

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-074-803G)

1998 Chevrolet Astro Van

Nebraska

September/1998

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16. Abstract <p>This remote investigation focused on the redesigned air bag system deployment of a 1998 Chevrolet Astro minivan. This minor injury crash occurred in September, 1998 in the afternoon. The weather was clear and the concrete roadway was dry. The crash occurred on a three lane divided roadway. The three eastbound travel lanes are separated from the three westbound travel lanes by a raised concrete median strip. The speed limit for this road is 56 kmph (35 mph). There are no traffic controls for this road at the area of impact. There is a downhill grade at this location. Vehicle 1, a 1998 Chevrolet Astro minivan (case vehicle) driven by a 39 year old female (160 cm/63 in, 82 kg/180 lb), was traveling west in the westbound left travel lane at a driver estimated speed of 48 kmph (30 mph). The driver was restrained by the manual lap/shoulder belt. There were no other occupants in the vehicle. A second vehicle, described as a "large red van", was traveling west in the westbound center lane just ahead of Vehicle 1. As Vehicle 1 was traveling west, the second vehicle encroached into the left lane. To avoid striking the second vehicle, the driver of Vehicle 1 steered the vehicle to the left. Vehicle 1 then crossed the concrete median strip and all three eastbound travel lanes. Vehicle 1 then departed the south roadside, striking the raised concrete curb with the front wheels (event 1), then struck a rocky landscaped embankment with the undercarriage (event 2). Vehicle 1 continued southwest and struck a tree (event 3) with the front plane (12FZEW3). A Delta V was calculated for event 3 for Vehicle 1, using WinSMASH, as 29 kmph (18 mph). As a result of the third event frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) deployed. Vehicle 1 came to rest engaged with the struck tree facing southwest. The driver of Vehicle 1 sustained minor non-incapacitating injuries in the crash but was not transported from the scene for medical attention. Vehicle 1 became disabled due to damage sustained in the crash and was towed from the scene.</p>			
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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Chevrolet Astro minivan. This minor injury crash occurred in September, 1998 in the afternoon. The weather was clear and the concrete roadway was dry. The crash occurred on a three lane divided roadway. The three eastbound travel lanes are separated from the three westbound travel lanes by a raised concrete median strip. The speed limit for this road is 56 kmph (35 mph). There are no traffic controls for this road at the area of impact. There is a downhill grade at this location.



Figure 1. Exterior, Vehicle 1 (Chevrolet Astro)

Vehicle 1, a 1998 Chevrolet Astro minivan (case vehicle) driven by a 39 year old female (160 cm/63 in, 82 kg/180 lb), was traveling west in the westbound left travel lane at a driver estimated speed of 48 kmph (30 mph). The driver was restrained by the manual lap/shoulder belt. There were no other occupants in the vehicle.

A second vehicle, described as a “large red van”, was traveling west in the westbound center lane just ahead of Vehicle 1.

Crash Events

As Vehicle 1 was traveling west, the second vehicle encroached into the left lane. To avoid striking the second vehicle, the driver of Vehicle 1 steered the vehicle to the left. Vehicle 1 then crossed the concrete median strip and all three eastbound travel lanes. Vehicle 1 then departed the south roadside, striking the raised concrete curb with the front wheels (event 1), then struck a rocky landscaped embankment with the undercarriage (event 2). Vehicle 1 continued southwest and struck a tree (event 3) with the front plane (12FZEW3).



Figure 2. Crash scene, approach to tree impact.

A Delta V was calculated for event 3 for Vehicle 1, using WinSMASH, as 29 kmph (18 mph).

As a result of the third event frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) deployed.

Vehicle 1 came to rest engaged with the struck tree facing southwest. The driver of Vehicle 1 sustained minor non-incapacitating injuries in the crash but was not transported from the scene for medical attention.

Vehicle 1 became disabled due to damage sustained in the crash and was towed from the scene.

Table 1. Delta V

	Case Vehicle	
	km/h	mph
Total	29	18
Longitudinal	-29	-18
Lateral	0	0
Barrier speed	29	18

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Chevrolet Astro Van
VIN	1GCDL19W5WB
CDC	12FZEW3



Figure 3. Exterior, Vehicle 1 (1998 Chevrolet Astro)



Figure 4. Exterior, Vehicle 1 (1998 Chevrolet Astro)

Table 3. Crush Measurements

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	160	1	10	18	32	22	4
	63	0.4	3.9	7.1	12.6	8.7	1.6

Interior of Case Vehicle

The interior of the Chevrolet Astro sustained minor damage from occupant contact. There were no areas of intrusion into the passenger compartment. There was occupant contact evidence to the left instrument panel consisting of a scuff. This was consistent with right knee contact.

The case vehicle was equipped with bucket seats with integral head restraints in the front left and front right seating positions. The front left seat was adjusted to the forward most track position. The front right seat was adjusted to the middle track position. The head restraints were not damaged.

Case Vehicle Occupant Protection Systems

The Chevrolet Astro minivan was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical I-configuration cover flaps which were not damaged. The circular air bag was equipped with two vent ports and two tether straps. No contact evidence was found on the bag and the bag was not damaged.



Figure 5. Driver's frontal air bag.

The front right air bag was housed in the mid instrument panel position and was concealed by symmetrical H-configuration cover flaps which were damaged. The top flap came completely disconnected from the console and was found on the floor of the vehicle. The rectangular air bag was equipped with two vent ports and two tether straps. No contact evidence was found on the bag but the bag was torn in several places primarily to the right side. The air bag module became separated from the instrument panel and pulled partially outward and down. The module anchorage bolts became detached. According to the driver, this was the original air bag and the bag had not been serviced. Figures 6 and 7 show this damage.



Figure 6. Passenger's frontal air bag. Module pulled out from instrument panel.



Figure 7. Passenger's frontal air bag. Close up of module retaining bolt failure.

Case Vehicle Occupant Demographics

Table 4. Case Vehicle Occupant Demographics

	Occupant 1
Age/Sex:	39/Female
Seated Position:	Front left
Seat Type:	Bucket - cloth covered
Height (cm/in.):	160 63
Weight (kg/lbs):	82 180
Pre-existing Medical Condition:	None noted
Body Posture:	Normal, upright facing forward
Hand Position:	Both on steering wheel
Foot Position:	On floor or foot controls
Restraint Usage:	Manual lap & shoulder restraint
Air bag:	Deployed redesigned air bag system

Occupant Injuries

Table 5. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Left shoulder skin contusion	790402.1	Seat belt webbing
Abdominal skin contusion	590402.1	Seat belt webbing
Right forearm skin contusion	790402.1	Driver's frontal air bag
Bilateral upper leg skin contusions	890402.1	Steering wheel rim

Occupant Kinematics

The driver (case occupant) of the Chevrolet Astro minivan was seated in a normal upright posture in the front left position of the vehicle. She was wearing the manual lap/shoulder restraint. Seat belt usage was determined through visual inspection by the researcher, the lack of prominent frontal contact evidence in the vehicle, and observations by the investigating police officer at the scene of the crash. There did not appear to be any indication of pre-impact braking so the occupant should have remained upright in the seat prior to impact.

At impact, the driver reacted to the 360 degree principle direction of force by moving forward and loading the lap/shoulder restraint. As the restraints locked, further forward movement of the case occupant was prevented. Impact with the locked seat belt webbing caused the left shoulder and abdominal contusions. As the driver's frontal air bag deployed, it struck the driver's right arm--causing the forearm contusion. The driver also struck the bottom of the steering wheel rim--causing the bilateral upper leg contusions. The case occupant was reported as having sustained non-incapacitating injuries but she received on-scene medical treatment only.



Figure 8. Interior, case vehicle

