

The influence of headform/helmet friction on head impact biomechanics in oblique impacts at different tangential velocities

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Abstract-

**Oblique impacts of the helmet against the ground are the most frequent scenarios in real-world motorcycle crashes. The combination of two factors that largely affect the results of oblique impact tests are discussed in this work. This study aims to quantify the effect of the friction at the interface between the headform and the interior of a motorcycle helmet at different magnitudes of tangential velocity. The helmeted headform, with low friction and high friction surface of the headform, was dropped against three oblique anvils at different impact velocities resulting in three different magnitudes of the tangential velocity (3.27 m/s, 5.66 m/s, 8.08 m/s) with the same normal component of the impact velocity (5.66 m/s). Three impact directions (front, left-side and right-side) and three repetitions per impact condition were tested resulting in 54 impacts. Tangential velocity variation showed little effect on the linear acceleration results. On the contrary, the rotational results showed that the effect of the headform's surface depends on the magnitude of the tangential velocity and on the impact direction. These results indicate that a combination of low friction with low tangential velocities may result into underprediction of the rotational headform variables that would not be representative of real-world conditions. **

Index Terms- motorcycle helmet; oblique impact; tangential velocity; friction

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Citation:

Juste-Lorente, O.; Maza, M.; Piccand, M.; López-Valdés, F.J. "The influence of headform/helmet friction on head impact biomechanics in oblique impacts at different tangential velocities", Applied Sciences, vol.11, no.23, pp.11318-1-11318-21, December, 2021.