TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

Advanced Information Engineering Services
A General Dynamics Company
Buffalo, NY 14225

GENERAL DYNAMICS REMOTE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION INVESTIGATION
SCI TECHNICAL SUMMARY REPORT

NASS/SCI COMBO CASE NO: 03-04-048E

VEHICLE: 2002 FORD EXPLORER

LOCATION: STATE OF NEW JERSEY

CRASH DATE: JULY 2003

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

DISCLAIMER

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 03-04-048E	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle General Dynamics Remote Side Impact Inflatable Occupant Protection Investigation Vehicle: 2002 Ford Explorer Location: State of New Jersey		*5. Report Date*: December 2004 *6. Performing Organization Code*	
7. Author(s) Crash Data Research Center		*8. Performing Organization Report No.*	
9. Performing Organization Name and Address Transportation Sciences Crash Data Research Center Advanced Information Engineering Services A General Dynamics Company P.O. Box 400 Buffalo, New York 14225		*10. Work Unit No.* C00410.0000.0199 *11. Contract or Grant No.* DTNH22-01-C-17002	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		*13. Type of Report and Period Covered* Technical Report Crash Date: July 2003 *14. Sponsoring Agency Code*	
15. Supplementary Note Remote investigation of a rollover crash that involved a 2002 Ford Explorer, which was sufficient to deploy the left and right side curtain occupant protection system.			
16. Abstract This remote investigation focused on the performance of the side curtain occupant protection system that deployed in a 2002 Ford Explorer sport utility vehicle. The Explorer was also equipped with redesigned frontal air bags for the driver and front right passenger positions. The frontal air bags did not deploy in this crash. The Explorer was involved in an intersection crash with a 1991 Nissan Pathfinder. The Explorer was deflected laterally to its right in a counterclockwise (CCW) yaw, and rolled over, right side leading. The Explorer rolled four quarter-turns and impacted a concrete landscape wall around a roadside cemetery before coming to rest upright on top of a the wall. As a result of the impacts, both side inflatable curtain (IC) air bags deployed. The Explorer was occupied by a 54-year-old male driver and a 49-year-old female front right passenger. The front right passenger's right arm was partially ejected through the right door window opening during the rollover event. She sustained deep complex lacerations and abrasions of the right forearm with glass and gravel debris embedded into the lesions. She also sustained a left hand abrasion and right arm contusion from interior vehicle contact during the rollover. The driver sustained a scalp abrasion and avulsion as a result of roof intrusion contact, bilateral arm and leg contusions, a left arm abrasion and a left knee abrasion as a result of interior contact during the rollover. Both the driver and the passenger of the Explorer were transported to a local hospital where they were treated and released.			
17. Key Words Rollover Inflatable curtain Side air bag		*18. Distribution Statement* General Public	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 11	*22. Price*

TABLE OF CONTENTS

GENERAL DYNAMICS REMOTE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION CRASH INVESTIGATION
SCI TECHNICAL SUMMARY REPORT
NASS/SCI COMBO CASE NO. – 03-04-048E
SUBJECT VEHICLE – 2002 FORD EXPLORER
LOCATION - STATE OF NEW JERSEY
CRASH DATE – JULY 2003

BACKGROUND

This remote investigation focused on the performance of the side impact inflatable occupant protection system that deployed in a 2002 Ford Explorer sport utility vehicle **(Figure 1)**. The Explorer was also equipped with redesigned frontal air bags for the driver and front right passenger positions. The frontal air bags did not deploy in this crash. The Explorer was involved in an intersection crash with a 1991 Nissan Pathfinder. The Explorer was deflected laterally to its right in a counterclockwise (CCW) yaw, and rolled over, right side leading. The Explorer rolled four quarter-turns and impacted a concrete landscape wall around a roadside cemetery before coming to rest upright on top of a the wall. As a result of the impacts, both side inflatable curtain (IC) air bags deployed. The Explorer was occupied by a 54-year-old male driver and a 49-year-old female front right passenger. The front right passenger's right arm was partially ejected through the right door window opening during the rollover event. She sustained deep complex lacerations and abrasions of the right forearm with glass and gravel debris embedded into the lesions. She also sustained a left hand abrasion and right arm contusion from interior vehicle contact during the rollover. The driver sustained a scalp abrasion and avulsion as a result of roof intrusion contact, bilateral arm and leg contusions, a left arm abrasion and a left knee abrasion as a result of interior contact during the rollover. Both the driver and the passenger of the Explorer were transported to a local hospital where they were treated and released.

Figure 1. Damaged 2002 Ford Explorer

Notification of the crash was provided to the General Dynamics SCI team by the General Dynamics NASS Zone Center during a quality control review of the case. A summary of the crash was forwarded to NHTSA and the case was assigned as a remote investigative effort on April 14, 2004. The SCI effort involved the review of the NASS EDS file and preparation of a narrative report.

VEHICLE DATA - 2002 FORD EXPLORER

The 2002 Ford Explorer was identified by the Vehicle Identification Number (VIN): 1FMDU75W82Z (production sequence omitted). The vehicle was a four-door, 4 x 4, sport utility vehicle that was equipped with a 4.6 liter, V-8 Flex Fuel engine, which could operate on gasoline or a gasoline/ethanol blend E85. The Explorer was equipped with the

LTD trim package which included a five-speed automatic transmission, four-wheel power disc brakes with four-wheel ABS, power adjustable pedals, power steering, and a tilt steering wheel with steering wheel radio controls. The exterior was also configured with side running boards and a roof-mounted luggage rack. The Ford Explorer was equipped with Goodyear Wrangler AP P245/70R16 tires mounted on OEM aluminum/alloy wheels. The manufacturer's recommended tire pressure was 207 kpa (30 psi) and 241 kpa (35 psi) for the front and rear tires, respectively. The specific tire details are as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	228 kpa (33 psi)	8 mm (10/32")	No	None
LR	200 kpa (29 psi)	6 mm (7/32")	No	None
RF	0.0 kpa	8 mm (10/32")	No	De-beaded
RR	0.0 kpa	6 mm (7/32")	No	De-beaded

The Explorer was configured with front buckets seats with adjustable head restraints. Both front seats were equipped with power track adjustments and both were positioned in a mid-track position. Both front seat backs were slightly reclined. The second seating positions in the Explorer were configured with a three-person split bench seat with adjustable head restraints for the outboard positions. The third row was configured with a two-person bench seat with a folding back and adjustable head restraints.

VEHICLE DATA – 1991 NISSAN PATHFINDER

The 1991 Nissan Pathfinder was identified by the VIN: JN8HD17Y4MW (production sequence omitted). The vehicle was a 4 x 4 sport utility vehicle configured with a 3.0 liter, 6-cylinder engine, an automatic transmission, power brakes with rear ABS, power steering, and a tilt steering wheel. The Pathfinder was equipped with Toyo Radial Open Country P235/75R15 tires that were mounted on alloy wheels. The manufacturer's recommended tire pressure was 179 kpa (26 psi).

CRASH SITE

This two-vehicle crash occurred during the daylight hours of July 2003 in the state of New Jersey. At the time of the crash, the weather was clear and the asphalt roadway surface was dry. The crash occurred at a four-leg intersection of two local roadways. The north/south roadway was configured with two travel lanes in each direction that were separated by a double-yellow centerline. The east/west roadway was configured with one travel lane in each direction, separated by a double-yellow centerline. The east/west roadway was also configured with a center left turn lane at each leg of the intersection. Traffic flow through the intersection was controlled by overhead 3-phase traffic signals. The posted speed limit for each roadway was 48 km/h (30 mph). The roadways were each bordered by concrete curbs, grassy areas, and concrete sidewalks. The roadside environment consisted of commercial properties and a cemetery on the southeast corner. A concrete landscape wall that measured approximately 30 cm (12") in height surrounded

the cemetery adjacent to the sidewalks around the southwest corner of the intersection and along the east and south legs of the intersection. The wall was designed with a break at the apex of the southwest intersection corner that facilitated a brick walkway into the cemetery. The wall gradually increased in height to approximately 76 cm (30”) at the corners of the break in the wall, and the walkway measured approximately 1.5 m (5.0’) in width.

CRASH SEQUENCE

Pre-Crash

The 54-year-old male driver of the 2002 Ford Explorer was operating the vehicle in an eastbound direction on the two-lane roadway on approach to the four-leg intersection **(Figure 2)**. The three-phase traffic signal was in the green phase for east/west traffic. The driver of the 1991 Nissan Pathfinder was operating the vehicle in a southbound direction on approach to the intersection **(Figure 3)**. The three-phase traffic signal was in the red phase for north/south traffic. As the Explorer was passing through the intersection, the driver of the Pathfinder disregarded the red traffic signal and proceeded into the intersection.

Figure 2. Eastbound approach for the Ford Explorer

Figure 3. Southbound approach for the Nissan Pathfinder

Crash

The front of the Nissan Pathfinder struck the left side passenger aspect of the Explorer. The initial impact resulted in moderate damage to both vehicles. The initial impact was sufficient to deploy the left side Inflatable Curtain (IC) in the Explorer. The damage algorithm of the WinSMASH program computed a total delta-V of 18.0 km/h (11.2 mph) for the Explorer based on the documented left side crush profile, and SCI-revised Collision Deformation Classification (CDC). The longitudinal and lateral components were –13.8 km/h (-8.6 mph) and 11.6 km/h (7.2 mph), respectively. The WinSMASH program computed a total delta-V of 21.0 km/h (13.0 mph) for the Pathfinder, based on an estimated frontal crush profile from NASS photographs. The impact caused the Explorer to initiate a counterclockwise (CCW) yaw in the intersection. The yaw caused the both right side tires to debead from the alloy wheels, and the edge of the right rear wheel gouged the asphalt road surface in a semi-circular pattern. The gouging of the right wheel and resistance of the debeaded right front tire tripped the Explorer into a four quarter-turn rollover with the right side leading. The right IC deployed as the right side of

the Explorer struck the ground during the rollover event. During the rollover event, the front right passenger's right arm was partially ejected through the right front window. The Explorer rolled onto its roof and left side across the southwest corner of the intersection toward the cemetery walkway and concrete wall. The Explorer rolled onto the southwest corner with its left side and struck the south edge of the concrete wall (at the walkway) with the left rear side aspect, which fractured the struck portion of the wall. The Explorer rolled to an upright attitude and the undercarriage (gas tank and muffler, forward of the rear axle) struck the north edge of the wall (at the walkway). The Explorer came to rest straddling the brick walkway and opening in the wall **(Figure 4)**. The Nissan Pathfinder rotated CCW and came to rest near the center aspect of the intersection.

Figure 4. View of struck wall

Post-Crash

The driver of the Explorer exited the vehicle with assistance, although the left front door was jammed shut and his specific method of egress was not reported. The front right passenger of the Explorer was removed from the vehicle by rescue personnel. Both of the Explorer's occupants were transported by ambulance to a local hospital for treatment and released.

VEHICLE DAMAGE

Exterior Damage – 2002 Ford Explorer

The 2002 Ford Explorer sustained moderate left side damage as a result of the initial impact with the 1991 Nissan Pathfinder **(Figure 5)**. The direct contact damage began 110 cm (43") forward of the left rear axle and extended 115 cm (45") forward along the left side. The maximum crush measured 15 cm (6") and was located at C5; 194 cm (76") forward of the left rear axle. The left front door and left rear door sustained lateral crush, paint transfers and longitudinal abrasions. The direct contact damage was concentrated below the beltline and on the mid and lower aspects of the left doors. The cladding on the front left door was separated and the cladding on the left rear door was partially separated. Both left side doors were slightly displaced, although it appeared that rescue attempts with hydraulic tools might have contributed to the longitudinal deformation and displacement. The combined direct and induced damage began 60 cm (24") forward of the left rear axle and extended 240 cm (94") forward along the left side. Six crush measurements were

Figure 5. Left side damage to the Ford Explorer

documented by the NASS researcher and were as follows: C1 = 0 cm, C2 = 0 cm, C3 = 11 cm (4”), C4 = 12 cm (5”), C5 = 15 cm (6”), C6 = 6 cm (2”). The CDC was revised to reflect an 11 o’clock direction of force versus a 10 o’clock direction of force, based on crash dynamics and vehicle damage. The SCI-revised Collision Deformation Classification (CDC) for the initial impact with the Nissan Pathfinder was 11-LPEW-2.

The Explorer sustained moderate damage as a result of the subsequent rollover. Both right side tires were debeaded and gouges were present on both alloy wheels from direct contact with the roadway surface. Angled abrasions were present on the entire length of the right side plane. Heavy lateral abrasions were present on the top aspect of the right A-pillar and right roof side rail. The roof sustained abrasions and the luggage rack was fractured and partially separated. The left aspect of the windshield header and the left roof side rail were crushed vertically from the rollover event **(Figure 6)**. The windshield sustained fractures and was holed on the top right aspect as a result of the left A-pillar and windshield header deformation. The top aspects of the left front and left rear doors were deformed vertically as a result of the rollover. The CDC for the rollover event was 00-TDDO-3.

Figure 6. Rollover damage

The left rear corner impact with the concrete wall resulted in minor damage to the left rear bumper corner and left rear quarter panel **(Figure 7)**. The direct contact began at the left rear bumper corner and extended 30 cm (12”) forward along the left side plane. The direction of force was non-horizontal and resulted in the lateral and upward displacement of the left rear bumper corner. There was no structural involvement. The combined direct and induced damage began at the left rear bumper corner and extended 93 cm (37”) forward. The left rear tail light assembly was separated. The CDC for the left rear corner impact to the concrete wall was 00-LBEE-3.

Figure 7. Close-up of left rear damage from wall contact

The Explorer sustained minor undercarriage damage as a result of the undercarriage contact with the landscape wall as it came to rest.

Figure 8. View from left side showing contact to fuel tank and muffler

Concrete transfers were present on the bottom aspect of the HDPE fuel tank **(Figure 8)** and on the bottom aspect of the muffler. There was no visible crush or deformation to the fuel tank or muffler in the NASS images. Although not included in the EDS file, a CDC for the undercarriage impact of 00-UPYW-1 was documented by the SCI reviewer.

Exterior Damage – 1991 Nissan Pathfinder

The 1991 Nissan Pathfinder sustained moderate frontal damage as a result of the impact with the Ford Explorer. The direct contact damage began on the front right bumper corner and extended laterally across the entire frontal plane. Although the NASS researcher was unable to document a frontal crush profile, the maximum bumper crush was estimated to be 38 cm (15”). The entire frontal structure was shifted to the left due to the forward momentum of the Ford Explorer. The hood also sustained longitudinal buckling as a result of the frontal impact. The CDC for the impact with the Ford Explorer was 01-FDEW-2. The CDC was incremented by 80 to account for the end shift to the left, and the revised CDC was 81-FDEW-2. Six crush measurements were estimated along the front bumper from NASS photographs as follows: C1 = 0 cm, C2 = 10 cm (4”), C3 = (8”), C4 = 25 cm (10”), C5 = 30 cm (12”), C6 = 38 cm (15”).

Figure 9. Damaged 1991 Nissan Pathfinder

Interior Damage – 2002 Ford Explorer

The 2002 Ford Explorer sustained moderate interior damage as a result of passenger compartment intrusion and occupant contact. Integrity loss occurred in the holed windshield and the front and rear side windows. The knee bolster was displaced and exhibited a scuff mark from contact with the driver’s left knee. The intrusion of the roof on the left aspect **(Figure 10)** allowed the driver’s head to contact the headliner, evidenced by a scuff mark above the driver’s position. The left front interior door panel was displaced around the release handle, possibly a result of contact with the driver’s left leg. The intruded roof contacted the top aspect of the driver’s head restraint. Multiple passenger compartment intrusions were documented by the NASS researcher as follows:

Figure 10. View of driver's seating area and vertical intrusion

Position	Intruded Component	Magnitude of Intrusion	Direction
FL	Windshield header	6.0 cm (2.4”)	Vertical

Position	Intruded Component	Magnitude of Intrusion	Direction
FL	Left A-pillar	9.0 cm (3.5”)	Vertical
FL	Left B-pillar	20.0 cm (7.9”)	Vertical
FL	Left roof side rail	20.0 cm (7.9”)	Vertical
FR	Right A-pillar	7.0 cm (2.8”)	Vertical
FR	Windshield header	5.0 cm (2.0”)	Vertical
2nd L	Left roof side rail	19.0 cm (7.5”)	Vertical
2nd L	Roof	23.0 cm (9.1”)	Vertical
2nd L	Left C-pillar	14.0 cm (5.5”)	Vertical
2nd C	Roof	15.0 cm (5.9”)	Vertical
2nd R	Roof	2.0 cm (1.6”)	Vertical
3rd L	Roof	12.0 cm (4.7”)	Vertical

MANUAL RESTRAINT SYSTEMS – 2002 FORD EXPLORER

The 2002 Ford Explorer was configured with manual 3-point lap and shoulder belts for the front seat positions. Both were configured with sliding latch plates and adjustable D-rings that were in the full-down positions. The driver’s safety belt was configured with an Emergency Locking Retractor (ELR) and the front right passenger’s safety belt was configured with a switchable ELR/Automatic Locking Retractor (ALR). Both front safety belts were configured with buckle pretensioners that did not actuate in this crash. The NASS researcher did not document any loading evidence on the safety belt webbing for the front seat occupants. The NASS researcher documented a scuff mark on the driver’s lap belt, and scuff marks on the front right passengers lap and shoulder belts. Minor deformation was noted to the driver’s and front right passenger’s shoulder belts from occupant loading in the NASS photographs.

Figure 11. View of front right passenger's safety belt

The second row was configured with manual 3-point lap and shoulder belts with sliding latch plates, switchable ELR/ALR’s, and adjustable D-rings for the outboard positions. The second row center position was configured with a lap belt with a sewn-on latch plate and switchable ELR/ALR. The third row two-person bench seat was configured with manual 3-point lap and shoulder belts for both seating positions.

SUPPLEMENTAL RESTRAINT SYSTEM – 2002 FORD EXPLORER

The 2002 Ford Explorer was equipped with redesigned frontal air bags for the driver and front right passenger positions. The driver's air bag was housed in the center of the steering wheel hub and the front right passenger's air bag was housed in a mid-mount module located on the right instrument panel. The frontal air bags did not deploy in this crash. The Explorer was also equipped with safety belt buckle pretensioners that were designed to actuate in conjunction with the frontal air bag system. The buckle pretensioners did not fire in this crash.

SIDE IMPACT INFLATABLE OCCUPANT PROTECTION SYSTEM

The 2002 Ford Explorer was equipped with side impact inflatable curtains (IC) that were designed to deploy in the event of a side impact. The left side IC deployed as a result of the initial side impact and the right IC deployed during the rollover event as the right side of the Explorer impacted the ground. The IC's **(Figures 12 and 13)** deployed downward from the left roof side rail through a separation in the outboard aspect of the headliner that measured 145 cm (57") in length between the left A- and C-pillars. Each IC was rectangular in shape and measured 150 cm (59") in length and 37 cm (15") in height. Each IC was tethered on the forward aspect by rope-type tethers. The right side IC tether had been cut by rescue personnel. There was no occupant contact evidence on either IC.

Figure 12. Left side IC (front aspect)

Figure 13. Right side IC (front aspect)

OCCUPANT DEMOGRAPHICS – 2002 FORD EXPLORER

Driver

Age/Sex:	54-year-old male
Height:	173 cm (68")
Weight:	120 kg (265 lb)
Seat Track Position:	Mid-track
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Prescription eyeglasses
Type of Medical Treatment:	Transported by ambulance to a local hospital for treatment and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Probable Injury Mechanism
Scalp avulsion (top of head)	Minor (190800.1,5)	Roof
Scalp abrasion (top of head)	Minor (190202.1,5)	Roof
Bilateral arm contusions	Minor (790402.1,3)	Unknown
Left forearm abrasion	Minor (790202.1,2)	Left interior door
Bilateral leg contusions	Minor (890402.1,3)	Unknown
Left knee abrasion	Minor (890202.1,2)	Knee bolster

Injury source: Emergency room records

Driver Kinematics

The 54-year-old male driver was operating the vehicle in an upright attitude and was restrained by the manual 3-point lap and shoulder belt. At impact with the Nissan Pathfinder, the left side IC deployed and the driver initiated a forward and lateral trajectory to the left in response to the 11 o'clock direction of force. He loaded the safety belt and left interior door panel, which resulted in a left forearm abrasion. His head probably contacted the deployed left IC. He continued to respond to the left as the Explorer rotated CCW and initiated the rollover with the right side leading. He was displaced slightly as the Explorer rolled over, but the use of the safety belt prevented significant movement throughout the vehicle. He sustained bilateral arm and leg contusions from contact within the vehicle during the rollover event. He also sustained left knee abrasion from contact with the knee bolster during the rollover. As the Explorer rolled from the roof onto its left side, the left roof side rail and roof intruded into the passenger compartment. The top of the driver's head contacted the intruded roof, which caused a scalp abrasion and scalp avulsion to the top of the head. He exited the vehicle with some assistance, and was transported by ambulance to a local hospital for treatment and released.

Front Right Passenger

Age/Sex:	49-year-old female
Height:	155 cm (61")
Weight:	84 kg (185 lb)
Seat Track Position:	Mid-track
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a local hospital for treatment and released

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Right arm: ragged, deep, dirty 13 cm complex laceration of the forearm, (2) 1 cm (0.4”) lacerations to the lateral palm, (2) 1 cm (0.4”) parallel lacerations above the elbow, 1 cm (0.4”) laceration of the forearm	Minor (790602.1,1)	Ground/broken glass
17 cm (7”) of abrasion (road rash) on right forearm	Minor (790202.1,1)	Ground
Left hand abrasion	Minor (790202.1,2)	Right instrument panel
Right arm contusion*	Minor (790402.1,1)	Unknown

Injury source: Emergency room records, *interview

Front Right Passenger Kinematics

The 49-year-old female front right passenger stated in the NASS interview that she was seated in an upright attitude and restrained with her hands on her lap. She was restrained by the manual lap and shoulder belt. At impact, the front right passenger initiated a forward and lateral trajectory to the left. She loaded the safety belt webbing and was displaced slightly left as the Explorer rotated CCW. She was further displaced to the left as the vehicle began to roll over, with the right side leading. The right side IC deployed in response to the right side impact with the ground during the rollover, and the front right passenger was redirected to the right. The right side glazing disintegrated as the right side plane of the Explorer initiated contact with the ground. Her head contacted the deployed IC and she did not sustain any head injury. Although the IC provided significant protection from ejection, her right arm was partially ejected under the IC during the first quarter turn of the rollover. Her arm contacted the asphalt roadway surface and glass fragments as the Explorer continued to roll, which resulted in a ragged, deep, dirty 13 cm (5”) complex laceration of the forearm and a 17 cm (7”) of abrasion (road rash) on right forearm. Additional lacerations from glazing included two 1 cm (0.4”) lacerations to the right lateral palm, two 1 cm (0.4”) parallel lacerations above the right elbow, and a 1 cm (0.4”) laceration of the right forearm. During the rollover, her left hand probably struck the instrument panel, which resulted in a left hand abrasion. The female passenger also identified a right arm contusion, although the specific source was unknown. She continued to be redirected as the Explorer rolled over and struck the landscape wall with the left rear aspect. The use of the manual safety belt mitigated significant movement throughout the vehicle. She came to rest in the front right seat as the Explorer came rest upright on the landscape wall. She was removed from the vehicle by rescue personnel and transported by ambulance to a local hospital for treatment and released.

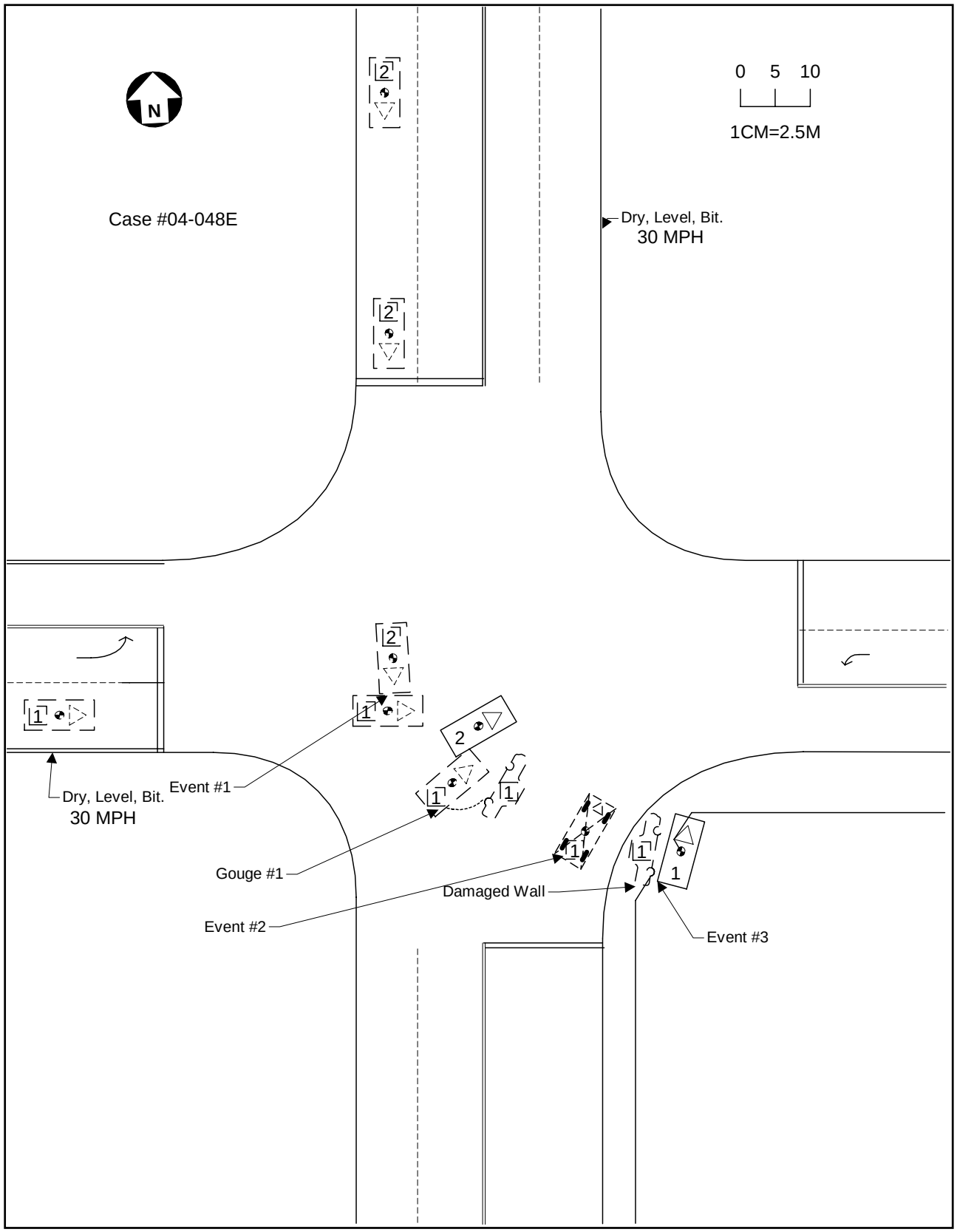

Figure 14. NASS scene schematic