Joseph Giacomin is a professor of Human Centred Design at Brunel University London whose work deals with the design of future autonomous road vehicles.

Should The Speed Limit Be lower For Autonomous Vehicles?

The movement of people or goods from point A to point B is the reason why road vehicles were invented. And getting from A to B should be safe. Driving should adhere to the rules of the road and should respect human capabilities, norms and social practices. And, when something goes wrong, the vehicle should provide crash protection.

It is thus not surprising that researchers have analysed the safety of autonomous vehicles (AVs). For existing AVs a 2020 review of accident statistics by University of Belgrade researchers reported a reduced incidence of broadside and pedestrian collisions with respect to human driven vehicles, but increased incidence of rear-end collisions. They suggested that human-driven vehicles were often following too closely or at unsafe speeds. Human drivers thus sometimes collide with AVs.

And a 2020 analysis by researchers of The Insurance Institute For Highway Safety (IIHS) of more than 5,000 NHTSA database entries suggested that AVs are unlikely to avoid many of the current crashes. Many were caused by mechanical failures such as a blown tyre or a broken axle which would not be different with an AV. And those causes such as incapacitation or sensing or perceiving where AVs might prove superior to humans only accounted for 23% of the crashes. AVs seem unlikely to avoid more than two thirds of the of the NHTSA database crashes.

Such findings suggest a question which has yet been explored, the possible need for a low speed limit for AVs. In many road accidents the driver becomes aware of the mechanical failure or error a small number of seconds before impact. And there is usually some attempt at steering away from the point of impact and at slowing the vehicle through braking. Instead, a major failure of an AV's planning system or control system is likely to lead to a crash which is characterised by little or no swerving or braking before the moment of impact. Such collisions are likely to be brutal.

During any crash the momentum of the vehicle is brought from its starting value to zero. And since physical momentum is proportional to the product of the mass multiplied by the square of the velocity, the momentum which needs arresting grows with the square of the velocity. Small increases in velocity lead to big increases in the momentum which needs arresting, leading to big increases in the forces involved and big increases in the number and severity of the injuries.

Many studies have investigated the passenger injuries from frontal impact, side impact, rollover and other dynamics. And several have also investigated the injuries of motorcyclists, bicyclists and pedestrians. In all cases both the incidence and the severity of the injuries grows with the speed of the vehicle at the moment of impact. Injuries and severity are not large for speeds up to

about 20 km/h for pedestrian impacts and 30km/h for vehicular impacts, but the statistical curves grow rapidly from those thresholds onwards.

Given the physics, it seems natural to ask if a low speed limit is needed for AVs. Aircraft autopilots benefit from margins of error due to the free space around the aircraft. But AVs can suffer nearly immediate impacts due to the free space being a few centimetres or a few meters at most. The margins of error for road vehicles have always been slim, and have shrunk as the vehicles have grown in size while the roadways haven't. Thus the question for legislators is: what maximum speed will you allow for the AVs?