INITIAL FIELD EXPERIENCE OF SIDE AIRBAG PROTECTION SYSTEMS IN THE UK

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KEYWORDS: Side Airbags, Side Impacts, Injury Severity, Thorax, Restraint Injury

INTRODUCTION At present, it is not possible to undertake overall benefit analyses of side airbags, as is the case with frontal airbags, due to the small amount of field data. However, individual case reviews are possible and such reviews allow a preliminary assessment of the benefits together with initial indications of any potential problems with side airbag technology.

CASE REVIEW METHODOLOGY AND OVERALL RESULTS The data for this work were collected as part of the UK Co-operative Crash Injury Study (CCIS - Hassan 1995). Cases were selected for this present work if a side airbag (thoracic or head) had deployed adjacent to a vehicle occupant, providing data on 47 crashes and 50 occupants, of which 19 occupants sustained a MAIS ≥ 2 injury. The sample was split into 5 categories based on crash type and injury outcome.

(a) No expected benefit of side airbag deployment due to crash type or low crash severity. This category included cases in which the occupant was not likely to have contacted the side of the vehicle due to the likely human kinematic response. From 50 occupants, 16 were judged to have been involved in such crashes (which included some rollovers, non-horizontal, non-struck side, primarily frontal and sideswipe impacts). A further 7 occupants were involved in crashes where interaction with the side airbag probably occurred but due to low crash severity, injury prevention was not necessary.

(b) No expected benefit of side airbag deployment due to high crash severity. This category included high-speed crash events in which the side airbag would be expected to offer little benefit to the adjacent occupant due to the severity of the crash. In total, 4 occupants in the sample were involved in such crashes, 3 crashes involved high crash severity and intrusion, another involved under-run.

(c) Perceived injury mitigation benefit through side airbag deployment. In this category, some injury mitigation benefit of the deploying airbag was determined from the available evidence. In total, 9 occupants were involved in crashes where the injury outcome was judged to have been less severe (mainly MAIS 1) than would be expected without an airbag.

(d) Unexpected injury with side airbag deployment. In this category, unexpected injury outcomes were observed. Of the 50 occupants in the sample, there were 3 cases, summarised below, where it is considered that the airbag contributed, at least in part, to injury outcomes. It is thought that crash circumstances would have induced occupant motion towards the area of side airbag deployment.

Case Example 1 The driver lost control of a vehicle on a left hand bend and the vehicle then rotated clockwise before sustaining a subsequent left side impact with the central reservation barrier, the front left corner making first contact. Residual damage (with a maximum crush of 23cm at the front left corner) occurred to the full left side of the vehicle. Little residual intrusion of the passenger compartment was apparent. The Equivalent Barrier Speed was calculated to be in the region of 29km/h. The driver was not injured, but the belted passenger, a 25 year-old female (weight 55kg, height 1.63metres) sustained fractured left 7th to 9th ribs with haemo-pneumothorax (AIS 3), a pulmonary contusion to the left lung (AIS 3) and a splenic tear (AIS 2). No significant occupant loading to the door was evident. It is suggested that deployment of the front passenger's seat-mounted side airbag may have contributed to these injuries.

Case Example 2 In this case, the vehicle left the road to the left and subsequently rolled (1/2 turn) down an embankment before coming to rest on its roof. There was little by way of residual crush to the vehicle and a maximum residual roof intrusion of 4cm. The driver of the vehicle was a belted 28-year old female (weight 59kg, height 1.68metres). The seat-mounted thoracic airbag deployed during the crash, with the driver sustaining fractures of the 6th to 8th right-side ribs with haemo-pneumothorax (AIS 3) and bruising to the posterior surface of the thorax (AIS 1). No significant occupant loading to the door was evident and it suggested that deployment might have contributed to these injuries.

Examples 1 and 2 involve similar injury outcomes to cases investigated in other international studies e.g. Morris et al (2000) and Chidester (2001). Injuries in these cases were attributed to side airbag deployment.

Case Example 3 The driver of the vehicle lost control on a left-hand bend, the vehicle rotating anti-clockwise whilst leaving the road to the left and then colliding with the side of a building during rotation. There was little overall damage to the passenger compartment and crash severity was not calculated. The direction of force was predominantly 'frontal', however the main area of damage was to the right front of the vehicle. The unbelted driver of the vehicle, a 21-year old male sustained multiple minor injuries (AIS 1) as well as a comminuted mid-shaft fracture of the right humerus (AIS 3). In this case the seat-mounted side airbag pierced through the door cladding. It seems possible that the driver was out of position at the time of deployment with the right arm being in the path of airbag deployment.

Duma et al (2001) observed comminuted mid-shaft humerus fractures in cadaver studies, although the subject positioning was considered to be worst case and low bone mineral content a factor. It is worth considering that the risk of upper extremity injuries, through interaction with side airbags, would not be detected in regulatory compliance testing using dummies, since no dummy currently used in such testing is instrumented to detect such a risk.

(e) Benefit difficult to assess due to crash complexity. Of 50 cases, there were 11 cases in which an assessment of benefit or dis-benefit could not be determined due to the complexity of the event. Such cases usually involved complicated crash conditions with multiple series of events in which it was difficult to fully determine the point of airbag deployment.

CONCLUSIONS

- Side airbag deployments are preventing injuries in the real world.
- Side airbag deployment is taking place in cases where it would not be expected, especially when the deployment is on the non-struck side and in some frontal impacts.
- Cases have been found in which the crash severity and/or type exceeded the protection capabilities of modern safety systems.
- In some cases, the side airbag deployment may have caused serious injury where it would not otherwise have been expected. Whilst the anecdotal nature of the study is acknowledged, the injury outcomes suggest a need for future real-world monitoring and evaluation.
- With so many different crash scenarios even in this initial sample, along with the retrospective nature of the data, the subjectiveness of these investigations is acknowledged. Review has been carried out keeping in mind previous field experience in side impact cases.

ACKNOWLEDGEMENTS The authors would like to acknowledge the funding of the initial stages of this work by the Department for Transport (DfT) in the United Kingdom. CCIS is managed by TRL Limited, on behalf of the DfT (Vehicle Standards and Engineering Division) who fund the project with Autoliv, Daimler Chrysler, Ford Motor Company, LAB, Nissan Motor Company, Toyota Motor Europe, and Visteon. The data were collected by teams from the Birmingham Automotive Safety Centre of the University of Birmingham; the Vehicle Safety Research Centre of Loughborough University; and the Vehicle Inspectorate Executive Agency of the DfT. http://www.ukccis.org

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