U.S. Department of Transportation
National Highway Traffic Safety Administration

ODI RESUME

Investigation: EA 05-007
Prompted By:
Date Opened: 04/14/2005 Date Closed: 04/11/2006
Principal Investigator: Tom Bowman
Subject: Tailgate Support Cables

Manufacturer: General Motors Corp.
Products: Gen Motors 1998-99, & Partial Year 2000 Silverados & Sierras
Population: 1667937

Problem Description: When the tailgate is in the open (horizontal) position, one or both of the tailgate support cables can break causing the supported individual and/or cargo to drop to the ground without warning.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	59	1589	1636
Crashes/Fires:	0	0	0
Injury Incidents:	6	77	82
# Injuries:	6	82	87
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Other*:	0	19449	19449

*Description of Other: GM Warranty Claims

Action: Close this Engineering Analysis. GM is conducting a Safety Recall (06V-066). The attached report summarizes additional investigation analysis.

Engineer: *Thomas Bowman* Date: *04/11/2006*
Div. Chief: *Richard Boyd* Date: *04/11/2006*
Office Dir.: *Kathleen C. DeMeter* Date: *04/11/2006*

Summary: General Motors is conducting a Safety Recall to remove and replace the tailgate support cables installed in 805,368 model year 1999 and 2000 GMT 800 model vehicles.

The model year 1999 and 2000 GMT-800 series vehicles that will be campaigned had contributed a significant majority of the total complaints (87%) and injuries (79%) associated with tailgate support breakage in the model year 1998 - 2000 C/K series vehicles addressed by this investigation.

Closing Report – EA05-007

Tailgate Support Cable Breakage in General Motors Model Years 1998-2000 C/K Silverado and Sierra Vehicles (GMT-400 and GMT-800 Vehicle Platforms)

CONTENTS

(1) Subject

This report addresses tailgate support cables corroding and breaking in 1998-2000 model years General Motors ("GM") C/K Series "Silverado" and "Sierra" model vehicles (GMT-400 and GMT-800 vehicle platforms).

On March 8, 2006, GM notified ODI of their decision to conduct a Safety Recall Campaign 06V-066 (GM Campaign Number 06019) to replace the galvanized tailgate support cables installed in model years 1999 - 2000 GMT-800 vehicles with tailgate support cables made of stainless steel.

Campaign 06V-066 does not address any vehicles manufactured in model year 1998.

Related Investigations:

(1) ODI investigations PE03-049 and EA05-004 preceded GM's Campaign 04V-129 announced on March 17, 2004. This campaign addressed model year 2000 - 2003 C/K series vehicles.
(2) ODI investigation RQ04-010, which preceded the current investigation EA05-007.

(2) Background

In 2003-2004, ODI conducted investigation EA04-005 which addressed 1999-2003 model years Silverado and Sierra vehicles and 2002-2003 model year Avalanche and Cadillac Escalade EXT vehicles. ODI closed this investigation after GM announced Campaign 04V-149 on March 17, 2004

Campaign 04V-149 excluded all 1999 model year C/K vehicles and a portion of 2000 model year C/K vehicles. At that time ODI noted in closing report EA04-005,

> "ODI is closing this investigation [EA04-005] because General Motors has decided to conduct a Recall Campaign (04V-129) to correct the identified issue in the affected model year 2000 – 2004 vehicles.

ODI is aware that tailgate cable breakage has occurred in C/K vehicles manufactured prior to October 1999 [not addressed by GM Campaign 04V-129] ... [B]ased on available data, the rate of tailgate cable breakage in ... pre-October, 1999 C/K vehicles is lower than the failure rate of tailgate cables that had been installed in MY 2000-2004 vehicles that are within the scope of Campaign 04V-129.

ODI is concerned that tailgate support cables have and will continue to break in ... C/K model vehicles manufactured prior to October 1999. Also, ODI believes that the incident count and incident rate are likely to increase since the failure modes, fatigue and corrosion, are regarded as "wear-out" types of failure modes that increase in rate and number as these components reach the end of their useful life. ODI is also concerned that the tailgate cables frequently break in an abrupt and catastrophic (complete) manner.

Without further investigation of the ... pre-October 1999 C /K vehicles, ODI cannot be certain whether certain factors might mitigate the frequency or severity of the risk when the tailgate cable(s) in these vehicles break. The preliminary injury statistics ... and incident rate of breakage based on warranty claims ... support the need for further investigation of these vehicles. Therefore, ODI has opened a Recall Query (RQ) to address tailgate support cable breakage in 1998 and 1999 model year C/K vehicles."

On September 28, 2004, ODI opened Recall Query RQ04-010 based on 43 complaints, ten of which were alleged to have resulted in a personal injury, which GM had identified on December 12, 2003, in response to ODI's request for information under Preliminary Evaluation PE03-049.

On April 14, 2005, ODI upgraded EA05-007 based on 682 complaints, 54 of which were alleged to have caused or contributed to a personal injury.

On March 8, 2006, General Motors filed Defect Notice 06V-066.

(3) Population

Production of GMT-400 and GMT-800 Vehicles by Model Year

	1998	1999	2000 (Partial Year)	Total
GMT-400	661,645	105,171	30,938	797,754
[redacted]				
Total	661,645	678,536	262,941	1,603,122

Source: GM provided GMT-400 volumes to ODI in an e-mail dated 12-12-05 in response to an ODI inquiry. GM provided GMT-800 volumes in an e-mail dated 3-3-06 in response to ODI inquiry.

The shaded cells indicate the 1999 - 2000 model year GMT-800 vehicles which will be recalled under Campaign 06V-066. GM did not manufacture the GMT-800 in model year 1998.

(4) Product Description

Each subject vehicle's tailgate has a support cable installed on the right side of the tailgate and a second support cable installed on the left side of the tailgate. One end of each cable attaches to a support bolt mounted into the side of the tailgate and the other end of each the cable attaches to a support bolt installed into the side of the tailgate frame.

When the tailgate is closed (raised), each cable is flexed or bent into a "U" shape within an enclosed space of the tailgate body. When the tailgate is opened (lowered), both cables straighten from the at-rest "U" shape to support the weight of the opened tailgate and any loads that may be placed on the opened tailgate (e.g., cargo, ramps, seated individuals, etc.).

The tailgate can be removed from the vehicle by unclipping the tailgate mounted ends of the right and left support cables from their respective frame mounted support bolts and partially opening (lowering) the tailgate to approximately 45 degrees from horizontal. At this position, the hinge trunnion mounted to the lower right side of the tailgate can be separated from the mating hinge post mounted to the tailgate frame and the left side trunnion can be disengaged from the left side hinge post by displacing the tailgate rightward.

According to General Motors (Response to Request No. 19, PE03-049 Information Request), "the right and left side tailgate support cables installed in GMT 400 subject vehicles are identical. The right and left tailgate support cables installed in GMT 800 subject vehicles (C/K) are of the same material and construction." The response also states that the difference between the right and left tailgate cables in the GMT 800 (C/K) models is the orientation of the eyelets installed on the cable ends.

Photographs of a representative GMT-800 vehicle and representative broken tailgate support cables and further discussion can be found in ODI closing report EA04-005

(5) Product Changes

October 17, 1999 -

During investigation EA04-005 that led to Campaign 04V-129, GM maintained that an inadvertent supplier-level material / process change had degraded / compromised the integrity of the thermoplastic olefin coating applied over the braided wire strands affecting vehicles manufactured after October 17, 1999. Without adequate coating integrity, water / moisture could penetrate the cable coating through cracks or abrasions in the coating or through the ends of the cable; penetrate through the interstitial areas of the tailgate support cable wire strands and contact the uncoated cable strands especially at the "low point" of the u-shaped at-rest tailgate-closed cable position. The presence of this unintended moisture could lead to corrosion and eventual weakening of the plated cable strands.

October 6, 2003 -

On October 6, 2003, the cable material was changed from, "4.8 (+.46 –0.00) dia.7 x 19 galvanized commercial braided steel" to "medium strength Type 302 or 304 stainless steel."

(6) ODI Investigation

ODI conducted several analyses of the complaint and injury rates and reviewed this information with GM at several review discussions.

ODI has included summaries of some of the more pertinent analyses in the following section, specifically.

(1) a summary and comparison of selected dimensions comparing the Tailgate Systems for supported and unsupported GMT-400 and GMT-800 tailgates;

(2) a comparison of GMT-400 to GMT-800 warranty claims, complaints, and injury rates;

(3) a comparison of complaint rates to peer vehicles manufactured by Ford, Daimler, and Toyota;

(4) an analysis of the timing of the complaints to determine the affect that publicity associated with Campaign 04V-129 may have influenced complaint activity;

(5) an analysis and discussion of selected Weibull failure rate analysis;

(6) risk assessment.

(7) ODI Assessment

(1) Summary and comparison of selected dimensions comparing the Tailgate Systems for supported and unsupported GMT-400 and GMT-800 tailgates

ODI observed that there appeared to be fewer complaints and injuries associated with GMT-400 vehicles than GMT-800 vehicles. (See the following section, "Comparison of GMT-400 to GMT-800 Warranty Claims, Complaints, and Injuries" for summary data.) To better understand the reasons for this phenomenon, ODI requested GM to provide information that would enable a comparison of the dimensions (such as tailgate length), properties (such as tailgate weight), and characteristics (such as "at-rest" tailgate-open positions) for the GMT-400 and GMT-800 tailgate systems.

Based on information that GM provided on January 14, 2005, the following table compares the nominal at-rest positions (stated as angular "tilt" or "attitude" from horizontal) of the GMT-400 and GMT-800 tailgate systems under two conditions: (1) when the tailgate is supported by both intact support cables and (2) when both support cables are disconnected simulating a condition in which both support cables are broken and the tailgate is supported solely by the vehicle bumper.

Comparison of the Nominal "At Rest" Positions of
GMT-400 and GMT-800 Opened Tailgates (1) when supported by both
Tailgate Cables and (2) when not supported by either Tailgate Cable

	GMT-400	GMT-800
Tailgate "Tilt" ("Attitude") for a tailgate fully supported by both cables	+ 3.4 degrees	+ 2 degrees
Tailgate "Tilt" (Attitude) for a tailgate without any cable support. This position simulates the tailgate attitude if both cables have broken and the tailgate is supported by the vehicle bumper.	- 1.1 degrees	- 8 degrees
Total Tailgate Displacement between fully cable-supported and non-supported positions. This data indicates the total tailgate displacement or "drop" if both cables have broken.	4.5 degrees	10 degrees

Source: GM Response to CDI Request No. 7, RQ04-010.

(2) Comparison of GMT-400 to GMT-800 Warranty Claims, Complaints, and Injuries

The following summary lists the warranty claims, complaints, and injury reports associated with 1998-2000 model year GMT-400 and GMT-800 vehicles as of December 2005. The shaded cells indicate vehicles being addressed by GM Campaign 06V-066.

GMT 400	1998 MY	1999 MY	2000 MY	Total
GMT 400 Production	661,645	105,171	30,938	797,754
GMT 400 Warranty Claims	6,087	1,389	620	8,096
GMT 400 Warranty Claim Rate (per 100,000 vehicles)	920	1,321	2,004	1,015
GM Complaints + ODI Complaints with VIN	159	33	22	214
GMT 400 Complaint Rate (per 100,000 vehicles)	24	31	71	22
GM Injuries	16	5	2	23
GMT 400 Injury Rate	2	5	6	3

GMT 800	1998 MY	[redacted]	Total
GMT 800 Production	0		808,381
GMT 800 Warranty Claims	0		11,353
GMT 800 Warranty Claim Rate (per 100,000 vehicles)	0		1,404
GM Complaints + ODI Complaints with VIN	0		1,508
GMT 800 Complaint Rate (per 100,000 vehicles)	0		187
GM Injuries	0		84
GMT 800 Injury Rate	0		10

ODI Complaints less Duplicates with GM (models not known)	15	23	9	47
ODI Injuries less Duplicates with GM				
GMT-400	0	1	0	1
GMT-800	0	4	1	5

ODI observed that the GMT-800 vehicles exhibited a higher warranty claim rate (1,404 vs.1,015 per 100, 000 vehicles), higher complaint rate (187 vs. 22 per 100,000 vehicles), and higher injury rate (10 vs. 3 per 100, 000 vehicles) than GMT-400 vehicles.

ODI attributes the higher complaint rate and injury rate associated with the GMT-800 to the larger tailgate displacement (drop of 10 degrees for the GMT-800 vs. 4.5 degrees for the GMT-400) from a cable-supported to a cable-unsupported position and the steeper final at-rest angle (-8 degrees for the GMT-800 vs. -1.1 degrees for the GMT-400) at the cable-unsupported position. (See the preceding section, "Summary and comparison of selected dimensions comparing the Tailgate Systems for supported and unsupported GMT-400 and GMT-800 tailgates.")

The differences between the tailgate system geometry and associated a greater complaint and injury rate between the GMT-800 and GMT-400 suggest that individuals are more likely to lose their balance and/or be dropped from the tailgates in the GMT-800 vehicles whose tailgates have the greater drop displacement and come to rest at a steeper angle following a support cable break than the GMT-400.

(3) Comparison of GM complaint rates to peer vehicles manufactured by Ford and Daimler Chrysler. (ODI has not summarized Toyota's data in this table because Toyota's complaint and injury rate was negligible.)

Summary of Warranty Claims, Complaints, and Injuries for Peer Vehicles

MODEL	1998 MY	1999 MY	2000 MY	2001 MY	2002 MY	2003 MY	2004 MY
Ford F-series populations	505,245	988,321	835,274	942,309	820,072	837,120	987,886
Warranty Rate Per 100,000	7	9	11	6	5	3	1
Warranty Claims (raw numbers)	33	91	92	52	42	22	11
Complaint Rate Per 100,000	0	0.4	0.5	0.3	0.4	0	0.3
Complaints (raw numbers)	0	4	4	3	3	0	3
Injuries	0	0	1	0	0	0	0
DCX Full Size (RAM)	397,186	393,137	203,477	540,681	368,333	438,446	486,614
Warranty Rate Per 100,000	432	346	153	200	73	42	29
Warranty Raw Numbers	1717	1360	312	1083	268	184	143
Complaint Rate Per 100,000	9	7	1	3	2	0.5	0
Complaints (Raw Numbers)	37	26	3	15	8	2	0
Injuries	2	2	0	1	1	0	0

Source: Summary of requested information from manufacturers of peer vehicles.

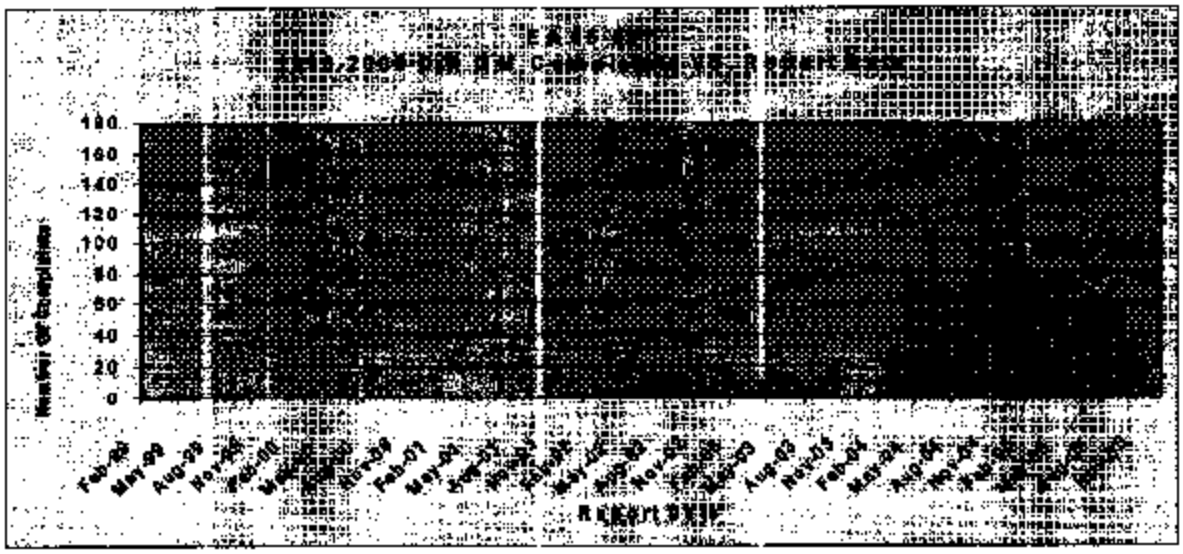
ODI noted that the complaint rate associated with the GMT-800 (187 complaints per 100,000 vehicles) is significantly larger than the complaint rate associated with Ford vehicles (less than 1 per 100,000 vehicles) and Daimler Chrysler (less than 10 per 100,000 vehicles).

If peer products were reasonable equivalent in integrity, comparative warranty and complaint rates between peer manufacturers would be expected to exhibit only small differences due to differences in search criteria techniques, warranty and complaint coding, retrieval systems and the like.

However, the differences in warranty claim rates, complaint rates, and injury rates between GM-400 and GMT-800 vehicles indicate a significant difference in the integrity of the tailgate support cables / tailgate support system between the GMT-400/GMT-800 and peer vehicles.

(4) Analysis of the timing of the complaints to determine whether publicity associated with Campaign 04V-129 may have influenced complaint activity

ODI believes that campaign publicity created a public awareness which was a factor in the observed increase of complaints to both ODI and GM. However, ODI believes that these complaints are not fabricated or inflated but rather represent under-reporting of incidents that had occurred prior to the publicity-generated public awareness. A significant portion of the complaints were reported several months after the publicity effect had faded and these complains appear to fairly represent the increasing incidents that would normally be expected of components that fail due to corrosion and fatigue.



(5) Analysis and Discussion of Selected Weibull Failure Rate Analysis

ODI analyzed Weibull analysis (see Appendix B) provided by GM. ODI determined that the complaint rates were likely to increase in GMT-800 series vehicles and injuries would increase proportionately to complaints unless the cables were replaced.

(6) Risk Assessment -

ODI's analysis has identified the three principle groupings of risks posed when one or both of the tailgate support cables break:

(1) Injuries and/or property damage caused by being tipped or jolted when the tailgate support cable broke unexpectedly

(a) when individuals were seated on the tailgate, or

(b) when individuals were standing on the tailgate while loading or unloading cargo, or

(c) when individuals were using ramps placed against the tailgate to load or unload equipment such as lawn mowers, ATVs, motorcycles, etc.

(2) Injuries caused by being struck or pinched by the dropping tailgate.

(3) The risk of complete or partial separation of the tailgate while the vehicle is stationary (during which the dropped door may pose a risk of injury to persons standing behind the vehicle) or being driven on a roadway (during which the partially or completely detached door may pose a risk to nearby individuals or vehicles).

(4) Injuries or fatalities associated with passengers riding on the tailgate and being dropped to the ground or pavements after one or both tailgate support cables break.

Fatalities-

ODI is not aware of any fatalities associated with a tailgate support breaking in the 1998-2000 model year C/K vehicles that are within the scope of EA05-007.

However, during the course of this investigation ODI learned of seven fatalities in which tailgate cable breakage is alleged to have been a causal or contributing factor. Each of these fatalities occurred after GM had announced Campaign 04V-129 but prior to the vehicles being repaired.

Since the identified fatalities are not within the direct scope of EA05-007, ODI has summarized this information in Appendix A. These incidents provide a useful context for assessing the potential severity of the risks associated with tailgate support cable breakage and, more importantly, demonstrate that riding on the tailgate of a moving vehicle is extremely hazardous.

(8) GM's Actions

General Motors filed a Defect Notice 06V-066 on March 8, 2006. This Notice provides for the replacement of the tailgate support cable in all model year 1999-2000 GMT-800 model vehicles.

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Appendix A
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Discussion of the Risks Associated with Falling from the Tailgate of a Moving Vehicle

ODI is not aware of any fatalities directly associated with one of both tailgate support cables breaking in the 1998-2000 model year C/K vehicles, i.e., those vehicles within the direct scope of EA05-007. However, during the course of this investigation, ODI has learned of seven fatalities in which one or both tailgate support cables installed in vehicles that are outside the scope of EA05-007 broke, and allegedly caused or contributed to the circumstances resulting in a fatality.

Each of these alleged fatalities occurred in GM GMT-800 (C/K) vehicles that were addressed by Campaign 04V-129 but occurred in or after March 2004 (the month that GM announced the Recall) and before December, 2004 (when GM distributed the initial replacement stainless steel tailgate support cables).

In April 2004, GM specifically notified owners to use caution until the cables could be replaced, stating, "Until stainless steel support cables can be installed on your vehicle, do not stand, sit, or apply loads onto the tailgate when it's in the full open (horizontal) position. This will reduce the potential of personal injury and damage to the outer panel of your tailgate..."

Summary of Fatalities alleged to have occurred when an individual riding on the tailgate was dropped to the ground as a result of one or both tailgate support cables breaking while the vehicle was traveling at low speeds (i.e., estimated at approx 10 MPH)

Make	Model	Model Year	Fatality Incident Date
Chevrolet	Silverado 2500	2002	3/14/2004
GMC	Sierra 3500	2002	10/31/2004
Chevrolet	Silverado 1500	2002	11/23/2004
GMC	Sierra 2500	2003	9/15/2004
Chevrolet	Silverado 2500	2003	8/22/2004
Chevrolet	Silverado 2500	2002	7/6/2004
Chevrolet	Silverado 1500	2002	5/6/2004

Source: GM

Each of these fatality incidents occurred in vehicles when a "passenger" who had been seated on the tailgate while the vehicle was traveling at low speeds (estimated to be less than 10 MPH) had been dropped to the ground or pavement.

ODI believes that riding on the tailgate in a moving vehicle is an unsafe practice since there is a constant risk of the rider being dropped to the pavement due to many reasons such as vehicle motion, unexpected jolts due to road conditions and, in the above-listed incidents, possibly caused or exacerbated by one or both of the tailgate support cables breaking. ODI also observes that riding on the opened (horizontal) tailgate of a moving vehicle is apparently not an uncommon practice.

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Appendix B
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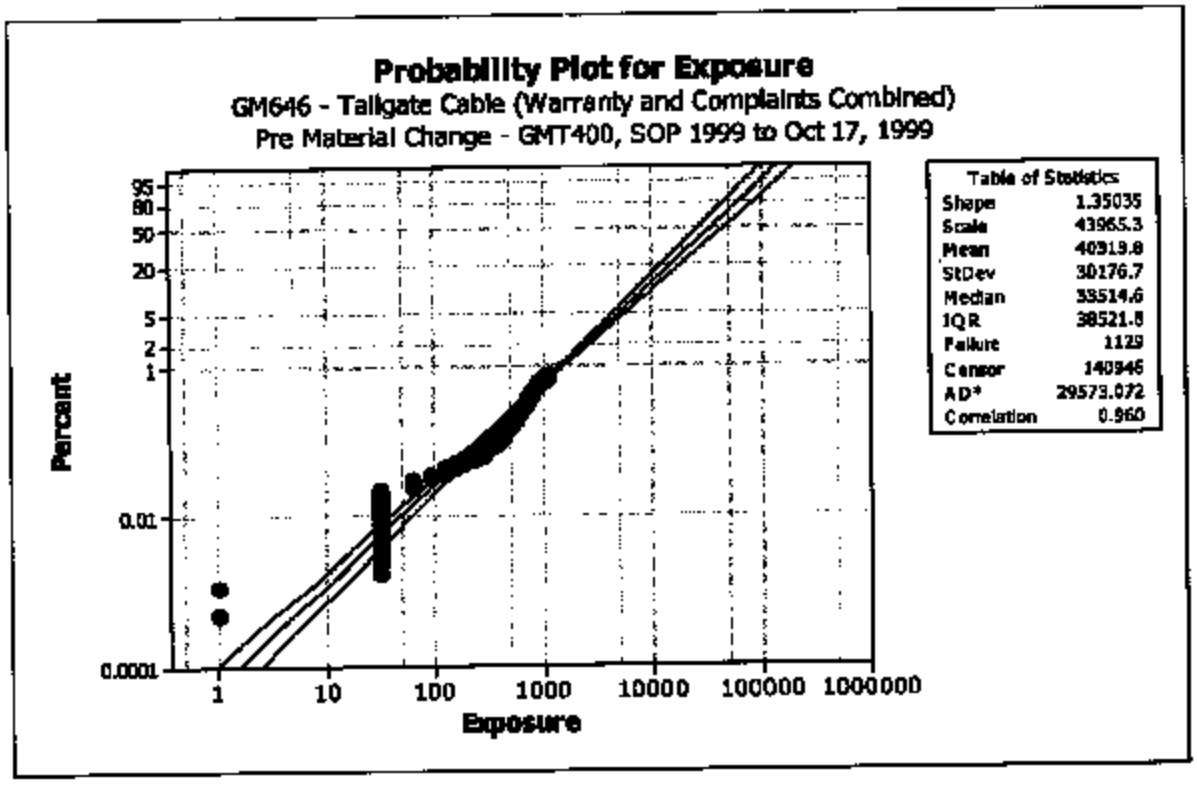
Weibull Plots of Tailgate Support Cable Failures on GMT-400 and GMT-800 for Vehicles Built Prior to October 17, 1999

GM provided a series of charts that depicted the Weibull distribution for a number of vehicle models and build date ranges. Following are the two of the charts pertinent to EA05-007.

Exposure (x-axis) is measured in days of service. The shape parameter (beta) indicates the whether the failure rate is increasing (beta < 1), constant (beta = 1), or decreasing (beta > 1).

The analysis indicates that the tailgate cable failure rate is increasing for both the GMT-400 (beta = 1.35) and GMT-800 (beta = 2.04), but that the failure rate for the GMT-800 is increasing at a faster rate.



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