MUARC ECIS Fact Sheet 4: Error and safety by design[1]

Safety by design: the role of road infrastructure in shaping driver behaviour

Driver error is a common driver performance failure and occurs due to driver, vehicle, and environmental influences. *Vision Zero* and the *Safe System* approach state that the road transport system needs to be designed and operated to support driver decisions and to be forgiving of error in the event of a crash.

Driver error was seen to have been a contributing factor in 59.5% of ECIS crashes. Other co-occurring contributing factors, including infrastructure design, were common.

Safety-by-design can support drivers to make safe decisions when driving and so avoid crashes in the first instance. Self-explaining roads are an example of this design process. Conversely, the layout of a road environment can make driver error more likely.

Criteria for the assessment of road environments to be classified as risky by design

In combination with a high posted speed limit (80 km/h or higher), crash sites with one or more of the following criteria were defined as presenting an in-built, ever-present latent infrastructure risk where driver decision-making and the exercise of *Normal Driving* is not supported:

1. Adverse or compromised road geometry impacting driver sightlines. This includes instances of lanes or roads converging at offset angles (irrespective of line markings), narrow width turn-off / exit lane(s), or other fixed hazards.
2. The presence of crests or dips in midblock sections, or on approach to intersections in midblock environments.
3. Narrow lanes with no, narrow, or poor-quality shoulder(s), with or without unprotected roadside objects (on straight or curve).
4. Misleading line markings combined with other road geometry flaws (e.g., crest) on approach to intersections.
5. Poorly delineated intersection. Indicated by inadequate and/or poorly placed traffic control signals or traffic control signs, and/or absent line markings, the negative effects of which are exacerbated by the natural terrain of the intersection location.
6. Insufficient infrastructure control of turn lanes to avoid cross-traffic manoeuvre (i.e., lack right-turn arrow).
7. Poor quality road surfaces with adverse camber or alignment on high-speed curves.
8. Absent or poorly placed advisory signs at midblock locations.

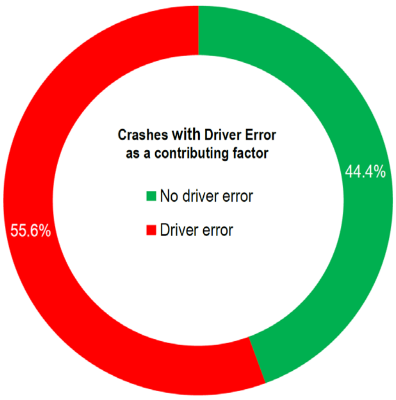
Driver error was more common at locations where latent infrastructure risk was identified

At 22% of locations where an ECIS crash occurred, one or more adverse design features in combination with a high-speed zone was evident. By meeting this criterion, these locations were classified as being inherently risky for drivers to make a safe decision. These locations are said to represent an in-built, or latent infrastructure, design risk for drivers.

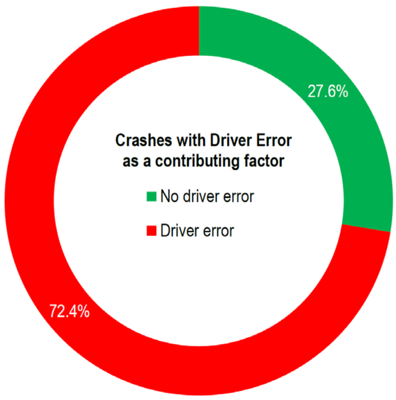
Driver error was a contributing factor in 72.4% of crashes at locations where this in-built design risk was present compared to 55.6% of crashes at locations where this design risk was absent.

Statistically, the risk of a driver making an error at locations where a latent infrastructure risk was identified was 58.7% higher than locations where no in-built design risk was present (p≤0.01).

No latent infrastructure risk



Latent infrastructure risk present



Implications

Road design and speed limits must account for the broad range of decision-making capabilities of drivers, especially at intersections. Supporting drivers to make safe and appropriate decisions is a key responsibility of road designers.

Active vehicle safety systems, such as cross-traffic alert, have potential to aid driver decision-making; however, the efficacy of these driver warning technologies is dependent on early detection of on-coming vehicles and on appropriate driver response.

1 Fitzharris, M, Lenné, MG, Corben, B, Pok Arundell, T, Peiris, S, Liu, S, Stephens, A, Fitzgerald, M, Judson, R, Bowman, D, Gabler, C, Morris, A & Tingvall. Enhanced Crash Investigation Study (ECIS): Report 1: Overview and Analysis of Crash Types, Injury Outcomes and Contributing Factors. Melbourne Vic Australia: Monash University, 2020. https://www.monash.edu/muarc/ecis