

Risk and Safety Assessment on Road Infrastructure



Olivera Djordjevic



This presentation:

- *How we score what we score*
- *Informed Investments Decisions: Safer Roads Investments Plans*
- *How it matters – best case study*
- *Piloting road safety innovation – RADAR project*



Star Rating for Safety

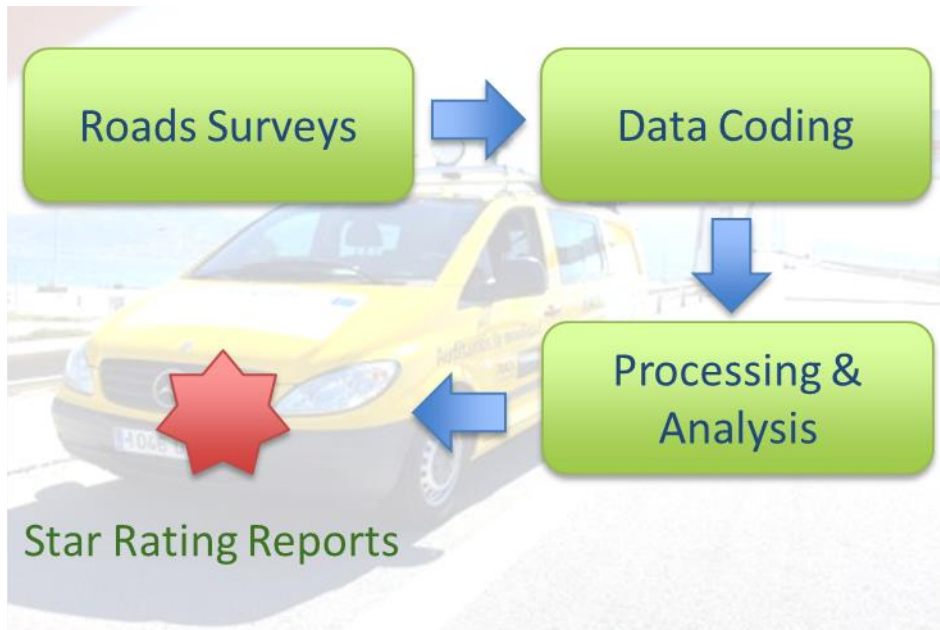


Video recording of the road

Survey of 52 road elements that lead to death or serious injury

Data collected every 100 meters

4 road users – vehicle occupants, motorcyclists, pedestrians and bicyclists



Examples of Star Ratings



<http://www.irap.org/en/about-irap-3/methodology>



A Europe free of high risk roads – adopting the 3-star minimum



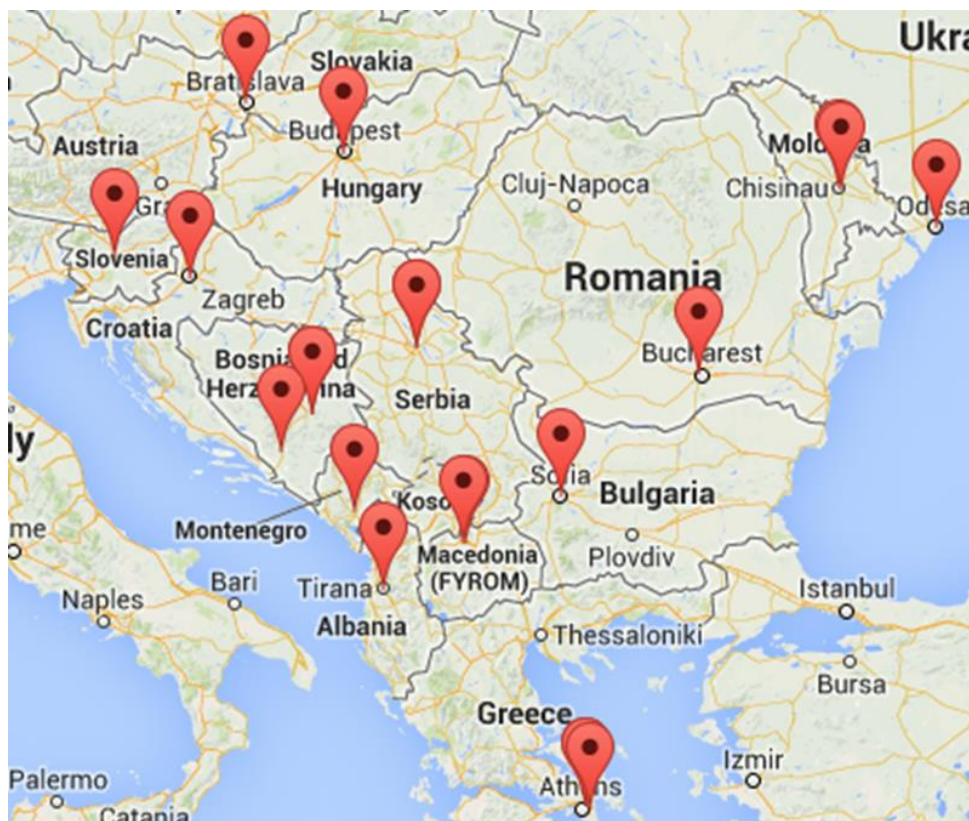


Star rating data now collected

Albania, Argentina, Australia, Bahrain, Bangladesh, Barbados, Belize, Bhutan, **Bosnia and Herzegovina**, Brazil, Brunei, Darussalam, **Bulgaria**, Canada, Cayman Islands, Chile, China, Colombia, Costa Rica, **Croatia**, Dominican Republic, Egypt, El Salvador, Ethiopia, **France**, Fiji, **FYROM**, **Germany**, Ghana, **Greece**, Guatemala, Haiti, Honduras, Hong Kong, **Hungary**, Iceland, India, Indonesia, Israel, Italy, Japan, Kenya, South Korea, Lebanon, Malaysia, Mexico, **Moldova**, Mongolia, **Montenegro**, Nepal, Netherlands, New Zealand, Nigeria, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Qatar, **Romania**, Russian Federation, **Serbia**, **Slovakia**, **Slovenia**, South Africa, **Spain**, **Sweden**, Tanzania, Thailand, Uganda, **Ukraine**, **United Kingdom**, United States, Uruguay, Vietnam, Yemen



2012-2014

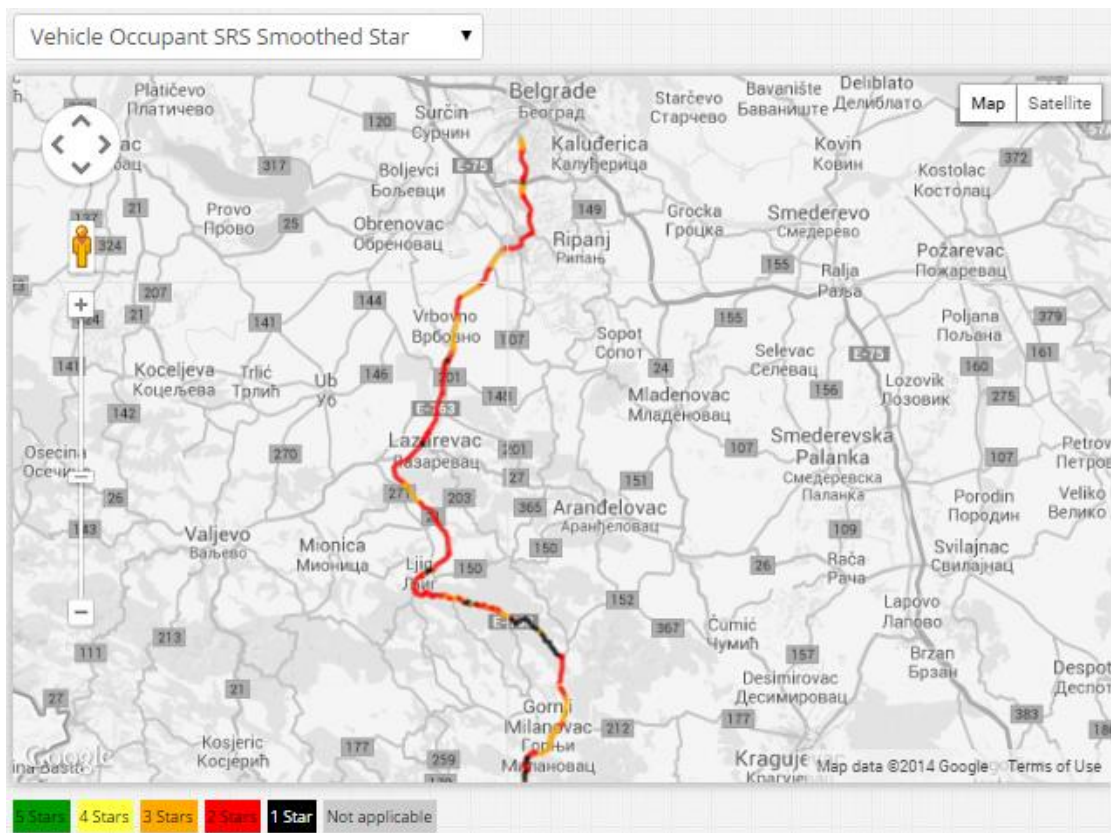


5 Survey teams collected data for 15,000km of roads

52 risk attributes collected every 100m of 20,000km carriageway – 10 million data points!



Aim for minimum 3-star!



Star Ratings	Vehicle Occupant	
	Length (kms)	Percent
5 Stars	1.0	1%
4 Stars	3.5	2%
3 Stars	53.2	38%
2 Stars	56.7	40%
1 Star	26.5	19%
Not applicable	0.0	0%
Totals	140.9	100%



A Europe free of high risk roads – adopting the 3-star minimum

SENSoR project Star Rating of motorways and other national roads in South East Europe



EuroRAP/IRAP Star Ratings provide a simple and objective measure of the level of safety 'built in' to the road for vehicle occupants, motorcyclists, pedestrians and bicyclists. 5-star roads are the safest, and 1-star roads are the least safe. Star Ratings are based on road inspection data collected through surveys and analysis. Further details at: <http://www.irap.org/en/about-irap-3methodology>

VEHICLES
Typically 50-70% of roads individual countries score 1 or 2 stars for vehicle occupants

PEDESTRIANS
 $\frac{3}{4}$ of roads with pedestrians have no footways
Nearly $\frac{1}{2}$ of all pedestrian crossings in poor condition

Star Ratings

- ☆☆☆☆☆
- ☆☆☆☆
- ☆☆☆☆
- ☆☆☆
- ☆☆
- ☆
- ★

Ratings on dual carriageway roads show the lowest rated carriageway

Legend:
 - Motorways
 - Single-limited roads
 - Other roads
 - International boundary

Scale:
 0 20 40 60 80 100km
 0 30 60 90 120 150km



Map was produced by EuroRAP/IRAP protocols. The map is produced as part of the SENSoR - South East Neighbourhood Safe Routes - project supported by the South East Europe Transnational Cooperation Programme co-funded by the European Union. Surveys completed by 2015/16 other than Maldives, 2011 (for State Road Administration - IRAP V2 data updated to V3 2014) and Ukraine, 2012 (for World Bank, updated speed data 2014). No results are presented for roads in grey.
 © International Road Assessment Programme (IRAP) 2014. © 2014 Europa Technologies Ltd. All rights reserved.
 © OpenStreetMap contributors.
 IRAP technology including protocols, processes and brands may not be altered or used in any way without the express written agreement of IRAP. Prepared under license from EuroRAP ASBL using protocols © Copyright EuroRAP ASBL.
 This map may not be reproduced without the written consent of the SENSoR Lead partner or EuroRAP ASBL. Such consent is not necessarily withheld.

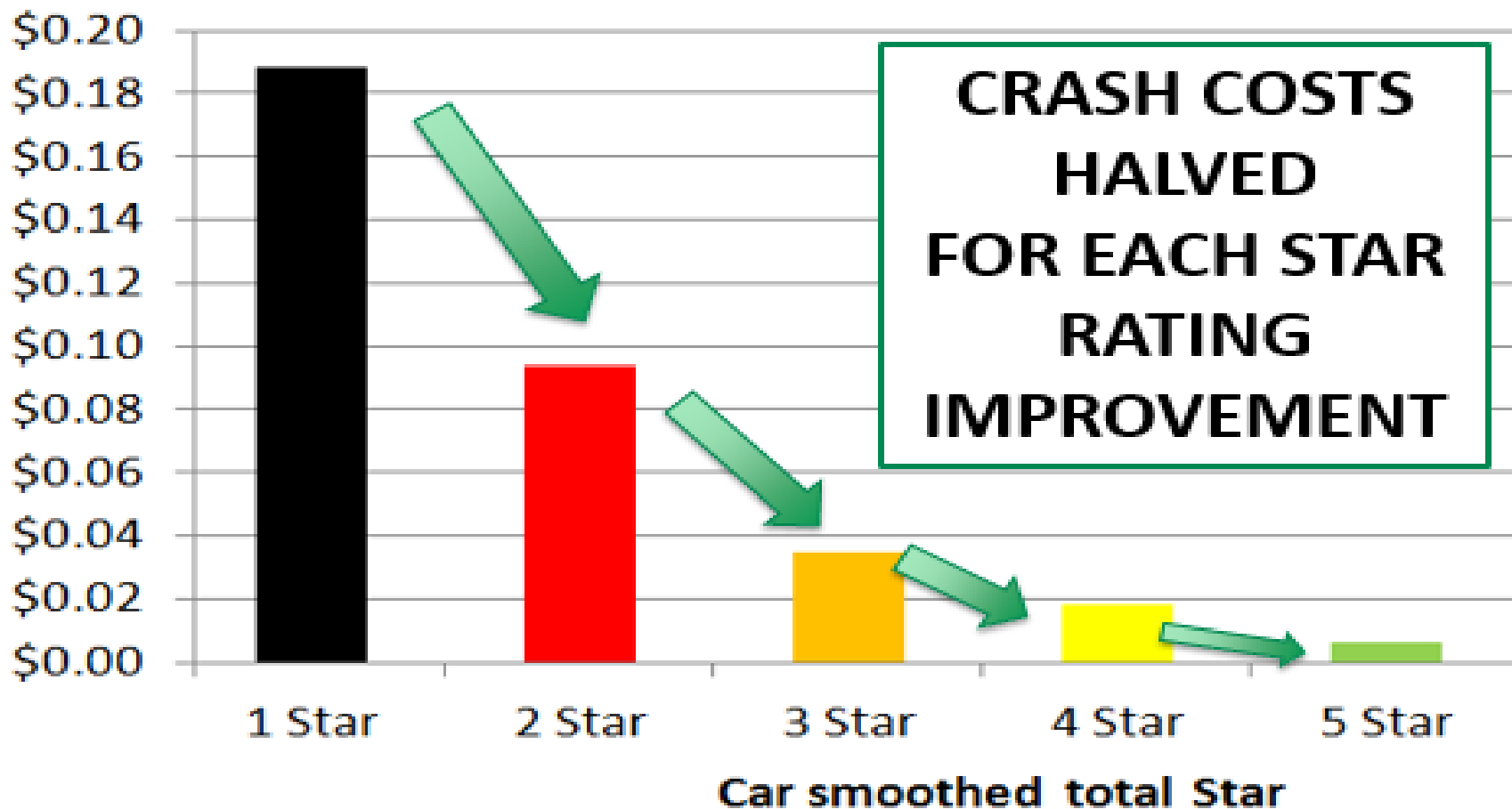
A Europe free of high risk roads – adopting the 3-star minimum





Star Rating vs crash costs or crash rates

Car smoothed Star Rating vs KSI cost per vKt



A Europe free of high risk roads – adopting the 3-star minimum



SRIP (Safer Roads Investment Plans)

Compares:

- **Risk at every 100m section**
- *Crash costs – costs of life, injuries and damage*

Suggests:

- **Infrastructure crash countermeasures for every 100m**
- *Looks at costs of infrastructure improvements*
- Compares **costs** and **benefits**





SRIPs (Safer Road Investment Plans)

Software assesses:

- *70 proven road improvements*
- *Compares cost of countermeasure*
- *Known effectiveness of measures*
- *Value of injuries reduced*
- *Benefits and costs compared*

**Benefit-Cost Ratios (BCR)
estimated**



Indicative casualty savings by countermeasure type



(Country sample, Benefit Cost Ratio threshold = 3)

Countermeasure	Crash type	Fatal and serious injuries saved over 20 years	Km
Side barrier	Run-off	12000	3000
Shoulder sealing	Run-off	4000	6000
Shoulder rumble strip	Run-off	4000	4000
Pedestrian footway	Pedestrians	4000	2000
Clear roadside hazards	Run-off	4000	4000
Signing and lining (includes intersections)	All	2000	1000
Road surface rehabilitation	All	1500	500
Median barrier/central hatching	Head-on	1400	600
Skid resistance improvement	All	700	100
Sight distance improvement	Intersection/pedestrian	700	300

Note: All results provisional and subject to stakeholder consultation and BCR threshold review



A Europe free of high risk roads – adopting the 3-star minimum



Roadside barrier example

- **Data collected shows risk** of run-off crash
- Example – data shows roadside hazard (eg tree)
- Example – data shows curve in road or steep slope

- **Matching risk to known countermeasures**
- Costs and benefits of each
- **SRIPs (Safer Road Investment Plans)**
- Identifying potential location of countermeasures by software zoom





Видин
Vidin

Русе
Ruse

Плевен
Pleven

Велико
Търново
Veliko
Targovo

Шумен
Shumen

Монтана
Montana

Враца
Vratsa

Ниш
Niš

Лесковац
Leskovac

София
Sofia

Сливен
Sliven

Перник
Pernik

Bulgaria

Пазарджик
Pazardzhik

Хасково
Haskovo

Благоевград
Blagoevgrad

Банско
Bansko

Пловдив
Plovdiv

Славяно
Славяно
(ROM)

Едрине
Edirne

E-75

Серрес
Serres

Кавала
Kavala











E90

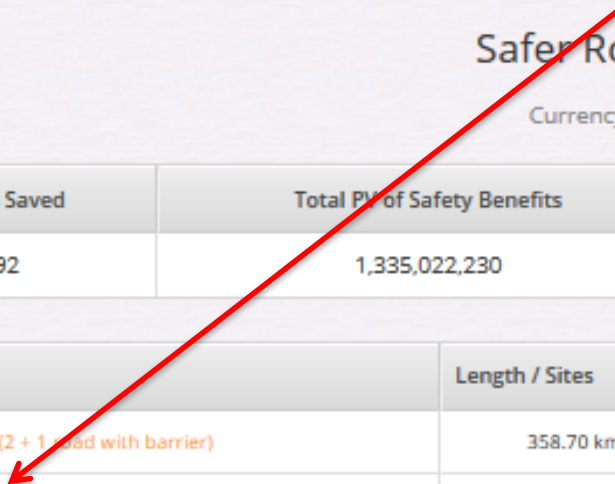
Location for barriers

Safer Roads Investment Plan

Currency: лв BGN - Analysis Period: 20 years

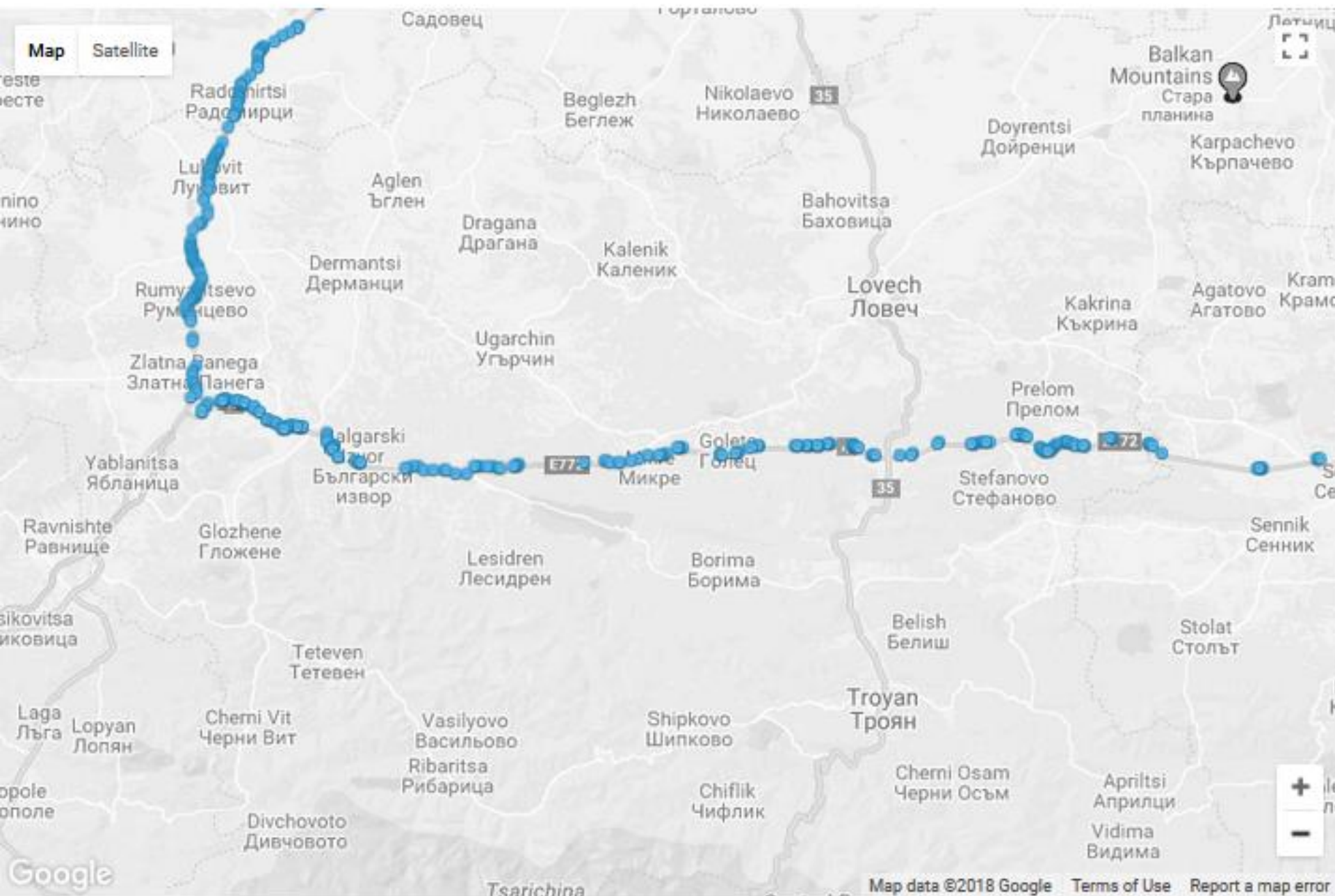
Total FSIs Saved	Total PV of Safety Benefits	Estimated Cost	Cost per FSI saved	Program BCR
14,192	1,335,022,230	219,788,651	15,486	6

Countermeasure	Length / Sites	FSIs saved ▲	PV of safety benefit	Estimated Cost	Cost per FSI saved	Program BCR
 Additional lane (2 + 1 road with barrier)	358.70 km	3,543	333,292,118	54,524,000	15,389	6
 Roadside barriers - driver side	188.00 km	1,627	153,034,070	37,600,000	23,112	4
 Shoulder rumble strips	467.60 km	1,008	94,800,334	6,046,727	6,000	16
 Duplication with median barrier	23.70 km	971	91,362,579	28,826,000	29,679	3
 Improve Delineation	334.20 km	940	88,458,345	8,468,948	9,006	10
 Road surface rehabilitation	237.30 km	874	82,234,236	8,859,865	10,135	9
 Footpath provision passenger side (adjacent to road)	167.80 km	805	75,730,903	14,162,000	17,591	5
 Footpath provision driver side (adjacent to road)	168.80 km	802	75,419,126	14,199,000	17,710	5
 Roadside barriers - passenger side	83.20 km	801	75,373,472	16,640,000	20,767	5
 Shoulder sealing driver side (>1m)	471.50 km	765	71,998,208	8,398,400	10,973	9



Location for barriers





Map Satellite



Map Satellite

Roadside barriers - driver side ✕

Road name: 4

Section: 3.BALGARSKI IZVOR - 4.X35

Distance: 35.819

Estimated programme details

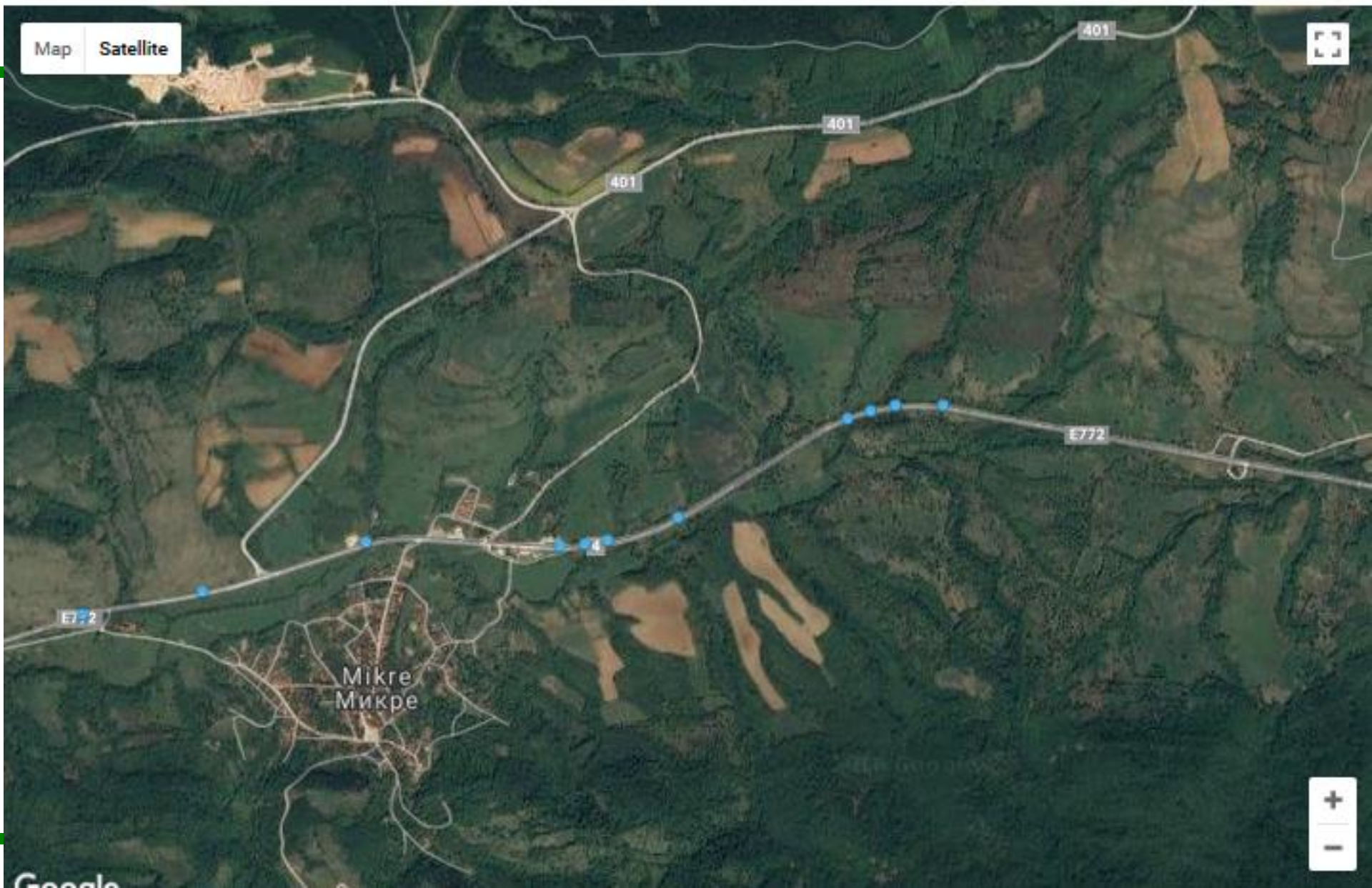
Cost: 20000

FSIs saved: 0.954072

Cost per FSI saved: 20962.79

BCR: 4.49

Микре
Микре



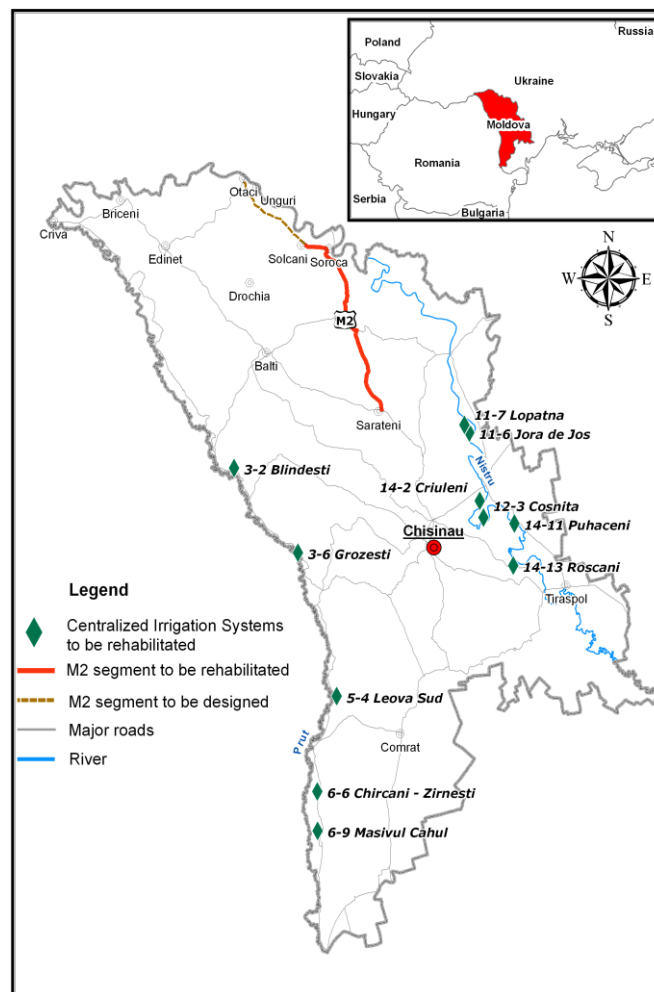


Barrier installation proposed



A Europe free of high risk roads – adopting the 3-star minimum

Moldova – best case study





M2-R7 iRAP Star Rating "Before"

M2 Saratenii-Soroca-Drochia Junction
93km



A Europe free of high risk roads – adopting the 3-star minimum




“Before” characteristics of M2

1. Poor quality single carriageway, markings and signs, very poor pavement in parts. Mixed traffic.
2. Lack of run-off protection generally. Existing safety fencing poor; many roadside hazards. Aggressive bridge parapet-ends. Junctions poor.
3. Villages – no speed reduction measures. Pedestrian footways poor quality. Few pedestrian crossings.




Before and after




 A Europe free of high risk roads – adopting the 3-star minimum



 A Europe free of high risk roads – adopting the 3-star minimum



 A Europe free of high risk roads – adopting the 3-star minimum





A Europe free of high risk roads – adopting the 3-star minimum 29







Piloting road safety innovation – RADAR project Partners



- **The European Institute of Road Assessment – EuroRAP**
- *AMZS, Slovenia – Technical Coordinator*
- *FPZ, University of Zagreb – Technical Coordinator*
- *UAMK, Czech Republic*
- *BBARS, Bulgaria*
- *KTI, Hungary*
- *Rotondo, Serbia – Technical Coordinator*
- *BIHAMK, Bosnia & Herzegovina*
- *KfV, Road Safety Board, Austria*
- *ACM, Moldova*





Associated Strategic Partners (ASP)

- *Ministry of Infrastructure – Slovenia*
- *Croatian Roads – Croatia*
- *Public company Roads – Bosnia and Herzegovina*
- *Ministry of Transport and Road Infrastructure Moldova*
- *South East Europe Transport Observatory*
- *Road and Motorway Directorate of the Czech Republic*
- *European Union Strategy for the Danube Region PA1b*
- *Road Infrastructure Agency, Bulgaria*
- *Romania National Transport Authority*
- *Ministry of Transport and Maritime Affairs, Montenegro*
- *National Motorway Company -- Slovakia*

- *Support from European Bank for Reconstruction and Development*



Piloting road safety innovation – RADAR project

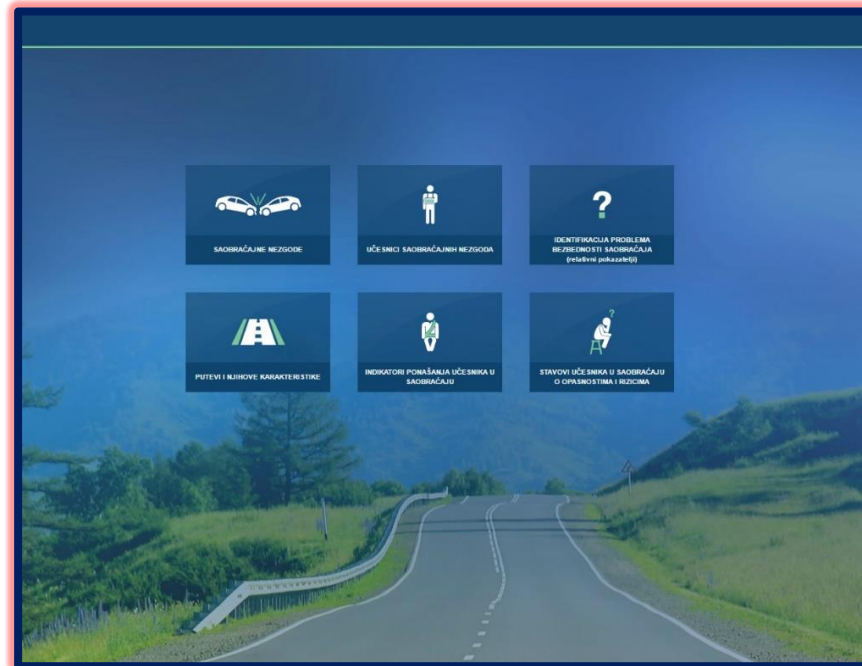


- Small number of road sections will be selected for Safer Roads Investment Plans using iRAP methodology (eg up to **5 road sections of 6-20km** per country)
- **8 pilot project** on using data for **SRIPs, vulnerable road users, speed management and safety near schools**
- Danube Infrastructure Road Safety Improvement **Strategy** and **Action Plan**

- Putting policies into action



An example: iRAP included in Road Safety Portal for cities and municipalities in Serbia





Road accident data in accordance with CADaS (EC)

Relative indicators – Risk analysis

Road safety reports

Godina	OP sa ROP	OP sa POP	OP sa WOP	Iznos
2010	11	254	270	339

Traffic sign cadastre

Video files

Naziv deonice	Dužina [m]	Opis deonice	Geografska širina (N) početna tačka	Geografska dužina (E) početna tačka	Geografska širina (N) krajnja tačka	Geografska dužina (E) krajnja tačka	Tip puta
0-Vrbas	45.0901	19.69969	45.66707	19.67339			Put bez izdvojenih kolovoznih traka
0-Vrbas	45.55404	19.72549	45.69801	19.57382			Put bez izdvojenih kolovoznih traka



A Europe free of high risk roads – adopting the 3-star minimum





Osnovni podaci	Podaci
Dužina (km)	0,0094918
Širina (m)	1
Opis deonice	Šibenik - Kraljevo
Geografska širina (Y)	45,7384
Geografska dužina (X)	20,72178
Tip puta	Put bez šifre razvrstanih kategoriziranih puteva
Ograničenje brzine	30 km/h
Tip rasvjetlene animirane vozilom	Nema
Broj semaforiziranih traka	0
Prisutnost puta animirane vozilom	Prisutno i rasvjetlo u noći
Šifra za rasvjetlo u noći	Šifra za rasvjetlo u noći

Ocena rizika sistemom zvezdica

1 od 4

Osnovni podaci

Fotografija

(1 od 3)

Results from EuroRAP/iRAP forming a layer in Portal



A Europe free of high risk roads – adopting the 3-star minimum





Key facts about road safety portal

- Comprehensive application on road safety data in local level
- Analytical support to management level on road safety issues
- Combining data from different sources that are not linked otherwise
- Providing fast road safety reports
- GIS based application with precise location positioning
- Tailor – made and upgradeable
- Cloud – based and available for large amount of users (e.g. citizens)
- Report contains data on road network length, analysis of road accidents, road safety indicators and attitudes of traffic participants
- Providing support to performance of local communities in road safety and making better foundation for benchmarking of local communities.





THANK YOU FOR THE ATTENTION

*Olivera Djordjevic | Project Director | EIRA - EuroRAP
European Institute for Road Assessment
Dunajska cesta 128, 1000 Ljubljana, Slovenia
Mail: olivera.djordjevic@eurorap.org
Web: eurorap.org | eira-si.eu*

