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REMOTE CHILD AIR BAG-RELATED FATALITY INVESTIGATION

CASE NUMBER - IN-03-035
LOCATION - Illinois
VEHICLE - 1997 Ford Taurus
CRASH DATE - August 2003

Submitted:
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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.

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15. Supplementary Notes Remote investigation of an air bag deployment crash involving a 1997 Ford Taurus that impacted a legally parked lowboy trailer.					
16. Abstract This report covers a remote investigation of an air bag deployment crash involving a 1997 Ford Taurus (case vehicle) that impacted a lowboy trailer. This crash is of special interest because the case vehicle's unrestrained front right passenger (10-year-old male) sustained critical injuries from contacting the deploying front right passenger's air bag, resulting in his death. The case vehicle was traveling southward in the southbound lane of a two-lane, two-way, residential/commercial city street, with a parking lane along both sides. The lowboy trailer was disconnected, empty, legally parked and unattended, headed south in the parking lane along the western curb, in the middle of the block near a construction site. It was daylight, the weather was clear and the asphalt road surface was dry and free of defects. There were five young children plus the driver in the case vehicle, none of whom were restrained. The group had just been to a drive-through restaurant and the driver was distracted by the children as they ate. The case vehicle drifted to the right and the case vehicle's front right corner impacted the lowboy trailer's back left corner, causing the case vehicle's driver and front right passenger air bags to deploy. The front right passenger moved forward in response to the impact deceleration and was struck in the face and head by the deploying front right air bag, causing critical brain injuries. He was lifted by the expanding air bag and his head impacted the windshield and/or front header, causing a skull fracture. He had a mouthful of food that was forced down into his trachea, causing significant respiratory difficulties. He was transported via ambulance to a local hospital, where he was pronounced brain dead approximately 22 hours post crash. The driver and one other child sustained minor injuries and were treated and released at the hospital emergency department. The remaining three children were not injured. The case vehicle was towed due to disabling right front wheel/tire damage. The lowboy trailer was pushed forward a short distance and otherwise not damaged.					
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This investigation was brought to the NHTSA's attention in August 2003 by a newspaper article. This crash involved a 1997 Ford Taurus GL (case vehicle) and a parked 2000 Dynaweld lowboy trailer. The crash occurred in August 2003 at 1:25 p.m., in Illinois, and was investigated by the applicable municipal police. This crash is of special interest because the case vehicle's unrestrained front right passenger (10-year-old male, black, unknown if Hispanic) was struck in his face/head by the deploying front right passenger air bag and the child was pronounced dead approximately 22 hours after the crash. In addition to the unrestrained driver (33-year-old female, black, unknown if Hispanic) and the fatal victim, there were four other unrestrained child passengers in the case vehicle. The driver and one other child sustained minor injuries, with the remaining three children not injured. The case vehicle was not available to be inspected and the involved parties declined to cooperate. This report is based on the police crash report with a special fatality supplement, police on-scene photographs, medical treatment data, the medical examiner's report of a non-invasive postmortem examination, occupant kinematic principles, and this contractor's evaluation of the available evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling southward in the southbound lane of a two-lane, two-way, residential/commercial city street, with a parking lane along both sides. The lowboy trailer was disconnected, legally parked and headed south in the parking lane along the western curb, in the middle of the block near a construction site. The statutory speed limit for this roadway was 40 km.p.h. [25 m.p.h.]. It was daylight, the weather was clear and the roadway was dry. The asphalt surface was somewhat worn and cracked but otherwise free of defects (**Figures 1 and 2**). The group in the case vehicle had just been to a drive-through restaurant. The case vehicle driver was distracted by the child passengers as they were eating and the case vehicle drifted to the right (west). The driver made no avoidance maneuvers prior to the impact. The crash occurred in the western parking lane.

The case vehicle's front right corner impacted the trailer's back left corner, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle pushed the trailer forward approximately 0.6 meters [2 feet] (as evidenced by scraping on the pavement by the case vehicle's front right wheel), rotated clockwise a few degrees and came to rest.



Figure 1: Case vehicle's southbound approach toward impact, showing case vehicle and parked trailer at final rest (case photo #01)

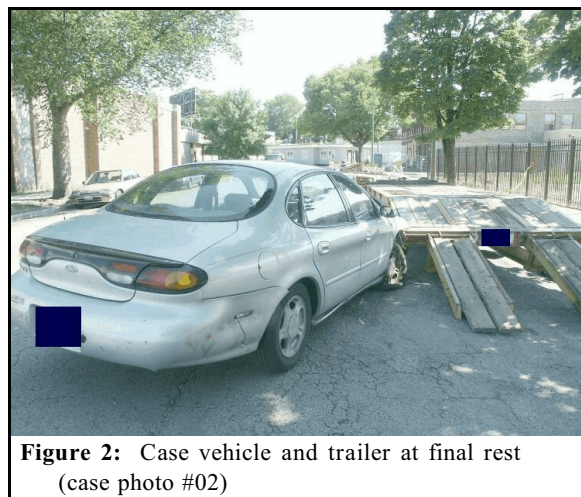


Figure 2: Case vehicle and trailer at final rest (case photo #02)

The case vehicle was a 1997 Ford Taurus GL front wheel drive, four-door, six-passenger sedan (VIN: 1FALP52U7VA-----), equipped with a 3.0 liter V6 gasoline engine and an automatic transmission with a column-mounted selector lever. Four wheel anti-lock brakes were an option for this model, but it is not known if the case vehicle so equipped. The Ford was fitted with first generation driver and front right passenger air bags, manual lap-and-shoulder safety belts in the four outboard seat positions, and lap-only safety belts in the front and back center seat positions. The case vehicle's odometer reading is not known. Its specification wheelbase was 276 centimeters [108.5 inches]. The case vehicle was towed due to disabling front right wheel/tire damage.

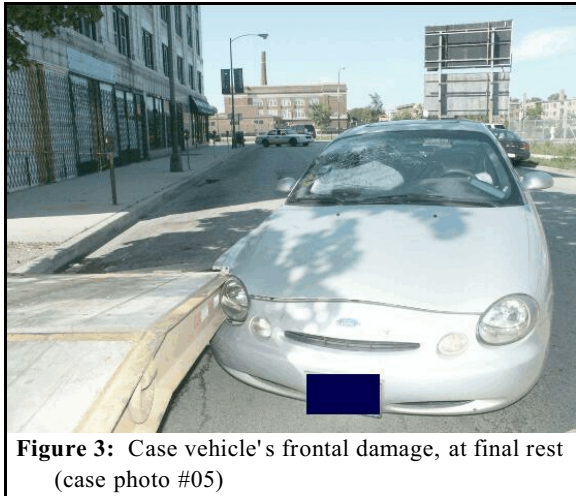


Figure 3: Case vehicle's frontal damage, at final rest (case photo #05)

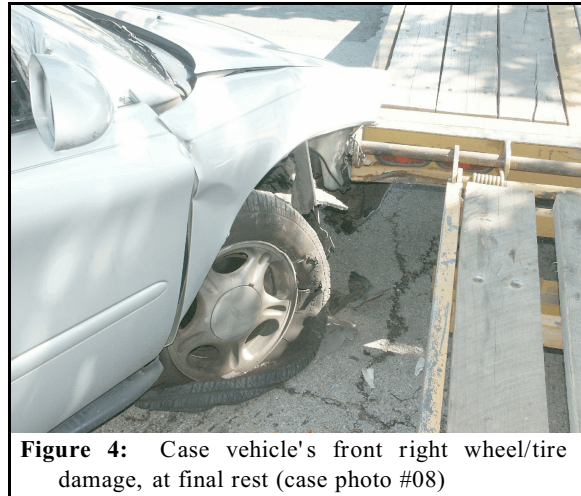


Figure 4: Case vehicle's front right wheel/tire damage, at final rest (case photo #08)

The case vehicle sustained a very narrow impact at its extreme front right corner, outboard of the right headlamp assembly, above the bumper and below the engine hood (**Figure 3**). The trailer's steel frame penetrated into the case vehicle's wheel well and impacted the tire, displacing the wheel and tire rearward and damaging the right front suspension (**Figure 4**). The right headlamp and the front portion of the vinyl bumper cover were not damaged. The trailer's penetrating steel frame member sliced through the bumper cover on the side and caused slight direct contact damage and substantial induced damage to the right fender, with the fender crushed and pushed rearward such that it was jammed against the right front door. The engine hood was forced slightly upward. The right front wheel/tire assembly was pushed rearward, against the trailing edge of the wheel well. The right front tire's outboard sidewall was torn and punctured and the tire was deflated, with no damage to any other wheel or tire. The right side of the windshield was heavily cracked and there was no other glazing damage. The case vehicle had various dents and scrapes on several different portions of its body, but these were judged to be pre-existing damage.

The CDC for the case vehicle's single impact was estimated from the available photographs as **12-FRME-2 (0 degrees)**. This impact is out of scope for the WinSMASH reconstruction program. This contractor estimates that this was a crash of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the case vehicle.

The case vehicle was equipped with driver and front right passenger first generation air bags. Both air bags deployed as a result of the single frontal impact (**Figure 7**).



Figure 5: EXEMPLAR vehicle, showing non-deployed front right passenger's air bag module NOT THE CASE VEHICLE (case photo #13)

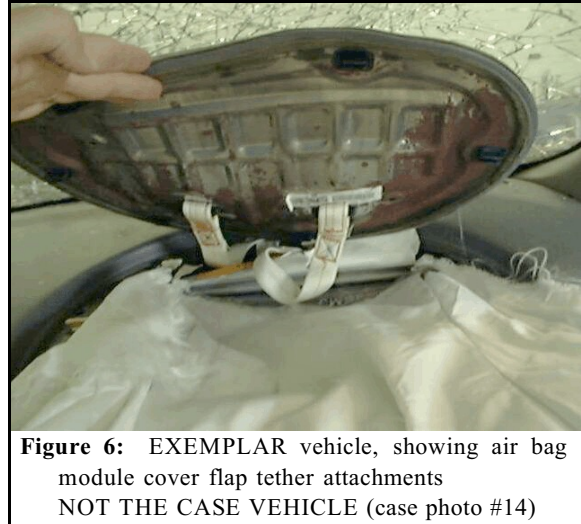


Figure 6: EXEMPLAR vehicle, showing air bag module cover flap tether attachments NOT THE CASE VEHICLE (case photo #14)

The front right passenger's air bag module was mounted in the top of the instrument panel on the right side. The cover flap is not visible in any of the available photographs. Photographs of exemplar 1997 Ford Taurus vehicles were obtained to illustrate the manner in which the front right passenger air bag was installed (**Figures 5 and 6**). The cover flap is oval (**Figure 5**) and is not hinged, such that, upon deployment, the entire cover flap is forced upward by the expanding air bag. The cover flap is attached to the module by fabric tether straps (**Figure 6**).



Figure 7: Case vehicle's front seat row, showing deployed driver and front right passenger air bags (case photo #10)



Figure 8: Case vehicle's windshield, showing damage from front right air bag module cover flap and front right occupant contact (case photo #06)

The case vehicle's front right passenger air bag module cover flap struck the case vehicle's windshield, causing extensive cracking in the lower and center areas. The size and shape of the air bag are not known. There is no obvious evidence of occupant contact or damage to the air bag visible in the available photographs (**Figures 7 and 8**).

The driver's air bag was mounted in the steering wheel hub. The size and shape of the driver's air bag are not known. The available photographs do not show any obvious evidence of occupant contact or damage to the air bag (**Figure 7**).

CASE VEHICLE FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's front right passenger (10-year-old male, black, unknown if Hispanic, 135 centimeters, 28 kilograms [53 inches, 62 pounds]) was not using his available, active, three-point, lap-and-shoulder safety belt system. The available photographs show that the right-center portion of the 70/30 split bench seat was adjusted somewhat rearward as compared to the left (driver's) portion of the seat (**Figure 7**). The child's posture is otherwise not known. The group in the case vehicle had just been to a drive-through restaurant and the front right passenger was eating chicken nuggets and french fries.

The case vehicle driver stated to the police that she was distracted by the children as they were eating. She did not attempt any avoidance maneuvers and the front right passenger's posture did not change immediately prior to the impact. The case vehicle's front right corner impacted the back left corner of the lowboy trailer. This was a “soft” impact, with the trailer's steel frame member slicing/punching through the sheet metal of the right fender, above the bumper, before contacting the wheel/tire assembly. The initial narrow end engagement and subsequent wheel interaction resulted in the air bag deploying late during the sequence of the impact. This delayed deployment occurred due to the prolonged change in time (ΔT) relative to the change in speed (ΔV) -- i.e., the “ramp versus spike” phenomenon. The front right passenger moved forward and upward in response to the impact deceleration, toward the 12:00 o'clock direction of force, and he was probably close to the front right air bag module when it deployed. The deploying front right air bag struck the child in the face and head, causing brain injuries as discussed below. The expanding air bag lifted the child and, in combination with his forward momentum, he struck the upper portion of the windshield and possibly the windshield header, causing a skull vault fracture in the right parietal region. He rebounded back into his seat, with the left side of his head striking the front center passenger in the face. The front right passenger was eating when the air bag deployed and the food was forced down into his trachea, resulting in significant respiratory difficulties as discussed below.

FRONT RIGHT PASSENGER'S INJURIES

The front right passenger was transported by ambulance to a local hospital, where he was admitted to the pediatric intensive care unit. His injuries proved to be unsurvivable. After appropriate testing, he was declared brain dead approximately 22 hours post crash and his body was prepared for organ harvesting. He was not autopsied.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Nonanatomic brain injury, unconscious 6 to 24 hours, with pupils fixed, dilated, and non-reactive; no spontaneous respirations, apnea ¹ ; hypoxia; unresponsive to painful stimuli, flaccid extremities, GCS = 3; with complications including: neurogenic shock, hyperglycemia, diabetes insipidus, and developing ARDS ² ; brain dead	critical 160212.5,0	Air bag, front right passenger's	Certain	Hospitalization records
2	Diffuse axonal injury (DAI), not further specified	critical 140628.5,9	Air bag, front right passenger's	Probable	Hospitalization records
3	Hematoma, minor, left subdural, not further specified	serious 140652.4,2	Air bag, front right passenger's	Possible	Hospitalization records
4	Cerebral edema with absence {loss} of basal cisterns	critical 140666.5,9	Air bag, front right passenger's	Certain	Hospitalization records

¹ The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:

apnea (ap'ne-a): 1. cessation of breathing. 2. asphyxia.

diabetes (di'e-be'tez): a general term referring to disorders characterized by excessive urine excretion (polyuria), as in diabetes mellitus and diabetes insipidus. When used alone, the term refers to diabetes mellitus.

d. insipidus, central: a metabolic disorder due to injury of the neurohypophyseal system, which results in a deficient quantity of antidiuretic hormone being released or produced, and thus in failure of tubular reabsorption of water in the kidney.

hypoxemia (hi'pok-se'a): deficient oxygenation of the blood; hypoxia.

hypoxia (hi-pok'se-a): reduction of oxygen supply to tissue below physiological levels despite adequate perfusion of the tissue by blood. Compare with *anoxia*.

neurogenic (noor'o-jen'ik): originating in the nervous system or from a lesion in the nervous system

neurogenic shock (shok): shock resulting from neurogenic vasodilation, which can be produced by cerebral trauma or hemorrhage, spinal cord injury, deep general or spinal anesthesia, or toxic central nervous system depression

shock (shok): 1. a sudden disturbance of mental equilibrium. 2. a condition of profound hemodynamic and metabolic disturbance characterized by failure of the circulatory system to maintain adequate perfusion of vital organs. It may result from inadequate blood volume (hypovolemic shock); inadequate cardiac function (cardiogenic shock); or inadequate vasomotor tone (neurogenic shock, septic shock).

² The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:

Acute respiratory distress syndrome: fulminant pulmonary interstitial and alveolar edema, which usually develops within a few days after the initiating trauma, thought to result from alveolar injury that has led to increased capillary permeability. Called also adult respiratory distress s. and shock lung.

fulminant (fu'l-m-mnt) [L. Fulminare to flare up]: sudden, severe; occurring suddenly and with great intensity.

syn drome (sin'drm) [Gr. syndrom concurrence]: a set of symptoms that occur together; the sum of signs of any morbid state; a symptom complex. In genetics, a pattern of multiple malformations thought to be pathogenetically related. See also *disease*.

The ARDS was likely secondary to aspiration and hypoxic ischemic insult. The child was eating chicken nuggets and french fries at the moment of impact. Blood and food were noted from patient's nose. Acute lung injury as a result of food aspiration at time of crash – food was obtained when suctioning the patient's endotracheal tube.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
5	Fracture right cranial vault, parietal region, non-depressed	moderate 150400.2,1	Front right windshield's header and/or glazing	Probable	Post-mortem examination
6	Hematoma right skull soft tissue, not further specified	minor 190402.1,1	Front right windshield's header and/or glazing	Probable	Hospitalization records
7	Abrasions, 8.4 x 4.6 cm (3.3 x 1.8 in) behind left ear	minor 190202.1,2	Other occupant: front center	Possible	Post-mortem examination

CASE VEHICLE DRIVER'S KINEMATICS

The case vehicle's driver (33-year-old female, black, unknown if Hispanic, 165 centimeters, 68 kilograms [65 inches, 150 pounds]) was not using her available, active, three-point, lap-and-shoulder safety belt system. The left portion of the 70/30 split bench seat was adjusted somewhat forward as compared to the center-right portion. The driver's posture is otherwise not known, but she had at least one hand on the steering wheel with her feet on the floor or operating the foot controls. The group in the case vehicle had just been to a drive-through restaurant and the five child passengers were eating.

The case vehicle driver stated to the police that she was distracted by the children as they were eating and was probably looking to her right. She did not attempt any avoidance maneuvers and her posture did not change immediately prior to the impact. The case vehicle's front right corner impacted the back left corner of the lowboy trailer, causing the case vehicle's driver and front right passenger air bags to deploy. The driver probably moved forward and slightly upward in response to the impact deceleration. Because she was looking to her right, she encountered the deploying driver's air bag with the left side of her face, sustaining an abrasion of the cornea in her left eye, abrasions on her left eyelid and abrasions on the left side of her face. Her position at final rest is not known, but she probably rebounded into the driver's seat.

DRIVER'S INJURIES

The driver was transported via ambulance to a local hospital, where she was treated and released in the emergency department.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Abrasion left cornea with positive conjunctival erythma	minor 240602.1,2	Air bag, driver's	Probable	Emergency room records
2	Abrasion left upper eyelid, not further specified	minor 297202.1,2	Air bag, driver's	Probable	Emergency room records
3	Abrasion left cheek with excoriation	minor 290202.1,2	Air bag, driver's	Probable	Emergency room records

CASE VEHICLE FRONT CENTER PASSENGER'S KINEMATICS

The case vehicle's front center passenger (3-year-old male, black, unknown if Hispanic, height unknown, 16 kilograms [35 pounds]) was not seated in a child safety seat and was not restrained by the available manual lap-only safety belt. The front seat consisted of a 70/30 split bench with separate backs, with the right portion of the split bench adjusted somewhat to the rear with respect to the left (driver's) portion of the bench seat. His posture is otherwise not known.

The case vehicle driver did not make any avoidance maneuvers and the front center passenger's posture did not change immediately prior to the impact. The case vehicle's front right corner impacted the back left corner of the lowboy trailer and the front center passenger probably moved forward and slightly upward in response to the impact deceleration. The frontal air bags deployed and the front right passenger was lifted upward and then rebounded rearward and the left-back portion of the front right passenger's head impacted the front center passenger in the face, causing an abrasion on the front center passenger's forehead, a laceration on the interior of his upper lip and caused one of his front teeth to be loosened. The front center passenger's position at final rest is not known, but he probably fell back onto the front seat after his interaction with the front right passenger's head.

FRONT CENTER PASSENGER'S INJURIES

The front center passenger was transported via ambulance to a local hospital, where he was treated and released in the emergency department.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Abrasion, minor, 3 x 3 cm (1.2 x 1.2 in) right forehead	minor 290202.1,7	Other occupant: front right	Possible	Emergency room records
2	Laceration, 1.3 cm (0.5 in) upper, inner lip	minor 290602.1,8	Other occupant: front right	Possible	Emergency room records
3	Dislocation {loose} left front tooth, not further specified	minor 251402.1,8	Other occupant: front right	Possible	Emergency room records

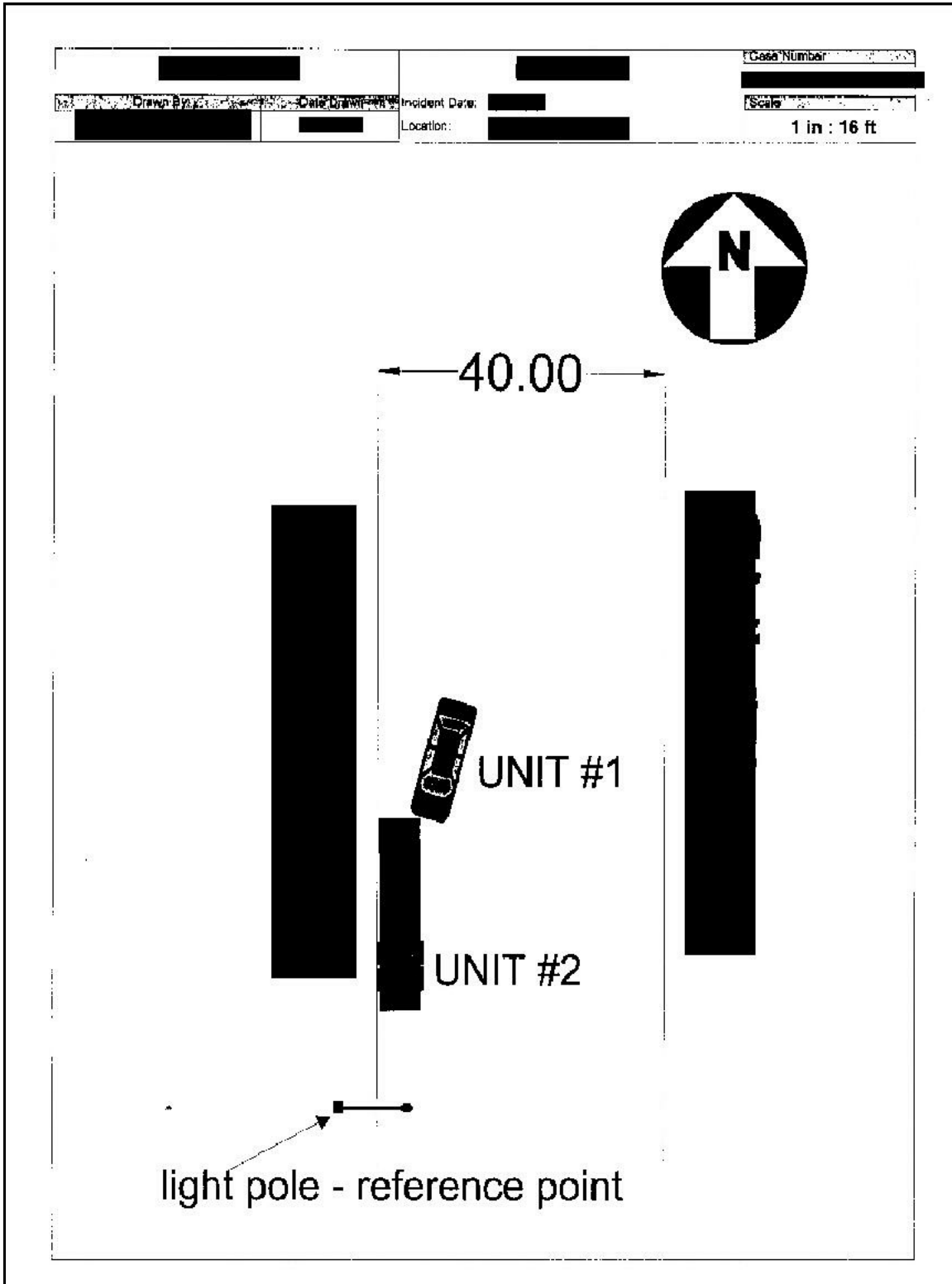
UNINJURED BACK SEAT PASSENGERS

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The case vehicle had three additional child passengers in the back seat, as follow: back left, 10-year-old female; back center, 11-year-old male; back right, 12-year-old male (all black, unknown if Hispanic, height and weight unknown). None of these children were using the respective available manual restraint system. Their pre-crash posture is unknown. All were engaged in eating at the time of the impact. The police cash report lists each of these three children as sustaining “ C” (possible) injuries, with no further details. All three of the back seat passengers accompanied the front seat occupants to the same hospital in the same ambulance. There were no treatment records at the hospital for any of the three children in the back seat.

OBJECT CONTACTED

The case vehicle impacted a legally parked, disconnected and unattended 2000 Dynaweld lowboy trailer (VIN: 4U161AEX0Y1-----) that was used to haul heavy construction equipment (**Figures 2, 3 and 4**). The trailer's length, curb weight, number of axles and manner of attachment to a power unit are not known. The back end of the trailer's deck sloped down and had folding ramps to enable the loading and unloading of heavy machinery, and the ramps were folded down at the time of the crash. There is no evidence visible in the available photographs that the trailer sustained any damage as a result of the crash.



Copied from police crash report.