E-scooters
Sustainability or Safety?

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E-scooters quickly diffused since they represent a sustainable solution to the "last-mile" problem.

A significant number of accidents occurred due to road space sharing between vehicles with different speeds and masses.
E-scooters’ diffusion in Italy

**SHARED E-SCOOTERS**

Number of e-scooters

- **2019:** 4650
- **2020:** 35500 (+29%)
- **2021:** 45900 (+663%)

**PRIVATE E-SCOOTERS**

- **Increase in sales in e-mobility industry between 2019 and 2020:** +140%

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*Growth from Knowledge*
Accidents involving micromobility vehicles

N° of crashes - Italy

<table>
<thead>
<tr>
<th>Year</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crashes</td>
<td>5374</td>
<td>5148</td>
<td>6898</td>
<td>7042</td>
</tr>
</tbody>
</table>

Covid pandemic + 28% + 31%

N° of crashes - Milan

<table>
<thead>
<tr>
<th>Year</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crashes</td>
<td>992</td>
<td>1,018</td>
<td>1,803</td>
<td>1,701</td>
</tr>
</tbody>
</table>

Covid pandemic + 82% + 71%
Results from a case study in Milan
Objectives and Methods

1. Citizens’ Perception of E-Scooters
   - Questionnaire to a sample of Italian respondents

2. E-Scooter Users’ Behaviour in Milan (Italy)
   - On-site surveys in the city of Milan

3. E-Scooters – Pavement Interaction
   - Field tests using an on-board accelerometer


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1. Citizens’ perception of e-scooters

Do you consider e-scooters dangerous for other road users?

<table>
<thead>
<tr>
<th>USERS</th>
<th>NON-USERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>1%</td>
</tr>
<tr>
<td>27%</td>
<td>12%</td>
</tr>
<tr>
<td>37%</td>
<td>32%</td>
</tr>
<tr>
<td>22%</td>
<td>20%</td>
</tr>
<tr>
<td>4%</td>
<td>35%</td>
</tr>
</tbody>
</table>

- Not dangerous at all
- Low risk
- Medium risk
- High risk
- Extremely dangerous

Users show significant risk awareness
Non-users perceive higher risk

Safety perception of users in relation to different circulation zones

- Roads with speed limit > 30 km/h: 89% Low, 6% Medium, 5% High
- Zone 30: 27% Low, 22% Medium, 51% High
- Sidewalk: 32% Low, 31% Medium, 37% High
- Cycle path: 4% Low, 16% Medium, 80% High

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2. Users’ behaviour in Milan (Italy)

Selection of circulation zone

- **ROAD WITH CYCLE PATH**
  - 8% Vehicle lane
  - 13% Sidewalk
  - 79% Cycle path

- **ROAD WITHOUT CYCLE PATH**
  - 17% Vehicle lane
  - 83% Sidewalk

Strong preference for the cycle path
Driving on the sidewalk is forbidden!

Use of helmet

- **SHARED E-SCOOTERS**
  - 3% With helmet
  - 97% Without helmet

- **PRIVATE E-SCOOTERS**
  - 17% With helmet
  - 83% Without helmet

It is more likely that private users wear the helmet

BUT over 18 it is not compulsory!

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2. Users’ behaviour in Milan (Italy)

Carriage of object/passenger

- With object/passenger: 45%
- Without object/passenger: 55%

Prohibited behaviour!
Reducing speed on stone pavements has major beneficial effects.
What’s next
E-scooters: vulnerable or dangerous?

Both, depending on the road user they interact with.
E-scooters and inter-modality

Safety concerns related to fire risk.
Driving simulators

Driving simulation to analyse the interaction between motor vehicles and light mobility vehicles.
Geofencing techniques

Easily applied to shared vehicles to reduce speed or prohibit transit. Extremely difficult to be applied to private vehicles.
Conclusions

Rules are widely disregarded. The **NUMBER PLATE** is an essential element in ensuring that the rules are observed.

Head impact is an extremely risky condition for e-scooter riders. **HELMETS** should be mandatory regardless of driver age.

**SPEED** is a crucial aspect for driving stability. It should be adjusted according to pavement and weather conditions.

The sharing of road space between e-scooters and other vehicles is dangerous. **INFRASTRUCTURE** should be adapted to new needs.
Thank you for your attention