U.S. Department of Transportation

National Highway Traffic Safety Administration

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

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Investigation:	EA 08-015		
Prompted by:	PE08-026		
Date Opened:	08/08/2008	**Date Closed:**	04/12/2010
Principal Investigator:	Michael Lee		
Subject:	Unexpected Closing of Power Liftgate		

MANUFACTURER & PRODUCT INFORMATION

Manufacturer:	HONDA (AMERICAN HONDA MOTOR CO.)
Products:	2005 Honda Odyssey Touring
Population:	25,230
Problem Description:	When the liftgate struts fail and cannot support the liftgate in the open position, the liftgate can drop unexpectedly and can power-close.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	2	60	62
Crashes/Fires:	0	0	0
Injury Incidents:	0	12	12
Number of Injuries:	0	12	12
Fatality Incidents:	0	0	0
Other*:	0	2212	2212

***Description of Other:** Warranty claims for liftgate strut replacements.

ACTION / SUMMARY INFORMATION

Action: This Engineering Analysis is closed (NHTSA Recall No. 10V-055).

Summary:

Honda will replace the liftgate struts in approximately 21,776 model year 2005 Honda Odyssey Touring vehicles equipped with power liftgates that were built before a manufacturing change of the liftgate strut assembly on July 16, 2005 (NHTSA Recall No. 10V-055). Vehicles built after the change experience significantly lower failure rates. The recall will inform consumers of the dangers of the existing struts and provide the opportunity for vehicle owners to obtain new struts that are more robust.

Based on Honda's action, the agency has decided to close the investigation. While Honda has not made a decision that the recalled vehicles contain a safety-related defect, in view of the recall, further use of the agency's resources does not appear to be warranted. The agency reserves the right to take further action if warranted by the circumstances.

Additional information can be found in the attached Engineering Analysis Report.

Engineering Analysis Report

Regarding

EA08-015: Honda Odyssey Power Liftgates

U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Enforcement
Office of Defects Investigation

April 2010

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I. OVERVIEW

A. Background

In 2007, the National Highway Traffic Safety Administration's (NHTSA) Office of Defects Investigation (ODI) conducted a comparative study that included collecting the number of complaints, injuries, and warranty claims related to liftgate strut failures in several minivan models equipped with power liftgates, including the Honda Odyssey. The study was done as part of ODI's investigation of unexpected liftgate closings on certain Toyota Sienna vehicles (EA06-020). At the time, Honda reported 36 complaints on model year (MY) 2005 Honda Odyssey Touring[1] vehicles equipped with power liftgates, three of which indicated injuries. Honda also reported 1,413 warranty claims of liftgate strut replacements on these vehicles. Based on that information, on April 10, 2008, ODI opened a Preliminary Evaluation (PE08-026) to investigate unexpected liftgate closings on MY 2005 Odyssey Touring vehicles.

ODI collected and analyzed field and technical information from Honda during the PE08-026 investigation and found that the liftgate gas struts for the Odyssey may contain damaged seals that allow gas to leak from the struts and cause the liftgate to close unexpectedly. Some of the complaints alleged injuries resulting from a person being struck by a liftgate closing unexpectedly. Based on these findings, on August 8, 2008, ODI upgraded the investigation to an Engineering Analysis (EA08-015). At that time, ODI was aware of 51 complaints with ten alleged injuries. The scope of EA08-015 was MY 2005 Odyssey Touring vehicles; however, ODI also collected and reviewed information on MY 2006 and 2007 Odyssey Touring vehicles. Table 1 shows MY 2005-2007 Odyssey Touring population by model year.

Table 1. Honda Odyssey Touring Population

Model Year	2005	2006	2007	Total
Population	25,230	23,984	20,544	69,758

B. Subject Vehicles Population

During this investigation, ODI adjusted the scope of its investigation to approximately 22,000 MY 2005 Honda Odyssey Touring vehicles (Odyssey or subject vehicles) manufactured prior to a modification of the liftgate strut manufacturing process directed by Honda on July 16, 2005.

C. Alleged Defect

The alleged defect is unexpected or unintended closing of the power liftgate.

[1] The power liftgate feature was available only on the Honda Odyssey Touring model; non-Touring Odyssey vehicles are equipped with manual liftgates and were excluded from this investigation.

ODI found that liftgate support struts in the subject vehicles are susceptible to failing in significant numbers. When the struts fail and cannot support the liftgate, a liftgate in the fully-open position can drop and automatically close under power (i.e., close by the power liftgate motor). The user assumes that the liftgate will remain in the fully-open position. Persons below the liftgate have been hit by the liftgate and injured.

ODI believes that the failure of the original equipment liftgate struts on the subject vehicles is the result of defects in design and manufacturing, and these struts will continue to fail in a similar and significant fashion as has been demonstrated by the facts gathered during the investigation. These struts exhibit a high early-life failure rate and an increasing failure trend. Failing struts pose a risk of injury to persons standing under the liftgate or accessing the rear cargo area in these vehicles.

D. ODI's Recall Request and Honda's Response

On October 6, 2009, ODI requested that Honda initiate a safety recall, in accordance with 49 U.S.C. § 30118-30120, to notify all owners, purchasers, and dealers to provide a free remedy for each of the subject vehicles. In its November 20, 2009, letter, Honda responded that a safety recall is not warranted.

E. Honda's Action

In its letters dated February 18 and 26, 2010, Honda stated that it will conduct a campaign to replace the liftgate struts in each of the subject vehicles with newly-designed struts. Although it has not determined the alleged defect to be a safety-related defect, Honda will refer to the campaign as a safety recall in its letters to the owners of the subject vehicles.

II. DESCRIPTION OF HONDA ODYSSEY POWER LIFTGATE SYSTEM

A. The Power Liftgate System

Mechanical Components

The liftgate is the large door on the rear of the vehicle. The liftgate is hinged at the roofline and latches at the bottom just above the bumper. The frame is steel and includes a glass backlight; the complete liftgate door weighs about 86 pounds. The interior of the liftgate is covered with a plastic panel. There is a button located on the bottom of the liftgate that, when depressed, will activate the automatic close feature. The liftgate system is supported by two gas-filled struts, one on each side, that hold the liftgate up when fully-open (see photograph on next page). The liftgate is held closed by a mechanical latch located at the bottom center of the liftgate.

The operator may open and close the liftgate manually or electrically.

Electrically Powered Components

The main electrical components for the power operation of the liftgate are: the power liftgate latch, the control module, the electric motor, and the switch devices for power actuation (power-opening and power-closing).

Manual Operation of the Liftgate

The liftgate can be opened or closed manually at any time.

Electrically Powered Operation of the Liftgate

To power-open the liftgate, the operator may press the liftgate button located either on the *Remote Transmitter* (key fob) or on the dashboard to the left of the steering column. When the operator depresses the button, the control module provides power to automatically unlatch the door and to the electric lift motor to open the liftgate. The electric motor is connected to a drive arm located on the left side of the liftgate. When the liftgate reaches a few degrees short of the fully-open position, the motor stops and disengages from the drive mechanism. The combined lifting force of the two struts opens the liftgate to the fully-open position and holds it open.

To power-close the liftgate, the operator may depress the liftgate button on the *Remote Transmitter*, on the dashboard, or on the liftgate. Any of these actions will initiate power-closing.

Safety Features

For normal operation, when the liftgate begins to power-close or power-open, a single audible warning beep is emitted and the hazard lights flash three times.

The power liftgate system has an “auto-reverse” feature. This feature automatically reverses the direction of the liftgate motion when the power liftgate control module detects an obstruction in the path of the moving liftgate. The control module detects an obstruction by monitoring the change in speed of the drive motor. When the motor speed drops, the module senses this as an obstruction in the path of the moving door, then the module reverses the direction of the motor rotation, the door reverses its direction, and three warning beeps are emitted. The “auto-reverse” feature also uses touch sensors (pressure or contact sensors) along the perimeter (side edges) of the liftgate. If the touch sensors detect an object caught between the perimeter of the liftgate and the body of the vehicle during power-closing operation, an electrical signal is sent to the control module and the module will reverse the direction of motor rotation and initiate power-opening.

If the operator depresses any of the three liftgate buttons while the liftgate is power-opening or closing, three warning beeps are emitted and the liftgate will stop moving, reverse direction, and stop in the fully opened or closed position.

B. Liftgate Strut Design and Failure Modes

The liftgate strut is a supporting device for the liftgate. The strut is a high-pressure gas cylinder with a piston rod, a piston, and other internal components such as piston guide and seal for keeping the gas pressure contained within the cylinder. When the liftgate is closed, the struts are in retracted or gas-compressed condition. When the liftgate begins to open, the struts produce force during extension and provide lifting force for assist in opening the liftgate. When the liftgate is in the fully-open position, the struts provide the force necessary to maintain the liftgate in the open position.

This investigation revealed that the liftgate struts in a significant number of subject vehicles have leaked the internal high pressure gas. Honda's supplier of the liftgate struts (Stabilus) has identified the failure mode. The seal may be damaged by scratches on the strut rod, which may occur as a result of side loading, guide burr, and guide design (sharp edge).

C. Honda's Modifications of Liftgate Struts

To address the liftgate strut failures, Honda implemented two significant changes to the design and manufacture of the liftgate struts in MY 2005-2007 Odyssey vehicles. In July 2005, Honda directed a manufacturing change to remove burrs on the strut's plastic guide element. In May 2006, Honda directed a design change to remove a sharp edge on the guide element. These changes made the new struts more robust and appear to have improved the durability of the struts.

Honda also implemented a temporary change to add a dust seal cover to prevent debris from entering the seal and potentially damaging the seal. However, Honda later determined that this change was ineffective and rescinded the change.

D. Power Liftgate Operation with Reduced-Gas Struts

Struts that contain less than a full charge of gas produce a reduced lifting force. Depending on available strut lifting force, a fully-opened liftgate may close either without or with motor assist. After the liftgate reaches the fully-open position, the motor disengages. If the struts cannot support the liftgate, it will drop unassisted under the force of gravity. If the drop speed is not sufficient to engage the motor, then the liftgate will drop slowly and then more quickly as it nears the closed position. If the speed of the drop is sufficient to be detected by the control module, the motor will engage and assist in controlling the speed at which the liftgate drops. More specifically, with significantly reduced strut lifting force, the liftgate in the fully-open position drops without motor engagement (initial drop) about two to five inches from the fully-open position, at which point the motor engages and power-opens the liftgate. The motor then disengages and the liftgate drops again, at which point the motor will engage, reopen the liftgate a second time, and then initiate power-closing. When the liftgate drops the

second time, a continuous warning beep sounds until the liftgate is fully closed. This audible warning is different than the single beep during the normal power opening or closing operation.

III. TESTING

A. NHTSA's Testing

The Vehicle Research and Test Center (VRTC) conducted extensive testing to assess the operation of the power liftgate in the subject vehicles under various strut conditions.

A pair of original equipment liftgate struts provides about 400 pounds of lifting force. The following is a summary of the test protocols and results.

- *Measure the minimum force required to support the liftgate in the fully-open position and other positions between the fully-open and closed positions. Perform the test at room temperature.* Table 2 shows the minimum force required to support the liftgate in the fully-open position is about 307 pounds, and the combined force on the struts ranges from 309 to 336 pounds in the lower liftgate positions. The height of a fully-opened liftgate is about 71 inches when fully-functional struts are used.[2]

Table 2. Force Required to Support Liftgate

Liftgate Position (degrees down from fully-open)	Distance from Liftgate Striker to Floor (in)	Force on Strut (lb)
0	71.2	307
15	58.5	309
30	47.5	326
45	37.5	336

- *Install struts with various lifting forces and record the result on power liftgate operation. Record the action of the liftgate after it reaches its apex: A) remains open; B) drops without engaging the electric drive motor; or C) drops quickly followed by automatic motor engagement. Perform the test at room temperature and record the amount and rate of initial drop of liftgate and rate of power-closing liftgate following the initial drop.* The term "initial drop" refers to the liftgate dropping quickly before the motor engages. Table 3 shows that when the combined strut lifting force falls to between 280 and 285 pounds, the struts will not be able to maintain the liftgate in the open position and the liftgate will close under the force of gravity. At a combined strut lifting force of 275 pounds or less, the liftgate will drop quickly and the motor will engage to power-close the liftgate.

[2] When the liftgate struts have leaked sufficient gas, the liftgate will open up to about 65 inches from the floor, then drop about two to five inches, automatically reopen, drop again, reopen again, and automatically close.

Table 3. Initial Drop Angle/Rate and Power-Close Rate

Combined Strut Lifting Force (lb)	Amount of Initial Drop (deg)	Initial Drop Rate (deg/sec)	Power Close Rate (deg/sec)	Category of Liftgate Action
320	N/A	N/A	N/A	A
310	N/A	N/A	N/A	A
300	N/A	N/A	N/A	A
290	N/A	N/A	N/A	A
285	N/A	N/A	N/A	A
280	N/A	N/A	N/A	B
275	3.2	6.4	9.2	C
270	3.2	6.2	9.0	C
250	3.6	11.4	8.9	C
230	3.5	15.0	9.2	C
180	3.6	17.5	8.9	C
160	3.2	16.0	9.2	C
140	3.6	14.7	8.7	C
0	5.3	24.5	9.5	C

Category	Description
A	Liftgate did not drop.
B	Liftgate dropped slowly without engaging motor then dropped quickly as liftgate approached closed position.
C	Liftgate dropped quickly and engaged motor (as describe in Footnote 2).

- *Install struts with various lifting forces and record the contact force exerted by the liftgate during the initial drop and during power-closing at different positions between the fully-open and closed positions. Perform the test at room temperature.* Tables 4 through 6 show the results of these tests.

Table 4. Contact Force in Category B

Combined Strut Lifting Force (lb)	Liftgate Position (degrees down from fully open)	Contact Force (lb)
280	15	6
280	30	23
280	45	29
280	66	117

Table 5. Contact Force during Initial Drop in Category C

Combined Strut Lifting Force (lb)	Liftgate Position (degrees down from fully open)	First Contact Force (lb)
270	10	39.4
250	10	54.3
230	10	74.2
180	10	97.6
160	10	111.4
140	10	134.4
0	10	149.0

Note: Contact force from first initial drop was always significantly higher than forces from subsequent initial drops. Thus, only first initial drop forces are shown.

Table 6. Contact Force during Power-Close in Category C

Combined Strut Lifting Force (lb)	Liftgate Position (degrees down from fully open)	First Contact Force (lb)	Second Contact Force (lb)
270	15	29.5	30.1
270	30	33.2	35.1
270	45	31.5	32.8
250	15	33.1	33.0
250	30	35.7	35.7
250	45	33.7	32.3
230	15	43.0	42.3
230	30	39.5	38.1
230	45	36.1	35.9
180	15	48.7	64.9
180	30	47.2	68.9
180	45	28.3	31.5
160	15	50.3	65.0
160	30	48.0	71.7
160	45	45.5	59.3
140	30	52.3	77.5
0	30	66.5	91.5

Note: When the liftgate encounters an obstruction during the initial power-close sequence, the liftgate automatically reopens and power-closes until it encounters the obstruction again, at which point the motor disengages and the liftgate remains resting on the obstruction (the load cell). The First Contact Force was measured during the initial power-close sequence. The Second Contact Force was measured during the second power-close sequence.

B. Honda's Testing

Honda provided the results of its liftgate testing of the Odyssey and Sienna vehicles. To simulate failed struts on the Odyssey, Honda removed one strut and measured the contact force of a falling liftgate at a position within the range of the initial drop. Honda reported the contact force ranged between 42 to 57 pounds. Using a similar test method on the Sienna, the contact force ranged between 60 and 69 pounds. Honda reported that the force to reverse a power-closing liftgate on the Odyssey and cause it to automatically reopen ranged between 27 and 38 pounds, and that of Sienna ranged between 24 and 51 pounds.

To measure the contact forces described above, Honda used a load cell equipped with a 20 N/mm spring specified by the power window pinch test protocol in Federal Motor Vehicle Safety Standard No. 118. This standard requires that power windows stop and reverse with a contact force less than 100 N (22.5 lb). However, Honda did conduct a single test in order to duplicate NHTSA's test method, i.e., no spring on the load cell. With both struts removed (zero strut lifting force) and no spring on the load cell, Honda reported the force to reverse a power-closing liftgate on the Odyssey and automatically reopen it was 59 pounds.

C. ODI Analysis

Power Liftgate Operation with Reduced Gas Struts

The force needed to maintain the liftgate in the fully-open position is provided by the liftgate struts. As shown in Table 2, the Odyssey liftgate requires a lifting force from the struts of about 307 pounds to maintain it in the fully-open position. A pair of original equipment liftgate struts provides enough force (about 400 lb) to keep the liftgate in the fully-open position. When gas leaks from the strut, the amount of force the strut produces decreases. Also, when the ambient temperature decreases, the amount of force the strut produces decreases.

When the combined force of the struts in the fully extended configuration diminishes to between 280 and 285 pounds (Category B in Table 3), the liftgate falls relatively slowly (not power close) until it nears the fully-closed position, at which point the liftgate will drop rapidly.

When the combined force of the struts in the fully extended configuration diminishes to 275 pounds or less (Category C in Table 3), the liftgate drops without motor engagement (initial drop) about two to five inches from the fully-open position, at which point the motor engages and power-opens the liftgate. The motor then disengages and the liftgate drops again, at which point the motor will engage, reopen the liftgate a second time, and then initiate power-closing. When the liftgate drops the second time, a continuous warning beep sounds until the liftgate is fully closed.

- Initial Drop. During the initial drop, the liftgate falls from a fully-open position and drops about two to five inches. Any person standing or bent over underneath the liftgate who stands five feet or taller is in danger of being

struck on the head, neck or back by the falling liftgate. During this freefall, the liftgate can drop at a rate between 6 and 24 degrees per second (Table 3) and an object in the path of the liftgate can receive an initial impact of between 39 and 149 pounds of force (Table 5). The less force the struts produce, the faster and larger the initial drop will be.

- Power Closing. During power-closing after the initial drop, the liftgate can close onto a person of any height positioned in its path. The liftgate power closes between 9 and 10 degrees per second (Table 3) and requires between 28 and 66 pounds of force to stop power-closing and automatically reverse (Table 6). A person can be knocked or forced to the ground or temporarily pinned by the closing liftgate until enough force is applied to reverse the movement of the liftgate.

In some circumstances, a person below the liftgate can receive an impact greater than the force produced by a falling liftgate. For example, when a person reaches into the rear cargo area of the vehicle and then moves rearward or stands up as the liftgate is closing unexpectedly, the motion of the person's head or body moving towards the closing liftgate will result in a greater combined impact force due to the liftgate and the person converging.

Liftgate Warning Features

When the combined lifting force of the struts diminishes to the Category B scenario (as described in Table 3), no warnings accompany the slowly closing liftgate. When this force diminishes to the Category C scenario, a continuous audible warning beep is emitted after the liftgate drops a second time and continues until the liftgate is power-closed.

Honda Test Results Compared with NHTSA Test Results

Honda's results of Odyssey and Sienna testing provided to NHTSA—initial drop force and force to stop and reverse a power-closing liftgate—indicate lower measured forces than NHTSA obtained through its testing of the vehicles. This appears to be due to the Honda's use of a 20 N/mm spring at the contact point between the liftgate and the load cell. When Honda tested without the spring, its result was similar to NHTSA's.

Honda Odyssey vs. Toyota Sienna

NHTSA and another vehicle manufacturer previously examined unexpected closing of power liftgates. ODI's investigation (EA06-020) of certain Toyota Sienna vehicles resulted in a safety recall (NHTSA Recall No. 08V-244) to replace the liftgate struts installed on 196,000 MY 2004-2006 Sienna vehicles. The original liftgate struts on Odyssey and Sienna were made by the same supplier, and the failure modes and mechanisms of the struts in both are similar. Comparing the liftgate systems in Odyssey and Sienna shows that the two systems were designed and operate similarly. Likewise, the forces generated by each liftgate during

the initial drop and the power-closing sequences are similar.[3] The incidences of reported failures and injuries associated with the alleged defect are similar for the two vehicles.[4]

IV. FIELD DATA ANALYSIS

A. Honda Odyssey

i. Complaints

Consumer complaints indicate that when the liftgate on a subject vehicle equipped with failing struts is power-opened, it reaches the top and unexpectedly closes on its own. Consumers report that the problem was fixed by replacing the original struts. NHTSA has verified many of the consumer complaints via inspection and testing of the allegedly failed struts, video documentation of the power liftgate malfunction, and telephone interviews of the complainants.

Table 7 shows the total number of complaints reported to NHTSA (as of March 2010) and Honda (as of March 2009) that relate to the alleged defect in Odyssey vehicles by model year. All 62 complaints on MY 2005 Odyssey were on the subject vehicles.

Table 7. Complaints on Odyssey Vehicles by Model Year

Model Year	2005	2006	2007	Total
No. of Complaints	62	11	5	78
Complaints per 1000 vehicles	2.5	0.5	0.2	1.1

Figure 1 shows an overall steady trend of complaints on the subject vehicles over time.

ii. Warranty Claims

Honda reported 3,020 warranty claims (as of March 2009) that involved the replacement of liftgate struts in MY 2005-2007 Odyssey vehicles. Table 8 shows the number and rate of

[3] NHTSA conducted its testing at room temperature using liftgate struts with various lifting forces capable of power-opening the liftgate to the full open position but not capable of maintaining the liftgate in the open position. During the initial drop, Odyssey and Sienna liftgates produced impact forces ranging from about 40 to 150 pounds and from about 55 to 240 pounds, respectively. During power-closing, Odyssey and Sienna liftgates require a force ranging from about 28 to 66 pounds and from about 28 to 68 pounds, respectively, to stop and reverse the power-closing liftgate.

[4] Incidences of reported failures and injuries were calculated for the approximately 21,000 MY 2005 Odyssey vehicles built before June 2005 and all MY 2004 Sienna vehicles using field data from approximately the same vehicle exposure period for each of the two vehicles. For Odyssey, the rates are 2.9 complaints, 0.6 injuries and 97 warranty claims per 1000 vehicles. For Sienna, the rates are 3.0 complaints, 0.7 injuries and 96 warranty claims per 1000 vehicles.

warranty claims by model year. Out of the 2,212 claims regarding liftgate struts on MY 2005 Odyssey vehicles, 2,170 claims concerned the subject vehicles. Multiple warranty claims on the same vehicle are not counted separately; they are counted as one claim for each unique vehicle.

Figure 1. Complaints by Report Year/Quarter

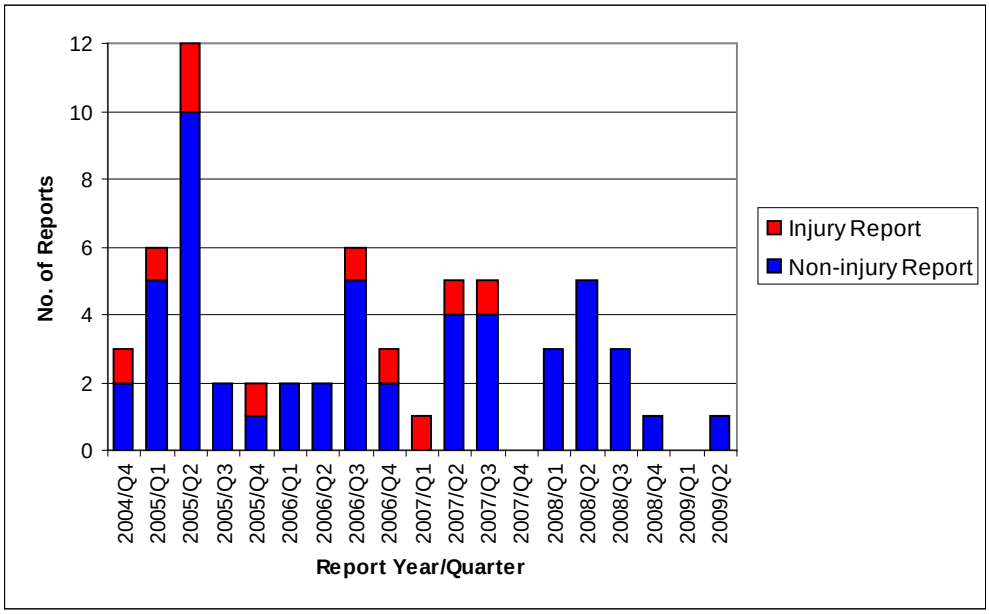


Table 8. Warranty Claims on Odyssey Vehicles by Model Year

Model Year	2005	2006	2007	Total
No. of Warranty Claims	2,212	413	395	3,020
Claims per 1000 vehicles	88	17	19	43

Figure 2 shows warranty claims by strut design change[5] and claim date. It shows that warranty claims for the subject vehicles have increased over time. Most of the Odyssey vehicles were covered by the basic 3-year/36,000-mile warranty period; relatively few vehicles had extended warranties.

ODI performed a Weibull analysis using Honda's warranty claim data for MY 2005 through 2007 Odyssey vehicles. Figure 3 shows the result with each version of the strut used in the Odyssey vehicles shown separately. The Beta value represents the slope parameter: the Beta

[5] The original (ORIG) design for the liftgate strut was used in MY 2005 Odysseys built before July 2005 (subject vehicles); the first modification (MOD1) was used in MY 2005 and 2006 Odysseys built between July 2005 and May 2006; and the second modification (MOD2) was used in MY 2006 and 2007 Odysseys built after May 2006. Refer to page 4 for the description of each modification.

is about 1.8 for the ORIG strut design and it is about 1.3 for MOD1 and MOD2 strut designs.[6] The Weibull analysis indicates an increasing failure trend for the ORIG strut design used in the subject vehicles. The Eta value is called the characteristic life and represents the time in service when 63 percent of the population is expected to fail: the Eta is about 120 months for the ORIG strut design which is much shorter than that of MOD1 and MOD2 strut designs, about 844 and 481 months, respectively.

Figure 2. Warranty Claims by Year/Quarter

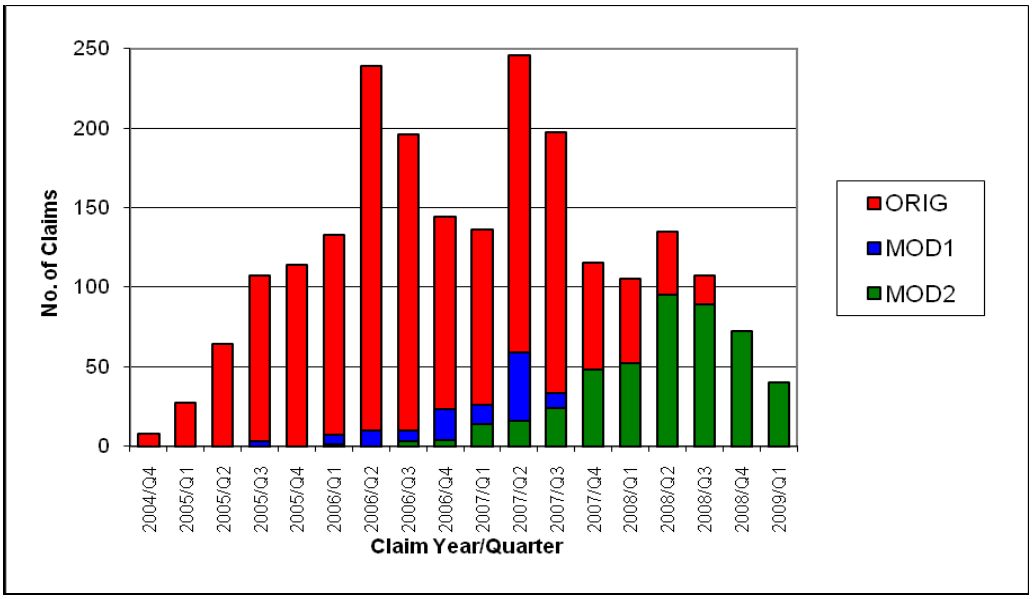
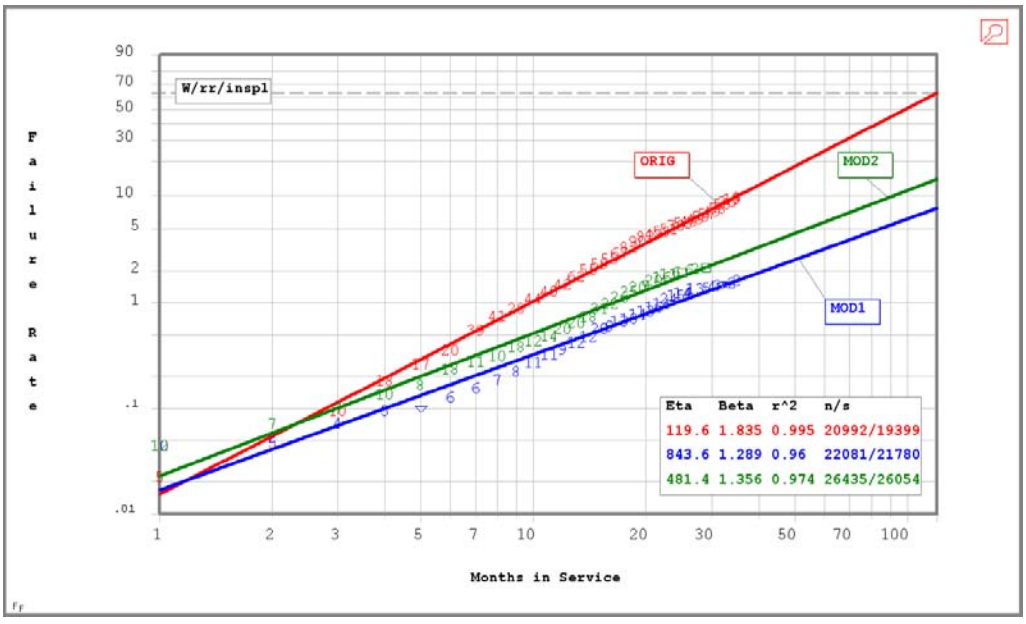


Figure 3. Weibull Analysis of Warranty Claims



[6] In Weibull analysis, Beta values greater than one represent an increasing failure trend over time, Beta values less than one represent a decreasing trend, and Beta value of one represents a steady or random trend.

iii. Injuries

ODI is aware of 12 reported injuries due to the failure of the liftgate struts installed on the subject vehicles and the resulting unexpected dropping and power-closing of the liftgate. Several owners were struck in the head by an unexpected liftgate closing; some were pinned or knocked or forced to the ground by a power-closing liftgate.

B. Real-World Observations

ODI observed the way people open a vehicle liftgate and go under the open liftgate to gain access to the rear cargo area. ODI made random and inconspicuous observations at the passenger arriving area at Reagan National Airport. We observed an assortment of minivans, SUV's and one station wagon. ODI's informal survey of liftgates being operated both automatically and manually showed that it was common for the person opening the liftgate to place his or her head and body beneath the liftgate before it completed its opening motion and reached a fully-open position.

C. Peer Vehicles

As part of a comparative study during the Toyota Sienna investigation, ODI obtained field data from the manufacturers of the following vehicles: Honda Odyssey, Dodge Caravan/Chrysler Town and Country, Ford Freestar/Mercury Monterey, and Nissan Quest. Table 9 shows the number and rate of manufacturers' complaints (Comp.), injuries (Inj.), and warranty claims (Warr.) on these vehicles.

Table 9. Field Data of Peer Vehicles – Manufacturer Data[7]

Model	Model Year	Vehicle Population	Comp.	Comp./ 100K	Inj.	Inj./ 100K	Warr.	Warr./ 100
Sienna	2004	82,870	105	126.7	15	18.1	5,839	7.0
	2005	59,548	13	21.8	1	1.7	2,175	3.7
	2006	53,662	0	0.0	0	0.0	175	0.3
Odyssey	2005	25,227	36	142.7	3	11.9	1413	5.6
	2006	23,982	5	20.8	1	4.2	123	0.5
Caravan/ Town & Country	2004	49,198	6	12.2	2	4.1	157	0.3
	2005	236,368	10	4.2	0	0.0	859	0.4
	2006	151,144	1	0.7	0	0.0	105	0.1
Freestar/ Monterey	2005	8,037	37	460.4	5	62.2	376	4.7
	2006	5,957	8	134.3	0	0.0	69	1.2
Quest	2004	57,055	40	70.1	1	1.8	69	0.1
	2005	23,638	12	50.8	0	0.0	358	1.5
	2006	12,107	0	0.0	0	0.0	99	0.8

[7] This comparative analysis included only manufacturer complaint and injury data (Vehicle Owner's Questionnaire reports were excluded) because, at that time (mid-2007), while a number of VOQ's were reported on Sienna, only a few or no VOQ's were reported on Odyssey and other vehicle models.

D. ODI Analysis

Honda Odyssey

The liftgate struts in the subject vehicles have been failing prematurely at a high and still increasing rate. There have been a significant number of performance failures of liftgate struts and more are expected. The complaint and warranty claim rates related to struts failing on the subject vehicles are particularly high based on reports received by ODI and Honda: 3.0 complaints and 103 warranty claims per 1000 vehicles. In addition, an analysis of Honda's warranty claims shows a steady increase in failures for the subject vehicle population.

To address the premature failures, Honda implemented a change to the manufacturing process of the liftgate strut assembly. This change was made on struts installed on MY 2005 Odyssey vehicles starting on July 16, 2005. The field data for Odyssey vehicles manufactured after the change was implemented shows a decrease in the failures based on complaints, injuries and warranty claims for the struts on these vehicles.

The consequence of the strut failures—unexpected dropping and power-closing of the liftgate—poses an unreasonable risk of injury. When the liftgate power-closes unintentionally, persons standing in the path of a closing liftgate or accessing the rear cargo area of the vehicle can be injured by being struck by the closing liftgate. The unintended dropping and/or power-closing of the liftgate due to the failure of the liftgate struts in the subject vehicles have caused 12 reported injuries. Several owners were struck in the head by an unexpected liftgate closing; some were pinned or knocked or forced to the ground by a power-closing liftgate.

The subject vehicles have an "auto-reverse" feature that will reverse the direction of the closing (or opening) liftgate when an obstruction has been met. Honda asserts that this feature, coupled with automatic initiation of the power-close feature (which prevents the liftgate from falling completely closed), mitigates the risk of injury. In the Agency's view, neither this feature nor the audible warning has prevented injuries to owners of vehicles with failed liftgate struts.

The normal operation of the power liftgate system in the subject vehicles does not appear to be noticeably different than operation of the system with failed liftgate struts. When the struts fail, the liftgate drops and reopens twice before automatic initiation of the power-close feature, and a continuous beep is emitted during the power-closing sequence. (During normal operation, the power liftgate system emits a single beep when an operator initiates power liftgate operation.) Interviews with owners reveal that many owners were not aware of the changes in the liftgate operation (e.g., they did not hear an audible warning or were unsure if they did) and/or did not take any evasive action to avoid being struck by the closing liftgate.

The real-world experience has shown that the liftgate struts in the subject vehicles do not appear to be performing to Honda's expectations. The liftgate struts on the subject vehicles are failing at high rates. Honda instituted design and manufacturing changes to improve the

performance of the liftgate struts. If the struts were not wearing out prematurely, such changes would not be necessary.

Peer Vehicles

The complaint, injury and warranty rates for the MY 2005 Odyssey are high compared to peer vehicles (Table 9).

The MY 2005 Freestar/Monterey[8] has the highest manufacturer complaint rate (using manufacturer's data) at 460 complaints per 100,000 vehicles. The MY 2004 Sienna, MY 2005 Odyssey and MY 2006 Freestar/Monterey are all between 125 and 145 complaints per 100,000 vehicles. A lower rate is shown for the MY 2004 Quest (70) and the rest are 50 or below.

Using the manufacturer's data, the MY 2005 Freestar/Monterey has the highest injury rate at 62 per 100,000 vehicles. The MY 2004 Sienna is 18 and MY 2005 Odyssey is 12. All the rest are 4 or below.

For warranty claims, the MY 2004 Sienna has the highest rate at 7.0 claims per 100 vehicles. The MY 2005 Odyssey is 5.6, the MY 2005 Freestar/Monterey is 4.7, the MY 2005 Sienna is 3.7, the MY 2005 Quest is 1.5 and the MY 2006 Freestar/Monterey is 1.2. All the rest are 0.5 or below. Both MY 2004 Sienna and MY 2005 Odyssey rates exceed the rate of MY 2005-2006 Freestar/Monterey.

V. HONDA'S ACTION

Honda will replace the liftgate struts in approximately 22,000 MY 2005 Honda Odyssey Touring vehicles equipped with power liftgates and manufactured prior to a modification of the liftgate strut manufacturing process directed by Honda in July 2005 (NHTSA Recall No. 10V-055). This action will provide the opportunity for the vehicle owners to obtain new struts that have the same design modifications incorporated into the Odyssey vehicle production in July 2005 and additional modifications thereafter. The new struts are more robust and should provide a much longer usage life than the struts originally installed in the subject vehicles.

[8] In March 2006, Ford initiated a safety recall of all MY 2005 and some MY 2006 Ford Freestar and Mercury Monterey vehicles equipped with optional power liftgates (NHTSA Recall No. 06V-069). Ford stated that after the liftgate is power-opened, the liftgate motor disengages. When the struts fail, the liftgate can fall freely without prior warning. The recall remedy involved reprogramming the power liftgate control module to provide audible warning and to power-close in the event the struts cannot support the liftgate.

VI. CONCLUSIONS

1. The originally-installed liftgate struts in the subject Honda Odyssey Touring vehicles have been failing prematurely at a high and still increasing rate.

2. The liftgate struts do not appear to meet Honda's design or expected life.

3. To address the liftgate strut failures, Honda implemented two significant changes to the design and manufacture of the liftgate strut installed in Odyssey vehicles.

4. In the early-stage failure condition of struts, the liftgate can drop relatively slowly (without power actuation) until it nears the fully-closed position, at which point the liftgate will drop rapidly.

5. In the more advanced failure condition of struts, the liftgate drops about two to five inches from the fully-open position and the automatic close feature engages and the liftgate shuts completely.

    a. During the first several-inch drop, the liftgate can drop quickly and exert a significant force to an object or a person in its path.

    b. During the power-close stage, the liftgate can drop via power actuation and exert a significant force in order to stop closing and automatically reopen.

6. Unintended or unexpected closing incidents of liftgates in subject vehicles reportedly have caused 12 injuries.

7. The "auto-reverse" feature does not prevent the injuries inflicted upon the owners of vehicles with failed liftgate struts.

8. The audible warning (continuous beeping sound) when the liftgate begins to power-close has not been a sufficient warning and is not effective in preventing injuries.

9. The failure experience of model year 2005 Odyssey ranks high among several peer vehicles.

10. Based on Honda's action to replace the liftgate struts in the subject vehicles, this investigation is closed.