

# The CPA test proposed by KOREA

24. Feb. 2016

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# 1. Purpose of CPA test

- Verify the cause of glass breakage while driving and establish the correct direction of GTR 6 amendment by conducting experimental tests on Ceramic Printed Area (CPA) of toughened glass on panoramic sunroof.
  - Analyze the cause of glass breakage caused by something such as external impacts, driving vibration, vehicle structure movement and temperature conditions while driving due to vulnerable strength of CPA.
  - Propose the direction of regulation amendment for reflecting CPA within GTR 6
- Use the experimental data for developing GTR 6 amendment to limit the CPA which can increase the risk of glass breakage on panoramic sunroof while driving.
  - Use the experimental data for developing both the methods and the specific range to limit CPA.

## 2. CPA test outline

- **External Impact test depending on various shapes of objects**

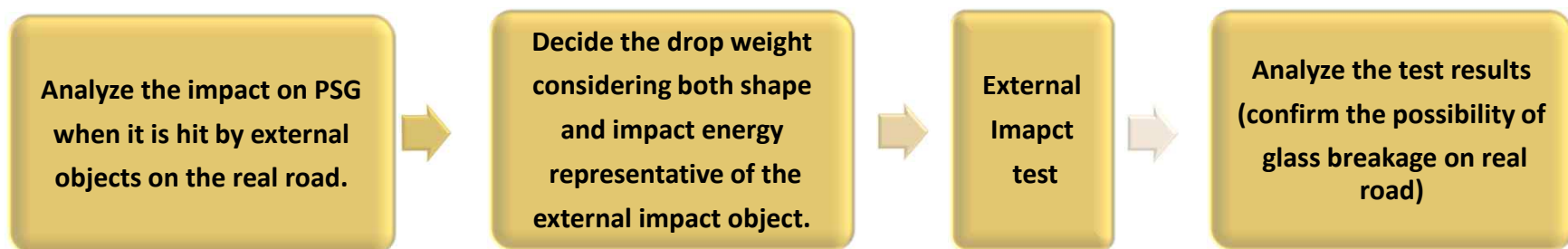
- Background: this test intends to evaluate the result of external impacts from various shapes of objects on CPA in order to simulate the glass breakage of panoramic sunroof while driving on real road.

- ※ The common tiny stones at the shoulder of highway in Korea

- These stones can fly easily and break the glass of vehicle while driving because of their small, light and sharp.



- Test procedure:



## 2. CPA test outline

- **External Impact test depending on various shapes of objects**

- **Test method: conduct test on both ceramic printed sample and non-ceramic sample**

- ① Place the test sample(300x300mm) in the fixture described in the 227g ball test of GTR 6.
- ② Drop the weight at the centre of the supported area from the decided drop height.
- ③ Measure the drop height when the sample breaks.

- **Review:**

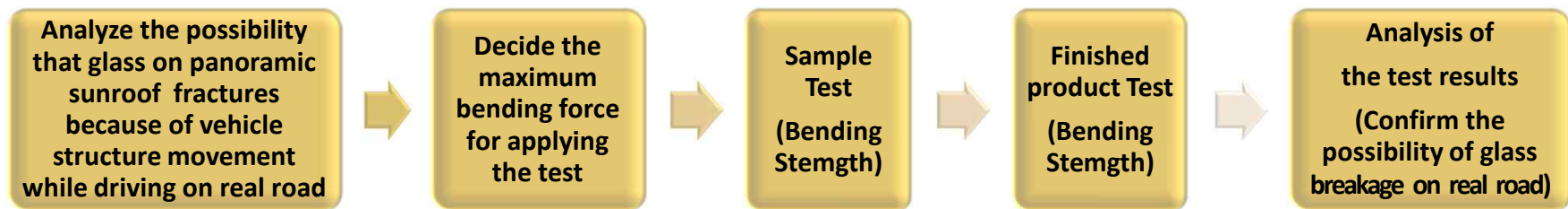
- ① The 227g ball drop test of GTR6 already represented the impact by object. Is this necessary to conduct additional test?
- ② The 227g ball drop test has already confirmed the vulnerable strength of CPA. Is additional test necessary?

## 2. CPA test outline

- **Bending strength test**

- **Background:** this test intends to evaluate the fracture strength of CPA of panoramic sunroof when the roof structure is bent compressively by steep grade of road.

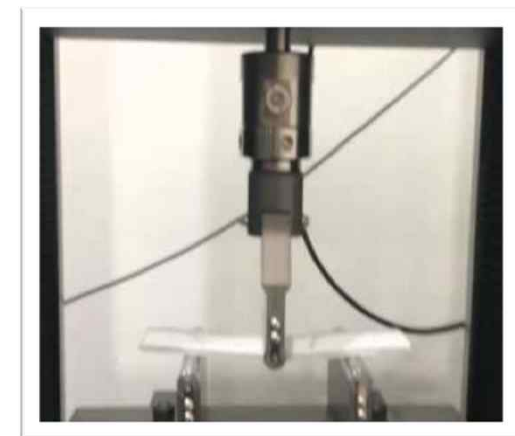
- **Test Procedure:**



- **Test Method:** bending strength test on test samples of various ceramic printed area (ex ::0%, 20%, 40%..100%)



- ① Fix test sample(300x300 mm) or the finished product in the test jig of 3 point bending machine.
- ② Apply the normal load which constantly increases to test sample up to maximum bending force.
- ③ Measure the maximum bending strength when the test piece breaks.



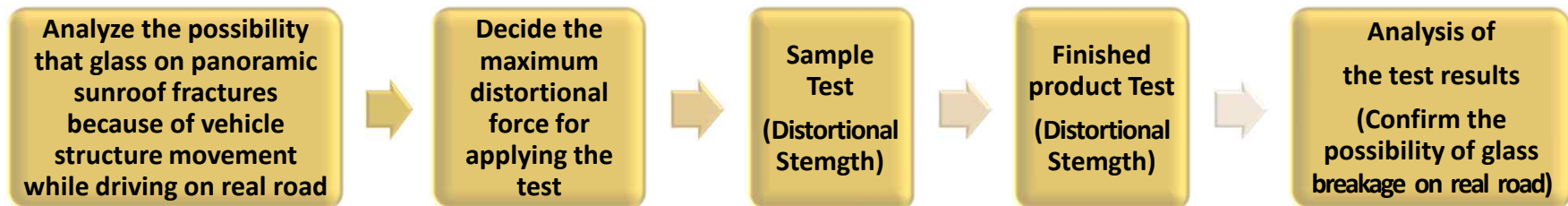
<3 point bending machine>

## 2. CPA test outline

- **Distortional strength test**

- **Background:** this test intends to evaluate the fracture strength of CPA of panoramic sunroof when the vehicle roof structure is distorted by steep grade while driving on real road.

- **Test Procedure:**



- **Test Method:** distortional strength test on samples of various ceramic printed area (ex ::0%, 20%, 40%..100%)

- ① Fix 3-point corners of test sample(300x300 mm) or the finished product in the test jig.
- ② Apply constantly increasing tensile load at non-fixed corner up to maximum distortional force.
- ③ Measure the distortional strength when the test piece breaks.



<Distortional strength machine>

**KATRI**

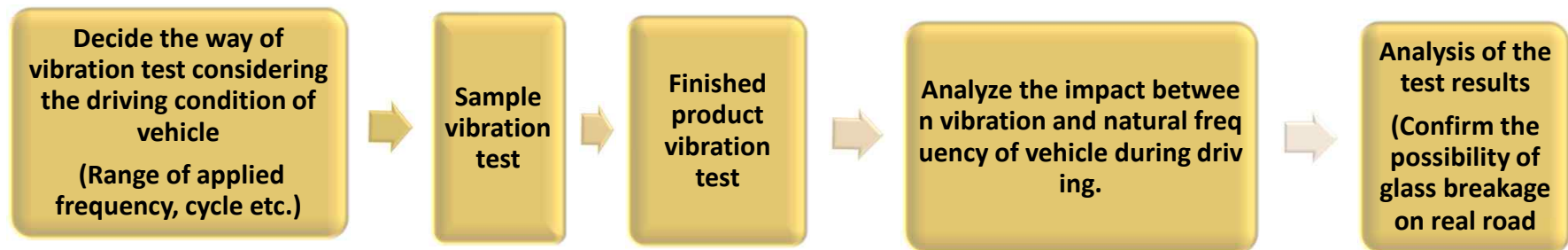
Korea Automobile Testing & Research Institute

## 2. CPA test outline

- **Vibration (wave) test**

- **Background:** this test intends to evaluate the mutual influence **between the vehicle vibration while driving and natural frequency of CPA** of panoramic sunroof on real road.

- **Test Procedure:**



- **Test Method:** Vibration strength test on test samples with various ceramic printed area (ex: 0%, 20%, 40%..100%)

- **The maximum natural frequency test**

- ① Fix test sample (300x300 mm) or finished product on the base of shaker.
- ② Apply frequency of Z-axis to test piece and increase the frequency until the test piece fractures.
- ③ Measure the natural frequency when the test piece fractures.

- **Vibration endurance test**

- ① Fix test sample (300x300 mm) or the finished product on the base of shaker.
- ② Apply the decided cycles of specific frequency to test pieces repeatedly.
- ③ Measure number of cycles that breaks the test piece.



<Shaker>



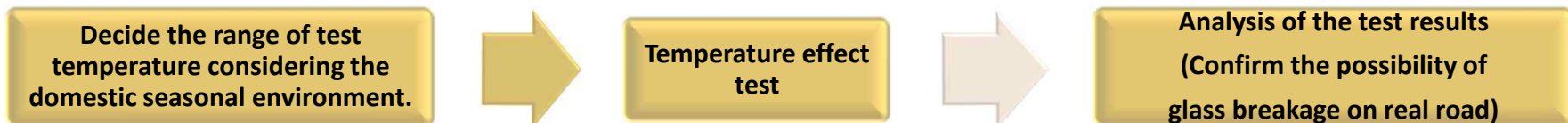
## 2. CPA test outline

- Temperature effect test

- Background: this test intends to evaluate the thermal impact characteristics of CPA of panoramic sunroof depending on the outside temperature condition on real road .

<p>NBC Charlotte Investigates: Shattering sunroofs put drivers at risk</p>  <p>NBC CHARLOTTE INVESTIGATES SHATTERING SUNROOFS PUT DRIVERS AT RISK HUGE SHARKS CAUGHT WILDFIRE PHOTOS FIRST WARN FORECAST</p>	 <p>Exploding Sunroofs On Cars &amp; SUV's</p>
<p>News contents(August 6, 2015, NBC News)</p> <ul style="list-style-type: none"><li>- Experts say, <b>when it's really hot out</b>, you should leave the shade to your sunroof open when you're not in the car, so heat doesn't build up <b>between the glass and the shade that will put more pressure on the glass</b></li></ul>	<p>News contents(Jul 31, 2015, KPRC)</p> <ul style="list-style-type: none"><li>- KYW-TV reported that <b>heat trapped in the car between the sunroof and a closed sunroof shade could play a role</b>. This is why Phillips suggested on exceptionally hot days that car owners with sunroofs leave their sunroof shade upon to reduce pressure</li></ul>

- Test Procedure :



## 2. CPA test outline

- **Temperature effect test**

- **Test method:**

- **Strength test at various temperature** : conduct test on both ceramic printed sample and non-ceramic sample

- ① Condition the test sample (300x300 mm) at specified temperature for at least four hours (ex : -30 ... 30 °C, 50 °C, 70 °C).

- ② Conduct the test such as 227g ball test of GTR 6.

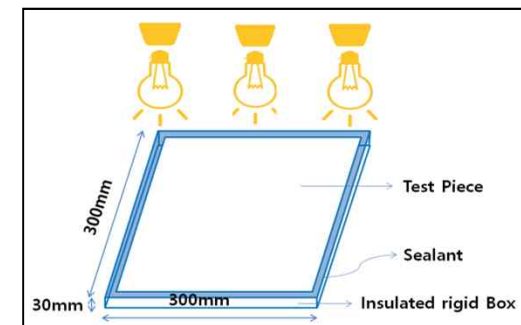
- ③ Measure the drop height when the test piece breaks.

- **Glass thermal expansion test** : confirm the thermal expansion characteristics of test samples with various ceramic printed area (ex : 0%, 20%, 40%..100)

- ① Seal the test piece (300x300mm) by the sealant on insulated apparatus (300x300x300mm) in the environmental chamber (Control both solar-light and temperature).

- ② Condition the test sample at specified temperature (ex: 40 °C) and sunlight for at least 12 hours.

- ③ Measure the condition of test piece when the test is finished



<Schematic diagram of thermal expansion test>

### 3. Summary

- Korea will try to seek various causes of glass breakage according to the vulnerable strength characteristics of CPA on panoramic sunroof.
- The test methods proposed by Korea are not formal test methods. Korea has rather proposed test methods that has considered glass breakage of panoramic sunroof on real road. Therefore, these test proposals need to be modified through discussion with IWG PSG.
- Each CPA test results are expected to be utilized for the amendment to GTR 6 and for developing detail contents of acceptable CPA ranges.
- Korea proposes to perform the test together with the IWG PSG or assign these tests to the participants, considering the reliability and objectivity of test. We need to discuss the followings during this PSG session.
  - Select organizations and research institutions for conducting CPA tests
  - Select representative test piece and cooperate with test sample offer, etc.

# 4. Time schedule

Task	No.	Specific Task	Feb		Mar				Apr				May	
			1	2	3	4	5	6	7	8	9	10	11	12
CPA Test	Establish CPA test methods	1	Research the glass breakage cases of panoramic sunroof on real road	Yellow	Yellow									
		2	Decide test factors for characteristic performance of CPA	Yellow	Yellow									
		3	Set up the specific test methods of CPA	Yellow	Yellow	Yellow	Yellow							
	Perform CPA Test	4	Test preparation				Yellow	Yellow	Yellow					
		5	Perform test						Yellow	Yellow	Yellow			
		6	Analyze and compile test results							Yellow	Yellow	Yellow		
	Report Test results	7	Report the CPA influence regarding to glass breakage of Panoramic sunroof									Yellow	Yellow	PSG-04



**Thank you!**