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SCI/NASS COMBINATION CASE REPORT

CASE NUMBER - NASS-1997-72-103A

LOCATION - Illinois

VEHICLE - 1996 Ford Taurus

CRASH DATE - August 1997

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Contract Number: DTNH22-94-D-17058

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

This case was originally investigated when the Electronic Data Collection System (EDCS) and the revised paperless field protocols were still in development. Various aspects of the coded NASS case reflect the difficulties encountered during this transition. This SCI report is based on the authors' interpretation of the available data. A discussion of issues pertaining to the coded NASS/EDCS case is presented as an attachment to this report. When this SCI report differs from the coded case, please refer to Appendix A.

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15. <i>Supplementary Notes</i> Combination SCI/NASS investigation involving a 1996 Ford Taurus LX station wagon with dual front air bags and manual safety belts that ran head-on into a rigid pole.					
16. <i>Abstract</i> This report covers a combination SCI/NASS investigation of an air bag deployment crash that involved a 1996 Ford Taurus LX station wagon (case vehicle) that ran off-road and struck a heavy steel traffic signal support pole. This crash is of special interest because the unrestrained driver (62-year old female) sustained fatal injuries in a crash of moderate severity, partially due to being struck by her deploying driver air bag. The case vehicle was traveling north on a two-lane, undivided city street, with parallel parking on both sides. For whatever reason the case vehicle departed the left (west) road edge, mounted a low curb, and traveled obliquely across the tree plot just prior to impact. The front of the case vehicle impacted a non-breakaway traffic signal support pole, causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle's driver was seated but, because the driver was the sole occupant and subsequently expired and the seat track appears to have been moved post-crash, there is no knowledge of her seat track location. The tilt steering column was adjusted between the center and down most positions. She was not restrained by her available, manual, three-point, lap-and-shoulder safety belt system and sustained, according to her noninvasive post-mortem examination, serious injuries which included: fractured ribs (number and aspect not specified) with left pneumothorax, a cervical dislocation (vertebral location not specified), and fractures of her right tibia and fibula. In addition, she sustained abrasions and contusions to her right upper abdomen (including right lower chest), bilateral knee abrasions, and contusions to her right anterior forearm and posterior hand. Note: the case vehicle also had minor scraping along the right side, and the right outside rearview mirror was torn off. The source of this damage is not known. It seems likely, however, that the right side of the case vehicle scraped a parked car or other object, causing the driver to overcorrect, lose control, and run off the road to the left (west).					
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This combination SCI/NASS report was brought to the NHTSA's attention in August 1997 by NASS-CDS sampling activities. This crash involved a 1996 Ford Taurus LX (case vehicle) that ran off-road and struck a heavy steel traffic signal support pole. The crash occurred in August 1997 at 10:50 p.m., in Illinois and was investigated by the applicable city police department. This crash is of special interest because the case vehicle's driver (62-year old female) sustained fatal injuries in a crash of moderate severity, partially due to being struck by her deploying driver's air bag. The NASS PSU team conducted the investigation and forwarded the field materials to SCI Team #2. This report is based on the Police Crash Report, the NASS/CDS data from the scene and vehicle inspections, the coroner's report of a non-invasive death examination, occupant kinematic principles, and this contractor's evaluation of the evidence. The case data and photographs are encoded as NASS/EDCS-1997-72-103A.

CRASH CIRCUMSTANCES

The case vehicle was traveling north on a two-lane, undivided, city street, with parallel parking on both sides, and was approaching a four-leg intersection that was controlled by an automatic signal. Because the driver was the sole occupant and subsequently expired, there is no knowledge of the driver's intentions or pre-crash actions. For whatever reason, the case vehicle drifted/veered northwestward and departed the left (west) road edge. The case vehicle mounted a low curb (i.e., not a barrier curb) approximately 7 meters [23 feet] south of the intersection, leaving tire scrubs but without sustaining wheel or tire damage, and traveled obliquely across the tree plot just prior to impact.

The front of the case vehicle impacted a non-breakaway traffic signal support pole, causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy (**Figures 1 and 2**). The crash severity to the case vehicle was moderate [24-40 km.p.h. (15-25 m.p.h.)]. The case vehicle was towed away from the scene due to disabling damage.

The case vehicle also had minor scraping along the right side, and the outside rearview mirror on the right was torn off. It is not know if this minor damage was pre-existing, was a result of an unknown event immediately prior to the pole impact, or was a result of post-crash handling and



Figure 1: Northward view of case vehicle's north-westward travel path off left road edge (curb) into impact with signal pole



Figure 2: Southeastward view of case vehicle's north-westerly approach path, view from final rest position

storage. It seems likely, however, that the right side of the case vehicle scraped a parked car or other object, causing the driver to overcorrect, lose control, and run off the road to the left (west).

CASE VEHICLE

The case vehicle was a front wheel drive 1996 Ford Taurus LX, five-passenger, four-door station wagon (VIN: 1FALP58S2TG-----) equipped with a 3.0 liter, V-6 engine and a four-speed automatic transmission, with the transmission selector lever mounted as a part of the center console. Anti-lock brakes are an option for this model, but it is not known if the case vehicle was so equipped. The case vehicle's wheelbase was 276 centimeters [108.5 inches], and the odometer reading at inspection was 12,739 kilometers [7,916 miles]. The case vehicle had a power sun roof directly above the front seat row.

The case vehicle was fitted with bucket seats in the front row. Upon inspection, the driver's seat track was found adjusted between the middle and rearmost track position, with the adjustable seat back tilted rearward to the mid-range position. Although it is not known how the driver's seat back came to be tilted rearward, it is unlikely that this was a result of the collision events. Rather, the seat back was probably adjusted during post-crash attention to the injured driver. The tilt steering column was adjusted between the center and down most positions. The top quarter-section of the steering wheel rim (11-12-1 o'clock sector) was bent forward 1 centimeter [0.4 inch]. There was no gross evidence that the steering column had moved, and the energy absorbing devices on the steering column were not inspected. The instrument panel had padded knee bolsters, and there was an area of deformation that aligned with the probable location of the driver's right knee. The rearview mirror was displaced, and the roof-mounted control panel for the sun roof had come out of its mounting and was dangling by its wires. The four outboard seat positions were equipped with manual, three-point, lap-and-shoulder safety belt systems, with a lap-only safety belt in the rear center position. The adjustable upper anchorage for the driver's safety belt system was at the down-most position.

CASE VEHICLE DAMAGE

The front of the case vehicle struck a rigid (non-breakaway) steel pole slightly to the right of center (**Figure 3**), resulting in a narrow impact with maximum crush 58 centimeters [23 inches]. The pole had a diameter of approximately 20 centimeters [8 inches]. The pole was not damaged and did not move. The left and right front bumper corners were pulled inward symmetrically, approximately 40 centimeters [16 inches] on each side, and there was remote buckling on the right and left fenders. The engine hood was folded and sustained narrow crushing at the center. The folded hood was pushed against the windshield, causing extensive cracking across the entire width. In



Figure 3: Case vehicle's left side and damaged front from signal pole impact

addition, the front right passenger air bag module's cover flap struck the windshield immediately above the module, causing particularly dense cracking of the windshield in that localized area. There was no other glazing damage. The wheelbase was shortened by 4 centimeters [1.6 inches] on the left and 12 centimeters [4.7 inches] on the right. None of the tires were deflated, but the right front wheel was restricted due to having been pushed rearward against the back of the wheel well. There were no intrusions into the passenger compartment. The CDC for the pole impact was determined to be: **12-FCEN-3**, with direction of principal force 0 degrees. The WinSMASH reconstruction program, BARRIER-POLE option -- and observing the revised data input protocols (see Appendix B) -- was used on the case vehicle's most severe impact. The Total, Longitudinal and Lateral Delta Vs are, respectively: 31 km.p.h. [19 m.p.h.], -31 km.p.h. [-19 m.p.h.] and 0 km.p.h. [0 m.p.h.].

The case vehicle also had minor scraping along the midline of the right front and rear doors, and the right outside rearview mirror was torn off (**Figure 4**). It is not know if this minor damage was pre-existing, was a result of an unknown event immediately prior to the pole impact, or was a result of post-crash handling and storage. It seems likely, however, that the right side of the case vehicle scraped a parked car or other object shortly before running off the road to the left (west). The CDC for the right side damage is estimated as: **12-RPMS-1**.



Figure 4: Case vehicle's right side and damaged front from signal pole impact; Note: unknown damage exists on right side

AUTOMATIC RESTRAINT SYSTEM

The driver's air bag was located in the steering wheel hub, with the module cover flaps in the "H" configuration (**Figures 5 and 6**). The flaps opened along the perforations, with no evidence of damage to the flaps, the adjacent structures, or the air bag itself. The deployed driver's air bag was round with diameter 63 centimeters [25 inches], with no vent ports, and two tether straps. The NASS investigator annotated several areas of apparent contact to the front of the driver's air bag, but these are not visible in the photographs. The NASS investigator concluded that the driver contacted the driver's air bag with her face and chest.



Figure 5: Case vehicle's front seating area from left showing deployed driver and front right passenger air bags

The front right passenger air bag was located in the top of the instrument panel. The NASS investigator did not record any information about the shape, size dimensions, or condition of the front right passenger air bag. The passenger air bag module's cover flap struck the windshield causing an area of dense cracking immediately above the module.

Because the driver (62-year-old female, black, non-Hispanic, 163 centimeters, 66 kilograms [64 inches, 146 pounds]) was the only occupant of the case vehicle and subsequently expired, there is no knowledge of her pre-crash seat adjustments, seated posture or avoidance actions. The Police Crash Report indicated “unknown” for safety belt use. The NASS investigator reported evidence of recent use on the driver’s safety belt system, but concluded that the driver was not restrained during this crash. In addition, there was no evidence of belt pattern bruising and/or abrasions on the driver’s body. Based on the available information, this contractor concluded that the driver was not restrained by her available, manual, three-point, lap-and-shoulder safety belt system.



Figure 6: Case vehicle’s driver’s air bag

The following discussion of the driver’s motion and injury mechanisms is based on the principles of occupant kinematics. There is no knowledge of the driver’s actual movements. The case vehicle was probably involved in a swiping-type impact with a parked car on the right side of the road, with the right side of the case vehicle impacting the left side of the parked vehicle. The driver overcorrected to the left, lost control, and departed the left (west) road edge. As a result of what was probably an abrupt steering maneuver, her torso probably shifted to the right. Because of the acute angle at which the case vehicle encountered the curb, there were four separate minor impulses as each of the wheels mounted the curb. The driver was jostled erratically as the car bumped over the curb and probably moved slightly forward in response to the deceleration resulting from the tire impacts. The impact with the signal pole was slightly off-center to the right of the case vehicle’s front and induced a slight clockwise rotation. The impact caused the driver and front right passenger air bags to deploy and caused the driver to move further forward and upward. Because she had moved forward in response to the pre-impact deceleration, the driver’s air bag deployed against her chest as her momentum caused her to move further forward. The forward motion of her torso against the air bag caused the air bag to expand against the steering wheel rim and the combined force of her momentum and the air bag’s expansion caused the 1 centimeter [0.4 inch] rim deformation reported above. The force of the air bag backed by the steering wheel rim resulted in fractured ribs (i.e., aspect and number not specified), contusions and abrasions on her right upper abdomen and lower chest, and a dislocation of her cervical spine (i.e., vertebral location not specified). Both of her knees impacted the knee bolster, along the lower edge of the instrument panel, causing bilateral abrasions. Her right lower leg flailed upward, striking the underside of the center instrument panel causing fractures of the right tibia and fibula (i.e., location not specified). Finally, her right arm flailed forward and upward, and her right forearm impacted the rearview mirror, causing a contusion.

CASE VEHICLE DRIVER INJURIES

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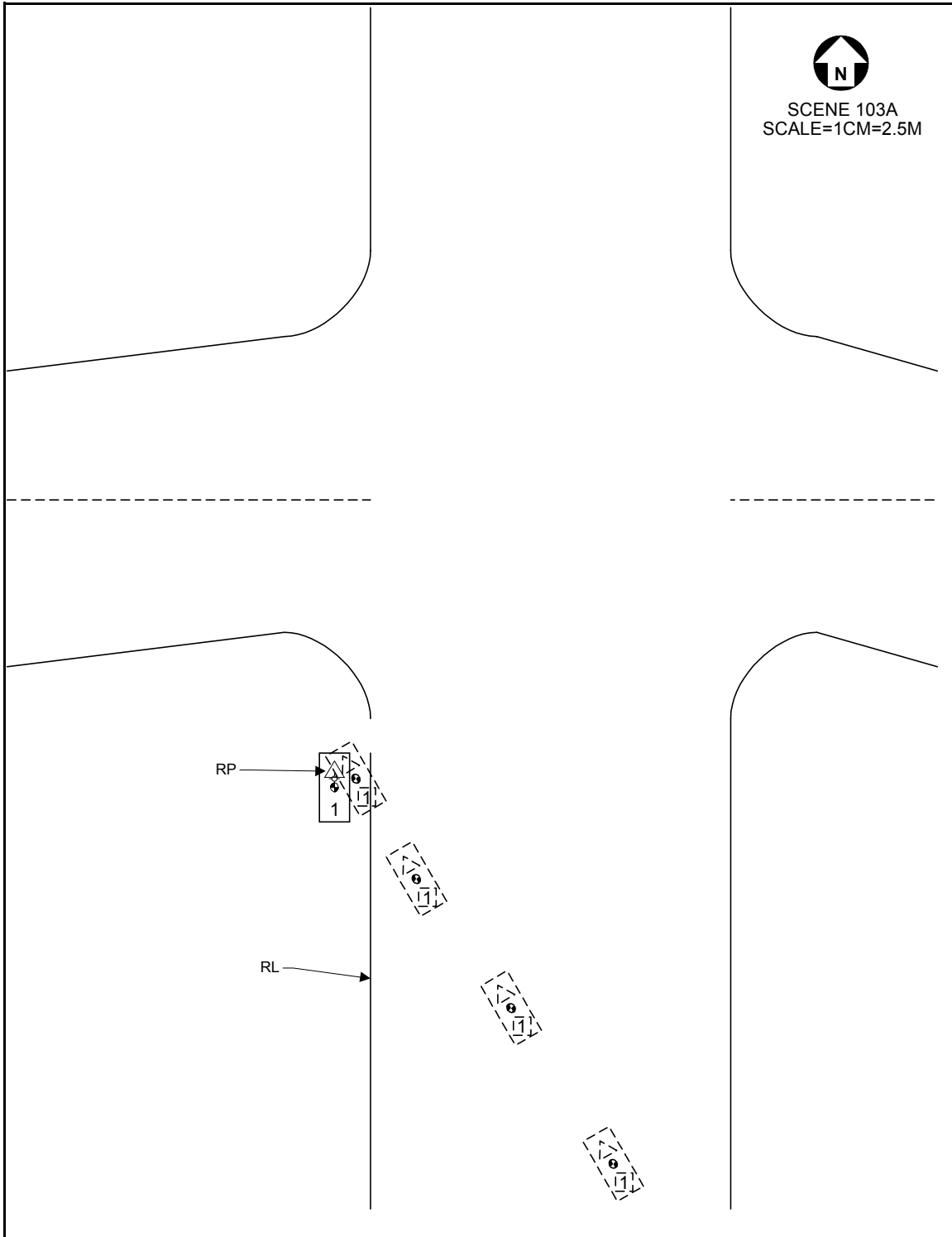
The driver was transported to a hospital via ambulance. She was pronounced dead approximately 30 minutes post-crash. The following injuries are based on a non-invasive post-mortem examination.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion, 3 x 2.5 inch, right upper quadrant of abdomen	590402.1 minor	Air bag, driver's	Certain	Post-mortem examination
2	Abrasion, superficial, right upper quadrant of abdomen	590202.1 minor	Air bag, driver's	Certain	Post-mortem examination
3	Abrasion, lower right chest	490202.1 minor	Air bag, driver's	Certain	Post-mortem examination
4	Contusion, lower right chest	490402.1 minor	Air bag, driver's	Certain	Post-mortem examination
5	Contusions, right anterior forearm	790402.1 minor	Mirror	Probable	Post-mortem examination
6	Fractured right fibula, location not specified	851605.2 moderate	Knee bolster	Certain	Post-mortem examination
7	Fractured right tibia, location not specified	853422.3 serious	Knee bolster	Certain	Post-mortem examination
8	Abrasions over right and left knees	890202.1 minor	Knee bolster	Probable	Post-mortem examination
9	Fractured ribs, anatomical location (i.e., rib number and/or aspects) not specified, with left pneumothorax ¹	450222.3 serious	Air bag, driver's	Probable	Post-mortem examination
10	Dislocation C-spine, vertebral location not specified	650204.2 moderate	Air bag, driver's (indirect)	Certain	Post-mortem examination

¹ According this patient's post-mortem, noninvasive examination, the left pneumothorax caused a rightward shift to the mediastinum.

CRASH DIAGRAM

NASS-1997-72-103A



CASE FORM

1. There is only one event (left departure into a pole) encoded in the NASS version of this case, but there is damage on the right side of the vehicle that is suggestive of a sideswipe-type event. The roadway is a two-lane, two-way residential street with parallel parking on both sides. A scenario where V1 swipes a parked car, causing V1's driver to over-correct, lose control and run off the road to the left is consistent with the evidence and explains why V1 made the left departure. Under this scenario, the right side swiping-type impact (to a “parked car” or an “unknown object”?) would be event #1 and the pole impact would be event #2.

GENERAL VEHICLE FORM

2. If the alternative scenario presented in #1 is adopted, then Critical Pre-Crash Event would be “this vehicle traveling/over the lane line on the right” [*currently encoded “this vehicle traveling/off the edge on the left”*].

3. If the alternative scenario presented in #1 is adopted, then Crash Type would be code 11 (“forward impact-parked vehicle”) or code 16 (“forward impact-specifics unknown”) [*currently encoded code 6 (“left side departure-drive off road”)*]. NB: even if the alternative scenario is not accepted, Crash Type should probably be code 7 (“left side departure-control/traction loss”).

4. On the Specifications tab, Curb Weight is 1,509 kilograms but should be 1,579 kilograms (the coded weight is for a luxury sedan but the case vehicle is a station wagon). Average Track is blank and should be 155 centimeters, Rear Overhang is blank and should be 126 centimeters, Undeformed End Width is blank but 170 centimeters was used in the original WinSMASH reconstruction.

5. On the Official Records tab, the NASS coding indicates “no test given” for Alcohol and for Other Drugs. The coroner’s report includes toxicological findings of blood alcohol 89 mg/dl, vitreous humor alcohol 94 mg/dl and no other drugs. Blood Alcohol Test should be coded “test performed” and Test Result should be 0.089. Other Drug Test Result should be coded “drug(s) not found in specimen”. This information became available after the NASS case was closed.

EXTERIOR VEHICLE FORM

6. On the Crush Profile tab, the CDC is not linked and Field L D is blank. The raw C-values seem reasonable, but the adjustments in the grid are confusing and C-max seems too large -- the raw C-values, the adjustments to the C-values and the post-crash measurements on the vehicle sketches do not sum correctly. The Length of Direct Contact is coded 21 centimeters, but the description on the Crush Location sub-tab indicates greater direct contact. The coded WinSMASH results are suspect. A revised WinSMASH run is included as Appendix B.

7. If the alternative scenario presented in #1 is adopted, then a new CDC would be written for the new event. The SCI narrative report has this as 12-RPMS-1.

INTERIOR VEHICLE FORM

8. On the Integrity tab, none of the Integrity Loss check boxes are marked -- V1 did not have any integrity loss and “no integrity loss” should be checked.
9. The presence of glazing is not coded correctly -- RR2 and LR2 are coded “no glazing” but V1 is a station wagon and these windows are present. Other Glazing is coded as present, but when RR2 and LR2 are coded correctly, there is no “other” glazing. Roof Glazing is coded “no glazing” but V1 had a sunroof that was closed and not damaged.
10. On the Instrument Panel tab, Knee Bolsters Deformed is encoded “no deformation” but the Contact grid includes item F, contact to the knee bolster, with “deformation” given as the evidence.
11. On the Steering tab, Location of Rim/Spoke Deformation is encoded “quarter section C” (the 5-6-7 o’clock [bottom] section), but the steering wheel was inverted at the time of inspection and the deformation appears to be actually at quarter section A (the 11-12-1 o’clock [top] section). The IV Contact Sketch page depicts the damage at the top of the steering wheel and in several photos the top of the wheel seems possibly to have been slightly bent. The Steering Worksheet and Drawing sub-tabs are blank.
12. On the Contact tab, Contact J is the driver’s face to the air bag, with Evidence coded “transfer (specify)” but the specify extension is blank.

SAFETY SYSTEMS FORM

13. On the Seat Attributes sub-tab (and repeated on the Occupant form), Seat Performance is encoded “deformed by impact of occupant”, but there is no evidence of deformation anywhere in the case coding or photographs, except that Seat Back Incline - Post is encoded “moved to rearward midrange position.” The photos show a very modest degree of incline, definitely not “midrange.”
14. On the Air Bag tab, for the front right passenger air bag, Redesigned Class is blank and should be “not redesigned”.

OCCUPANT FORM

15. On the Ejection tab, Ejection Type (“no ejection”) is not linked.
16. On the Seat Definition sub-tab, Posture is coded “other abnormal posture (specify)” but the specify extension is blank.

OTHER

17. There are 10 photographs classified under “V1-Driver Air Bag” and none of them have captions. Four or five of these are apparently extreme closeups of the air bag fabric that are entirely washed out such that nothing is visible except a white screen.

The screenshot shows the WinSMASH software interface with the following details:

- Title:** SCI IN97-026 = NASS97-72-103A
- Vehicle 1:**
 - Year: 1996
 - Make: FORD
 - Model: TAURUS
 - Body Style: SW
 - CDC Value: 12FCEN3
 - PDOF: 0 degrees
 - Heading Angle: 0 degrees
- Vehicle 2:**
 - Year: 0
 - Make: (empty)
 - Model: (empty)
 - Body Style: (empty)
 - CDC Value: BARRIER
 - PDOF: 0 degrees
 - Heading Angle: 0 degrees
- Language:** Metric (selected), English
- Buttons:** Continue, Open, Exit
- Additional Button:** NASS (located next to the title field)

The screenshot shows the WinSMASH software interface. The title bar reads "WinSMASH - C:\Program Files\WINSMASH\IN97026.cr4". The main window is titled "Vehicle Information" and contains a sub-section for "Vehicle 1".

Input fields for Vehicle 1:

- Wheelbase: 276 cm
- Length: 507 cm
- Width: 185 cm
- Weight: 1644 kg
- CG Location: 0 cm
- Radius of Gyration: 0 cm
- d0: 0 sqrt(N)
- d1: 0 sqrt(N)/cm
- Size Category: 3
- Stiffness Category: 3

A "Database" button is located next to the Size Category field. At the bottom of the window, there are radio buttons for "Metric" (selected) and "English", and buttons for "Continue", "Previous", and "Exit".

The screenshot shows the WinSMASH software interface. The title bar reads "WinSMASH - C:\Program Files\WINSMASH\IN97026.cr4". The main window is titled "Damage Information" and contains a section for "Vehicle 1".

Vehicle 1 settings:

- ROLDMISS
- Pole impact
- Offset Impact
- End Shift

Damage Length: 82 cm

Damage Offset: 0 cm

Field L - D: 3 cm

C1: 0 cm

C2: 5 cm

C3: 18 cm

C4: 58 cm

C5: 21 cm

C6: 0 cm

At the bottom, there are radio buttons for "Metric" (selected) and "English". To the right are buttons for "Continue", "Previous", and "Exit".

