ANALYSING THE RELATIONSHIP BETWEEN FREEWAY FLOW PARAMETERS AND SAFETY, THROUGH THE FUNCTIONAL FORM OF A CRASH PREDICTION MODEL. THE CASE OF RUN-OFF-ROAD CRASHES.

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This study examines the relationship between traffic flow parameters, such as volume, density, speed, and safety, using a calibrated CPM developed with the modified Ricker model and fitted to Portuguese freeways run-off-road (ROR) crash data.

KEY POINTS:
The conventional functional form of CPMs (FF1) assumes that the traffic flow model component continuously increases crash frequencies over the covered range of values. In the case of ROR crashes, using a functional form that shapes the curve between crash frequency and traffic flow in a concave way, the modified Ricker model (FF2), shows better quality model fit.

RESULTS:
• When traffic density is low, the number of crashes increase at a high rate with an increase in traffic. The combination of low traffic densities and higher operating speeds is such that the probability of a ROR crash increases substantially and thus the steep reach of the function.
• Once a critical density is reached – at an Average Daily Traffic (ADT) of approximately 25,000 vehicles in a four lane divided carriageway road – the function begins to level off, the number of crashes almost stabilizes, and accident rates start to decrease significantly, due to higher traffic volumes and lower operating speeds.
• The number of crashes reaches its maximum for a density between 11 and 16 passenger cars per kilometre per lane - Level of Service (LOS) C. Under these circumstances, vehicles speeds are near the freeway Free Flow Speed (FFS), and drivers have restricted freedom. However, lane changes are still possible but gaps are shorter, requiring more care and vigilance from drivers.
• Past the point of maximum density (for an ADT of nearly 35,000) the function begins to decrease at a slower rate with an increase in traffic. Under constant perception–reaction time, vehicle and roadway characteristics, and speeds, it is highly plausible to expect a decreased probability of ROR crash occurrence as a result of 50% more cars in the same space (LOS E). The decrease in the number of crashes may be explained by the fact that at this level of traffic density headways are so small that, even though the operating speed is lower, it is difficult for an errant vehicle to encroach the roadside without previously hitting another car.