TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

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REMOTE AIR BAG NON-DEPLOYMENT INVESTIGATION

VERIDIAN CASE NO. CA98-062

VEHICLE - 1996 FORD CROWN VICTORIA (POLICE CRUISER)

LOCATION - WASHINGTON D.C.

CRASH DATE - OCTOBER, 1998

Contract No. DTNH22-94-07058

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness of the involved vehicle(s) or their safety systems.

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17. Abstract

This remote investigation focused on a 1996 Ford Crown Victoria police vehicle that was involved in a severe frontal impact sequence with the frangible base support of a breakaway pole. The vehicle was equipped with a front Supplemental Restraint System that consisted of driver and right front passenger air bags that failed to deploy as a result of the crash. The on-duty female police officer was not restrained by the vehicle's manual belt system at the time of the crash. She sustained police reported disabling injuries and was admitted to a local hospital for treatment.

The National Highway Traffic Safety Administration's (NHTSA's) Office of Defects Investigation (ODI) initially received notification of the crash. NHTSA representatives from ODI and SCI inspected the vehicle, documented and photographed the vehicle's damage profile. In addition, technical representatives from the Ford Motor Company evaluated the air bag system's on-board diagnostic module for fault codes. This information was subsequently forwarded to the Special Crash Investigation team at Veridian/Calspan for a remote level investigative effort.

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BACKGROUND

This remote investigation focused on a 1996 Ford Crown Victoria police vehicle that was involved in a severe frontal impact sequence with the frangible base support of a breakaway pole. The vehicle was equipped with a front Supplemental Restraint System that consisted of driver and right front passenger air bags that failed to deploy as a result of the crash. The on-duty female police officer was not restrained by the vehicle's manual belt system at the time of the crash. She sustained police reported disabling injuries and was admitted to a local hospital for treatment.

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SUMMARY

Crash site:

This two vehicle/fixed object crash occurred in the afternoon hours of October 1998. At the time of the crash, it was daylight and the weather was not a factor. The asphalt road surface was dry. The crash occurred at the 4-leg intersection of a northeast/southwest two lane roadway and a north/south two lane roadway. The intersection was controlled by stop signs for the north/south traffic. **Figure 1** is a northeast trajectory view of the Ford. The police investigation identified 41 m (136 ft) of pre-crash tire marks attributed to the police vehicle. The 1996 Ford Crown Victoria struck the frangible base supporting a breakaway pole located in the northeast quadrant of the intersection. The impact partially fractured the frangible base and it was removed prior to the scene inspection. The pole was located at the traffic cone in the background of Figure 1. The speed limit in the area of the crash was 40 km/h (25 mph).

Figure 1: Trajectory view of the Ford.

Pre-Crash

The 1996 Ford Crown Victoria was driven by an on-duty 33 year old female police officer and was traveling northeast in pursuit of a Mazda RX7. An occupant within the Mazda reportedly pointed an unknown caliber hand gun at the officer; and the Mazda then accelerated to a high rate of speed in an attempt to elude the police officer. The police officer activated the siren and all emergency lights and began a vehicle pursuit. The officer reportedly unbuckled the vehicle's manual restraint system and removed her service revolver, while in pursuit of the Mazda.

A northbound 1994 Ford Taurus came to a stop at the 4-leg intersection, coincident to the approach of the Mazda and Ford. It was intention of the Ford Taurus to turn left and travel southwestward. As the Ford Taurus accelerated forward and was in the process of the turn, the Mazda RX7 passed by at a high rate of speed. The Mazda passed by without making contact. The driver of the Taurus reportedly heard the police cruiser's emergency siren, however he could not ascertain its direction and continued his turn to the left. The female driver of the police cruiser reacted to the imminent collision by steering counterclockwise (left) and applying the brakes.

Crash

The Ford Taurus continued forward and the forward right side of the police cruiser end-swiped the front of the Taurus. The estimated Collision Deformation Classification (CDC) of this minor impact was 12-FRES-9. Reportedly, the Taurus's front bumper separated as a result of the contact. The Ford Taurus was not available for inspection.

The end-swipe collision redirected the police cruiser in a counterclockwise direction as it traversed the intersection. The police cruiser departed the left curb line and struck the frangible base support of a breakaway pole located in the northeast quadrant of the intersection. The center aspect of the vehicle's front plane struck the frangible base resulting in approximately 86 cm (34 in) of bumper deformation. The delta V of the crash was calculated to be approximately 35 km/h (22 mph). The frontal air bag system in the Ford Crown Victoria did not deploy.

The unrestrained driver of the police cruiser reportedly sustained a fractured femur as a result of the crash. She was transported and admitted to a local hospital for treatment of her injuries. The driver and right front passenger of the Ford Taurus were also reportedly transported for examination.

AIR BAG VEHICLE

The 1996 Ford Crown Victoria was identified by the Vehicle Identification Number (VIN): 2FALP71W0TX (production sequence deleted). The vehicle's body style was configured as a police department interceptor 4-door sedan. The drive train consisted of a 4.6 liter/V8 engine linked to a 4-speed automatic transmission. The vehicle was equipped with manual 3-point lap and shoulder belts in the front outboard seated positions and a front Supplemental Restraint System that consisted of driver and right front passenger air bags. The odometer read 91,605 km (56,922 miles) at the time of the crash.

Figures 2 and 3 are the front and left lateral views of the Ford Crown Victoria taken during the inspection. The vehicle's front plane sustained 36 cm (14 in) of direct contact damage that began 8 cm (3 in) right of the vehicle's centerline and extended to the left. The measured crush profile was as follows: C1=38.1 cm (15.0 in), C2=72.4 cm (28.5 in), C3=80.0 cm (31.5 cm), C4=54.6 cm (21.5 in), C5=27.9 cm (11.0 in), C6=8.0 cm (3.0 in). The field L used in this profile was 88.0 cm (34.6 in). The maximum crush measured 86.5 cm (34.0 in) and was located 3.6 cm (1.4 in) right of centerline. The left and right side wheelbases were foreshortened approximately 13 cm (5 in) and 5 cm (2 in), respectively. The CDC was 12-FYEN-3. The barrier model of the WINSMASH program calculated a damaged based delta V of 34.9 km/h (21.7 mph). Technical representatives from Ford indicated the must fire deployment threshold's for the Supplemental Restraint System in the 1996 Ford Crown Victoria were 14 mph barrier/17 mph pole.

Figure 2: Front view of the 1996 Ford Crown Victoria.

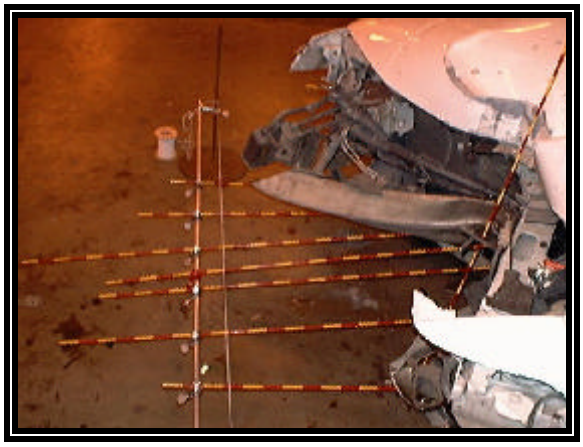

Figure 3: Left lateral view across the Ford's front plane.

SRS FAULT CODE TESTING

In an effort to determine the cause of the non-deployment, technical representatives from Ford performed a diagnostic test of the Supplemental Restraint System. The fault codes stored in the system's diagnostic module were read as a flash sequence from the air bag indicator light mounted in the instrument cluster. The results of the diagnostic test revealed that the only stored active code was Code 52 - internal thermal fuse open. This open circuit prevented the deployment of the SRS at the time of the crash. The root cause of the open fuse was not be determined. The police department reported that a review of the vehicle's history indicated the SRS had not required service. Further, to their knowledge the indicator light was not illuminated at the time of the crash.

It should be noted that the Veridian/Calspan SCI team has detected this fault code on a previous investigation (refer to CA98-37). This investigation focused on the non-deployment of a driver air bag in a 1995 Ford E350 cargo van. This vehicle impacted a bridge pillar resulting in a 45 km/h (28 mph) delta V.

DRIVER KINEMATICS

The Ford Crown Victoria was driven by a 33 year old unrestrained female. She was seated in a mid to forward track position at the time of the crash. Upon impact with the pole, the unrestrained driver initiated a forward trajectory in response to the 12 o'clock direction of the impact. Her left knee contacted and loaded the knee bolster. The bolster reportedly deformed from this contact. Her right hip contacted the center console. This contact displaced the radio units mounted to this region. The driver reportedly sustained a fracture of the upper femur as a result of this contact. The driver's chest loaded and compressed the energy absorbing steering column. Approximately 2.5 cm (1.0 in) of compression was noted during the inspection, refer to **Figure 4**. The driver was subsequently removed from the vehicle, transported and admitted to a local hospital for treatment of her injury.

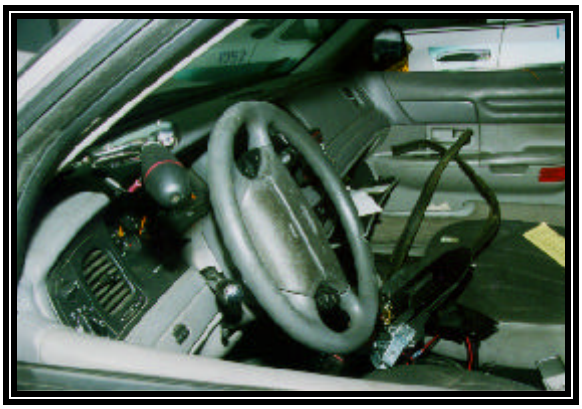

Figure 4: View of the non-deployed SRS and compressed steering column.