ABSTRACT

To estimate damage energy and related impact speed for a typical Indian PTW crash, this work addresses the research question, *"**Is there a deformation-based energy model to estimate impact speed of a PTW in crash reconstruction studies?**"*

Estimation of the damage energy related to significant energy absorbing components under dynamic loading has been quantified. A component-level testing under dynamic loading conditions was conducted for the tubular structure of a PTW in a crash. Deformation measurement and the absorbed energy were quantified from a three-point bending test under a drop tower test setup. The FE model of the front fork tube under bending load conditions was validated using experimental data. The Finite Element (FE) and Multi(-Rigid)-Body (MB) models of a typical Indian PTW (Engine capacity: 100 cc) were developed and partially validated in a rigid wall crash test. The feasibility of using a FE PTW model in a crash was evaluated and compared to a similar class of PTW used in the crash tests for a frontal impact against the door of a passenger vehicle (PV). The energy absorbed and related impact speed of the developed PTW FE model against a FE model of the passenger vehicle used in the simulation was reasonable.

A real-world PTW crash with damage details was selected from National Highway-8 (NH-8) database collected by IIT-D and reconstructed in FE. The events in the FE simulation, the direction of motion, and the final rest position after impact were correlated. The damage energy and deformation of the front fork in FE analysis were reasonably correlated with experimental data. A method to predict energy absorbed and related impact speed based on the damage component was demonstrated. Hence this study serves as a good starting point to predict impact

speed based on damage details of significant energy absorbing components of a typical Indian PTW in a real-world road traffic accident (RTA).