Proposed ESAR Paper: Motorcyclist Post Impact Trajectory Analysis

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ABSTRACT: Powered Two Wheeler (Motorcycle) crashes are overrepresented in EU, England, and United States casualty statistics for both fatal and serious injuries. While regional geographic differences are evident for motorcycle size, type, and engine displacement, the casualty statistics consistently indicate significantly higher injury rates for all motorcycle riders when compared to car occupants. Accident analysis and reconstruction of these motorcycle crashes is a necessary process to gain further understanding of potential injury mitigation strategies.

This paper focuses on the analysis of the rider post impact trajectory in the immediate moments following a crash. The rider and motorcycle, while loosely coupled by seating position leading up to a crash, quickly decouple as the crash forces develop. As a result, the rider moves relative to the motorcycle and relative to the collision partner. This movement, or trajectory, is primarily influenced by the type and configuration of the impact, the type and configuration of the motorcycle and collision partner, and the speeds involved. Understanding the rider's post impact trajectory will assist in the development of injury mitigation strategies.

Both the free flight trajectory of the rider and the rider's trajectory as influenced by interaction with the motorcycle and collision partner are examined. Rider trajectories in full scale crash testing and real world motorcycle crashes are both studied and presented. The resulting physical evidence that can be observed by an accident analyst is discussed. The application of projectile motion physics is analyzed and the necessary input parameters, such as initial launch angle, are studied. This study will assist in understanding the post-impact dynamics of a motorcyclist, and will provide useful information to analysts evaluating real world crashes.