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# ON-SITE LOW SPEED VEHICLE INVESTIGATION

CASE NUMBER - IN10026
LOCATION - Michigan
VEHICLE - 2002 FORD TH!NK NEIGHBOR
CRASH DATE - April 2010

Submitted:

September 16, 2010



Contract Number: DTNH22-07-C-00044


Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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.

**Technical Report Documentation Page**

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15. *Supplementary Notes*
On-site investigation of a crash involving 2002 Ford Th!nk Neighbor low speed vehicle that ran off the road and impacted a non-breakaway pole

16. *Abstract*

This report covers an on-site investigation of a crash involving a 2002 Ford Th!nk Neighbor that was involved in a minor impact with a non-breakaway pole. The Ford was a rear-wheel-drive, no-door, four-passenger low speed vehicle, equipped with a 72-volt direct current, 4 horsepower electric motor powered by rechargeable, deep-cycle lead acid batteries, manufactured in compliance with Federal Motor Vehicle Safety Standard 500. The Ford had a governed maximum speed of 40 km/h (25 mph). The Ford was traveling southward in the outside southbound lane of a divided city street and was negotiating a curve to the right. The Ford's driver became distracted by her dog, which was in the back seat. As a result of the driver's distraction, the Ford departed the roadway to the right (west). The driver did not attempt any avoidance maneuvers. The Ford mounted the curb, traveled along the roadside a short distance and its front left corner area impacted a non-breakaway luminaire support pole that was located approximately 1 meter (3.3 feet) west of the curb. The Ford rotated approximately 5 degrees counterclockwise and came to rest against the pole. The driver and the front right passenger were both restrained by the available lap-and-shoulder safety belt system and remained inside the vehicle at final rest. Both occupants were conscious and able to exit the vehicle without any assistance. The driver (53-year-old female) was transported via ground ambulance to a local hospital, where she was treated in the emergency room and released. Her injuries included bilateral black eyes and a broken nose. The front right passenger (19-year-old female) accompanied the driver to the hospital but the passenger was not injured and did not receive any medical treatment. There were no other occupants in the Ford. The Ford was towed from the scene due to disabling wheel/axle damage.

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TABLE OF CONTENTS IN10026

The focus of this investigation is the crashworthiness of a 2002 Ford Th!nk Neighbor (**Figure 1**) that was involved in a minor impact with a non-breakaway pole. The Ford was manufactured as a Low Speed Vehicle (LSV) in compliance with Federal Motor Vehicle Safety Standard (FMVSS) 500. This crash was brought to the National Highway Traffic Safety Administration's attention by sampling activities of the National Automotive Sampling System-Crashworthiness Data System (NASS-CDS). The crash occurred at 1738 hours in April 2010, in Michigan, and was investigated by the applicable municipal police department. A NASS researcher inspected the Ford and the crash scene on April 27, 2010. The crash was assigned to this contractor as a Special Crash Investigations (SCI) case on August 4, 2010. This report is based on the police crash report, interviews with the driver and a body shop technician, scene and vehicle inspections and the evaluation of available evidence.

**Figure 1:** 2002 Ford Th!nk Neighbor; note damage to front left wheel/axle, fender and headlamp area

## CRASH CIRCUMSTANCES

***Crash Environment***: The Ford was traveling on a four-lane, divided city street traversing in a generally north-south direction. The trafficway consisted of two travel lanes in each direction separated by a landscaped median, with curbs and rain gutters along the inside and outside edges of the travel lanes. It was daylight with no adverse weather conditions and the asphalt road surface was dry. At the location where the crash occurred, there was a slight uphill slope with a gentle curve to the right for southbound traffic. The speed limit was 56 km/h (35 mph).

**Figure 2:** Ford's southbound approach toward right side departure and pole impact

***Pre-Crash***: The Ford was traveling southward in the outside southbound lane (**Figure 2**) and was negotiating the curve to the right. The Ford's driver became distracted by her dog, which was in the back seat. As a result of the driver's distraction, the Ford departed the roadway to the right (west). The driver did not attempt any avoidance maneuvers.

***Crash***: The Ford mounted the curb, traveled along the roadside a short distance and its front left corner area impacted a non-breakaway luminaire support pole that was located approximately 1 meter (3.3 feet) west of the curb (**Figure 3**). The Ford rotated approximately 5 degrees counterclockwise and came to rest against the pole.

***Post-Crash***: The driver and the front right passenger remained inside the vehicle at final rest. Both occupants were conscious and able to exit the vehicle without any assistance. Police and emergency medical services responded to the scene. The driver was transported via ground ambulance to a local hospital. The front right passenger accompanied the driver to the hospital but the passenger was not injured. There were no other occupants in the Ford. The Ford was towed from the scene due to disabling damage.

**Figure 3:** Steel luminaire support pole; hexagonal cross-section, approx. 18 cm (7 inches) diameter

## CASE VEHICLE: 2002 FORD TH!NK NEIGHBOR

The case vehicle was a 2002 Ford Th!nk Neighbor, rear-wheel-drive, no-door, four-passenger low speed vehicle (VIN: 1FABP225X20------), equipped with a 72-volt direct current, 4 horsepower electric motor powered by rechargeable, deep-cycle lead acid batteries. The Ford had a governed maximum speed of 40 km/h (25 mph). The Ford was furnished with two box-mount bucket seats in the front and a bench seat in the back. Each seat position had an integral head restraint and a lap-and-shoulder safety belt system. There were no automatic safety system components.

**Figure 4:** Front and right side

**Figure 5:** Front and left side

## CASE VEHICLE DAMAGE

***Exterior Damage***: The Ford sustained direct contact at the front left area (**Figures 1, 4** and **5**) measured as 24 cm (9.4 in) wide, beginning at the front left corner. The impact caused the left front fender to break away completely (**Figures 6** and **8**). The front left axle and suspension were broken, the wheel rim was deformed and the entire wheel/tire assembly broke off (**Figures 6** and **7**). The wheelbase was shortened by 2 cm (0.8 inches) on the left. The pole engaged the headlight/turn

signal area. According to the driver, the windshield had a few linear cracks on the left side (the windshield glazing was removed prior to the vehicle inspection). The windshield was the only glazing panel installed in this vehicle. A crush profile was measured but it is not useable because the plastic fender components broke away entirely.

**Figure 6:** Damaged area, view from left; broken off wheel and tire set in place

**Figure 7:** Wheel and suspension/steering components broken off

***Damage Classification***: The Collision Deformation Classification (CDC) for the Ford is **12FLEE5** (0 degrees). This collision is beyond the scope of the WinSMASH reconstruction program because the Ford is an out-of-scope vehicle. The estimated damage severity is minor.

The manufacturer's recommended tire size is P145/80R12 (for street use only) or 21X8.50-12 (for turf or street use). The Ford was fitted with four Cheng Shin 21X8.50-12 tires. The tire data are shown in the table below.

**Figure 8:** Damaged pieces of the left front fender

| *Tire* | *Measured Pressure* | | *Vehicle Manufacturer's Recommended Pressure* | | *Tread Depth* | | *Damage* | *Restricted* | *Deflated* |
|---|---|---|---|---|---|---|---|---|---|
| | kPa | psi | kPa | psi | milli-meters | 32nd of an inch | | | |
| LF | 0 | 0 | unk | unk | 4 | 5 | None | No | yes |
| LR | 193 | 28 | unk | unk | 4 | 5 | None | No | No |

| *Tire* | *Measured Pressure* | | *Vehicle Manufacturer's Recommended Pressure* | | *Tread Depth* | | *Damage* | *Restricted* | *Deflated* |
|---|---|---|---|---|---|---|---|---|---|
| | kPa | psi | kPa | psi | milli-meters | 32nd of an inch | | | |
| RR | 193 | 28 | unk | unk | 4 | 5 | None | No | No |
| RF | 200 | 29 | unk | unk | 4 | 5 | None | No | No |

***Power System***: The Ford was powered by an array of six 12-volt, rechargeable, deep-cycle lead acid batteries, connected in series to produce 72-volt direct current. The batteries were located in a cabinet under the front seat row. The cabinet was intact and there was no evidence of damage to the batteries or the wiring, nor was there any leaking of the electrolyte. Recharging the batteries was accomplished via an on-board recharge system designed to be connected to standard residential 120-volt alternating current using conventional 3-prong household plug heads. The recharge port was located on the instrument panel, to the left of the steering column. The power system also included regenerative braking.

***Vehicle Interior***: Inspection of the Ford's interior revealed several points of contact, including scuffing on the left instrument panel (attributed to the driver's right lower leg), deformation of the foot controls (attributed to the driver's right foot), and scuffing on the right A-pillar (attributed to the front right passenger's right hand). There were no intrusions nor any other damage to the seating area.

## MANUAL RESTRAINT SYSTEM

The Ford was furnished with two box-mount bucket seats in the front row and a bench seat in the back row. Each seat position had a continuous loop, three point, lap-and-shoulder safety belt system. For the two front bucket seats, the safety belt retractors were located on the outboard side of the box structure on which the bucket seats were mounted, with the upper anchorages and D-rings attached to the roof. For the back seats, the retractors were attached to the structure on which the bench seat was mounted and the upper anchorages were fixed to the seat back frame.

## CASE VEHICLE DRIVER KINEMATICS

The Ford's driver (53-year-old female, 152 cm [60 inches], 52 kg [115 pounds]) was restrained by the lap-and-shoulder safety belt. Her seat track was adjusted between the middle and forward most position and her seat back was not adjustable (**Figure 9**). She was turned to her right, attending to her dog in the back seat.

**Figure 9:** Driver's seat and steering assembly

According to the driver's interview statement, she turned back around to a forward-facing posture and found that she was impacting the pole. She moved forward in response to the impact deceleration and loaded her safety belt, causing bruising on her left breast and chest. Her face contacted the steering wheel rim and she sustained bruising around her nose and both eyes, a fracture of the nasal bone and a fracture of the nasofrontal process of the left maxilla. She remained in her seat at final rest.

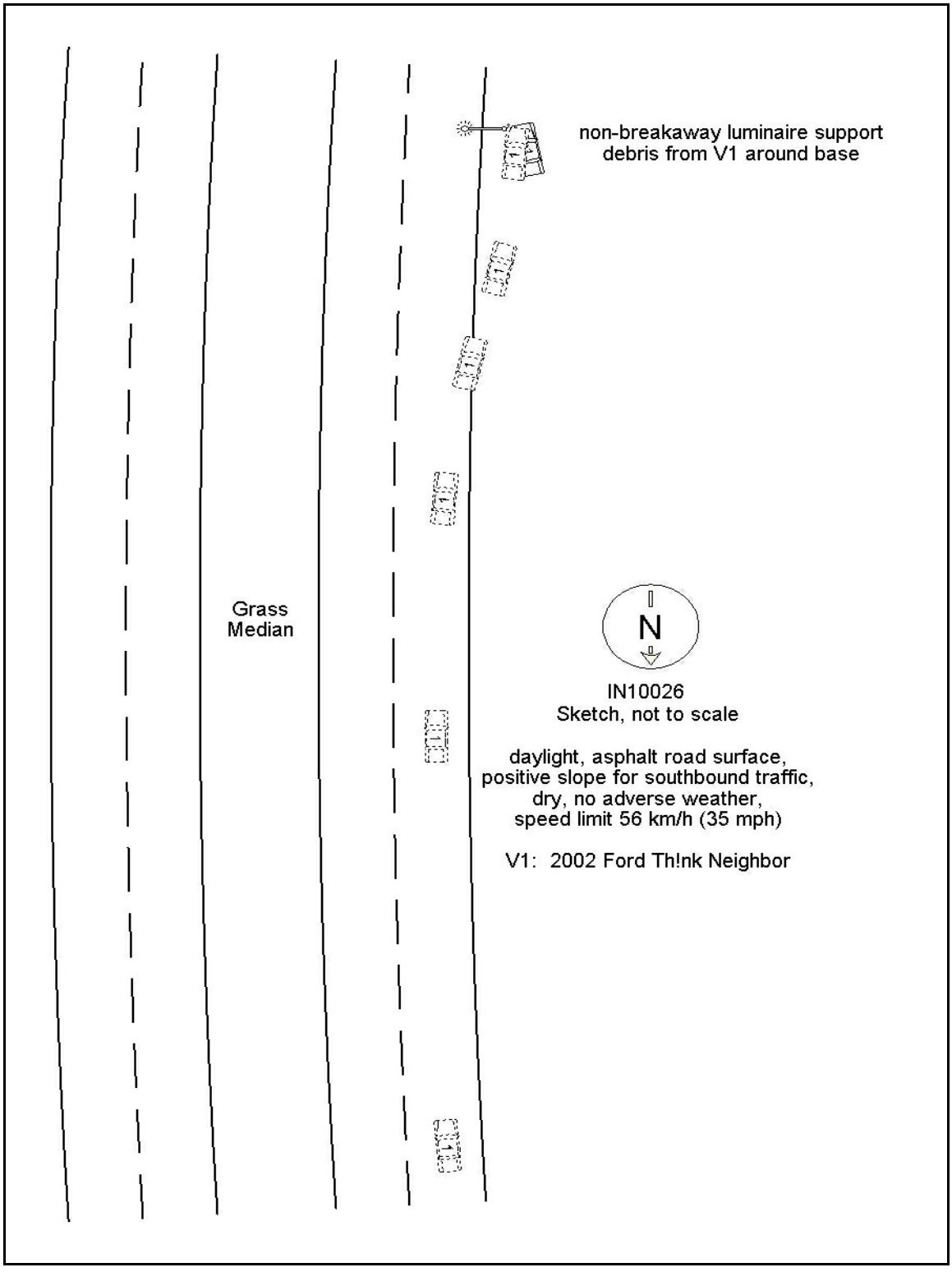
## DRIVER'S INJURIES

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

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 05 | Injury Source | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 1<br>2 | Contusions, periorbital, bilateral | 210402.1,1<br>210402.1,2 | Steering wheel rim | Probable | Emergency Room |
| 3 | Contusion, bridge of nose | 210402.1,4 | Steering wheel rim | Probable | Emergency Room |
| 4 | Fracture, nasofrontal process of left maxilla, medially displaced | 250800.2,2 | Steering wheel rim | Probable | Emergency Room |
| 5 | Fracture, nasal bone | 251000.1,4 | Steering wheel rim | Probable | Emergency Room |
| 6 | Contusion, around left axilla and left breast | 410402.1,2 | Belt restraint | Probable | Emergency Room |

## CASE VEHICLE FRONT RIGHT PASSENGER

The Ford's front right passenger (19-year-old female, 150 cm [59 inches], 36 kg [80 pounds]) was seated in an unknown posture. She was restrained by the available lap-and-shoulder safety belt. Her seat track and seat back were not adjustable. The front right passenger did not sustain any injuries and did not receive any medical treatment.


non-breakaway luminaire support
debris from V1 around base
Grass
Median
N
IN10026
Sketch, not to scale
daylight, asphalt road surface,
positive slope for southbound traffic,
dry, no adverse weather,
speed limit 56 km/h (35 mph)
V1: 2002 Ford Th!nk Neighbor