

# Understanding Toyota Sudden Acceleration

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As a materials and manufacturing engineer with decades of experience with failure analysis of manufactured products, and as an owner of a Toyota vehicle, I am saddened by the lack of expertise and insight shared with Congress and the public about the sudden acceleration problem.

When products fail due to a systemic design, materials or manufacturing flaw, large and statistically significant levels of problems emerge fairly rapidly. This is definitely not the case with the Toyota problem. With many millions of Toyota models on which even more millions of miles have been driven, if there had been an inherent materials or manufacturing design defect, then we would have seen untold thousands of cases of sudden acceleration. It literally would have been virtually a daily event happening all over the country in many Toyota models. But, in fact, little more than 1,000 Toyota and Lexus owners have reported since 2001 that their vehicles suddenly accelerated on their own. This is a tiny, minuscule percentage of Toyotas.

This infrequent runaway car problem is not analogous to a serious case of bacterial contamination of a major food product causing many thousands of cases of food poisoning in a relatively short period. It is even more difficult to find the cause of.

Understanding this nature of defects also means that the so-called solutions of replacing floor mats and gas pedals are sheer nonsense. Indeed, it did not surprise me to read today that there have already been cases of sudden acceleration in cars that had received fixes by Toyota. More than 60 Toyota owners have complained to the National Highway Traffic Safety Administration about cars already repaired under the two major Toyota recalls, saying they aren't fixed and their throttles can still race out of control.

While recognizing the agony and suffering of sudden acceleration accidents and deaths it is also necessary to appreciate the statistically rare occurrences of this problem. Only by doing so is it possible to understand that the ultimate explanation - and solution - to the sudden acceleration problem will be a non-systemic flaw or defect in a critical component. In other words, either a random defect in a material or some unusual and infrequent deviation in a manufacturing process of some critical component. Only such a situation can logically explain so few sudden acceleration problems in so many millions of cars being operated for many more millions of hours and miles.

In my professional opinion, the likely scenario is a defect in a semiconductor chip used in the electronic control system. A defect that was caused by some infrequent flaw in a raw material or manufacturing process that would not show up in routine quality control testing of raw materials or components. That so many different Toyota models over many years

have been found defective signifies the likelihood of a particular problem component made in a specific factory that has been used for quite a while. Moreover, the defect obviously does not ordinarily impair vehicle performance but only manifests itself under some infrequent conditions, as yet undetermined.

Rita Taylor of Fort Worth , Texas experienced runaway acceleration, took her car to a Toyota dealer, and had the floor mats removed. A few months later she had another frightening runaway episode. Ditto for Eric Weiss in California , who also had a second episode months after the first one and after removing the mats. Others who have not died and kept using their Toyotas have also had repeat events. Thus, perfectly normal vehicle performance is possible between runaway events.

Make no mistake, the precise cause of such a sporadic event is incredibly difficult to pin down and even more difficult to remedy. An extremely intense and costly investigation is necessary. It is the classic needle-in-the-haystack problem.

If my thinking is correct, then it is sheer folly to believe that replacing floor mats or gas pedals can solve the sudden acceleration problem. However, there is one aspect to the sudden acceleration problem that also is crystal clear and, in some ways, even more aggravating than the acceleration problem. This is the absence of an override system that absolutely prevents fuel being fed to the engine when brakes are employed while a car is accelerating. It is gratifying that the federal government is seriously considering requiring such an override system in all vehicles. An effective override system might, in the long run, be a faster and more cost-effective solution than chasing-the-defect strategy, especially for retrofitting many millions of vehicles.

Alternatively, finding the cause of the sudden acceleration problem requires a standard failure analysis methodology, namely to obtain absolutely every Toyota vehicle that has experienced sudden acceleration. Then meticulously examine through microscopic and other types of analysis and testing all critical components of the electronic system (called by Toyota the Electronic Throttle Control System with intelligence). Think of it like an autopsy.

This does not appear to have been done. To the contrary, the firm hired by Toyota tested several ordinary vehicles and components. One of the primary authors of the Exponent report said they did not examine any vehicles or components that had the unintended accelerations. This makes no sense whatsoever if the defect is rare and, therefore, its finding that there was nothing wrong was meaningless. Worse, it was a deception and distraction.

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