Laminated Coach Bodyside Windows - To Consider Their Role in Occupant Retention ref EU R66 Roll over Regulations

INTRODUCTION

The prime function of bodyside windows in coaches is to provide passengers with a clear view of the coach surroundings and to enhance sightseeing opportunities. In the event of an incident, however, the windows may need to provide secondary functions – first one of containment followed by a second one of escape.

CONTAINMENT

The contemporary style in European coaches is to use curved tinted double-glazed toughened glass units, externally bonded directly onto the body. Originally constructed from two pieces of 5mm toughened glass, the current trend is to use two pieces of 4mm. However, 3mm glasses are beginning to appear in some later models. During the course of an accident, the windows are potentially a weak link in the integrity of the passenger saloon of an overturning vehicle and, if the toughened glass breaks, it shatters and falls away, exposing adjacent passengers to the risk of being drawn out through the resulting aperture and becoming seriously or fatally injured under the vehicle. The risk of death or serious injury is far greater if a passenger is either fully or partially ejected from a vehicle rather than contained within.

To provide adequate containment of the passengers, the glass used for the windows needs to be very strong and impact resistant. Laminated glass, the industry standard for body sideglass in rail passenger carrying vehicles across Europe, is designed to remain attached to the interlayer upon impact. In addition, the interlayer stretches on impact and spreads the impact force across a larger portion of the glass. This stretching characteristic of the interlayer controls the head-injury criteria (see automotive EU Regulation 43, 3.4.1.2, page 123). The product is ideally suited to providing containment but is not effective in an escape situation.

ESCAPE

In the aftermath of an accident, when vehicles have come to rest, the windows potentially need to provide an escape route from the vehicle. To provide a means of escape, it must be possible for passengers to break the glass in the window and to exit the vehicle quickly. The means of breaking the glass must be reliable and quick when used by an average passenger and all facilities required to break the glass must be readily identifiable, accessible and understandable. Toughened glass, the industry standard in body sideglass in road passenger carrying vehicles in Europe, is a frangible product designed to break into small cube-like dice fragments. The size and shape of these fragments are considered to be less injurious than the longer shards potentially found in broken non-toughened glass. The product is ideally suited to an escape situation but is not effective at providing containment.

CONFLICT

Increasing the impact integrity of window systems to improve passenger containment will make it more difficult to use windows for escape. The role of the window as a means of containing passengers is in discord with its potential role in an emergency escape or rescue. It is evident that the requirements for containment and escape are mutually conflicting. There is currently research being undertaken by the UK rail industry to resolve the dichotomy of containment

versus escape and European glass processors are putting forward a number of possible solutions.

EXTRICATION

In 2001 it was estimated that half a million cars were currently on the road in Europe using laminated sideglass. Although the primary benefit for their use was from a security perspective, passenger containment along with lower noise levels and better UV/IR light protection were advantageous by-products of this technology.

The UK emergency services already have tools available to remove glass quickly with the Glassmaster tool. This was specifically designed for the rapid removal of car windscreens in a crash situation and has been adapted to incorporate both piercing and levering capabilities needed for body sideglass. However, the emergency services do not consider the fitting of laminated sideglass in passenger cars as a major issue in terms of the ability to rescue vehicle occupants following an accident.

DISCUSSION

If laminated glass is to be used in coach windows and assuming that glass thickness remains the same, the current construction of toughened / toughened double glazed units will need to change to:

- Toughened outer / laminated inner - probably the best combination as this unit will offer both containment and a better resistance to vandalism

- Laminated outer / toughened inner - hard to envisage any advantages using this combination in this position. However, using the laminated glass on the outside will not offer the same resistance as toughened.

- Laminated outer / laminated inner - the best combination for containment but external impact resistance will be lower than with toughened.

For laminated glass to be of assistance in the containment of passengers, the window to bodyside fixing would need to be considered. It is unlikely that EPDM glazed windows could offer the same security and structural benefits as direct glazing.

Hammerless glass break systems are making headway in transport applications around the world. If a device were fitted inside a double glazed unit constructed of toughened glass outer and a toughened glass perforated laminate on the inside, a push of an interlocked button would trigger the unit into breaking both panes of glass allowing it to be pushed out of the vehicle.

CONCLUSION

A different evacuation strategy based upon the requirements for containment and escape would need to be developed for the industry before seriously considering laminated glass as the containment solution.

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