Strong reduction of crash frequency and severity in the EU (CARE Database, 2007-2016):

- Less 17% of injury crashes;
- Less 41% of fatalities;
- Supported by strong investments in infrastructure, enforcement, education, and vehicle safety.

  - Human errors are still the main cause of 75% of road crashes and are involved in some way in 90% of crashes;
  - The “Vision Zero” target heavily relies on fully automated road transport.

Main challenges for automated vehicles (AV’s):

- Safe and intuitive driver-vehicle interaction;
- Compliance with driver’s behavioural intentions;
- Safe interaction with other road users;
- Legislation / liability issues;
- Public acceptance / market penetration.
Análise da Exploração de Redes Urbanas de Transporte Ferroviário - O Caso do Metro do Porto

**RESEARCH WORKFLOW**

- **SIESTA (2017-2018)**
  - Driver inattention and drowsiness during non-automated driving
  - Based on the number of alerts and driver/journey characteristics
  - Heuristic study (data provided by HealthyRoad)

- **AWAREE (2018-2019)**
  - Detailed driver/journey characterization
  - Monitoring of driver biometric parameters
  - Full control of experiments (driving simulator)

- **AUTODRIVING (2019-2021)**
  - Driver-vehicle interaction during automated driving

**THE AUTODRIVING PROJECT: OVERVIEW**

**STAGE 1: EVALUATION OF DRIVERS’ EXPECTATIONS ON AV TECHNOLOGY**

- Survey with 500+ participants with driving license:
  - Socio-demographic characteristics
    - Gender / age
    - Place of residence
    - Education
    - Professional safety / income
    - Tech-savviness
  - Perceptions on AV safety and operation
    - Trust on different L2+ configurations
    - Preferred driving modes
    - Compliance with behavioural intentions
    - Ease of use
    - Provision of manual override

- Define the requirements / use cases of AV technology for different groups of drivers.

- Assess current levels of acceptance of AV’s.

- Design of baseline scenarios for the next stage.

**STAGE 2: DRIVING SIMULATOR STUDY OF DRIVER-VEHICLE INTERACTION**

- 50+ drivers of representative groups.
- L2-L3 simulation settings – focus on safety:
  - Analyze the impacts of inattention and mental workload during takeover events;
  - Test different visual/audio alerts to minimize takeover times and maximize drivers’ awareness;
  - Analyze the contribution of roadside or in-vehicle information about changing road conditions.
AN INCREMENTAL APPROACH TO STUDY DRIVER-VEHICLE INTERACTION IN THE CONTEXT OF PROGRESSIVE AUTOMATION

STAGE 2: DRIVING SIMULATOR STUDY OF DRIVER-VEHICLE INTERACTION

- L4-L5 simulation settings with manual override – focus on behavioural intentions:
  - Analyze drivers’ perceived safety and comfort by testing tolerance limits of dynamic driving (e.g., speed, acceleration/deceleration rate, following distance and lateral clearance);
  - Test situations of moral dilemma in pre-crash scenarios.

STAGE 2: STUDY OF DRIVER-VEHICLE INTERACTION

- Driving simulator existing at CITTA/FEUP (DriS).
- Driver monitoring equipment (e.g., ambulatory ECG/EKG, eye tracking, head and face monitoring, skin conductor).
- Questionnaires regarding driver characteristics, personality traits, and state of mind.

ANALYSIS OF SURVEY AND EXPERIMENTAL DATA

STAGE 3: DATA ANALYSIS AND RECOMMENDATIONS FOR AV TECHNOLOGY DEVELOPMENT

- Comprehensive mapping of the risk factors and requirements for L2+ AV’s from the driver’s perspective
- Recommendations for the design of collaborative AV technology, including takeover alert systems tailored to different driver profiles
- Validation through a new survey
- Evaluation of the impacts on public acceptance

CLOSING REMARKS

- Main expected impacts:
  - Promote the development of new, collaborative, and safe concepts of ADAS and HMI that comply with the requirements of different groups of drivers;
  - Increase the societal acceptance and market adoption of AV’s;
  - Promote social inclusion through technology;
  - Contribute to the “Vision Zero” strategy.
- Main limitations:
  - Interaction between vehicles and other road users;
  - Development of prototypes.
ACKNOWLEDGEMENT

The AUTODRIVING project is funded by Portuguese Foundation for Science and Technology (grant agreement no. POCI-01-0145-FEDER-028526).

Thank you for your attention!