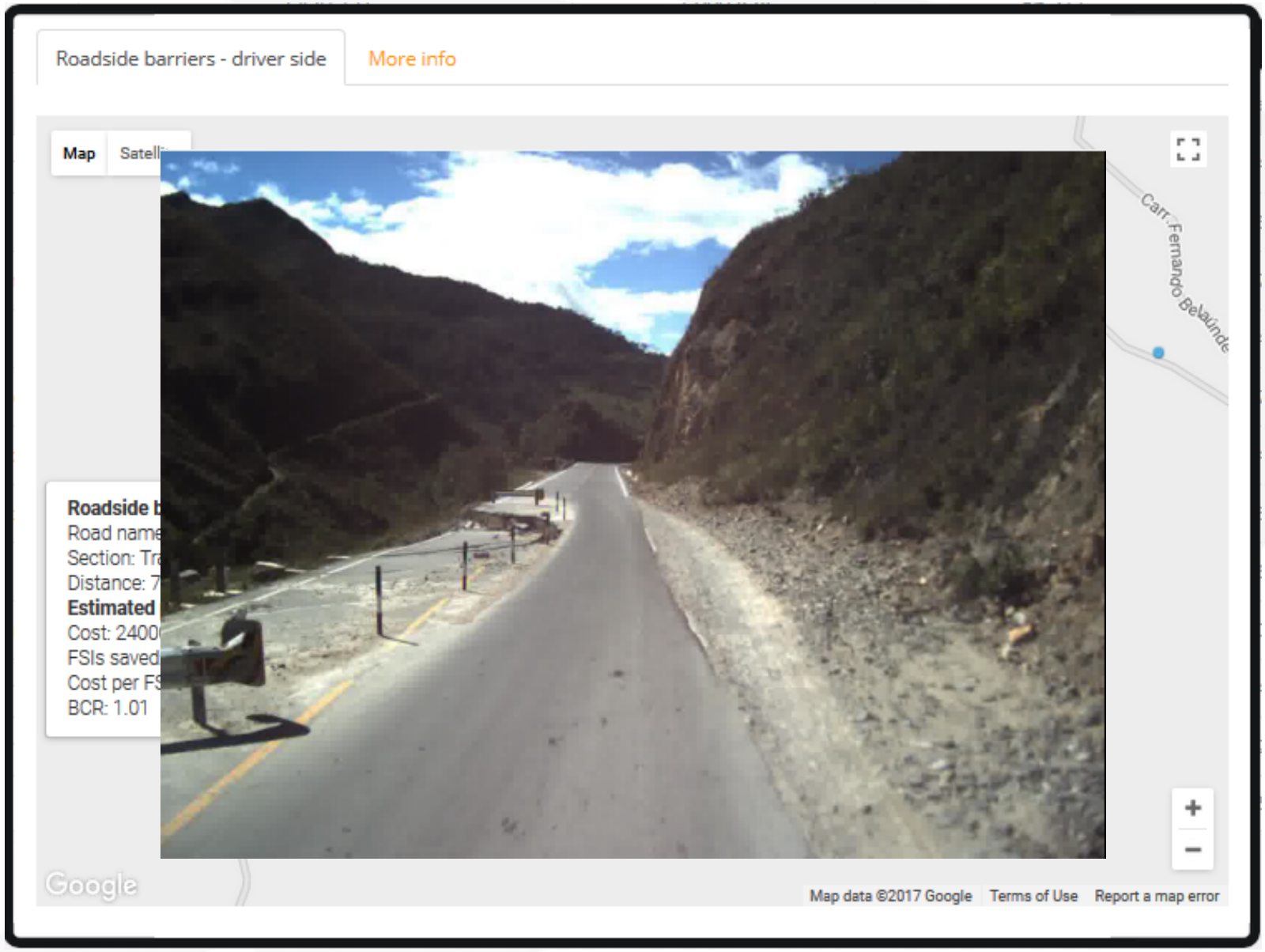
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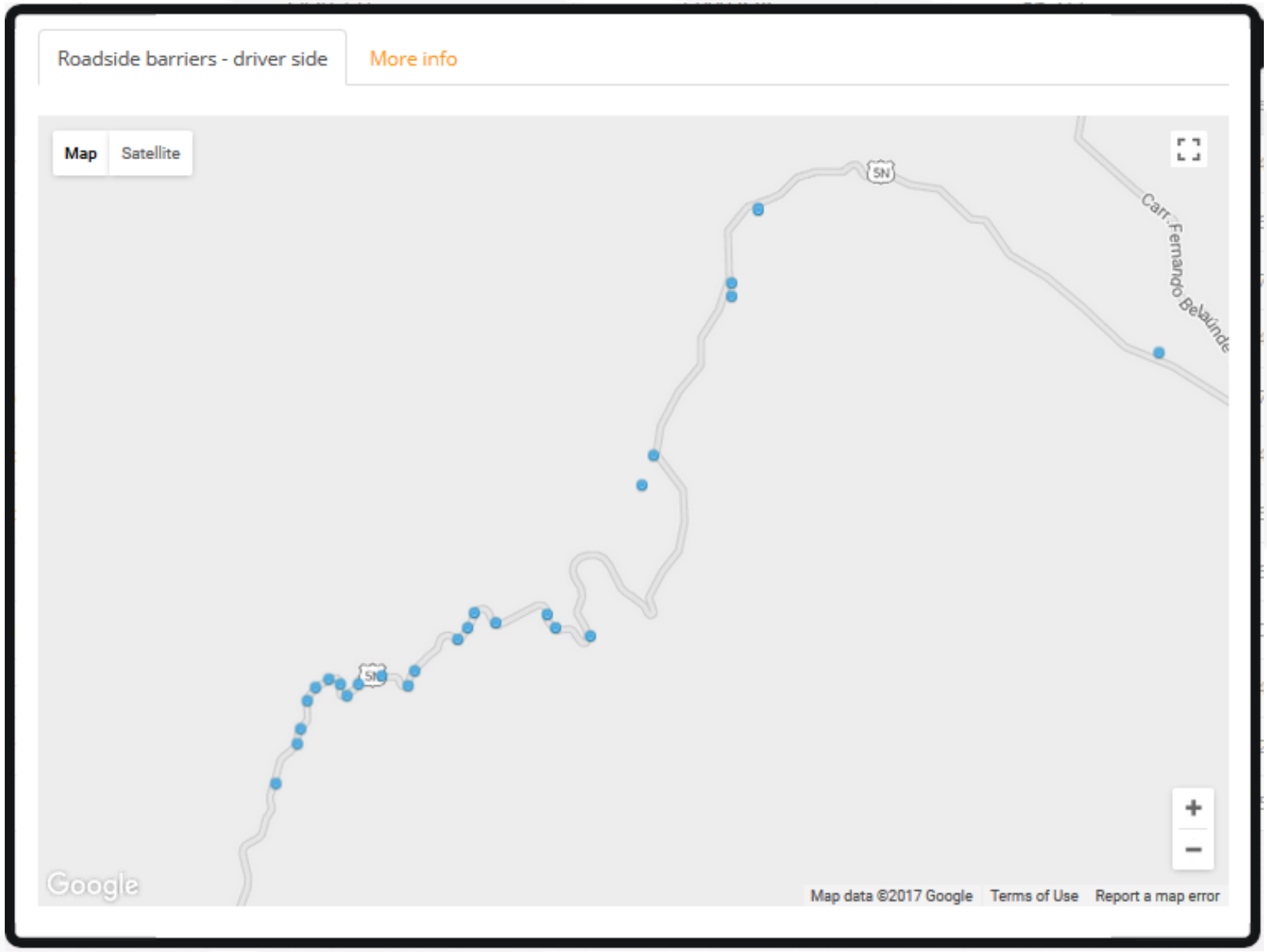
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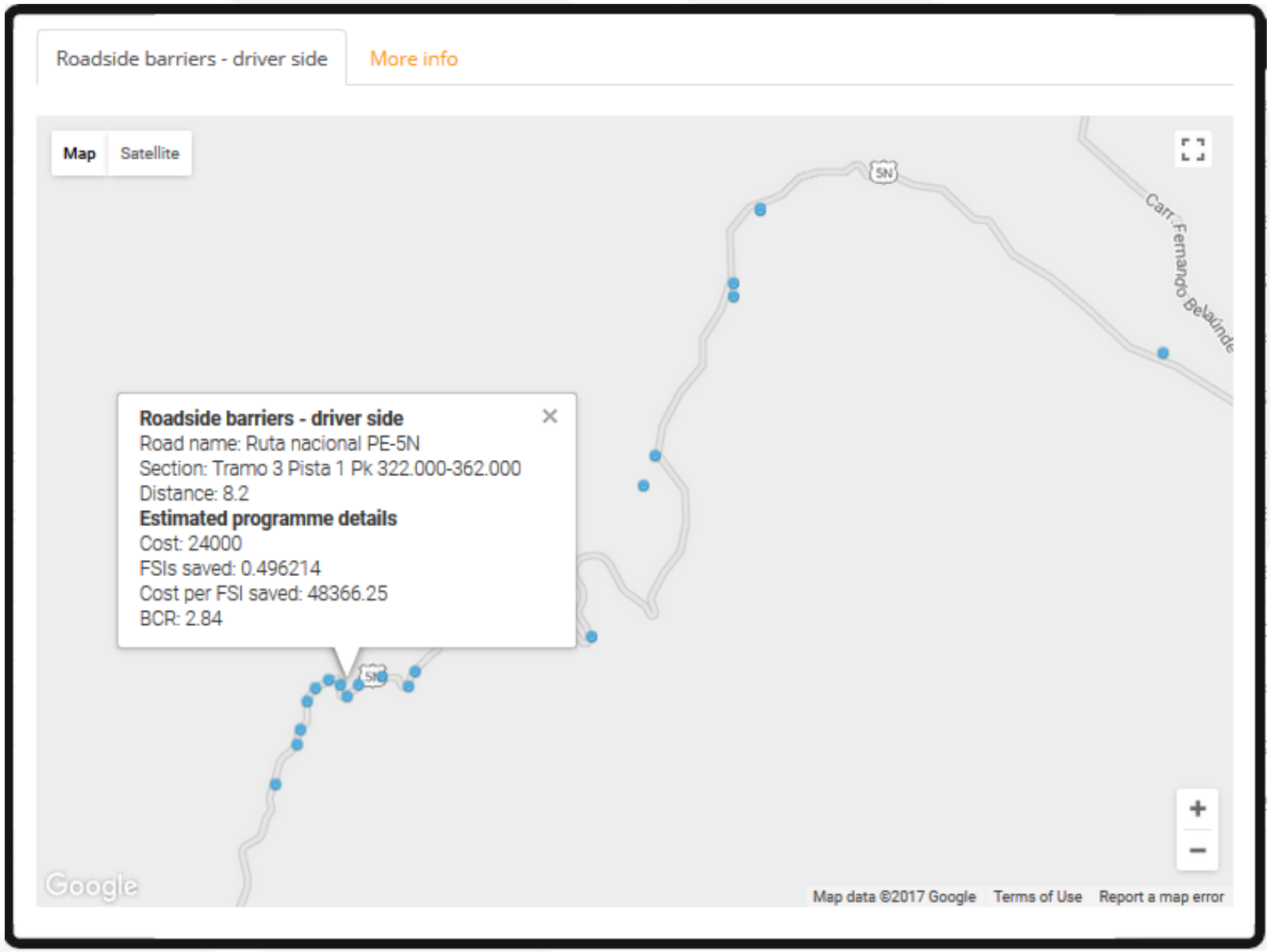
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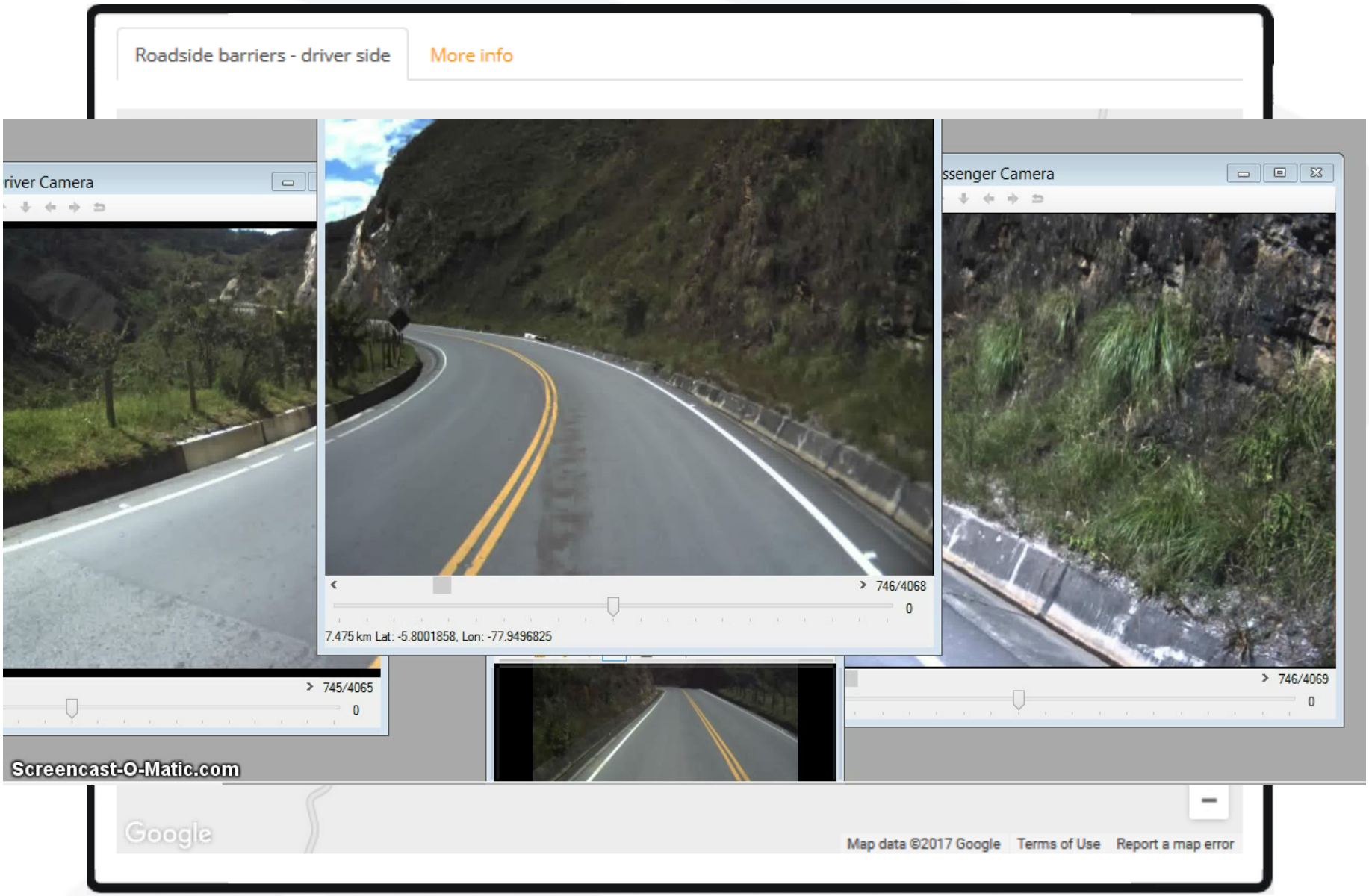
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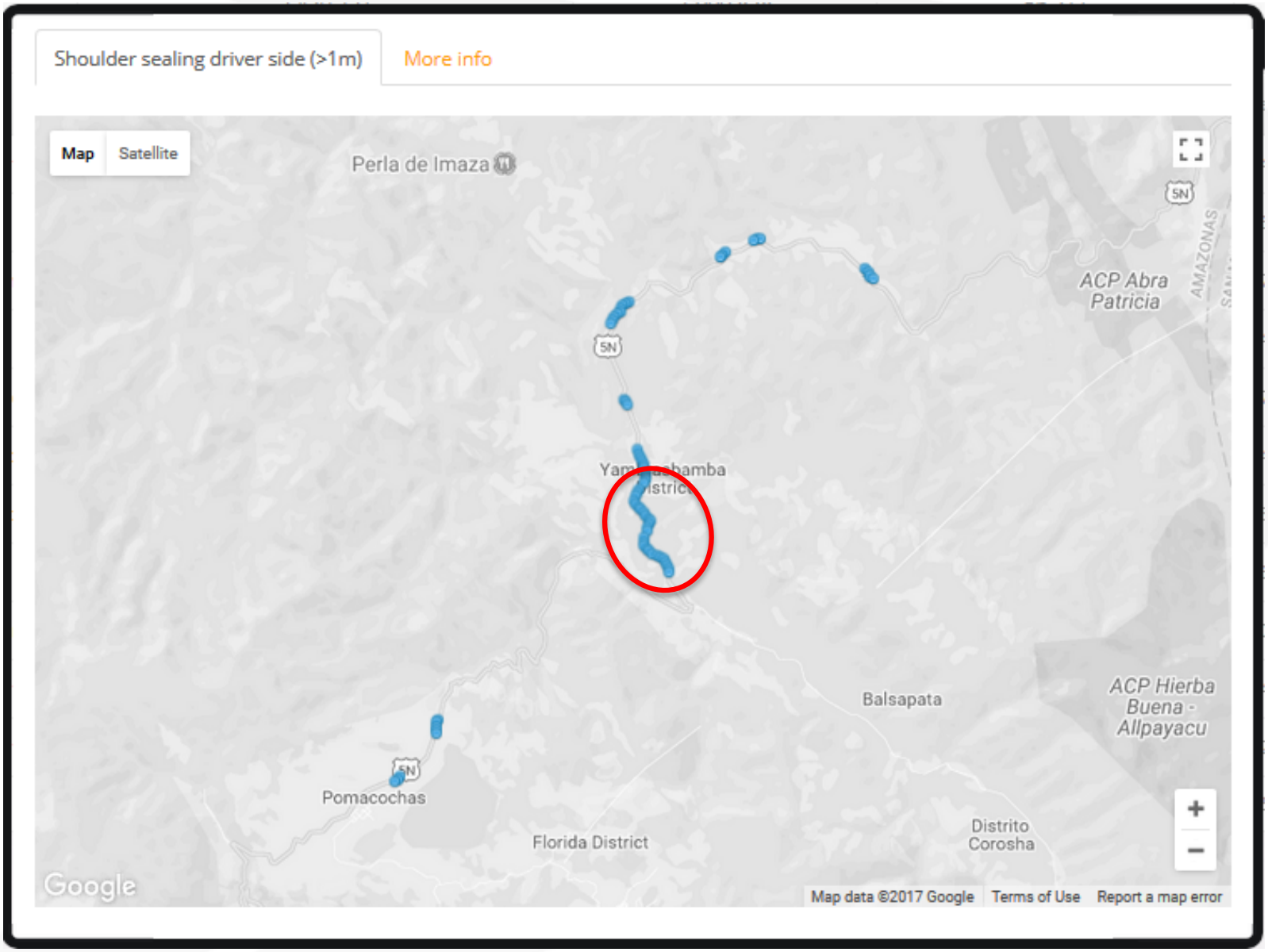
Shoulder sealing driver side (>1m)
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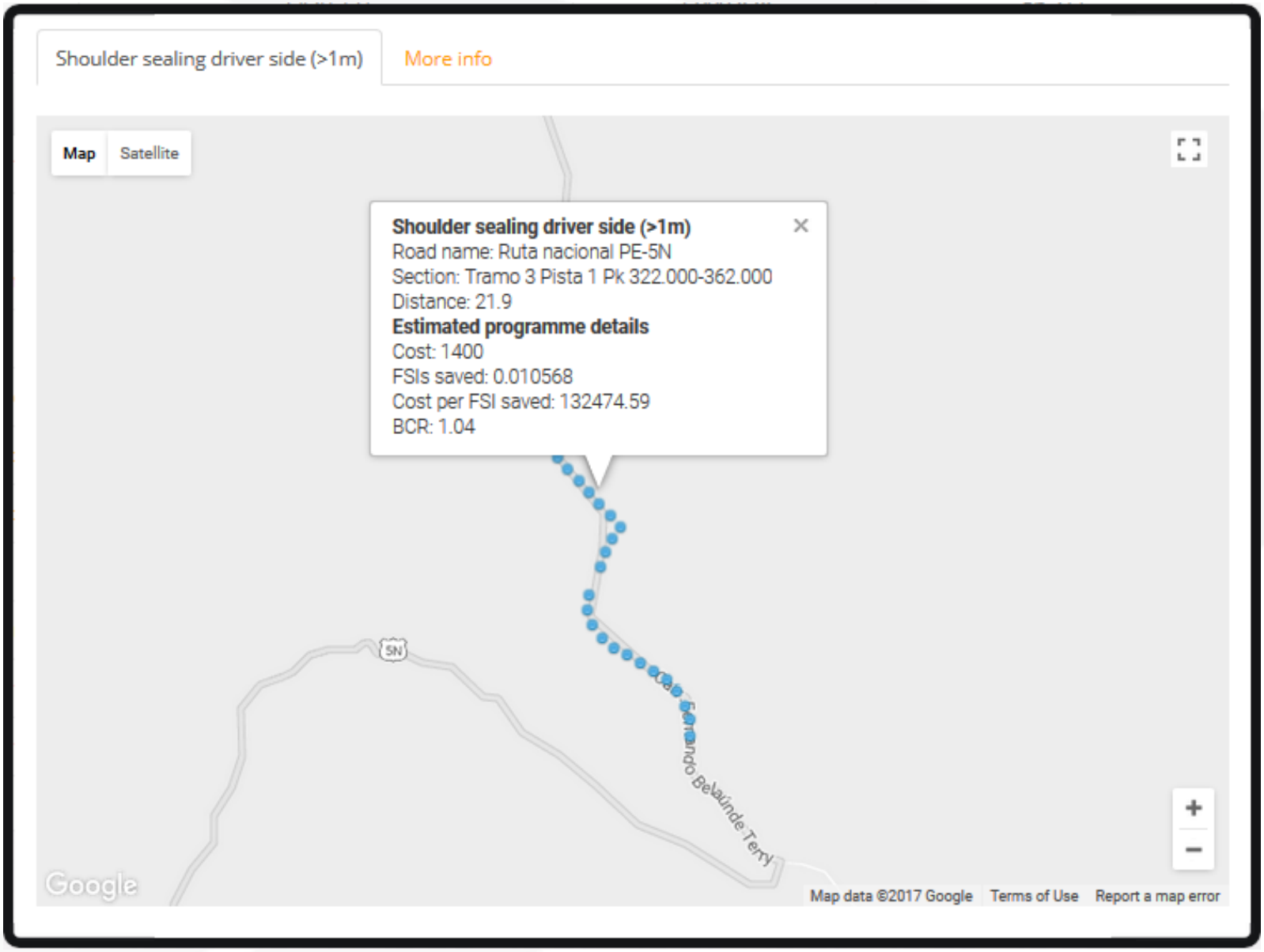
Shoulder sealing driver side (>1m)
More info
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Section: Tramo 3 Pista 1 Pk 322.000-362.000
Distance: 21.9
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BCR: 1.04
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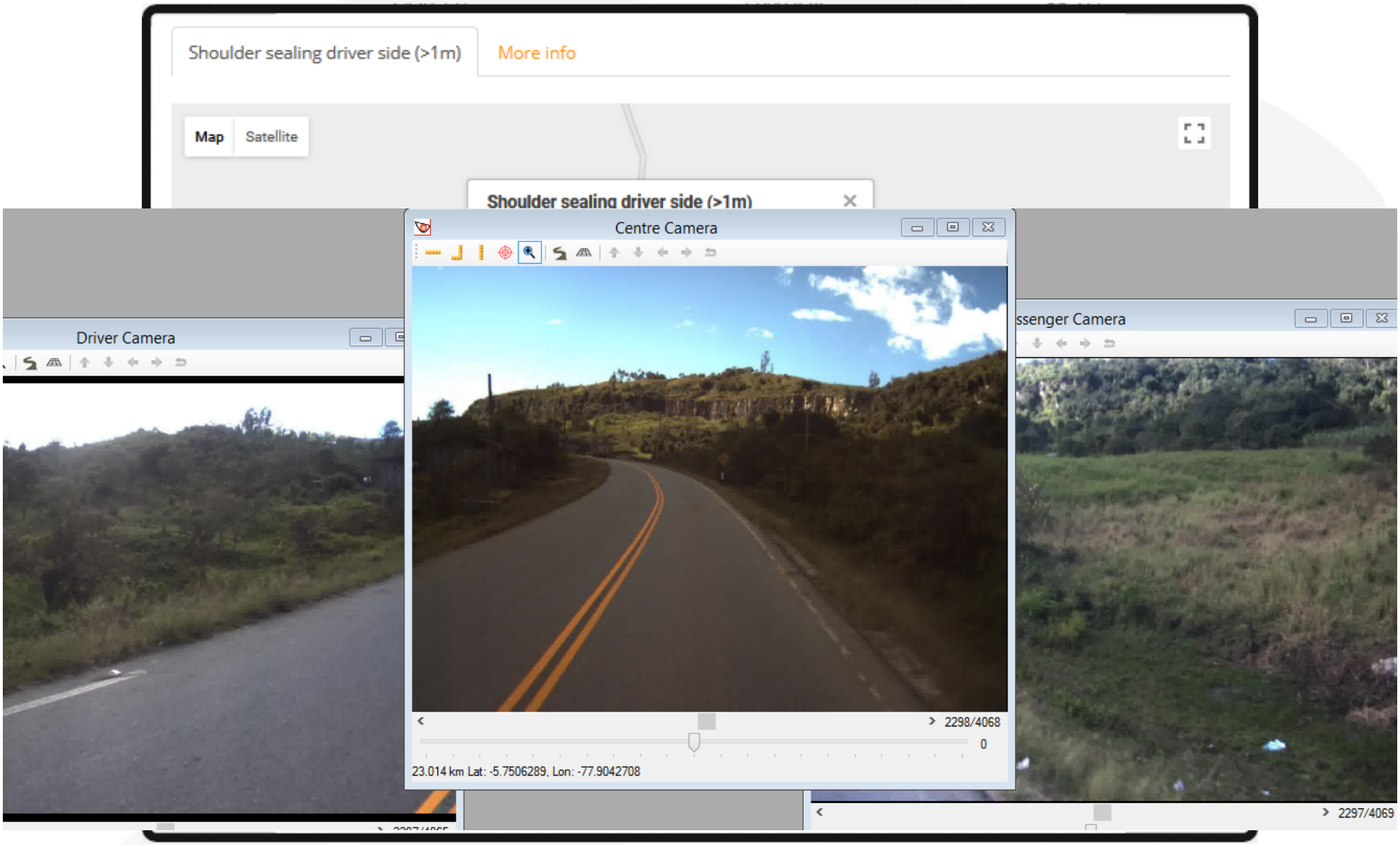
Shoulder sealing driver side (>1m)
More info
Map
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Shoulder sealing driver side (>1m)
Driver Camera
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2298/4068
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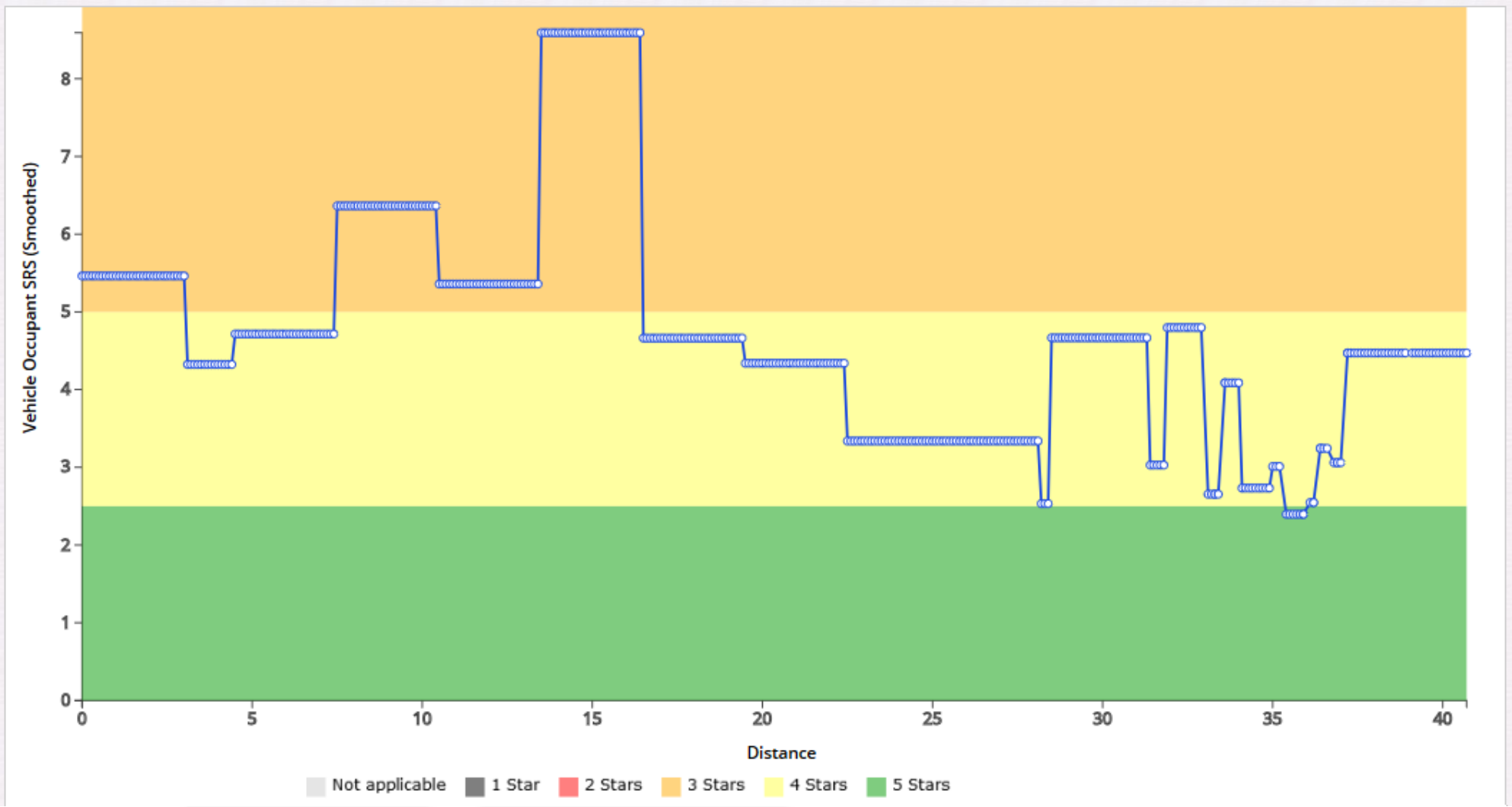
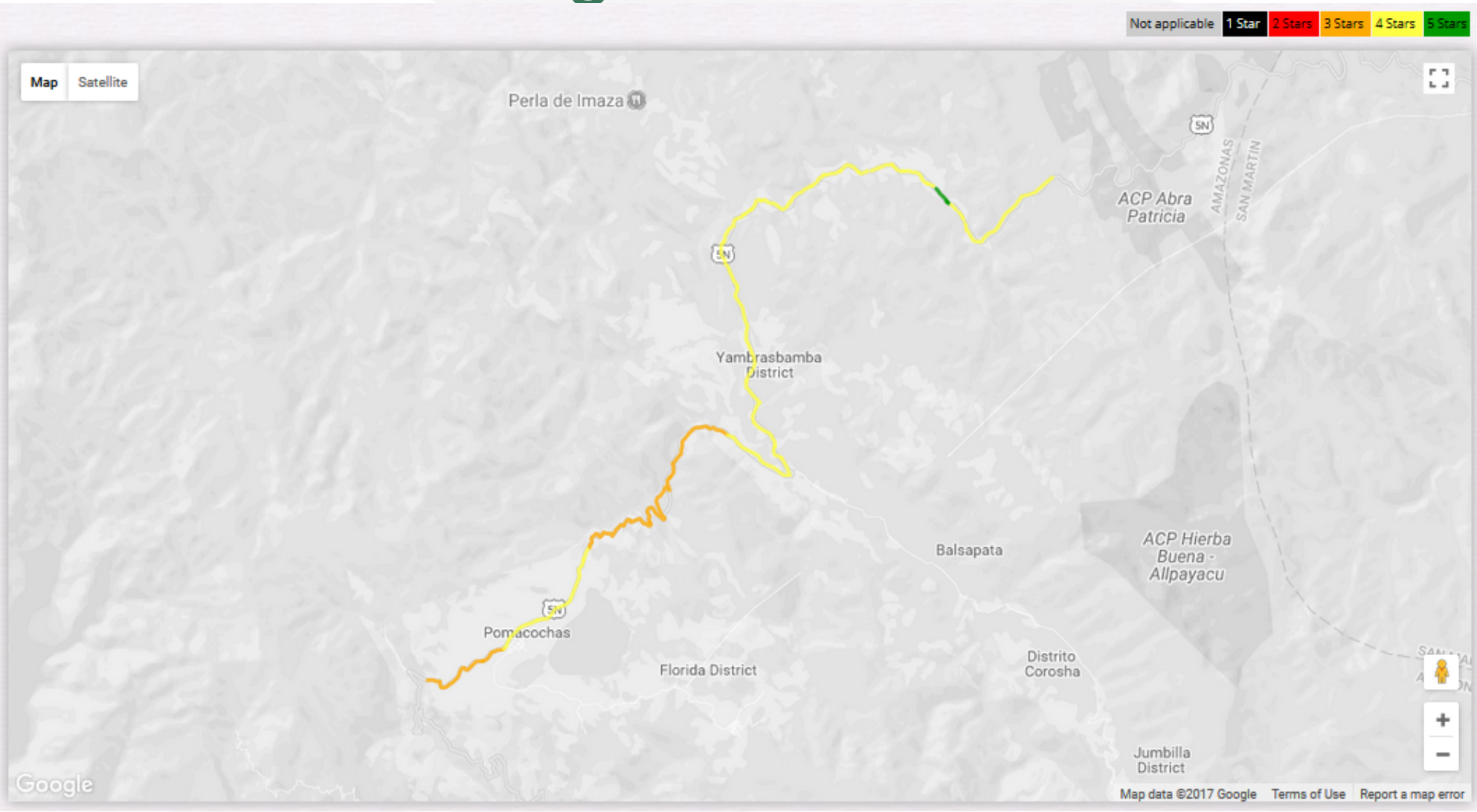
23.014 km Lat: -5.7506289, Lon: -77.9042708
2297/4069

Risk Worm (Before and After)



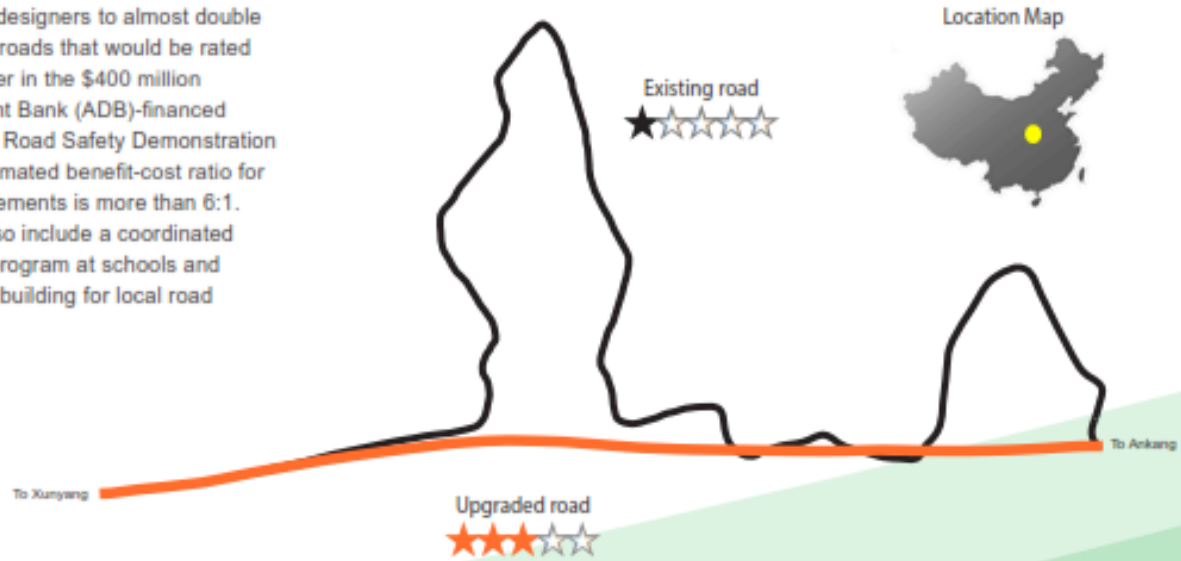
Star Ratings Before and After



SNAPSHOT: STAR RATING DESIGNS IN SHAANXI

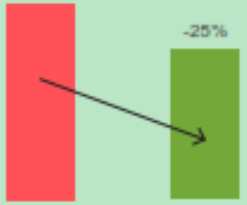
ChinaRAP, a partnership between the Research Institute of Highway (RIOH) in the Ministry of Transport and iRAP, is working with local designers to enhance safety on rural highways and on roads in villages, towns and cities

In Shaanxi, China, the ChinaRAP team helped local road designers to almost double the percentage of roads that would be rated three stars or better in the $400 million Asian Development Bank (ADB)-financed Shaanxi Mountain Road Safety Demonstration project.[45] The estimated benefit-cost ratio for the safety enhancements is more than 6:1. The project will also include a coordinated safety education program at schools and on-going capacity building for local road engineers.



The existing road experiences a higher-than-average number of vehicle occupant deaths and serious injuries. It is in mountainous terrain and has many sharp curves and hazardous roadsides

The new design includes updated safety barriers, realignments, paved shoulders, improved delineation and curve markers, enhanced skid resistance and traffic calming



It estimated that the road improvements will result in 25% fewer deaths and serious injuries, even though traffic speeds are expected to increase

STAR RATING FOR SCHOOLS

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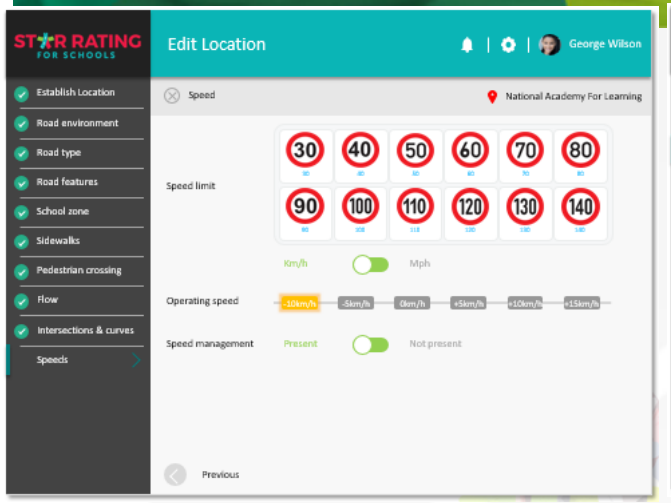

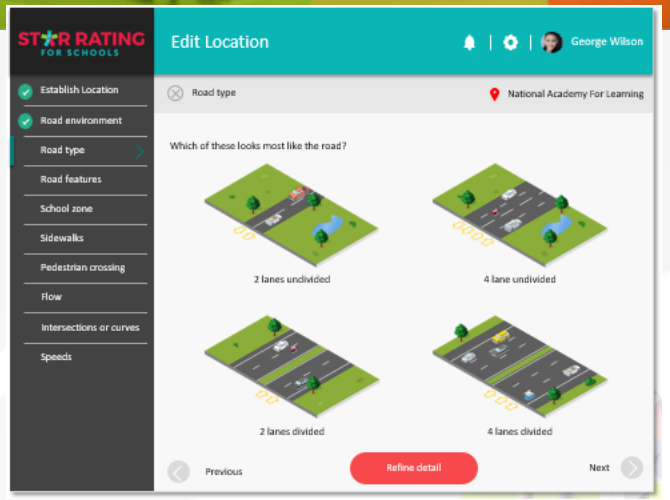

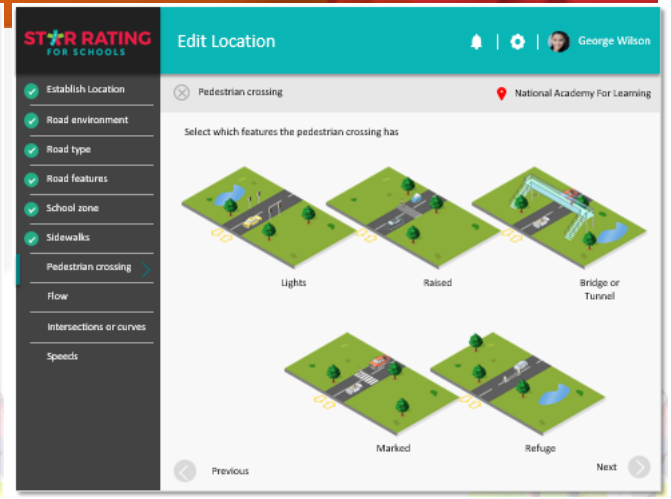

A World Free of High Risk Roads

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For more information

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Website: http://toolkit.irap.org

ViDA: http://vida.irap.org

Demonstrator: http://demonstrator.vida.irap.org

Star Rating for Schools: http://schools.irap.org

Road Safety Toolkit: http://toolkit.irap.org