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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

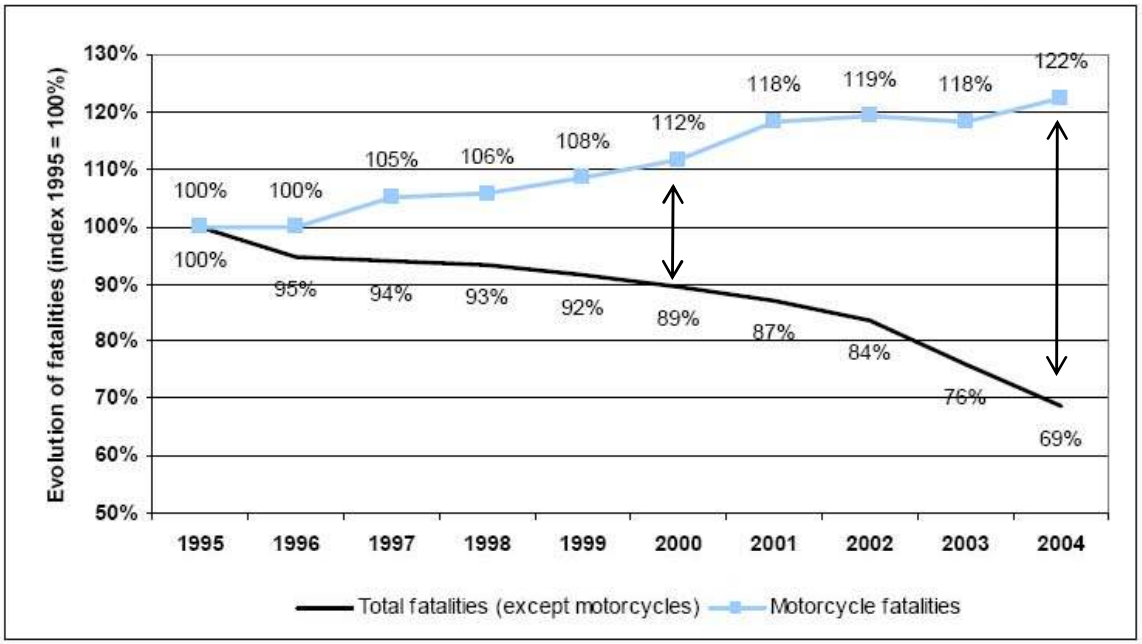
PTW circulation in EU

- 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.

PTW circulation in the EU

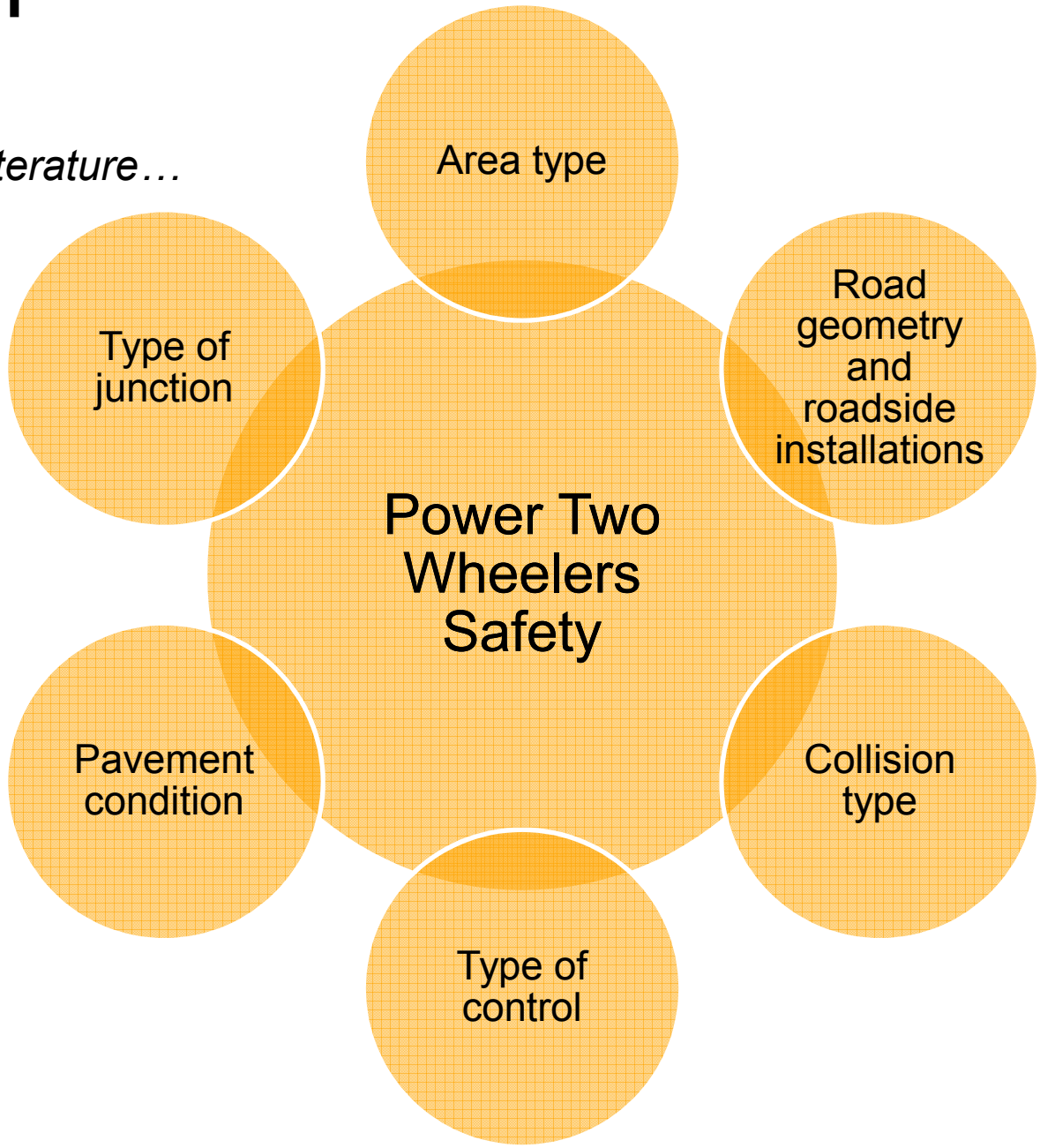


Evolution of total fatalities and of motorcycle in EU-14, 1995 - 2004 (Source: CARE)

- 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

INTERACTION BETWEEN ROAD INFRASTRUCTURE AND PTW SAFETY

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

Literature Remarks

Summary of findings concerning risk factors with regards to their influence magnitude and the need for further research.

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

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.