C13 Forces in Vehicle Side-View Mirror Collisions

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The goal of this presentation is to present force data associated with folding a vehicle's side-view mirror forward or backward.

This presentation will impact the forensic science community by presenting case studies that demonstrate the use of the force data to analyze actual or claimed interactions between the side-view mirror with another vehicle or a pedestrian.

This presentation includes the results of measured forces necessary to fold side-view mirrors forward and rearward and how they were used in two case studies involving vehicle and possible pedestrian interactions with vehicles' side-view mirrors. After attending this presentation, the attendees will understand the forces and accelerations involved in interactions with a vehicle's side-view mirror.

Case 1: This case arose from a sideswipe type accident in which contact was limited to only mirror-to-mirror contact between two vehicles. The side mirror of the subject vehicle was struck and folded forward, striking the A-pillar, as shown in Figure 1.

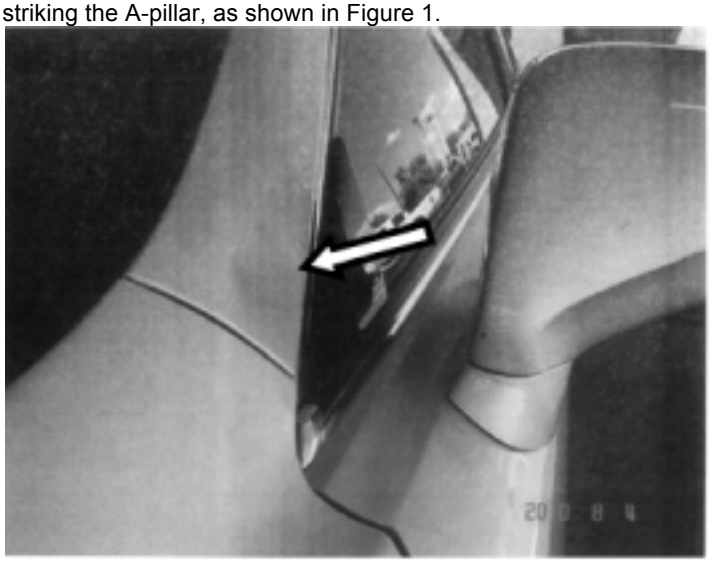

Figure 1: Damage due to mirror-to-mirror contact.

In order to determine the accelerations experienced by the vehicle and its occupant, three vehicles were used to measure the force required to fold their side-view mirrors forward. The force ranged between 9 and 12 pounds, which corresponded to about 1/50th of 1g or a Delta V less than 1/20th of one mph for the subject vehicle. For comparison, as shown in Figure 2, the longitudinal vehicle accelerations associated with normal driving were measured as a vehicle was driving on a normal roadway prior to a steering-induced rollover and were about 1/4th of one g. As such, the forces and accelerations which the vehicle and the occupant were subjected to were far less than those associated with vehicle vibrations while driving normally.

Thus, with contact limited to only mirror-to-mirror contact, the occupant would not be able to discern the contact from the vehicle vibrations associated with normal driving, other than the sound of the mirror contact.

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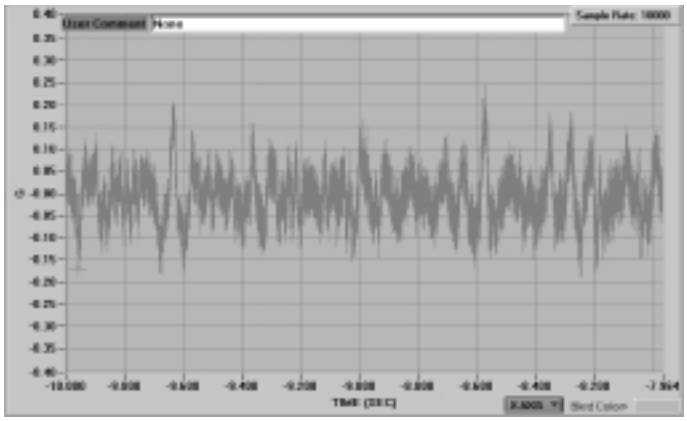

Figure 2: Longitudinal acceleration trace under normal driving conditions.

Case 2: This case arose from a vehicle versus pedestrian accident in which the pedestrian claimed that the vehicle's side-view mirror struck the pedestrian's right elbow resulting in injury. Video surveillance determined the speed of the vehicle to be between 11 and 13 mph as it passed the pedestrian. Interestingly, as shown in Figure 3, the height of the pedestrian combined with the pedestrian's forearm being raised holding a video camera was found to prevent direct mirror to elbow contact. In addition, surveillance video analysis showed that the mirror was not rotated rearward as it passed the pedestrian. The force necessary to fold the subject vehicle's mirrors was measured to be between about 11½ and 15 pounds. Certainly, had the vehicle's side-view mirror had significant contact to the bony structures of the pedestrian's arm as it passed at 11 to 13 mph, the side-view mirror would have been expected to fold rearward.

Figure 3: Surrogate demonstrating arm-to-mirror clearance

An examination of two case studies was performed. In these case studies, the amount of force necessary to fold the side-view mirror forward was measured to be between 9 and 12 pounds, which in Case Study 1 corresponded to vehicle accelerations that were far less than those which would be normally experienced while driving on a roadway and not discernible from the vehicle's normal vibrations. In Case Study 2, the amount of force necessary to fold the side-view mirror rearward was measured to be between about 11½ and 15 pounds, which, in addition to the height of the pedestrian's elbow/arm preventing contact, showed that the side-view mirror, would have been expected to fold rearward had it actually had significant contact with the boney structures of the pedestrian's elbow/arm.

Side Mirror Contact Forces, Injury, Case Study

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