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Can Experienced Riders Benefit from an Autonomous Emergency Braking System?

Giovanni Savino
Facts

• Risks for riders 10-40 times higher than passenger cars (Blackman 2013)

• No braking/poor braking in multi-vehicle crashes (Penumaka 2013)

• Experienced riders far from immune to risk (Harrison 2005)
Automatic braking for PTWs – why in the world?

One of the most effective safety interventions (Grant 2008)

www.pisa-project.eu
What is MAEB?

MAEB stands for Motorcycle Autonomous Emergency Braking

- Obstacle detection unit
- Braking unit
- Electronic control unit
How does MAEB operate?

- Autonomous braking if rider does not brake
- Enhanced braking if rider does brake
- Activated only when collision is physically unavoidable
Can experienced riders benefit from an Autonomous Emergency Braking system?
Method

- Collection of real-world crashes
- Team of reviewers evaluated applicability of MAEB
- Where MAEB applicable, simulations to evaluate quantitative benefits considering:
  - Actual rider behaviour
  - Range of possible rider behaviours including experienced rider
Material  58 in-depth cases

- Single vehicle: 7
- Rear-end/fixed obstacle: 9
- Other scenarios: 11
- Crossing: 31
Material

![Graph showing impact speed vs. MAIS](chart.png)
Material

Experience

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Applicability

• Score 1 to 4

Roll angle > 10°? or no obstacle? NO

Fast crossing obstacle? or PTW into car? or narrow obstacle? or rider tried to swerve? or fast oncoming obstacle? YES

Crossing obstacle? NO

YES

NO

2

3

4
Quantitative estimation of benefits

- Computer simulations, Matlab based
- Simplified, longitudinal dynamics
- Range of possible rider behaviours:
  - No reaction
  - Late reaction, low/high deceleration
  - Early reaction, low/high deceleration
Results

- MAEB potentially applicable in 39 out of 58 cases

- Considering rear-end and crossing cases only (37 cases):
  - 17 cases (46%): no rider reaction
    - 5 out of those 17 cases (30%) were experienced riders
    - In 11 out of those 17 cases (65%) MAEB was applicable
    - 3 experienced riders would have benefitted (speed reduction in the range 4.7 – 11.5 km/h)

16th October 2013
IMSC 2013
Results  actual rider behaviour

- **CFS**
- **CRS**
- **no reaction**
- **braking at triggering** 6 m/s²

**Legend**:
- △ rear end
- ○ crossing

**Axes**:
- **x-axis**: Impact speed (km/h)
- **y-axis**: Absolute speed reduction (m/s)

**Graph Details**:
- Impact speeds range from 0 to 108 km/h.
- Speed reductions range from 0 to 8 m/s.
- The graph shows the relationship between impact speed and speed reduction for different scenarios.

**Data Points**:
- Various data points are plotted to illustrate actual rider behaviour.

**Notation**:
- **IMSC 2013**: 16th October 2013
- **15**: Page number
Results range of rider behaviours

![Graph showing the range of rider behaviours with markers for different reaction times and theoretical reactions.](image-url)
Results

- Rider may have avoided the crash
- Rider may have benefited from MAEB

IMSC 2013 16th October 2013 | 17
Let’s summarize

1. Experienced riders far from immune to risk
2. Automatic braking as a potential help
3. Triggering strategy: automatic braking as last resort solution
4. Results indicate benefits for any rider including experienced riders
Conclusions

With potential collisions – unavoidable for even the most experienced of riders – advanced technical solutions should be considered as potential allies whenever it can be proved that they are able to assist in otherwise unrecoverable riding situations.
Acknowledgements

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Richard Frampton, *Loughborough University, UK*

Jason Thompson, *Monash University, VIC, Australia*

The research leading to these results has received funding from the European Community’s Seventh Framework Programme FP7/2007-2013 under the Grant Agreement n. 328067
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