# Windscreen Angle: a factor for pedestrian head injury risk

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## I. INTRODUCTION

Recent multibody modelling showed that steeper windscreens may lead to lower linear/angular accelerations of the head [1]. However, the analysis was limited to a single pedestrian/vehicle size and speed and pedestrian gait and speed. Here, a range of pedestrian impact configurations is considered.

## II. METHODS

MADYMO pedestrian simulations were performed using a previous model as a baseline [1-2]. The following were assessed for their influence on the relationship between windscreen angle and head injury risk: vehicle/ pedestrian speed, pedestrian gait, size and arm position, and vehicle braking, approach angle, windscreen stiffness and shape. Head injury risk is assessed through peak linear and angular acceleration of the head.

## III. INITIAL FINDINGS

Sample results for the influence of pedestrian orientation and pedestrian speed are shown in Fig 1 and Fig 2.

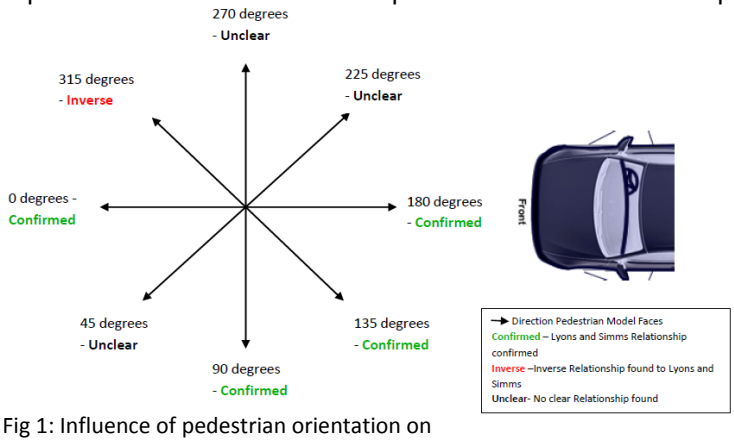


Fig 1: Influence of pedestrian orientation on Lyons and Simms [1] windscreen angle predictions

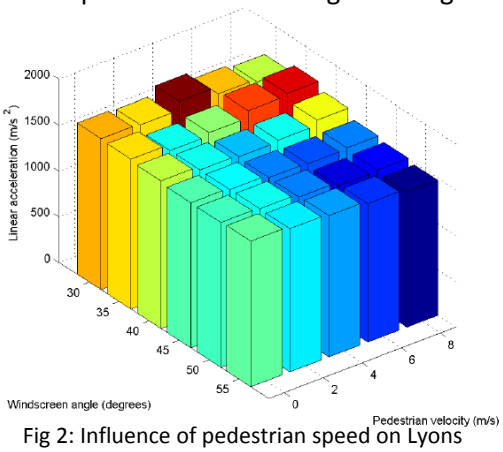


Fig 2: Influence of pedestrian speed on Lyons and Simms [1] windscreen angle predictions

## IV. DISCUSSION

Broadly speaking, the following parameters have little influence on the previous prediction that steeper windscreens pose a lower pedestrian head injury risk [1]: vehicle braking, pedestrian orientation, pedestrian speed, and pedestrian arm position. However, the following parameters do influence the predicted trend for head injury risk as a function of windscreen angle: vehicle speed, vehicle bonnet leading edge height/pedestrian size, pedestrian gait stance. For windscreen stiffness, the form of the contact characteristic is important, and experimental data is limited.

These additional findings are noted: (1) a pedestrian with a higher leading arm position when struck may result in a higher head injury risk compared to a lower leading arm position; (2) the predicted increased head injury with decreased windscreen angle is robust for some, but not all, pedestrian gait stances; (3) a higher bonnet leading edge height relative to the pedestrian mass centre reduces the dependence of head injury risk on windscreen angle.

## V. References

[1] Lyons M & Simms CK, Proceedings of IRCOBI Conference 2012.
[2] Elliot et al, IMechE Journal of Multibody Dynamics, 2012.

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