Saving Lives Assessing and Improving TEN-T Road Network Safety

Grant Agreement Number: **INEA/CEF/TRAN/M2018/179967**

Project acronym: **SLAIN**

Project full title:
Saving Lives Assessing and Improving TEN-T Road Network Safety

Due delivery date: 31st January 2021
Actual delivery date: 1st February 2021

Organization name of lead participant for this deliverable:
EuroRAP

D1.5 Risk Map - Catalonia

Co-financed by the Connecting Europe Facility of the European Union

Document Control Sheet

Version	Date	Authors	Summary of changes
0.1	15-01-2021	SCT	Draft for peer review
1.0	29-01-2021	EuroRAP	Final for Submission

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Abbreviations and Acronyms

Acronym	Abbreviation
SCT	Servei Català de Trànsit
RACC	Real Automóvil Club de Cataluna
SLAIN	Saving Lives Assessing and Improving Network Safety
TEN-T	Trans-European Transport Network

Table of Contents

Executive Summary 4

1 Objectives 5

1.1 SLAIN project objectives 5

1.2 SLAIN Activity 1 5

2 Methodology 6

2.1 Task 1.1: Define the Core TEN-T network to be mapped and resources 6

2.2 Task 1.2: Allocate traffic data 7

2.3 Task 1.3: Disaggregate crashes and allocate to network for each section by type and severity 7

2.4 Task 1.4: Review 7

2.5 Task 1.5: Compute and assess crash risk per kilometre travelled and density of crashes per kilometre 7

2.6 Task 1.6: Assemble required data and produce high-quality risk maps 8

3 Results 9

3.1 Maps of individual and collective risk 9

3.1.1 Catalonia (Spain)- primary roads network individual risk (fatal and serious crashes per billion vehicle kilometre) with normalisation to Risk Bands 2020. 9

3.1.2 Catalonia (Spain)- individual risk Core Ten-T (fatal and serious crashes per billion vehicle kilometre) Risk Bands 2020. 10

3.1.3 Catalonia (Spain)- Core TEN-T collective 3-years risk (fatal and serious crashes per kilometre) Risk Bands 2020 11

3.1.4 Catalonia TEN-T network 12

References 17

Executive Summary

Crash Risk Maps have been produced for Catalonia, for the Core TEN-T.

The maps presented show both individual and collective risk measured in terms of crashes per billion vehicle kilometre and crashes per kilometre respectively. Results are being launched or released on websites, subject to local consultation and discussion, as appropriate.

Differences in the nature and distribution of these crashes have been analysed and differences in the ratios of fatal to other severities of crash noted on different road types. Such differences have implications for the presentation of Crash Risk Maps and there is discussion of steps to be taken if a map for one country is to be presented alongside others for comparison.

Comment is made on the use of maps for the assessment of risk by road-users and by road operators and the application of such maps in the Road Infrastructure Safety Management Directive 2019/1936/EC.

Recommendations have been made for updating the EuroRAP guidelines on crash rate risk mapping.

1 Objectives

1.1 SLAIN project objectives

The project's Action fits in the EC's 2010 Communication 'Towards a European Road Safety Area' and aims to contribute to the long-term goal for zero road deaths in 2050. With partners in the different countries, Project SLAIN is a transnational project aiming to extend the skills and knowledge base of partners in performing network-wide road assessment. It demonstrates how Crash Risk Mapping may be a useful tool in supporting the aims of Road Infrastructure Safety Management Directive 2019/1936/EC. The main areas to be covered within the SLAIN project are:

- Demonstration of a methodology of network-wide assessment
- Assessment of the Safety Performance Management of the TEN-T core road network and, if possible beyond, in 4 European countries: Croatia, Italy, Greece and Spain where we will perform road surveys (10,000 km of mapping)
- Proposals of section-specific, economically-viable crash countermeasures designed to raise infrastructure quality to achieve significant reductions in severe injuries and deaths
- Preparation of the readiness of Europe's physical infrastructure for automation.

The SLAIN consortium consists of eight core partners, coming from six EU member states, namely Greece, Italy, Spain, Croatia, UK and Belgium. The list of partners is: EuroRAP - Project Coordinator, Anas, FPZ, RSI Panos Mylonas, RACC-ACASA, DGT Spain, SCT Spain, TES Spain (Catalonia), iRAP.

1.2 SLAIN Activity 1

The objective of Activity 1 is to produce maps showing crash risk as an overall part of network-wide road assessment for Croatia, Greece, Italy, Spain (and Catalonia). The present deliverable concerns Catalonia only.

Subject to the availability of appropriate data, the objective of this task was to produce a Crash Risk Map of death and serious injury for each country illustrating both the individual risk and the collective risk for crashes for at least sections of the TEN-T Core Network in each of the four countries plus Catalonia. This provides a preliminary and immediate basis for comparison of the safety of the networks being examined and is often used as the basis for further analysis. Such maps can be used to compare current performance and also track that over time. The relevant beneficiaries in each territory have been responsible for producing the map in that territory and for collecting the data from which they are formed.

Crash Risk Maps are a convenient and relatively inexpensive means of portraying risk across a network and how that changes as one travels from one road section to the next. They relate the number of severe crashes to the amount of vehicle travel on each section (crashes per billion vehicle kilometre) or to the length of the section (crashes per kilometre) for given time periods. Mapped over time, the crash rates of individual road sections can track the performance of the road.

The report on these Deliverable (D1.5) is written both from the perspective of an analysis of the maps and data and from the perspective of assessing how useful such information is as a tool in network-wide road safety assessment. This Report is also written with refinement of the techniques and analysis provided in the first round of mapping that was originally performed one year ago (with data for the period 2014-2018). This work includes assessment of changes over time and comparison.

2 Methodology

2.1 Task 1.1: Define the Core TEN-T network to be mapped and resources

The network for the Core TEN-T in Catalonia has been identified and mapped. The network also includes the Comprehensive TEN-T. The methodology used is described in the RAP-RM-2-1 Risk Mapping Technical Specification in the methodology section of the iRAP website:

http://resources.irap.org/Specifications/RAP-RM-2-1_Risk_Mapping_technical_specification.pdf.

RAP-RM-2-1 sets out the technical specification for the production of RAP Risk Mapping to a standardised format. It details how networks are constructed and the rationale for the selection of road sections and their related parameters in building a data set. RAP-RM-3-1 sets out the design and cartographic specification for the production of RAP Risk Mapping to a standardised format and will be considered for use in future productions of these maps. It too is stored on the iRAP website: http://resources.irap.org/Specifications/RAP-RM-3-1_Risk_Mapping_design_specification.pdf.

The mapping in the Grant Agreement is limited to the relevant Core TEN-T network (see **Figure 1**) although, as described above, at no additional cost to the project, in some circumstances it has been possible to provide mapping that includes other roads and to include roads included in the Comprehensive TEN-T.

Figure 1: Core TEN-T in the SLAIN Grant Proposal and Agreement

2.2 Task 1.2: Allocate traffic data

This task involves collecting Annual Average Daily Traffic (AADT) volumes for each section from counts provided by the relevant road authorities in Catalonia.

In Catalonia, data were collected from the traffic counting publications made available publicly by Catalan Roads Ltd. Traffic flows were assigned to road sections according to the data contained in the publications. The data were the latest currently available (i.e. for the most recent time periods, including years 2015-2019).

2.3 Task 1.3: Disaggregate crashes and allocate to network for each section by type and severity

All relevant data on traffic crashes for the TEN-T network road sections in Catalonia has been collected. Data about the number, severity, types and locations of road traffic crashes for the observed time period were collected from the available publications. This includes the data obtained from the Catalan Traffic Service (SCT) databases and from additional data provided by the remaining relevant highway concessionaires. The collected data on road traffic crashes were disaggregated by type and severity and then assigned to the corresponding road network sections.

The iRAP/EuroRAP methodology sets an aspirational target of 20 fatal and serious crashes per network section, in order to reduce the effect of random variation in the number of collisions between years, but it has been noted that in practice in many circumstances this is impossible to achieve without extending the length of network sections. Extending the length of sections diminishes the ability to differentiate risk (and in particular to identify higher risk road lengths) or means that it is necessary to group data together from much longer time periods.

2.4 Task 1.4: Review

Data were reviewed for accuracy of allocation and for under-reporting. It is well-known for example that some crash types are under-reported, notably low severity and pedestrian crashes. Comment has been passed on the relevant observations in the reporting of results.

2.5 Task 1.5: Compute and assess crash risk per kilometre travelled and density of crashes per kilometre

Calculations were based upon crashes divided by the amount of traffic using the road or by the number of crashes per kilometre and ranked using an excel file.

The task computed the crash risks according to the standard procedures for RAP Risk Mapping Type I: Individual crash risk per vehicle km travelled and RAP Risk Mapping Type II: Crash density (Collective or Community risk). Crash risk per kilometre travelled (Type I Crash risk) is expressed as the number of fatal and serious crashes per billion vehicle kilometres travelled. This is the risk for individual road users of being involved in a crash involving fatal or serious crash injury whilst using a specific road length. The crash risk rates once computed were then allocated into five RAP risk bandings (low, low-medium, medium, medium-high and high risk categories) and the standard Type I and Type II Risk Maps were produced, along with the Type III, Type IV, and Type V Risk Maps.

2.6 Task 1.6: Assemble required data and produce high-quality risk maps

This task was done using mapping shapefiles. In order to produce the EuroRAP Risk Maps, the data on road network geometry, road traffic crashes and road traffic volume data, extracted from the relevant databases were recorded in shapefile (.shp) format, compatible with the webGIS systems which was used for further data processing and calculation of crash risk and crash density rates. The resulting Crash Risk Maps were also stored in shapefile format in order to enable fast and easy data transfer between stakeholders.

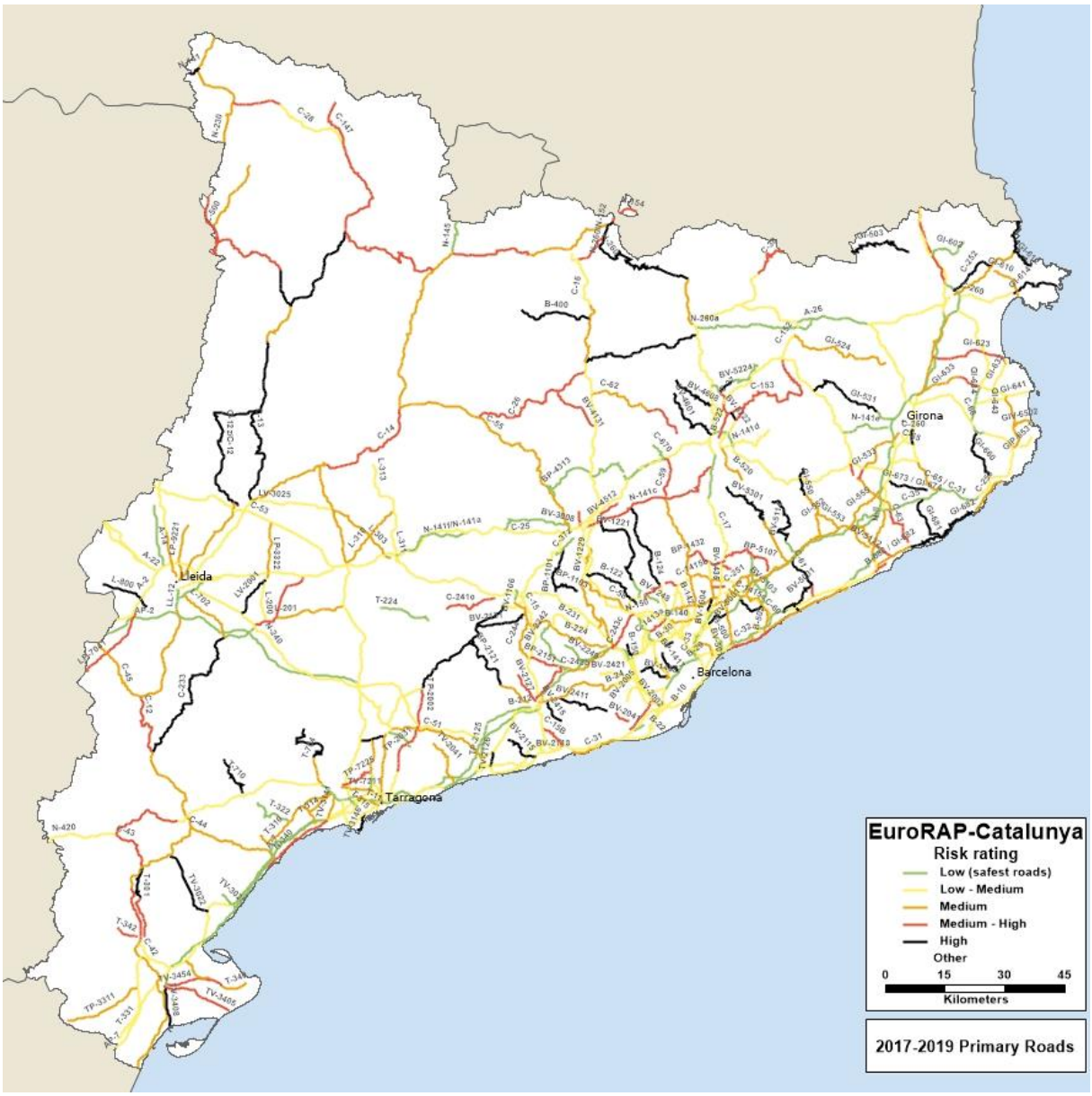
Unless otherwise stated, the maps presented are normalised for comparison between countries using "Risk Bands 2020". The rationale and methodology adopted is explained at section 8.2.1, from page 35 at:

http://resources.irap.org/Specifications/RAP-RM-2-1_Risk_Mapping_technical_specification.pdf

3 Results

3.1 Maps of individual and collective risk

3.1.1 Catalonia (Spain)- primary roads network individual risk (fatal and serious crashes per billion vehicle kilometre) with normalisation to Risk Bands 2020.

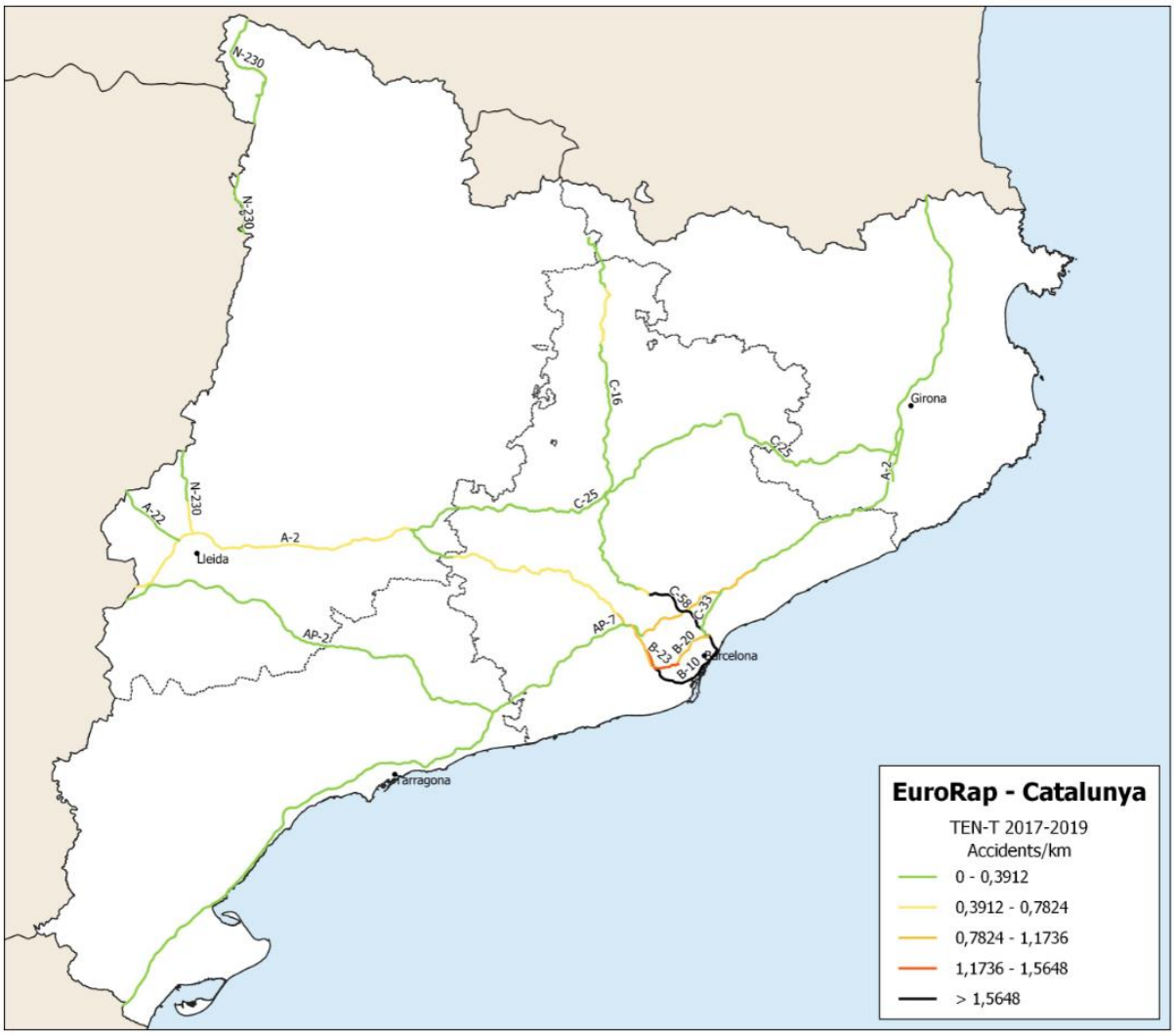


The Catalan primary roads network (xarxa bàsica) is a network of 6.300 km of interurban roads owned by the State, the Generalitat (regional government) and the provincial councils.

Source: Generalitat de Catalunya

3.1.2 Catalonia (Spain)- individual risk Core Ten-T (fatal and serious crashes per billion vehicle kilometre) Risk Bands 2020.

3.1.3 Catalonia (Spain)- Core TEN-T collective 3-years risk (fatal and serious crashes per kilometre) Risk Bands 2020



3.1.4 Catalonia TEN-T network

The EuroRAP study has been published every year in Catalonia since 2002, and it analyses more than 6,300 km of interurban roads owned by the State, the Autonomous Community and the Provincial Councils. The road network analysed by EuroRAP accounts for 53% of the total network and 90% of the Catalan road mobility. The analysis considers the number of serious and fatal crashes of the last three years (2017-2019).

For each of the sections, crash data and traffic flows were used to calculate the density of crashes (collective risk) and the risk rate (individual risk). Starting from the 2020 risk bands indicated in the TEN-T network in Catalonia with an extension of 1147km represents the 6% of total network analysed using the EURORAP methodology. The distribution of individual risk normalised by section and extension is shown in the figures below. The scaling factor used in order to normalise the Risk Bands 2020 is 4.89.

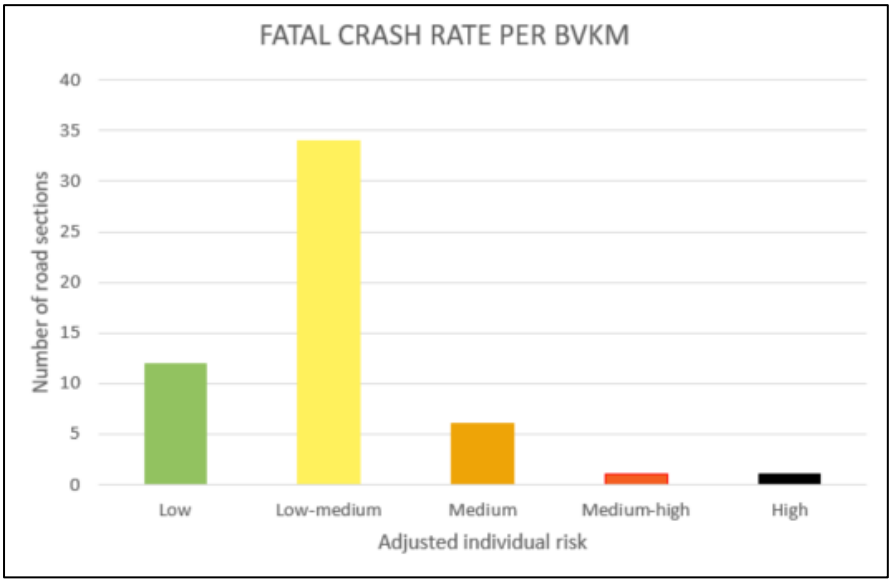


Figure 2 Individual risk distribution per section. Catalan TEN-T network

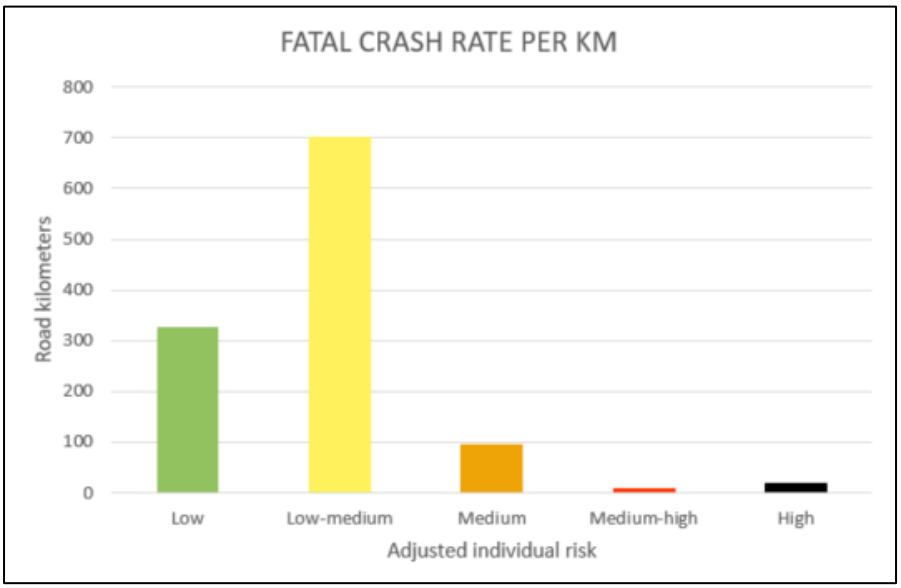


Figure 3 Individual risk distribution per km. Catalan TEN-T network

The table below shows the resume of Individual risk data. More than 60% of the Catalan TEN-T network is categorized as Low-Medium for the individual risk and only 1,5% is categorized as High.

Risk	km	%km	Sections	%Sections
Low	326	28,44%	12	22%
Low-medium	702	61,24%	34	63%
Medium	94	8,16%	6	11%
Medium-High	7	0,63%	1	2%
High	17	1,52%	1	2%
Total	1147	100,00%	54	100%

Table 1 Adjusted individual risk

The following pictures show the Collective risk distribution (3-years) for the Catalan TEN-T networks by section and kilometre. The scaling factor used in order to normalise the Risk Bands 2020 is 4.89.

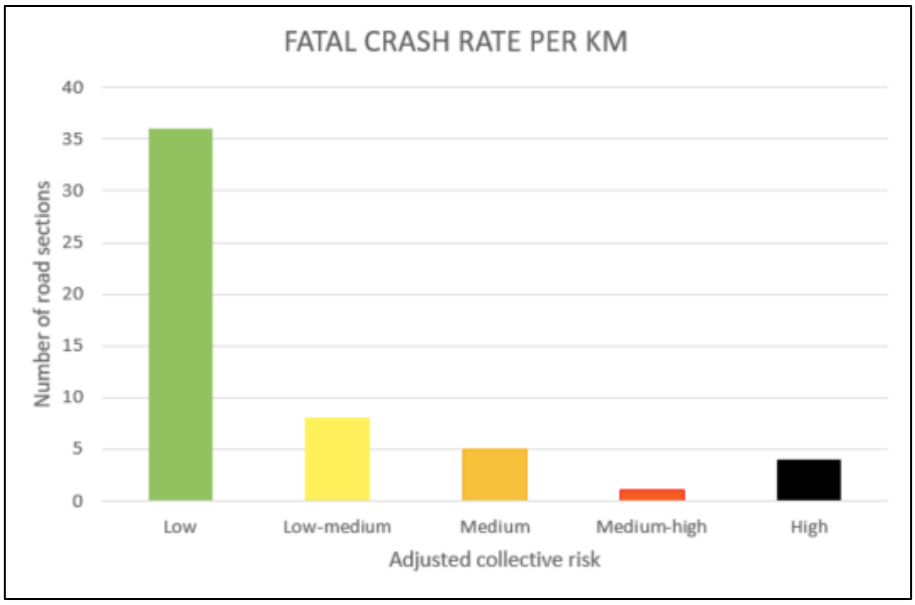


Figure 4 Collective risk distribution per section. Catalan TEN-T network

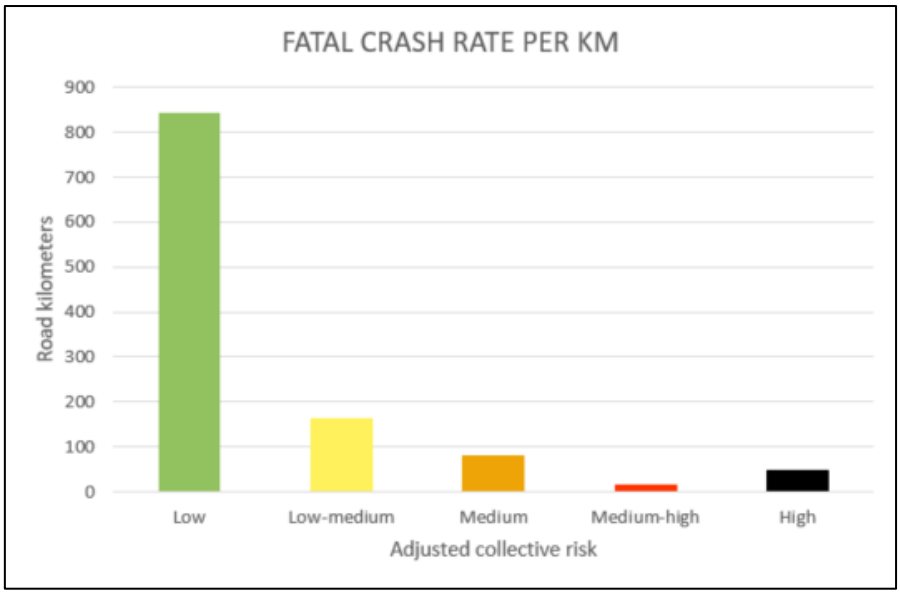


Figure 5 Collective risk distribution per kilometre. Catalan TEN-T network

Risk	km	%km	Sections	%Sections
Low	842	73,43%	36	67%
Low-medium	161	14,06%	8	15%
Medium	81	7,05%	5	9%
Medium-High	16	1,36%	1	2%
High	47	4,09%	4	7%
Total	1147	100,00%	54	100%

Table 2 Adjusted collective risk

In the Catalan TEN-T network there are more than 800 kilometres with a Low risk, which account for 73% of the network. Less than 5% of the km are categorized as High risk.

After calculating the road risks for 2017-2019 period, a performance tracking comparing with the previous period was done. The results are shown in the following graphics.

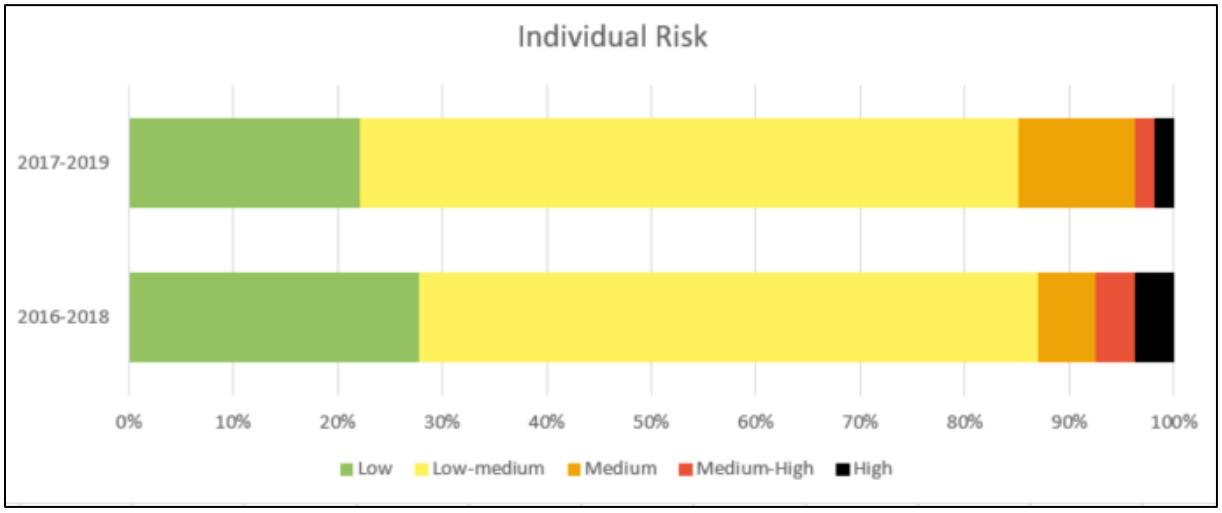


Figure 6 Individual risk comparison between the two periods

Regarding the Individual risk, the performance tracking conclusions are summarized:

- **4 road sections that were rated as Low risk in the previous period are rated now as Low Medium.** This change is due to a restriction of heavy vehicles on some primary roads that was implemented in September 2018. The increase of fatal and serious crashes occurred in 2019 on this road section and had heavy vehicles involved.
- **2 road sections that were rated as Low Medium risk are rated now as Medium.** In the previous period these roads had a Low Medium risk very close to the risk band.
- In the 2017-2019 period only one section is rated as High risk.

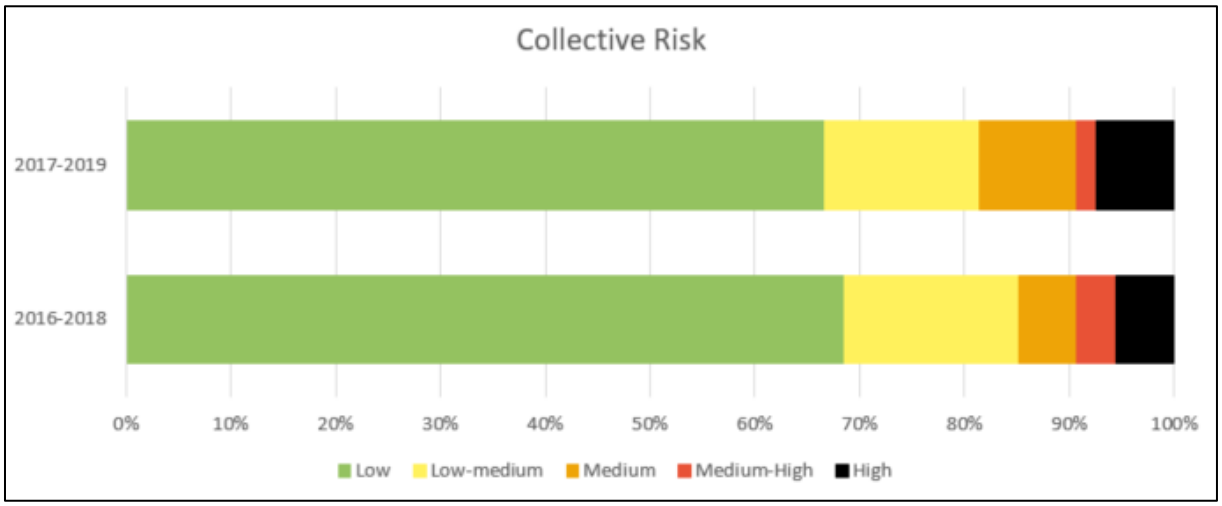


Figure 7 Collective risk comparison between the two periods

Regarding the Collective Risk, the performance tracking conclusions are summarized:

- 1 section rated as Medium High risk in the previous period is now rated as High risk. A slight Fatal and Serious crash increase (2 crashes) is causing this change in this risk band.
- The heavy vehicles restriction mentioned previously is causing most of the changes between risk bands low, low-medium and medium.

Appendix 1

Catalonia (Spain)

item	Units/Description	Data
Network description		
Current year		
Data Sources	Crash Data	Servei Català de Trànsit
	Traffic Data	Ministerio de Fomento España, Generalitat de Catalunya, Diputacions
Data period 1	year	2017
	total fatal	128
	total serious	520
	total serious and fatal	648
Data period 2	year	2018
	total fatal	140
	total serious	523
	total serious and fatal	663
Data Period 3	year	2019
	total fatal	143
	total serious	556
	total serious and fatal	699
Data period all		2017 to 2019
	total fatal	411
	total serious	1599
	total serious and fatal	2010
Scaling Factor	F&S/F	4,89

Risk Bands	Band	Collective	Individual
standard	Low	0	0
	Low-Medium	0,08	1,2
	Medium	0,16	4,9
	Medium-High	0,24	8,4
	High	0,32	14,2
Adjusted	Low	0	0
	Low-Medium	0,39	5,87
	Medium	0,78	23,96
	Medium-High	1,17	41,08
	High	1,56	69,45

References

Lawson S (2017) Analysis of changes in the rate of severe crashes for typical road infrastructure investments. Report to the European Bank for Reconstruction and Development. Road safety framework procurement (Reference 41196) consultancy services, December https://www.irap.org/2018/01/analysis-of-changes-in-the-rate-of-severe-crashes-for-typical-road-infrastructure-investments/