



SLAIN

Saving Lives Assessing and Improving
TEN-T Road Network Safety

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D1.4 Crash Risk Maps - Spain



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Executive Summary

Crash Risk Maps have been produced for Spain for state network and for the Comprehensive TEN-T.

This mapping was published previously in 2019-20 and it is therefore possible to make a comparison of the two data sets and maps over time. This report is concerned only with the data published in Spain in 2020-21 and comparison of the Spanish data with that published in 2019-20.

The maps presented show both individual and collective risk measured in terms of crashes per billion vehicle kilometre and crashes per kilometre respectively. In Spain the measure used in the Crash Risk Mapping is of fatal and serious crashes.

As before, results for Spain are being launched or released on websites, subject to local consultation and discussion, as appropriate.

An illustration is provided of how to track the safety performance of the network over time.



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 in four European countries: Croatia, Italy, Greece and Spain where about 10,000 km of mapping has been performed
- Sharing of ideas on section-specific, economically-viable crash countermeasures designed to raise infrastructure quality to achieve significant reductions in severe injuries and deaths
- Assessment of the 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 Spain 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. 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 this Deliverable (D1.4) was submitted early in 2020 as part of a combined report including D1.1-D1.5. The present report provides a supplementary data update for Spain.



2 Methodology

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

The network for the Comprehensive TEN-T in Spain has been identified and mapped. 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 Crash 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. This is the case for Spain.



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

2.2 Task 1.2: Allocate traffic data

Traffic and crash data have been supplied by partners at Dirección General de Tráfico in the Spanish government.

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

In Spain, the data related to the road crashes has been sourced by the Dirección General de Tráfico (Spanish road safety authority) and the data regarding average traffic from the Ministerio de Fomento. The data were the latest currently available (i.e. for the most recent time periods). The collected data on road crashes were disaggregated by 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 in D1.1-1.5.

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

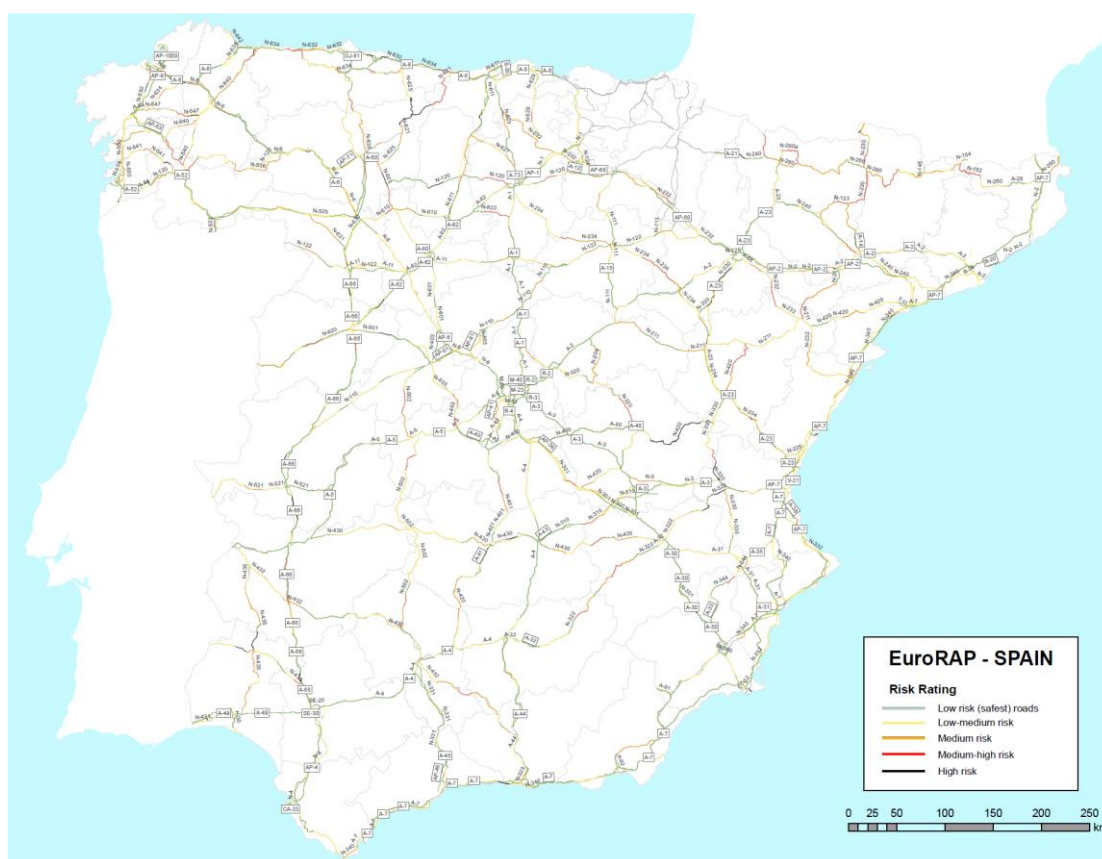


3 Results

The following pages show the latest maps of individual risk in Spain for the Spanish state road network and the Comprehensive TEN-T and collective risk for the Comprehensive TEN-T. The Spanish state road network (Red de Carreteras del Estado) is the network managed by the Spanish Ministry for Public Works and Transport. It includes 1,388 road sections, that make up a total of 25,082km. The source is Ministerio de Transportes. The TEN-T Comprehensive network has length 11,053km, comprised of 506 sections for the purpose of the mapping here. The map of state roads is provided here for visual comparison alongside the Comprehensive TEN-T. The analysis of data in this report (at 3.1.4) relates only to the Comprehensive TEN-T.

3.1 Maps of individual and collective risk

3.1.1 Spain - state road network individual risk (fatal and serious crashes per billion vehicle kilometre) without scaling factor



3.1.2 Spain –Comprehensive TEN-T network individual risk (fatal and serious crashes per billion vehicle kilometre) Risk Bands 2020 with scaling factor



Source of TEN-T network roads: TENEC portal: https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/maps_upload/annexes/annex1/Annex%20-%20VOL%2017.pdf



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



3.1.4 Spanish TEN-T network

Analysis has been made of the Comprehensive TEN-T in Spain, comprising 506 road sections, that make up a total of 11,053km of the State Road Network managed by the Spanish Ministry for Public Works and Transport. The analysis considers the number of serious and fatal accidents of the last three years (2017-2019).

For each of the sections, crash data and traffic flows were used to calculate the risk rate (individual risk) and the density of accidents (collective risk).

The analysis referred to here uses EuroRAP’s Risk Bands 2020, normalised with the other countries participating in the SLAIN Crash Risk Mapping with a scaling factor of 3.37.

The distribution of individual risk by both number of road section frequency and by number of kilometres is shown in Figures 1 and 2.

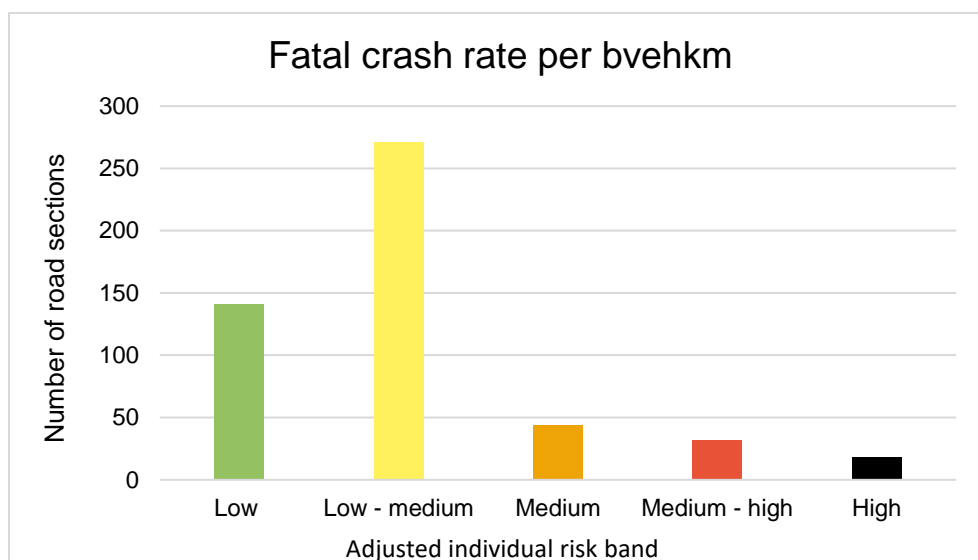


Figure 2 Individual risk distribution per section. Spanish Comprehensive TEN-T network

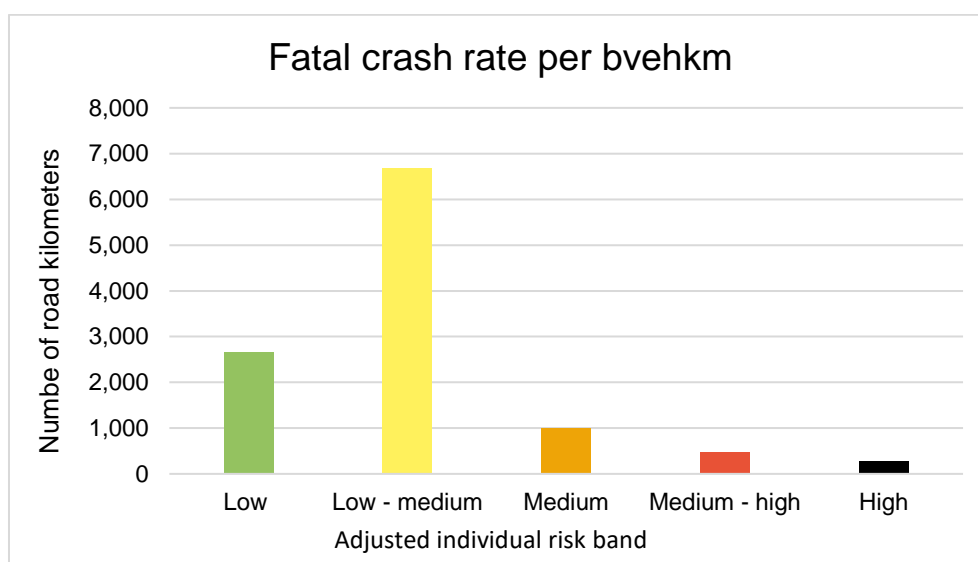


Figure 3 Individual risk distribution per kilometre. Spanish Comprehensive TEN-T network

Table 1 shows the summary of individual risk data. Around 84% of the Spanish TEN-T network length is categorized as Low or Low-Medium individual risk and only 6% is categorized as Medium-high or High. For road sections, this is 10% of the road section categorised as Medium-high or High risk, while 82% of the road section are categorized as Low-medium or low risk.

Risk	km	% km	Sections	% Sections
Low	2.653	24%	141	28%
Low - medium	6.678	60%	271	54%
Medium	984	9%	44	9%
Medium - high	465	4%	32	6%
High	273	2%	18	4%
Total	11.053	100%	506	100%

Table 1 Adjusted individual risk

The following figures display the collective risk distribution (3-years) for the Spanish TEN-T network by section and by kilometre.

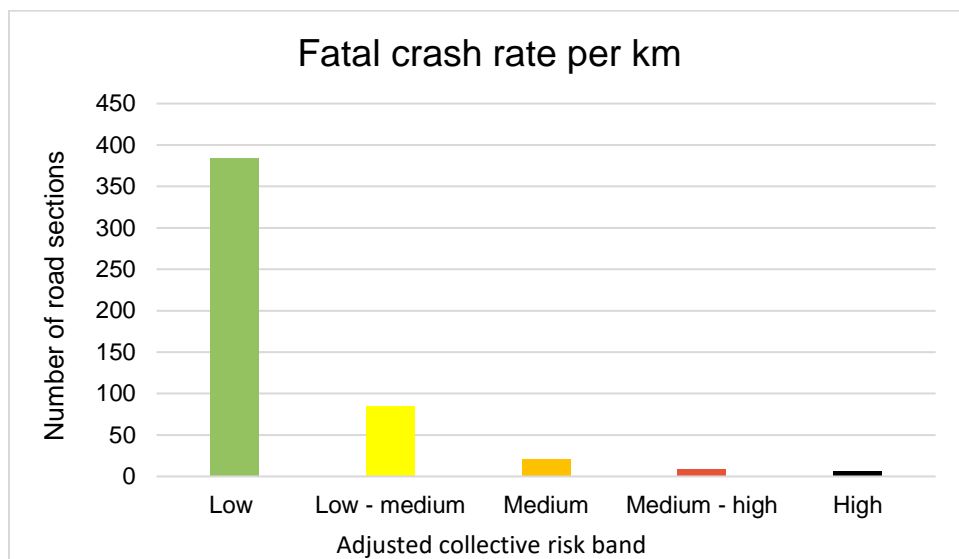


Figure 4 Collective risk distribution per section. Spanish Comprehensive TEN-T network

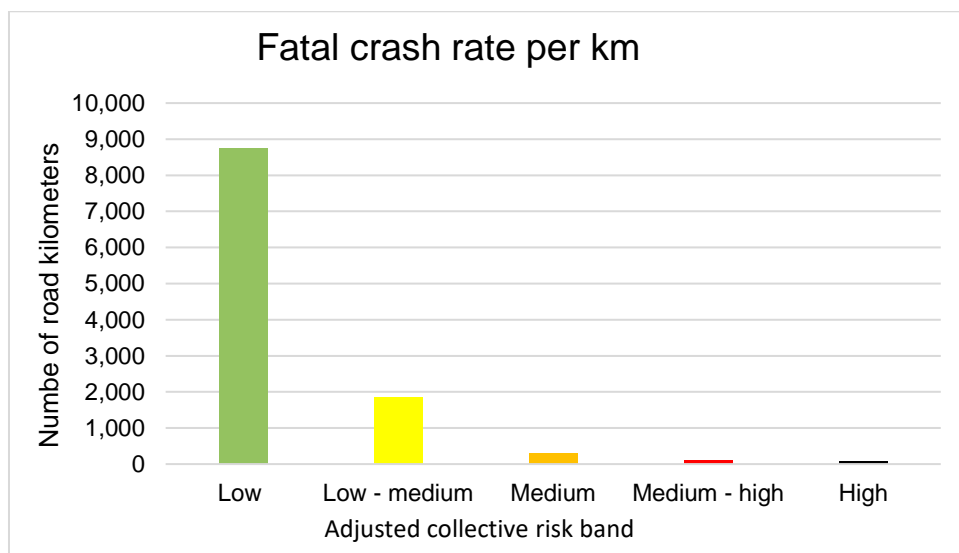


Figure 5 Collective risk distribution per kilometre. Spanish Comprehensive TEN-T network

Risk	km	%km	Sections	% Sections
Low	8.740	79,1%	384	76%
Low - medium	1.842	16,7%	85	17%
Medium	293	2,7%	21	4%
Medium - high	111	1,0%	9	2%
High	67	0,6%	7	1%
Total	11.053	100%	506	100%

Table 2 Adjusted collective risk. Spanish Comprehensive TEN-T Network



In the Spanish TEN-T network there are more than 8.700 kilometers with a Low risk, which accounts for 79% of the network. Less than 1% of the km are categorized as High risk, which count for 1% of the road sections. In total, 10.582km of the 11.054 (96%) are categorised as Low-Medium or Low collective risk.

After calculating the road risks for the 2017-2019 period, a performance tracking comparing with the previous period (2016-18) was done. The results are shown in Figure 5.

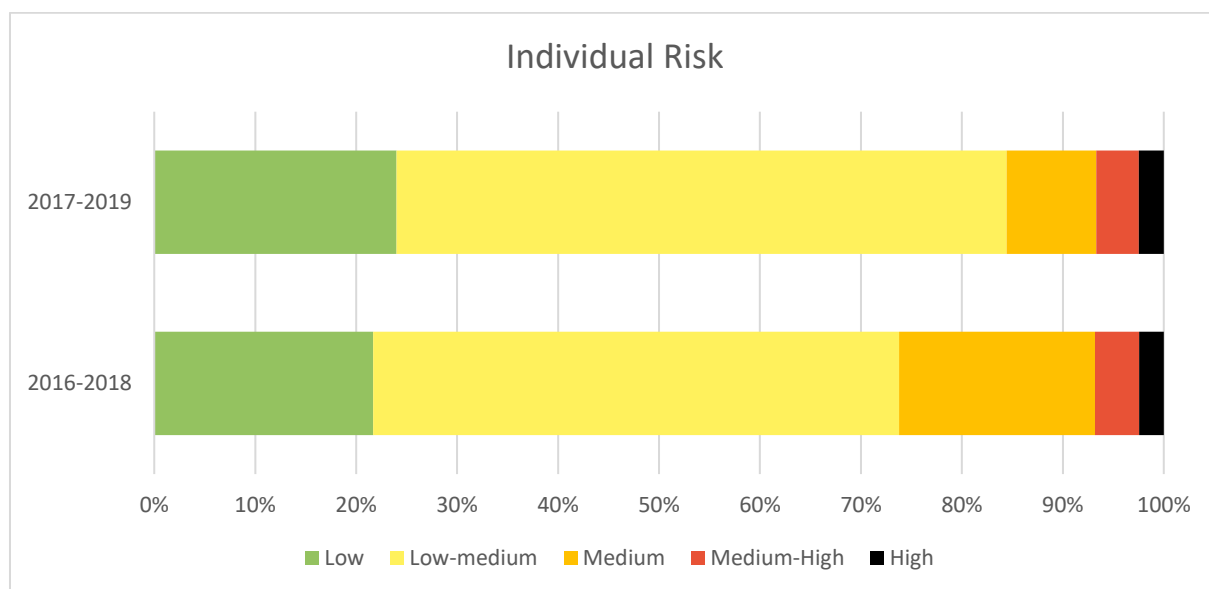


Figure 6 Individual risk comparison between the two periods on the Comprehensive TEN-T in Spain

Regarding the individual risk, the performance tracking conclusions are:

- The overall number of sections categorized as High Risk remains at 18 section (4% of the section) but the number of kilometres goes up from 269 km in the last period to 283. This is due to 1 section that goes from High to Medium-High and another section that goes from Medium-High to High. This change is due to slight changes in the estimated daily traffic flows rather than to crash numbers.
- The percentage of kilometres categorized as low risk goes up from 22% to 24% of the network.
- The number of kilometres categorized as Low-Medium increases from 5.761km to 6,678km, which is 60% of the network length.
- The number of kilometres categorized as High or Medium-High remains stable, with a slight decrease in the kilometres categorised as such.
- The length categorized as Medium risk drops substantially with increases in the Low-Medium and Low risk bands.



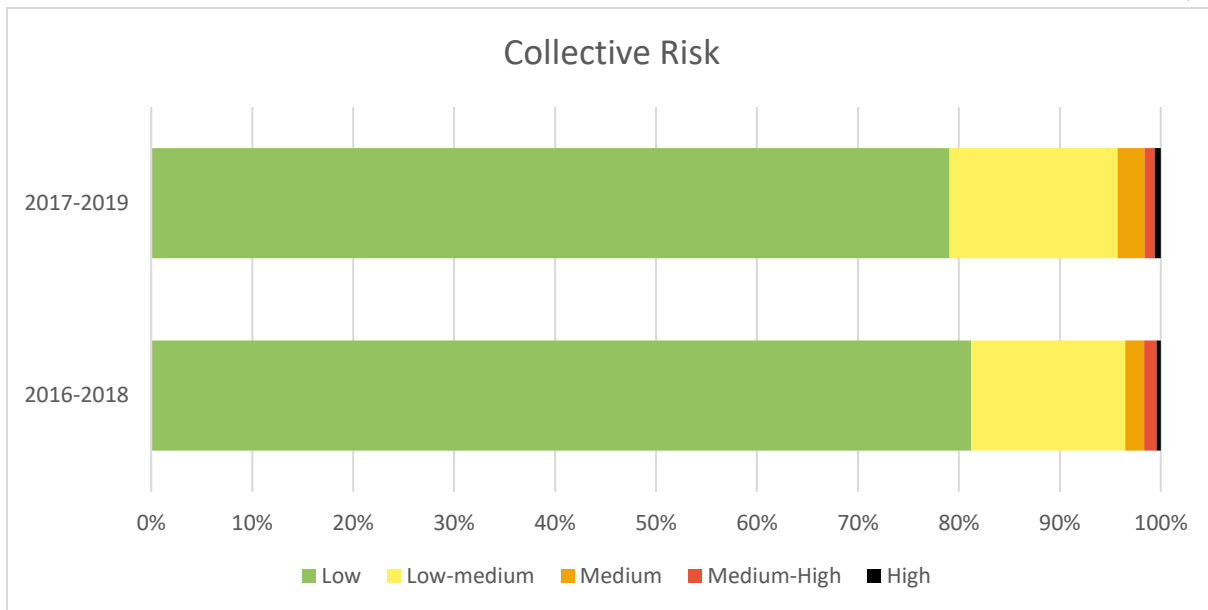


Figure 7 Collective risk comparison between the two periods on the Comprehensive TEN-T in Spain

Regarding the collective Risk, the performance tracking conclusions are:

- The overall collective risk distribution remains relatively constant from one period to another, with changes showing a slight increase in the higher risk bands and a decrease in the Low-risk band.
- One section rated as Medium-High risk in the previous period is now rated as High risk.
- The total number of km rated as low risk decreases from 8.975 to 8.740km (from 81% to 79%).
- The total length rated as Medium Risk increases from 1.9% to 2.7% while the kilometreage rated as Medium-High decreases slightly.



4 Conclusions

Updated Crash Risk Rate maps have been produced for the relevant networks including the Comprehensive TEN-T in Spain, supplementing those produced in accordance with the deliverables required in Activity 1, namely D1.3 for Spain.

Detailed description of the data has been provided. Results are being launched or released on websites, subject to local consultation and discussion, as appropriate.

The maps:

- show the risk to individual road-users of being involved in crashes as they move from one road section to another
- provide guidance for operators on where there has been a concentration of crashes
- can be used to show where crash rates deviate from the norm expected for roads of a particular type
- (and the data used to produce the maps) show the potential to track performance of the network over time
- have regional applications (such as they have been in other parts of SLAIN in Catalonia) in showing how to compare risk on the major road network with risk on adjacent roads
- provide the opportunity to track the safety performance of the network over time.

Appendix 1 – Country meta-analysis - Spain

item	Units/Description	Data	
Network description			
Current year			
Data Sources	Crash Data	DGT	
	Traffic Data	Ministerio de Transportes, Movilidad y agenda urbana	
Data period 1	year	2017	
	total fatal	351	
	total serious	961	
	total serious and fatal	1,312	
Data period 2	year	2018	
	total fatal	423	
	total serious	875	
	total serious and fatal	1,298	
Data Period 3	year	2019	
	total fatal	359	
	total serious	847	
	total serious and fatal	1,206	
Data period all		2017 to 2019	
	total fatal	1,133	
	total serious	2,683	
	total serious and fatal	3,816	
Scaling Factor	F&S/F	3,37	
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	0,2696	4,044
	Medium	0,5392	16,513
	Medium-High	,8088	28,306
	High	1,0784	47,854

