Contributory factors of powered two wheelers crashes

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Research Framework

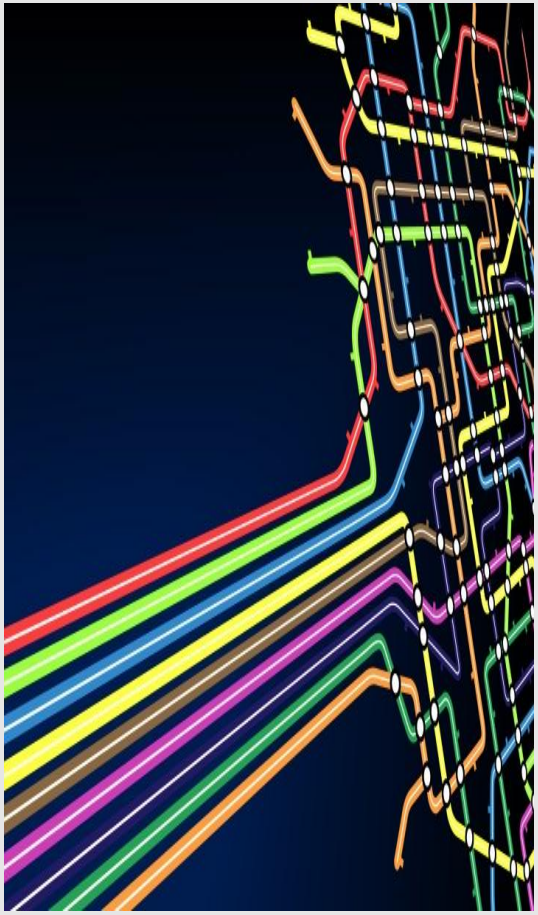
This work was carried out within
the Working Group on
Power Two Wheeler (PTW) Safety and Mobility
of the Joint Transport Research Committee (JTRC)
of the Organisation for Economic Cooperation and Development (OECD) and
the International Transport Forum (ITF),
started in 2011
and expected to conclude within 2013.

Background

- Moped and motorcycle riders have higher risk of getting injured in road traffic than other means of transport.

- Contibutory factors of PTW crashes and injuries:
  - Road user related (age, experience, alcohol, speed, etc.);
  - Infrastructure related (type of road-traffic environment, elements of road design, etc.);
  - Vehicle related (power to weight ratio, etc.).

- Usage of personal safety equipment (e.g. helmets, protective clothing) is important for the injury risk of PTWs.



Objective

- Discussion on contributory factors to PTWs crashes.
- Literature review for the quantified impact of various factors on PTW crash and injury risk.
- Emphasis on the association of risk factors.
- Focus on developed countries, not on “PTW – dependent” countries.

PTW – Driver related Factors in fatal crashes

Table 1. Driver-Related Factors in Fatal Crashes of Motorcycles versus Other Vehicles in the US, 2004-2008.

Driver-Related Factor	Percentage of Fatal Motorcycle Crashes	Percentage of Fatal Non-motorcycle Crashes
Driving too fast for conditions or in excess of posted speed limit	37.1	29.5
Failure to keep in proper lane	25.7	41.5
Under influence of alcohol, drugs, or medication	15.3	18.9
Inattentive/careless	8.4	9.8
Operating vehicle in erratic, reckless, careless, or negligent manner or at erratic or suddenly changing speeds	6.4	5.8
Non-moving traffic violation	3.5	2.4
Failure to obey traffic actual signs, traffic control devices or traffic officers, failure to observe safety zone traffic laws	2.9	5.0
Making improper turn	2.5	3.9
Operator inexperience	2.5	0.8
Failure to yield right of way	2.1	8.0
Over correcting	1.7	7.9
Following improperly	1.5	0.8
Driver has not complied with physical or other imposed restrictions	1.5	0.5
Passing with insufficient distance or inadequate visibility or failing to yield to overtaking vehicle	1.4	0.8
Improper or erratic lane changing	1.3	1.1
Avoiding, swerving, or sliding due to live animals in road	1.3	0.4
Operating without required equipment	1.2	1.5
Driving on wrong side of road (intentionally or unintentionally)	0.9	1.8
High-speed chase with police in pursuit	0.9	0.7
Passing where prohibited by signs, pavement markings, hill or curve, or school bus warning not to pass	0.8	0.4

Note: Each driver-related factor refers to the driver of a vehicle with at least one fatality injured occupant, and each such vehicle is counted as a fatal crash. The top 20 driver-related factors cited in fatal motorcycle crashes are listed. Some crashes involved two or more driver-related factors. Source: National Highway Traffic Safety Administration Fatality Analysis Reporting System, 2004-2008.

- The most prevalent behaviours in fatal crashes are the excessive speed and failure to keep in proper lane (responsible for 3 out of 5 fatal crashes).

PTW – Driver related Factors in fatal crashes

Excessive and inappropriate speed

- Responsible for around 2/3 of single vehicle fatal crashes.
- Young riders is the most vulnerable group concerning the speed risk.
- Tendency of power vehicles to go faster leads to more severe crashes.
- Motorcyclists ride at higher speeds than cars and PTW crashes occur at higher speed than cars.

PTW – Driver related Factors in fatal crashes

Non respect of traffic rules (other than speed)

- Increased flexibility leads to inappropriate manoeuvers (e.g. overtaking)
- Manoeuvers (overtaking in front of curves/at intersections, filtering) are the most common type for PTW - traffic rules violation.
- Correlation with other characteristics (e.g. age, experience, etc.).

Impaired riding: alcohol, drugs and fatigue

- Increased risk of fatal crashes when under the influence of alcohol.
- Interaction for PTW – alcohol crashes with younger riders, speeding, at night time, during the weekend.
- Amplification of drugs effect for PTWs.

PTW – Driver related Factors in fatal crashes

Gender, age and experience

- Gender:
  - Factors for risk variation (risk taking, natural fragility, travel purposes, choice of vehicle, etc.).
  - Men are more prone to traffic crashes (impulsive behaviour).
- Age:
  - Increased risk for young motorcyclists (lack of experience, risky behaviour).
  - Increased risk for riders above 60 years old (decreased ability, difficulties in complex situations).

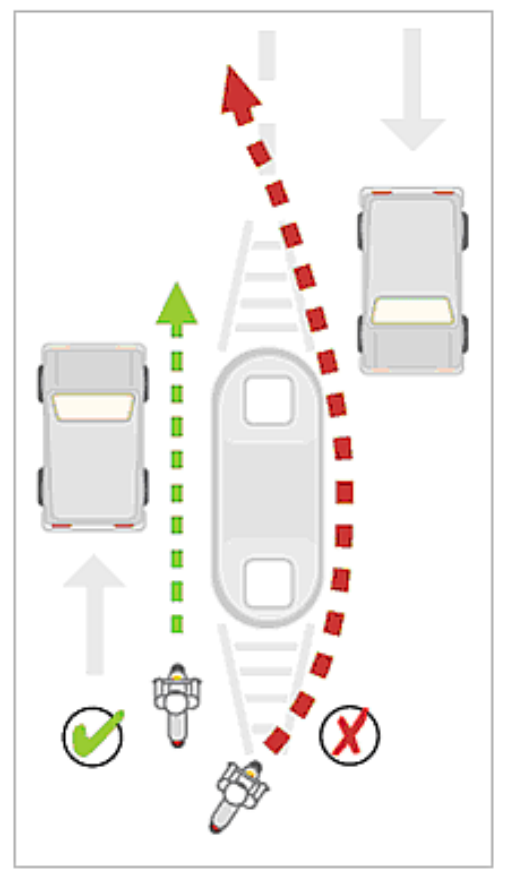
PTW – Driver related Factors in fatal crashes

Personal protective equipment

- Usage of helmet reduce accident severity.
- Common non-helmet use by young males (reckless driving behaviour).

Atypical behaviour

- PTWs riders may surprise other road users (“atypical behaviour”).
- Includes all the manoeuvers - overtaking within a small space/on the right, filtering, intense accelerations, etc.



Perception and Awareness

- 60% of car drivers involved in a crash with a PTW meet a detection problem.

Typical situations of perception problems vis-a-vis PTW

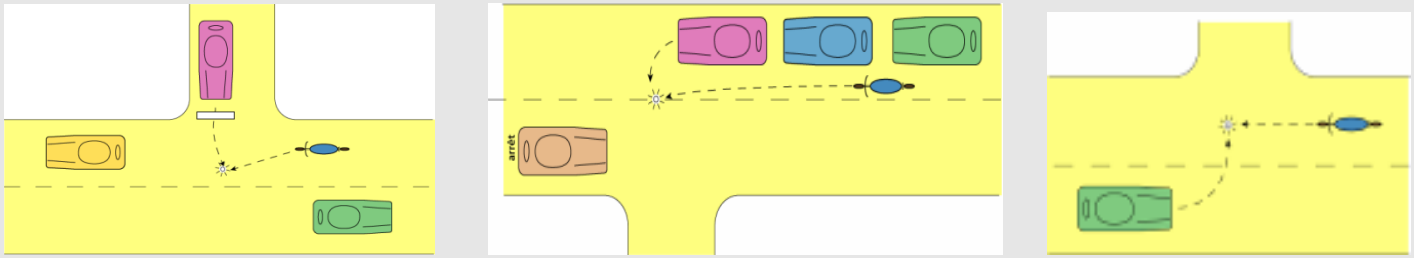


Figure 1: Typical situations of detection problems (Guyot et al., 2008)

- "Looked-but-failed-to-see" crashes or "motorcycle conspicuity-related crashes".
- High level of severity crashes.

Perception and Awareness

PTW perception and its role in traffic crashes

- Weaknesses of the human visual perceptive system in driving environment (motorcycles have different shape, behaviour).
- Small size of motorcycle
- Environmental impairments on visibility (PTW is easily hidden by an object).
- Role of PTW rider behaviour (blind angle of cars, speeding, unpredictable behaviour).
- Difficulties with appraisal – evaluation and decision (size – arrival effect).

The Road Environment

- Limited contribution (primary cause for only 7,7% of all PTW accidents).

Road Design

- Influence the interaction of road users with the roadway.
- Horizontal/ vertical curves, junctions (higher severity of PTW accident than other road users), roadside design, road restraint systems/barriers, joints, traffic calming measures.

Pavement Condition

- High sensitivity of PTWs to roadway conditions.
- Road surface defects , aquaplaning.

The Road Environment

Road Maintenance

- Defects must be detected in a timely manner.
- Maintenance operations may represent an additional risk.

Weather Conditions

- Weather is a minor contributory factor of PTW accidents compared to other factors.
- Contributory factor in less than 10% of PTW road accidents.

The Vehicle

- Vehicle related factors are responsible for less than 2% of PTWs crashes.
- More likely with mopeds.

Vehicle age

- PTWs' risk decreace with motorcycle age.

Association of PTW Risk Factors

- Risky behaviours are often correlated.
- Combination of younger age, less experience, risky behaviour and “unsafe” attitudes is a potential risk factor.
- Riders under the influence of alcohol have more risk of speeding and not wearing a helmet.
- Several combinations of factors including nighttime is associated with PTW – pedestrian crashes.

Conclusions

- Driver and rider – related behaviour factors are more prevalent in PTW accidents, compared to vehicle and road environment factors.
- Vehicle – related factors are minor PTW road accident contributory factors.
- Road design – environment factors influence accident severity rather than occurence.
- Inappropriate speeding and manoeuvering are the most common contributory factors.
- Interaction with other road users and PTW conspicuity are critical factors.

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