

14th International Road Safety Conference

GAMBIT 2023

NEW DECADE - NEW ACTIVITIES - NEW TECHNOLOGIES

Gdańsk University of Technology, 29-31 May 2023



HONORARY PATRONAGE



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WORKSHOP ORGANIZERS



**14th International
Road Safety Conference**

GAMBIT 2023

New Decade – New Activities – New Technology

Gdansk University of Technology, 29-31 May 2023

**PRACTICAL
APPROACH TO NETWORK-WIDE ROAD SAFETY
INSPECTION BASED ON IRAP METHODOLOGY: CASE
STUDY OF CROATIA**

Anđelo Marunica, Leonid Ljubotina, Marko Šervović, Bojan Jovanović

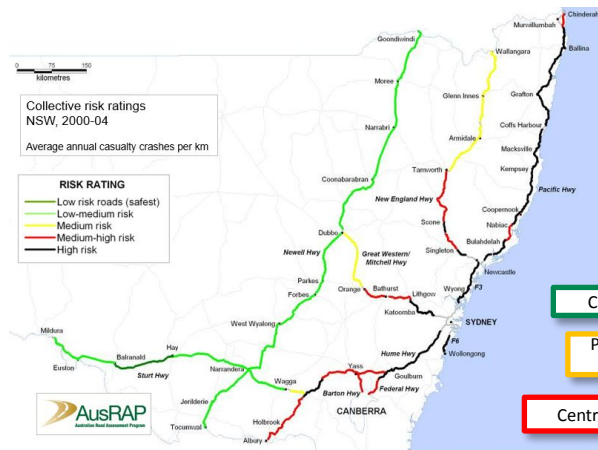


2019 RISM EU DIRECTIVE - Article 5

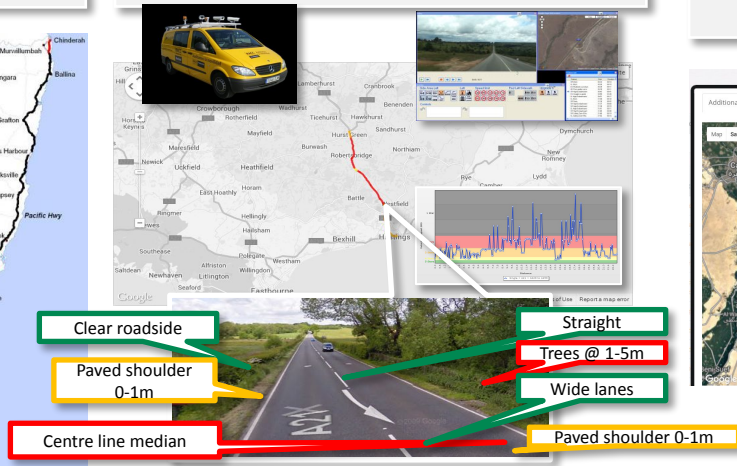
- 1. Member States shall ensure that a **network-wide road safety assessment** is carried out on the entire road network in operation covered by this Directive.
- 2. Network-wide road safety assessments shall evaluate accident and impact severity risk, based on:
 - (a) primarily, **a visual examination**, either on site or by electronic means, of the design characteristics of the road (**in-built safety**); and
 - (b) an analysis of **sections of the road network** which have been in operation for **more than three years** and upon which a **large number of serious accidents in proportion to the traffic flow** have occurred.
- 3. Member States shall ensure that the first network-wide road safety assessment is **carried out by 2024 at the latest**. Subsequent network-wide road safety assessments shall be sufficiently frequent in order to ensure adequate safety levels, but in any case shall be carried out at **least every five years**.
- 4. In carrying out the network-wide road safety assessment, Member States may take into account the **indicative elements set out in Annex III**.
- 5. The Commission shall **provide guidance on the methodology** for carrying out systematic network-wide road safety assessments and safety ratings.
- 6. On the basis of the results of the assessment referred to in paragraph 1, and for the purpose of prioritisation of needs for further action, Member States shall classify all sections of the road network in **no fewer than three categories according to their level of safety**.

iRAP protocols

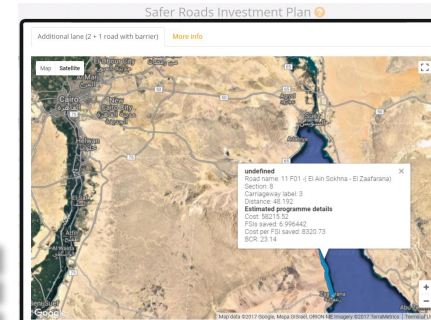
RISK MAPS



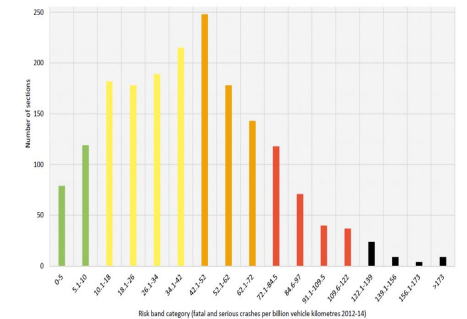
STAR RATING



INVESTMENT PLANS



PERFORMANCE TRACKING



Measuring Road Risk

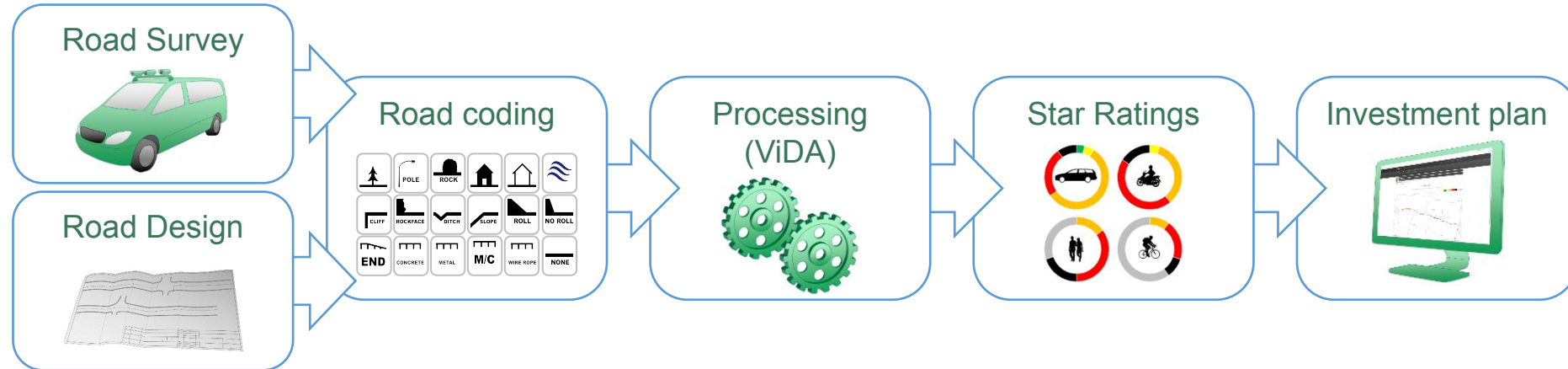
- Reactive
- Measuring crashes **per km travelled**

- Proactive
- Measuring **infrastructure risk**
- Can be completed in the **absence of crash data**
- Five-star road segments are the safest while one-star are the least safe

- Prioritises and costs improvement options to increase Star Ratings and save lives
- Considers 90 **proven** road improvement options

- Regular risk mapping or star rating to monitor **performance over time**
- Enables celebration of success and informs action to address persistently high-risk roads

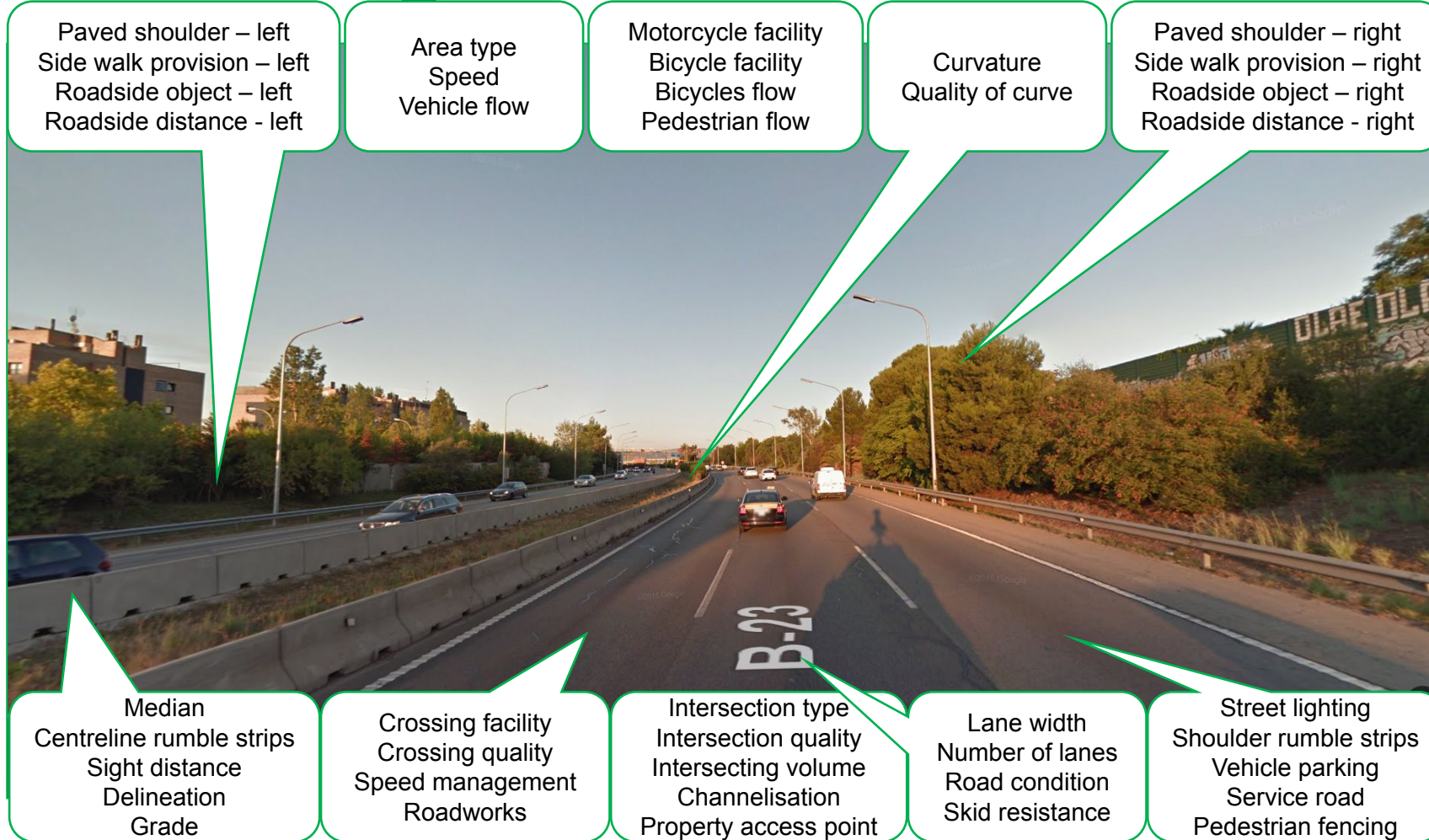
iRAP Star Rating



Star Rating is a measure of an **individual road users risk** which is **'built in'** to the road.

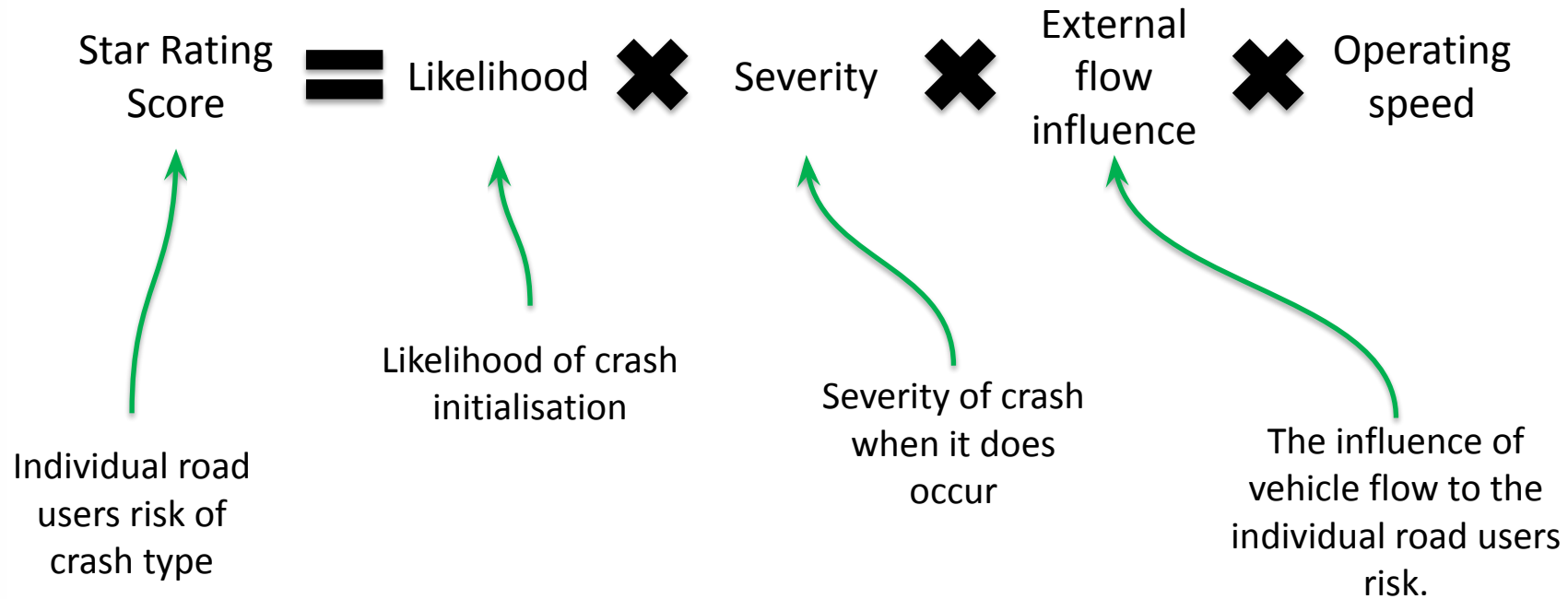
- Measured every 10m – calculated for every 100m
- Based on robust international research
- Technical oversight by iRAP Global Technical Committee

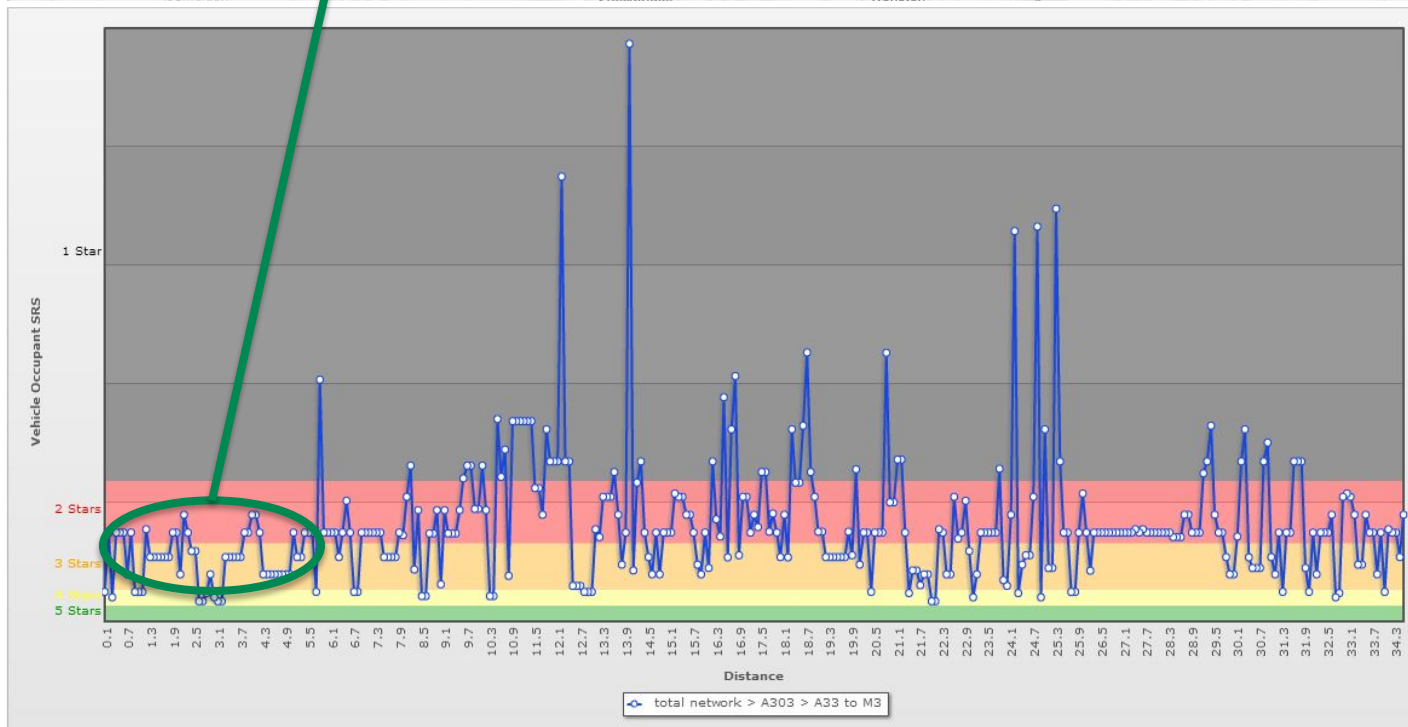
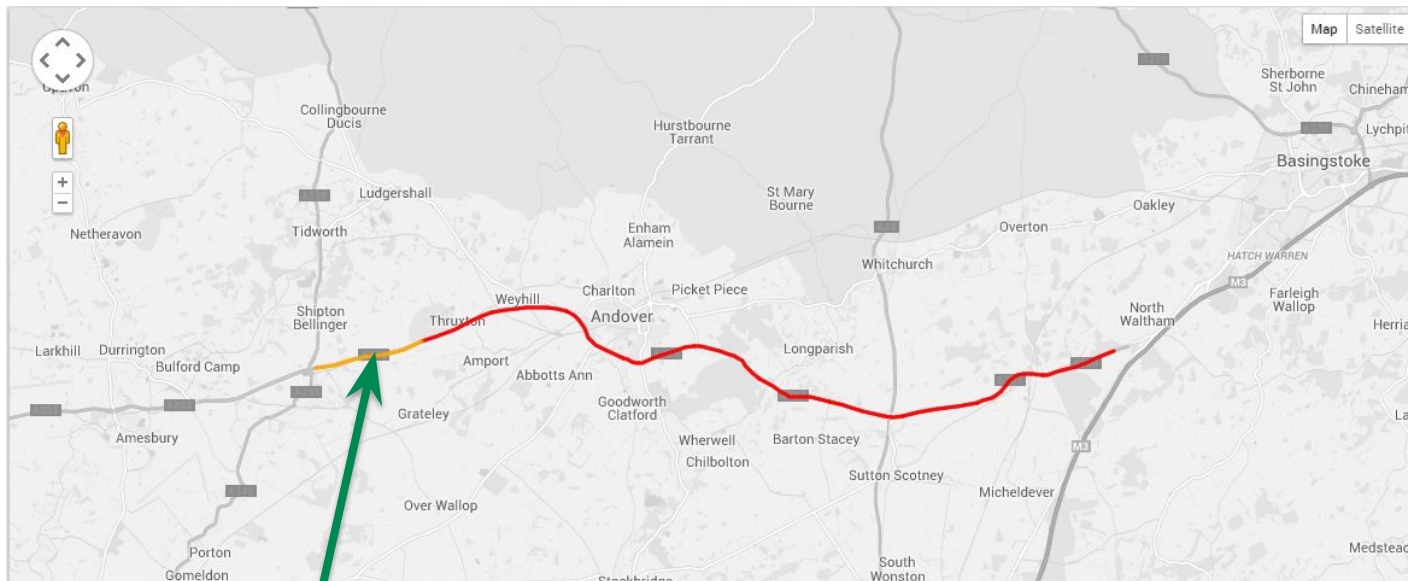
Road Coding Attributes



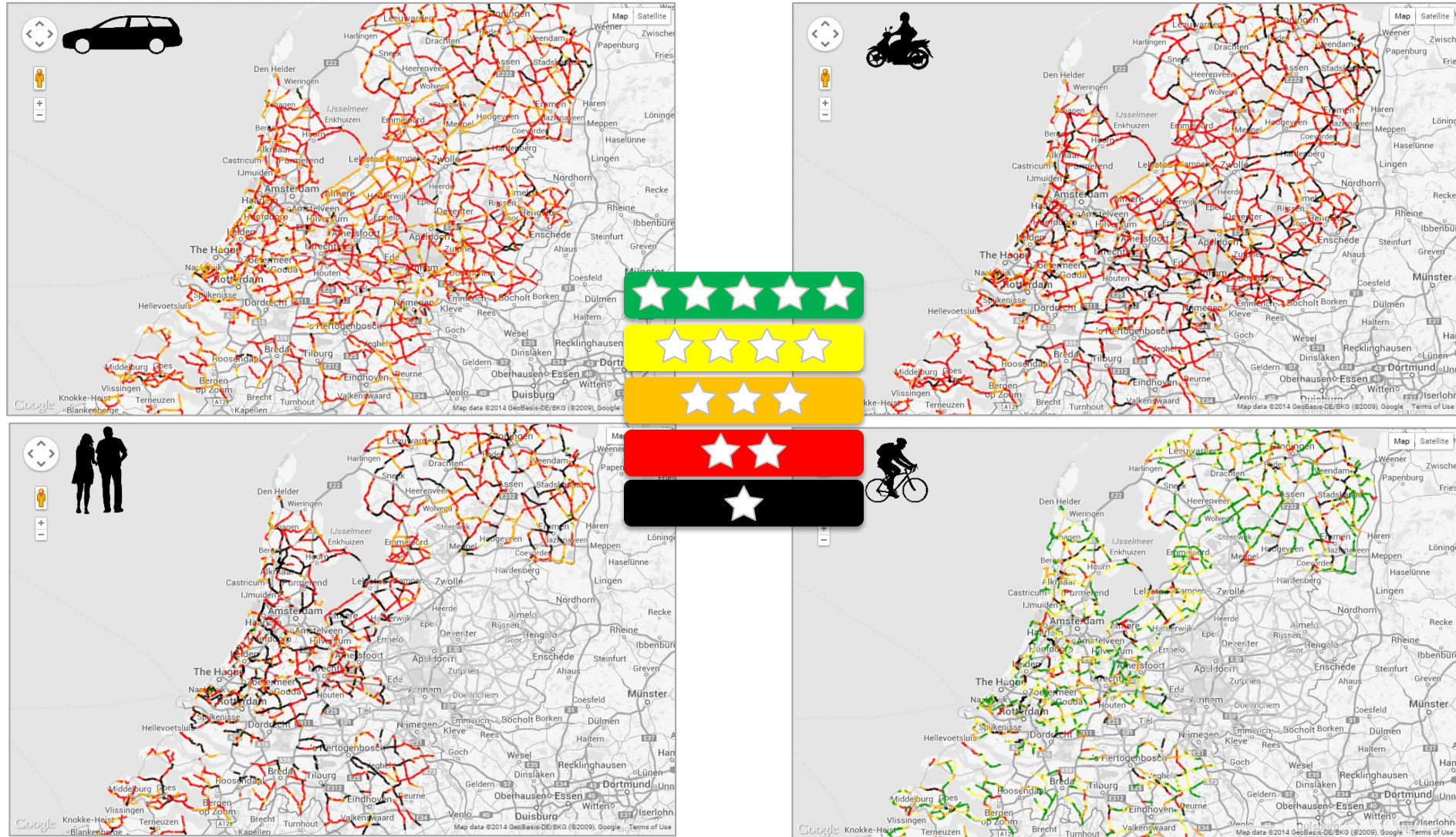
Star Rating equation

- For each user group crash type the format per 100m is:





Road user specific maps



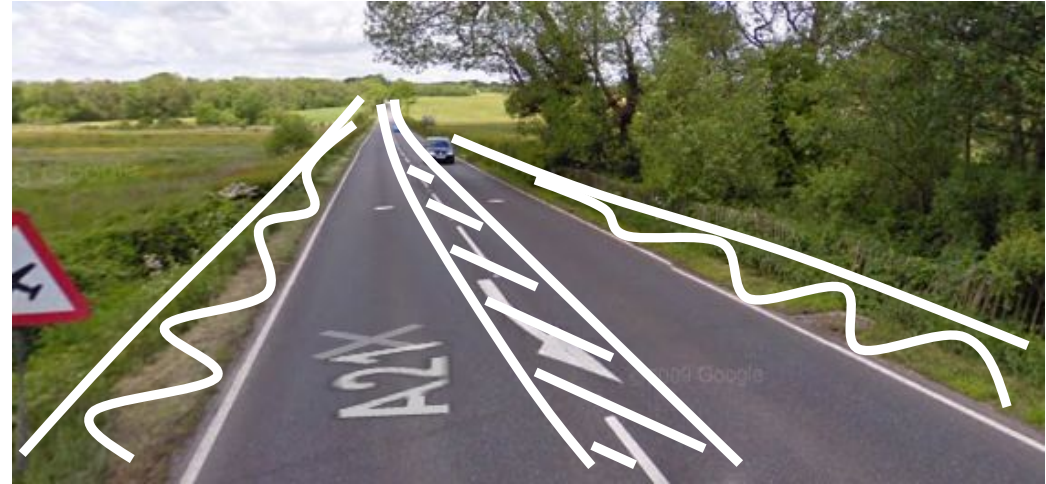
iRAP Safer Roads Investment Plans

90 proven countermeasures

300+ engineering trigger sets

Calculate potential lives saved

Minimum BCR criteria set



EuroRAP in Croatia

PARTNER INVOLVEMENT



UNIVERSITY OF ZAGREB
FACULTY OF TRANSPORT AND TRAFFIC SCIENCES
DEPARTMENT OF TRANSPORT PLANNING



FPZ Survey vehicle

All the surveys were conducted according to iRAP standards by an FPZ equipped survey vehicle.

The specialized survey vehicle has recorded the videos with a Single front/back camera mode

- Video resolution 1920x1080 at 30 FPS (170 degrees angle of view, progressive scan).

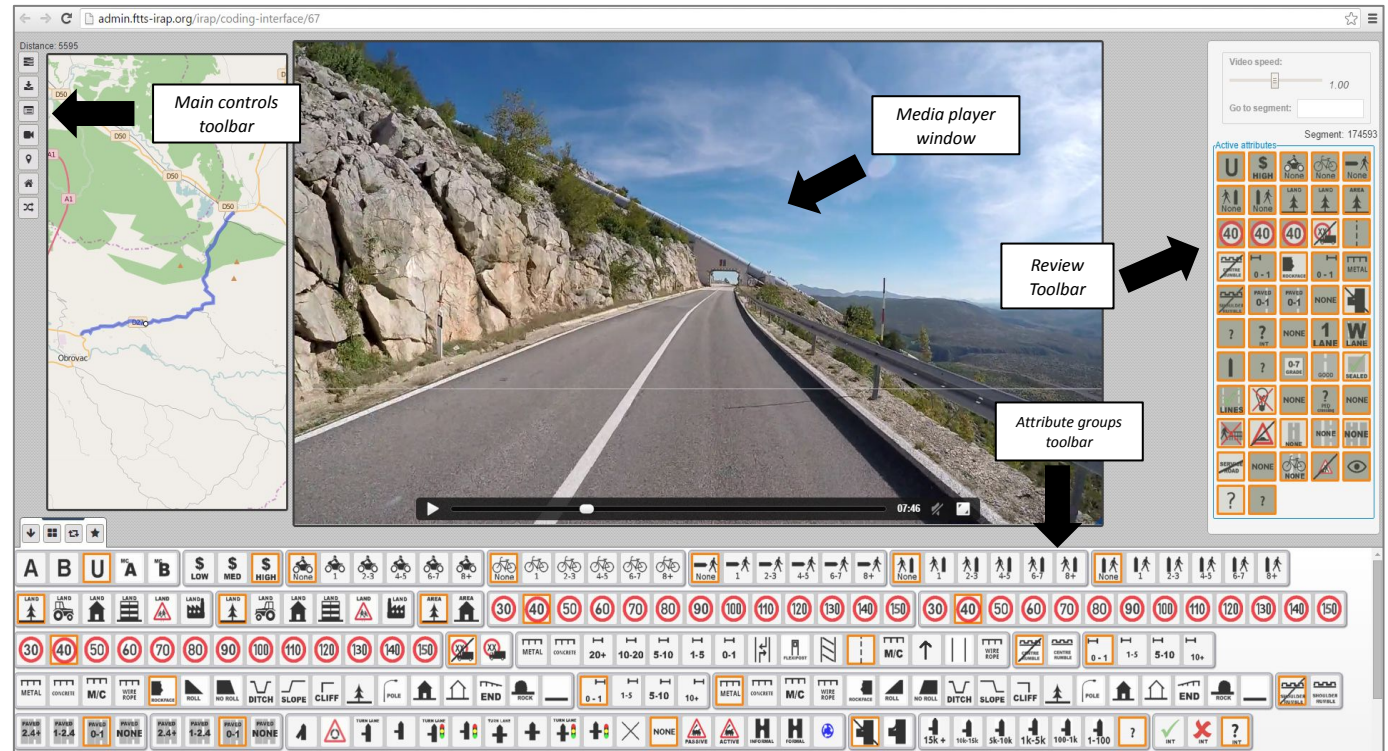
The video surveys are georeferenced using satellite positioning devices of SPS accuracy.

- Georeferencing interval is 10 Hz, interval length varying regarding vehicle speed, between 0.04 m at 5 km/h and 1.2 m at the speed of 130 km/h, respective to position accuracy.

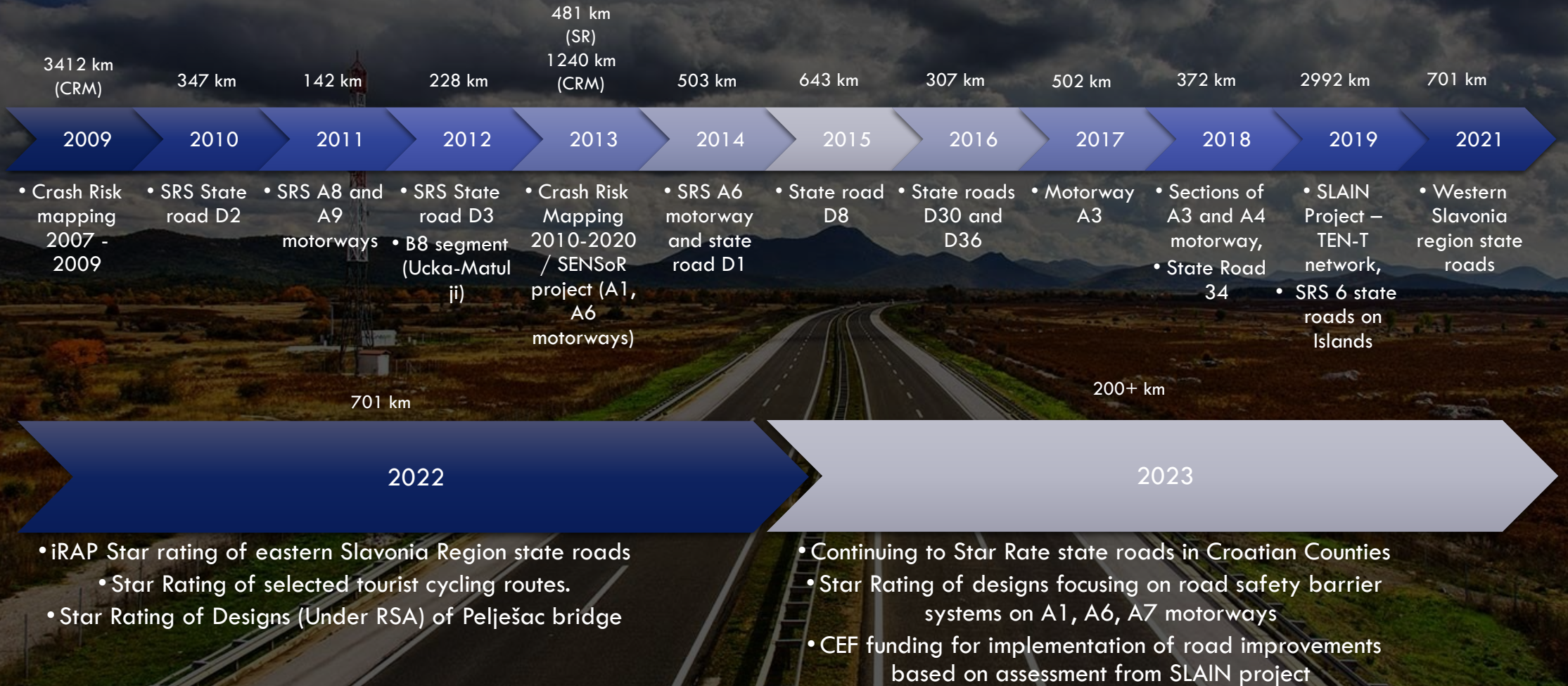


FPZ Coding tool

- FPZ has, in partnership with the Faculty of Geodesy and software developers, created a WebGIS software for road attribute coding.
 - 10 m survey segment resolution

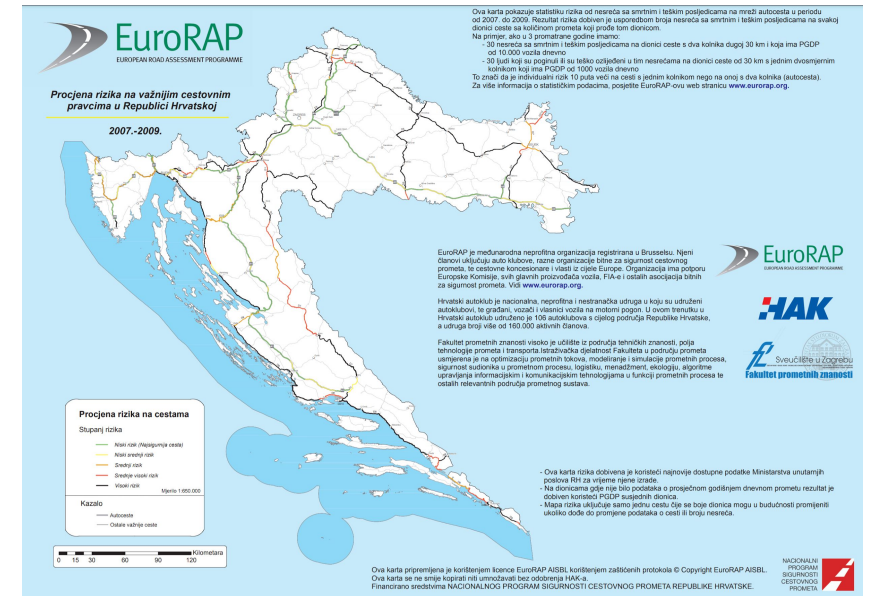


EuroRAP in Croatia - Timeline



EuroRAP – Crash Risk Mapping, 2007-2009.

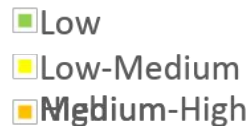
- First Risk Mapping protocol in Croatia covers the period of 2006 to 2009.
- Scope of Risk Mapping:
 - 1262 km of motorways
 - 2150 km of state roads



Individual risk - State Roads

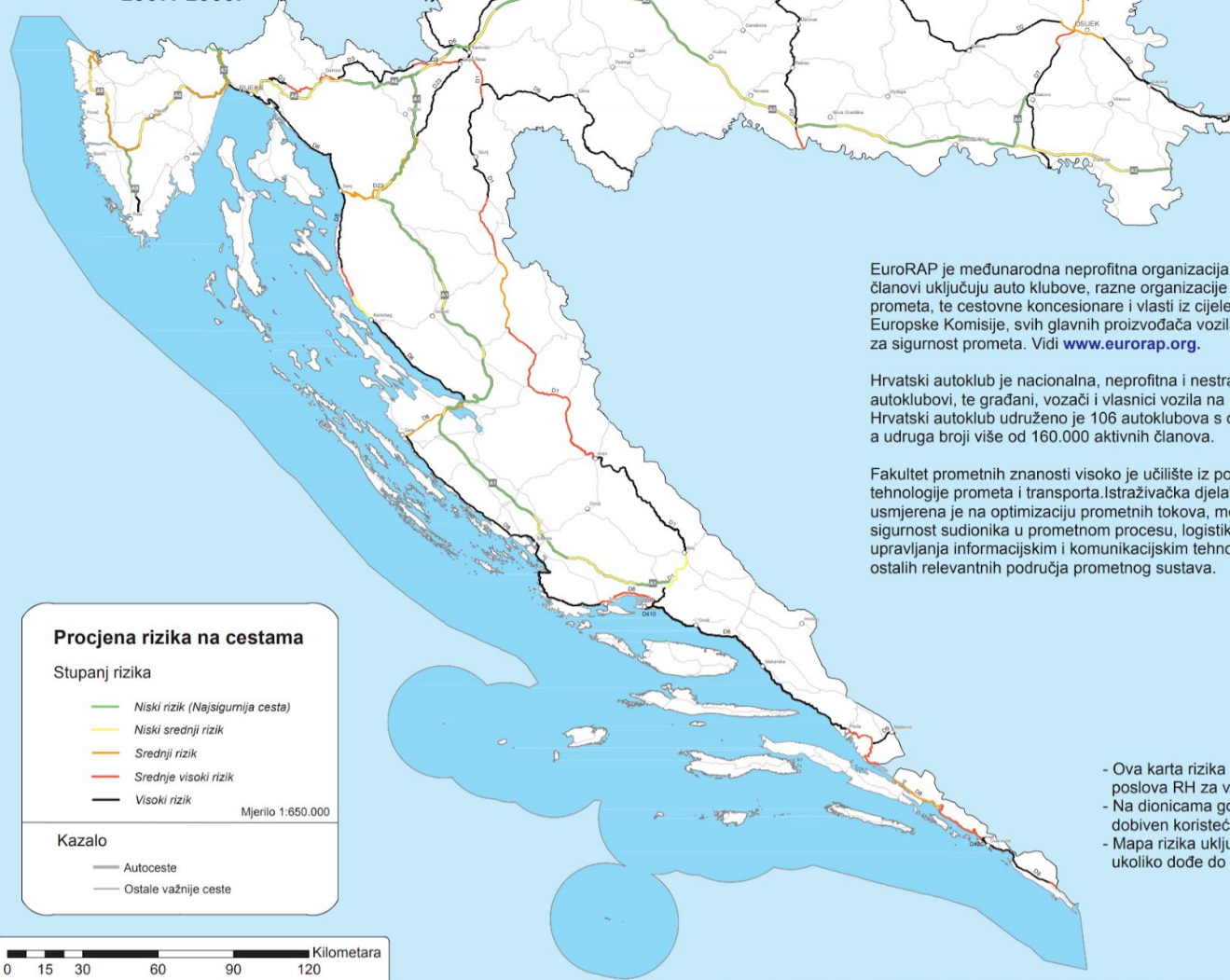


Individual risk - Motorways



Procjena rizika na važnijim cestovnim pravcima u Republici Hrvatskoj

2007.-2009.



Ova karta pokazuje statistiku rizika od nesreća sa smrtnim i teškim posljedicama na mreži autocesta u periodu od 2007. do 2009. Rezultat rizika dobiven je usporedbom broja nesreća sa smrtnim i teškim posljedicama na svakoj dionici ceste sa količinom prometa koji prođe tom dionicom.

Na primjer, ako u 3 promatrane godine imamo:

- 30 nesreća sa smrtnim i teškim posljedicama na dionici ceste sa dva kolnika dugoj 30 km i koja ima PGDP od 10.000 vozila dnevno
- 30 ljudi koji su poginuli ili su teško ozlijeđeni u tim nesrećama na dionici ceste od 30 km sa jednim dvosmjernim kolnikom koji ima PGDP od 1000 vozila dnevno

To znači da je individualni rizik 10 puta veći na cesti s jednim kolnikom nego na onoj s dva kolnika (autocesta).

Za više informacija o statističkim podacima, posjetite EuroRAP-ovu web stranicu www.eurorap.org.

EuroRAP je međunarodna neprofitna organizacija registrirana u Brüsselu. Njeni članovi uključuju auto klubove, razne organizacije bitne za sigurnost cestovnog prometa, te cestovne koncesionare i vlasti iz cijele Europe. Organizacija ima potporu Europske Komisije, svih glavnih proizvođača vozila, FIA-e i ostalih asocijacija bitnih za sigurnost prometa. Vidi www.eurorap.org.

Hrvatski autoklub je nacionalna, neprofitna i nestranačka udruga u koju su udruženi autoklubovi, te građani, vozači i vlasnici vozila na motorni pogon. U ovom trenutku u Hrvatski autoklub udruženo je 106 autoklubova s cijelog područja Republike Hrvatske, a udruga broji više od 160.000 aktivnih članova.

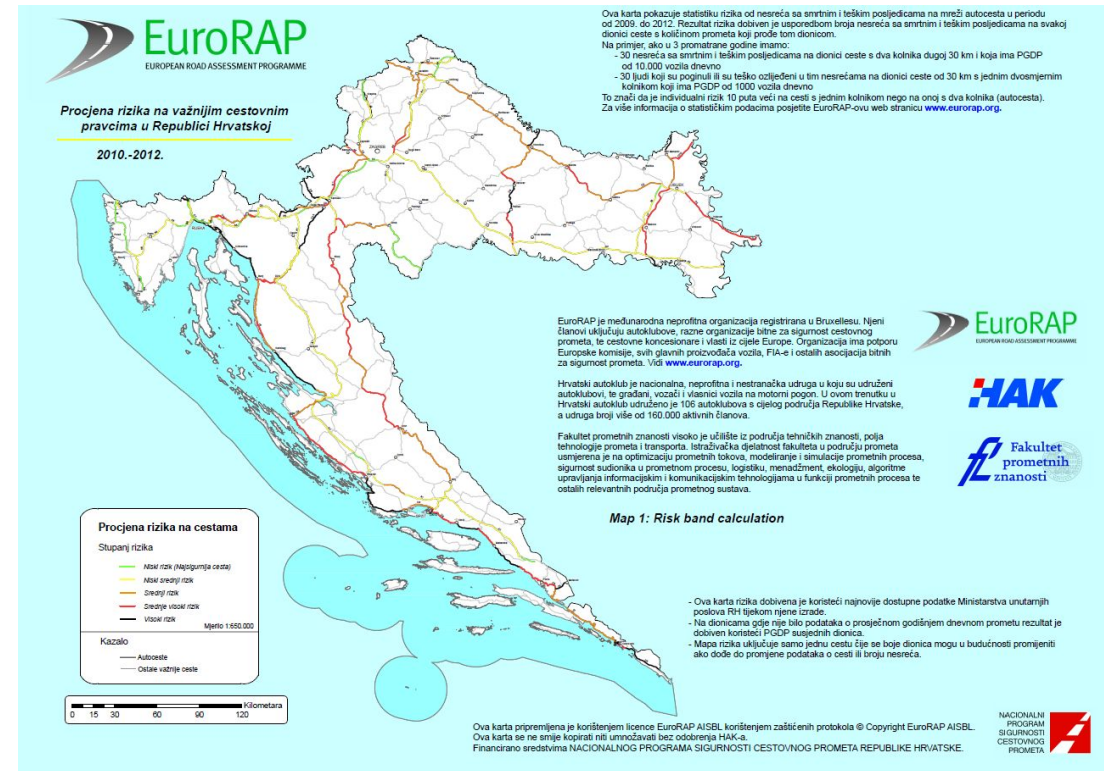
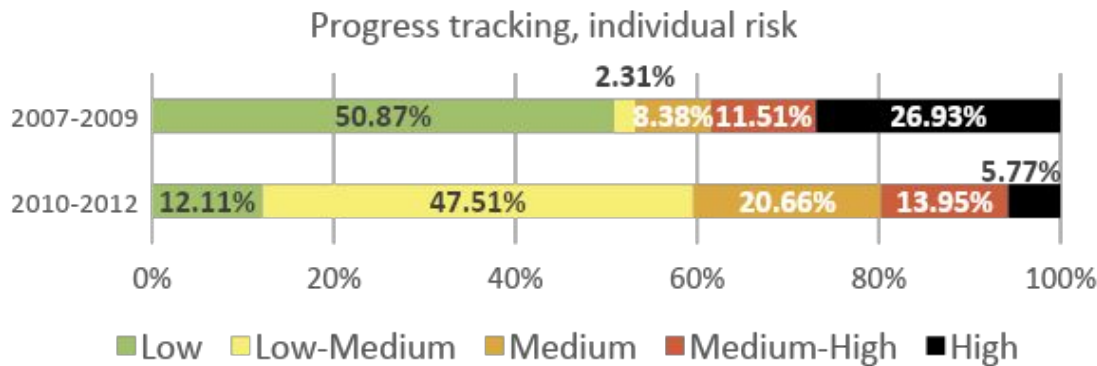
Fakultet prometnih znanosti visoko je učilište iz područja tehničkih znanosti, polja tehnologije prometa i transporta. Istraživačka djelatnost Fakulteta u području prometa usmjerena je na optimizaciju prometnih tokova, modeliranje i simulacije prometnih procesa, sigurnost sudionika u prometnom procesu, logistiku, menadžment, ekologiju, algoritme upravljanja informacijskim i komunikacijskim tehnologijama u funkciji prometnih procesa te ostalih relevantnih područja prometnog sustava.



- Ova karta rizika dobivena je koristeći najnovije dostupne podatke Ministarstva unutarnjih poslova RH za vrijeme njene izrade.
- Na dionicama gdje nije bilo podataka o prosječnom godišnjem dnevnom prometu rezultat je dobiven koristeći PGDP susjednih dionica.
- Mapa rizika uključuje samo jednu cestu čije se boje dionica mogu u budućnosti promijeniti ukoliko dođe do promjene podataka o cesti ili broju nesreća.

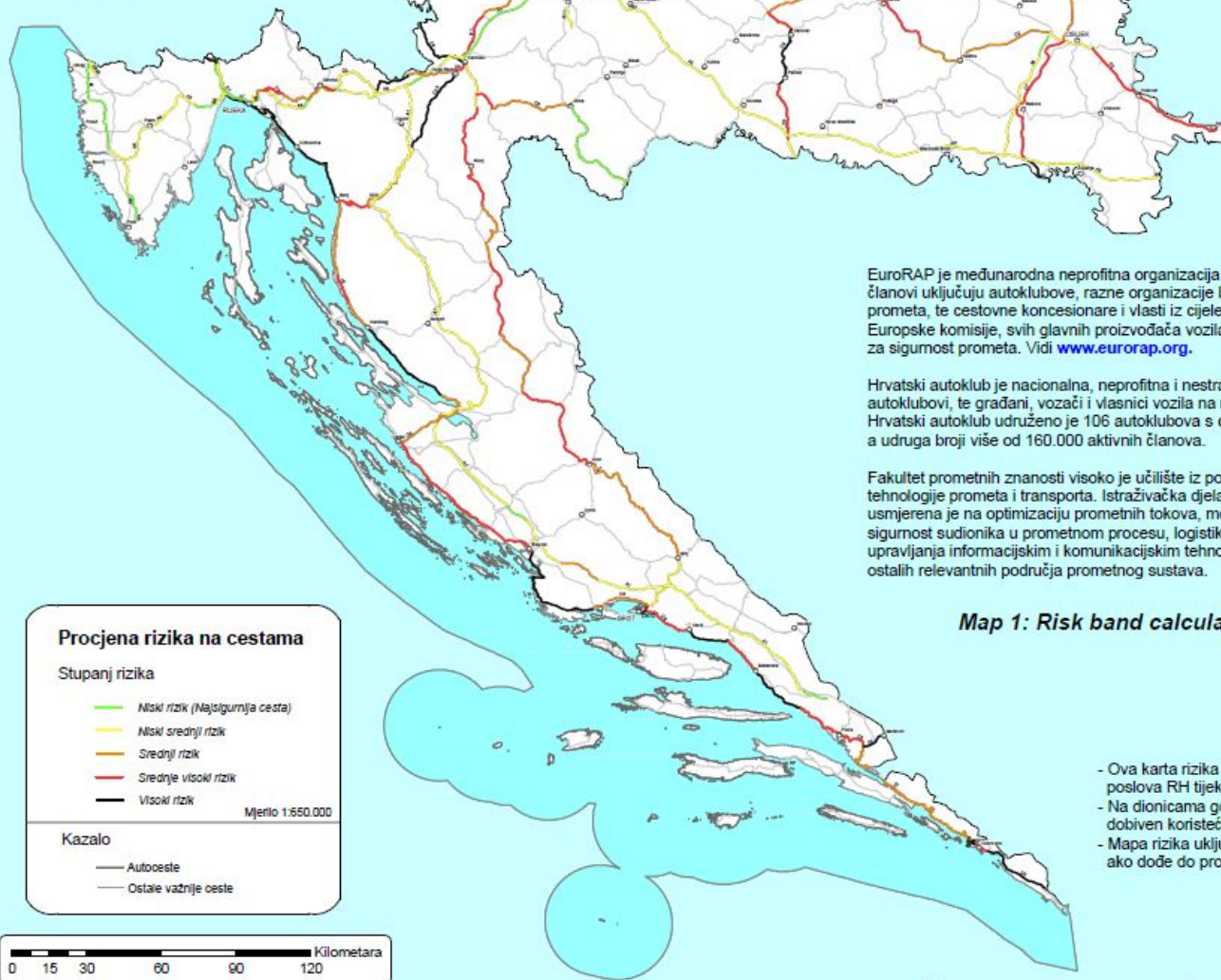
EuroRAP – Crash Risk Mapping, 2010-2012.

- Second Risk Mapping protocol in Croatia covers the period of 2010 to 2012.
- Scope of Risk Mapping:
 - 1240,7 km of the road network
- When compared with 2007-2009 period, the share of risk levels on the entire length of the observed road network shows a positive trend of high-risk roads reduction.



**Procjena rizika na važnijim cestovnim
pravcima u Republici Hrvatskoj**

2010.-2012.



Ova karta pokazuje statistiku rizika od nesreća sa smrtnim i teškim posljedicama na mreži autocesta u periodu od 2009. do 2012. Rezultat rizika dobiven je usporedbom broja nesreća sa smrtnim i teškim posljedicama na svakoj dionici ceste s količinom prometa koji prođe tom dionicom.

Na primjer, ako u 3 promatrane godine imamo:

- 30 nesreća sa smrtnim i teškim posljedicama na dionici ceste s dva kolnika dužoj 30 km i koja ima PGDP od 10.000 vozila dnevno
- 30 ljudi koji su poginuli ili su teško ozlijeđeni u tim nesrećama na dionici ceste od 30 km s jednim dvosmjernim kolnikom koji ima PGDP od 1000 vozila dnevno

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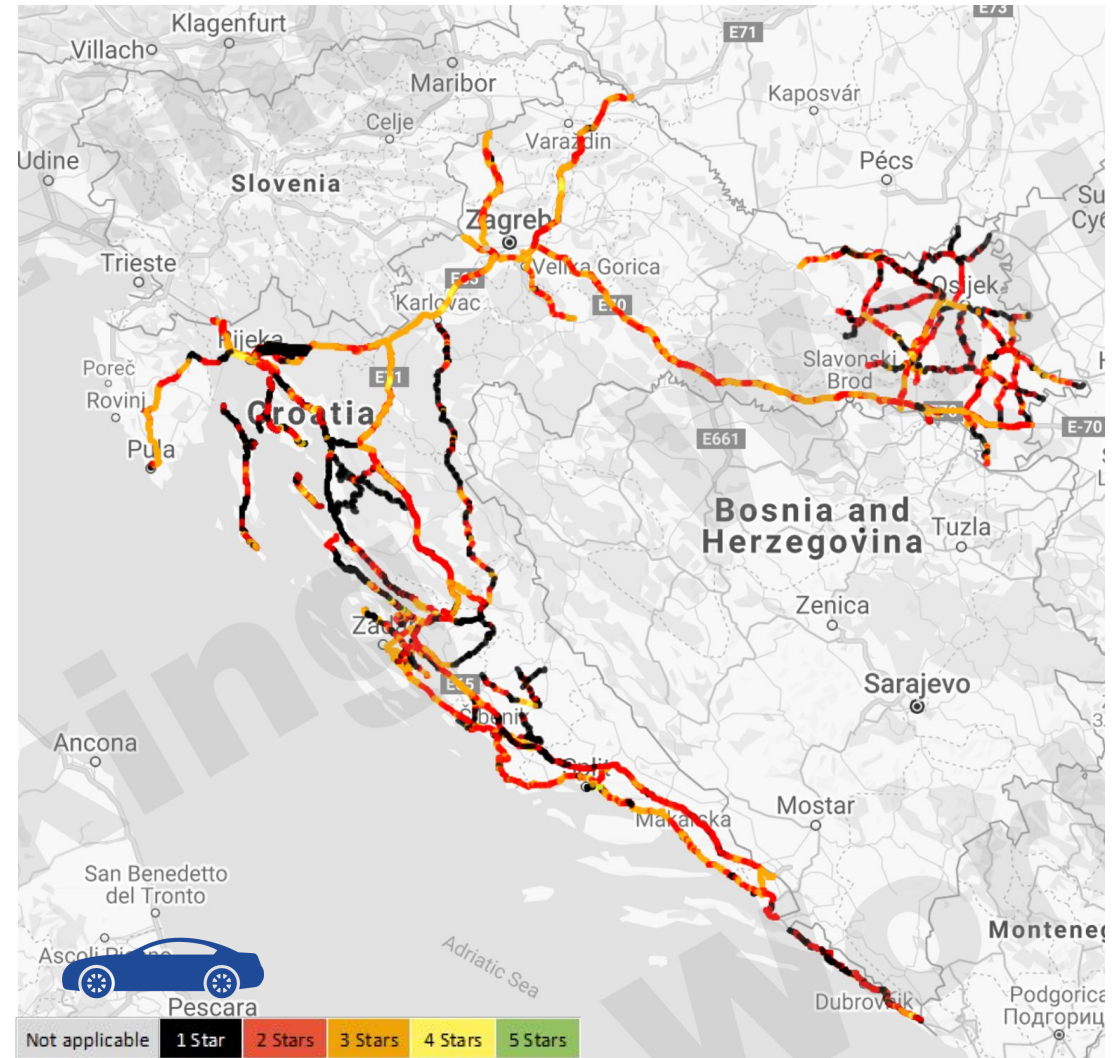
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Map 1: Risk band calculation

- Ova karta rizika dobivena je koristeći najnovije dostupne podatke Ministarstva unutarnjih poslova RH tijekom njene izrade.
- Na dionicama gdje nije bilo podataka o prosječnom godišnjem dnevnom prometu rezultat je dobiven koristeći PGDP susjednih dionica.
- Mapa rizika uključuje samo jednu cestu čije se boje dionica mogu u budućnosti promijeniti ako dođe do promjene podataka o cesti ili broju nesreća.

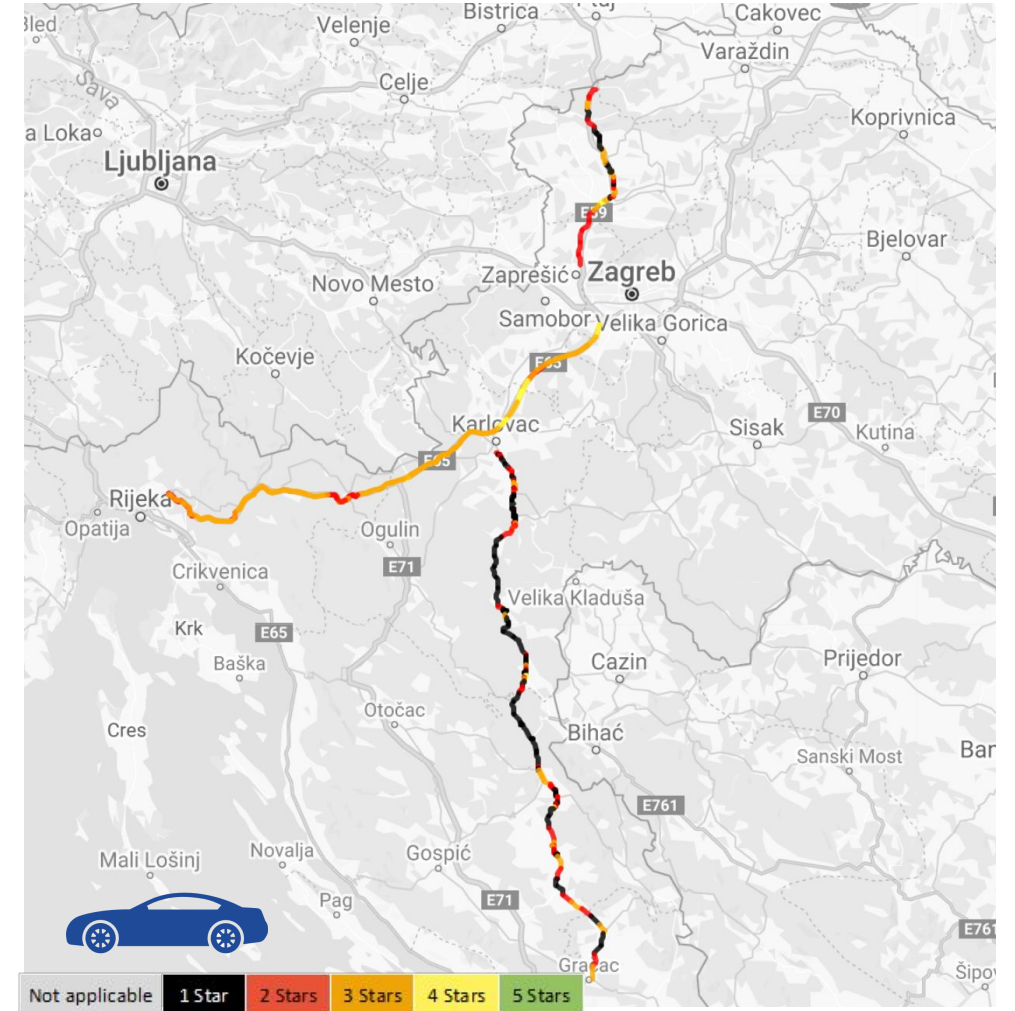
Star Rating protocol

- Most of the SR reports are either funded by the National Road Safety Programme (Ministry of the Interior) Croatian Auto Club, or Road Authorities.
- Alternatively, assessments are developed under respective EU funded projects.
- FPZ has surveyed over 7000 km of roads in Croatia



Project SENSoR – Road Network in Croatia

- SR Survey & Coding of 481 km of road network
 - D1 (state road – single carriageway)
 - 52 km - From Gornji Đurmanec To: Jablanovec
 - 159 km - From Karlovac – Mostanje To: Gračac
 - A1, A6 (motorways – dual carriageway)
 - 135 km - From NP Lučko (toll booth) To: NP Rijeka (toll booth)
 - 135 km – From: NP Rijeka To: NP Lučko (toll booth)

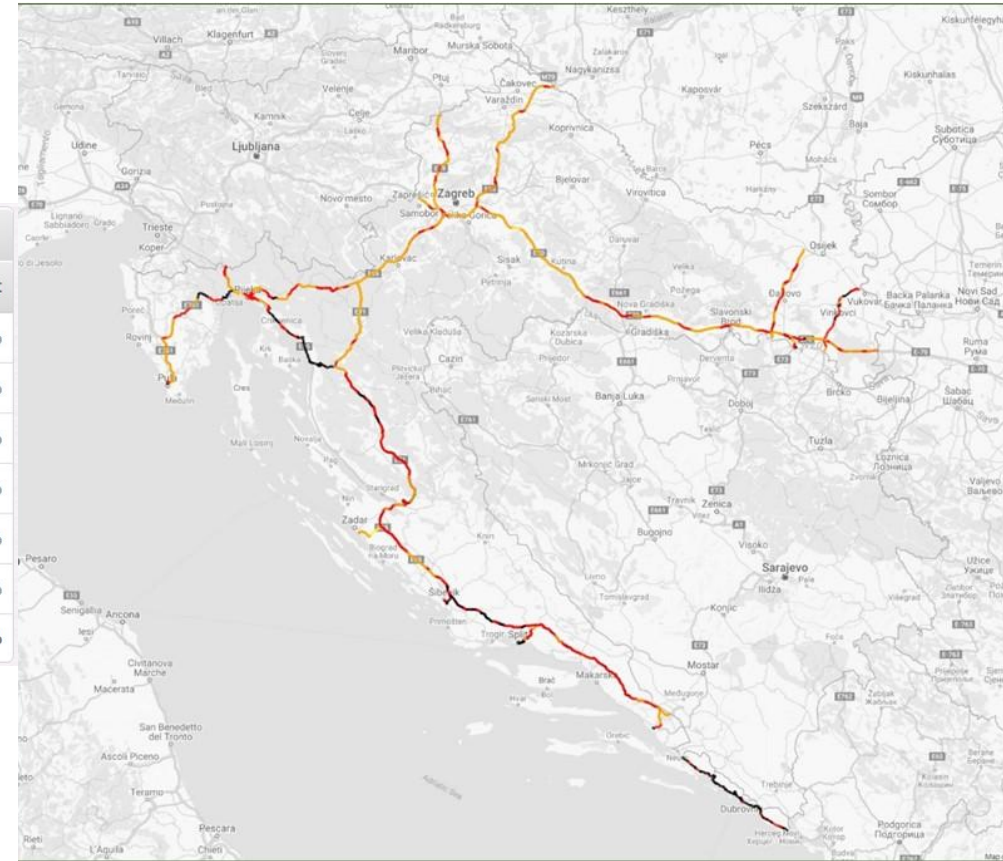


Project SLAIN

Star Rating before countermeasure implementation - TEN-T road network, Republic of Croatia

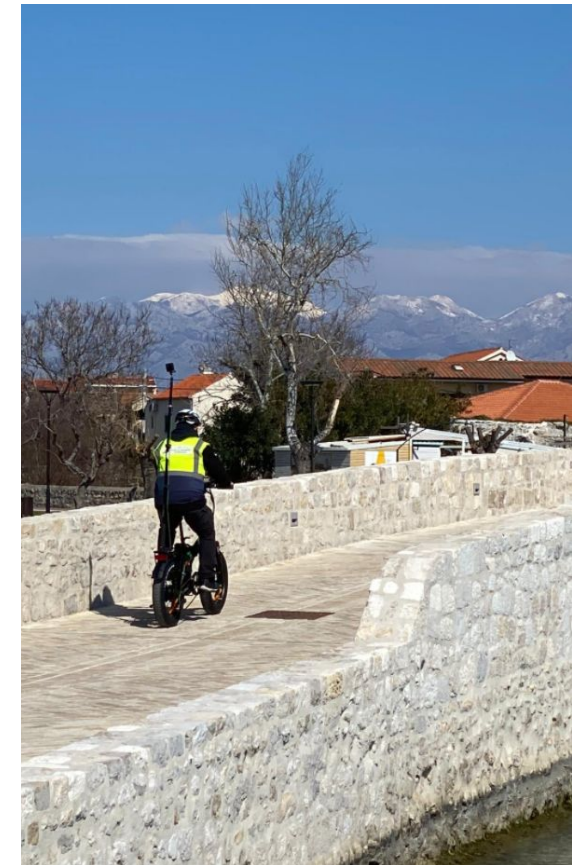
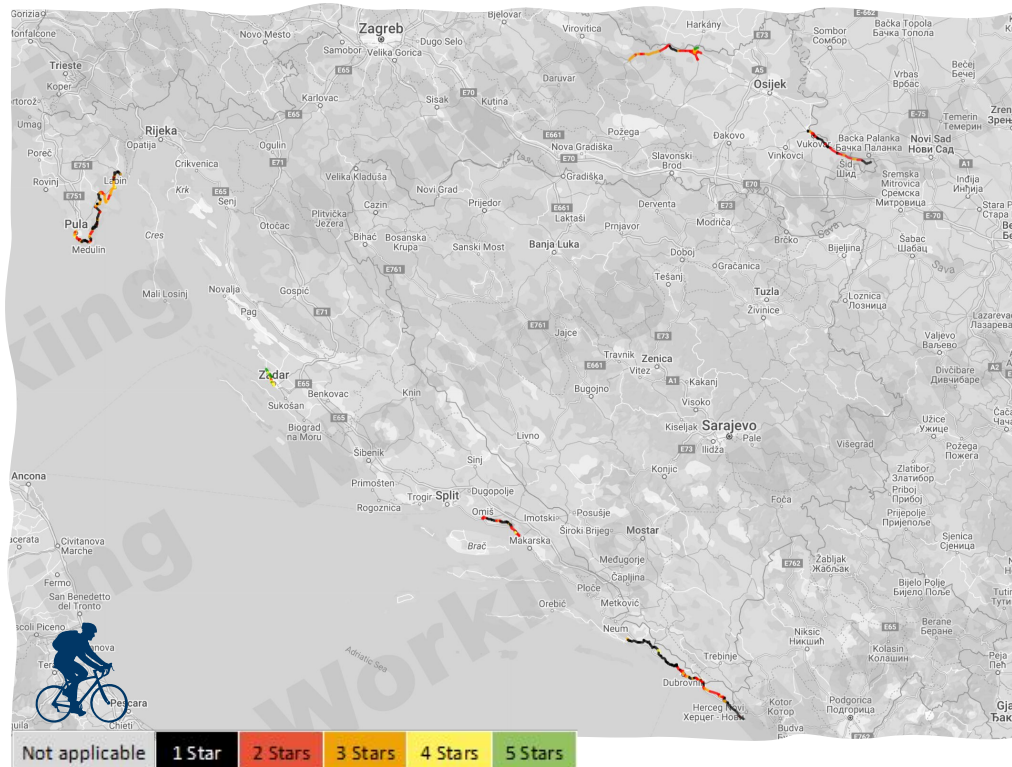


Star Ratings	Vehicle Occupant		Motorcyclist		Pedestrian		Bicyclist	
	Length (km)	Percent	Length (km)	Percent	Length (km)	Percent	Length (km)	Percent
5 Stars	10.20	0.37%	0.30	0.01%	1.10	0.04%	3.50	0.13%
4 Stars	308.90	11.24%	4.00	0.15%	3.10	0.11%	1.50	0.05%
3 Stars	1,350.60	49.15%	144.60	5.26%	13.20	0.48%	26.10	0.95%
2 Stars	530.60	19.31%	868.30	31.60%	44.90	1.63%	64.80	2.36%
1 Star	547.30	19.92%	1,730.40	62.97%	327.70	11.93%	197.60	7.19%
Not applicable	0.40	0.01%	0.40	0.01%	2,358.00	85.81%	2,454.50	89.32%
Totals	2,748.00	100.00%	2,748.00	100.00%	2,748.00	100.00%	2,748.00	100.00%



SABRINA – Safer Cycling Routes in Danube Region

- Cycling routes risk mapping
 - Approx. 2,700 kilometers of cycling routes in Danube Region will be surveyed and Star Rated.
 - EuroRAP Star Rating, CycleRAP and ECS methodologies.



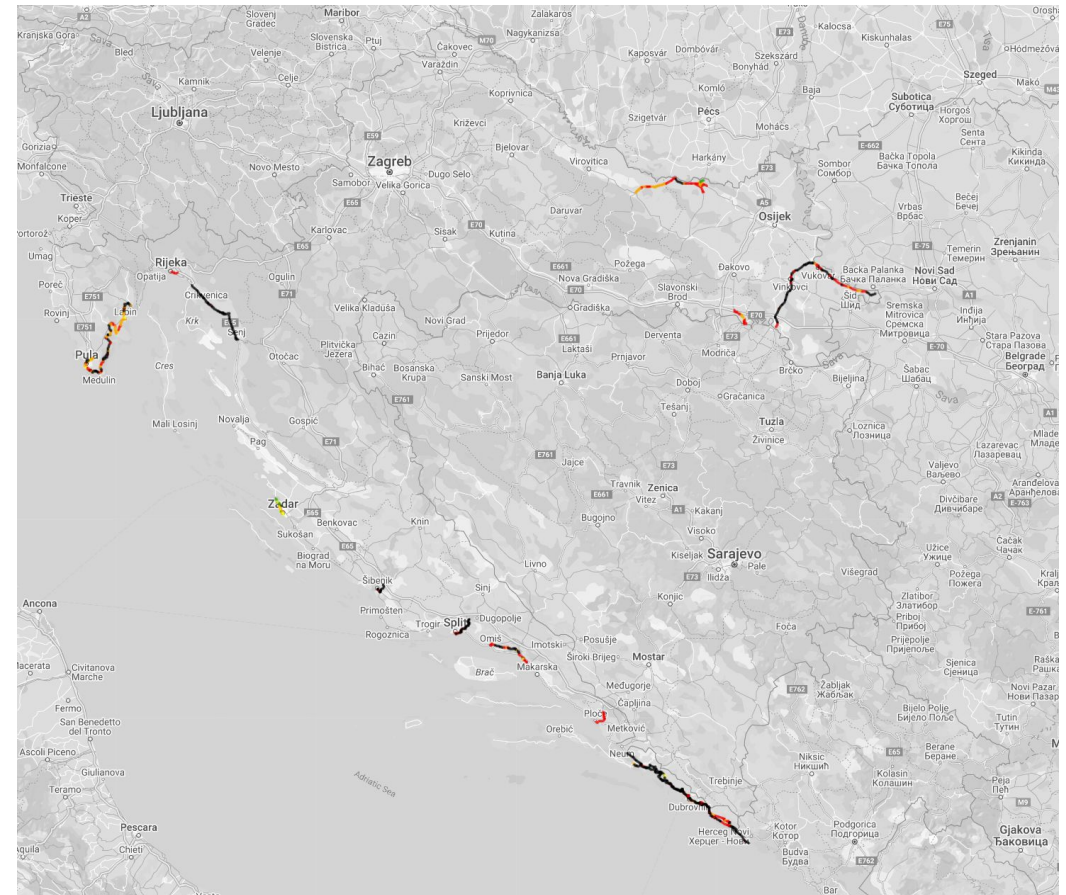
EuroS@P – European Road Safety Partnership

- Demonstrating iRAP Star Rating as a pre-screening approach for RSI methodology developed under the EuroS@P project

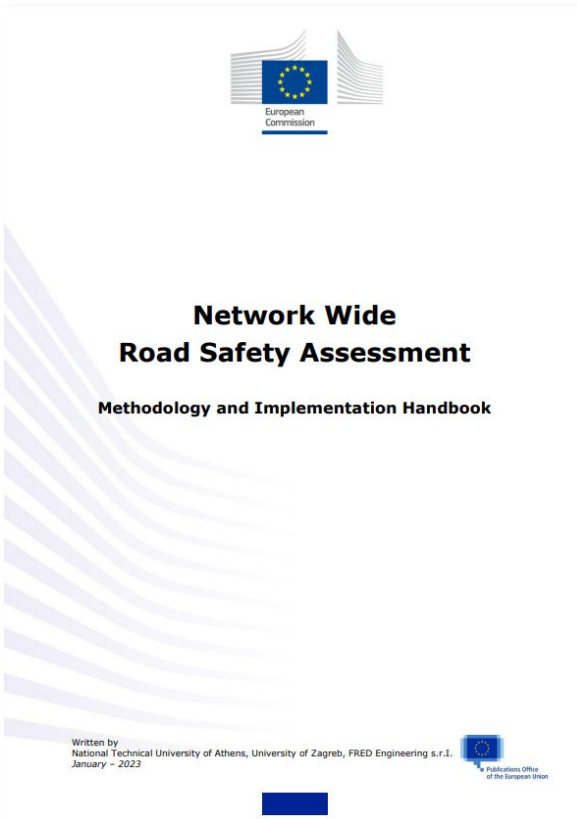


Increasing traffic safety on TEN-T roads in accordance with EuroRAP

- The project covers the road safety works **on 12 road sections** of the Croatian Comprehensive TEN-T road network.
- It is **based on the network-wide road safety assessment** carried out in accordance with Directive (EU) 2019/1936 and in **line with the EuroRAP/iRAP** star rating methodology.
- To **remove the main hazards** and consequently, to **reduce the number of fatalities** on the roads from 50 in 2021 to **approximately 20 by 2041**.



About the NWA Network Wide Road Safety Assessment Methodology



- **Study** on a Methodology for Network-wide Road Safety Assessment
- Developed under **NetSafety project** for European Commission*
- Research study with the aim to **assist EU member states** in developing a methodology for a common network-wide road safety assessment and a safety rating system **in accordance** with the 2019 RISM Directive



National Technical University of Athens (NTUA)



University of Zagreb, Faculty of Transport and Traffic Sciences (FPZ)



FRED Engineering s.r.l. (FRED)

About NWA: https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/infrastructure/road-infrastructure-guidelines_en

Handbook: <https://road-safety.transport.ec.europa.eu/system/files/2023-01/NWA-Handbook7.pdf>







*Directorate-General for Mobility and Transport Directorate DG — MOVE Unit C2 — Road Safety



About the NWA Network Wide Road Safety Assessment Methodology



About NWA: https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/infrastructure/road-infrastructure-guidelines_en
Handbook: <https://road-safety.transport.ec.europa.eu/system/files/2023-01/NWA-Handbook7.pdf>

	13 JANUARY 2023 Network Wide Road Safety Assessment - Methodology and Implementation Handbook English (3.89 MB - PDF)	Download 
	13 JANUARY 2023 Network Wide Road Safety Assessment - Proactive tool English (46.66 KB - XLSX)	Download 
	13 JANUARY 2023 Network Wide Road Safety Assessment - Reactive tool English (513 KB - XLSX)	Download 

- **Although not mandatory, these guidelines aim to help public authorities in EU Member States to carry out the safety assessments of their road networks**

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