ROAD INFRASTRUCTURE AND SAFETY OF POWER TWO WHEELERS

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Structure of Presentation

- Power two Wheeler circulation characteristics in Europe
- Critical review of the relation and interaction between Power Two Wheelers (PTW) and infrastructure
- Towards a holistic methodological approach of PTW accident risk
- Conclusions
Power Two Wheelers (PTWs) = mopeds (<50cc) + motorcycles

There are currently an estimated 33 million PTWs in circulation in the EU 27 countries, from small 50cc mopeds to powerful motorcycles.

- These represent about 14% of the entire European private vehicle fleet (cars and PTWs only), but they account for around 17% of the fatalities. PTW use varies across EU.

PTW use is also an international concern.
PTW circulation in EU

- extraordinary growth of the PTW community
  - the number of motorcycles on European roads has (more than) doubled over the last two decades.
  - motorcycle sales are expected to continue to increase over the next decade.

- Motorcycling is no longer a youth phenomenon.
  - people from all classes and professions have taken up motorcycling.
  - today more women are riding motorcycles than ever before.

- PTWs with far lower emissions have penetrated the market in recent years
  - Could become a sustainable form of transport if there is a reduction in crash injuries.
What is the problem?

- PTW accidents are potentially more dangerous when compared to car accidents
- PTW accidents severity constantly increasing
- Infrastructure is rarely focused on this vulnerable category of road users
What have we learnt from literature…
PTW Risk Factors related to Infrastructure

- Roadway design defects
- Insufficient visibility along road sections
- Insufficient or negative crossfall
- Roadside obstacles
- Insufficient road surface condition
Summary of findings concerning risk factors with regards to their influence magnitude and the need for further research.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Interaction</th>
<th>Magnitude</th>
<th>Need for Further Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway design defects</td>
<td>Infrastructure</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Roadway maintenance defects</td>
<td>Infrastructure</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Road surface condition</td>
<td>Infrastructure</td>
<td>High</td>
<td>Mid</td>
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<tr>
<td>Collision with road side barriers in a run-off accident</td>
<td>Infrastructure</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>Critical curve radii</td>
<td>Infrastructure</td>
<td>High</td>
<td>Mid</td>
</tr>
<tr>
<td>“Negative” crossfall</td>
<td>Infrastructure</td>
<td>Mid</td>
<td>Low</td>
</tr>
<tr>
<td>Combined effect of crossfall, gradient and direction of curve</td>
<td>Infrastructure</td>
<td>High</td>
<td>Mid</td>
</tr>
<tr>
<td>Intersections</td>
<td>Infrastructure</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Road markings, manhole covers and cattle guards</td>
<td>Infrastructure</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Collision type</td>
<td>Infrastructure</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Drivers’ Perception of motorcycles</td>
<td>Infrastructure/vehicle</td>
<td>Low</td>
<td>Mid</td>
</tr>
</tbody>
</table>
Literature Remarks

- Literature seems to be fragmented when it comes to identifying prevailing PTW risk factors related to infrastructure
  - some have been systematically treated, whereas others have been either disregarded or poorly treated due to the lack of data.
- Research is mainly focused on statistically analyzing accident records rather than accident configurations.
- Accident configurations could reveal the causalities involved in an accident.
Towards a holistic methodological approach

Research questions

1. What knowledge has already been obtained for each road user?
   → LITERATURE REVIEW

2. What are the most relevant accident configurations at European level?
   → DESCRIPTIVE ANALYSIS

3. Why accidents of those configurations take place?
   → IN-DEPTH ANALYSIS
Findings from Macroscopic Analysis

- Most PTW accidents occur inside urban areas.
- Accident severity is higher outside urban areas.
- Most PTW accidents inside urban areas occur at intersections (angle collisions, lateral collisions).
- Outside urban areas the most frequent accident type is the single vehicle accident (run-off the road).
Findings from Macroscopic Analysis

- Critical factors seem to be curves and descending gradients (Greece)
- Roundabouts have got a high accident figure given the relative frequency of this intersection type (GB)
- Less front to side accidents at roundabouts in comparison to other junction types (Spain)
- Accidents on wet and slippery roads are less severe than on dry roads (Italy)
Findings from Microscopic Analysis

- Methodology
  - In-depth accident data analysis
  - Linkage of crash data, road geometry data and road surface data using special measurement vehicle and software tools
Findings from Microscopic Analysis

- **Risk factors:**
  - Negative sequence of curve radii (especially consecutive curves with very different or with decreasing curve radii)
  - Left curves (especially in sections with descending gradient)
  - Critical curve radii lower than 100m
  - Deficits concerning the longitudinal evenness and the transversal evenness seems to present risk factors for PTW rider
  - Barriers are the most dominant roadside element influencing PTW accident (severity) risk
  - The curvature change rate [gon/km] is higher on unsafe road sections than on safe road sections
Concluding Remarks

- A core problem of identifying significant correlations between road infrastructure parameters and accident information is the lack of relevant data.
- Quality and availability of accident queries that could capture causalities when an accident has already occurred.
  - In-depth studies or specific vehicle-infrastructure-interaction-simulations (VIIS) including the road infrastructure (virtual road generated by measurement data) that could shed light to the factors that cause a PTW accident are very rare.
Concluding Remarks

The synthesis of the preliminary findings from the macroscopic and in-depth studies reveals better the complete size and the characteristics of the road accidents phenomenon.

The use of different accident configurations adds value to the analysis results.
Concluding Remarks

- Exposure disaggregate data (veh-kms etc) are necessary for the identification of accident risk.

- Datasets should be reliable, compatible and comparable across Europe through the use of common collection form.