Forgiving roadsides – the perspective from car and two-wheeler road users

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"Forgiving roadside" is a road design concept corresponding to a roadside environment (and median, on dual carriageway roads) without hazards that can seriously injure or kill road users in the case their vehicles have unplanned trajectories off the carriageway[1,2]. These hazards include, for example, trees, poles and fences; irregular or steep slopes; as well as critical areas, such as water streams and surface pipelines.

The main purpose is that drivers of out-of-control vehicles entering the roadside are able to recover control or allowed to safely bring the vehicle to a stop. This involves providing an obstacle free zone (clear zone) with adequate width, removing existing obstacles, changing their characteristics so they are not dangerous (e.g., passive safe poles complying with EN 12767, and gentle slope rates), or reducing the probability of their being hit by errant vehicles. If none of these options are viable, traffic is protected from hitting obstacles by applying vehicle restraint systems such as safety barriers or crash cushions with standardized performance (e.g., EN 1317). Such systems ensure that the proper containment level is provided, and that errant vehicles are redirected in a controlled way and that prevents serious secondary collisions.

This design approach has proven benefits[3], and has been applied for some time in Europe, and other continents, on primarily motorways and major roads, in some cases supported by benefit-cost analysis[4].

Nevertheless, some 33% of all fatalities in the EU[5] (37% in rural roads[6]) are still associated with run-off-road (single vehicle) crashes. As shown in a recent FERSI report[7], run-off-road crash (ROR) percentages are likely to be even higher on secondary interurban roads – for example, 60% in The Netherlands, 40% in Portugal and 39% in Czechia. At the EU level, ROR accidents on rural roads are especially important for cars (43% of car occupant fatalities) and for motorcycles and HGVs (38% of motorcycle rider fatalities)[6].

There is broad agreement on factors relevant for defining reasonable roadside safety criteria for passenger cars, based on the concept of a safe speed [e.g.,8, 9]. This concept has its roots in vehicle crashworthiness and road user biomechanics resistance knowledge. However, the set of crash scenarios considered are based on old empirical observation data, and updating the validation of

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[4] Roque, C.; Cardoso, J.L. (2015). SAFESIDE: A computer-aided procedure for integrating benefits and costs in roadside safety intervention decision making. Safety Science, 74, 195-205, https://doi.org/10.1016/j.ssci.2015.01.001
[5] https://road-safety.transport.ec.europa.eu/european-road-safety-observatory_en
[6] ETSC, 2024. Reducing road deaths on rural roads. PIN Flash 46. (https://etsc.eu/reducing-road-deaths-on-rural-roads-pin-flash-46/)
[7] https://fersi.org/2024/05/23/secondary-roads-road-safety-challenges
[8] SWOV (2018). Sustainable Safety. 3rd edition – The advanced vision for 2018-2030. SWOV-Institute for Road Safety Research, Netherlands.
[9] CEDR (2012). Forgiving roadsides design guide. https://www.cedr.eu/download/Publications/2013/T10_Forgiving_roadsides.pdf

their basic criteria (e.g., encroachment angles) is desirable[10,11]. Registered crash data indicates that the thresholds for CEN/EN 1317 impact severity levels A and B need review: in practice they currently seem to be identical[12]. Also, it is debatable whether the specified test vehicle characteristics are still representative of the current vehicle fleet, particularly regarding the mass, the height of the centre of gravity height and structural steel stiffness of vehicles. Despite these shortcomings, a further pressing problem is that of non-standardized safety barriers, terminals and transitions – these should be progressively upgraded to CEN/EN 1317 compliant restraint systems.

Identifying a common understanding on roadside safety criteria for unprotected road users (occupants of motorcycles, mopeds and bicycles) is more difficult than for passenger cars. The diversity of protective personal devices that riders may wear, and the small number of crashes that have been in-depth analysed, hinder the identification of the most relevant injury production scenarios. This results in a lack of specific criteria for these users in obstacle free zones. For PTW riders, road restraint systems, particularly safety barriers, are positively correlated with severe and fatal crashes. This is closely associated with a general lack of adequate post protection in the form of motorcycle shields or motorcycle friendly guardrails (e.g., compliant with CEN/TS 17342). However, despite the use of these shields in Portugal, fatal and serious injury PTW crashes are still the result of collisions with these restraint systems[13]. For secondary interurban roads, including upright driving impact tests is desirable.

Developing roadside safety criteria for unprotected road users is progressively important, given their increasing amount of travelled distance and their growing share of the safety burden. Between 2017 and 2022, the EU's passenger vehicle fleet increased by 1.5% annually, while the motorcycle fleet increased by 2.6% annually[14]. Also, between 2019 and 2022 the total number of fatalities in passenger cars decreased by 5.2% annually whereas motorcycle occupant deaths decreased by only 3.6% annually.

Realising the roadside safety problem for bicycles is comparatively recent. Successful EU and Member States' policies for promoting bicycle use are contributing to a trend towards greater number of bicycle journeys and traffic and forcing interventions to reduce this mode's single vehicle crash risk.

Assuming that motorcycle crashworthiness does not improve from the current state, that progress in two-wheeler lane keeping ADAS proceeds at the current pace, and that motorcycle traffic as well as active travel continue to increase, then developing and implementing roadside safety criteria for these unprotected road users is both a major and an urging safety challenge for the further deployment of a safe system approach.

This column is written in a personal capacity and reflects only the view of the author.

[10] Roque, C.; Cardoso, J.L. (2015). Integrating large samples of errant vehicles encroachment angles from google street view in a roadside safety assessment framework. 5th International Symposium on Highway Geometric Design, Vancouver, Canada.

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