

BONNET DESIGN WITH RESPECT TO PEDESTRIAN SAFETY

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The evaluation of the head injury criterion (HIC) assessing injuries of a pedestrian when hit by a vehicle, if simply defined, provides no practical hint for designing a bonnet structure with good safety performance. We have studied relations between the time history of the impact, HIC performance and bonnet structure; based on that, we established a method how to define, visualize and remove shortcomings of an existing bonnet design. The abilities of the approach are demonstrated on the results of practical application.

Key words: pedestrian safety, design research, head impact, bonnet design, head injury criterion

1. Introduction

The issue of bonnet design with respect to the head impact of a pedestrian represents an uneasy challenge for design engineers. They are supposed to combine two subjects, which have evolved completely independently.

Older of both is vehicle bonnet; in the beginning it was meant to cover engine compartment; with the time several new demands have emerged – adequate stiffness, natural frequency, driver visibility or styling design, to name a few.

Later, as a result of real accidents, the head injury criterion (HIC) was established; separately, based on the proportions of a human body, a skull to be accurate. The criterion covers the assessment of head injuries of a pedestrian when impact conditions are known; nevertheless, the criterion has no linkage to a bonnet structure, which would provide design engineers with an idea how to design a new bonnet effectively.

As to the current state of a research in this field, several tests on existing vehicles have been carried out [9] and differences for various impact locations studied. Achieved results revealed the existence of a relation between under-bonnet clearance and yielding HIC performance. More accurately, they proved that the most severe impact does not come from bonnet itself, but rather from under-lying components in engine compartment.

Based on this fact, there has been a proposal for an adaptable bonnet structure [4], which would avoid the complication with limited under-bonnet clearance resulting from the demand for maximal utilization of the space in engine compartment. Nevertheless, the additional costs of such a system persuade the manufacturers to prefer a mechanical solution as far as the HIC issue is concerned.

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