HONDA

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January 25, 2010

EA08-015

Mr. Scott Yon
Chief, Vehicle Integrity Division
NATIONAL HIGHWAY TRAFFIC SAFETY
ADMINISTRATION
Attn: Vehicle Integrity Division (NVS-212)
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Yon:

This letter is in response to our meeting on January 6, 2010 to discuss the issue of gas-charged liftgate struts on certain 2005 model year Honda Odyssey vehicles equipped with power liftgates. In that meeting Honda shared technical information in response to questions posed by your staff, some of which required additional testing and follow-up.

As we discussed, one question in particular required additional testing by Honda to assure that our test method was consistent with that used by VRTC. Our results are described in our revised response to NHTSA question 2-1 and an updated Attachment 1.

If you or your staff have any additional questions, please do not hesitate to contact me.

Sincerely,

AMERICAN HONDA MOTOR CO., INC.

Jay Joseph
Senior Manager
Product Regulatory Office

JWJ:nis

Honda Response to Questions Provided by NHTSA December 3, 2009, and Follow-up to January 6, 2010 Meeting

January 18, 2010

This document responds to questions NHTSA provided to Honda on December 3, 2009 as a follow-up to the reply from Honda to NHTSA's recall request letter. Portions of this response were updated following our January 6, 2010 meeting reflecting the clarification of certain questions and additional testing done by Honda. NHTSA's questions are restated in **bold** text for identification purposes.

Questions for Honda:

1. Body of the letter:

(1) **Please note that we disagree with the statement in the third paragraph of page one regarding the data CD and accompanying documents not being provided to Honda in a timely manner.**

(2) **Does Honda advise vehicle operators in the owner's manual, or in any other manner, that the vehicle will emit a continuously sounding warning tone when the power liftgate closes in failsafe mode due to diminished gas struts, as discussed in paragraph four of page one? How does the operator know what this tone means?**

Response (1): At the time of our earlier response Honda was not aware that we had received the VRTC report and accompanying CD. After further discussion with NHTSA staff and determining that the FedEx Package had been received by American Honda the day after it had been shipped by NHTSA, the package was located within our office. It had been misplaced with other materials without having been opened. NHTSA is correct that the package was shipped as you had stated, and was in our hands, though we were not aware we had received it. We apologize for our mistake, and for the incorrect intimation that NHTSA had failed to provide the VRTC report and accompanying CD to Honda in a timely manner.

Response (2): The vehicle owner's manual describes the audible tone for normal operation of the power liftgate and pinch sensing systems (see Attachment Q1). Although the system is designed to produce continuous warning beep when a power closing operation occurs after sensing a falling liftgate, there is no description of this in the owner's manual. We contend that the difference between the single one-second tone issued during a normal power liftgate closing operation compared to the continuous tone issued during a failure mode power closing operation are obvious and self-explanatory.

Consider the sequence and context of when the continuous alert tone is issued:

1. The user issues a power open command, either by the instrument panel switch or from the remote key fob
2. The hazard flasher lights flash twice and a one-second continuous audible tone is issued, then the power liftgate opens to the fully opened or nearly fully opened position
3. After dropping a short distance the power liftgate is reopened under power
4. If the liftgate falls (a short distance) a second time, a continuous warning tone is issued while the liftgate is reopened and then closed under power with the tone continuing until the liftgate has been latched in the closed position

Compared to a normal power opening condition, we are confident that any user will recognize the differences in operation and the meaning of the warning tone, without description in the owner's manual. The fact that the liftgate is closing under power without the user initiating that operation and the simultaneous and unique audible tone serve as obvious and easily understood indications to the user that the liftgate is not operating normally. We continue to believe that even if this information were included in the owner's manual, that would not significantly contribute to a more widespread understanding of the meaning of the continuous warning tone.

With respect to describing each possible vehicle failure in the owner's manual, Honda does not believe it is beneficial to the user for us describe each system in detail in the owner's manual. Already, the owner's manual for the Honda Odyssey is more than 500 pages long, and adding such detail would further discourage users from referring to the owner's manual, instead of increasing their understanding. This concept of "overwarning" is well documented. In this specific case, the engineers that designed the power liftgate system for the Honda Odyssey decided that a detailed description of the failsafe operations was unnecessary as the audible warning itself is designed to be an obvious and easily understood warning.

Please note that several conditions may result in the fall-sensing system being activated, such as a large amount of snow sticking to the liftgate, the application of non-Honda Genuine accessories to the liftgate or decreased gas reactive strut performance. The continuous audible tone of the Odyssey provides significantly more indication to the user than the Toyota Sienna that the fall-sensing system has been activated, as the Sienna only emits the normal operation tone when closing due to the fall-sensing system.

Also, when a falling liftgate is sensed by the Odyssey, the liftgate cycles twice through a short drop and re-opening sequence in the nearly fully open position before issuing the continuous warning tone and closing under power. These two methods of alerting the user to abnormal operation, and that the liftgate is being closed under power are significantly more information than competitor's vehicles provide, though NHTSA apparently accepts the competitor's vehicles as adequate as this were not changed in prior recalls.

Honda judges that the method used in the Odyssey to alert the user to the fall-sensing function is effective based on the large number of warranty claims on the 2005 model year Odyssey Touring with power liftgate. Honda has received 2,376 claims, or roughly 9.4%, which we believe indicates that users are aware of and understand that the liftgate system is not working properly and requires repair. Please see Attachment Q1 for additional information.

In support of our judgment, in the document titled "Engineering Analysis Report Regarding EA06-020: Toyota Sienna Power Liftgates" issued by NHTSA in June, 2008, conclusion 10 on page 17 states "The audible warning (beeping sound) when the liftgate begins to power-close may not always occur and when it does, may not be a sufficient warning to an owner and is not effective in preventing injuries." In comparison, the continuous tone issued by the Odyssey to indicate a power closing due to fall-sensing is persistent and distinctive from normal operation.

For the reasons provided above, Honda continues to believe that we provide appropriate information to the user as to the status of the power liftgate.

2. Attachment 1 of Honda letter (Failure Modes):

(1) Explain the note at the bottom left of the table which reads "Method of pinch measurement is the one for power window. We think the load is different as it is equipped with 20N/mm spring."

(2) There are significant differences between the measured NHTSA and Honda maximum values for "Pinch sensing load" (293N vs. 170N) for the Odyssey model. Can Honda provide any insight as to why this is (is this due differences in measurement method, process, other?). Does this also explain the differences shown in the Sienna column?

(3) What does the row labeled "Range for pinch sensing" mean?

Response (1): When VRTC measured the value for "Pinch sensing load", a piece of dummy "skin" was placed on the sensor. However, when Honda measured the value for "Pinch sensing load", a spring of 20N/mm was equipped on the load cell. Accordingly, Honda considers that the impact load measured by VRTC is higher than the impact load by Honda because the spring constant used by VRTC is also higher than Honda. When a moving object contacts an obstacle resulting in an impact load, the impact force varies depending on the differences in acceleration of the struck object and the deceleration of the striking object. Therefore, there is a difference between the Honda and VRTC measurement values because of variations in the spring rate constant when comparing a load cell affixed to a jig and an object placed on the load cell.

We selected the method of using a spring with the load cell to minimize the inertia effect of the liftgate striking a fixed object resulting in an unrealistic high initial "peak" force and large variability in measurement. Including the spring between the liftgate and the load cell allows us to capture a more representative and consistent value for the striking force.

In our testing, Honda used the technique of measuring a pinch load of 20 N/mm consistent with the test procedures for FMVSS 118 (for test rods up to 200 mm in diameter used for sensing the pinch load of an auto-reversing power window – as opposed to 65 N/mm for finger pinch sensing for test rods less than 25 mm in diameter).

While we chose this method to measure the force of the power liftgate in this failure mode, we recognize that a person is not a rigid structure like the test rig, and the natural human reaction to head contact is to move their head in the opposite direction of the contacting force.

Response (2): We have re-tested the "pinch sensing load" in a manner more similar to VRTC, and the results are consistent with VRTC's data. Please find Attachment Q2-2 (a revised version of the earlier Attachment 1) with the updated values. Honda agrees that the condition tested (removal of both gas struts) represents the force measured at a downward angle of 30° from fully open exerted by a liftgate when allowed to drop unimpeded, though we continue to question the likelihood of this condition occurring in the marketplace. This condition would require that both struts completely fail, which we maintain is a condition that would require continued use without repair and is one that has neither been reported to us, nor is it one that we have observed in returned parts.

Response (3): In an earlier draft of this document we had included the Ford Freestar in an additional column. Due to the Ford Freestar not being equipped with pinch sensing, that row should have been labeled "Vehicle equipped with pinch sensing" with each cell in the row indicating "yes" for the Odyssey and Sienna and "no" for the Freestar. Due to a translation error and deletion of the column containing information about the Ford Freestar, we apologize that this row did not make sense. This row should have simply indicated that both the Honda Odyssey and Toyota Sienna are equipped with pinch-sensing capabilities.

3. **Attachment 2 (Alerts):**
   (1) Verify that Condition "C" should be <275 lb for Odyssey and <145 lb for Sienna (not >275 lb and >145 lb).
   (2) Discuss and explain the statement in the row labeled "Period of B condition" under the Honda column regarding more precise sensing, and the related footnote at the bottom of the page on the same subject.

Response (1): NHTSA's clarification is correct. Through editing we had inadvertently misplaced the "<" and ">" symbols. As indicated by NHTSA, condition "C" should be <275 lb for Odyssey and <145 lb for Sienna (not >275 lb and >145 lb).

Response (2): The period of time that the power liftgate remains in the "B" condition is uncontrolled, and we cannot accurately predict how long the vehicle will remain in this condition as the gas struts are failing.

We point out that the range of Condition B for the Odyssey, from 285-275 lbs of force, represents a range of only 2% of the gas strut as it is failing, as opposed to a much wider range of condition B for the Sienna (see Attachment Q3-1). Our comment that we anticipate period B to exist for a "shorter period in the market" was based only on the narrow range of 2%, compared to a span of 13% for the Sienna. We believe any Odyssey strut that is failing will remain in condition B for a very short time, but we have no reliable method to forecast how long (see Attachment Q3-2).

The VRTC report does not indicate which market-returned struts were cycled 1225 times, but we note that of parts labeled B-G, only strut B is producing a force of less than 200 pounds. As VRTC found, a force of 200 pounds per strut (a combined force of 400 pounds) is normal for healthy struts, though it is not stated in the VRTC report whether the market returned struts were installed in a vehicle to confirm their reported failed condition. Accordingly, we believe that of the six market-returned struts, only strut B is indicating a failure. We cannot tell whether strut B was included in the testing, but we are not surprised that the other struts did not exhibit any loss of performance in this brief test, even though the horizontal orientation of the struts is not representative of the in-use condition, and can result in a lack of lubrication to the upper portion of the seal during testing. We would like to know if VRTC installed the market returned parts in a vehicle to confirm that they were unable to support the liftgate, and also whether the vehicles they were received from had any aftermarket accessories, such as a bike rack, installed on the liftgate that would have affected performance.

4. Attachment 3 (Initial Drop):

(1) Verify that Condition "C" should be <275 lb for Odyssey and <145 lb for Sienna (not >275 lb and >145 lb).

(2) Provide any insight as to why there are significant differences in the "Height of full open C condition" between the NHTSA and Honda measurements.

(3) Provide any insight as to why there are significant differences in the maximum values for the "Load of initial drop" forces between the NHTSA and Honda measurements. Did Honda "filter" or otherwise modify the data from these tests, or is "raw" data?

(4) Describe the test protocols for measuring the stated heights/distances and forces, including:

1. Make, Model and S/N of test equipment (load cell, signal processors, etc.)

2. Location of the measured forces (e.g., latch cover)

3. Any pictures and/or video of the test setup and the tests conducted

Response (1): Yes, similar to the response to question 3-(1), Honda transposed the signs. NHTSA's clarification is correct, the ranges should have been stated ">275 lb for Odyssey and >145 lb for Sienna.

Response (2): Our measurement was taken at the height of latch. We measure from the latch to allow consistent measurement from a fixed body point, as opposed to the plastic inner door liner that is attached to the liftgate and may introduce some variability in measurements. The latch is located approximately 35 mm above the inner door lining of a fully opened liftgate, which was the point of measurement used by VRTC. The value by VRTC's measurement was 1651 mm and by Honda was 1710 mm. Accordingly, 1710-35=1675 mm. The remaining differences of 24 mm between Honda and NHTSA measurements may be due to the variation of vehicle height (any cargo in the vehicle, suspension and/or tire pressure, etc).

Response (3): We believe the first part of this question has been addressed in our response to question 2, parts (1) and (2) above.

Honda did not filter or modify the data and it is "raw" data.

We are not concerned about the different values between the VRTC and Honda measurements because there is no regulatory test procedure for measuring any load related to power liftgates. From the verification of values, however we point out that regardless of how or where the measurements took place, all of the data show that the contact force measured for Odyssey was less than Sienna.

Response (4):

1. See attachment Q4-1 for details on the test equipment used by Honda.

2. Measurement location was latch cover, as indicated in attachment Q4-2.

3. See attachmentQ4-2 for pictures of test setup and see video for the test conduction.

5. Attachment 4 (Injury Level):

(1) For calculating the linear velocity of the falling liftgate, why does Honda use the length to be the distance from hinge to the center of gravity?

(2) Please confirm the revisions from the first to the second version of this document (is it only the change from 2.22 to 22.2)?

Response (1): To accurately calculate the energy of the liftgate when closing we determined the distance from the hinge to the center of gravity of the liftgate and measured the angular speed of the closing liftgate.

To calculate the inertial moment of the liftgate, we used the formula: $E = 0.5(mv^2)$. We believe this is the standard method of calculating energy in this type of system, and that this formula yields results more representative of real world conditions.

To achieve this, the weight of the liftgate was calculated by determining the load applied to the center of gravity of the liftgate, not by the load applied to the bottom edge of the liftgate. The linear speed at the center of gravity is necessary. To determine the linear speed at the center of gravity, we calculated this value by using the angular speed and the distance from the hinge to the center of gravity.

In our earlier response to EA 08-15 we calculated the values for the Odyssey and Sienna using the same technique by the formula shown above. This shows that the relative energy resulting from the Odyssey liftgate falling is less than the Toyota.

See Attachment Q5 to find calculations using the Honda our method of determining the energy, and the method used by Toyota in their technical response. By either method it is clear that the relative energy of the Odyssey liftgate falling is significantly less than the Sienna, though both yield values in the non-serious injury range.

Response (2): The only change was the correction to a typographical error introduced while editing the document.

6. Attachment 5.3 (Owner's manual)
Does the "CHECK POWER TAILGATE" message appear on the multi-information display when the struts degrade and/or the liftgate closes without command?

Response: The "CHECK POWER TAILGATE" message is only triggered by certain electrical faults in the power tailgate system. As a result, gas reactive strut failures do not cause this message to appear on the multi-information display.

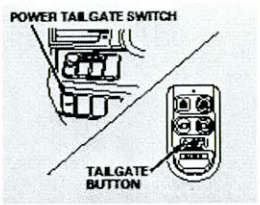
Honda Response Attachments

January 6, 2010

Attachment Q1

Normal operation

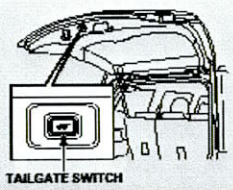
Power Tailgate



On Touring models only
The tailgate can be opened and closed with the remote transmitter or the switch on the dashboard when both front doors are unlocked.

Press and hold the tailgate button on the remote transmitter or the dashboard switch for about 1 second to open or close the tailgate. Each time you press the button on the remote transmitter or the dashboard switch, you will hear a beep, and some front and rear lights will flash.

If you push the same button or switch again while the tailgate is opening or closing, you will hear three beeps, and the tailgate will stop moving, reverse direction, and stop at the fully opened or closed position.

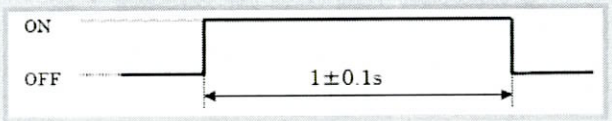


The tailgate can also be closed by pressing the button on the tailgate. If you press the button again while the tailgate is closing, you will hear three beeps, and the tailgate will stop moving, reverse direction, and stop at the fully opened position.

To open or close the tailgate manually, see page 163.

CONTINUED

≪ Pattern of buzzer sound≫



Pinch sensing

Auto-Reverse
The power tailgate has an auto-reverse feature. If it meets resistance while opening or closing, it will beep three times and reverse direction. However, the tailgate may not reverse immediately. Always make sure passengers and objects are clear of the tailgate before opening or closing it.

⚠WARNING

Closing a power tailgate while anyone is in the path of the tailgate can cause serious injury.

Make sure everyone is clear before closing the power tailgate.

Also check that passengers, especially children, do not have their hands on the edge of the tailgate or on the tailgate sill. The auto reverse feature stops working when the tailgate is about to latch so the motor can pull the tailgate shut.

If your vehicle's battery is disconnected, goes dead, or the fuse is removed while the tailgate is fully open, the power tailgate needs to be reset. After connecting the battery or installing the fuse, close the tailgate fully by hand.

The power tailgate may not open or close under the these conditions:

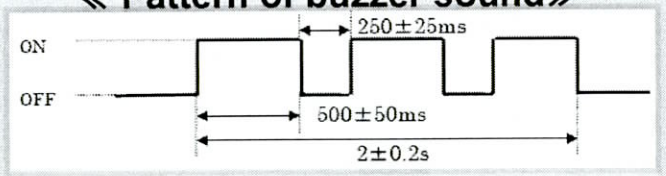
- The vehicle is parked on a steep hill.
- When the vehicle is swayed in a strong wind.
- When the tailgate or the roof is covered with snow or ice.

Do not install any accessories on the tailgate. It may cause the tailgate not to function properly. If there is snow or ice on the tailgate, make sure to remove it before you operate the tailgate.

If you pull the tailgate release handle while the tailgate is opening or closing, it will stop moving. You need to open or close it the rest of the way manually.

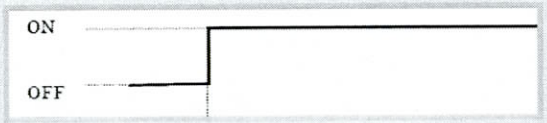
The tailgate has sensors on both sides. Be careful not to damage them. If the sensors are damaged, the power tailgate does not function properly.

≪ Pattern of buzzer sound≫



Fall sensing

≪Pattern of buzzer sound≫



Sound continues until liftgate is closed.

Attachment Q2-2

Attachment # 1, revised January 12, 2010

Comparison of Honda Odyssey and Toyota Sienna Power Liftgate Failure Modes

		Honda Odyssey		Toyota Sienna
Fall sensor function		Yes		Yes
Warning condition when fall sensor operates		Two initial drops (no buzzer) ↓ ※One warning beep during normal closing Power close with continuous warning beep		Initial drop ↓ ※Same warning condition as normal closing Power close with two warning beeps and two hazards
Pinch (Catch) sensing load	NHTSA Measurement value	28-66 lbs. (Approx.124-293N)	検証条件	28-68lb (Approx.124-302N)
	Toyota Measurement value			50lb (222N)
	Honda Measurement value	**261.3 N (58.8 lbs.)**		~~105-226N~~
Reverse function during catch sensing		Clutch is disengaged after two reverses		Repeated reverse
Range for pinch sensor		Yes		Yes

※Method of pinch measurement in Honda is the one for power window
We think the load is different as it is equipped with 20N/mm spring

※Red letter: Value in recall request letter to Honda
※Blue letter: Value in response to NHTSA from Toyota
※NHTSA final report (June 2008)

⇒The following elements of the failsafe mode for the Honda Odyssey are unique to our power liftgate system:

①Two initial drops occur before a power close operation is initiated, and it is distinguished from a normal closing by the audible tone.

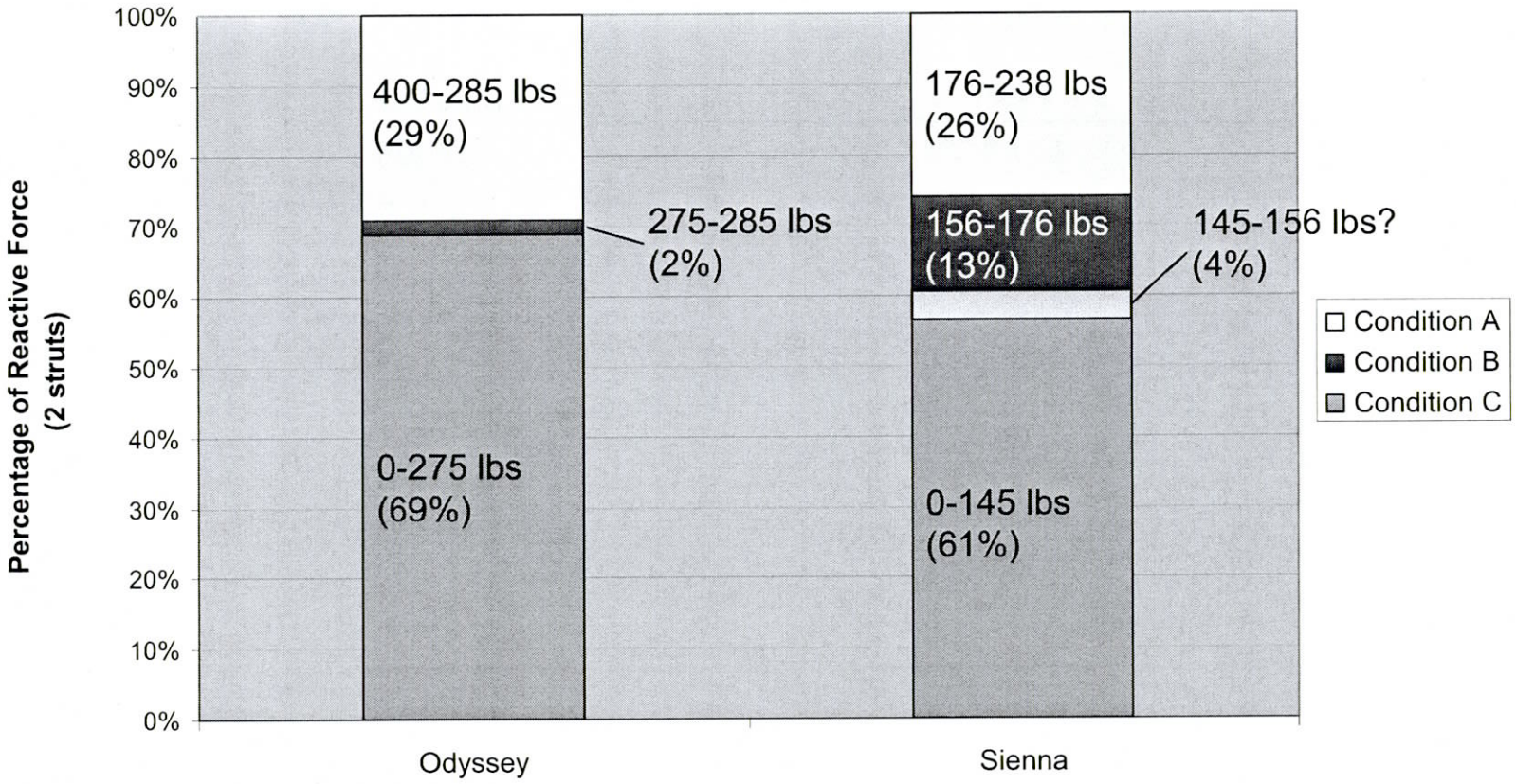
②The Odyssey uses one distinct beep for normal operation and a separate continuous warning tone when closing in failsafe mode due to diminished strut performance.

③The Honda Odyssey auto-reverse function will release the clutch at the stopped position after two cycles.

The red box above reflects revised measurements made on January 12, 2010, using the same 30° down from fully open with both struts removed

Attachment Q3-1

Comparison of Strut Performance



The Odyssey remains in "Condition B" for only 2% of the performance range as gas strut performance degrades, compared to a 13% range for the Sienna in Condition B.

Attachment Q3-2 Difference in fall sensing sensitivity between Odyssey and Sienna

Attachment #2 Alerts to User When Gas Strut Performance is Diminished

	Full opening for Odyssey(77°)			Full opening for Sienna(79°)		
Gas strut reactive force during full open (per vehicle)	Normal 400 lbs	『B』 285~275 lbs ▲~29%	『C』 >275 lbs ▲~31%	Normal 238 lbs	『B』 176~156 lbs ▲~26%	『C』 >145 lbs ▲~39%
Opening speed	12.8° /sec	12.8° /sec	12.8° /sec	11° /sec	9° /sec	(7° /sec)
Time before full open	6 sec	6 sec	6 sec	7 sec	9 sec	(10. 5 sec)
Height of full open (Height from the ground to LNG surface on room side)	1850 mm	Drop slowly from 1710 mm(67.2°)	Drop slowly from 1710 mm and clutch is engaged at 1570 mm	Toyota value 1820 mm	Toyota value 1720 mm	
				1860 mm	Drop slowly from 1750 mm (75.5°)	Drop slowly from 1750 mm and clutch is engaged at 1520 mm
Period of 『B』 condition		*Not estimated by Honda – but due to more precise sensing ability we anticipate shorter period in market.*			10 months with normal use (1000 times / year) 5 months with double pace	

:Measurement value by Honda

※Blue letter: Value specified in response to NHTSA from Toyota

⇒The following differences between the normal condition and conditions with diminished strut capacity function as alerts to the user in the column B condition shown above:

①The user can recognize that the opened liftgate height is approximately 140 mm lower than the normal condition – a difference of about 10%

②The liftgate immediately starts to drop slowly. If the user has opened the liftgate by using the outer door handle they will recognize this due to their proximity. If they have used the remote, the closing liftgate should be apparent to them by the time they arrive in proximity to the liftgate.

⇒The Odyssey power liftgate is designed to minimize the likelihood of a slow closing condition such as the range identified in column "B" above than competitor models by having increased sensitivity to detect a slowly closing tailgate due to diminished gas strut performance.

Odyssey

"B"condition ; 275-285 lbs

Combined Strut Force (lb)	from fully open)	from fully open)	down from fully open)	Drop Rate (deg/sec)	Drop Rate (deg/sec)	Description
320	-0.5	-0.5	N/A	N/A	N/A	A
310	-3.3	-3.3	N/A	N/A	N/A	A
300	-6.9	-7.4	N/A	N/A	N/A	A
290	-8.7	-8.6	N/A	N/A	N/A	A
285	-5.6	-5.7	N/A	N/A	N/A	A
280	-5.7	N/A	-10.1	7.0	14.0	B
275	-6.2	N/A	-9.4	6.4	9.2	C
270	-7.7	N/A	-10.9	6.2	9.0	C
250	-8.4	N/A	-12.0	11.4	8.9	C
230	-9.0	N/A	-12.5	15.0	9.2	C
180	-9.2	N/A	-12.8	17.5	8.9	C
160	-10.2	N/A	-13.4	16.0	9.2	C
140	-10.7	N/A	-14.3	14.7	8.7	C
0	-12.3	N/A	-17.6	24.5	9.5	C

A = Liftgate remains open

B = Liftgate opens closed without motor or warning

C = Motor controls closing with warning horn

Table 3
Performance of Liftgate at Various Combined Strut Forces

Sienna

"B" condition ; 156-176 lbs

Strut ID	Force at Full Compression (lb)	Force at Full Extension (lb)	Category of Liftgate Action
DH	260	259	A
DF	260	226	A
FI	262	211	A
BD	260	209	A
BH	246	196	A
BF	246	193	A
BI	242	194	A
CD	233	188	A
CH	217	176	B
CF	217	173	B
CI	213	174	B
DG	197	158	B
BC	182	156	B
GH	183	145	C
FG	183	142	C
GI	179	143	C
BG	163	125	C
D	147	121	C
A	147	119	C
CG	134	105	C
H	133	108	C
F	133	105	C
I	129	106	C
B	113	88	C
C	84	68	C
G	50	37	C

Reason of reactive force range for Odyssey is narrow in "B" condition in the attachment 2

The condition in which liftgate can not hold at full open position due to diminished gas reactive force is classified into 2 conditions of "B" and "C". In "B" condition, liftgate closes slowly by reactive force of open stay without sensing fall and not controlled by motor. If falling speed is faster than "B" condition, the sensor detects causing power close, which is "C" condition controlled by motor. Therefore, the timing to classify into 2 conditions of "B" and "C" varies depending on the speed to judge fall.

■Judgment speed for odyssey

Fall angular speed is over 3.16deg/sec

■ Judgment speed for Sienna

Fall angular speed is between 12.5deg/sec and16.6deg/sec

As stated above, Odyssey contains safer system by minimizing "B" condition which is not controlled and increasing "C" condition which has controlled system and power close due to sensitivity of angular speed to judge the fall.

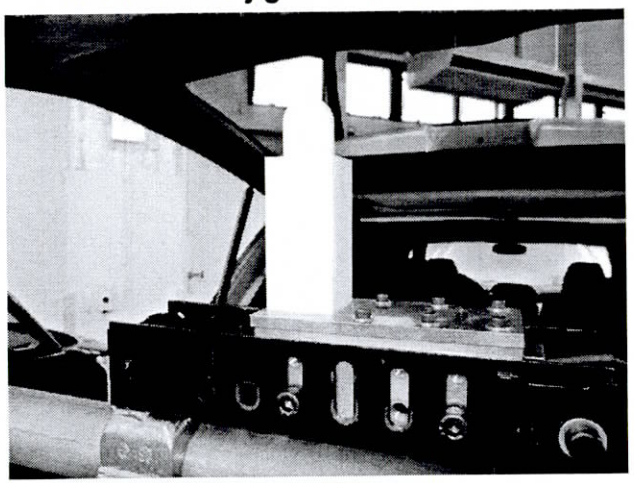
For operating method of power close, switch is attached in Odyssey to actuate. However it is not attached in liftgate of Sienna.
Power close system for Sienna actuates after the liftgate is closed to 120mm for 0.5 sec manually.
Therefore, power close might actuate when user intends to close the liftgate if judgment speed for Sienna to sense the fall is sensitive. So, it is considered that judgment speed is not sensitive intentionally from the point of view of prevention for improper operation.

Incidentally, Power close operation for Sienna is actuated by closing for 0.5 sec manually and fall sense.
It is prospected that the warning beep is same as normal operation when failure such as fall sensing occurs because Sienna judges by same judgment speed.

Attachment Q4-1

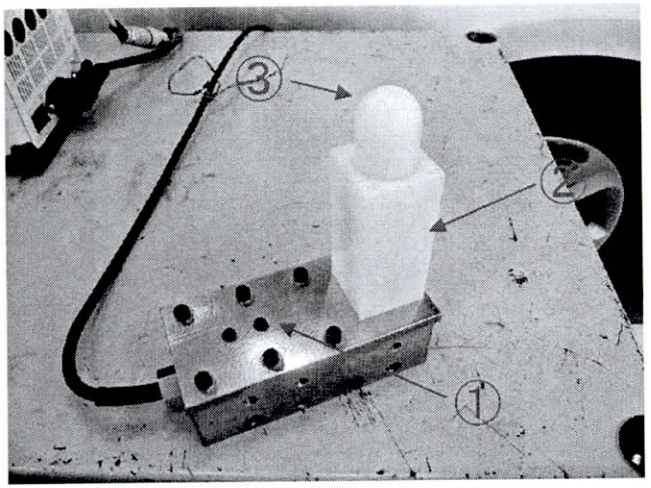
Load measuring equipment ･･･FOR FORCE MEASUREMENT

Condition with jig attached

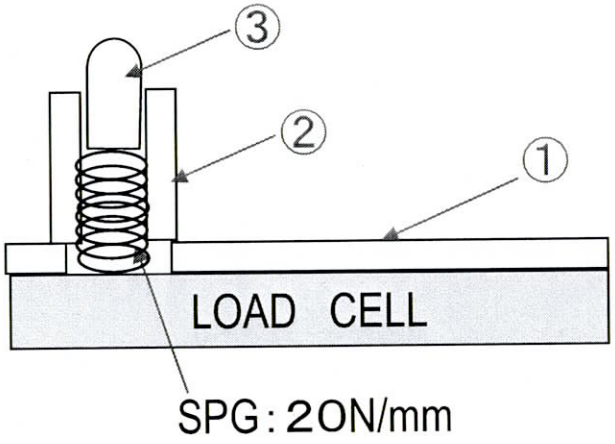


LOAD CELL
Manufacture : TEAC
Type : TU-CR500N
S/N : 418592

Load cell unit

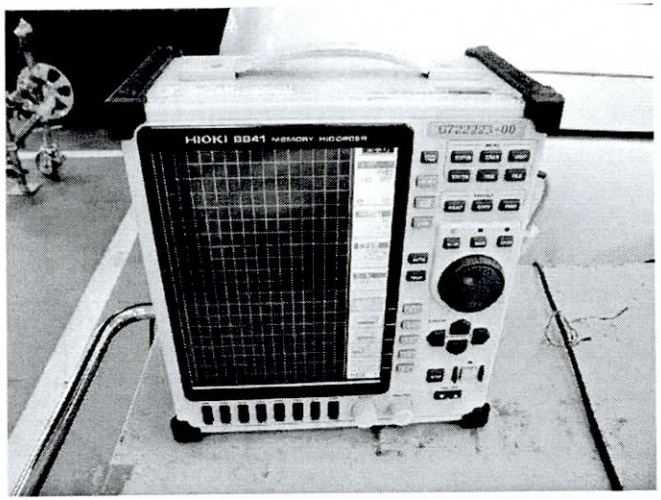


Structure of load cell unit



Cross-section view of load cell unit

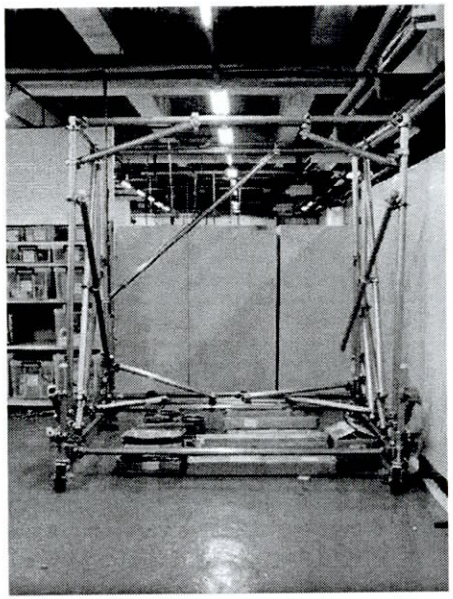
Attachment Q4-1



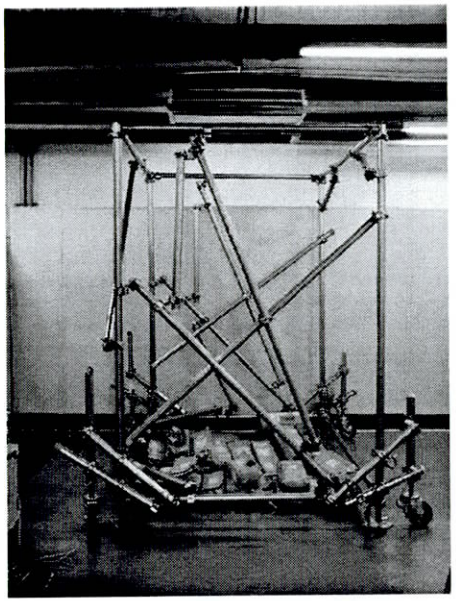
Data handling unit
Manufacture : HIOKI
Product name : HIOKI 8841 MEMORY HiCORDER
S/N : 0337341

Connection unit
Manufacture : HIOKI
Type : STRAIN UNIT 8939・・FORCE MEASUREMENT

Jig for measuring



Front view



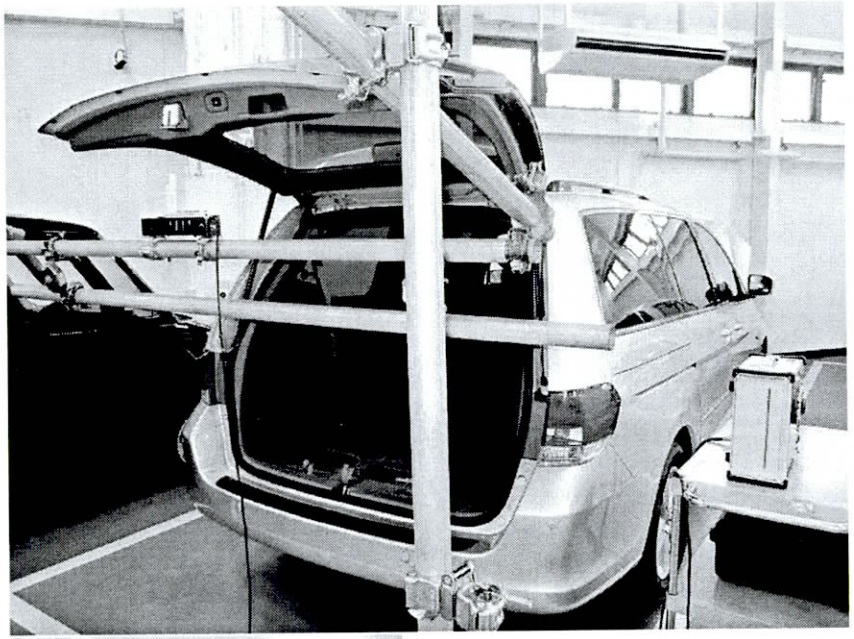
Side view

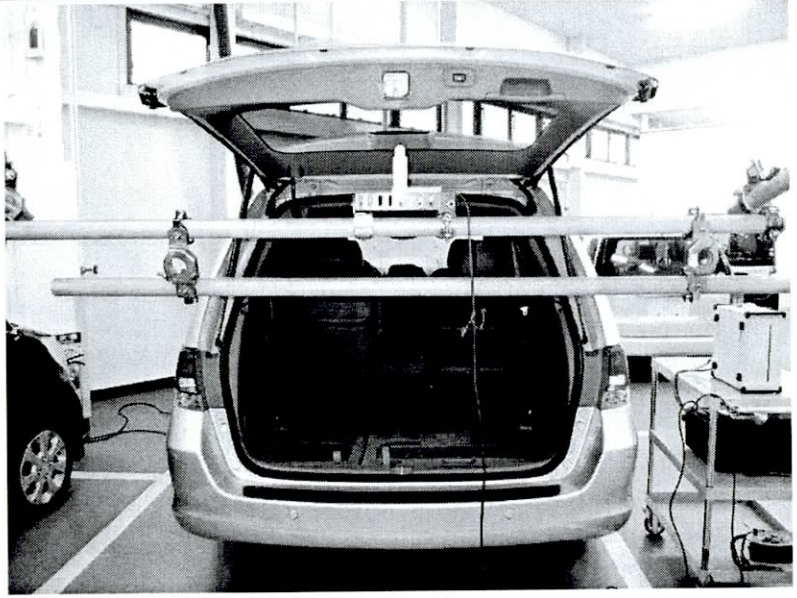
Measuring jig
HONDA original

Attachment Q4-2

Measurement of load

Pictures

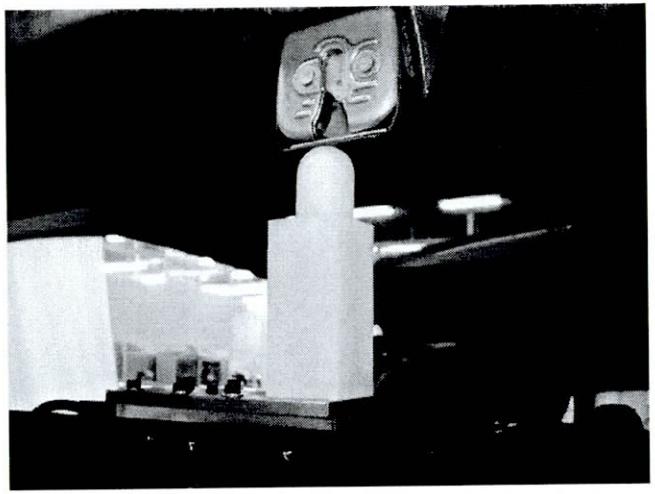


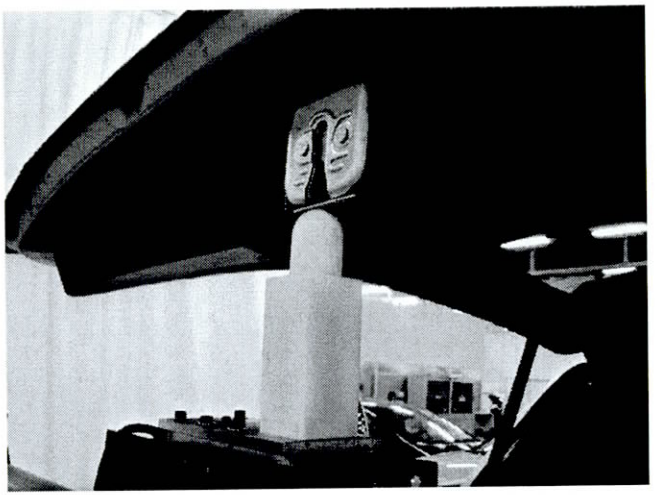


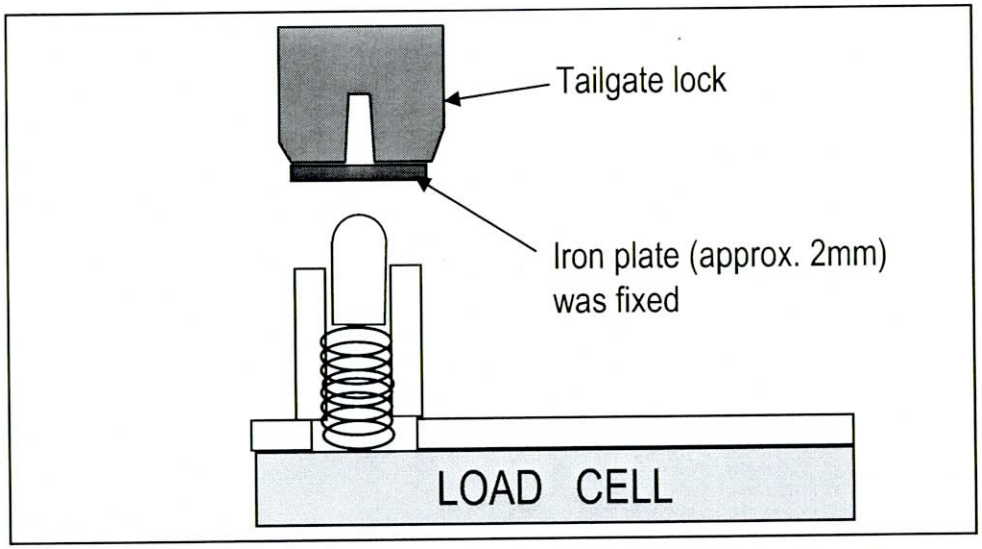
Attachment Q4-2

Measurement of load

Details







Attachment Q5-1: Comparison for the energy conversion during initial drop.

Energy calculated by Toyota method:

➢With the angle velocity that NHTSA accepted.

	Odyssey	Sienna
Length (m)	1.1730	1.1412
Weight (kgf)	37.8	34.9
Angle V (deg/sec)	※1 17.5	※2 37.8
V Linear (m/sec)	0.358	0.753
Energy (J)	2.43	9.89

※1 Measured by NHTSA, 55% force reduction
※2 Measured by Toyota, 50% force reduction

According to reference, energy amount to cause serious injury to Head, as to the case that user hits head during initial drop of the gate is:

・45 (J) : Unconscious concussion ⇒categorized as AIS-1 (minor injury) by AIS

・75 (J) : Lapse of consciousness for more than 1 min

In-house angular speed measurement value and calculation method for energy (calculate at gravity center of gate) is different from Toyota's data. (See right table)

Energy calculated by Honda method:

➢With the angle velocity that Honda measured.
➢Also with the length (=hinge center to C of G).

	Odyssey	Sienna
Length (m)	0.7430	0.8050
Weight (kgf)	37.8	34.9
Angle V (deg/sec)	20.1	22.2
V Linear (m/sec)	0.261	0.312
Energy (J)	1.28	1.70

➢With the angle velocity that Honda measured.
➢Also with the length (=hinge center to lock body that Toyota used).

	Odyssey	Sienna
Length (m)	1.1730	1.1412
Weight (kgf)	37.8	34.9
Angle V (deg/sec)	20.1	22.2
V Linear (m/sec)	0.412	0.442
Energy (J)	3.20	3.41

By either energy calculation method, Odyssey value is still significantly lower than AIS-1, also lower than Sienna.

Attachment Q5-2: Comparison for the energy conversion during initial drop.

➢With the angle velocity that NHTSA accepted.

	Odyssey	Sienna
Length (m)	1.1730	1.1412
Weight (kgf)	37.8	34.9
Angle V (deg/sec)	※1 17.5	※2 37.8
V Linear (m/sec)	0.358	0.753
Energy (J)	2.43	9.89

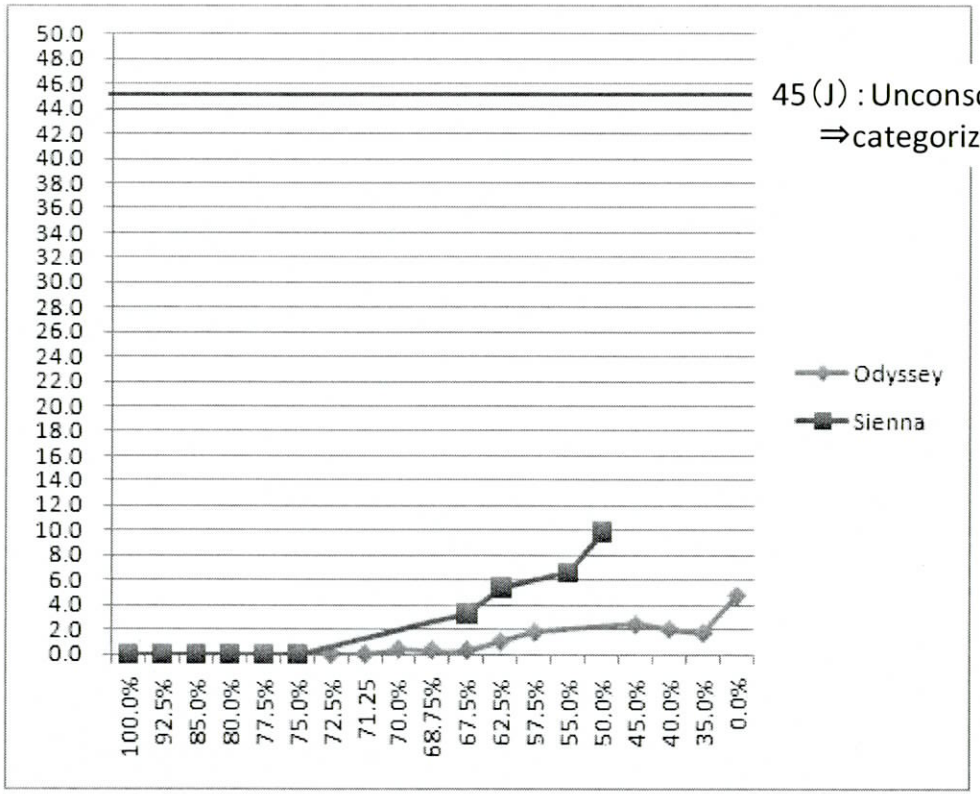
※1 Measured by NHTSA, 55% force reduction
※2 Measured by Toyota, 50% force reduction

➢Energy that Toyota provided.

	Case	Vehicle Condition : Gas remaining in Damper Stays (total both sides)	Peak Anglar Velocity (deg/sec)	Linear Velocity (m/s)	Enrgy (J)
06 Sienna	1	100.0%	0.0	0.00	0.0
	2	92.5%	0.0	0.00	0.0
	3	85.0%	0.0	0.00	0.0
	4	75.0%	0.0	0.00	0.0
	5	67.5%	21.7	0.43	3.3
	6	62.5%	27.8	0.55	5.4
	7	55.0%	30.9	0.62	6.6
	8	50.0%	35.6	0.71	8.8
	9	50.0%	36.0	0.72	9.0
	10	50.0%	37.7	0.75	9.8
	11	50.0%	37.8	0.75	9.9

➢Energy based on NHTSA measured Ang. Velocity.

	Case	Vehicle Condition : Gas remaining in Damper Stays (total both sides)	Peak Anglar Velocity (deg/sec)	Linear Velocity (m/s)	Enrgy (J)
05 Odyssey	1	100.0%	0.0	0.00	0.0
	2	80.0%	0.0	0.00	0.0
	3	77.5%	0.0	0.00	0.0
	4	75.0%	0.0	0.00	0.0
	5	72.5%	0.0	0.00	0.0
	6	71.25	0.0	0.00	0.0
	7	70.0%	7.0	0.143	0.39
	8	68.75%	6.4	0.131	0.32
	9	67.5%	6.2	0.127	0.30
	10	62.5%	11.4	0.233	1.03
	11	57.5%	15.0	0.307	1.78
	12	45.0%	17.5	0.358	2.43
	13	40.0%	16.0	0.328	2.03
	14	35.0%	14.7	0.301	1.71
	15	0.0%	24.5	0.502	4.75



45(J) : Unconscious concussion
⇒categorized as AIS-1(minor injury) due to AIS

Odyssey shows a lower level of energy than Sienna & significantly less than an AIS-1 level injury