

**TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER**

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SIDE IMPACT OCCUPANT PROJECTION INVESTIGATION

VERIDIAN CASE NO: CA03-012

VEHICLE: 2003 FORD CROWN VICTORIA POLICE INTERCEPTOR

LOCATION: NEW YORK

CRASH DATE: FEBRUARY, 2003

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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 are 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 performance of the involved vehicle(s) or their safety systems.

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SIDE IMPACT OCCUPANT PROJECTION INVESTIGATION
VERIDIAN CASE NO: CA03-012
VEHICLE: 2003 FORD CROWN VICTORIA POLICE INTERCEPTOR
LOCATION: NEW YORK
CRASH DATE: FEBRUARY, 2003

BACKGROUND

This investigation focused on the occupant protection provided by the left side impact air bag in a 2003 Ford Crown Victoria that deployed during a left side impact crash with a 1993 GMC Sonoma pick-up truck. The Ford Crown Victoria was a New York State Police Troop Car equipped with the Police Interceptor package. The Ford was equipped with a passive safety system that consisted of advanced driver and front right passenger air bags, front safety belt retractor pretensioners, and seat mounted side impact air bags for the front occupants. The left side impact air bag deployed as a result of a minor left side impact, **Figure 1**. There were no injuries as a result of the crash.



Figure 1: Left side damage to the Ford.

The Special Crash Investigations team at Veridian Engineering was notified of the crash by the Fleet Management Office of the New York State Police (NYSP) on February 19, 2003. The Veridian SCI team in-turn notified the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) and an on-site investigation was assigned February 20, 2003. The Ford was in storage at a NYSP facility and was available for inspection. The GMC Sonoma was driven from the scene and was unavailable for inspection.

SUMMARY

Crash Site

This two-vehicle crash occurred during the morning hours of February, 2003. At the time of the crash, it was daylight and it was snowing. The road surface was snow covered and slippery. The crash occurred on a two-lane north/south state route. An east/west road intersected the primary road from the west forming a three-leg intersection at the crash site. The speed limit in the area of the crash was 89 km/h (55 mph). **Figure 2** is a northbound trajectory view approaching the intersection.



Figure 2: Northbound trajectory view.

Pre-Crash

The 1993 GMC Sonoma was northbound driven by a 19 year old restrained female. The 2003 Ford Crown Victoria Police Interceptor was southbound responding to a property damage crash that had previously occurred off the east shoulder of the road. The Ford was operating with its emergency lights activated. Reportedly, the officer had pulled his vehicle onto the west road shoulder and was slowing to a stop in the northwest quadrant of the intersection. He had just released his safety belt and was preparing to come to a complete stop. The driver of the GMC reacted to the emergency lights by locking the brakes and the driver lost control of the vehicle on the slippery pavement. The GMC rotated counterclockwise approximately 15 degrees and crossed the center line of the road. The driver probably released the brakes and counter-steered. Reportedly, the GMC was in a near tracking trajectory upon impact. The NYS Trooper was covering the brake and locked the Ford's brakes immediately prior to impact. He reported that he was aware of the impending crash and leaned his body to the right away from the door.

Crash

The left aspect of the GMC's front bumper impacted the left side of the Ford at the center aspect of the front door. The Principle Direction of the impact Force (PDOF) was in the 11 o'clock sector with respect to the Ford. The impact speed of the GMC was an estimated 24 km/h (15 mph). The impact induced deceleration caused the Ford's left side impact air bag to deploy. The GMC was deflected along the left side of the Ford and disengaged from contact in the area of the left C-pillar. The GMC then came to a controlled stop approximately 18 m (60 ft) north of the Ford on the west shoulder. Neither the NYS Trooper nor the GMC driver were injured in the crash. Both vehicles were driven from the scene at the conclusion of the police investigation. **Figures 3 and 4** are on-scene photographs taken during the police investigation. A schematic of the crash is attached to the end of this report **Figure 11**.



Figure 4: Southeast view of the final rest position of the GMC.



Figure 3: Southward view of the final rest position of the Ford.

1993 GMC SONOMA

The 1993 GMC Sonoma, **Figure 5**, was not available for inspection. Analysis of the police photographs indicated the collision damage was isolated to the outboard 10 cm (4 in) of the left corner of the front bumper. The contact pattern then wrapped onto the left front fender

approximately 20 cm (12 in). The maximum crush was located at C1 and was an estimated 8 cm (3 in). The Collision Deformation Classification (CDC) was 12-FYEE-1.



Figure 5: Front view of the GMC.

2003 FORD CROWN VICTORIA POLICE INTERCEPTOR

The 2003 Ford Crown Victoria was identified by the Vehicle Identification Number (VIN): 2FAHP71W43X (production sequence deleted). The rear-wheel drive, 4-door sedan was equipped with the Police Interceptor package. The power train consisted of a 4.6 liter, V8 engine linked to a 4-speed automatic transmission. The vehicle was equipped with passive safety system that consisted of advanced driver and front right passenger air bags, front safety belt retractor pretensioners, and seat mounted side impact air bags for the front occupants. The date of manufacture was October 2002. The odometer had recorded 5,608 km (3,485 miles). The vehicle's repair estimate totaled \$6,615 (parts and labor).

Exterior Damage

The left side plane of the Ford sustained 169.4 cm (66.7 in) of direct contact damage. The direct contact began 203.7 cm (80.2 in) forward of the left rear axle and ended 33.8 cm (13.3 in) forward of the rear axle. The impact damage was greater in magnitude on the left front door, in the area of initial engagement, and pocketed forward of the B-pillar. The contact then tapered to abrasions and paint transfer on the left rear door as the vehicles separated. The residual crush profile measured at the mid door elevation was as follows: C1 = 0, C2 = 0, C3 = 0.5 cm (0.2 in), C4 = 10.9 cm (4.3 in), C5 = 7.1 cm (2.8 in), C6=0. The maximum crush was located 27.4 cm (10.8 in) forward of the B-pillar at C4. The front door was jammed shut by deformation. The right rear door remained operational. The force of the impact shattered the left front glazing. The Collision Deformation Classification (CDC) was 11-LPEW-1. The total delta V calculated by the Damage Only Algorithm of the WINSMASH model was 9.0 km/h (5.6 mph). The longitudinal and lateral delta V components were -6.9 km/h (-4.3 mph) and 5.8 (3.6 mph), respectively.



Figure 6: Left side view of the damaged Ford.

Interior Damage

The only interior damage to the Ford was directly related to the deployment of the left side impact air bag. There was no intrusion or identified interior contacts as a result of the low level crash forces.

Side Impact Occupant Protection System

Figure 7 is an interior view depicting the deployed side air bag. The left side impact air bag module was located in the outboard aspect of the seat back. The module measured 36 cm (14 in) in length and was located 25 cm (10 in) above the seat cushion. The air bag was designed to offer both head and thorax protection. The module was identified by the following manufacturer's nomenclature:

TRW 3W1A54611D10AA
TTQF248020012



Figure 7: Right interior view depicting the deployed side impact air bag.

The air bag was rectangular in shape and measured 63.5 cm x 24.1 cm (25.0 in x 9.5 in), height by width. The forward excursion of the bag was measured from the seat bolster. The estimated depth of the thorax aspect of the inflated bag was 8 cm (3 in). The inflation was controlled an internal tether. The tether stitching measured 15 cm (6 in). A tether in the head aspect of the bag controlled the depth of inflation to an estimated 5 cm (2 in). The bag was not externally vented.

Figure 8 is a close-up view of the deployed air bag.



Figure 8: Deployed side impact air bag.

The deployment of the side impact air bag was controlled Restraint Control Module (RCM) located on the center tunnel. The RCM received side impact sensing from the satellite sensor located below the retractor at the base of the B-pillar. **Figure 9** is a view depicting the satellite sensor. The following nomenclature identified the sensor:

Takata 3W7A-14B345-BA
9473A0226100229

The SRS indicator in the instrument cluster displayed the Flash Code 13 upon activation of the ignition.

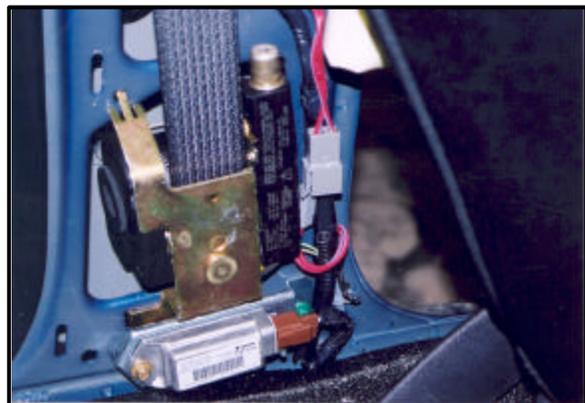


Figure 9: Location of the side impact sensor.

OCCUPANT ISSUES

The driver of the Ford was a NYS Trooper with a stated height and weight of 180 cm (71 in) and 107 kg (235 lb). At the time of the impact, he prepared for the impact by leaning to the right away from the side structure and window. He recalled the air bag deploying and inflating past his left arm. The inflating air bag contacted the outboard aspect of his upper arm without

displacing the extremity. He was not injured in the event. **Figure 10** is a reconstructed view of his position at the time of the impact.



Figure 10: Reconstructed position of the driver at impact.

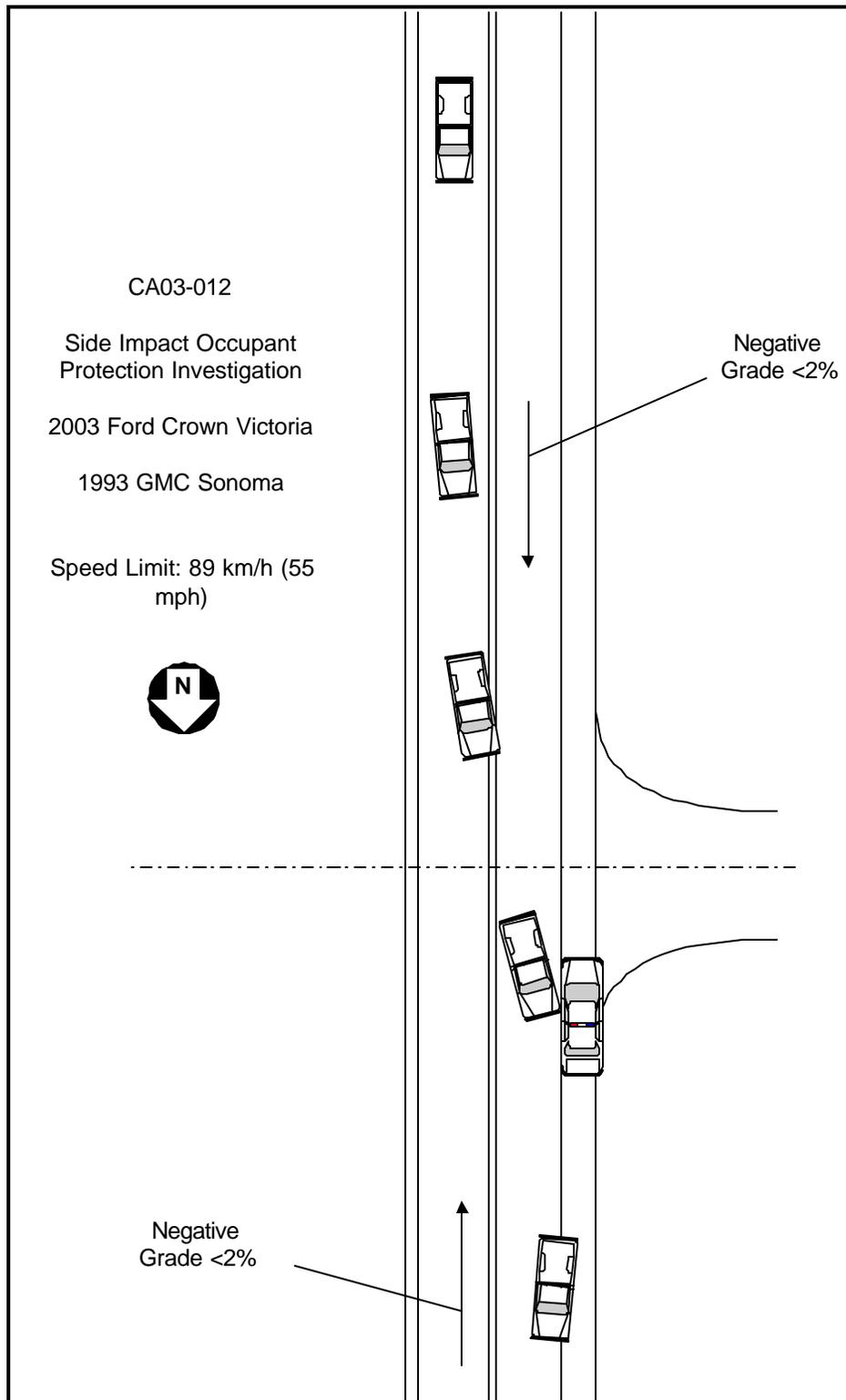


Figure 11: Crash Schematic.