

AIRBAG PROTOTYPE FOR A MID-SIZED TOURING MOTORCYCLE

F. Alexander Berg, Peter Rücker
DEKRA Automobil GmbH, Stuttgart, Germany

Keywords: Airbags, Protection, ISO, Full-Scale Tests

One of the most dangerous situations for a motorcyclist is the perpendicular impact on the side of a passenger car. If the motorcycle rider's head impacts on the roof edge of the car, serious injuries or fatalities may occur. A motorcycle airbag has a high potential to reduce the injury risk of such impacts. In addition the airbag could be able to guide the motorcyclist's movement into an upward direction over the roof of the car.

For a mid-sized touring motorcycle *Yamaha FZ 600 Fazer* an airbag prototype was designed and constructed. Compared with the situation without airbag, its performance was tested using sled tests and full-scale crash tests according to ISO 13232 (configuration 413). Differing from ISO 13232 a standard pedestrian dummy Hybrid III (50th percentile male) was used to represent the motorcycle rider.

Full-Scale Test without Airbag

Yamaha FZ 600: 48,0 kph, 305 kg
VW Golf II: stationary, 1.107 kg



t = 0 ms: Start of impact



t = 42 ms: Start of occupant movement relative to motorcycle



t = 104 ms Head Impact to Roof Edge

Full-Scale Test with Airbag

Yamaha FZ 600: 48,1 kph, 305 kg
VW Golf II: stationary, 1.105 kg



t = 0 ms: Start of impact



t = 42 ms: Start of occupant movement relative to motorcycle



t = 77 ms Interaction with Airbag

For the full-scale test without airbag the 3-ms value of the dummy's head acceleration is 79 g near to its limit of 80 g. The test with airbag shows this value at 31 g, that corresponds to a reduction of 61 %. The HIC is reduced from 396 (without airbag) to 69 (with airbag) corresponding to a reduction of 83 %.

The neck was loaded with a 45-ms value of the axial compressive force (z-direction) of 0.4 kN without airbag and of 0.2 kN with airbag (reduction 50 %). The neck shear force (x-direction) was reduced from 0.9 kN (without airbag) to 0.6 kN (with airbag) corresponding to a 67 % reduction. Almost the same level and far below the limit of 57 Nm was the retroflexion moment of the neck with 23 Nm (without airbag) respectively 21 Nm (with airbag).

With 21 g (without airbag) and 19 g (with airbag), the 3-ms values of the resulting chest acceleration were close together and far below the limit of 60 g. The results of the 3-ms values pelvis acceleration with 27 g (without airbag) and 24 g (with airbag) were close together and far below the limit of 60 g.

The femur loads without airbag were 9 kN (left femur) respectively 1 kN (right femur). With airbags the left and the right femur were not loaded.

In addition to the dummy loads, the film evaluations show that for the chosen test situation an airbag for a mid-sized touring motorcycle could be useful to reduce impact induced loads to the rider as well as to guide the rider's movement into an upward direction over the roof of the impacted car.

