



U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

ODI RESUME

Investigation: EA 08-018
Prompted by: Consumer Complaints
Date Opened: 08/28/2008
Investigator: Kyle Bowker
Approver: Frank Borris
Subject: Front Suspension Coil Spring Fracture
Date Closed: 06/30/2011
Reviewer: Jeff Quandt

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: FORD MOTOR COMPANY
Products: 2002-2003 Ford Taurus and Mercury Sable in Salt Belt States
Population: 410,000 (Estimated)
Problem Description: Alleged front suspension coil spring fracture, which may result in tire puncture, loss of inflation pressure, and subsequent loss of vehicle control.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	888	1,915	2,401
Crashes/Fires:	3	2	4
Injury Incidents:	1	0	1
Number of Injuries:	1	0	1
Fatality Incidents:	0	0	0
Other*:	0	1,411	1,411

*Description of Other: Subject vehicles with one or more warranty claims related to the alleged defect.

ACTION / SUMMARY INFORMATION

Action: This Engineering Analysis has been closed.

Summary:

To date, ODI is aware of 2,401 non-duplicative complaints related to the alleged defect. In addition, ODI is aware of 1,411 subject vehicles with one or more warranty claims related to the alleged defect. In total, ODI is aware of 3,645 unique subject vehicles that have experienced one or more front suspension coil spring fractures. ODI is also aware of four minor crashes related to the alleged defect resulting in one minor injury.

With greater than eight years of exposure, a large subject vehicle population and approximately 2,052 reported front tire punctures caused by fractured coil springs (at all speeds), there have been no reported severe crashes, deaths or injuries related to the alleged defect. The real world consequences of these defective coil springs have been a small number of minor control problems that resulted in minor damage; suggesting that the effect of the defect on vehicle control is minor.

A safety-related defect has not been identified at this time and further use of agency resources does not appear to be warranted. Accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist. The agency will continue to monitor this issue and will take further action if warranted by the circumstances.

See the EA08-018 Engineering Analysis Closing Report for more details.

ENGINEERING ANALYSIS CLOSING REPORT

SUBJECT: Alleged front suspension coil spring fracture.

INVESTIGATION: EA08-018

SUBJECT VEHICLES: Model year (MY) 2002 through 2003 Ford Taurus and Mercury Sable vehicles manufactured by Ford Motor Company (Ford), sold or registered in “salt belt” states. (Note: for purposes of this investigation, the "salt belt" includes Connecticut, Delaware, the District of Columbia, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia and Wisconsin).

BASIS: The National Highway Traffic Safety Administration’s (NHTSA) investigation of alleged front suspension coil spring fracture in the subject vehicles was prompted by consumer complaints. Accordingly, on August 28, 2008, NHTSA’s Office of Defects Investigation (ODI) opened Engineering Analysis EA08-018.

DESCRIPTION OF COMPONENT OR VEHICLE SYSTEM: The subject vehicles are equipped with a MacPherson strut front suspension system with conventional hydraulic telescoping dampers and cylindrical coil springs made of a proprietary steel alloy. The wheel and tire assembly is attached to the vehicle via the wheel hub mounted to the lower portion of the MacPherson strut assembly. The original equipment manufacturer (OEM) tire fitment is P215/60R16 mounted to either a 6 in. or 6.5 in. width steel or aluminum alloy wheel. Several different suspension calibrations were available depending on trim level, body configuration, and optional equipment. All front suspension coil springs share the same spring rate and the same coil spring supplier was used regardless of which wheel and tire assembly or suspension calibration with which the vehicle was originally equipped.

VEHICLE POPULATION: The manufacturer provided Vehicle Identification Number (VIN) level detail for each of the subject vehicles, as defined by ODI, including the date of production, the date the warranty coverage period commenced, and the U.S. state where the vehicle was first sold. Using this data, along with state registration data, ODI estimates the subject vehicle population to be approximately 410,000 vehicles.

THE ALLEGED DEFECT: The alleged defect is any front suspension coil spring fracture, which may result in tire puncture, loss of inflation pressure, and subsequent loss of vehicle control.

FAILURE MECHANISM: Moisture and road debris may collect in the front suspension MacPherson strut lower spring seat area. Contact at the coil spring/lower spring seat interface results in abrasion of the coil spring’s protective paint coating and exposes the spring steel to the environment. Subsequent corrosion creates stress risers that result in fatigue cracking on the underside of the coil spring and may ultimately lead to complete coil spring fracture.

FREQUENCY OF THE ALLEGED DEFECT: Table 1 provides a count of consumer complaints (including manufacturer field reports, property damage claims and lawsuits) and warranty claims by authorized Ford dealers that allege one or more front suspension coil spring

fractures reported to ODI and/or the manufacturer. ODI is aware of 2,401 non-duplicative complaints related to the alleged defect in the subject vehicles. In addition, ODI is aware of 1,411 subject vehicles with one or more warranty claims related to the alleged defect. In total, accounting for all reported complaints and warranty claims, ODI is aware of 3,645 unique subject vehicles that have experienced one or more front suspension coil spring fractures.

	ODI	Manufacturer	Total
Complaints:	888	1,915	2,401
Crashes:	3	2	4
Injury Incidents:	1	0	1
# Injuries:	1	0	1
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Warranty Claims:	0	1,411	1,411

Table 1: Count of Subject Vehicles with Front Suspension Coil Spring Fracture

CONSEQUENCES OF THE ALLEGED DEFECT: ODI is aware of 4 reported crashes related to the alleged defect resulting in one minor injury. All 4 crashes are reportedly single-vehicle incidents involving collision with roadside objects such as guardrails, ditches, or curbs resulting in minor vehicle damage, as depicted in Figure 1 below. ODI also received 5 separate crash allegations that, upon further investigation, we do not consider to be crash incidents. Rather, the complainants described the coil spring fracture and subsequent tire puncture itself as the crash event or “accident.”

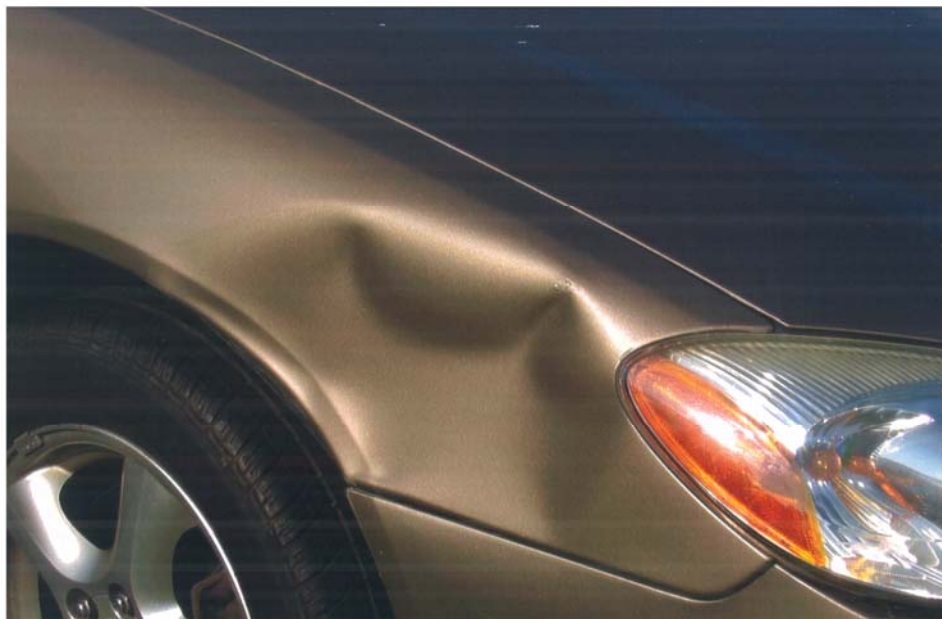
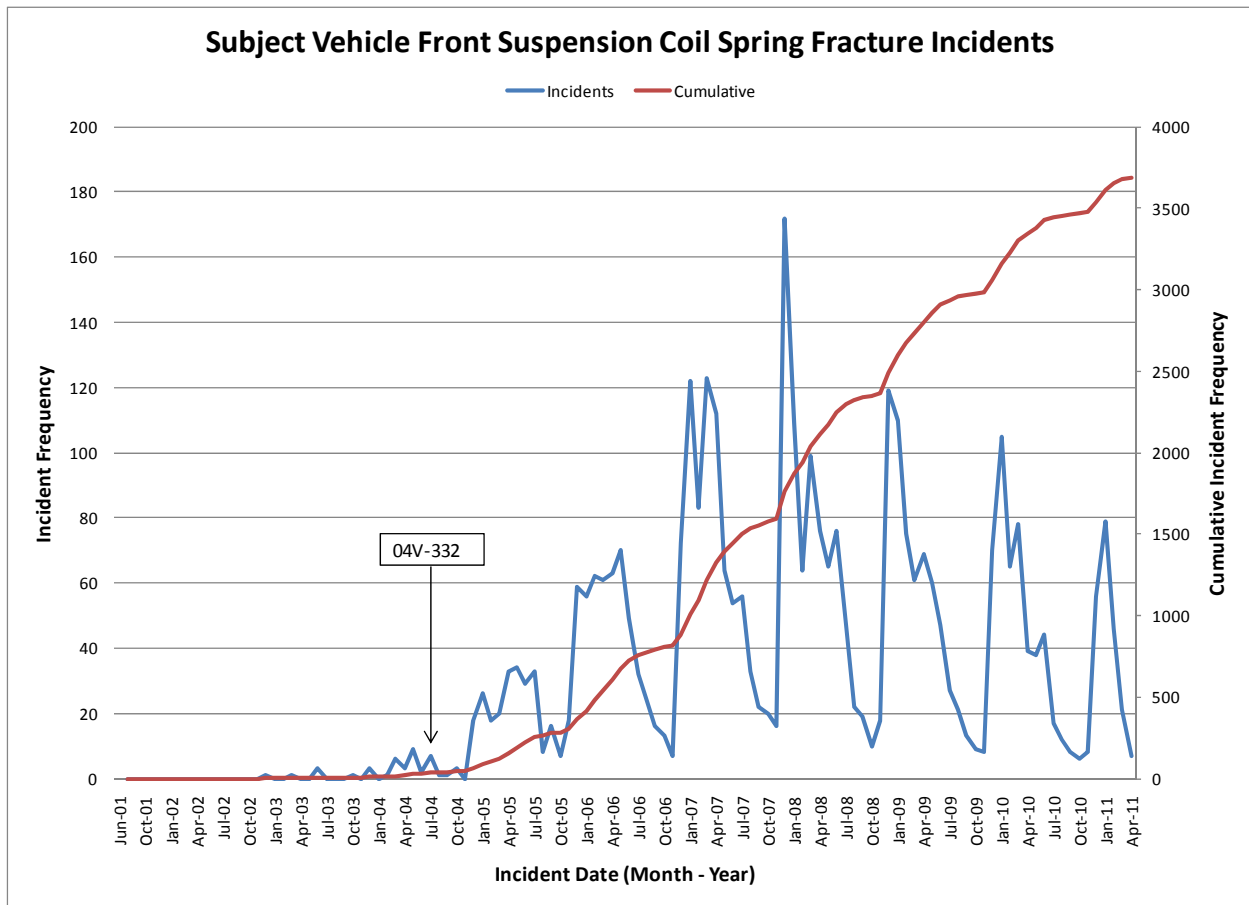


Figure 1: Photograph of a subject vehicle that sustained crash damage due to the alleged defect

ODI has also received 20 reports of non-crash loss of vehicle control incidents. These incident descriptions vary dramatically. The descriptions include allegations that the vehicle

momentarily departed from the intended travel lane and crossed either a yellow center line pavement marking or a white lane line pavement marking, and complaints reporting “loss of control” with no discernable consequence. When questioned further, some complainants describe being startled by the coil spring fracture and subsequent tire puncture, while others simply report how they perceived the sensory feedback from the coil spring fracture and subsequent tire puncture to be the “loss of control.”

PRIOR SAFETY RECALL: By letter dated July 6, 2004, Ford notified the agency that it would conduct a safety recall (NHTSA Recall No. 04V-332) to address defective front suspension coil springs in certain MY1999-2001 Ford Taurus and Mercury Sable vehicles. Ford maintained that coil spring fracture, even with tire puncture and rapid air loss, did not present an unreasonable risk to motor vehicle safety. However, to address both the agency’s and customers’ concerns, Ford decided to conduct a safety recall. The front suspension coil springs of the recalled vehicles (MY1999-2001 Ford Taurus and Mercury Sable) are the same as or substantially similar to the front suspension coil springs in the subject vehicles of this investigation (MY2002-2003 Ford Taurus and Mercury Sable). The scope of 04V-332 excluded the subject vehicles because at the time Ford determined a defect existed in the recalled vehicles, the subject vehicles did not yet have sufficient time in service for an apparent defect trend to materialize.



MANUFACTURER'S ASSESSMENT: Ford does not believe the alleged defect in the subject vehicles presents an unreasonable risk to motor vehicle safety. Ford states the rate for tire air loss related to coil spring fracture remains low. If the spring contacts the tire and causes air loss, these incidents often occur either while the vehicle is parked or at low speeds. If the fractured coil spring punctures the tire at higher speed, Ford states that testing under a variety of conditions demonstrates that test drivers can maintain control of subject vehicles and, to date, Ford is not aware of any severe crashes related to the alleged defect.

ODI ANALYSIS: In evaluating this issue, ODI studied the risk of a front suspension coil spring fracture resulting in puncture of the adjacent tire. Detailed examination of subject vehicle complaint and warranty claim data indicates that spring/tire contact occurs approximately 57% of the time there is a front suspension coil spring fracture (2,093 out of 3,645 total incident vehicles). For each incident vehicle that experienced spring/tire contact, approximately 98% of those (2,052) resulted in a tire puncture with air loss. Therefore, the incident exposure rate of front suspension coil spring fracture is approximately 104 per 100,000 subject vehicles per year of service (compared to approximately 787/100K/yr for the Saab 9-3 vehicles investigated under ODI investigation EA08-026 at the time that investigation was closed without a recall). The incident exposure rate of front suspension coil spring fracture resulting in a tire puncture is approximately 59 per 100,000 subject vehicles per year of service (compared to approximately 43/100K/yr for the Saab 9-3 vehicles in EA08-026).

ODI evaluated incident speed. Almost a quarter (23%) of all front suspension coil spring fracture incidents occurred while the vehicle was stationary, while nearly three-quarters (74%) of all incidents occurred at vehicle speeds below 20 miles per hour (mph). A fraction of these incidents (17%) occurred at vehicle speeds above 20 mph. The remainder (9%) had indeterminate vehicle speeds. Further, a number of owners were unaware that the front suspension coil springs had fractured until they were told there was a fraction by a technician during an unrelated maintenance service.

If spring/tire contact occurs at slower speeds the sharp pointed end of the fractured coil spring is more likely to get entangled in the sidewall of the tire and may inhibit rotation. If spring/tire contact occurs at higher speeds the sharp pointed end of the fractured coil spring is more likely to wear a groove around the entire circumference of the sidewall of the tire and may eventually compromise the structural integrity of the tire and cause rapid loss of air.

VRTC TESTING: Working in conjunction with NHTSA's Vehicle Research and Test Center (VRTC), ODI conducted a test program to assess the impact on subject vehicle control attributed to a simulated coil spring fracture and subsequent tire puncture using an exemplar test vehicle and professional test drivers. VRTC testing determined that a front suspension coil spring fracture and subsequent tire puncture results in reduced lateral acceleration capability and that the limit of lateral acceleration with a deflated outboard front tire is approximately 0.4G, compared to approximately 0.7G with fully inflated tires. According to the Manual on Uniform Traffic Control Devices (MUTCD) Section 2C.36 Advisory Exit, Ramp, and Curve Speed Signs, a 16-degree ball bank indicator reading equates to a lateral acceleration of 0.28G on a 100ft radius curve. When simulating the alleged defect in such a curve, VRTC test drivers were able to maintain the intended path with minimal effort as there remained reserve lateral acceleration capability and the lateral acceleration, hand wheel force, and steering angle required to negotiate the curve were roughly the same whether the outboard front tire was inflated or deflated. When

the right front brake was isolated to simulate what would happen if the spring fractured and locked the right front wheel at 35mph, the force required on the steering wheel to maintain a straight line was negligible (< 2 lbs.) and the car remained stable and controllable by test drivers. VRTC test drivers concluded that a coil spring fracture and subsequent tire puncture on the subject vehicles under these test conditions was an unremarkable event from a vehicle control standpoint. This conclusion is consistent with NHTSA's Federal Motor Vehicle Safety Standard (FMVSS) No. 110 compliance testing of the subject vehicles and Ford's test results.

NCSA CRASH DATABASE ANALYSIS: Working in conjunction with NHTSA's National Center for Statistics and Analysis (NCSA), ODI studied the Fatality Analysis Reporting System (FARS) and the State Data System (SDS) crash databases to identify subject vehicle crash incidents where the tire was identified as being involved in the cause of the crash. ODI found no fatal crashes related to the alleged defect nor any fatal crashes attributed to the type of tire disablements related to the alleged defect. Analysis of state data indicated that subject vehicle crash incidents with tire involvement remain a very low percentage of all police reported crashes (0.05%-0.21%).

REASON FOR CLOSING: The coil springs in the subject vehicles are defective. The data supplied by Ford, along with the frequency of consumer complaints and warranty claims related to the alleged defect and the prior safety recall (04V-332) conducted by Ford, tends to support the position that, in general, the coil springs that fractured on many subject vehicles did not achieve the expected service life. However, in regard to the subject vehicles, a front suspension coil spring fracture itself has a marginal effect on vehicle control. The majority of the reported coil spring fractures occurred while the vehicle was stationary or moving at low speeds. Also, rapid air loss in the front tires occurring at high speeds have had a minor effect on vehicle handling. Vehicle tests performed by the agency indicate that front coil spring fractures and rapid loss of air pressure have minimal impact on vehicle ride and handling. The reported incidents of punctured tires due to coil spring fractures appear to corroborate vehicle testing.

With greater than eight years of exposure, a large subject vehicle population and approximately 2,052 reported front tire punctures caused by fractured coil springs (at all speeds), there have been no reported severe crashes, deaths or injuries related to the alleged defect. The real world consequences of these defective coil springs have been a small number of minor control problems that resulted in minor damage; suggesting that the defect's effect on vehicle control is minor. Further, when controlling for vehicle age, the subject vehicles have a front suspension coil spring fracture incident rate that is lower than the Saab 9-3 vehicles studied under EA08-026, which closed without a recall. Similarly, the rate of tire punctures due to coil spring fractures is comparable for the subject vehicles and the Saab 9-3 vehicles studied under EA08-026. A safety-related defect has not been identified at this time and further use of agency resources does not appear to be warranted. Accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist. The agency will continue to monitor this issue and will take further action if warranted by the circumstances.