



## CLIENT PROJECT REPORT CPR1343

### An investigation of the quality and safety of windscreen replacements in the Republic of Ireland

Final report

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**Prepared for:** Carglass Limited, trading as Autoglass®

**Project Ref:** AGE90036

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## Contents amendment record

This report has been amended and issued as follows:

<b>Version</b>	<b>Date</b>	<b>Description</b>	<b>Editor</b>	<b>Technical Referee</b>
1	31/05/12	Final report	Mike McCarthy	Louise Lloyd

## 1 Introduction

In the course of carrying out windscreen replacements, anecdotal evidence from Autoglass® technicians in the Republic of Ireland suggested that a relatively significant proportion of previously replaced windscreens were of poor quality, in some cases to such an extent that the previous replacement might potentially constitute a risk to safety. Autoglass® were concerned about this apparent feature of their market and asked TRL to design and implement a research study which aimed to quantify the percentage of previously replaced windscreens that have quality or safety deficiencies in the Republic of Ireland vehicle fleet.

This report presents a description of how the study was designed and conducted and presents the results of the study with respect to the project aim.

## 2 Why is a good windscreen replacement important?

### 2.1 Replacement quality

It is important that, when a windscreen becomes damaged and the damage cannot be repaired, the windscreen is replaced such that the car is returned to its original condition. Poor replacements – replacements for which the incorrect products or procedures have been used - have the potential to lead to increased wind noise and ingress of water into the passenger compartment. This can occur if the bond does not have full adhesion around the windscreen perimeter, or if the windscreen is not aligned in the aperture correctly. While these issues may not directly affect safety, they are indicative that the replacement has not been conducted with diligence and professionalism. At the extreme, replacements which are poorly conducted have the potential to affect safety and, furthermore, replacements which have quality issues could conceivably become safety issues over time. This is particularly true for the strength of the bond if the incorrect products have been used, or if poor procedures allow moisture to leak into the bond. Over time, this may weaken the adhesion and allow rust to form around the windscreen perimeter.

### 2.2 Replacement safety

A correctly fitted, bonded windscreen is important to safety for several reasons. These issues are discussed in the following sections.

#### 2.2.1 Airbag inflation

A strongly bonded windscreen is important for the correct deployment and stability of a passenger airbag because it inflates directly against the windscreen.

In a vehicle impact, the airbags deploy to offer protection to the occupant by arresting the occupant before striking any hard structures. The timing and position of the airbag inflation is important for the level of protection that the system provides. Passenger airbags typically deploy marginally later than the driver airbag and inflate against the windscreen. If the windscreen becomes displaced from the frame the airbag will be less supported and the position of the airbag could be influenced. This has the potential to affect the level of protection offered by the airbag, meaning that the occupant does not receive the level of protection intended by the airbag system.

### **2.2.2 Roof crush resistance and occupant ejection**

In an accident involving car rollover, the protection of the occupant compartment, and particularly the roof, is critical to safety. Research has shown that in such accidents, the displacement of the roof towards the occupant may be increased by up to 30% if a windscreen is not present (Phillips and McGrath, 2000). Therefore, the ability of the windscreen to remain *in situ* in a rollover reduces the risk of occupant injury in these severe accidents. Furthermore, the likelihood of occupant ejection, where the risk of serious or fatal injury is greater may be reduced, particularly if the occupant is not wearing a seat belt.

The main accident mechanism associated with occupant ejection is vehicle rollover (e.g. McCarthy and Brett, 2001; Digges, 2002; Batzer, 2007); in such instances, accident data indicates that retaining the occupant within the vehicle is associated with lower severity injury outcomes. For example, in a study based on Co-operative Crash Injury Study (CCIS<sup>1</sup>) data from Great Britain, Morris *et al.* (1993) state that the risk of severe or fatal injuries for partially or fully ejected occupants is increased between 3 and 40 times compared with if they were retained within the vehicle.

In Great Britain, approximately 50% of occupant ejection events occur as a result of rollover accidents (Morris *et al.*, 1993). However, the link between severity and ejection may not be a simple relationship, since those accidents in which the occupant was ejected are typically the most severe accidents and therefore might be expected to result in higher injury, irrespective of whether ejection occurred. Despite this complication, which probably accounts for at some of the association between occupant ejection and the risk of fatal or severe injury, retaining the occupant within the vehicle, where the vehicle structure and restraint systems offer protection, is widely considered to reduce the risk of injury.

### **2.2.3 Torsional and structural stiffness**

A windscreen also affects the torsional stiffness of a vehicle, which is important to its handling characteristics. Previous work by TRL found that in a full-scale vehicle torsion test, the presence of a windscreen contributed approximately 34% of a passenger car's stiffness (Phillips and McGrath, 2000). Therefore, a correctly-fitted and bonded windscreen contributes to the stiffness of the vehicle and this may affect the handling characteristics of the vehicle. The magnitude of the safety effects of this is difficult to judge, but deviations from the 'design performance' should be avoided.

In addition, computer simulations have demonstrated that windscreens have a role in preserving the integrity of the occupant safety cell and subsequently the safety of the occupants (Phillips and McGrath, 2000).

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<sup>1</sup> <http://www.ukccis.org/>