Newsletter No. 3

(October 2021)

Safety performance and economic benefits

The main goal of the PIONEERS project is to improve the safety of Powered-Two-Wheelers by providing an integrated approach to rider protection considering on-rider (Personal Protective Equipment) and on-board systems. The implementation of the PIONEERS' main results will contribute to reducing PTW fatalities and injuries by defining test methods to develop protective systems and on-board systems to reduce impact severity.

In order to assess if this major conclusion of the PIONEERS project is being fulfilled and to quantify the benefit, an Impact Evaluation has been developed in this document.

This evaluation concerns both economical and safety benefits (in terms of avoided or mitigated accidents, reduction of morbidity and severity of injuries) of the following proposed PTW safety countermeasures that have been developed in PIONEERS:

• Pre-Crash Braking System (PCB)

• Airbag jacket and the PTW-PPE communication system

• Motorcycle and scooter leg protector

Concerning the **PCB**, the evaluation was obtained via computer simulations of a set of 60 real-world in-depth crashes. The effects were assessed in terms of a reduction of the absolute and relative impact speed of the PTW. A parametric approach in which PCB intervention parameters were varied (field of view, range, deceleration, fade-in jerk, triggering strategy…) was adopted to compute the effects of the system for different conditions. Such approach led to the identification of three combinations of parameters to represent typical system effects assuming a pessimistic (low efficiency), average, and an optimistic approach (high efficiency). Depending on the set of parameters, benefits in terms of speed reduction can go until a median value of 15km/h. Then societal benefits have been calculated in terms of casualties' reduction or crashes using Injury Risk Function and the new relative impact speed distribution. Results show that global benefits for slight, serious or fatal injuries are included between -4% to -31%. Finally, economic benefits in terms of cost were evaluated using the SafetyCube software. Several configurations were considered like the implementation rate of PCB among all motorcycles in Europe, the cost to promote such systems, the horizon, etc. In a 5 years period, this cost will be balanced by savings from health and social expenses, and in a high rate of implementation (with the average evaluation) Europe could save, at least, 30 human lives in this period. With an optimistic configuration, the net value of the benefits could reach between approximately 500k€ until more than 90 M€.

Concerning the **Airbag jackets**, the societal benefits calculation was first based on the establishment of Injury Risk Function for slight, serious and fatal injuries on the trunk without the airbag. In order to establish these IRF, four accident databases and 382 accidents concerned a rider with at least one injury in trunk body region were considered. Then, according to the work performed in others WP's of the Pioneers project, three hypotheses have been considered for the level of protection and the reduction of injuries. They considered that the airbag jacket provides a reduction of an AIS-1 for speed impact lower than 20km/h, respectively 30km/h and 40km/h. Results of the societal evaluation show that between 1,3% until 19% of injuries could be avoided in function of the configuration. From an economical point of view, with a high implementation rate (6%) in the next 5 years, a net value of more than 140M€ could be saved.

Concerning the **Lateral Protectors**, Injury Risk Function of the Lower Leg in lateral impact configuration were first established based on 81 accidents. Then, based on the findings from the lateral protection devices that have been developed in the PIONEERS project (in particular WP3), two hypotheses have been retained for the level of protection of such systems: one considered as a "low-speed" countermeasure (only effective until 15km/h) and one considered as "medium-speed" countermeasure (only effective between 15 to 30km/h). Global societal and economic benefits have been observed but results have to be taken very cautiously. Indeed, the economic evaluation show that an amount of more than 5M€ for the net benefits could be saved with the best configuration. But it is important to remind that these systems are not still available in the market, so these evaluations have to be considered as a theoretical exercise.

In conclusion, this work allowed to evaluate safety and economic benefits of several protective systems: Pre-Crash Braking, airbag jackets, Lateral protectors. But because some of these systems are prototypes and not yet on the market, **all the evaluations have to be taken very carefully**. In particular, results from societal and economical evaluations are sensible and have to be considered cautiously. Beyond these specific evaluations, theoretical methodologies have been defined and could be applied on other systems.