

On-scene Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS00-010
2000 Ford Taurus
Missouri
June, 2000

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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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16. Abstract <p>This two-vehicle crash occurred in Missouri in June, 2000 at 1010 hours. The crash took place on a curved two-lane, one-way interstate ramp. It was raining at the time of the crash and the level asphalt roadway was wet. The posted speed limit is 89 km/h (55 mph).</p> <p>The case vehicle, a 2000 Ford Taurus 4-door sedan driven by an unrestrained 67-year-old male, was traveling eastbound in the second lane from the right. The other vehicle, a 1985 Chevrolet C20 4 x 2 four-door pickup truck driven by a 23-year-old male, was traveling eastbound in the first lane from the right at a higher speed than the case vehicle. The front right seat was occupied by 42-year-old female. The other vehicle was pulling a four-wheel, two-axle trailer.</p> <p>As the other vehicle was negotiating the curve, the driver lost control, crossed the lane line and struck the right side of the case vehicle. Both drivers lost control of their vehicles. The other vehicle veered to the right and struck a concrete barrier on the right side of the roadway, over-rode the barrier, and came to rest on top of it.</p> <p>The case vehicle also veered to the right (possibly after over-correcting to the left), crossed the adjacent lane, and also struck the concrete barrier with its front end. Both front air bags deployed at this time. According to the EDR, this was a first stage deployment. The case vehicle rotated clockwise after striking the barrier and contacted the right side of Vehicle 2 with its left side.</p> <p>The driver of the case vehicle sustained a minor contusion to his lower abdomen. He was not treated or transported. The driver and front right occupant of the other vehicle did not report any injuries. Both vehicles were towed from the scene due to damage.</p>					
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Dynamic Science, Inc.
Accident Investigation
Case Number: DS00-010

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BACKGROUND:

Description: This Advanced Occupant Protection Systems (AOPS) case was generated by DSI through existing insurance contacts. NHTSA was notified of the case on August 9, 2000. DSI was assigned the case on August 9,2000. Field work was completed on August 12, 2000.

Investigation Type: On-scene

Crash Location: Missouri

Crash Date: June, 2000

Notification Date: August 9, 2000

Field Work Completed: August 12, 2000

SUMMARY:

This two-vehicle crash occurred in Missouri in June, 2000 at 1010 hours. The crash took place on a curved two-lane, one-way interstate ramp. It was raining at the time of the crash and the level asphalt roadway was wet. The posted speed limit is 89 km/h (55 mph).

The case vehicle, a 2000 Ford Taurus 4-door sedan driven by an unrestrained 67-year-old male(173 cm/68 in., 91 kg/200 lbs), was traveling eastbound in the second lane from the right. Restraint use was based on a lack of physical evidence showing usage and a “Not Engaged” indication from the Event Data Recorder (EDR) report¹.

The other vehicle, a 1985 Chevrolet C20 4 x 2 four-door pickup truck driven by a 23-year-old male, was traveling eastbound in the first lane from the right at a higher speed than the case vehicle. The front right seat was occupied by 42-year-old female. The Chevrolet C20 was pulling a four-wheel, two-axle trailer.

As the Chevrolet was negotiating the curve, the driver lost control and this vehicle crossed the lane line and struck the right side (06RZES1) of the case vehicle. Both drivers lost control of their vehicles. The Chevrolet veered to the right and struck a concrete barrier on the right side of the roadway. The Chevrolet then over-rode the barrier and came to rest on top of it.



Figure 1. Front view, case vehicle – barrier impact

¹See Attachment 1

The case vehicle also veered to the right (possibly after over-correcting to the left), crossed the adjacent lane, and also struck the concrete barrier with its front end (12FDEW1). The case vehicle sustained a longitudinal delta v of -19.2 km/h (-11.9 mph)². Maximum crush was located at C₆ and measured 17.5 cm (6.9 in.). The EDR reported a longitudinal cumulative delta V of -23.9 km/h (-14.9 mph) at the 78 ms mark.



Figure 2. Left side vehicle, Vehicle 1– impact 3

Both front air bags deployed at this time. According to the EDR, this was a first stage deployment. The case vehicle rotated clockwise after striking the barrier and contacted the right side of the other vehicle with its left side (09LDEW1).



Figure 3. Right side view, Vehicle 1

The driver of the case vehicle sustained a minor contusion to his lower abdomen. He was not treated or transported. The driver and front right occupant of the other vehicle did not report any injuries.

Both vehicles were towed from the scene due to damage.

The case vehicle was equipped with front left and front right frontal air bags and seat belt pretensioners at the front left and front right seating positions.

The driver's air bag was circular and measured 45 cm (17.7 in.) in diameter. It was equipped with two tethers and two vent holes. There appeared to be eight horizontal folds and possibly five vertical folds. There was black smudges on top left quadrant and an unknown yellow-colored transfer on the top right quadrant. The module cover opened in an "H" configuration. There were no indications of any damage to the cover.

²Calculated using WinSmash barrier option and using averaged d0/d1 values from NCAP test.

The front right occupant's frontal air bag was rectangular and measured 58 cm (22.8) laterally. It was equipped with two vent ports and did not have any tethers. On the face of the air bag there was cover-related scuffing. The single flap module did not sustain any damage.

Both front seat positions were equipped with seat belt pretensioners. The pretensioner barrels were checked and measured 11 cm (4.3 in.), indicating that they had not deployed.

There was no steering column stroke and the steering column breakaway coupling was intact. There was no intrusion nor any integrity loss.

The data from the RCM module was downloaded on scene.

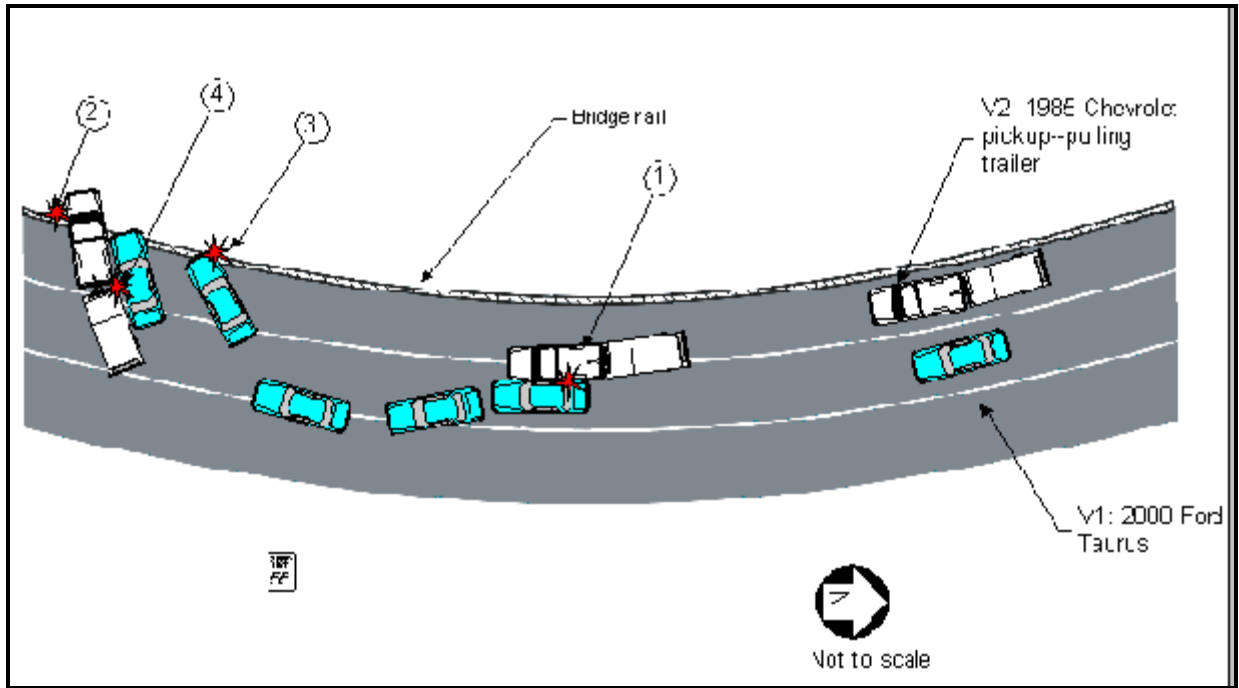


Figure 4. Driver's seated position—shows left knee contact



Figure 5. Overview of deployed air bags

Scene Diagram



DETAILED INFORMATION**Vehicles**Case vehicle

Description:	2000 Ford Taurus SE four-door	
VIN:	1FAFP56S4YGxxxxxx	
Odometer:	13,848 km (8,605 miles)	
Engine:	3.0 L 6	
Reported Defects:	None	
Cargo:	None	
Damage Description:	Moderate damage to front bumper. Light contact to right rear side. Moderate contact damage along entire left side. Towed from the scene.	
CDC:	Impact 1: 06RZES1 Impact 2: 12FDEW1 Impact 3: 09LDEW1	
Delta V (Impact 2) ³ :	Total	12.9 km/h (8.0 mph)
	Longitudinal	-12.8 km/h (-7.9 mph)
	Latitudinal	2.2 km/h (1.4 mph)
	Energy	11,461 joules (8,452 ft-lbs)

³EDR reported a longitudinal cumulative delta V of -23.9 km/h (-14.9 mph) at the 78 ms mark.

Other vehicle

Description:	1985 GMC conventional cab 4 x 2 four-door 3/4 ton pickup truck-pulling a trailer	
VIN:	1GTGC23W1F5xxxxxx	
Odometer:	Unknown	
Engine:	7.4L V8	
Reported Defects:	None	
Cargo:	Unknown	
Damage Description:	Police indicate contact damage to the rear of the right side, rear of the left side, and to the undercarriage. Vehicle was towed from the scene.	
CDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Occupants

<u>Case vehicle</u>	Occupant 1
Age/Sex:	67/Male
Seated Position:	Front left
Seat Type:	Bucket–cloth covered
Height:	173 cm (68 in.)
Weight:	91 kg (200 lbs.)
Occupation:	Sales
Pre-existing Medical Condition:	None reported
Alcohol/Drug Involvement:	None
Driving Experience:	>20 years
Body Posture:	Normal, upright
Hand Position:	Both on steering wheel. Left higher than right while in turn.
Foot Position:	Right foot on accelerator, left on floor prior to initial impact
Restraint Usage:	None used
Air bag:	Deployed during second impact (impact with bridge rail)

<u>Other vehicle</u>	Occupant 1	Occupant 2
Age/Sex:	23/Male	42/Female
Seated Position:	Front left	Front right
Seat Type:	Unknown	Unknown
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	NA
Driving Experience:	<10 years	NA
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder, per police	Lap and shoulder, per police

Injuries and Injury Mechanisms

Case vehicle

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Contusion, lower abdomen	590402.1,4	922.2	Air bag

Other vehicle

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Not injured			
FR occupant:	Not injured			

Occupant Kinematics

The male driver (173 cm/68 in., 91 kg/200 lbs) of the case vehicle was seated in normal, upright position. At the time of the inspection, the seat was found to be located 29 cm rearward of the A pillar. According to the EDR report, the driver seat track was in the forward position⁴. The driver does not appear to have been wearing the available lap and shoulder belt. There were indications of usage, but nothing related to this crash. The EDR report indicated that the driver seat buckle was not engaged. There was negligible driver movement during the initial sideswiping type impact on the right side of the vehicle. The driver steered to the left in response to the impact, then steered sharply to the right as he overcorrected. As the case vehicle struck the barrier, the driver pitched forward and engaged the deploying air bag with his chest and lower abdomen. There is an indication that his left knee contacted the lower instrument panel.



Figure 7. Left knee contact



Figure 8. Left knee contact

⁴The “forward” position reported by the RCM is not fully forward.

Attachment 1. EDR report

2000 Taurus/Sable EDR Report - Summary Page



Investigation Data

File Name:	ds00-010.hex	File Save Date:	14-Aug-2000
File Read-out Date:	N/A	Report Date:	14-Aug-2000
Report Version:	1.3		

EDR Control Module Data

Data Validity Check:	Valid	EDR Model Version:	141
Time From Side Safing Decision to Left (Driver) Side Bag Deployment:			Not Deployed
Time From Side Safing Decision to Right (Passenger) Side Bag Deployment:			Not Deployed
Passenger Airbag Switch Position During Event:			N/A
Diagnostic Codes Active When Event Occurred:			0

Algorithm Times

Actual initiation depends on restraint system status (below).

	ms
Time From Algorithm Wakeup to Pretensioner:	76
Time From Algorithm Wakeup to First Stage - Unbelted:	76
Time From Algorithm Wakeup to First Stage - Belted:	0
Time From Algorithm Wakeup to Second Stage:	0

Restraint System Status

Driver Seat Belt Buckle:	Not Engaged
Passenger Seat Belt Buckle:	Not Engaged
Driver Seat Track In Forward Position:	Yes
Passenger Seat Weight Switch Position:	N/A

Deployment Initiation Attempt Times

	Driver	Passenger
Time From Algorithm Wakeup to Pretensioner Deployment Attempt:	Unbelted	Unbelted
Time From Algorithm Wakeup to First Stage Deployment Attempt:	76	76
Time From Algorithm Wakeup to Second Stage Deployment Attempt:	Disposal	Disposal

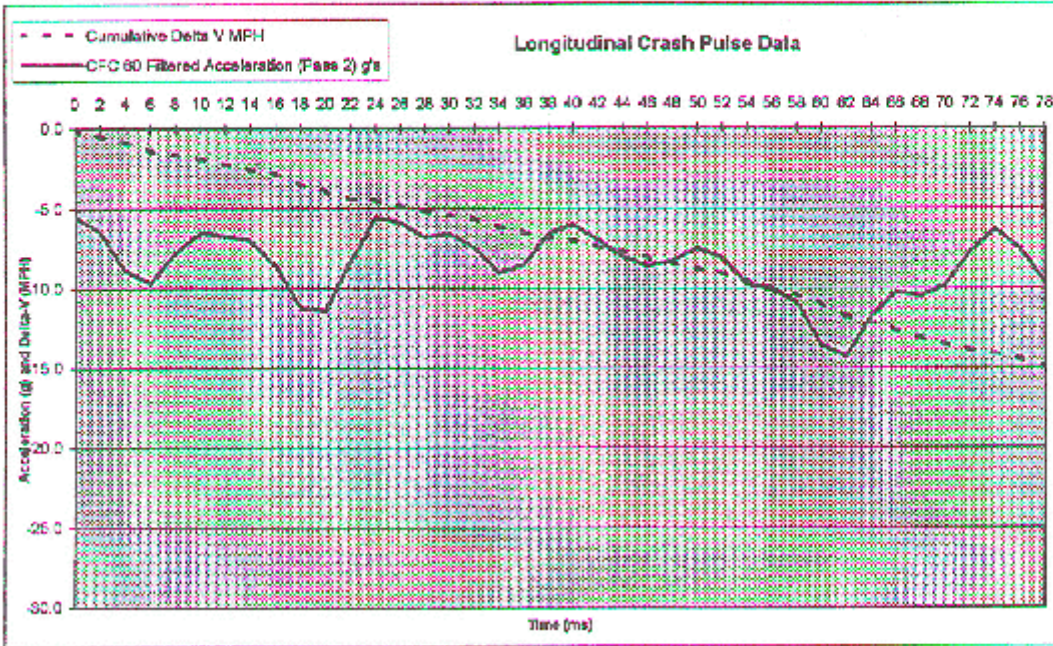
Notes

1. Read-out date is set by the PC interface tool.
2. Features and data parameters which are not available on the module are marked "N/A".
3. CFC 60 is a Butterworth 4-pole phaseless digital filter. (See SAE J211 Part 1 Appendix C dated March 1995.)
4. Total and maximum Delta-V results are not available from truncated/incomplete crash pulses.
5. Algorithm wakeup (0 ms) is not the first moment of vehicle contact or impact.
6. The Excel "Analysis ToolPak" Add-in must be enabled for this spreadsheet to operate properly.

2000 Taurus/Sable EDR Report - Charts

Longitudinal Cumulative Delta-V

Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	-0.3	-1.9	-3.9	-5.4	-7.0	-8.6	-11.0	-13.9	-16.9



Lateral Cumulative Delta-V

Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	0.2	0.1	0.5	-0.2	-1.0	-2.0	-2.5	-2.9	-3.0

