MOVEWISE

Micromobility Optimization through Vehicle, Environment & Wellbeing-centred Integrated Safety Engagement

What we are looking for?

In order to meaningfully advance our proposal we are looking for high-profile partners covering the following expertise:

Public sector: Magdeburg, Valencia (requested) + one Eastern EU city for piloting and co-creation.

Social sciences: Sociologists, disability NGOs, gender/age mobility experts for inclusive design.

Design & technology: UX/interface designers, and planning consultancies for co-developing safe, sensor-equipped vehicles and infrastructure.

Industry & policy: Insurance partners (risk modelling) and a standardisation body (KPIs, taxonomy).

Stress sensing: Experts in biometric monitoring and wearable stress data integration for field deployment.

1. Motivation & policy context

Micromobility, including cycling and e-scooters, has rapidly expanded in European cities, enhancing urban mobility and sustainability. Despite these benefits, vulnerable road users (VRUs) still represent over 40% of EU road fatalities. Particularly concerning is a 20% rise in severe injuries from e-scooter incidents, despite reduced injury rates per kilometre travelled (Micro-Mobility for Europe). Addressing these challenges, the Horizon Europe call HORIZON-CL5-2026-01-D6-13 aims specifically at enhancing safety for pedestrians, cyclist, and users of electrically assisted small vehicles and other micromobility devices and users (MMUs).

Current EU-level accident data reveals significant data and knowledge gaps at the EU that currently prevent effective safety assessments and interventions:

- **Mode differentiation gap**: CARE/Eurostat collapse e-bikes, e-scooters & mopeds into "other two-wheelers," preventing mode-specific risk analysis.
- **Exposure data gap**: No systematic data on usage intensity, distances, fleet sizes or user counts from private/sharing operators.
- **Reporting inconsistency gap**: Non-harmonized definitions for injury severity, vehicle classes and accident causes across member states.
- **Infrastructure/context gap**: Missing harmonized data on cycle-path quality, intersection layout, lighting, and pavement condition.
- **Behavioural data gap**: Lack of indicators for risk perception, rider awareness, and social norm adherence that drive safety-critical decisions.

MOVEWISE addresses these gaps through a stepwise framework:

1) Close the data gaps through novel sensing and data integration tools;
2) Develop and integrate structural and technological solutions
3) Evaluate the road safety impact of these solutions in large-scale field pilots;
4) Derive EU-level KPIs, reporting standards, and policy guidance.

2. Research objectives

MOVEWISE follows an integrated, impact-oriented structure that builds on and extends past EU projects (e.g., AsPeCSS, PROSPECT, XCYCLE, InDeV):

1) Close the data gaps through novel sensing and data integration tools

Address missing exposure, behavioral, and infrastructure-related data by generating harmonized, high-resolution, multi-source micromobility safety data.

Methodology:

- **Multimodal sensor integration:** Equip e-scooters and e-bikes with cost-efficient embedded sensors (e.g., GNSS, gyroscope, IMU, camera) and biometric stress trackers (e.g., wristband sensors) to capture evasive manoeuvres, sudden braking, and stress reactions in risky contexts.
- **Mobile infrastructure sensing:** Develop safety and stress heatmaps by fusing sensor and smartphone camera data with MMU2X communication to identify high-risk zones, poor infrastructure, or environmental hazards.
- **Exposure and usage data:** Colaborate with fleet operators and public authorities to to access anonymized usage data and harmonize GNSS trajectory data, usage patterns, and fleet characteristics (owned vs. shared, personal vs. delivery).
- **Behavioural data collection**: Helmet usage will be detected via AI-based image classification using smartphone or vehicle-mounted cameras, optionally confirmed by user input.
    - Rule compliance (e.g., riding direction, red-light adherence) will be inferred by comparing GNSS traces with local traffic regulations and infrastructure.
    - Smartphone distraction will be captured via screen activity logs (opt-in).
    - Risk perception and subjective safety will be measured using in-app micro-surveys and gamified feedback, asking users to rate perceived safety or tag hazards in real-time.
    - These inputs will be combined with biometric stress signals to validate and weight reported perceptions.
- **Data fusion and harmonization:** Integrate crash, exposure, behavioural, and contextual infrastructure data into a common EU-wide taxonomy and open data framework.
- **User and technology acceptance:** Implement a structural evaluation of user acceptance, usability, and privacy perceptions of the sensing technologies. Findings will inform iterative design improvements and support long-term integration across cities and operators.

2) Developing technical and structural innovations for improving road safety fur MMUs

Demonstrate and validate the effectiveness of technological and infrastructure interventions to improve micromobility safety.

Methodology:

- **Technological modules for micromobility devices**: Develop and implement advanced safety features such as turn-assist technology and V2X collision-warning modules for e-scooters/e-bikes, plus road-condition monitoring via embedded sensors and stress biometrics.
- **Infrastructure co-creation:** Partner with municipalities (e.g., Magdeburg, Valencia, EasyPath-NL) to co-design and implement safety-enhancing infrastructure such as protected bike lanes, geo-fenced parking and slow zones, smart adaptive signage
- **Integration phase:** Practical integration of the developed innovations on the test sites and test micromobility devices. Initial tests to ensure the functionality in preparation of the large scale demonstration
- **Evaluation:** Use mixed-method approach to assess impact (e.g. before-after comparisons, behavioural logs, spatial risk clustering, and rider interviews).

3) Evaluate these innovations in large-scale field pilots
Demonstrate and validate the effectiveness of technological and infrastructure interventions to improve micromobility safety.
Methodology: - **Technological modules for micromobility devices**: Develop and implement advanced safety features such as turn-assist technology and V2X collision-warning modules for e-scooters/e-bikes, plus road-condition monitoring via embedded sensors and stress biometrics. - **Infrastructure co-creation:** Partner with municipalities (e.g., Magdeburg, Valencia, EasyPath-NL) to co-design and implement safety-enhancing infrastructure such as protected bike lanes, geo-fenced parking and slow zones, smart adaptive signage - **Setup of living labs:** Conduct **demonstrations** in three diverse urban contexts (Western/Eastern European cities, mixed modal shares); **100+ micromobility users** participate per city over multiple months; **measure** behavioral adaptation, safety outcomes, and acceptance. - **Technical evaluation:** Use mixed-method approach to assess impact (e.g. before-after comparisons, behavioral logs, spatial risk clustering, and rider interviews). - **User and technology acceptance:** We will conduct a structured evaluation of the gathered data to analyse patterns in user behaviour, acceptance, and interaction with the solutions. The aim is to derive insights that support continuous improvement and long-term integration of technology.

4) Derive EU-level KPIs, reporting standards, and policy guidance
Translate pilot insights into harmonized, scalable instruments for safety governance at EU and city level.
Methodology: - **EU-level data model:** Define a harmonized micromobility-specific crash classification, injury severity scale, and exposure taxonomy, building on CARE and Eurostat but extending for new modes (e-scooters, e-bikes, delivery). - **Behavioral KPIs:** Define and validate indicators (e.g., helmet use rates, compliance behavior, incident precursors, stress levels). - **SUMP integration toolkit:** Develop city-friendly dashboards and simulation modules (e.g., what-if scenarios based on exposure-adjusted risk maps); provide easy-to-apply procedures for local authorities to integrate micromobility safety into planning tools and SUMPs. - **Policy guidelines:** Develop recommendations for accident reporting (bottom-up improvement), V2X integration, and micromobility data sharing with cities.