Unveiling road safety insights in Catalonia

Introduction :

In this comprehensive analysis, we delve into the dataset spanning 2010-2021 to decode critical insights and offer actionable recommendations for enhancing road safety in Catalonia.

1) General trends

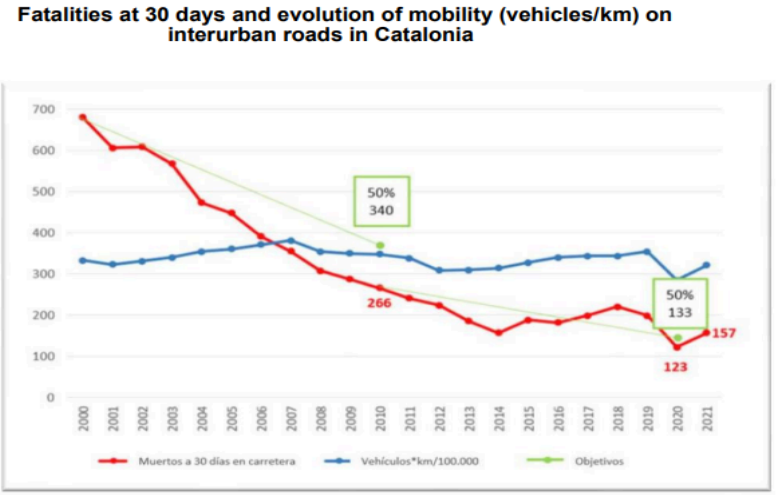
Key findings :

- Traffic accidents, fatalities, and serious injuries have shown a general increasing trend, with fluctuations over the years.

In the previous 10 years, deaths on the Catalan road network have been reduced by more than 50%: in 2010 they lost 266 people died in traffic accidents while, in 2020, there were 123 fatalities, according to data from the Servei Català de Trànsit.

This success has only been apparent, since it is the result of reduced mobility due to the COVID-19 pandemic. When mobility has recovered, the number of fatalities has increased again, but without reaching 2019 levels. For example, between 2019 and 2021, there have been 17 serious and fatal accidents on a 7.1-kilometre-long section.

Data visualization :



Red line : Deaths within 30 days on the road
Blue line : Vehicles*km/100 000
Green line : Goals

- ![Yearly Trends](link-to-yearly-trends-chart) - A line chart illustrating the yearly trends in accidents, fatalities, and serious injuries.

2) Accident characteristics

Severe accidents characteristics :

Accidents are often more severe on highways and during night time. Higher speed limits are associated with an increase in the severity of accidents.

Conventional highways (with a single lane in each direction) accumulate almost all of the sections with "very high", "high" and "medium" risk. On the other hand, on split roads (highways and motorways) practically all the sections are of "low" or "very low" risk.

Data visualizations :

• La Arrabassada once again stands as the section with the highest risk of accidents in Catalonia. In 88% of accidents with fatalities and serious injuries (17 in the last three years) on this road, at least one motorcycle is involved.

In Catalonia, 25% of the road network analyzed presents a "high" or "very high" risk of serious or fatal accident, which represents four percentage points less than the previous year, which represents a significant part !

On the other hand, the kilometers with "very low" and "low" risk have decreased slightly. "very high" (2%). - Girona is the district where the km with "high" and "very high" risk drop the most. They have gone from being 55% to 53%, so that the sections with a 'medium' risk index have grown significantly (from 16% to 22%).

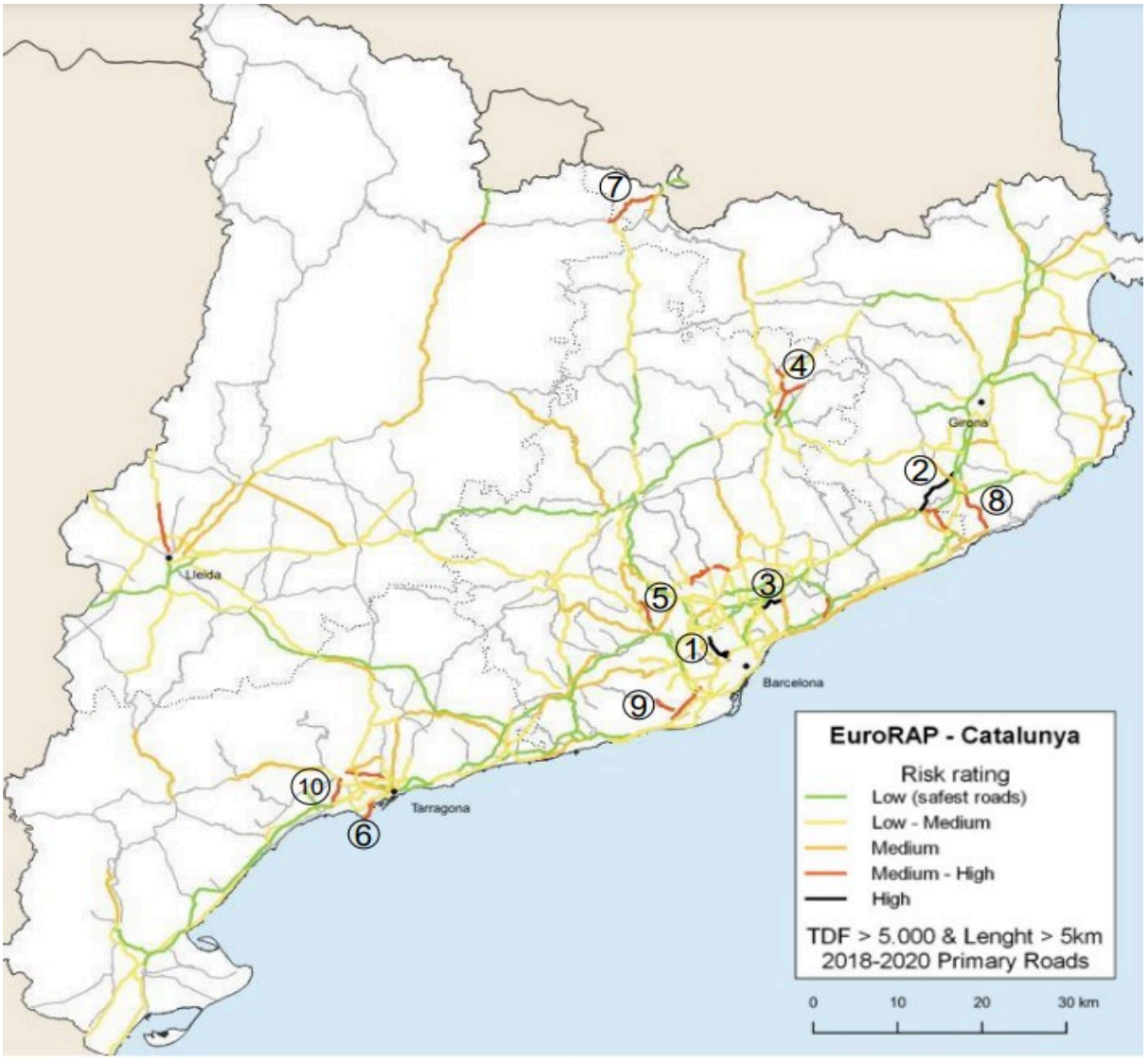
3) Geographical insights

Accident hotspots :

Barcelona and its surrounding areas exhibit the highest incidence of traffic accidents. This means that the correlation between accident rates and population density is evident.

For the seventh consecutive year, the C-58 between Barcelona and Cerdanyola is the stretch of road with the most serious and fatal accidents per kilometer in Catalonia for all vehicles. As mentioned earlier, between 2019 and 2021, there have been 17 serious and fatal accidents on a 7.1-kilometre-long section.

Data visualization :



The 10 sections with the highest risk of serious or fatal accident in Catalonia (2019-2021)

Carretera	Inicio de tramo	Final de tramo	Long (km)	IMD	Tipo de vía	Demarcación	Mediana Acc.MiFG	Riesgo
BP-1417	Barcelona (X B-20)	St. Cugat del Vallès (X BV-1462)	11,4	7.091	Convencional	Barcelona	5,7	Muy alto
GI-555	Sils (X N-II)	Massanes (X C-35)	14,2	5.123	Convencional	Girona	3,3	Muy alto
BV-5001	Martorelles (X B-500, X BV-5006)	Vilanova del Vallès (X BP-5002)	6,5	9.958	Convencional	Barcelona	2,3	Muy alto
BV-5224	Manlleu (X B-522)	Torelló (X BV-5225)	6,3	6.963	Convencional	Barcelona	1,3	Alto
BV-1201	Olesa de Montserrat (X B-120)	Castellbisbal (X C-243c)	8,3	6.573	Convencional	Barcelona	1,3	Alto
TV-3146	Port de Tarragona (X C-31B)	Far de Salou	5,4	5.239	Convencional	Tarragona	0,7	Alto
N-260	X N-152 (La Cerdanya)	X N-1411	14,0	6.125	Convencional	Girona	2,0	Alto
C-63	Lloret de Mar (X GI-680)	Vidreres (X C-35)	11,3	11.693	Convencional	Girona	3,0	Alto
BV-2041	Gavà (X av. Joan Carles I)	Begues (X BV-2411)	6,3	9.396	Convencional	Barcelona	1,3	Alto
TV-3141	Cambrils (X N-340)	Reus (X T-316)	7,3	8.056	Convencional	Tarragona	1,3	Alto

In grey, sections already present in the previous edition.
Median. Acc. MiFG= Annual average of accidents with deaths and serious injuries

4) Yearly trends

Changing patterns over time :

A gradual decrease in accidents, fatalities, and serious injuries is observed.

In this sense, in 2021, the total number of accidents with motorcycles or mopeds involved reached 1,807 (in 2005, when they began to be counted, there were 873). Of these more than 1,800 accidents, 224 are with deaths and serious injuries (in 2005 there were 451).

In other words, despite the fact that motorcycle accidents have increased substantially, fatalities or serious casualties have decreased since 2005.

Data visualization :

	2018-2020	Diferencia	2019-2021
Media Accidentes con Muertos y Heridos Graves	599	-8,7%	547
Movilidad (vehículos*km)	30,5	-3,0%	29,6
Índice de Riesgo	19,6	-6,1%	18,5

Datos: Red EURORAP

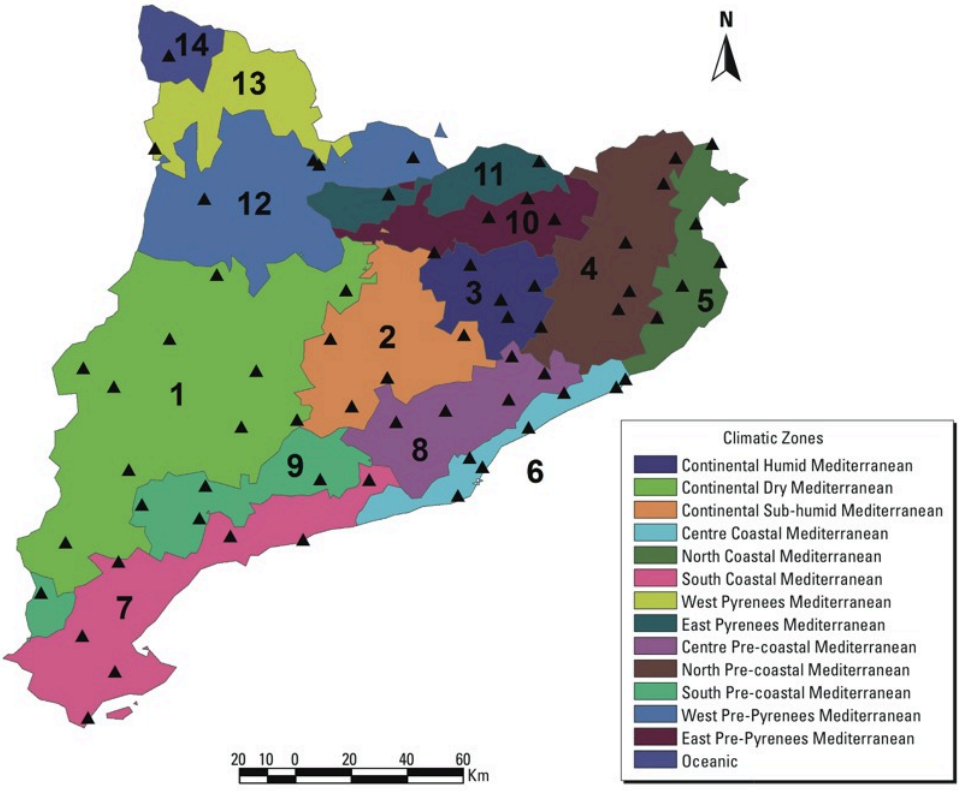
Day and time patterns :

Obviously, most accidents occur on weekdays, with a notable increase during rush hours. Weekends see a shift in accident patterns, with increased occurrences in the evening.

5) Environmental impact

Weather conditions influence :

Adverse weather conditions, poor visibility correlate with increased accident likelihood. Severity tends to be higher in hot weather conditions. Indeed, the more the temperature increases, the more accidents happen.



«…Motor vehicle crashes were assigned the minimum and maximum temperature and precipitation values recorded on the date of the crash at the closest weather station within the same climatic region.

Then, within each climatic region, traffic crashes were aggregated by date to obtain the daily number of motor vehicle crashes and the daily number of vehicle crashes with driver performance…This adjustment was expected to provide a better control

for traffic volume of the day, as the resulting RR (Relative Risk) of temperature could be interpreted as the increase in risk of crashes with driver performance–associated factors for each 1°C increase in temperature on days that had the same number of vehicle crashes without driver performance».

6) Road and traffic features

Road features impact :

Speed limits influence accident severity, with higher limits leading to more severe accidents. For instance, accidents on highways tend to be more severe.

The section of the GI-555 highway between Sils and Massanes has gone from third place in the last edition to second with the highest risk in this year's edition.

Furthermore, as we said earlier, conventional highways (with a single lane in each direction) accumulate almost all of the sections with "very high", "high" and "medium" risk.

Data visualization :

The 10 sections with the highest risk of serious or fatal accident in Catalonia (2019-2021)

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7) Vehicle types and accident severity

Vehicle involvement impact :

Involvement of heavy vehicles correlates with more severe accidents. However, as we have seen previously, motorcycles are associated with a higher likelihood of severe accidents. The data linked to Barcelona shows it (which can be extrapolated).

Data visualizations :

Sections with more heavy vehicle accidents per km (2019-2021)

Carretera	Inicio de tramo	Final de tramo	Long (km)	IMD	Tipo de vía	Demarcación	Med. Acc. pesados MiFG/km	% Acc. pesados / total
A-2	Enllaç amb AP-2	Enllaç B-20, B-10, C-32	6,6	115.981	Desdoblada	Barcelona	0,15	25%
A-2	Bellpuig (X N-lla)	Cervera (enllaç C-25)	21,5	28.728	Desdoblada	Lleida	0,11	64%
B-502	Vilassar de Mar (X N-II)	Argentona (X C-1415c)	6,3	7.568	Local	Barcelona	0,11	67%
A-2	Panadella (enllaç B-100)	Jorba (X N-lla)	13,2	25.877	Desdoblada	Barcelona	0,10	100%
AP-7	Enllaç C-60	Enllaç Papiol	34,5	96.985	A. Peatge	Barcelona	0,10	43%
TV-3141	Cambrils (X N-340)	Reus (X T-316)	7,3	8.056	Comarcal	Tarragona	0,09	50%
C-63	Lloret de Mar (X GI-680)	Vidreres (X C-35)	11,3	11.693	Básica	Girona	0,09	33%
N-340	Inici variant Vilafranca	Final variant Vilafranca	11,3	23.456	Básica	Barcelona	0,09	33%
B-23/AP-2	Barcelona	Enllaç Papiol	15,6	78.237	Desdoblada	Barcelona	0,09	29%
A-2	Inici variant Lleida	Final variant Lleida (X L-11)	33,4	24.200	Desdoblada	Lleida	0,08	40%

In grey, sections already present in the previous edition.

Median. Acc. MiFG= Annual average of fatal and serious heavy vehicle accidents divided by the length of the section.

Sections with more motorcycle and moped accidents per km (2019-2021)

Carretera	Inicio de tramo	Final de tramo	Long (km)	IMD	Tipo de vía	Demarcación	Medl. Acc. Moto MiFG/km	% Acc. Moto/total
B-10	Nus de la Trinitat	Enllaç B-20, A-2, C-32	19,8	88.886	Desdoblada	Barcelona	0,67	93%
C-58	Barcelona (X C-33, X C-17)	Cerdanyola del Vallès(X A-P7)	7,1	126.984	Desdoblada	Barcelona	0,66	82%
A-2	Enllaç amb AP-2	Enllaç B-20, B-10, C-32	6,6	115.981	Desdoblada	Barcelona	0,50	83%
BP-1417	Barcelona (X B-20)	St. Cugat del Vallès (X BV-1462)	11,4	7.091	Comarcal	Barcelona	0,44	88%
B-20	Esplugues (X B-23)	Nus de la Trinitat	12,3	116.805	Desdoblada	Barcelona	0,43	84%
C-58	Cerdanyola del Vallès(X A-P7)	Terrassa (X C-16)	13,4	81.115	Desdoblada	Barcelona	0,35	64%
C-32 (inc. B20)	Sitges (X C-246)	Esplugues (X B-23)	20,6	86.842	Desdoblada	Barcelona	0,34	84%
C-31	El Prat del Llobregat (X C-32B, X C-31C)	L'Hospitalet (Gran Via, límit TM Barcelona)	7,4	68.306	Desdoblada	Barcelona	0,32	78%
N-II	Montgat, rotonda del Mil·lenI (B-20)	Enllaç Mataró sud amb C-32	11,7	25.406	Local	Barcelona	0,28	63%
N-II	Enllaç Mataró sud amb C-32	Enllaç Mataró nord amb C-32	6,2	21.315	Local	Barcelona	0,27	71%

In grey, sections already present in the previous edition.

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*The section of the C-58 does not include the BUS-HOV lane

Conclusion :

Examining Catalonia's road safety data from 2010 to 2021 provides essential insights. Despite a general uptrend in accidents, there's a significant reduction in deaths over the past decade, partly influenced by reduced mobility during the COVID-19 pandemic. Post-pandemic fatalities increased but remained below 2019 levels.

Recent years show a positive shift with decreasing accidents, particularly in motorcycle-related incidents. Catalonia exhibits hotspots, and specific road sections witness changes in risk levels.

Accidents peak on weekdays during rush hours, with weekends seeing more evening occurrences. Adverse weather correlates with higher accident likelihood and severity.

Higher speed limits contribute to more severe accidents. Involvement of heavy vehicles correlates with severe accidents, while motorcycles exhibit a higher likelihood.

Here are different key points that might help :

Technology integration :

Widespread adoption of advanced vehicle safety technology, such as automated braking and lane departure warning systems, promises a decline in accidents.

Smart infrastructure :

Enhanced road safety is expected through the implementation of smart infrastructure, including intelligent traffic management systems and upgraded signage.

Public awareness and education :

Ongoing campaigns and driver education efforts are anticipated to foster safer driving habits and contribute to lower accident rates.

Data-driven decision making :

Increasing reliance on data analytics and artificial intelligence is foreseen for targeted interventions, ensuring proactive road safety measures.

Sustainable transport initiatives :

Investment in sustainable transport modes, like cycling and public transit, aims to alleviate congestion and reduce accidents.

Regulatory changes :

Anticipation of regulatory shifts aligning with evolving road safety priorities.

Collaboration and research :

Ongoing partnerships among government, researchers, and technology providers are expected to yield innovative solutions and a deeper understanding of emerging challenges.

Climate adaptation measures :

Crucial measures to address the impact of climate change on road conditions for sustained road safety.

Community engagement :

Active community involvement in safety initiatives, including neighborhood watch programs, is expected to contribute to a safer road environment.

Adaptation to urbanization :

Essential adjustments to road infrastructure to accommodate evolving traffic patterns and urban density.

In an inherently uncertain future, a proactive approach embracing technology, regulation, and societal engagement holds the potential for enhanced road safety. Continuous evaluation and adaptation will be pivotal in addressing evolving challenges and ensuring the well-being of all road users in Catalonia !

This summary underscores the evolving road safety dynamics, emphasizing the need for targeted interventions and policies, especially considering the shifts observed in the late 2010s and early 2020s.

Appendices :

- https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1409223
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- https://irap.org/2023/01/21-years-of-performance-tracking-catalonias-latest-risk-mapping-results-released/

- file:///C:/Users/billy/Downloads/2022_EuroRAP_Catalonia_Risk_Mapping_Results_RACC_Press_Release.pdf