CRASH DATA RESEARCH CENTER

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SIDE IMPACT OCCUPANT PROTECTION INVESTIGATION

VERIDIAN CASE NO. CA01-012

VEHICLE - 2000 INFINITY I30

LOCATION - STATE OF NEW JERSEY

CRASH DATE - JANUARY, 2001

Contract No. DTNH22-94-D-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 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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16. *Abstract* This on-site investigation focused on the performance of the side impact air bag system of a 2000 Infinity I30 4-door sedan. The Infinity I30 was equipped with redesigned frontal and side impact air bags for the front seating positions. The Infinity's left front side impact air bag deployed as a result of a right angle collision with a 2000 Ford Focus SE 4-door sedan. The driver of the Ford Focus was operating the vehicle southbound on a multi-lane divided roadway when he failed to observe the red traffic signal or eastbound Infinity as he proceeded straight through a 4-leg intersection. As both vehicles entered the intersection, the front right area of the Ford impacted the left passenger area of the Infinity resulting in minor damage to each vehicle. The restrained 50 year old female driver of the Infinity initiated a lateral trajectory in response to the 9 o'clock impact force and loaded the deployed side impact air bag. She was uninjured in the collision. The unrestrained 51 year old male front right passenger of the Infinity initiated a lateral trajectory in response to the 9 o'clock impact force and loaded the center armrest and front left seat back. He sustained a lumbar strain which was a result of the sudden lateral torso movement as the pelvic region loaded the center armrest. The front right passenger was transported by ambulance to a local hospital for treatment and released.			
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BACKGROUND

This on-site investigation focused on the performance of the side impact air bag system of a 2000 Infinity I30 4-door sedan. The Infinity I30 was equipped with redesigned frontal and side impact air bags for the front seating positions. The Infinity's left front side impact air bag deployed as a result of a right angle collision with a 2000 Ford Focus SE 4-door sedan. The driver of the Ford Focus was operating the vehicle southbound on a multi-lane divided roadway when he failed to observe the red traffic signal or eastbound Infinity as he proceeded straight through a 4-leg intersection. As both vehicles entered the intersection, the front right area of the Ford impacted the left passenger area of the Infinity resulting in minor damage to each vehicle. The restrained 50 year old female driver of the Infinity initiated a lateral trajectory in response to the 9 o'clock impact force and loaded the deployed side impact air bag. She was uninjured in the collision. The unrestrained 51 year old male front right passenger of the Infinity initiated a lateral trajectory in response to the 9 o'clock impact force and loaded the center armrest and front left seat back. He sustained a lumbar strain which was a result of the sudden lateral torso movement as the pelvic region loaded the center armrest. The front right passenger was transported by ambulance to a local hospital for treatment and released.

The crash notification was provided to NHTSA by a local law enforcement agency on Wednesday, January 24, 2001 and immediately assigned to the Veridian SCI team as an on-site investigative effort. The on-site investigator departed on January 31 and concluded field activities on Thursday, February 1, 2001.

SUMMARY

Crash Site

This two vehicle crash occurred during the morning hours of January, 2001. At the time of the crash, it was daylight with no adverse conditions as the roads were dry. The crash occurred at a straight and level 4-leg intersection **(see Figure 12 - page 7)** which was controlled by an overhead signal system in green phase for eastbound traffic. The north/southbound lanes consisted of four asphalt travel lanes divided by a concrete (Jersey) barrier in the north sector of the intersection and by a painted median strip in the south sector. The roadway was bordered by wide paved shoulders and barrier curbs. An exit ramp (or "jug handle") was located approximately 274.0 meters (300.0 yards) north of the crash site which allowed southbound traffic access to the eastbound secondary road. The eastbound access road consisted of one asphalt lane which curved left on approach to the intersection. This access road was bordered by a W-beam guardrail to the south and a grassy median to the north. The posted speed limit at the crash site was 48 km/h (30 mph).

Pre-Crash

The 50 year old female driver of the 2000 Infinity I30 4-door sedan was initially stopped and facing east **(Figure 1)** when she entered the 4-leg intersection at a (driver reported) speed of 8 km/h (5 mph). Upon recognition of the impending harmful event, the driver accelerated in avoidance.

The 83 year old male driver of the 2000 Ford Focus SE 4-door sedan was operating the vehicle southbound **(Figure 2)** at a (driver reported) speed of 48 km/h (30 mph) when he failed to observe the red traffic signal or eastbound Infinity as he proceeded straight through the 4-leg intersection. Upon recognition of the impending harmful event, the driver steered left and braked in avoidance.

Figure 1. Eastbound approach for the 2000 Infinity I30.

Figure 2. Southbound approach for the 2000 Ford Focus.

Crash

As both vehicles entered the 4-leg intersection, the front right area of the Ford Focus impacted the left passenger area of the Infinity I30 resulting in minor damage to each vehicle. The missing vehicle algorithm of the WinSMASH reconstruction program computed velocity changes of 12.0 km/h (7.5 mph) for the subject vehicle and 16.2 km/h (10.1 mph) for the striking Ford Focus. The latitudinal component for the subject vehicle was 11.9 km/h (7.4 mph). The longitudinal component for the Ford Focus was -15.2 km/h (-9.4 mph). The impact was sufficient to deploy the Infinity's left front side impact air bag *(and the Ford's redesigned frontal air bag system).*

As the vehicles crushed to maximum engagement, the Infinity rotated approximately 20 degrees counterclockwise and came to rest in the southeast sector of the intersection facing northeast. The Ford Focus rotated approximately 30 degrees counterclockwise and came to rest in the south sector of the intersection facing southeast.

Post-Crash

The occupants of the 2000 Infinity remained in the vehicle until police and rescue personnel arrived within minutes following the crash. The front right passenger of the Infinity was removed due to perceived serious injury through the right front door and transported by ambulance to a local hospital for treatment and released. The driver of the Infinity subsequently exited the vehicle through the right front door under her own power, and was uninjured in the collision. The driver of the Ford exited the vehicle through the left front door with some assistance from police. He sought treatment for back pain the next day from a private physician. Both vehicles were towed from the crash scene with disabling damage.

VEHICLE DATA

The 2000 Infinity I30 was manufactured in May, 2000 and identified by the vehicle identification number (VIN): JNKCA31A6YT (production number deleted). The driver-owned vehicle was a 4-door sedan equipped with front-wheel drive, four-wheel ABS and a 3.0 liter, V-6 engine. At the time of the crash, the odometer had recorded approximately 8,851 km (5,500 miles). The seating was configured with front bucket and rear bench seats (with folding backs). The driver reported no previous crashes or maintenance on the Infinity's frontal or side impact air bag system. A cell phone was present (and on), but not in use at the time of the crash.

VEHICLE DAMAGE

Exterior

The 2000 Infinity I30 sustained minor left side surface damage as a result of the impact with the Ford Focus **(Figures 3 & 4)**. Although the vehicle was under repair at the time of the SCI inspection, all damaged parts were immediately available for meticulous documentation. The direct contact damage began 43.0 cm (16.9 in) aft of the left front axle and extended 138.0 cm (54.3 in) rearward. The combined direct and induced damage length (Field L) began 38.0 cm (15.0 in) aft of the left front axle and extended 171.0 cm (67.3 in) rearward. Six crush measurements were approximated at the level of the mid-door: C1= 0 cm, C2= 3.0 cm (1.2 in), C3= 5.0 cm (2.0 in), C4= 10.0 cm (3.9 in), C5= 7.0 cm (2.8 in), C6= 0 cm. The Collision Deformation Classification (CDC) for this impact to the Infinity was 09-LYEW-1 with a principal direction of force of (-) 80 degrees. The left side tempered glazings were undamaged. Induced contact damage produced minor buckling along the leading edge of the A-pillar. The windshield was fractured at the lower left A-pillar from the impact force. Abrading was noted to the right front rim and attributed to pavement scrubbing during post-impact vehicle rotation.

Figure 3. Left side surface damage to the 2000 Infinity I30 4-door sedan.

Figure 4. Infinity damaged components.

The 2000 Ford Focus SE 4-door sedan sustained minor frontal damage as a result of the impact with the Infinity I30 **(Figures 5 & 6)**. Although the vehicle was under repair at the time of the SCI inspection, all damaged parts were immediately available for meticulous documentation. The direct contact damage began at the front right bumper corner and extended 72.0 cm (28.3 in) inboard. Maximum crush was approximated to be 15.0 cm (5.9 in) at the front right bumper corner area. The Collision Deformation Classification (CDC) for this impact to the Ford was 01-FZEW-1 with a principal direction of force of (+) 20 degrees. Bumper (only) shift to the left measured 11.5 cm (4.5 in). The windshield was fractured at the lower left A-pillar from exterior impact forces and the (interior) right mid-windshield area from the passenger air bag flap. All tempered glazings were undamaged.

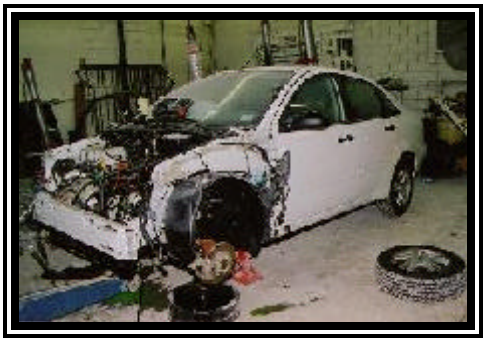

Figure 5. Frontal damage to the 2000 Ford Focus SE 4-door sedan.

Figure 6. Ford Focus damaged bumper cover and fenders.

Interior

Interior damage to the Infinity identified through the vehicle inspection was minimal and attributed to occupant contact **(Figures 7 & 8)**. Scuff marks were documented on the right aspect of the center armrest and left front door armrest. Scuff marks were also noted to the upper left front door panel area from the side impact air bag deployment. No intrusions were found in the vehicle.

Figure 7. Interior view of the 2000 Infinity I30.

Figure 8. Left front door.

MANUAL RESTRAINT SYSTEMS

The interior of the 2000 Infinity I30 consisted of a five passenger seating configuration with front bucket and rear bench seats (with folding backs). The driver 3-point manual lap and shoulder belt system consisted of a continuous loop belt webbing with a sliding latchplate and a dual mode retractor (inertial lock/belt sensitive). The front left restraint system also included a deployed retractor pretensioner which reduces the slack in both the lap and shoulder belt webbing. The front right 3-point

manual lap and shoulder belt system consisted of a continuous loop belt webbing with a sliding latchplate and a retractor equipped with an inertial and switchable lock mechanism. The rear seated positions were equipped with 3-point manual lap and shoulder belt systems which consisted of a continuous loop belt webbing with a sliding latchplate that retracted into an inertial sensitive and switchable locking retractor.

SUPPLEMENTAL RESTRAINT SYSTEMS

The 2000 Infinity I30 was equipped with redesigned frontal air bags for the driver and front right passenger positions. The air bags had not deployed as a result of the crash. The driver air bag was housed in the center of the steering wheel with a horizontally oriented flap tear seam (H-configuration). The front right passenger air bag was housed in the right mid-instrument panel area with a single cover flap design hinged at the top aspect.

The Infinity was also equipped with side impact air bags for the front seated positions. The air bag modules were housed in the outboard side aspect of the front seat backs with a vertically oriented tear seam integrated into the seat back stitching **(Figures 9 & 10)**. The left front side impact air bag deployed as a result of the crash and was identified by the following bar coded lot number: *PL3Y0005190484*. The air bag membrane inflated vertically to offer head and thoracic protection. The "elbow" shaped air bag measured 47.0 cm (18.5 in) in width and 40.8 cm (16.1 in) in height in its deflated state **(Figure 11)**. The bag was tethered by two vertical stitch patterns along the membrane. No vent ports were present. No contact evidence was identified on the side impact air bag, however, bag interaction by the driver produced the noted scuff marks to the left front door panel.

Figure 9. 2000 Infinity I30 deployed left front side impact air bag.

Figure 10. Side view.

Figure 11. Close-up view.

DRIVER DEMOGRAPHICS

Age/Sex:	50 year old female
Height:	168 cm (66 in)
Weight:	73 kg (160 lb)
Seat Track Position:	Middle position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	Vehicle inspection, driver interview
Eyeware:	Sunglasses
Type of Medical Treatment:	None

Driver Injuries

Injury	*Severity (AIS 90)*	*Injury Mechanism*
None	N/A	N/A

Driver Kinematics

The 50 year old female driver of the 2000 Infinity I30 was restrained by the available 3-point manual lap and shoulder belt system, seated in an upright posture with her hands placed at the 9 o'clock and 3 o'clock positions on the steering wheel rim. The driver stated she was belted, further evidenced by the deployment of the retractor pretensioner. At impact, the driver initiated a lateral trajectory in response to the 9 o'clock impact force and loaded the deployed side impact air bag with her left shoulder/arm/head areas. She was uninjured in the collision. The deployed side impact air bag provided protection against contact to left side components, and potential injury.

FRONT RIGHT PASSENGER DEMOGRAPHICS

Age/Sex:	51 year old male
Height:	180 cm (71 in)
Weight:	95 kg (210 lb)
Seat Track Position:	Middle position
Manual Restraint Use:	None
Usage Source:	Vehicle inspection, passenger interview
Eyeware:	None
Type of Medical Treatment:	Transported to a local hospital for treatment and released

Front Right Passenger Injuries

Injury	*Severity (AIS 90)*	*Injury Mechanism*
Lumbar strain	Minor (640678.1,8)	Center armrest (indirect contact injury)

Front Right Passenger Kinematics

The unrestrained 51 year old male front right passenger of the 2000 Infinity I30 was seated out-of-position in an upright posture with his head turned left and his left arm behind the driver's seat back. At impact, the passenger initiated a lateral trajectory in response to the 9 o'clock impact force and loaded the center armrest and front left seat back. He sustained a lumbar strain which was a result of the sudden lateral torso movement as the pelvic region loaded the center armrest. It should be noted that the passenger reported pre-existing back problems which may have been aggravated by the crash. He came to rest with his upper torso between the front seat backs. The front right passenger was transported by ambulance to a local hospital for treatment and released.

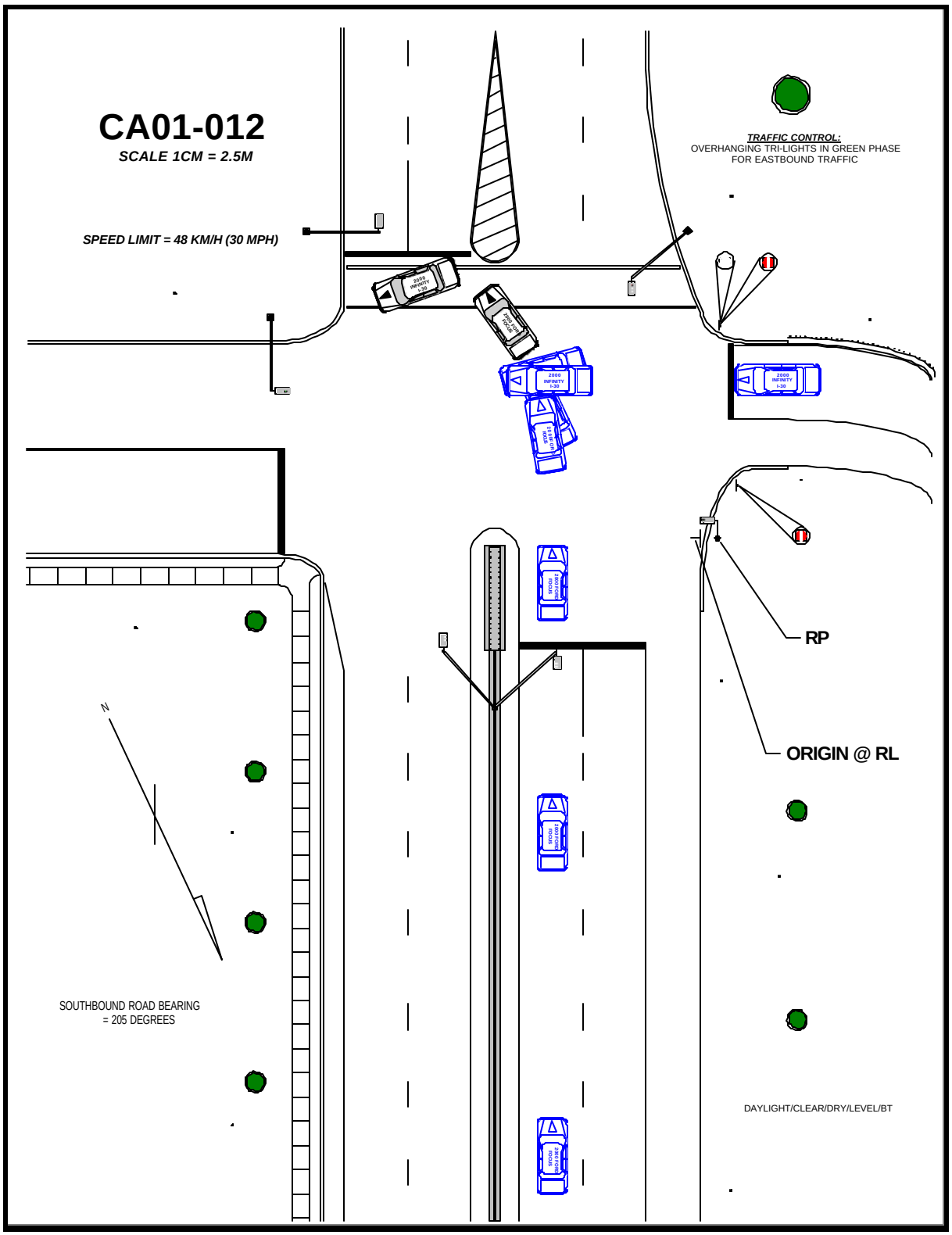

Figure 12. Scene Diagram.