

Closing Report – EA05-008

Tailgate Support Cable Breakage in General Motors Model Years 1998-2004 S/T (Sonoma and S-10) Series Vehicles

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(1) Subject

This report addresses tailgate support cables corroding and breaking in 1998-2004 model year General Motors S/T "Sonoma" and "S-10" vehicle models.

Prior Investigations:

- (1) ODI investigation RQ04-012 preceded EA05-008.

Related Investigations:

- (1) ODI investigation EA05-007 (GM Campaign 06V-066) addressed model year 1999 - 2000 C/K (Silverado and Sierra) series vehicles; and
- (2) ODI investigation EA04-005 (GM Campaign 04V-129) addressed model year 2000 - 2004 C/K series (Silverado, Sierra, Avalanche and Escalade EXT) vehicles.

(2) Background

In 2003-2004, ODI conducted investigation EA04-005 pertaining to tailgate support cable breakage in 1999-2004 model year Silverado and Sierra vehicles and 2002-2004 model year Avalanche and Cadillac Escalade EXT vehicles (designated C/K Models). ODI closed these investigations after GM announced Safety Recall 04V-129 on March 17, 2004.

Neither investigation EA04-005 nor Campaign 04V-129 addressed S/T vehicles. In September, 2004, at the time that Engineering Analysis EA04-005 was closed, ODI noted,

"ODI is aware that tailgate cable breakage has occurred in ... S/T model vehicles. Based on available data, the rate of tailgate cable breakage in S/T ... vehicles have occurred less frequently than the tailgate cables that had been installed in vehicles that are within the scope of Campaign 04V-129.

ODI is concerned that tailgate support cables have and will continue to break in S/T model vehicles ... Also, the incident rate is likely to increase at an increasing rate ... due to the cumulative effects of fatigue and corrosion. Without further investigation of these vehicles, ODI cannot be certain whether other factors might mitigate frequency or severity of the risk when a tailgate cable in these vehicles breaks. The preliminary injury statistics ... support[s] the need for further investigation of these vehicles."

On November 22, 2004, ODI opened RQ04-012 based on 42 complaints that ODI had received, five of which reported a personal injury resulting from tailgate support cable breakage in 1998-2003 S/T vehicles.

On April 14, 2005, ODI upgraded RQ04-012 to EA05-008 based on 749 complaints that ODI and GM had received (combined), 29 of which reported a personal injury.

In March 2006, General Motors advised ODI that GM will issue a "Special Policy Notice" to owners of 2000 - 2003 (excluding 1998 and 1999) model years S/T (Sonoma and S-10) Series vehicles.

(3) Population

S/T Vehicles Sold or Leased
in the United States by Model Year

Model Year	Production	
1998	309,507	
1999	220,930	
2000	306,823	
2001	209,238	
2002	181,725	
2003	205,678	Total = 903,464
2004	(*) 15,301	
Total	1,449,202	

(*) excludes 101,507 model year 2004 Chevrolet model Colorado and GMC model Canyon since these vehicles are equipped with a different tailgate support system than 1998-2003 S/T vehicle models.

The shaded cells indicate the 903,464 model year 2000 - 2003 S-10 and Sonoma vehicles that GM will address with a "Special Policy Notice."

(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 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 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.

(5) Product Changes

October 17, 1999 -

During investigation EA04-005 that preceded Campaign 04V-129, GM maintained that an inadvertent supplier-level process change had degraded / compromised the integrity of the thermoplastic olefin coating applied over the braided wire tailgate support cable strands in vehicles built 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, migrate through the unintended voids among the tailgate support cable wire strands, and contact, induce corrosion, and weaken the uncoated cable strands.

The “low point” of the u-shaped at-rest tailgate-closed cable position is the most likely location for the cable to break because moisture tends to wick down the cable into the lowest point of the “at rest” bent cable and because the “low point” of the cable is subjected to the greatest amount of cable flexing (bending fatigue) due to the opening and closing of the tailgate.

October 6, 2003 -

On October 6, 2003, GM changed the tailgate cable material 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 to evaluate and compare the vehicle dimensions and complaint and injury rates and trends. ODI has reviewed this information with GM at several review discussions.

ODI has included summaries of some of the analyses conducted, specifically:

- (1) a summary of selected dimensions comparing the S/T (mid size) and GMT-800 (full size) tailgate systems (Appendix A);
- (2) a summary and comparison of selected dimensions comparing the supported and unsupported S/T (mid size) and GMT-800 (full size) tailgate systems (Appendix A);
- (3) a summary of complaint and injury rates associated with S/T vehicles manufactured during model years 1998 -2003;
- (4) a comparison of complaint and injury rates for equivalent (mid-size) peer vehicles manufactured by Ford and Daimler-Chrysler;
- (5) an analysis of the timing of the complaints to determine the effect, if any, that publicity associated with Campaign 04V-129 may have influenced complaint activity;
- (6) a discussion of selected Weibull failure rate analyses;
- (7) a risk assessment.

(7) ODI Assessment

Since GM has conducted two Safety Recalls addressing GMT-800 tailgate support cables, one aspect of ODI's investigation was to compare the significant differences between GMT-800 and S/T tailgate systems to evaluate the extent to which the differences between these tailgate systems could affect the risk of injury associated with tailgate support cables breaking.

ODI's summary of selected dimensions and characteristics comparing the S/T (mid size) and GMT-800 (full size) tailgate systems is in Appendix A.

ODI also summarized complaint and injury information pertaining to the S/T model vehicles and peer vehicles. This information is provided in the following tables.

Summary of Complaint and Injury rates
Associated with Model Year 1998-2003 S/T Vehicles

1998-2003 S/T Pickup Tailgate Cables							
	1998 MY	1999 MY	2000 MY	2001 MY	2002 MY	2003 MY	Total
Production	309,507	220,930	306,823	209,238	181,725	205,678	1,433,901
Warranty Claims	1,162	877	2,502	2,151	957	262	7,911
Warranty Claim Rate (per 100,000 Vehicles)	375	397	815	1,028	527	127	55
Total GM Injury Incidents	1	1	4	16	5	1	28
Total GM Injuries	1	1	4	17	5	1	29
GM Injury Rate (per 100,000 vehicles)	0	0	1	8	3	0	2
GM Non-Injury Complaints	66	69	404	325	162	14	1040
GM Combined Injury and Non-Injury Complaint Rate	22	32	133	163	92	7	74
ODI Complaints	10	6	85	53	33	5	192
less Canadian	0	0	-2	-1	0	0	-3
less Duplicates from GM	-1	-1	-17	-12	-6	-1	-38
ODI Injuries	1	0	14	7	2	0	24
less Canadian	0	0	0	-1	0	0	-1
less Duplicates from GM	0	0	-2	-2	-1	0	-5
Total Non-Duplicated USA complaints	76	75	474	381	194	19	1219
Total Non-Duplicated USA Injuries	2	1	16	21	6	1	47

The shaded cells indicate the 903,464 model year 2000 - 2003 S/T (S-10 and Sonoma) vehicles that will be addressed by GM's "Special Policy Notice."

GM S/T Tailgate Support Cables
Summary of Warranty, Complaints, and Injuries Associated with Tailgate
Support Cable Breakage for Peer Vehicles

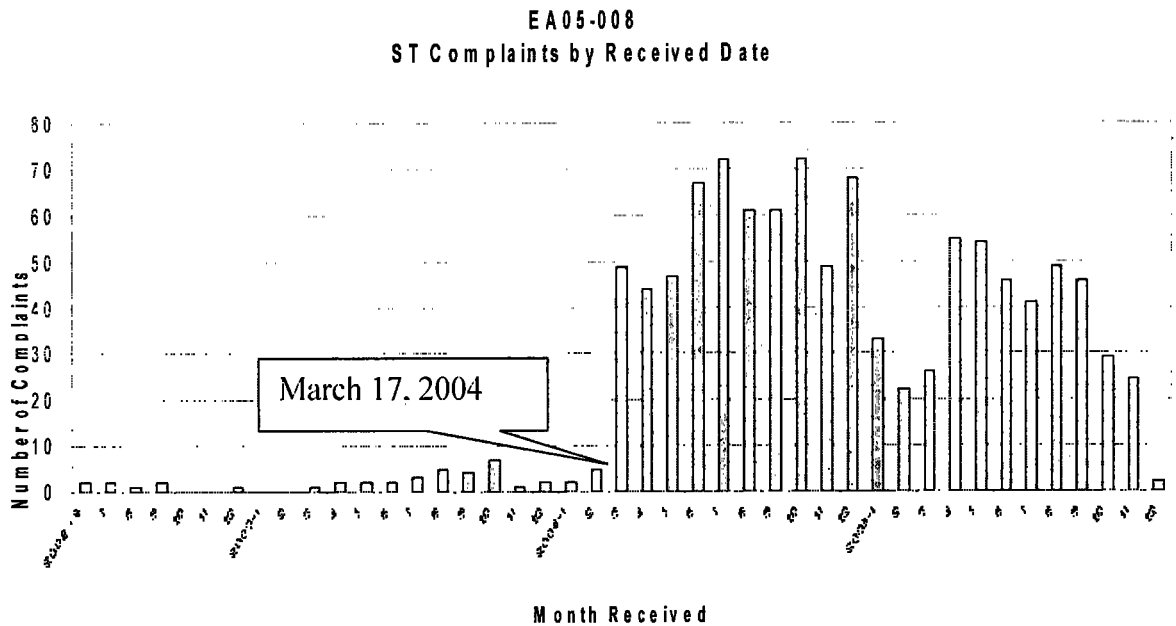
MODEL	1998 MY	1999 MY	2000 MY	2001 MY	2002 MY	2003 MY	2004 MY
Ford Mid Size (Ranger)	301,455	359,206	348,839	378,800	313,148	288,773	232,584
Warranty Complaints (raw numbers)	130	131	293	380	370	8	1
Ranger Warranty Rate Per 100,000	43	36	84	100	118	44	2
Complaints (raw numbers)	3	6	28	22	17	8	1
Ranger Complaint Rate Per 100,000	1	2	8	6	5	3	0.4
Ranger Injuries (raw numbers)	1	0	2	2	0	0	0
Ranger Injury Rate	0	0	1	1	0	0	0

DCX Mid Size (Dakota)	152,492	134,189	187,215	158,768	145,354	110,776	113,752
Warranty Complaints (raw numbers)	96	53	65	96	58	25	13
Warranty Complaint Rate Per 100,000	63	39	35	60	40	23	11
Complaints (raw numbers)	1	0	1	0	2	0	0
Complaint Rate Per 100,000	0.7	0	0.5	0	1	0	0
Injuries	0	0	0	0	0	0	0
Dakota Injury Rate	0	0	0	0	0	0	0

Source: Summary of requested information from manufacturers of peer vehicles. ODI has not summarized Toyota's data in this table because Toyota's complaint and injury rate was negligible.

ODI believes that peer products were reasonably equivalent in integrity, comparative warranty and complaint rates among 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. The differences in warranty claim rates, complaint rates, and injury rates between S/T and peer vehicles indicate a significant difference in tailgate cable integrity between S/T and peer vehicles.

Analysis of the timing of Tailgate Support Cable Breakage Complaints by Date Received



GM postulated that post-campaign announcement complaints were influenced by the publicity associated with GM's campaign to replace tailgate support cables in model years 2000-2003 C/K vehicles (04V-129) which was announced on March 17, 2004. As seen in the above chart, a significant number of complaints had been made after March 17, 2004, the date that GM announced Campaign 04V-129 (addressing model year 2000-2004 C/K vehicles).

ODI concurs that it is probable that campaign publicity created a public awareness which was a factor in the increase of complaints to both ODI and GM. However, ODI believes that these complaints are not inflated or fabricated but rather represent under-reporting of incidents that had occurred prior to the publicity-generated public awareness. In addition, a significant portion of the complaints reported several months after the publicity had faded more likely represent an increase in the number of complaints over time that is characteristic of components that fail due to corrosion and fatigue.

ODI analyzed Weibull analyses (see Appendix B) provided by GM. These analyses indicated that the complaint rates are likely to increase at a modest rate in S/T series vehicles and that injuries are also likely to increase at a proportionate rate.

Risk Assessment -

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

- (A) Injuries and/or property damage caused by being tipped or jolted when the tailgate support cable broke unexpectedly with the vehicle in a stationary position
 - (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.
- (B) Injuries caused by being struck or pinched by the dropping tailgate.
- (C) 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).
- (D) Injuries or fatalities associated with passengers riding on the tailgate of a moving vehicle 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 model years 1998-2003 S/T vehicles.

However, during the course of this investigation ODI learned of seven fatalities associated with 2002-2003 model year C/K (full size) vehicles 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 and but prior to the vehicles being repaired. Information regarding these fatality reports is summarized in Appendix A of the closing report for EA05-004.

GM's Special Policy letter reminds owners of the potential risks of riding on the open tailgate of a moving vehicle by stating that, "Owners should NEVER permit an individual to sit on the opened (horizontal) tailgate when a vehicle is in motion. Even when the vehicle is operated at low speeds, individuals seated on the tailgate can easily lose their balance in response to vehicle maneuvers, unexpected jolts due to road conditions, etc. Individuals who fall to the ground or pavement from a moving vehicle may be seriously injured or killed."

(8) GM's Actions

In March 2006, GM notified ODI of their decision to conduct a "Special Policy Notice" that offers owners their choice of two options:

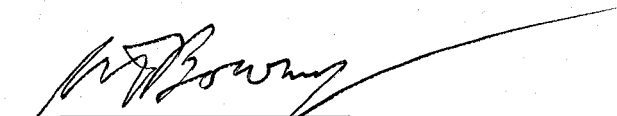
- (1) Owners may conduct an inspection of the galvanized steel tailgate support cables installed in their vehicles at least once each year or request their dealer to perform the recommended inspection; GM will provide and install replacement tailgate support cables at no cost in vehicles in which the tailgate cables and/or cable coatings have been found to exhibit indications of damage; or
- (2) If owners are unwilling or unable to inspect the tailgate support cables, owners may take their vehicle to any GM dealer who will replace the galvanized tailgate support cables at no cost on request of the owner.

The "Special Policy" addresses only 2000-2003 model year S/T vehicles. ODI is aware that tailgate cable breakage has occurred in 1998 and 1999 model year S/T vehicles which are not being addressed by the Special Policy Notice due to the significantly smaller number and rate of complaints than reported in model years 2000-2003 S/T vehicles.

(9) Conclusions

ODI is closing this investigation because General Motors has decided to conduct a Special Policy Notice that provides owners of model year 2000-2003 S/T (S-10 and Sonoma) with the opportunity to either inspect the tailgate support cables installed in their vehicles or request a GM dealership to replace the tailgate support cables on request at no cost.

GM also agreed to (1) issue a reminder follow-up of the Special Policy Notice every two years to all owners of model years 2000-2003 S/T vehicles whose tailgate cables have not been replaced; GM will issue the reminder Notice for a period of twelve years after the vehicle was placed into service; (2) provide ODI with quarterly reports for six quarters that summarizes the number of S/T vehicles whose tailgate support cables have been replaced; and (3) notify ODI immediately if GM receives a report of a fatality, whether or not confirmed, which is alleged to have occurred due to the breakage of one or both tailgate support cables in an S/T vehicle of any model year.

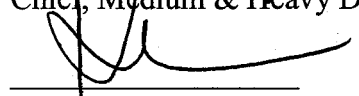

G. T. Bowman, Safety Defects Engineer

5/12/06
Date

I Concur:


Chief, Medium & Heavy Duty Truck Division

5/17/06
Date


Director, Office of Defect Investigation

5-17-06
Date

Following are summaries of selected dimensions and characteristics comparing the S/T (mid size) and GMT-800 (full size) tailgate systems.

(1) Summary of selected dimensions comparing the S/T (mid size) and GMT-800 (full size) tailgate systems

	S/T	C/K
Tailgate Mass	32.1 lbs.	46.9 lbs
Tailgate Height from Ground (opened)	27.5 inches	33.5 inches
Interior Bed Dimensions (indicating the differences in size and maximum cargo capacity volume)	Length 72.4" Width 55.1" Depth 16.5"	Length 96.0" Width 62.2" Depth 20.0"
ODI Calculation of Total Cargo Capacity Volume:	38.1 ft ³	69.1 ft ³
% of C/K Cargo Volume (based on ODI's calculation of the above dimensions)	55%	100%

Source: GM Response to Request 9(d), PE03-049)

(2) Summary and comparison of selected dimensions comparing supported and unsupported S/T (mid size) and GMT-800 (full size) tailgate systems

Unsupported Tailgate Tip or "Attitude" -

The following table provides a comparison of the nominal at-rest positions (stated as angular "tilt" or "attitude" from horizontal) of the S/T (mid-size) and the GMT-800 (full-size C/K) under two conditions: (1) when the tailgate is fully 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 then supported solely by the vehicle bumper.

	S/T	GMT-800
Tailgate "Tilt" ("Attitude") for a tailgate supported by both cables	+ 1.8 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.	- 7.5 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.	9.3 degrees	10 degrees

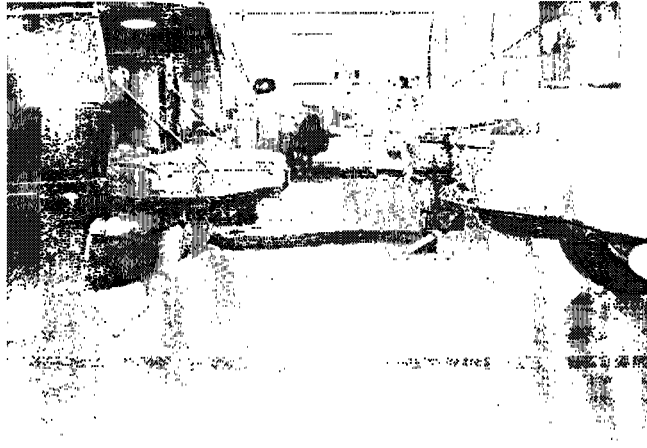
Source: GM Response to ODI Request No. 8, RQ04-012.

The above summary indicates that the "drop" and "at rest" positions after both tailgate cables have broken is not significantly different between the S/T and GMT-800 vehicle models.

(b) Height of Opened Tailgate from Ground Surface –

The height of an opened S/T tailgate (27.5") is 6 inches less than that of an opened C/K tailgate (33.5"). The lower height-to-ground of the S/T tailgate reduces the distance that an individual can potentially fall and sustain injuries.

This height difference appears to be a significant factor in the observed lower rate and severity of injuries associated with S/T tailgate cable breakage compared to GMT-800 model vehicles. See the following section "Summary of complaint rates associated with model year 1998-2003 S/T vehicles."



Photograph depicting a representative opened S/T (mid-size) tailgate (at left) at approximately 27.5" above the pavement surface compared to an opened C/K (full-size) tailgate (at right) at approximately 33.5" above the pavement surface.

(C) Geometry Factor (Cable Loading)

The "Geometry Factor" summarizes or abbreviates the geometric effects of (1) the tailgate length, (2) the position of the cable anchoring bolt along the length to the tailgate, and (3) the angle of the tailgate cable with respect to the tailgate in the open position into a single co-efficient. The "Geometry Factor" can be used to calculate the nominal cable load (i.e. "C" = "F" x "Geometry Factor", where "C" is the calculated cable load; "F" is the load on tailgate at furthest point from hinge; and the "Geometry Factor" is the co-efficient calculated from the above-listed dimensions for a vehicle's tailgate system).

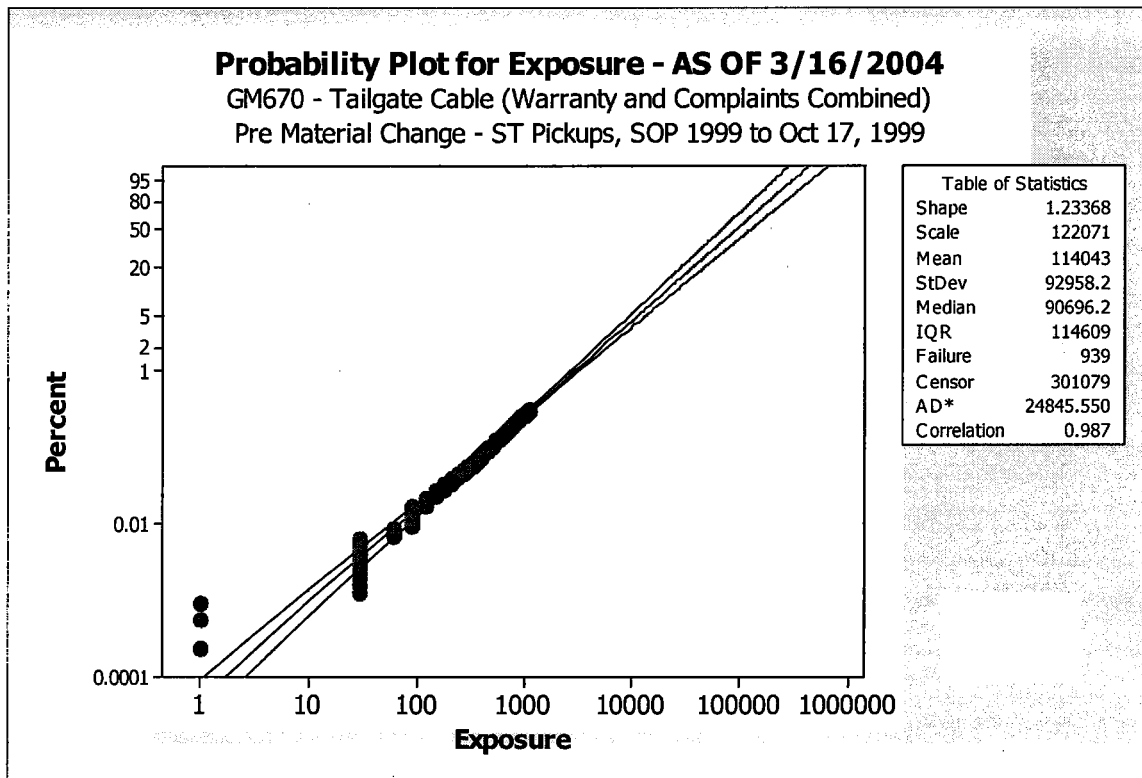
The "geometry factor" of the S/T (2.0) compared to the C/K (2.8) indicates that the S/T cable is subjected to approximately 29% less force than the C/K cable when subjected to the equivalent load imposed on the outermost lip of the tailgate.

(d) Usage Factors - In addition to the above geometrical and dimensional differences, GM provided a summary that indicates that the tailgate is opened and closed less frequently in S-10 / Sonoma vehicles than C/K vehicles because S-10 / Sonoma vehicles haul "large items" approximately 1/3 less frequently than C/K model vehicles.

Weibull Plots of Tailgate Support Cable Failures on S/T Vehicles Built Prior to and After October 17, 1999

GM provided a series of charts that depicted the Weibull distributions of tailgate support breakage for a number of vehicle models and build date ranges. Following are the two of the charts pertinent to EA05-008. Note that the failure data is derived solely from GM warranty and complaint data (does not include ODI data) on record as of March 16, 2004.

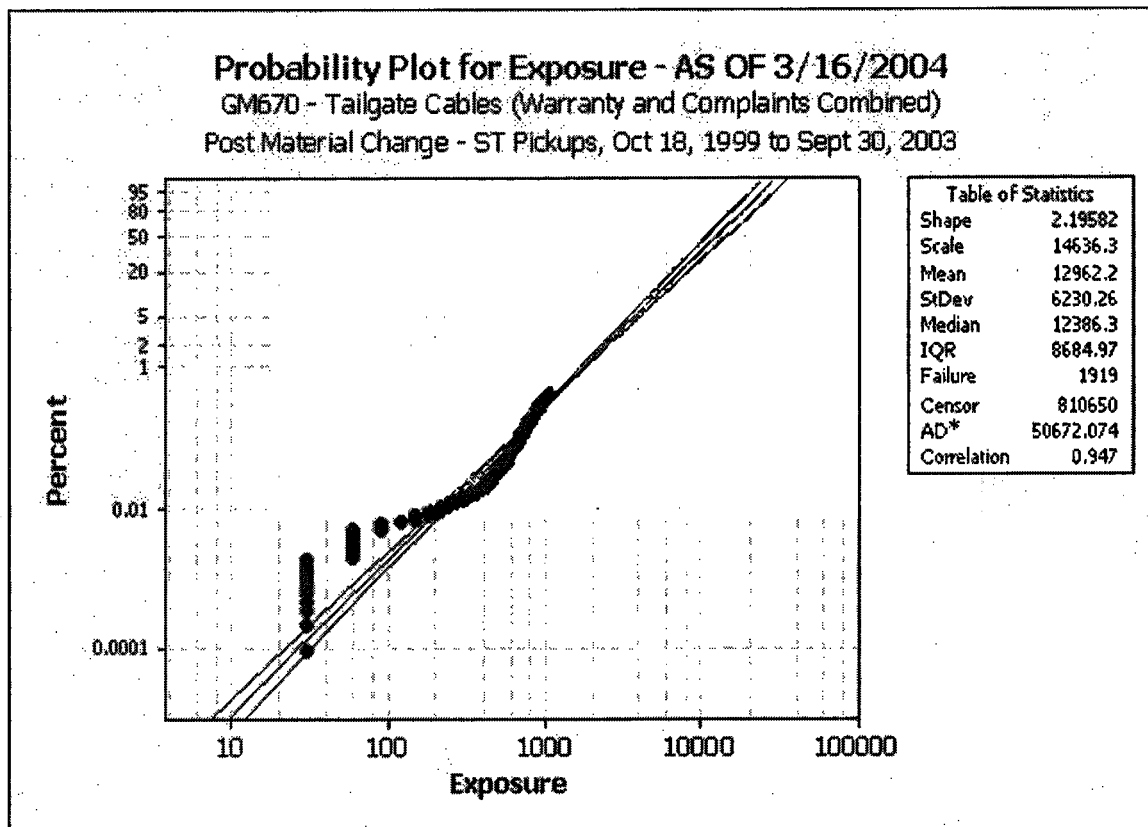
The shape parameter (beta) indicates whether the failure rate is increasing (beta > 1), constant (beta = 1), or decreasing (beta < 1). This analysis indicates that the tailgate cable failure rates in vehicles manufactured prior to October 17, 1999 (beta = 1.23 as depicted in the first chart) have been and are expected to continue to increase, but at a modest rate.



Exposure (x-axis) is measured in days of service.

The tailgate cable failure rates in vehicles manufactured after October 17, 1999 (beta = 2.19 as depicted in the second chart) also have been and are expected to continue to increase at a modest rate.

As expected by the loss of integrity in the tailgate cable coating, the failure rate for tailgate cables installed in vehicles built after October 17, 1999 have been and are expected to increase at a faster rate than vehicle built prior to October 17, 1999.



Exposure (x-axis) is measured in days of service.