Vehicular Forensic Engineering: Not Just Measuring Skid Marks—
Wheel Separation

For some individuals, “vehicular forensic engineering” conjures up the image of measuring skid marks, scene photographs, eyewitness accounts, and blood alcohol readings. Documenting the incident scene and evidence, and preserving the evidence are very important and require special skills. The prompt or early tests generally are related to the legal jurisdiction and the questions of, “Was there violation of the law?” and if so, “Was it a factor in the occurrence of the accident?”

There is another important part of the investigation that is becoming recognized: It is applying scientific testing and analysis to determine (1) how the incident occurred (mode and mechanism), (2) the responsibility (causality), and (3) elimination of the hazards or reducing risk. Typically, the cause is related to one or more of the following: design, materials, defect, construction/fabrication, operation/use, maintenance, inspection, protection. The textbooks Forensic Engineering: Part I and Part II [1] are used as reference texts for an introduction to some of the scientific methods and legal issues. The following are some examples that are discussed in the textbooks Forensic Engineering: Part I and Part II.

About fifty miles, on the same day, after purchasing four expensive alloy after-market rims, lug nuts, studs, and Pirelli tires for mounting, the owner of a Datsun (Fig. 1) was driving on a straight stretch of interstate highway when he noticed a vibration of the vehicle and a rattling sound, and the driver’s side (left) front rim and tire separated from the vehicle. The vehicle spun out of control and the driver’s seat released backwards as the driver applied the brakes with considerable force. The rim and tire installed by the retailer were specified for the vehicle make and model by the manufacturer; however, as manufactured, the rim would not fit on the front wheel hub flange due to a dimensional interference that could not be visually detected.

Fig. 1 Lug nuts and wheel separation (Datsun)

Fig. 2 Wheel separation by fracture (Mitsubishi)
Figure 2 shows the left front wheel hub and brake disk with a fractured part of a five-spoke “alloy rim” attached by five lugs to a Mitsubishi. The rim and tire separated when the spokes fractured upon impact with a 6 in. high curbing on a northbound three-lane concrete boulevard after sunset (Fig. 3). A unique feature of the roadway at the scene of the incident was that a driver heading on the north three lanes at night would encounter an “S” curve traffic sign on the narrow median separating the three south-bound lanes. Two hundred feet later, a driver would reach a hill crest and experience unexpectedly the three downhill lanes turning right (east) for

![Mitsubishi after impact](image)

![Lug bolts and wheel separation (Saab). (b and c) Saab wheel](images)

Fig. 3  Mitsubishi after impact

Fig. 4  (a) Lug bolts and wheel separation (Saab). (b and c) Saab wheel