



Transport Research Arena (TRA) Conference

EU countries' ranking in different road crash types  
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**Abstract**

Over the period 2010–2020, the European Union achieved a 37% decrease of road fatalities thanks to various road safety actions, along with COVID-19 confinement policies. However, the EU target for halving road fatalities by 2020, compared to the 2010 level was not met. The objective of this research is to explore the different ranking of EU countries in terms of road safety performance by examining different road crash types (i.e. transport mode, type of area, etc.), in order to better highlight the road safety problems on which countries should emphasize. Road crash data derived from the EC CARE database and population data from Eurostat for 2019 were analysed at different disaggregation levels. The results of the analysis reveal hidden road safety problems, allowing authorities to devise more addressed national road safety strategies and take the appropriate measures per country.

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*Keywords:* road safety performance; road fatalities; crash types; disaggregate data; European Union.

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**1. Introduction**

Road traffic injuries have been a major public health issue nowadays, accounting for approximately 1.35 million deaths every year. Globally, road crashes are the 8<sup>th</sup> leading death cause of all ages and the 1<sup>st</sup> leading death cause among children and young people aged 5–29 (WHO, 2018). On the way to Vision Zero, the ambitious strategy of eliminating all road deaths in 2050, the European Commission set an intermediate goal to halve road fatalities by 2020, compared to the 2010 level. Over this period, the various road safety actions resulted in a 37% drop of road fatal injuries in the European Union (EU) (ETSC, 2021). Nevertheless, lower traffic volumes due to the Covid-19 pandemic had a clear impact on the major drop of road fatalities in 2020.

Despite the outstanding progress, EU road safety strategies failed to accomplish the long-term goal for the period 2010–2020. The different demographic and geographic conditions, behavioral characteristics and modal shares of the

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European countries require diverse and more targeted measures per country for the period 2020–2030, as EU set a new long-term target to halve road deaths and serious injuries by 2030 (European Commission, 2018). A pan-European inspection is commonly arisen from the annual overall comparisons of national performances in terms of road crash fatalities per population. However, comparing total road fatalities per population only gives a general overview of the countries' road safety level, while when examining road fatalities at different disaggregation levels, the picture may differ significantly. On that purpose, a more thorough overview of road safety performance of the EU countries is proposed through the assessment of different road crash types (e.g. by transport mode, type of area, number of vehicles involved in a crash, etc.), in order to better highlight the road safety problems on which countries should emphasize.

The objective of the current research is to investigate how the ranking of road safety performance of EU countries changes when examining different road crash types. More specifically, road crash fatality data from the European Commission CARE database and population data from Eurostat for the 27 EU countries for the latest available year (i.e. 2019) were analyzed at different disaggregation levels. The results of the current analysis reveal hidden road safety problems, allowing authorities to devise more addressed national road safety strategies and take appropriate measures per country.

## 2. Overall road safety performance

In 2020, 18,836 persons were killed in road crashes in the EU countries, almost 11,000 fewer recorded deaths compared to 2010, due to the various road safety actions and the pandemic restrictions in 2020 (European Commission, 2021). The geographical depiction reveals a lower mortality in North Europe compared to the South and in Western countries compared to the Eastern ones. In 2020, Sweden ranks first with 18 road fatalities per million population and Romania last with 85, while the EU average is 42 fatalities per million population (67 in 2010). According to Figure 1, over the period 2010–2020, all EU Member States improved their road safety performance, but Greece was the only one that achieved the target of halving road fatalities in 2020 compared to 2010, by recording a reduction of 54%. Twelve countries had a reduction above the EU average (37%), with Spain (45%), Croatia (44%), Portugal (43%), Slovenia (42%) and Italy (42%) recording among the best performances.

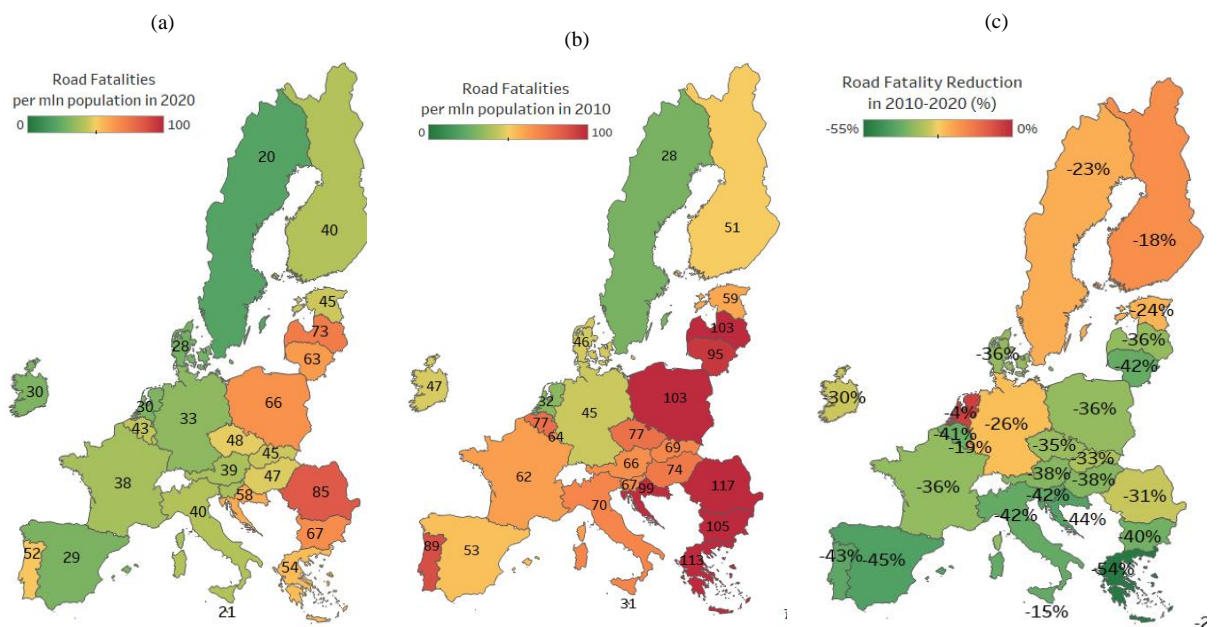


Fig. 1. (a) Road fatalities per million population, 2020;  
 (b) Road fatalities per million population, 2010;  
 (c) Road fatality reduction, 2010–2020.

### 3. Road safety performance by crash type

#### 3.1. Road safety performance by transport mode

Exposure data are often used in transportation and road safety analysis to compare safety performances among different units, populations or countries. More specifically, exposure data are measured as the number of road casualties divided by the amount of exposure over a time period (Hakkert and Braimaster, 2002; Hauer, 1995). Hence, population data from the Eurostat were used as exposure data in the following figures, since there is no reliable data available about vehicle kilometers or person kilometers travelled for all the EU countries. 2019 was the comparison year for all countries, except for Malta and Ireland, for which the latest available year was 2018 and 2016, respectively.

With regards to the transport mode, Figure 2 shows the diverse road fatality rankings among the 27 EU countries. Overall, in 2019, the majority of road fatalities occurred in passenger cars, ranging from 10.1 fatalities per million population in Sweden to 49.7 deaths per million population in Bulgaria, with an EU average of 22.6. Regarding powered two-wheelers (PTWs), the EU average was 9.3 fatalities per population, while the respective ratio for pedestrians was 10.4. Bicycles display fewer road fatalities compared to the other transport modes, with an EU average of 4.6 and a range between 0 to 10.2 fatalities per population among the countries, which is mainly explained by the lower bicycle traffic volumes compared to other means of transport.

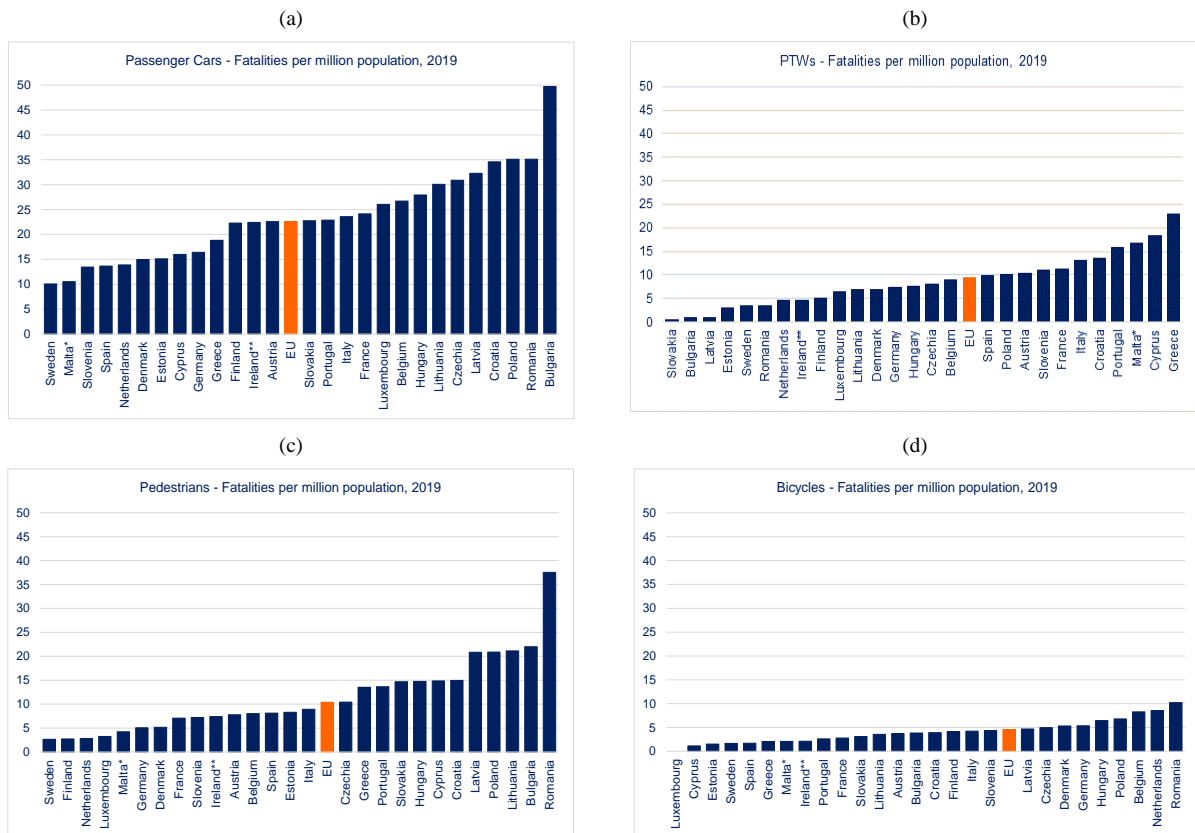


Fig. 2. Fatalities per million population, 2019: (a) Passenger Cars, (b) Power Two Wheelers, (c) Pedestrians, (d) Bicycles. (\*2018 Malta, \*\*2016 Ireland)

Northern European countries take in general the lead in all transport modes, showing a better road safety performance in terms of road fatalities per population, with an exception in cyclists, probably because of the increased bicycle use in these countries compared to the Southern countries. On the other hand, the Mediterranean countries

present worse road safety performance regarding PTWs, with Italy, Croatia, Portugal, Malta, Cyprus and Greece being ranked last among the EU countries. The respective fatality rates range between 13.1 and 23.0 fatalities per million population. Concerning the pedestrians, the Eastern EU countries (Latvia, Poland, Lithuania, Bulgaria and Romania) demonstrate higher fatality rates, from 20.8 to 37.5 deaths per population, which is 2 to 3.6 times higher than the respective EU average.

3.2. Road safety performance by area type

As far as area type is concerned, in 2019, 19.8 fatalities per population occurred in crashes inside built-up areas in the EU, while 31.1 fatalities per million population occurred outside built-up areas. The Eastern and Southern European countries, i.e. Latvia, Italy, Hungary, Malta, Poland, Lithuania, Bulgaria, Greece, Cyprus, Portugal, Croatia and Romania, demonstrate higher number of fatalities inside built-up areas, up to 62.5 deaths per population. Increased casualties in cities usually imply low road infrastructure development and decreased use of public transport. On the contrary, central Europe displays higher number of fatalities outside built-up areas. According to Figure 3, motorways, a sub-category of outside built-up areas, proved to be the safest road type in the EU, with road fatality rates ranging from 1.1 (Finland) to 10.1 (Belgium) deaths per population, and an EU average of 4.4. Nevertheless, Portugal, Slovenia, Spain and Belgium presented increased fatality rates on motorways, from 6.5 to 10.1 deaths per population. It should be noted that there are no motorways in Latvia, Estonia and Malta and thus these countries are not depicted in Figure 3.c.

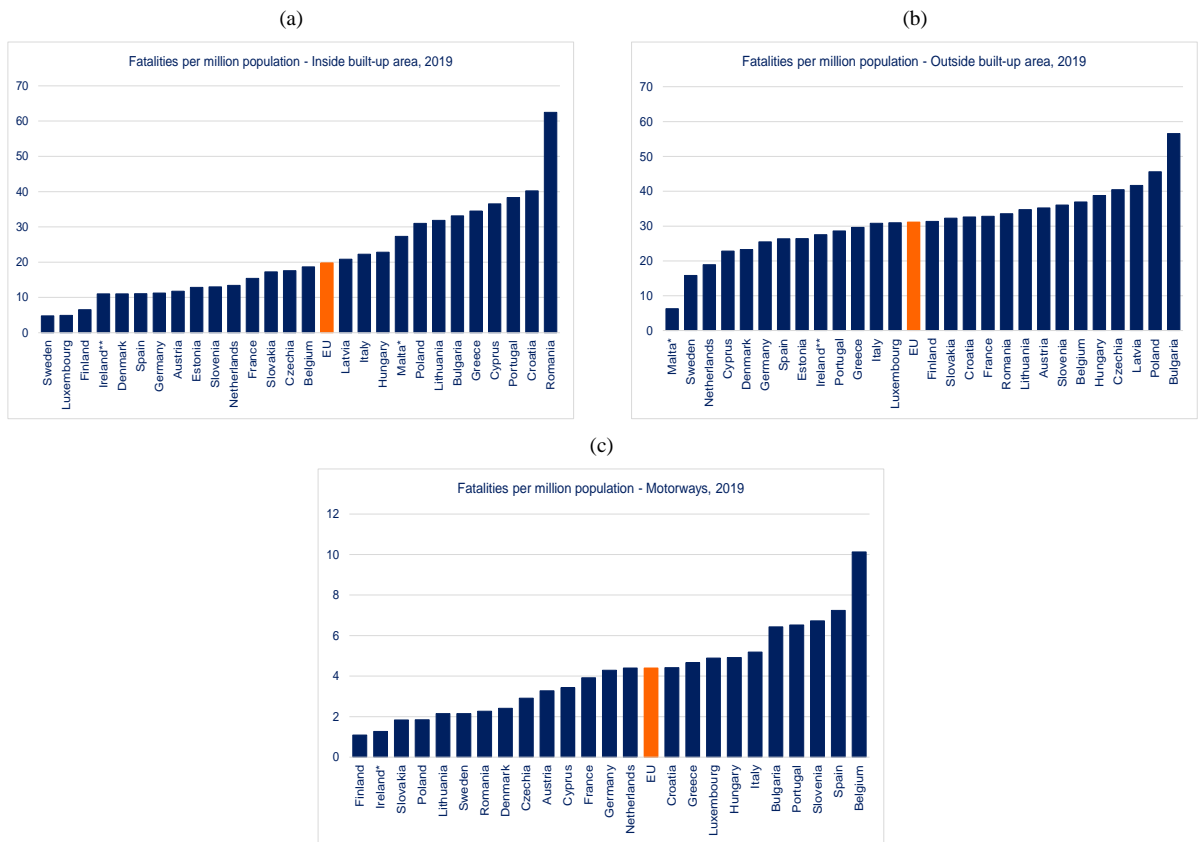


Fig. 3. Fatalities per million population, 2019: (a) Inside built-up areas, (b) Outside built-up areas, (c) Motorways. (\*2018 Malta, \*\*2016 Ireland)

Following a more detailed analysis, Figure 4 and Figure 5 portray passenger car and power two wheeler fatalities, inside and outside built-up areas separately. As Figure 4 shows, passenger cars are a major road safety threat mainly outside built-up areas, with an EU average of 17.7 deaths per population versus 4.9 inside built-up areas. More specifically, Sweden presents the best performance both outside and inside built-up areas, while Bulgaria has the worst performance outside built-up areas (41.6) and Croatia presents the worst performance inside built-up areas (16.4). On the other hand, motorcycles and mopeds crashes are a crucial issue inside built-up area mainly for southern European countries (Portugal, Greece and Cyprus). Concerning PTWs outside built-up area, Slovakia ranks first, while Greece ranks last with 9.1 fatalities per million population (the EU average is 5.6 fatalities per population). It is noted that due to very low national rates of Malta and Luxembourg, their performance is not discussed in these figures.

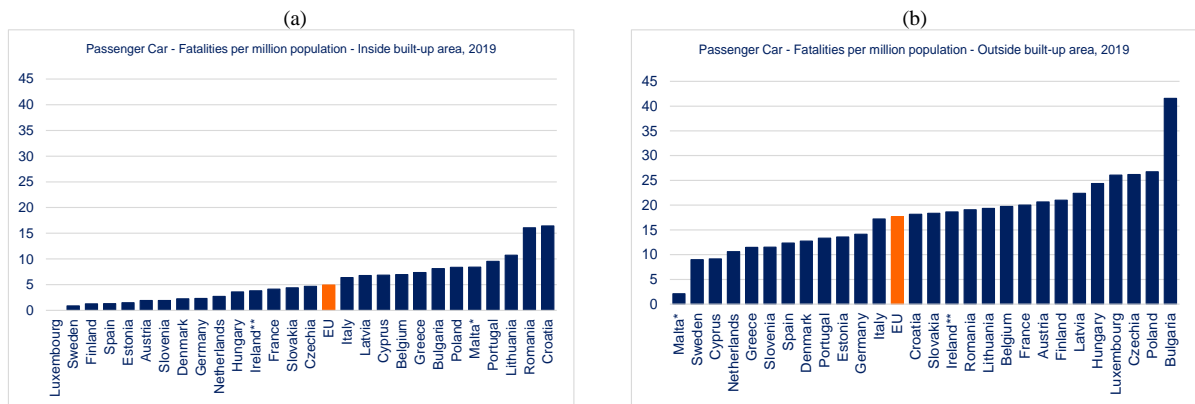


Fig. 4. Fatalities in Passenger Cars per million population, 2019: (a) Inside built-up areas, (b) Outside built-up areas. (\*2018 Malta, \*\*2016 Ireland)

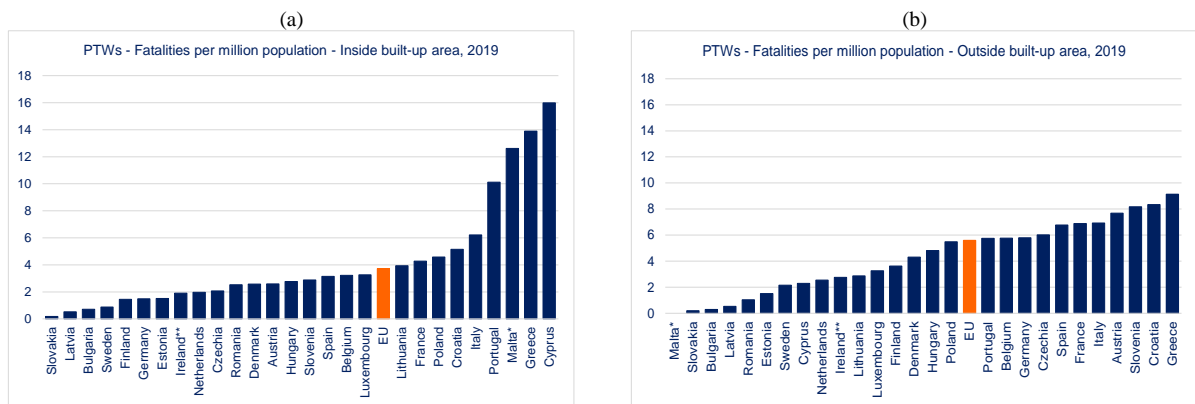


Fig. 5. Fatalities in PTWs per million population, 2019: (a) Inside built-up areas, (b) Outside built-up areas. (\*2018 Malta, \*\*2016 Ireland)

### 3.3. Road safety performance by number of vehicles involved in a crash

Single vehicle collisions are often linked to dangerous driving behaviors, e.g. speed, drinking and driving, fatigue, distraction, as well as to specific user and road characteristics, e.g. young drivers, car occupants, rural roads (ETSC, 2017b; Folla et al., 2018). Therefore, fatalities in single and multi-vehicle crashes should be examined separately to distinguish road safety weak spots. In 2019, the EU average in single vehicle crashes was 16.0 fatalities per population and the performance of the countries ranges from 7.2 to 28.1 fatalities per million population. The respective EU average for multi-vehicle crashes is 25.5, while fatality rates range from 11.7 to 41.0 among the examined countries.

According to Figure 6, Portugal and Greece present worse road safety performance in single vehicle crashes compared to multi-vehicle crashes, while Cyprus, Poland, Hungary, Slovenia and Ireland present the opposite results.

Focusing only on single vehicle crashes, Figure 7 shows the recorded fatalities per population separately for passenger cars and power two wheelers for the EU countries. Passenger car fatalities in single vehicle crashes account for 9.9 fatalities per population (EU average), three times more than the respective EU rate of PTW fatalities (3.3 fatalities per million population). Passenger cars range from 3.3 to 22.3, while PTWs from 0 to 10.5. The following graph outlines anew the serious fatality problem with PTWs in Mediterranean countries, but points out also hidden road safety problems. More specifically, Luxembourg, Poland, Slovakia and Ireland present high fatality numbers in single passenger car crashes, while Cyprus, Spain and Slovenia challenge higher number in single PTWs crashes.

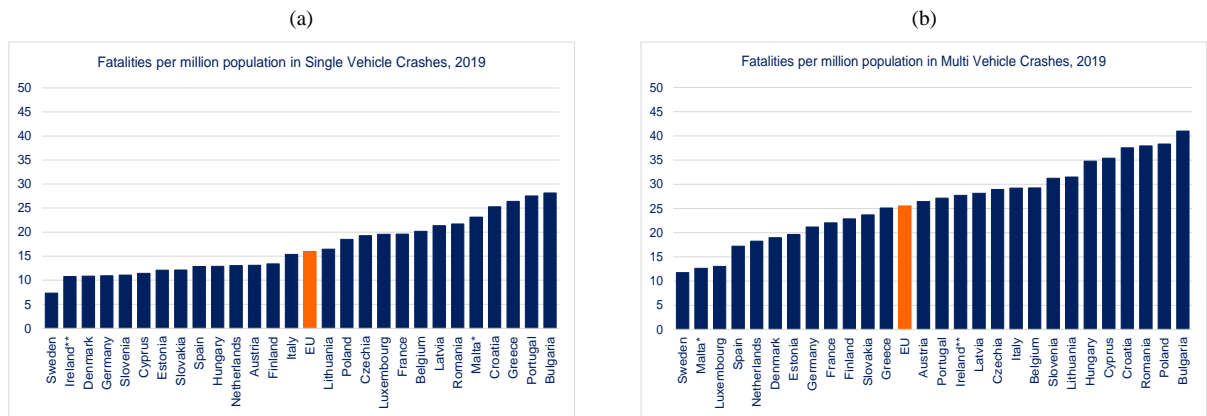


Fig. 6. Fatalities per million population, 2019: (a) Single Vehicle Crashes, (b) Multi Vehicle Crashes. (\*2018 Malta, \*\*2016 Ireland)

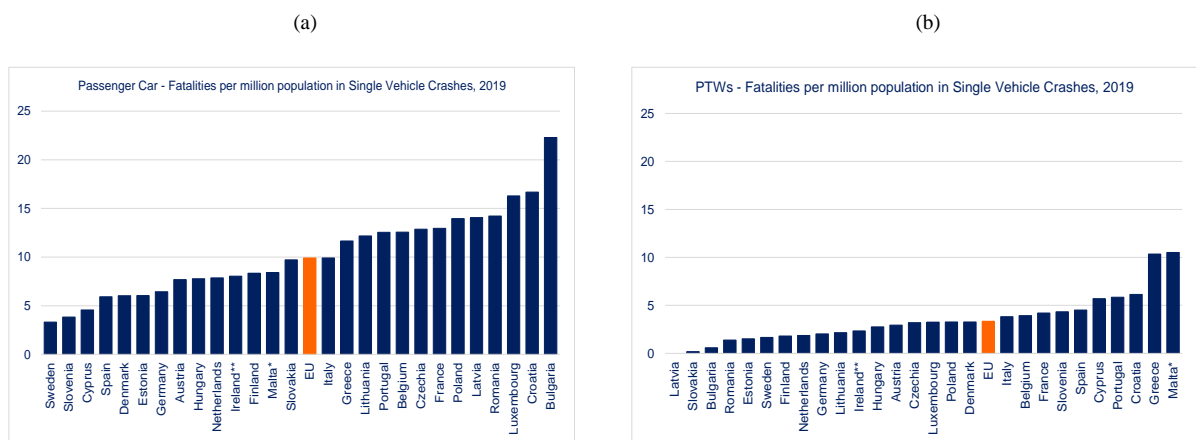


Fig. 7. Fatalities in Single Vehicle Crashes per million population, 2019: (a) in Passenger Cars, (b) in Power Two Wheelers. (\*2018 Malta, \*\*2016 Ireland)

### 3.4. The value of disaggregate data in crash analysis - The case of Greece

The overall assessment of the EU 27 road fatality rankings could be derived through the overview of the following interactive infographic of the NTUA Road Safety Observatory (<https://www.nrso.ntua.gr/nrso-ec2/>). In each crash type, the EU flag represents the average fatality rate per million population of the 27 EU Member States. The remaining flags are ranked above or below the EU average, from the best to the worst road safety performance. Such

a tool may allow authorities to inspect various road safety indicators and detect hidden threats by comparing their national road safety performance with those of the other EU countries, as well as with the EU average.

As mentioned above, Greece made an impressive road safety progress over the last decade, but still the overall road safety performance is below the EU average (20<sup>th</sup> position). By examining the different road crash types, it is evident that motorcyclist fatalities constitute a major problem, since Greece records the worst performance (27<sup>th</sup> position) not only compared to the European average, but also in comparison with the countries having also large motorcycle fleets (e.g. Italy, Spain, Portugal). It is impressive that when examining only passenger cars fatalities, Greece's road safety performance improves significantly, with Greece being ranked in the 10<sup>th</sup> position (below the EU average). Furthermore, Greece performs poorly in regards to crashes occurring inside built-up areas and single vehicle crashes, which are both associated with the high traffic of motorcycles and related crashes, but also with significant deficiencies (e.g. high rates of speeding and driver distraction, low helmet use rates, poor enforcement of traffic violations, inadequate public transport network, etc.).

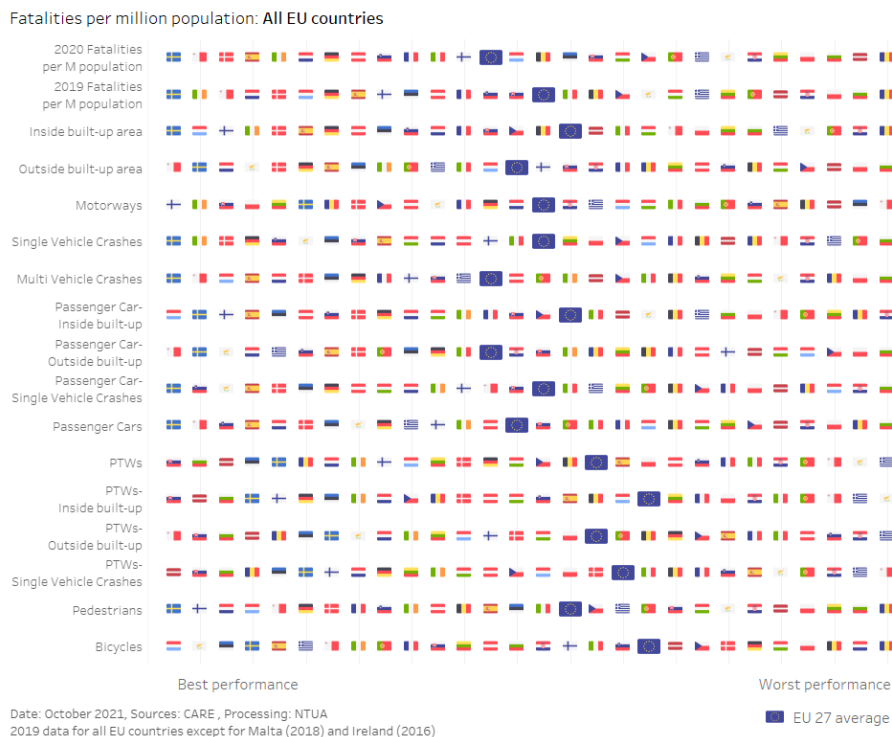


Fig. 8. EU Member States fatality ranking by crash type.  
(<https://www.nrso.ntua.gr/nrso-ec2/>)

#### 4. Conclusions

The assessment of different crash types reveals that the road safety performance of the EU countries and their ranking varies significantly when analyzing road crash data at a more disaggregate level. On that purpose, road fatality data from CARE database and population data from Eurostat for the latest available year, namely 2019, were utilized in order to compare national road safety performances in terms of fatalities per population. The different road safety performances, that countries present depending the transport mode, area type or crash type examined, reflect the diverse climates, behavioral characteristics, traffic volumes and modal shares among the EU countries, highlighting, also, the different road safety areas on which the countries should emphasize.

According to the detailed analysis, the Northern and Central European countries present an overall better road safety performance compared to the remaining countries. On the contrary, in the Southern European countries, PTW

fatalities are much higher than the EU average, which remains an ongoing problem, mainly due to the high traffic volumes of motorcycles and mopeds. Finally, Eastern European countries rank in last positions in almost all crash types examined, with worse performances being presented for pedestrians and crashes inside built-up areas.

Concluding, the proposed approach allows for a more detailed assessment of the road safety performance of the countries at both national and European level. Exploiting this tool, decision makers could identify the weak road safety aspects to emphasize in order to improve the overall performance of their countries. Additionally, the comparison with the other European countries could serve as a starting point for the identification of the best performances in Europe, and the exploration of the best practices and already successful road safety measures which could be integrated in their road safety policy. Nevertheless, for a more thorough analysis, exposure data related to the mobility of road users (travelled vehicle-kilometres by vehicle type, passenger-kilometres, number of vehicles in traffic by transport mode, etc.) could be utilized in order to better explain the road safety outcomes, allowing authorities to devise more addressed national road safety strategies and take appropriate measures. Similar benchmarking could be also implemented according to the national performances and progress over time (e.g. ranking based on the percentage change of road fatalities within a decade for different crash types, road user types, etc.). In addition, further research should consider the combination of the current macroscopic analysis with statistical models, in order to investigate the underlining reasons behind the EU road casualties.

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