International Transport Forum | CPB Corporate Partnership Board

irtad International Traffic Safety Data and Analysis Group

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ITF report on the safety of Micromobility

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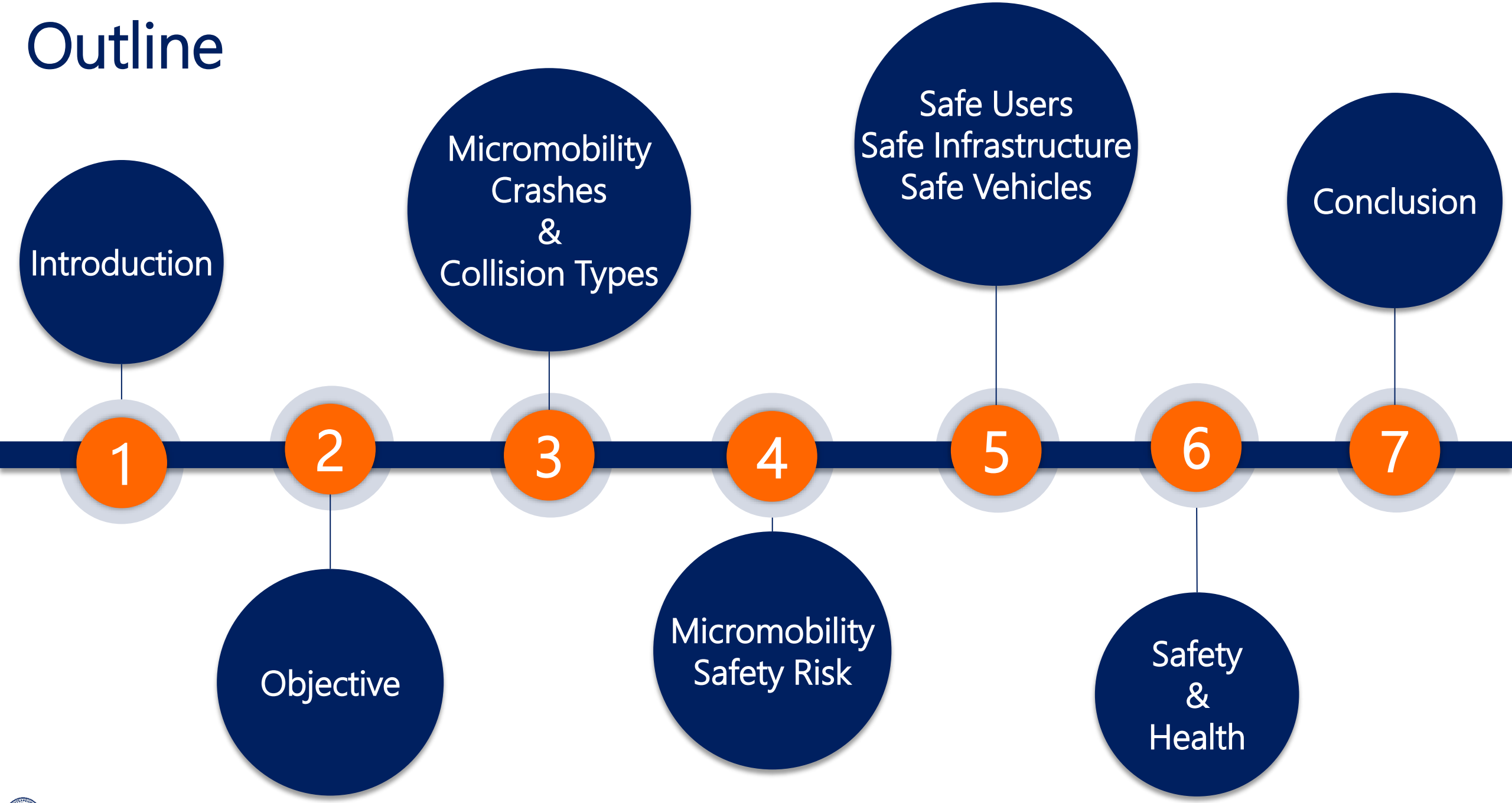
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Introduction

- The introduction of Micromobility (MM) services such as electrically assisted scooters (e-scooters) and cycles (e-bikes) in many cities is leading to significant changes in urban transportation daily, bringing new and pressing challenges for policymakers at the national level

- Simultaneously, there is widespread public concern about the increase in reports of MM crashes

- In 2020, the ITF published the report titled "Safe Micromobility" assessing the safety of MM and new mobility services

- However, in the three years since publication, much has changed in terms of the evidence base (especially for safety) and changes in technology and operations

Objective

The objective of this report is to comprehensively analyze and synthesize the most recent and key MM safety trends and risks & to formulate safety recommendations for both Authorities and Micromobility Operators

- These recommendations are led by the Safe System Approach and seek to contribute to the improvement of safety standards and mitigate risks associated with MM ecosystem considering users, infrastructure and vehicles

- This report aims to shed light to the following aspects:
  - Crash and injury trends
  - MM safety risk
  - Risk factors related to Vehicles, Users and Infrastructure
  - Findings and usability of surrogate safety data
  - Under-reporting

Methodology

- This report focuses on the safety impact of MM devices and specifically on e-scooters and e-bikes
- Both shared and owned e-scooters and e-bikes are considered and throughout the analysis there is an effort to differentiate between them
- To investigate key MM safety trends and risks an extensive review of the scientific and "grey" literature was conducted.
  - Findings at the **international level** were summarized and synthesized
  - **95 relevant studies** were identified and considered appropriate for this review
  - Most of e-scooter studies is based on the **2018-2020 data**
  - Resources on e-bikes are dated from **2007 to 2022**
- A questionnaire was crafted and completed by a select group of 5 MM Operators, arranged in alphabetical order:

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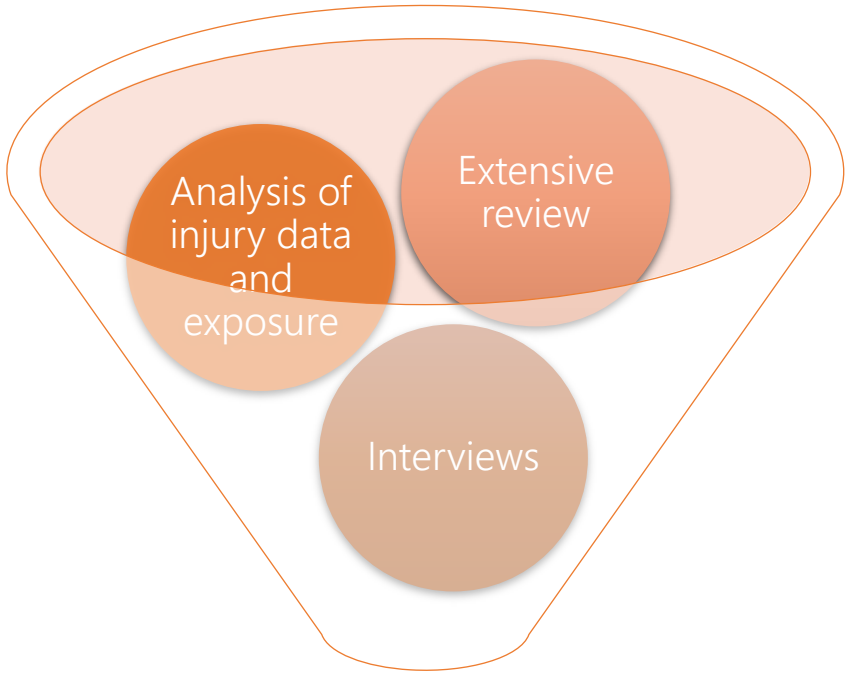
  - to gather comprehensive insights into the safety aspects encompassing both the physical features and the digital facets of MM vehicles
  - to identify challenges and lessons-learned



Micromobility

Risk factors

Safety Recommendations

Micromobility Crashes

Through the synthesis of the literature, it is evident that when a crash involves an e-scooter then:

- It is quite rare not to have an injury
- Most of the times it results in a minor injury (e.g., scratch)
- Injuries mostly affect the upper body and the head
- Fatalities correspond to 9% of reported injuries

For shared e-scooters:

- Incidents with personal damage: 85% of all incidents
- Incidents that required medical treatment: 15%
- Fatalities: 1%

For bikes and e-bikes:

- Crash and injury data as well as exposure data for bikes are much more abundant and reliable compared to e-scooter data
- E-bike crashes most of the times result in a minor injury
- E-bike crashes are in general equally severe as conventional bike crashe

Collision Types

- In their majority e-scooter reported injuries are due to single-user crashes
- Single-user e-scooter injuries mostly involve the rider and secondly, pedestrians who either are hit by a moving e-scooter or they trip over one
- Falls specifically account for a significant number of e-scooters and bikes crashes and injuries
- While MM vehicles and motor vehicle collisions account for a relatively small portion of injuries, they are mostly responsible for MM riders' fatalities

Micromobility Safety Risk

- Several sources such as sales of MM modes, travel demand data, survey data indicate that there is an increasing trend in MM
- As the demand for shared e-scooters grows alongside injuries requiring medical attention, the e-scooter safety risk has diminished across various markets
- The average injury risk on shared e-scooters in Europe is lower than on e-bikes by 32%
- Safety regulations vary significantly across markets reflecting the evolving nature of e-scooter as MM mode
- In markets where a reduction in e-scooter casualty risk is observed, several common regulatory measures stand out as potential contributors like the enforcement of minimum age for riders and the imposition of maximum design speed limits

Safe Users

For both bicycles and e-scooters the following behavioral factors have been associated with injuries and crashes:

- Speeding: Speeding has been found as a **risk factor for e-scooter** injuries (~30%)
- Riding under the influence of alcohol/drugs
- Helmet use: a small percentage of all injured **e-scooterists and cyclists** wore a helmet
- Double riding: Double riding affects the **kinematic energy** during the collision
- Visibility: both e-scooter and (e-)bike crashes occur during low visibility conditions
- User experience: The more a person uses MM the more her/his skills and safety regarding that mode improve

Safe Infrastructure

- Safe and convenient cycling infrastructure can attract road users to MM
- Riding a bike on cycling infrastructure instead of the road improves cyclist safety
- Safety is further improved when (a) cycling infrastructure is physically separated, (b) is connected and easy to navigate, (c) exists on both segments and intersections, & (d) driving speeds are reduced in the case of shared/ non-physically separated infrastructure
- The pavement quality of the cycling infrastructure is important too as poor quality has been found associated with single-road user crashes – particularly for e-scooters
- Cycling infrastructure and parking infrastructure are important for pedestrian safety & comfort, too

Safe Vehicles (1/2)

The following design features of MM modes have been found to positively affect MM safety: max design speed limit, larger wheels and tires, brakes, back and front lights, bells.

- Larger e-scooter wheels are vital for safety, mitigating the risk of falls and head injuries, especially on uneven surfaces and considering the higher and more forward center of gravity of e-scooter riders compared to seated bike users
- Air-chambered wheels have been found to confer more stability than solid rubber or honeycomb ones
- Braking system diversity in MM vehicles necessitates a universal model for safe operation, emphasizing the need for clarity
- E-scooters require longer braking distances compared to bikes, impacting their safety in emergency situations but excel in steering maneuvers

Safe Vehicles (2/2)

- **Visibility and audibility** are paramount for MM vehicle safety, emphasizing the importance of robust lighting standards and auditory signaling devices

- **Weight** influences stability, with heavier e-scooters demonstrating improved stability, highlighting the need to balance weight and performance for a safer ride

- The **fulcrum effect** of the steering mast, which operates differently from the front wheel/fork/handlebar's assembly of bicycles, plays a pivotal role in the dynamics of front-wheel obstacle crashes, thereby influencing the injury patterns observed in standing e-scooter riders versus cyclists.

Safety and Health

- The relationship between cycling and public health is straight-forward; the same cannot be said for the other MM modes for which public health benefits and impacts depend on the broader setting
- Safety is in most cases deteriorated (for the riders)
- Pedestrian safety is likely to be negatively affected
- E-assisted modes have the potential to improve local air quality & noise levels → physical & mental health benefits
- With the exemption of e-bikes, they are unlikely to improve physical activity
- Depending on the context and the operation MM might affect (positively or negatively): stress levels for the riders, drivers, and pedestrians, congestion levels, air pollution, accessibility

Safe System and Public Health

- The Safe System Approach principles have the potential to eliminate the externalities of MM and improve public health
- Some limited evidence from studies that have assessed the overall effect of combined measures (e.g., safe vehicles, safe infrastructure, safety campaigns) indicates that Safe Systems Approach policies can be effective for MM
- In terms of data, it was found that the use of surrogate safety metrics (e.g., metrics to assess speeding, compliance, helmet use, interactions between road users etc.) can support the understanding of crash/injury occurrence mechanisms

Preliminary Conclusions

- MM safety results are not black and white; they depend on infrastructure, riding and diving behavior, vehicle design, traffic volumes & speed and safety culture
- There are various safety risk factors primarily associated with e-scooters and cycling
- Even though MM crashes attract publicity, they consist of a very low percentage of the overall crashes inside and outside cities
- Most of MM crashes are single-vehicle but of low severity; whereas collisions with motor-vehicles lead to higher severity
- The type and mechanism of MM collisions in addition to the identified risk factors suggest that many collisions are preventable once appropriate actions are taken by Authorities and Operators

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