AN AUTOMOTIVE PERSPECTIVE TO SAVE MOTORCYCLISTS

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Powered2Wheelers

INTRODUCTION

Over the last 20 years, research on road safety has predominantly focused on protecting car occupants, with significant results, but the number of fatalities and injuries among other categories of road users has not fallen to the same extent, indeed, in some cases, it has risen[1]. In 2019, motorcyclists were nearly **29 times more likely to die than passenger car occupants** in a crash per vehicle miles traveled[2]. Thus, a transfer between these two fields is compelling.

OBJECTIVES

To build a **multi-method simulation approach** whereby the potential benefit of a **belted concept device**[3] for riders can be assessed.

METHODS

A sub-group of twenty-five configurations were extrapolated from ISO 13232-2. Only collisions between motorcycles (MC) and **passenger cars** (OV), recognized as the **most frequent obstacle**[4] [5] [6], were considered. To compute both biomechanical indexes and actual suffered injuries, two different groups of simulations were needed: i.e., Multi-Body (MB) method and Finite Element Method (FEM).

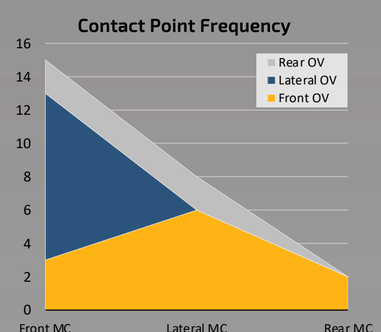
- MULTI-BODY -

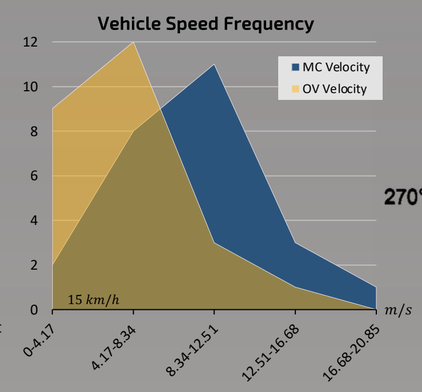
A Madymo environment, made up of a generic touring ellipsoid motorcycle[7], a finite element car (the Geo Metro model from NCAC's archive) and a facet dummy (MATD)[8], was set up to observe the device behavior in different crash conditions.

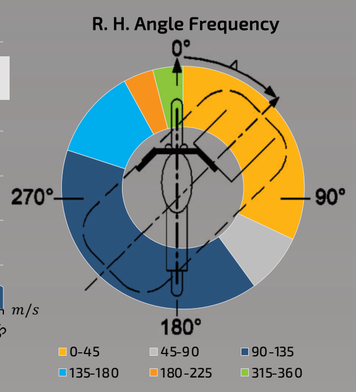
- DATA GENERATION | MINING -

In HyperStudy, **six variables were parametrized** to automatically match each simulation up with the related crash event:

– Impact speed for each vehicle (x2) – Relative Heading Angle (x1)
– Contact point for each vehicle (x2) – Safety device (Boolean) (x1)





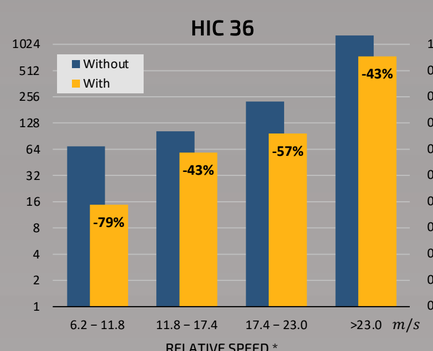


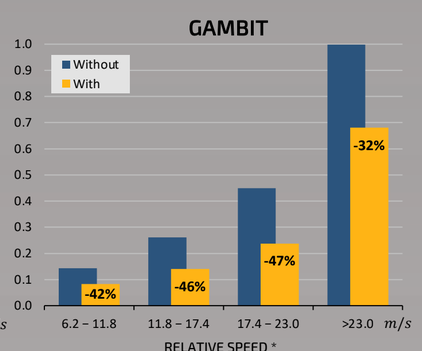
- FINITE ELEMENT -

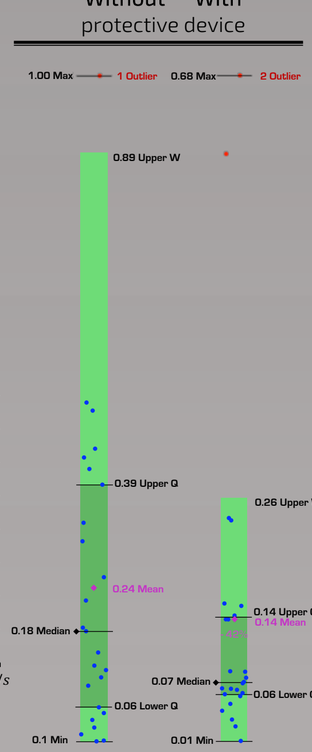
In Ls-Dyna, the HBM (THUMS)[9], helmeted and properly seated on a motorbike, was exploited for selected configuration to yield insights of **human body injuries:** bony fracture occurrences, organ tissue injuries and more.

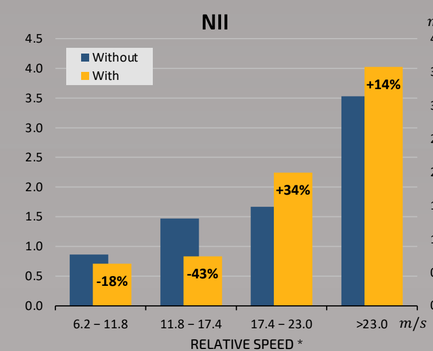
RESULTS

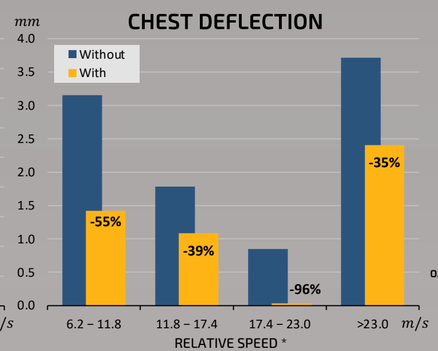
- MULTI-BODY -





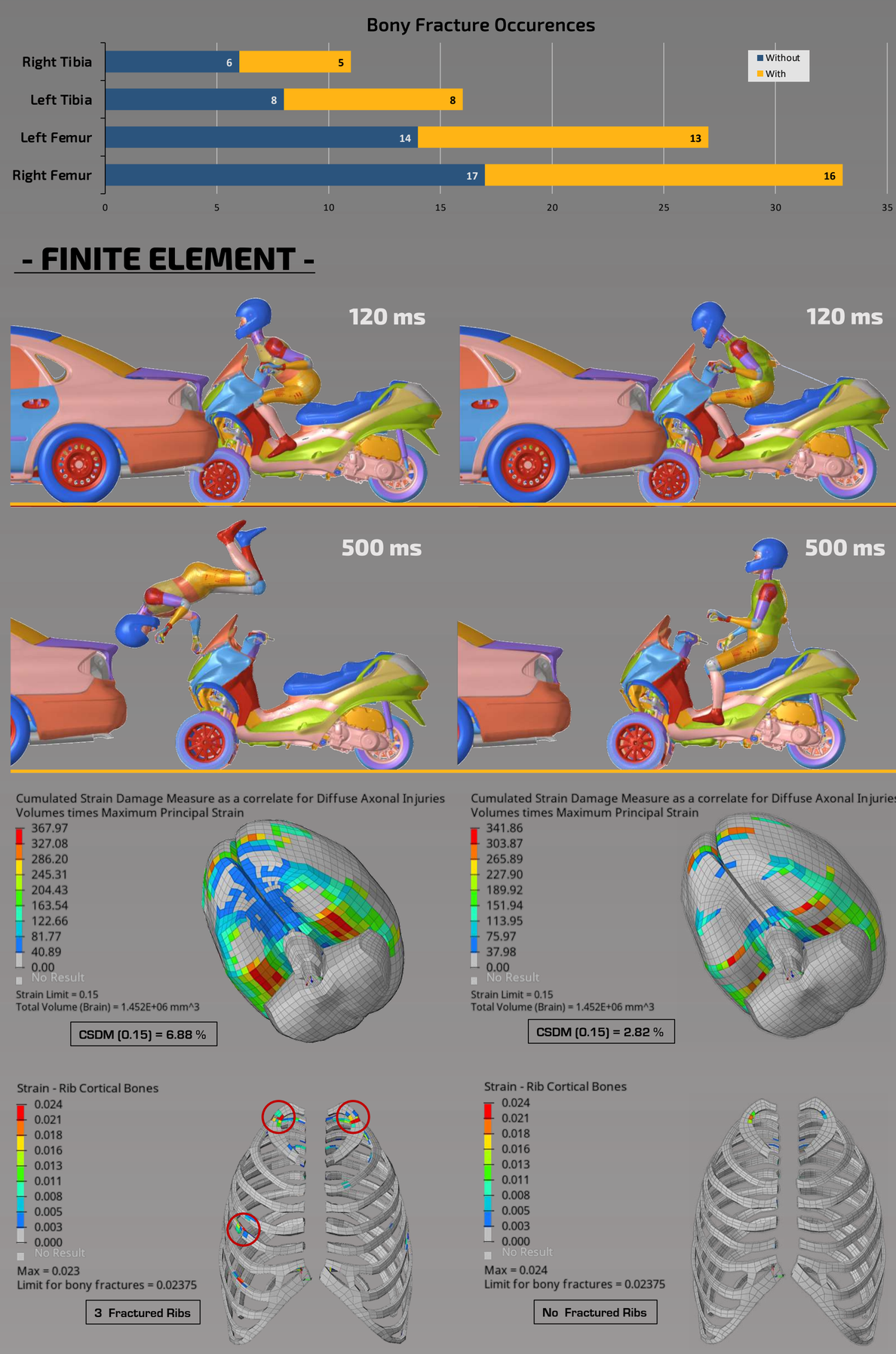






* Ranges of 20 km/h for the *relative speed*, which was found to be the best proxy for crash severity [10]

- FINITE ELEMENT -



CONCLUSIONS

The outlined approach allowed to investigate a concept device, via:

– an overview of its **potential benefits on body regions by biomechanical indexes,** over a large sample of configurations, via MB (Madymo) analysis;
– an in-depth study of its **potential benefits on organs by detailed injury analyses,** over a small sample of configurations, via FEM (Ls-Dyna).

The developed protective device exploited belt knowledge to protect riders. It turned out to be promising, but further steps are needed before drawing conclusions. A sensitivity analysis with **different vehicles** is currently ongoing, while an extensive **risk/benefit analysis will follow up** over broader samples of simulated crashes.

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