

Road Safety Assessment of Montenegro

PUBLIC SUMMARY REPORT

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In association with

COWI



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Overview

In 2019, Montenegro renewed its commitment to improve road safety by setting a target of reducing road deaths by 10% by end 2022, compared to 2018 levels. This target followed an earlier target set in 2009 to halve the number of road deaths by 2019. A new target to further reduce road deaths was announced by the Government of Montenegro in its Road safety programme for the period 2020-2022 which will be based on the implementation of the so-called “Safe Systematic Approach”.

In its aim to improve the driving condition of the roads, The Government of Montenegro has obtained grant from the European Union to complete an assessment of the road safety performance in the country. Road crashes create emotional and economic distress to a country. Emotionally, both in terms of the stress that an injury or fatality of a friend or relative may have and economically, due to the individual and Government costs from crashes, including the cost of any related hospital treatment and medical services, loss of production of any of those injured or killed, and any related congestion caused by crashes.

Initiatives to improve road safety are often structured around the collision itself. Broadly, initiatives aim to either (i) reduce the incidence of collisions; or (ii) reduce the severity of collisions –generally with a strong focus on changing user behaviour – whether through public information campaigns (e.g. on drink driving), legislation (e.g. speed limits) or improving the physical road infrastructure.

In 2018 Montenegro reported 7.7 fatalities per 100,000 population from road crashes where the best performing countries in Europe have a rate of around 3 fatalities per 100,000 so there is a lot of room for improvement for Montenegro.

It is within this context that Montenegro has invested in the completion of a countrywide road safety assessment programme which has been completed through the delivery of a series of activities conducted by a team of international Consultants over 14 months between November 2018 to January 2020. These activities include an iRAP (International Road Assessment Programme) study which has necessitated a detailed video survey of 1853km of roads and then conducting research and analysis of the results.

This has included identifying the highest risk areas, potential treatment measures and an estimated economic assessment of the cost of the measures together with subsequent savings made from reduced casualties. This initial high-level study has been supplemented by the completion of more in-depth Road Safety Inspections of 16 identified high risk locations throughout the country. This has been further supported by a series of road safety training programmes to help to develop the internal knowledge in road safety best practice of local officials.

Assessed roads have been evaluated through a star rating process and nearly 80% of the roads for vehicle occupants have received a rating of 1 or 2 stars from a maximum of 5 achievable for the safest roads. Typically, according to iRAP methodology, countries should strive to achieve a minimum of 3 star rating for all of their roads.

Although the results of the analysis do not show a high level of safety on the current road network, the outcome does indicate that the completion of an iRAP study was very useful. Solutions have been provided for achieving improvements, both in terms of short and long term measures. In some cases, the team of experts identified effective low-cost solutions, which the Montenegrin authorities can assess further to improve the safety of the road network, that would lead to reducing the rate of crashes.

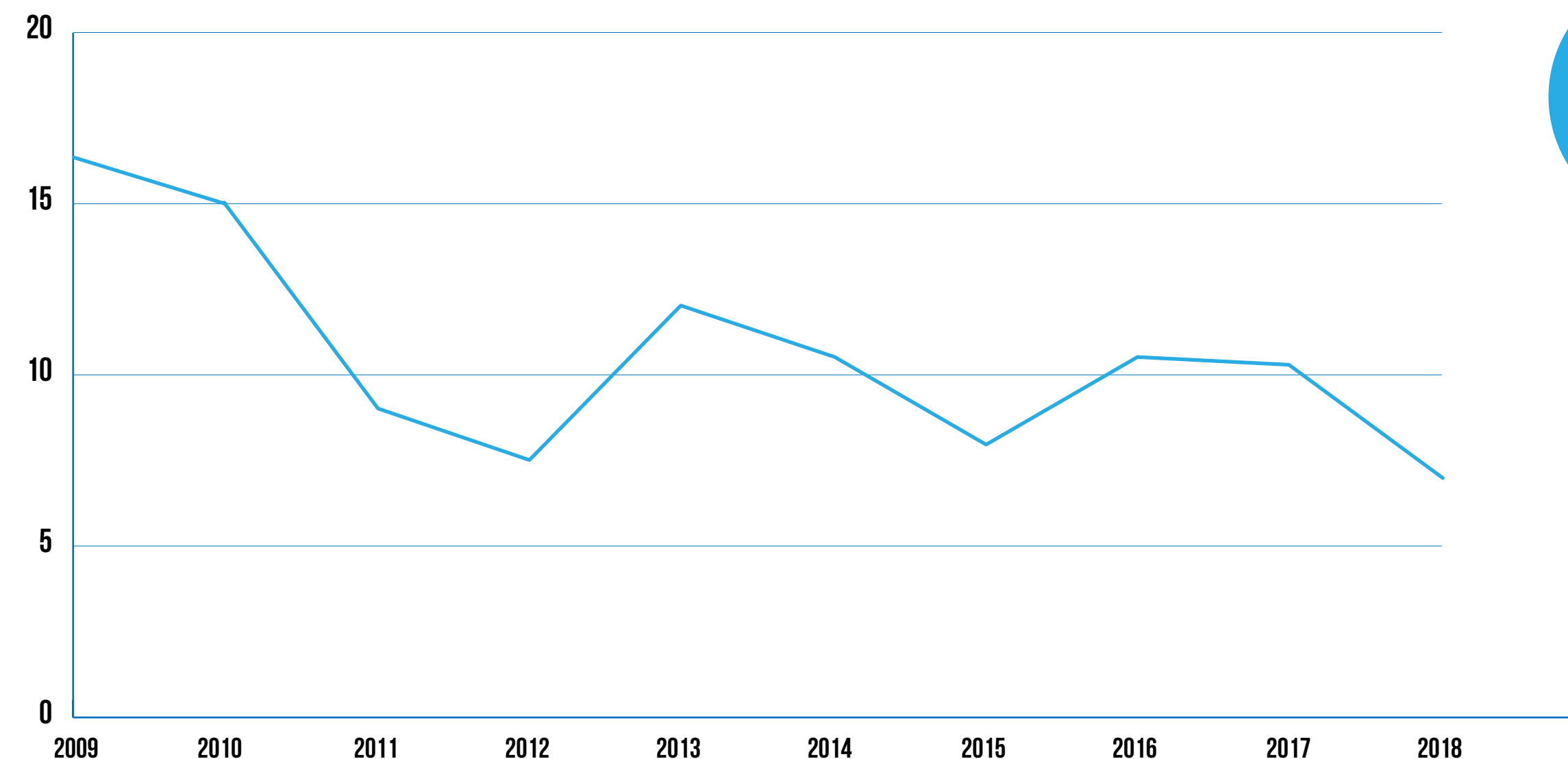
Overall the completion of the Road Safety Assessment programme for Montenegro has provided the Montenegrin authorities with a clear and well-defined direction on how to take improvements in road safety forward. High risk areas have been identified and treatment measures have been proposed. Training has also been conducted to develop the necessary skills in-house so that local staff are able to identify and apply appropriate road safety treatment measures for future site investigations.

The next challenge for Montenegro will be to raise the necessary financial resources to implement the required measures to improve road safety in order to harmonize the existing Star Rating maps developed for Montenegro with the best performing countries in Europe.

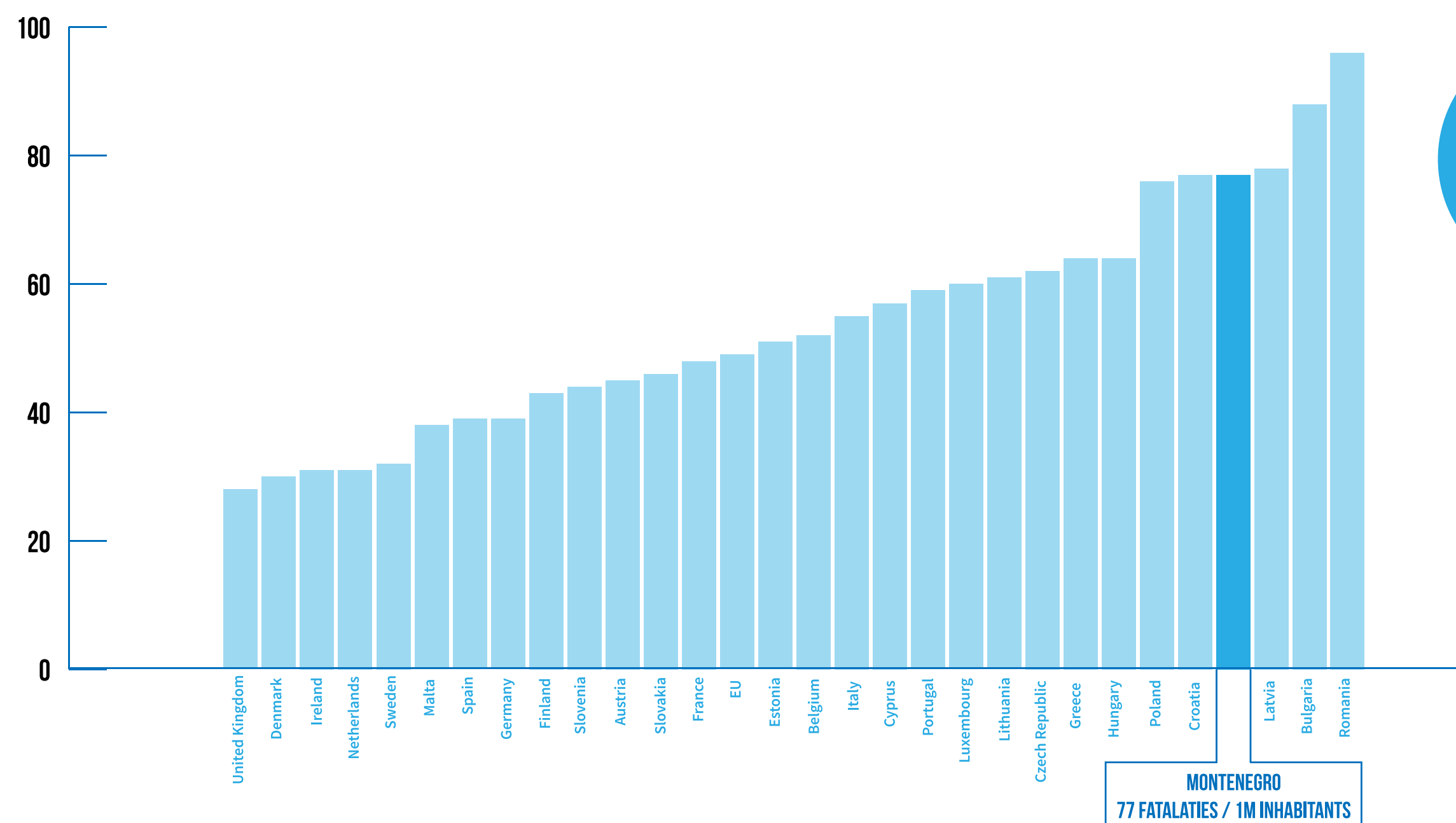
The Road Safety Situation in Montenegro

665 people lost their lives on Montenegrin roads in the period 2009 – 2018. During this time horizon Montenegro has reduced the number of road deaths by 50%, meeting the targets sets by end 2019.

However, the mortality rate per 1,000,000 inhabitants is still above the best performing countries in Europe. **Norway, Sweden, Switzerland** have a rate of **less than 30 deaths per 1,000,000 population**.



The annual rate of deaths per 100,000 population in Montenegro



Fatalities per 1M inhabitants by country, 2018 results

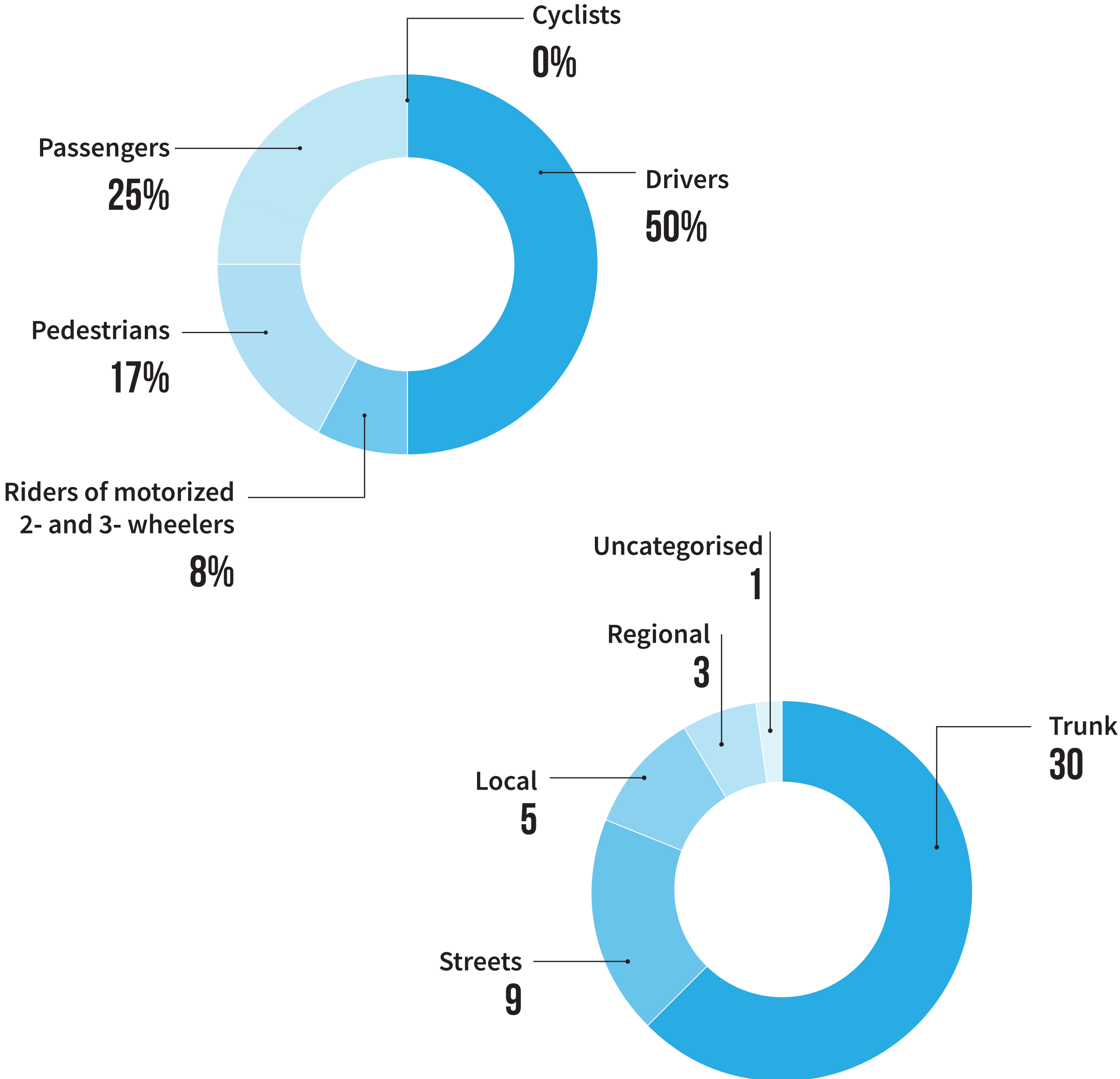
MONTENEGRO
77 FATALITIES / 1M INHABITANTS

Road Fatalities by Transport Mode and Road Type - Montenegro 2018

The World Health Organization Global Report on Road Safety indicates that in 2016, 42% of fatalities on Montenegro roads are drivers of light vehicles and 31% were vulnerable road users.

The latest received figures for 2018 indicate a fall in the number of vulnerable road user fatalities to 25%.

In 2018 most fatalities occurred on trunk roads. Trunk roads tend to carry the most traffic and typically vehicle speeds are higher.



Road Safety Assessment of Montenegro

In an effort to improve the Road Safety Situation in **Montenegro** a team of International Consultants has been appointed. The team have completed the following:

- **Road Safety Assessment** of the existing road network
- Completion of 16 **Road Safety Inspections** at high risk areas
- **Training** of local staff

The Montenegrin authorities have acknowledged that **road safety performance** in the country needs to improve to meet best international practice. A **targeted approach** has therefore been adapted to identify the problems and to develop the local skills to implement the solutions.



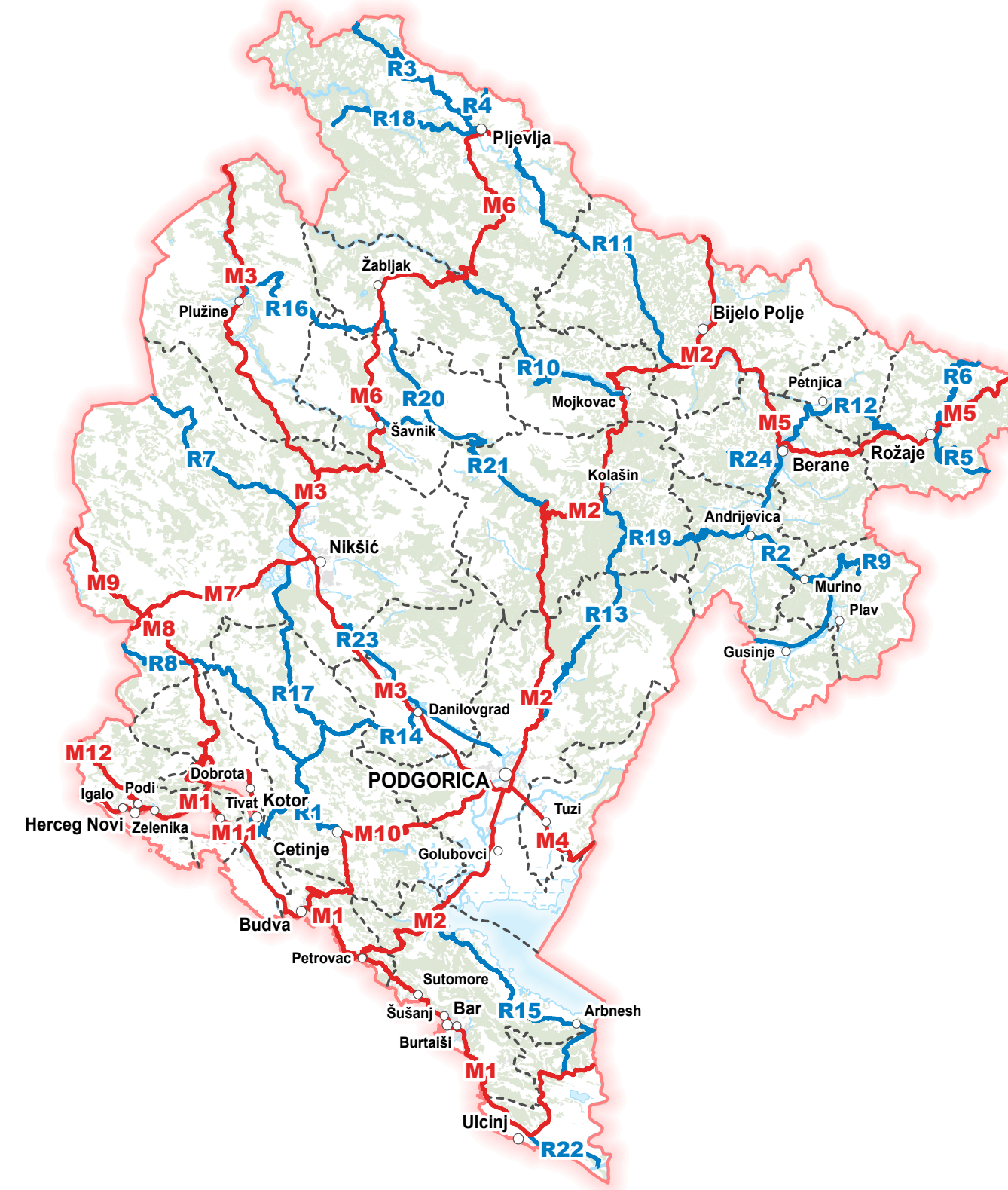
Montenegro has a challenging road environment created by the mountainous terrain.

iRAP investigative assessment of the existing road network in Montenegro

An International Road Assessment Programme (iRAP) has been completed.

1853kms of road has been surveyed by a specialist vehicle.

iRAP assesses the safety performance of the roads in Montenegro through the completion of Risk Maps, Star Ratings and Investment Plans.



Klívesnice udělosti

(c) 2019 AF-CITYPLAN s.r.o. | IRAP v6 - pravostřanný

4.12 CARRIAGEWAY LABEL
A B U A B

4.13 UPGRADE \$
S HIGH S MED S LOW

4.14 MOTORCYCLE FLOW
8+ 6-7 4-5 2-3 1 NONE

4.15 BICYCLE FLOW
8+ 6-7 4-5 2-3 1 NONE

4.16 PEDESTRIAN FLOW ACROSS
8+ 6-7 4-5 2-3 1 NONE

4.18 PEDESTRIAN FLOW ALONG LEFT
8+ 6-7 4-5 2-3 1 NONE

4.20 LAND USE LEFT
LAND LAND LAND LAND LAND

4.22 SPEED LIMIT
150 140 130 120 110 100 90 80 70 60 50 40 30

4.23 SPEED LIMIT MOTORCYCLES
150 140 130 120 110 100 90 80 70 60 50 40 30

4.17 PEDESTRIAN FLOW ALONG RIGHT
8+ 6-7 4-5 2-3 1 NONE

4.19 LAND USE RIGHT
LAND LAND LAND LAND LAND

4.30 LEFT DISTANCE
0-1 1-5 5-10 10+

4.25 DIFF. S.
XX

4.24 SPEED LIMIT TRUCKS
150 140 130 120 110 100 90 80 70 60 50 40 30

4.21 AREA
AREA AREA

4.28 RIGHT DISTANCE
0-1 1-5 5-10 10+

4.30 LEFT OBJECT
CLIFF POLE END ROCK
ROCKFACE DITCH ROLL SLOPE NO ROLL

4.27 CENTRE
CENTRE CENTRE

4.26 MEDIAN TYPE
0-1 1-5 5-10 CONCRETE METAL

4.39 NUMBER OF LANES
4 LANE 3 LANE 3&2 LANE 2 LANE 2&1 LANE 1 LANE

4.29 RIGHT OBJECT
CLIFF POLE END ROCK
ROCKFACE DITCH ROLL SLOPE NO ROLL

4.30 RIGHT OBJECT
CLIFF POLE END ROCK
ROCKFACE DITCH ROLL SLOPE NO ROLL

4.31 SHOULDER
SHOULDER SHOULDER

4.40 LANE WIDTH
N LANE M LANE W LANE

4.54 CALM.
CALM CALM

4.33 SHOULDER W LEFT
NONE 0-1 1-2.4 2.4+

4.41 CURVATE
CURVATE CURVATE

4.42 QUAL. CURVE
POOR GOOD

4.43 GRADE
10+ GRADE 7-10 GRADE 0-7 GRADE

4.55 PARKING
PARKING PARKING

4.32 SHOULDER W RIGHT
NONE 0-1 1-2.4 2.4+

4.57 SIDEWALK LEFT
NONE 0-1 1+ 1+ 1+ 1-3 3+ 3+

4.44 CONDITION
POOR MED GOOD

4.45 SKID RESISTANCE / GRIP
UNSEAL UNSEAL SEALED SEALED SEALED

4.46 DELIN.
LINES LINES

4.56 SIDEWALK RIGHT
NONE 0-1 1+ 1+ 1+ 1-3 3+ 3+

4.34 INTERSECTION TYPE
INTERSECTION TYPE

4.35 CHANNELIZ.
CHANNELIZ CHANNELIZ

4.38 ACCESS
ACCESS ACCESS

4.62 SIGHT
SIGHT SIGHT

4.48 PED CROSSING FACILITIES - INSPECTED ROAD
PED CROSSING FACILITIES

4.37 INT QUALITY
INT INT

4.47 LIGHT
LIGHT LIGHT

4.50 PED CROSSING FACILITIES - INTERSECTING ROAD
PED CROSSING FACILITIES

4.36 INTERSECTING ROAD VOLUME
INTERSECTING ROAD VOLUME

4.58 SERVIC
SERVIC SERVIC

4.61 ROADWORKS
ROADWORKS ROADWORKS

4.51 FENCING - 4.49 PED QUALITY - 4.52 SCHOOL WARNING
FENCING PED QUALITY SCHOOL WARNING

SABS - Systém pro analýzu bezpečnosti silnic - Jízda m1-7

Soubor Mapa Sestavy EuroRAP Nástroje Nastavení nápověda

Events: section 8500m - 8600m

| údilost | čas | ús. | typ |
|---|-------------|-----|-----|
| 31 Roadside severity - passenger | 0:09:22,500 | 0 | E |
| 32 passenger-side - Unprotected | 0:09:22,500 | 0 | E |
| 43 Curvature - Moderate | 0:09:25,000 | 0 | E |
| 44 Quality of curve - Adequate | 0:09:25,000 | 0 | E |
| 29 Roadside severity - driver-side | 0:09:27,500 | 0 | E |
| 30 driver-side - Unprotected safe | 0:09:27,500 | 0 | E |
| ----- konec úseku 8100 m -- 0:09:28,500 0 U | | | |
| 29 Roadside severity - driver-side | 0:09:33,250 | 0 | E |
| 30 driver-side - Unprotected safe | 0:09:33,250 | 0 | E |
| 31 Roadside severity - passenger | 0:09:33,250 | 0 | E |
| 32 passenger-side - Unprotected | 0:09:33,250 | 0 | E |
| ----- konec úseku 8200 m -- 0:09:34,250 0 U | | | |
| 31 Roadside severity - passenger | 0:09:35,000 | 0 | E |
| 32 passenger-side - Safety barre | 0:09:35,000 | 0 | E |
| 29 Roadside severity - driver-side | 0:09:38,000 | 0 | E |
| 30 driver-side - Tree | 0:09:38,000 | 0 | E |
| ----- konec úseku 8300 m -- 0:09:40,000 0 U | | | |
| 29 Roadside severity - driver-side | 0:09:41,000 | 0 | E |
| 30 driver-side - Unprotected safe | 0:09:41,000 | 0 | E |
| 31 Roadside severity - passenger | 0:09:41,000 | 0 | E |
| 32 passenger-side - Unprotected | 0:09:41,000 | 0 | E |
| ----- konec úseku 8400 m -- 0:09:45,750 0 U | | | |
| 14 Medium Upgrade cost | 0:09:47,000 | 0 | E |
| 29 Roadside severity - driver-side | 0:09:47,000 | 0 | E |
| 30 driver-side - Unprotected safe | 0:09:47,000 | 0 | E |
| 32 passenger-side - Safety barre | 0:09:47,000 | 0 | E |
| 41 One | 0:09:47,000 | 0 | E |
| ----- konec úseku 8500 m -- 0:09:51,250 0 U | | | |
| 31 Roadside severity - passenger | 0:09:52,000 | 0 | E |
| 32 passenger-side - Unprote | 0:09:52,000 | 0 | E |
| 14 High Upgrade cost | 0:09:55,500 | 0 | E |
| 29 Roadside severity - driver-side | 0:09:55,500 | 0 | E |
| 30 driver-side - Cliff | 0:09:55,500 | 0 | E |
| ----- konec úseku 8600 m -- 0:09:57,500 0 U | | | |
| ----- konec úseku 8700 m -- 0:10:03,750 0 U | | | |
| 29 Roadside severity - driver-side | 0:10:04,750 | 0 | E |
| 30 driver-side - Aggressive vertic | 0:10:04,750 | 0 | E |
| 31 Roadside severity - passenger | 0:10:04,750 | 0 | E |
| 32 passenger-side - Unprotected | 0:10:04,750 | 0 | E |
| ----- konec úseku 8800 m -- 0:10:10,250 0 U | | | |
| 29 Roadside severity - driver-side | 0:10:12,250 | 0 | E |

Průběh Editace

Aktuální čas: 0:09:55 / 0:15:11
Vzdálenost: 8568,5 / -97,1 [m]
Rychlost: 56,47 [km/h] Jdi na čas
Sev. šířka: 42:10:24,3400
Východní délka: 19:00:22,8300 Začátek ú.
Směrový oblouk: 475 [m] Konec ú.
Podélný sklon: 11 [%]
Start: Pause / Start: Stop
Zvětšení: 16
Rizika | Video | Stančení | 100 m úseky | Vzdálenost |
Tisk mapy
Do schránky
Bodové jevy
Liniové jevy
Včestavové jevy
Legenda
Odebrat jevy
Uložit obarvení
Načít obarvení

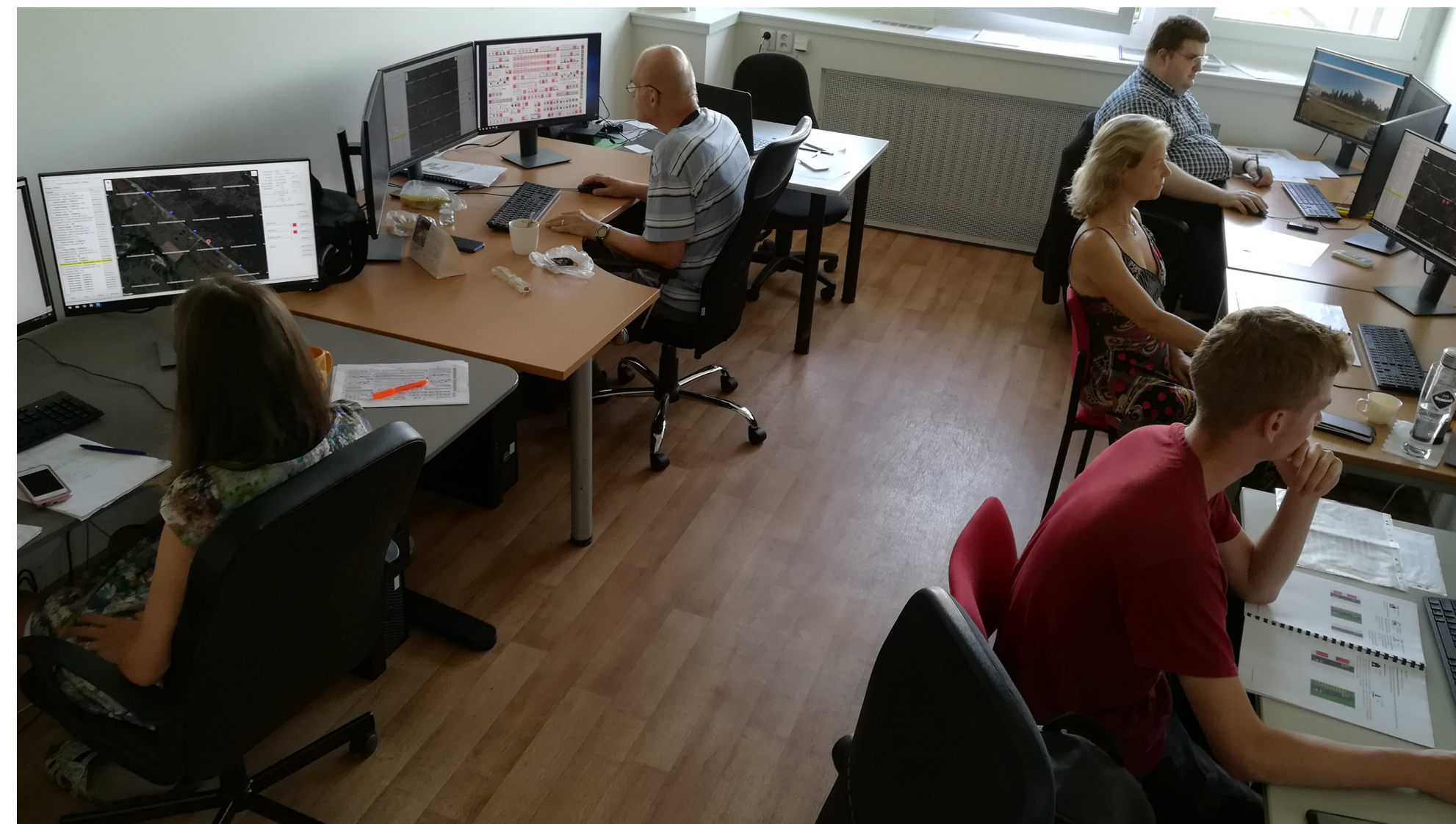
Video captured by the survey vehicle is analysed through specialist software

Assessment of the road network

iRAP reviews approximately **50 attributes** to assess the safety performance of the road.

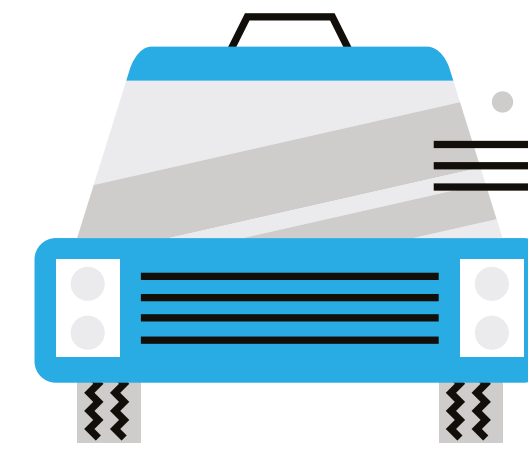
- Carriageway label
- Upgrade cost
- Motorcycle flow observed
- Bicycle flow observed
- Pedestrian observed flow
- Land use
- Area type
- Speed limit
- Differential speeds
- Median type
- Centreline rumble strips
- Roadside severity – distance & object
- Shoulder rumble strips
- Paved shoulder width
- Intersection type
- Intersection channelization
- Intersecting road volume
- Intersection quality
- Property access points
- Number of lanes

- Lane width
- Curvature & Quality of curve
- Grade
- Road condition
- Skid resistance / grip
- Delineation
- Street lighting
- Pedestrian crossing facilities & quality
- Pedestrian fencing
- School zone warning
- School zone crossing supervisor
- Speed management / traffic calming
- Vehicle parking
- Sidewalk provision
- Service road
- Facilities for motorised two-wheelers
- Facilities for bicycles
- Roadworks
- Sight distance



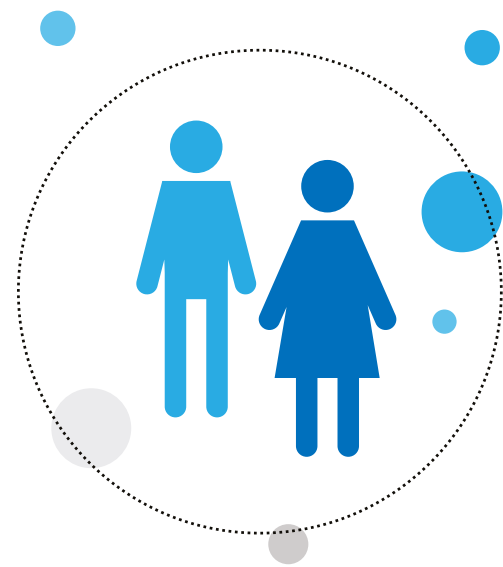
Coding the Montenegro survey results from iRAP

Snapshot of road safety performance in Montenegro



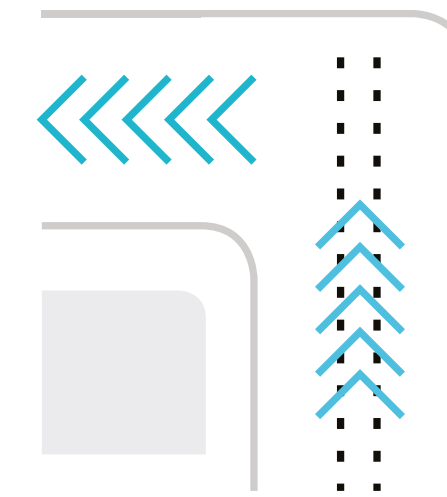
96%

of roads carrying traffic at 80km/h or more are undivided single carriageways



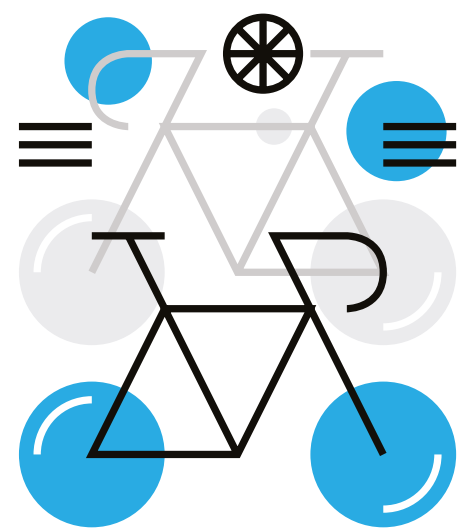
84%

of roads where pedestrians are present and traffic flows at 40km/h or more have no footpath



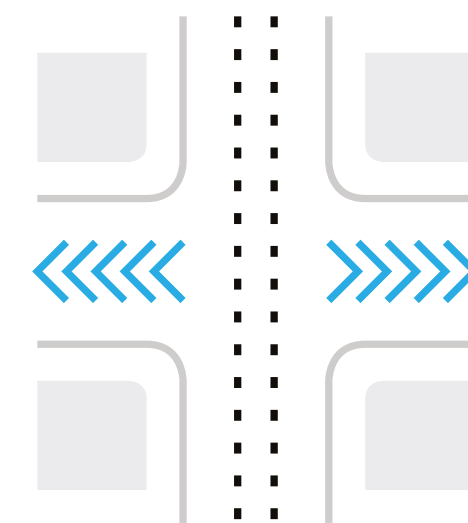
98%

of curves where traffic flows at 80km/h or more have hazardous roadsides



99%

of roads where bicyclists are present and traffic flows at 40km/h or more have no bicycle facilities



78%

of intersections where traffic flows at 60km/h or more have no roundabout, protected turn lane or interchange

Road near Risan


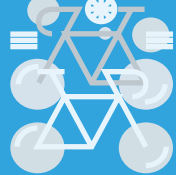

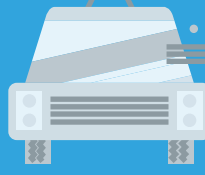


**Poor pedestrian provision,
tight radius curves, and
crossroad intersections
all contribute to the poor
road safety performance
in Montenegro.**

Star Ratings: One of the outputs from iRAP

Extract from iRAP website showing roadside features of roads with different **star ratings for different road user groups.**

Star Ratings are based on road inspection data and provide a simple and objective measure of the level of safety which is 'built-in' to the road for vehicle occupants, motorcyclists, bicyclists and pedestrians. **Five-star roads are the safest while one-star roads are the least safe.**

| STAR RATING |  |  |  |  |
|-------------|---|---|---|---|
| ★ | No sidewalk No safe crossing 60km/h traffic | No cyclepath No safe crossings, poor road surface 70km/h traffic | No motorcycle lane, undivided road trees close to road, winding alignment, 90km/h traffic | Undivided road with narrow centerline, trees close to road, winding alignment, 100km/h traffic |
| ★★★ | Sidewalk present, pedestrian refuge, street lighting, 50km/h traffic | On-road cycle lane, good road surface, street lighting, 60km/h traffic | On-road motorcycle lane, undivided road, good road surface, >5m to any roadside hazards, 90km/hr traffic | Wide centerline separating oncoming vehicles, >5m to any roadside hazards, 100km/h traffic |
| ★★★★★ | Sidewalk present, signalised crossing with refuge, street lighting, 40km/h | Off-road dedicated cycle facility, raised platform crossing of major roads, street lighting | Dedicated separated motorcycle lane, central hatching, no roadside hazards, straight alignment, 80km/h traffic | Safety barrier separating oncoming vehicles and protecting roadside hazards, straight alignment, 100km/h traffic |

Star rating for vehicle occupants in Montenegro

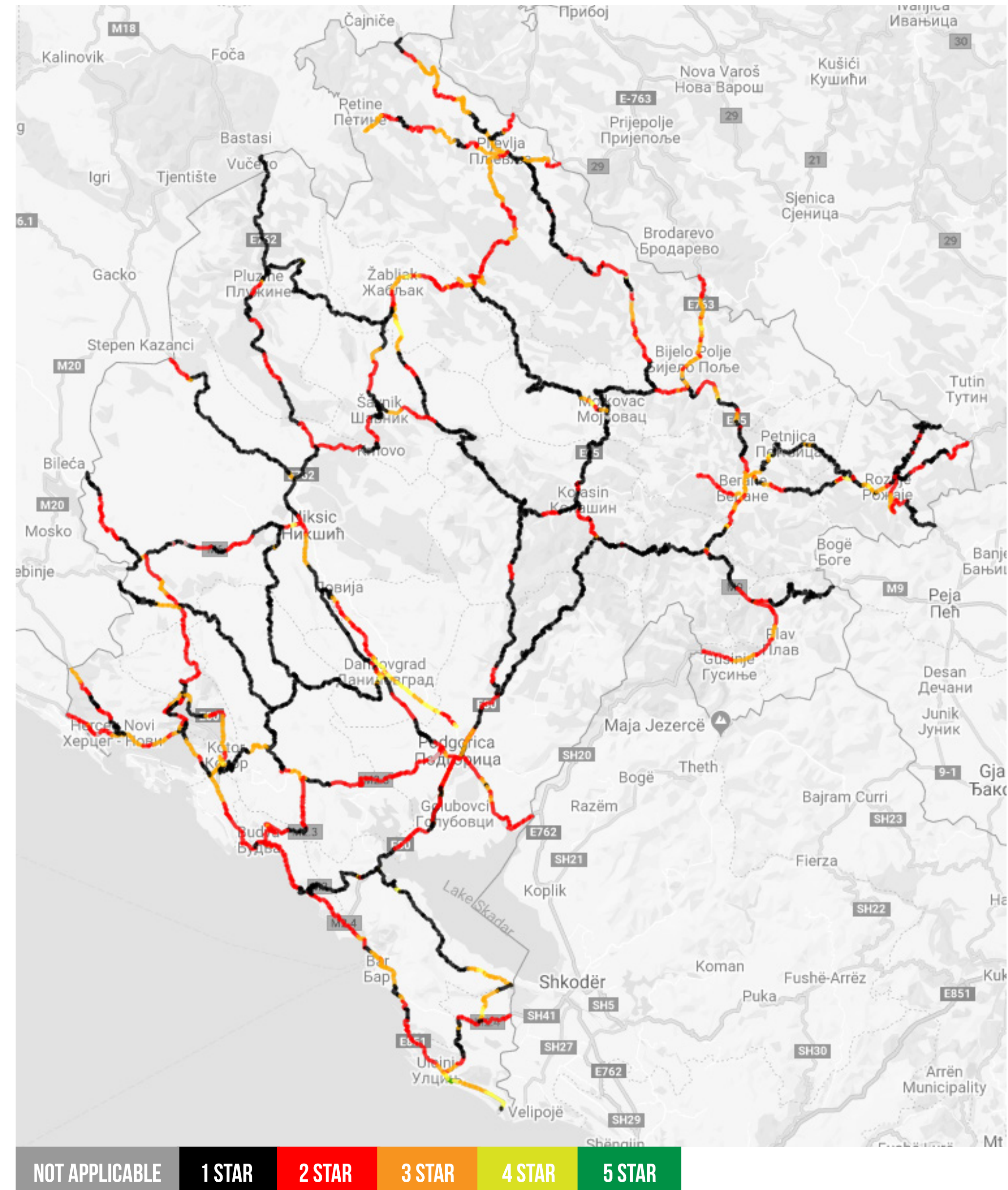
The results for Montenegro are not good.

Only 2 % of roads (39.5 km) received a 4 or 5 Star Rating. In contrast, almost 55 % of roads (more than 1,000 km) received the worst rating of 1 Star. A further 28 % (more than 500 km) of vehicle occupants received only 2 Stars. The vehicle occupant classification category is the most populated classification type of the four user types assessed.

For motorcyclists the results are even worse.

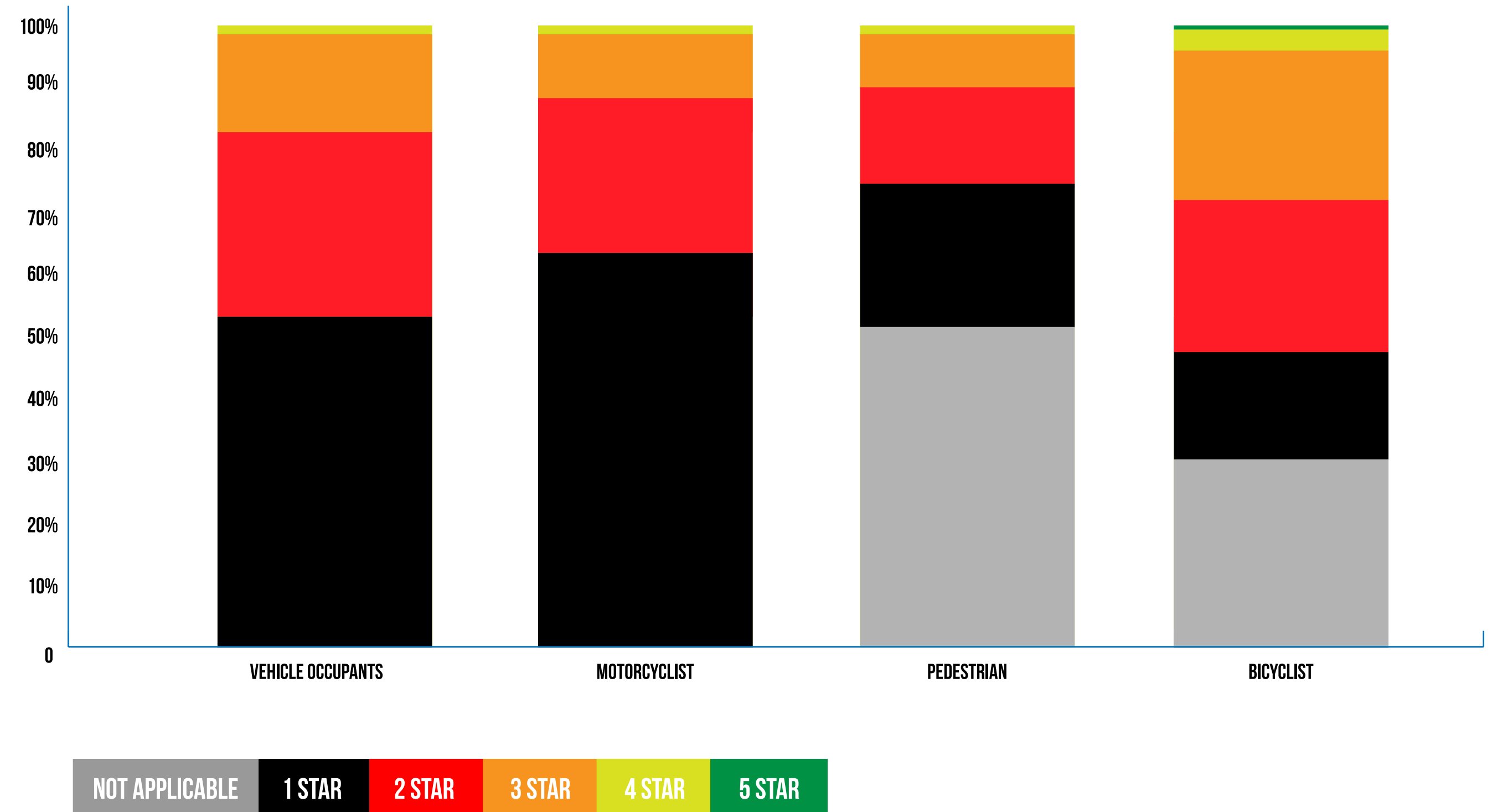
Almost two thirds (66 %) of the assessed road network for motorcyclists fall into the worst, 1-Star category.

Bicyclists include the highest proportion of 3 star rated roads compared to all the other category types evaluated. On some roads, Star Rating for Pedestrians and Bicyclists was not evaluated because no flow of these road user groups were present.



Star rating per road user group

Black and red sections show poor safety performance of roads in Montenegro for each of the different user groups. Grey areas indicate where there was insufficient information to gather results.



Number of KMs under each Star Rating

The results for Montenegro indicate a high proportion of roads which have a 1 & 2 star rating. Over 1,000 kms of road in Montenegro achieves a 1 star rating. iRAP states that countries should strive to achieve at least a minimum 3 star rating for roads to maximise road safety performance.

| STAR RATINGS | VEHICLE OCCUPANT | | MOTORCYCLIST | | PEDESTRIAN | | BICYCLIST | |
|----------------|------------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|
| | LENGTH (KM) | PERCENT | LENGTH (KM) | PERCENT | LENGTH (KM) | PERCENT | LENGTH (KM) | PERCENT |
| 5 STARS | 1.00 | 0.05% | 0.00 | 0.00% | 0.30 | 0.02% | 5.50 | 0.29% |
| 4 STARS | 38.50 | 2.06% | 32.80 | 1.76% | 42.60 | 2.28% | 60.20 | 3.23% |
| 3 STARS | 268.00 | 14.36% | 194.60 | 10.43% | 134.70 | 7.22% | 475.30 | 25.47% |
| 2 STARS | 529.90 | 28.40% | 422.30 | 22.63% | 296.40 | 15.88% | 463.00 | 24.81% |
| 1 STARS | 1,021.90 | 54.76% | 1,209.60 | 64.82% | 402.40 | 21.56% | 316.70 | 16.97% |
| NOT APPLICABLE | 6.80 | 0.36% | 6.80 | 0.36% | 989.70 | 53.04% | 545.40 | 29.23% |
| TOTALS | 1,866.10 | 100% | 1,866.10 | 100% | 1,866.10 | 100% | 1,866.10 | 100% |

Poorest performing sections of road for vehicle occupants

Based on the survey and **iRAP Star Rating**, these road sections were identified as the poorest performing (for Vehicle Occupants).

TRUNK ROADS (M ROADS)

- M-2 (section 2.1+2.2) Petrovac - Virpazar
- M-2 (section 2.6-2.9) Bioče - Mioska - Kolašin - Mojkovac - Slijepač Most
- M-3 (section 3.1) Ščepan Polje - Plužine
- M-3 (section 3.3+3.4) Jasenovo Polje - Vir - Nikšič
- M-6 (section 6.2) Trlica - Pljevlja
- M-7 (section 7.2) Vilusi - Ilino Brdo

REGIONAL ROADS (R ROADS)

- R-6 (section 6.1) Most Zeleni - Vuča
- R-9 (section 9.1) Murino - Bjeluha
- R-13 (section 13.1) Bioče - Mateševo
- R-16 (section 16.1) Plužine - Trsa - Pošcenski kraj
- R-17 (section 17.1-17.3) Čekanje - Resna - Čevo - Riđani
- R-19 (section 19.1) Mateševo - Andrijevića
- R-21 (section 21.1) Mioska - Semolj - Boan - Tušina

Safer road investment plans

The results from iRAP enable the calculation of an investment plan to implement the necessary measures to improve road safety. The level of investment provides differing Benefit Cost Ratios (BCR). The higher the initial investment the greater the reduction in the number of killed and serious injury crashes.

The analysing period for the assessment of economic return on investment is set to 20 years by iRAP.

Depending upon the level of investment the number of casualties saved from crashes varies from 31% to 60% depending on the extent of safety improvements proposed. This relates to nearly 3,000 fatal and serious injury crashes saved from the highest level of investment.

| VARIANT | BCR 1 | BCR 3 | BCR 5 |
|--|-------------|-------------|-------------|
| Total Fatal and Serious Injuries (FSIs) Saved | 2,997 | 2,030 | 1,522 |
| FSIs Saved Percentage (from 4,960) [%] * | 60 | 41 | 31 |
| Total Present Value (PV) of Safety Benefits [EUR] | 313,005,595 | 212,004,100 | 158,955,006 |
| Estimated Cost [EUR] | 148,432,172 | 41,520,998 | 20,249,302 |
| Cost per FSI saved [EUR] | 49,520 | 20,452 | 13,303 |
| Program BCR (final BCR of proposed countermeasures) ** | 2 | 5 | 8 |

* On the assessed road network over 20 years it is estimated that 4,960 people would die or be seriously injured in road crashes if no road safety improvements are undertaken. The application of differing levels of investment identified through iRAP can reduce the number of FSI by 60%, 41% or 31%.

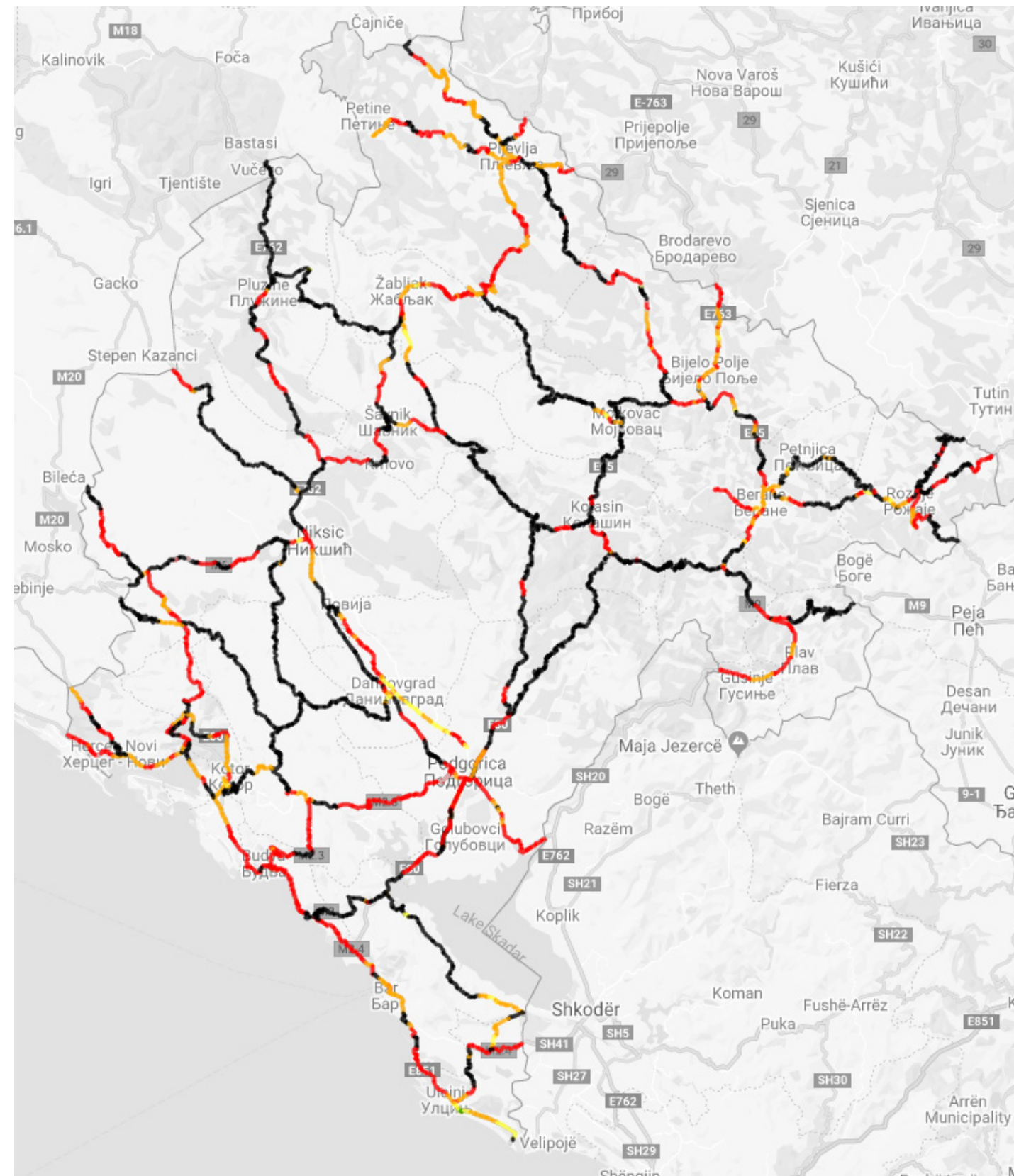
** The Program BCR of the proposed countermeasures is the PV of safety benefits divided by the estimated cost. EUR 148,432,172 represents the cost of implementing all identified countermeasures under variant BCR 1 therefore saving predicted 2,997 fatal and serious injuries (Estimated cost EUR 148,432,172 divided by Cost per FSI saved 49,520). Other alternatives shown include introducing a reduced number of countermeasures.

The following pages indicate differing levels of investment to implement road safety improvements in Montenegro.

**Each differing level of investment provides a change in the Star Rating map.
The following graphs show the before and after situation after the investment has been made.
The greatest investment results in the biggest reduction in red and black sections.**

Star Rating for Vehicle Occupants – Improvement for BCR 1

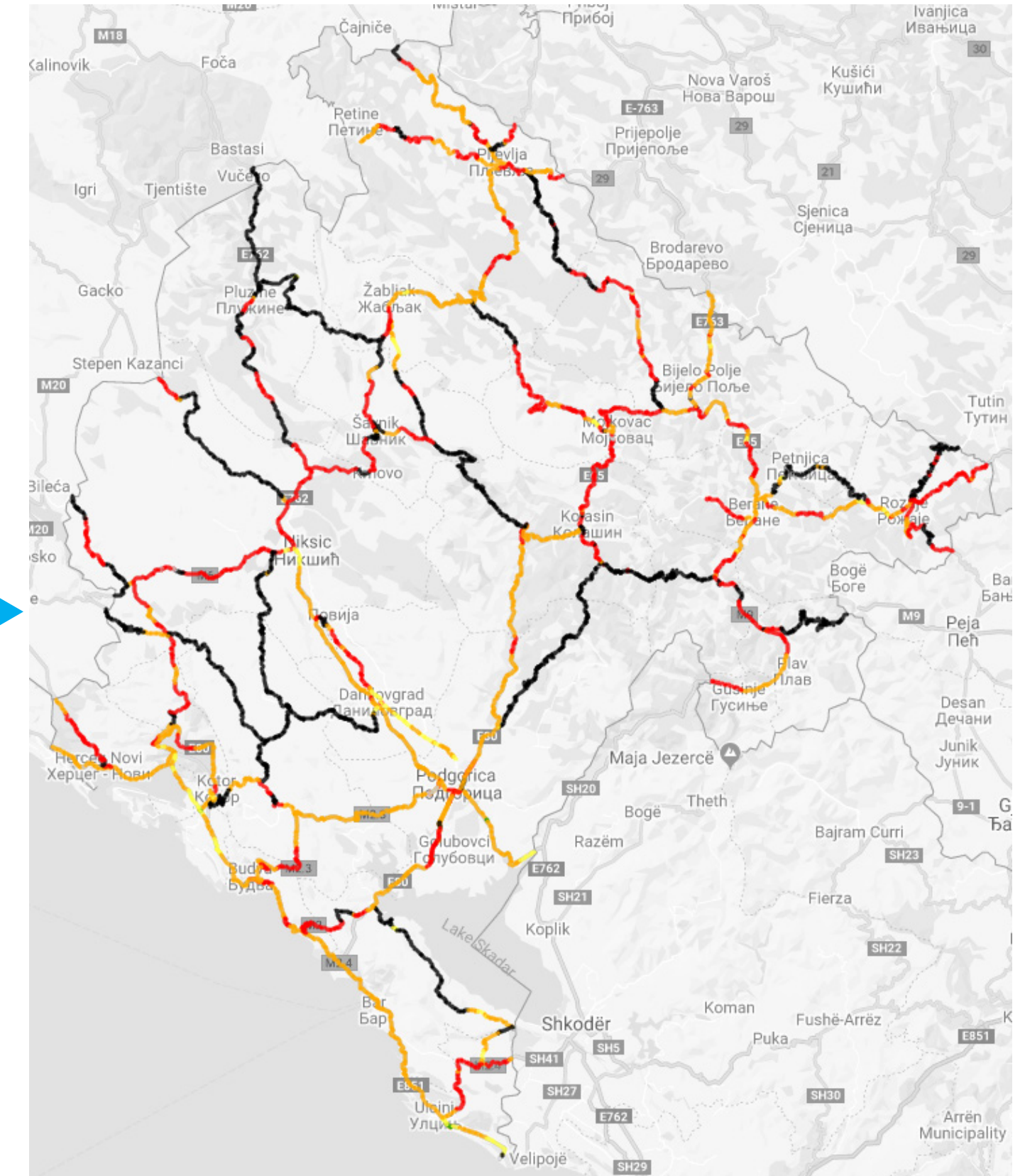
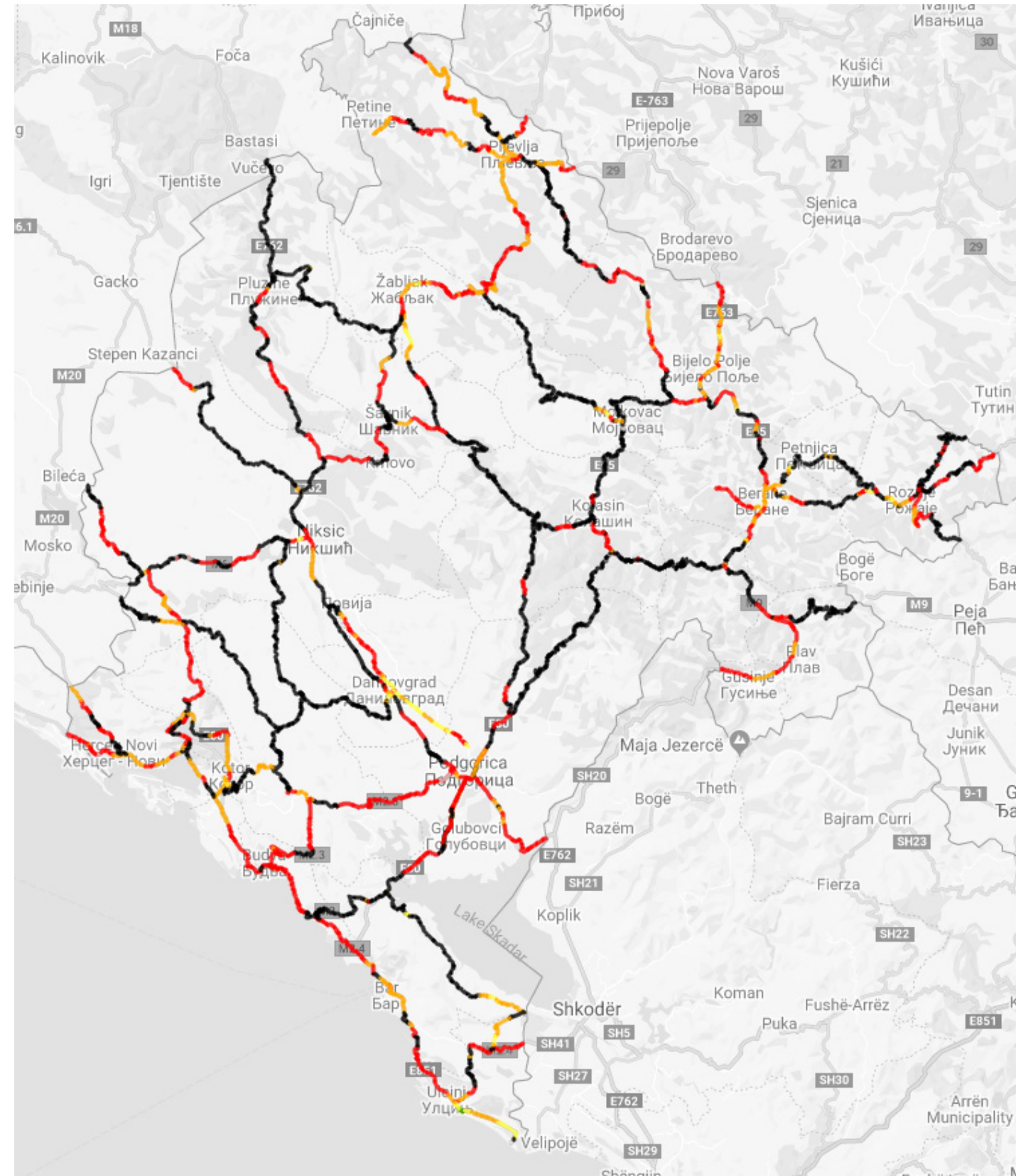
This variant is the most complex and also the most expensive. It would cost 148.432 million Euros for Montenegro to implement all the recommended road safety measures while achieving crash savings of 313.006 million Euros over 20 years.



Biggest reduction in black road sections

Star Rating for Vehicle Occupants – Improvement for BCR 3

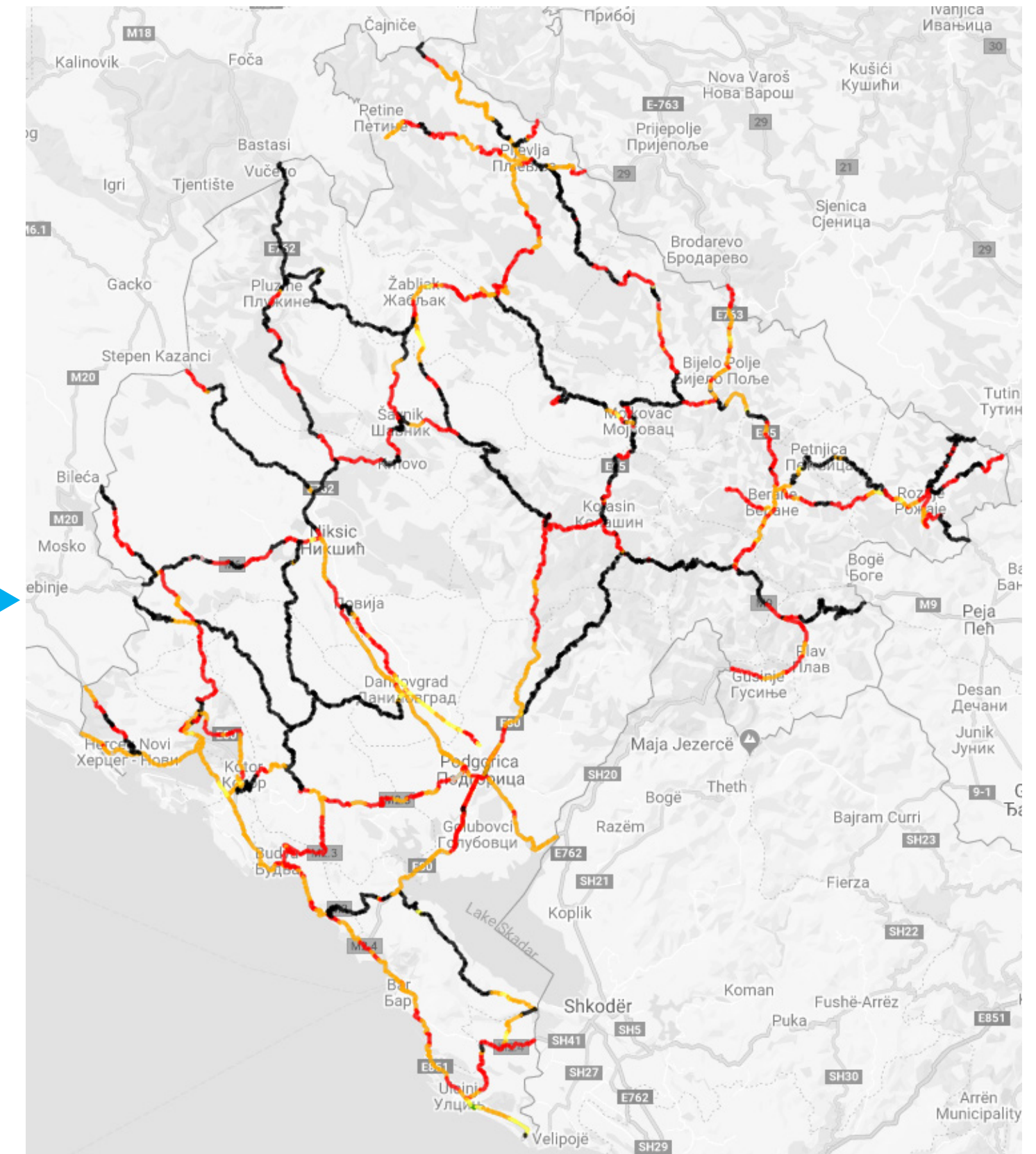
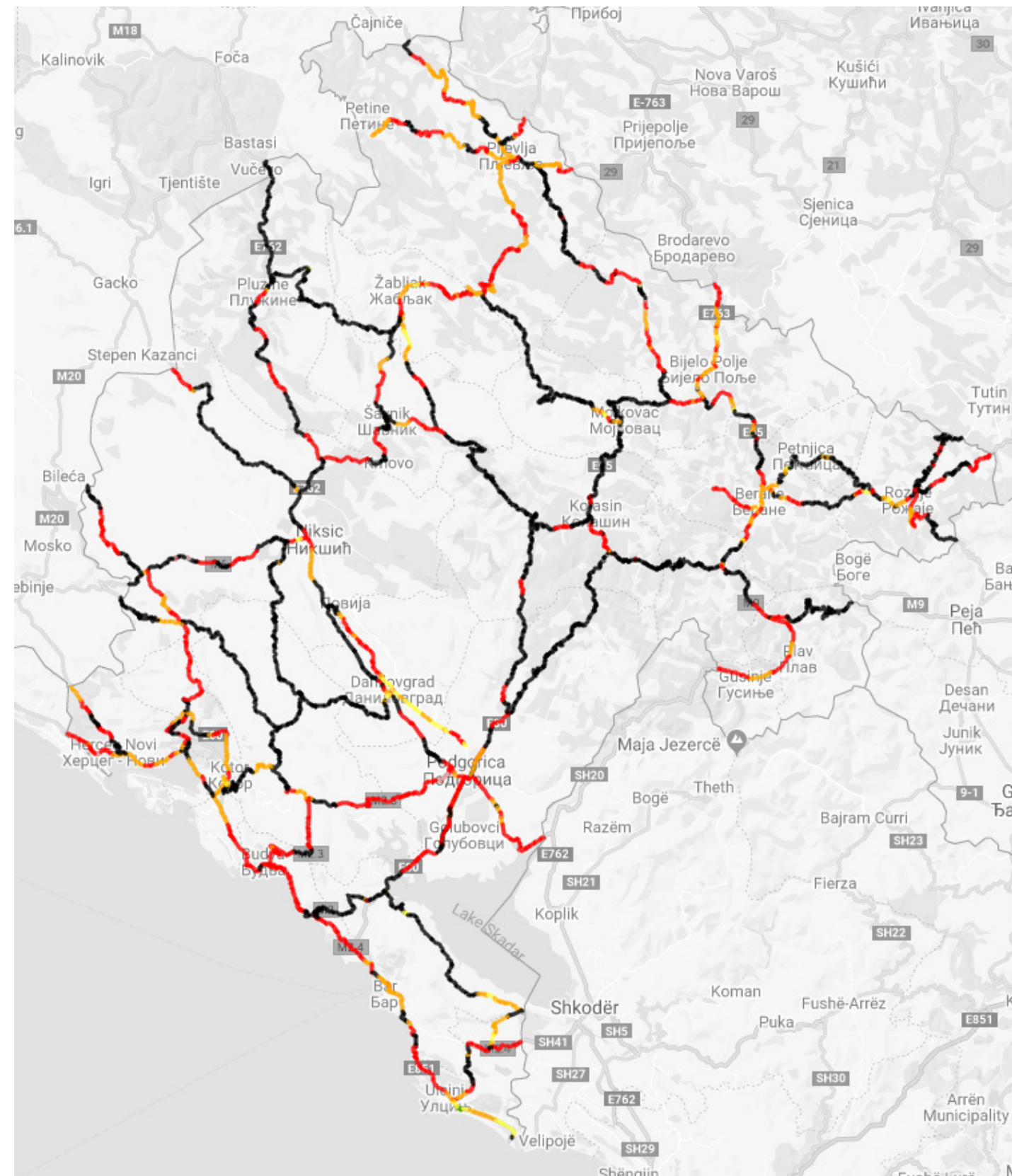
Less effective countermeasures are excluded from implementation in most cases under this variant. This variant would **cost 41.5 million Euros** to implement the treatment measures with potential **crash savings of 212.0 million Euros for Montenegro over 20 years.**



More red and black remains on the 'after' map

Star Rating for Vehicle Occupants - Improvements for BCR 5

Less effective countermeasures are not considered in most cases for implementation under this variant. This variant would cost **Montenegro 20.2 million Euros** with potential crash savings of **159.0 million Euros** over 20 years.











More red and black remains on the 'after' map

Risk Maps

Risk Map 1 identifies the individual risk map of a fatal or serious crash per billion vehicle kilometres travelled. The map identifies the risk of individual road users being involved in a fatal or serious crash whilst using a specific road section. The identification of risk for the road network in Montenegro is colour coded indicating the highest risk rating as a black and red colour.

Risk Map 2 identifies the risk rate expressed as the number of fatal and serious injury crashes per km per year. The Risk Map identifies the actual observed number of crashes per unit length and therefore where the highest and lowest numbers of crashes occur on the network.

IRAP ROAD RISK RATING

| | | | |
|---|-------------------------|---|-----------------------|
|  | Low-risk (safest) roads |  | Sections not assessed |
|  | Low-medium risk roads |  | Trunk roads |
|  | Medium risk roads |  | Regional roads |
|  | Medium-high risk roads | | |
|  | High risk roads | | |

The following pages identify two graphs which identify the Risk to road user groups based upon actual crash data.

Star Rating maps are based upon predicted locations of crashes.

Risk Map 1

Individual Risk Rate

Overall the individual risk for road users in Montenegro reported by iRAP, indicated that **35% of the road sections were defined as high risk.**

Individual risk per kilometre travelled, the **worst performing M-roads and R-roads were as follows:**

M-1, M-2, M-7, M-8, R-2, R-22 and R-23.



High risk roads are shown in black and red.

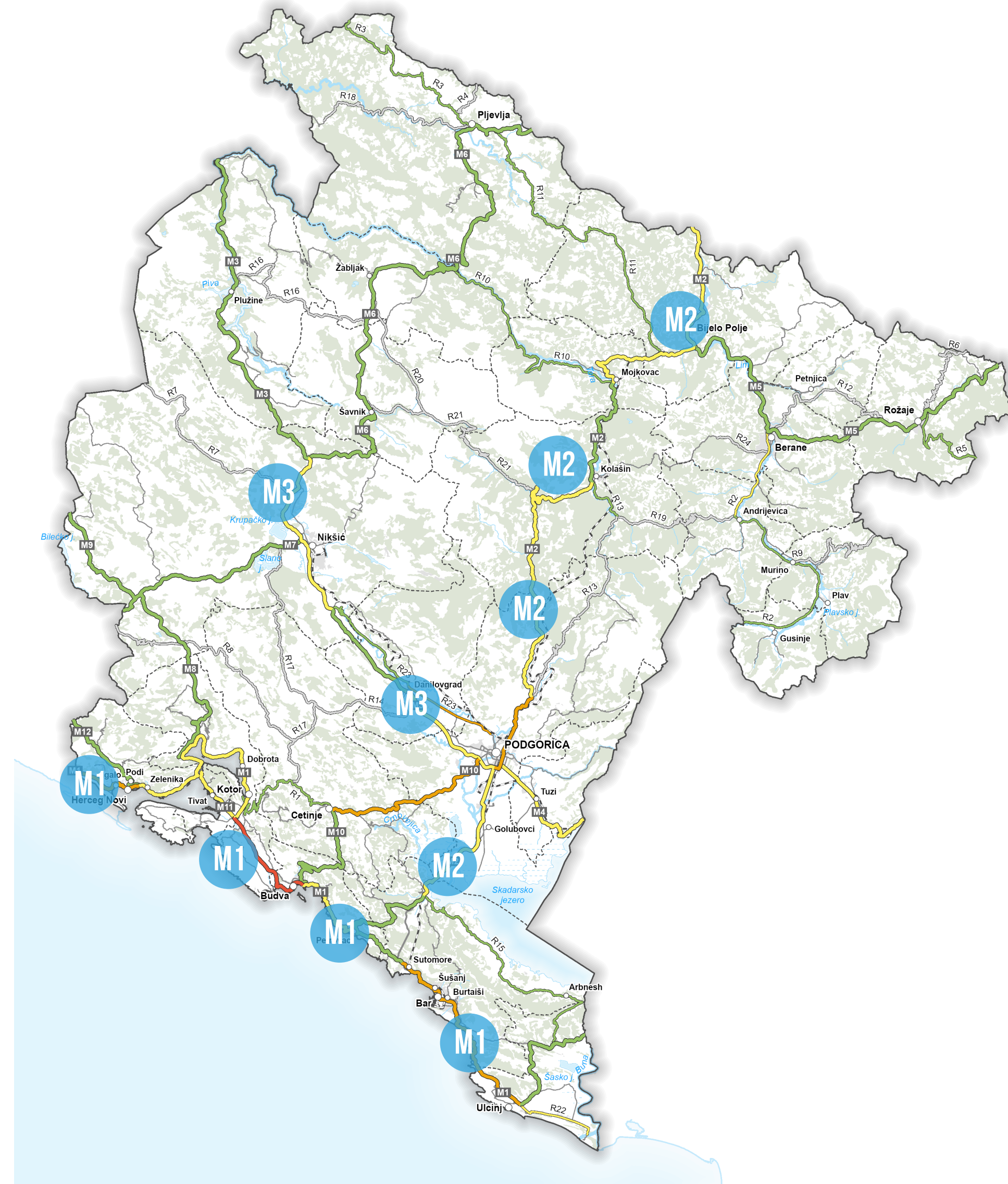
Risk Map 2

Collective Risk Rate

Collective risk rates are the worst for **roads with high traffic volumes** as these roads will have a higher probability of crashes based on more vehicles travelling on those roads.

The M-1 between Krtolska Junction and Budva which has received a **medium-high risk rate**, is shown as a red.

69 % of the road sections where the Risk Mapping evaluation for crash density was undertaken, received the best, low risk rate band. On these sections, a **low number of crashes** occurs compared to international standards. However, this is **mostly attributed to low traffic volumes** which in-turn reduce the probability of a crash occurring.



Road Safety Inspections

The results of the iRAP survey helped to identify priority areas of the road network for further detailed inspection. This was carried out at several critical locations on the following roads:

- R-2 Berane - Andrijevica
- M-1 Debeli Brijeg - Meljine
- M-1 between Ulcinj - Bar
- M-1 between Bar - Sutomore
- M-3 Jasenovo Polje - Vir
- M-8 Lipci - Grahovo
- M-8 Grahovo - Vilusi
- R-22 Ulcinj - Ada
- M-10 Podgorica 3 - Cetinje divided as follows: Urban section Podgorica, Gornji Kokoti - Go-kart track Junction and Dobrsko - Cetinje
- R-23 Danilovgrad - Spuž
- M-2 section at Monastir Morača
- M-2 section south of Monastir Morača
- M-2 section at Bioče settlement.
- M-2 section north of Podgorica.
- M-2 Grlo Bridge over the gorge of the Morača River
- M-2 The Dromira section

Road Safety Inspections have been completed at 16 locations



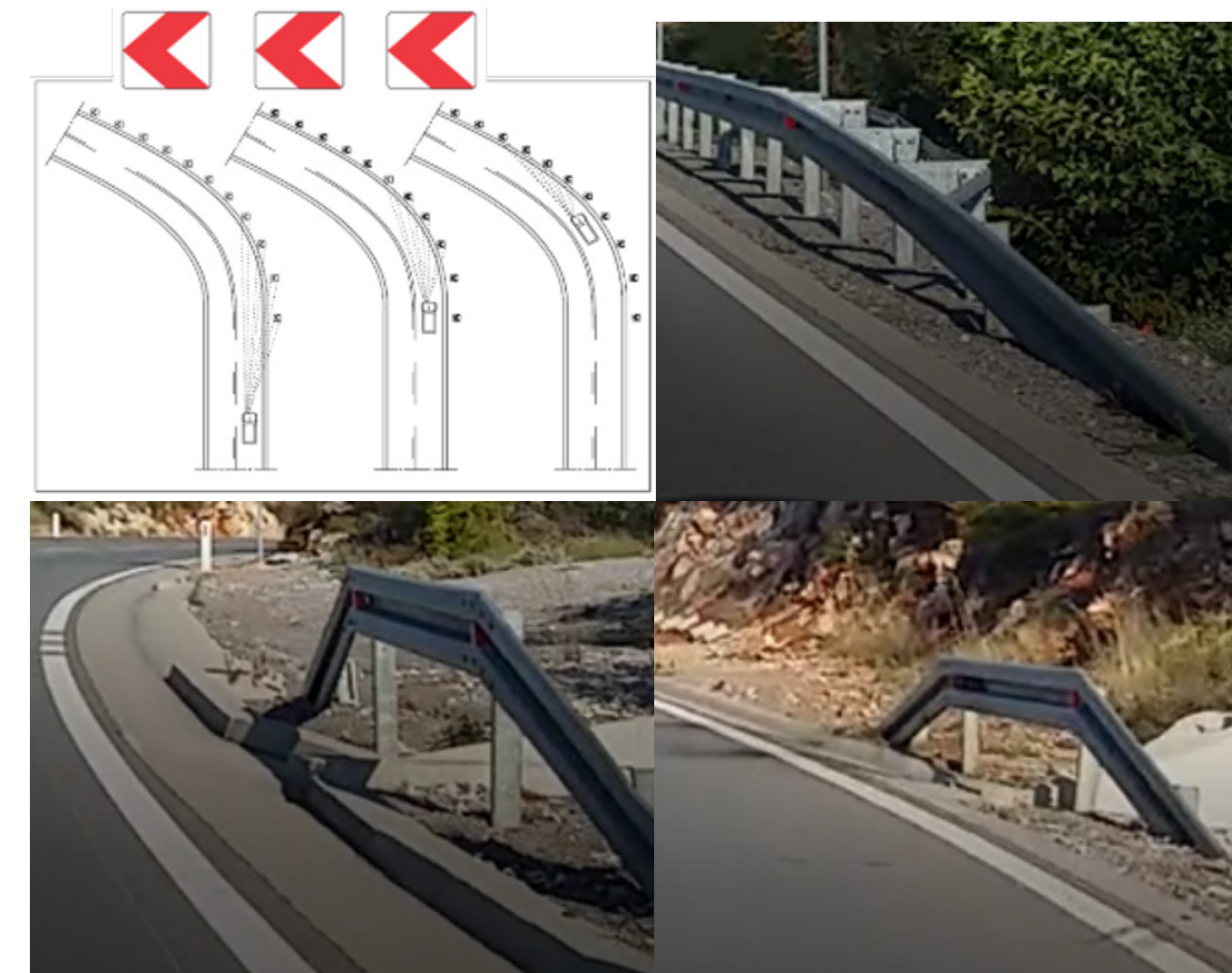
Road Safety Inspections

Road Safety Inspection reports have been completed for each of the 16 site locations visited and recommendations made for measures that may be implemented to improve the road safety situation.

Main road safety concerns identified:

- Sharp curves
- Missing or inadequate guardrails
- Inappropriate guardrail end terminals in place
- Fixed objects in the safety zone.

Training has been provided to local staff to ensure transfer of knowledge. This will help to develop internal expertise in road safety inspections.

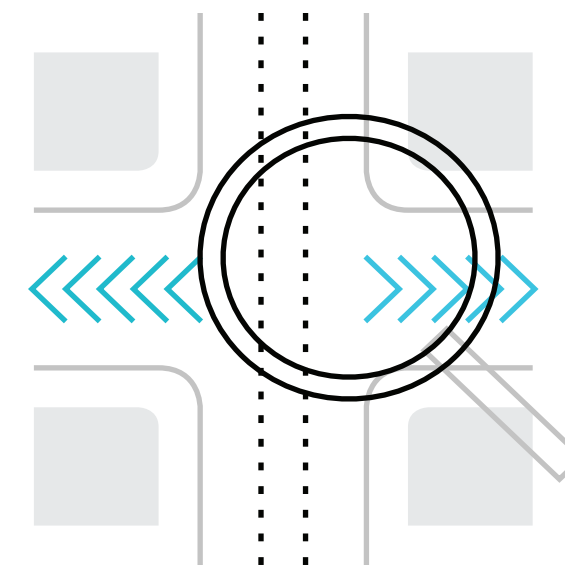


Conclusions

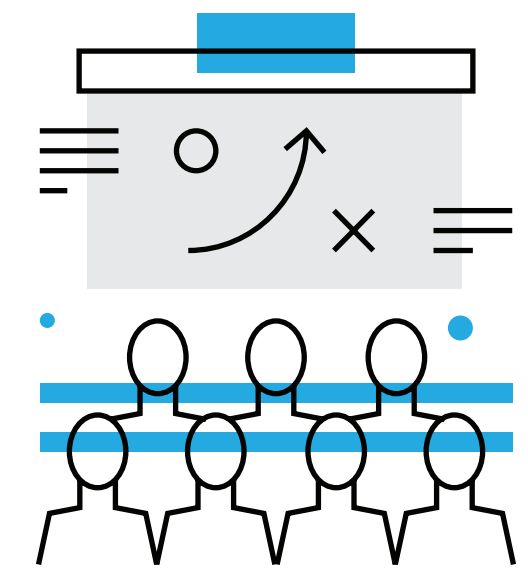
THREE KEY DELIVERABLE AREAS



**iRAP
Study**



**Road Safety
Inspections**



**Capacity Building
of local staff**

Conclusions

Whilst this initial review for Montenegro may not be viewed positively in terms of road safety performance, our view is that the assessment process is an important step for any country to undertake if it is serious about wishing to improve road safety performance.

The next steps for Montenegro to improve road safety performance is to review the recommendations raised within the Road Safety Inspection reports and start to implement the findings. As some of these locations have been selected from the iRAP study the treatment of these areas will also help to contribute to an overall improvement in the iRAP rating.



FUTURE AREAS OF STUDY AND DEVELOPMENT IN ROAD SAFETY

Develop a roadside design guide to ensure roads are built to best international standards

Develop a crash database system to ensure that interrogation of crashes can be undertaken therefore ensuring appropriate solutions can be undertaken.

Rerun iRAP results with 3 years of crash data.



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