

Overall Review of CPA

(CPA : Ceramic Printed Area)

29. Sep. 2015

MOLIT

Ministry of Land, Infrastructure and Transport

KATRI

Korea Automobile Testing & Research Institute

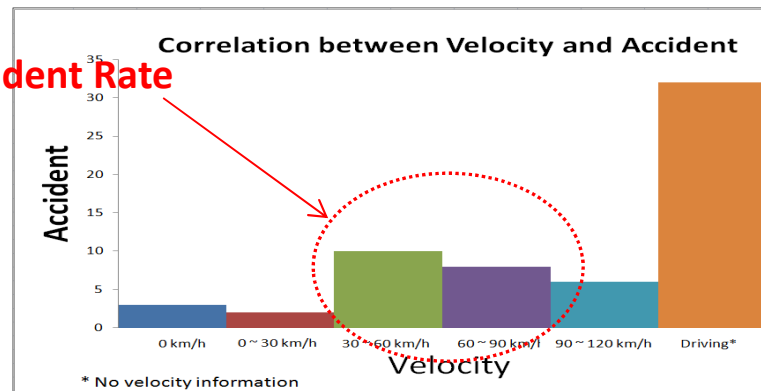
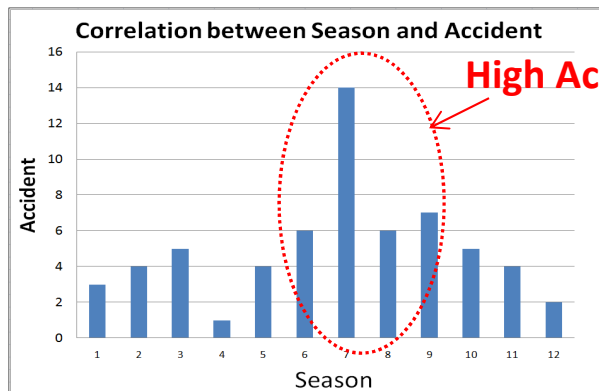
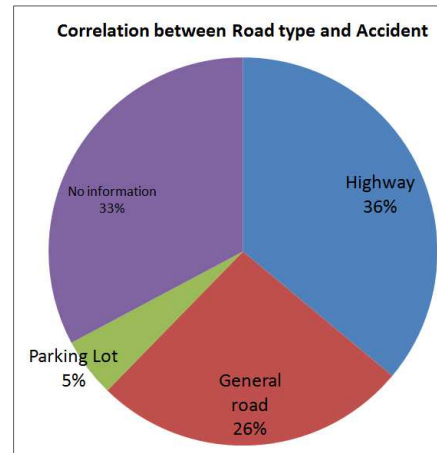
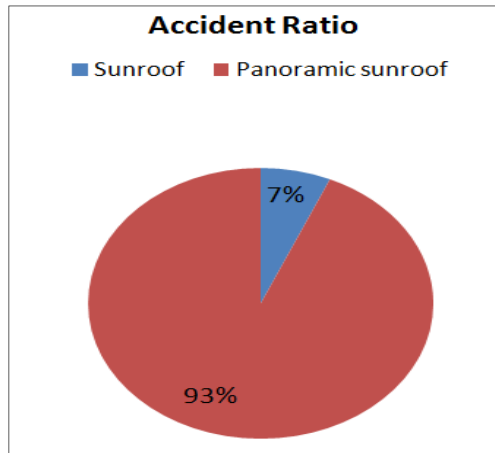
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1. Status of consumer defect complaints & media reports

- **Status of Consumer defect complaints in Korea**

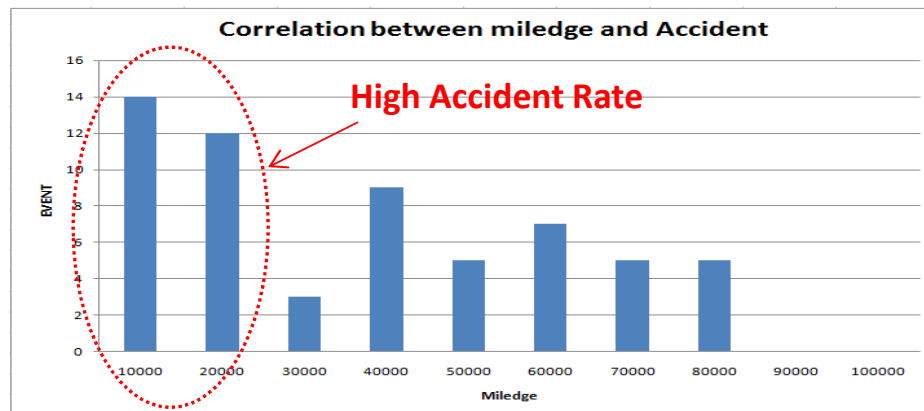
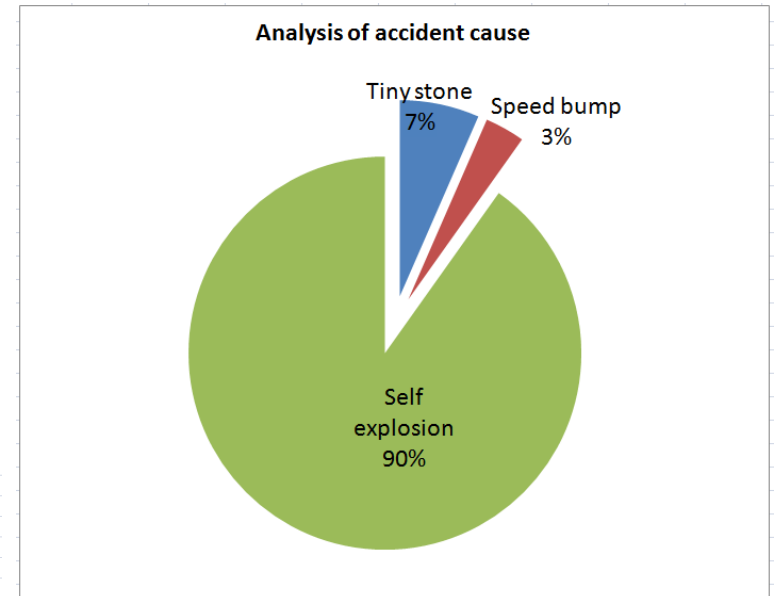
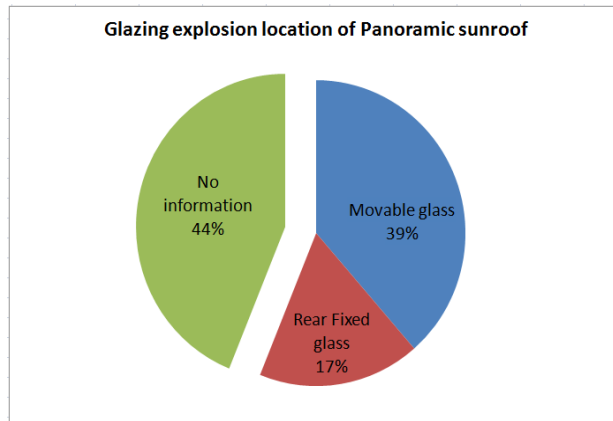
- The number of consumer defect complaints : **61** (2010~2015. 7)



- Most defect complaints due to glass breakage seem to be placed on panoramic sunroof of a large glass size.
- In terms of season, the glass breakage rate is high from June to September, of which temperature is high..

1. Status of consumer defect complaints & media reports

- **Status of Consumer defect complaints in Korea**
 - **Analysis of Consumer defect complaints**



1. Status of consumer defect complaints & media reports

● Media Reports in Korea

- Report about breakage of PSG (YTN, 14 July 2014)



- Response of the driver

- * The driver was shocked because he suddenly heard explosions like gunshots and then was not able to focus on driving for a while.
- * If there were other vehicles around his vehicle, that could lead to secondary accidents by hitting other vehicles.

1. Status of Consumer defect Complaints & Media Reports

- **Media Reports in USA**

- Report about breakage of PSG



<NBC_6 Aug 2015>



<ABC_7 Aug 2015>

- **Response of the driver**

- * The driver felt very surprised because he suddenly heard explosions like gunfight
- * The driver was not able to see for a moment because glass pieces fell into vehicle like rain. There were even the case of eye injuries of driver.

1. Status of Consumer defect Complaints & Media Reports

- **Summary**

- The main features of glazing breakage accidents are as follows
 - Accident rate is high during summer (July-August), in which sunshine is strong.
 - Accident rate is high when mileage (>20,000 km) is short.
 - Most of the complainants claimed self-explosion by unknown cause, some were hit by tiny stone and passing a speed-bump.
- The glazing breakages of sunroofs and Panoramic sunroof were worried about occupant injury risks and probability of secondary accidents by hitting other vehicles

2. Status of CPA application in Korea

- **Survey of sunroof and Panoramic sunroof**

- Toughened glass of sunroof (including panoramic sunroof) mounting on the vehicles sold in 2015 Korea market from the Korea vehicle manufacturer

: Sunroof : 20 models,

Panoramic sunroof : 21 models

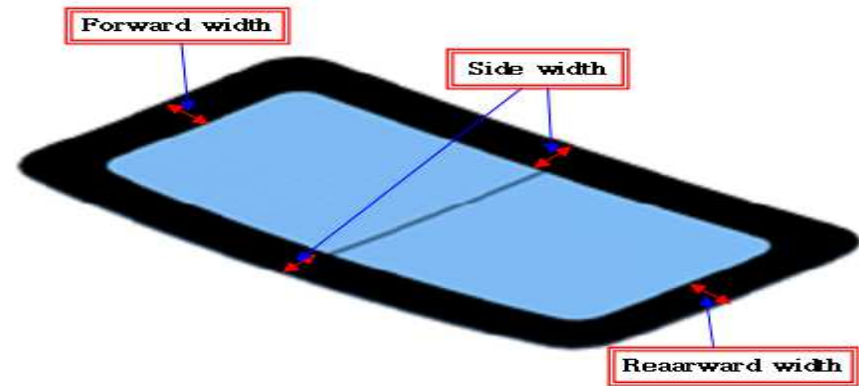
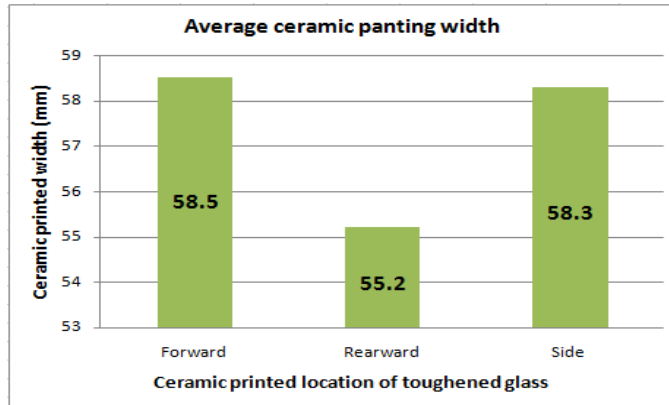


- Panoramic sunroof of Top-loading type is placed on about 95% of panoramic sunroof models mounting on vehicles and about 99% of sales volume in Korea

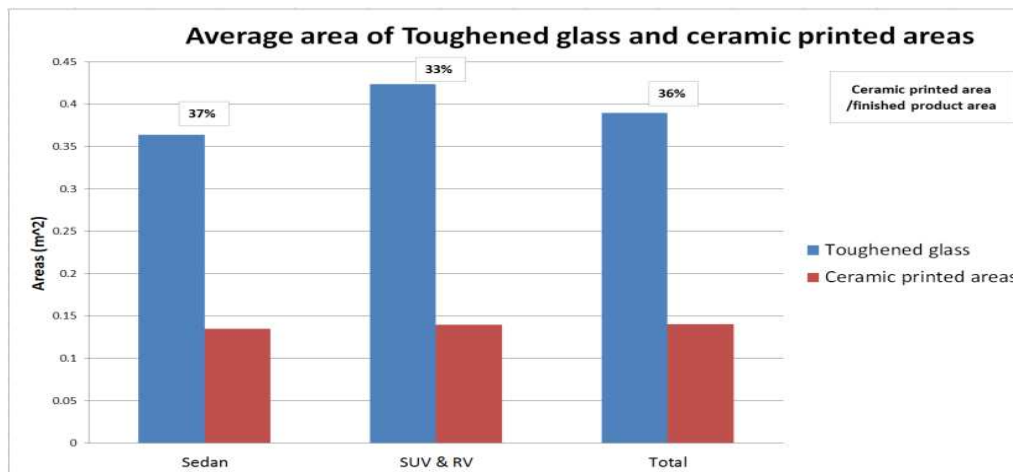
2. Status of CPA application in Korea

- Survey of Ceramic Printed Area(CPA) in Sunroof

- Average width of CPA at each location in sunroof glazing (20 models)

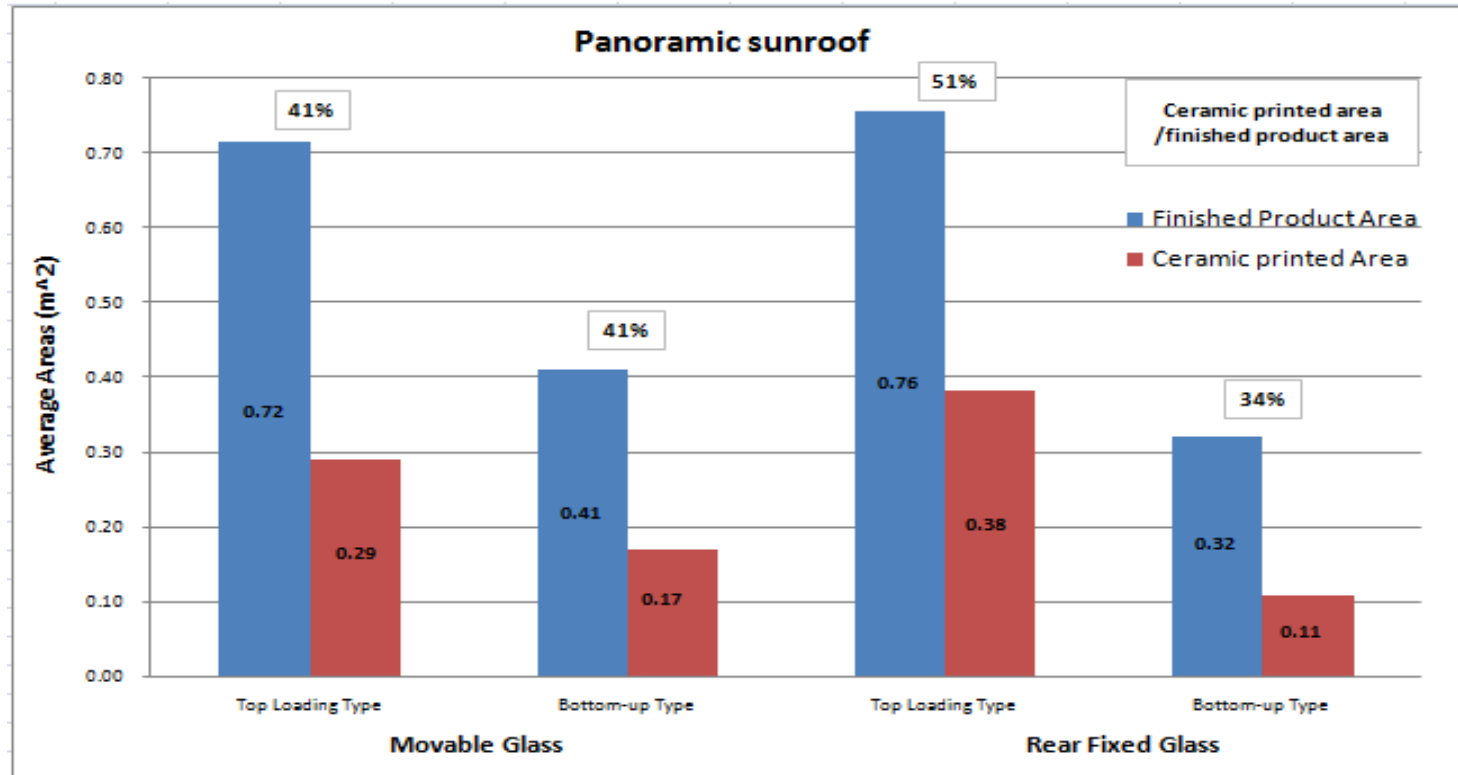


- Size and proportion of CPA sunroof glazing depending on vehicle type



2. Status of CPA application in Korea

- Survey of Ceramic Printed Area(CPA) in PSG
 - Proportion of CPA as a type of PSG (21 models)

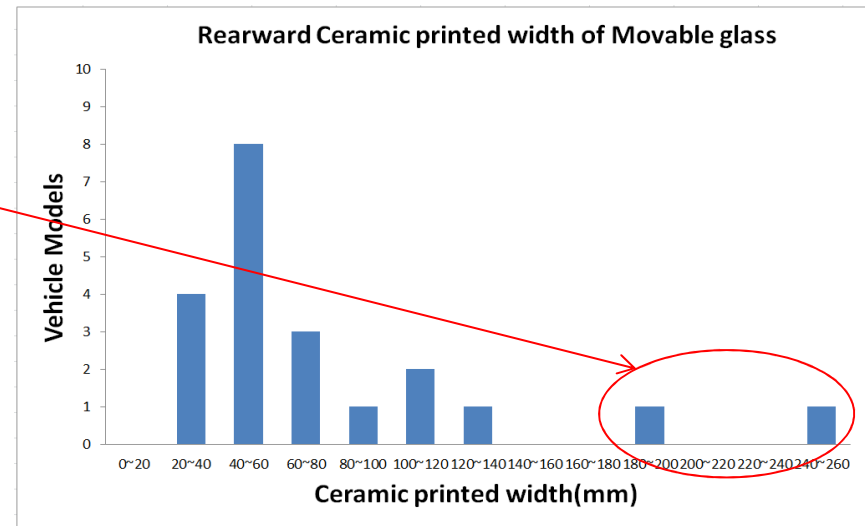
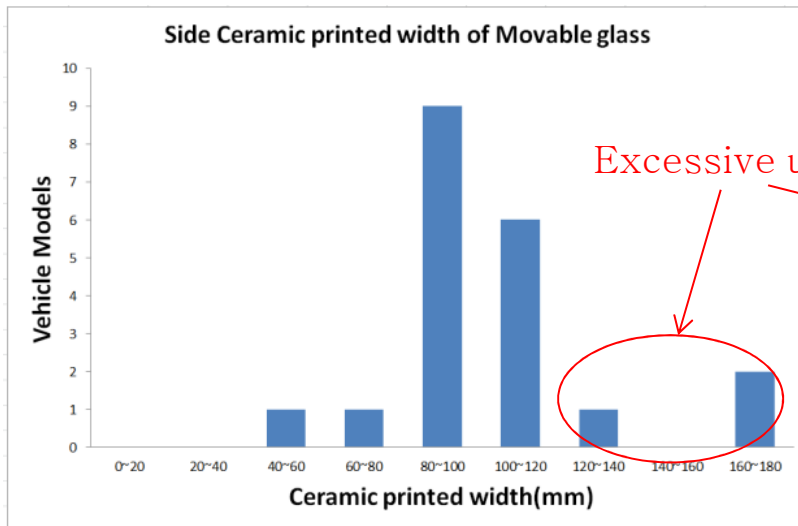
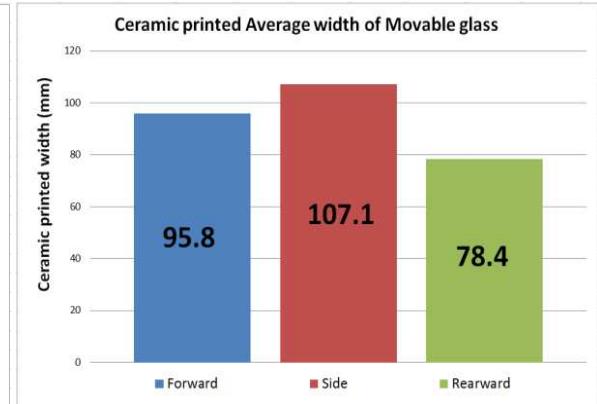
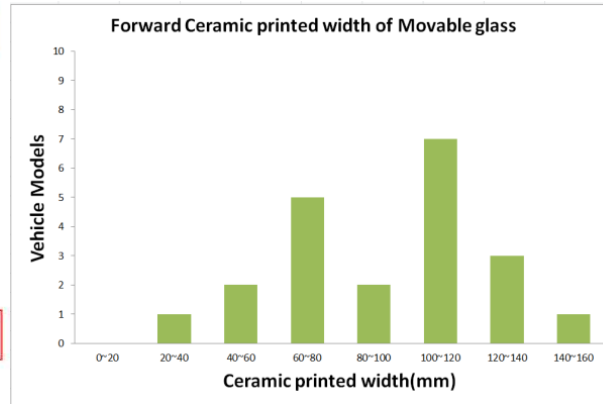
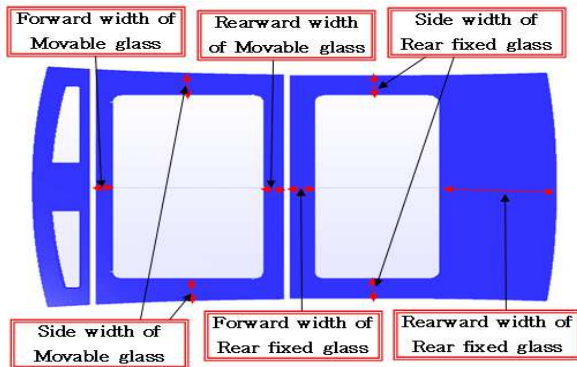


- ✓ The top-loading type seems larger toughened glass sizes and ceramic printed applicable areas compared to bottom-up type.
- ✓ **In particular, unlike bottom-up type, top-loading type has wider area of rear fixed glass and ceramic print applicable area**

2. Status of CPA application in Korea

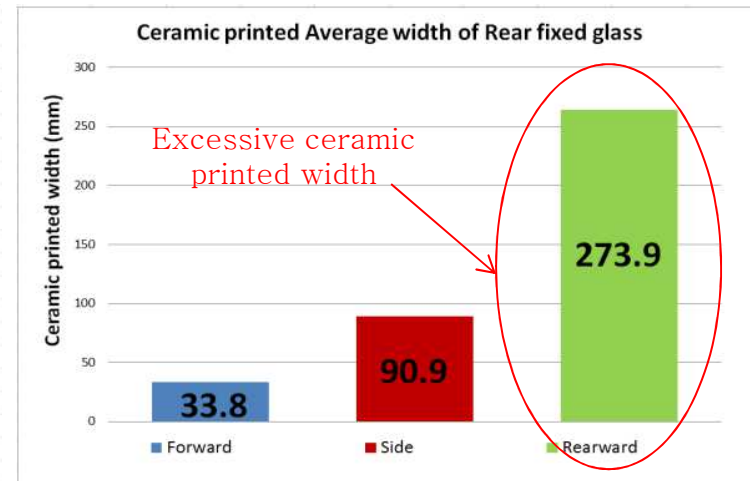
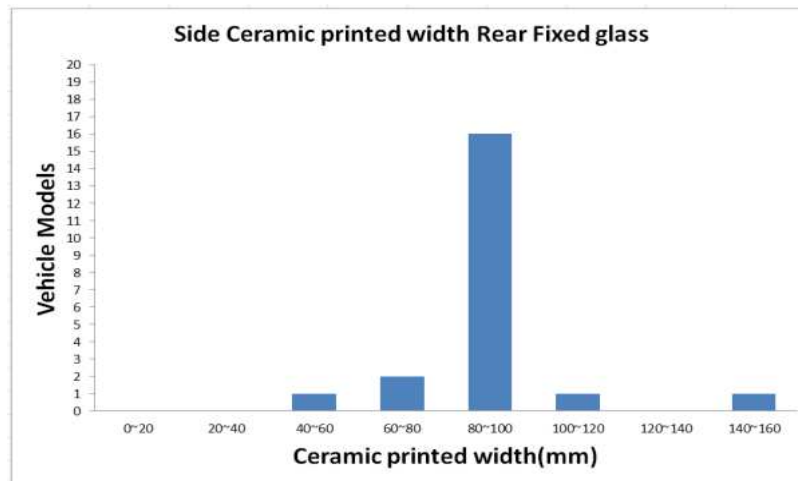
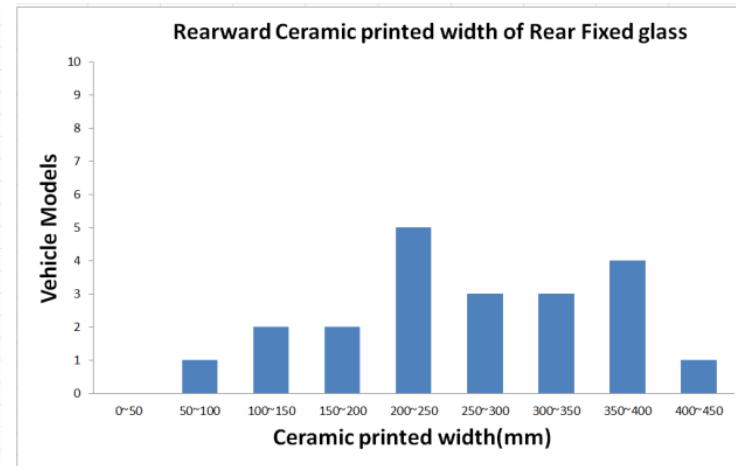
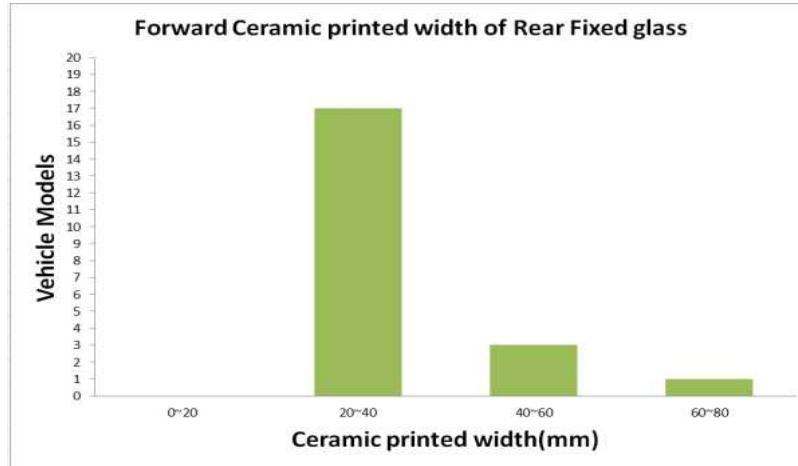
- Survey of Ceramic Printed Area(CPA) in PSG

- Width of CPA at each location in movable glass of PSG



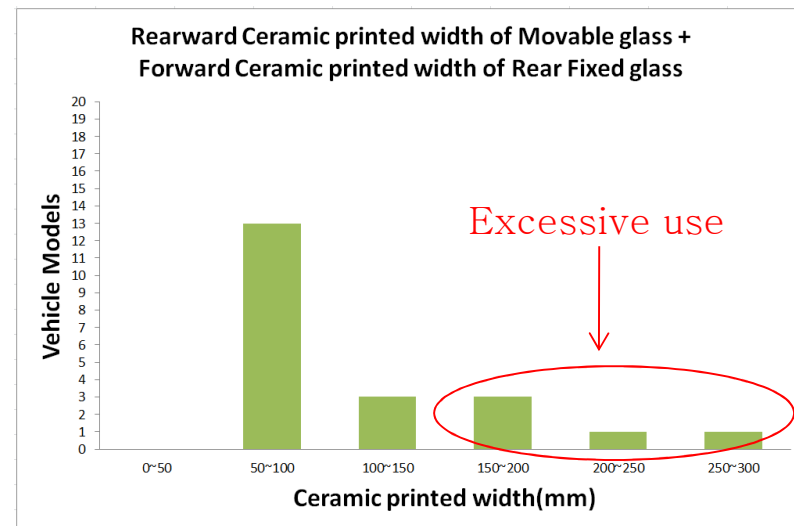
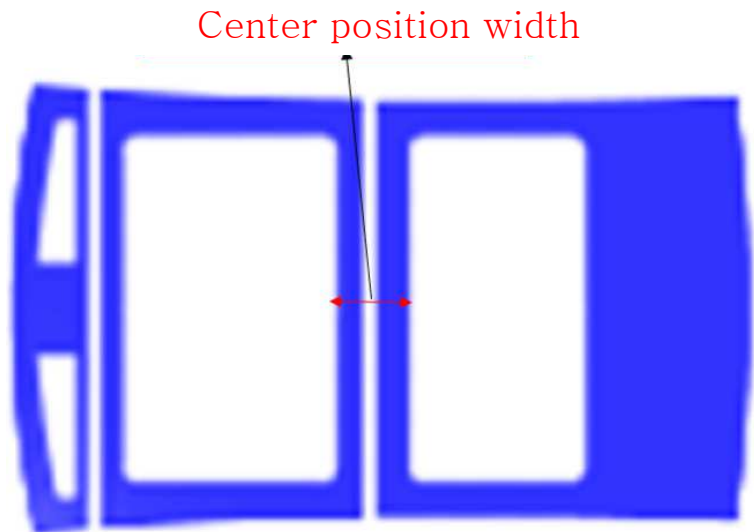
2. Status of CPA application in Korea

- Survey of Ceramic Printed Area(CPA) in PSG
 - Width of CPA at each location in Rear fixed glass of PSG



2. Status of CPA application in Korea

- **Survey of Ceramic Printed Area(CPA) in PSG**
 - **Width of CPA at the center position in PSG**
 - The location where two sheets of toughened glass adjoins becomes the center of a panoramic sunroof owing to the structural characteristics of a panoramic sunroof. Therefore, the width of ceramic printed area of that location shall be considered



3. Strength Characteristics of CPA in Toughened glass

- Manufacturing Process & Stress Distribution

	Toughened Glass	Toughened Glass With CPA
Process		
Stress Distribution		


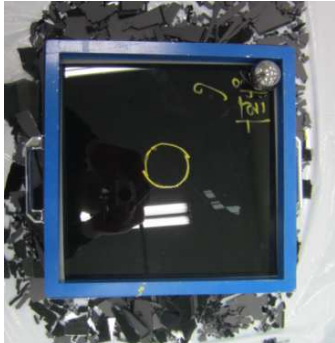
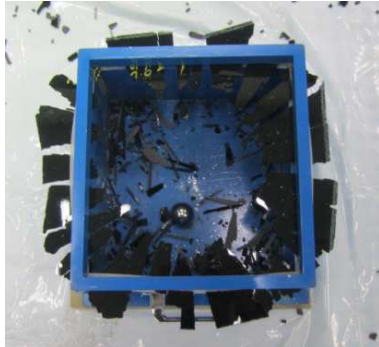
1/ The toughened glass becomes to have unstable stress distribution, because ceramic prevents compression by adhering to toughened glass surfaces during tempering process

↳ Becomes vulnerable in terms of the mechanical strength

3. Strength Characteristics of CPA in Toughened glass

- **227g ball drop test** (in accordance with GTR No.6)

- Test Results

Glass Type	Annealed Glass	Toughened Glass	Ceramic Printed Toughened Glass
Fracture Drop Height (m)	3.0 m 	More than 10m 	1.4m 



➔ The mechanical strength of ceramic printed toughened glass is weaker than that of annealed glass

3. Strength Characteristics of CPA in Toughened glass

- **Static Compressive Bending Test**

- **Test Method**

- Samples : Annealed, Toughened, Ceramic printed Toughened Glass
 - Sample size : 300 x 300 mm
 - Sample thickness : 4mm
- Test Vel. : 10mm/min



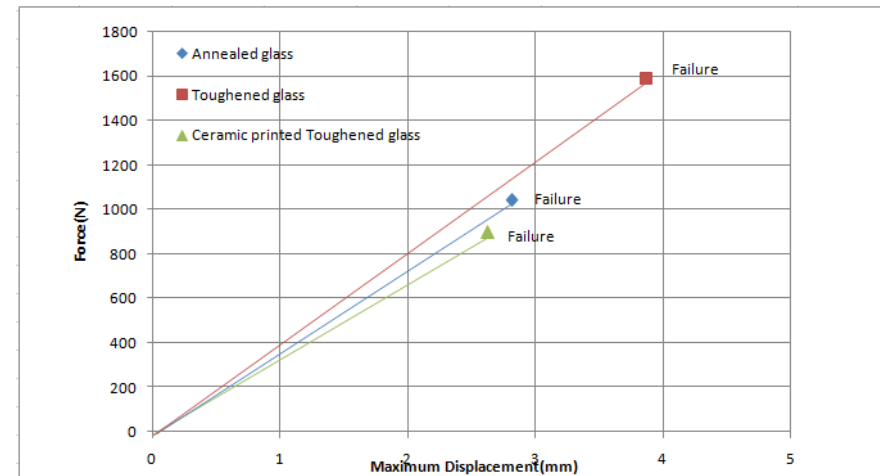
- Indenter : Plastic ball(Ø30mm)

- **Test Results**

- **Max. Displacement & Fracture Strength**

Glass Type	Annealed Glass	Toughened Glass	Ceramic Printed Toughened Glass
Max. Displacement (mm)	2.81	3.87	2.63
Fracture Strength (N/m ²)	11,577	17,666	9,977

<Apparatus>



- **Strength of Ceramic printed toughened glass is 43% lower than that of toughened glass**

4. Conclusions

- Toughened glass with ceramic printed area is more likely to be fractured because of its unstable stress distribution and low fracture strength
- A Sudden shattering of toughened glass at the roof of vehicle put drivers at risk and can cause secondary traffic accident while driving

➡ Need to minimize the usage of ceramic printed area of Toughened glass or find out other solutions



Thank you for your attention !

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