



This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101119590. The opinions expressed in this document reflect only the authors' view and in no way reflect the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.



IVORY Project: towards responsible AI for Vision Zero in Road Safety

Eleonora Papadimitriou, Project Coordinator

Delft University of Technology, Faculty of Technology, Policy & Management



JOINING THE DOTS...
Road SafetyGB

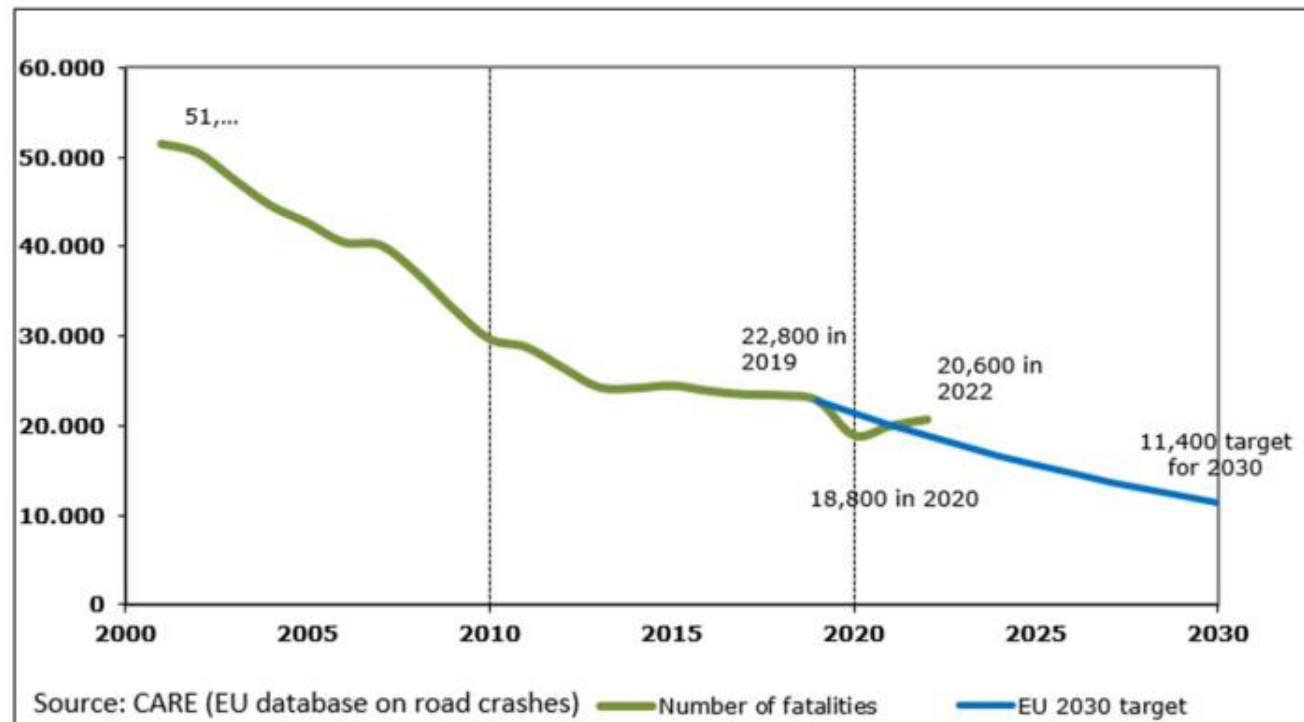
Background

- ❖ **IVORY – ‘AI for Vision Zero in Road Safety**
- ❖ A Marie Skłodowska-Curie action of Horizon Europe 2023
- ❖ A Doctoral Network
 - Industrial doctorates (min.50% of PhD time spent in industry)
 - 15 Doctoral Candidates (DCs)
 - 1st November 2023 – 30th October 2027
- ❖ Aims of the programme:
 - Make innovative research: **Interdisciplinary – Intersectoral – International**
 - Promote international mobility of academics
 - Train highly skilled researchers to take leadership for addressing the future challenges

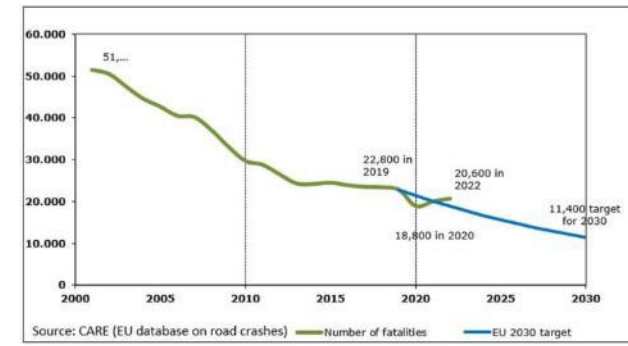


The Vision of IVORY

- ❖ The Vision Zero strategy of the EC is the new road safety paradigm; however, the efforts to improve road safety have plateaued in many countries.



The Vision of IVORY



- ❖ AI and its capabilities create opportunities for new ways of addressing this persistent global epidemic. However, AI is relatively underdeveloped in road safety:
 - Gaps between engineering, technology & society
 - Unequal opportunities for many countries around the globe
 - A ‘silos’ effect between sectors (academia, industry and policy) and disciplines involving AI (engineering, data science and ethics of technology),

IVORY’s ambition is to unlock the full potential of AI for road safety, so that new opportunities for global road safety impact can emerge.

Is AI (still) important for road safety?

- Let's ask the AI!



What additional research is needed for AI in road safety? (10 lines)



There are several areas in road safety where additional research is crucial for advancing AI technologies. Firstly, enhancing the accuracy and reliability of AI algorithms, especially in complex and dynamic traffic situations, requires continuous research and development. Investigating ways to minimize biases within AI systems is essential to ensure fairness and equity in road safety applications. Research into human-AI interaction is vital to design user-friendly interfaces and **driver assistance systems that promote safe driving behaviors.**



- ...or better not??



© 1996 Randy Glasbergen. E-mail: randy@glasbergen.com www.glasbergen.com





Safety Science

Volume 167, November 2023, 106244



The risks of using ChatGPT to obtain common safety-related information and advice

Oscar Oviedo-Trespalacios ^a  , Amy E Peden ^b, Thomas Cole-Hunter ^c, Arianna Costantini ^d, Milad Haghani ^e, J.E. Rod ^f, Sage Kelly ^g, Helma Torkamaan ^h, Amina Tariq ⁱ, James David Albert Newton ^j, Timothy Gallagher ^k, Steffen Steinert ^a, Ashleigh J. Filtness ^l, Genserik Reniers ^{a m}

Research Goals - Objectives

- ❖ **RG1.** To develop responsible, fair and impactful AI for road safety (WP4)
- ❖ **RG2.** To develop new ways of supporting road users and human-vehicle-environment interaction by means of AI (WP5)
- ❖ **RG3.** To develop new scalable and equitable AI technologies for proactive infrastructure safety management (WP 6)
- ❖ **RG4.** To create a sustainable learning, knowledge sharing and networking framework on AI for road safety.

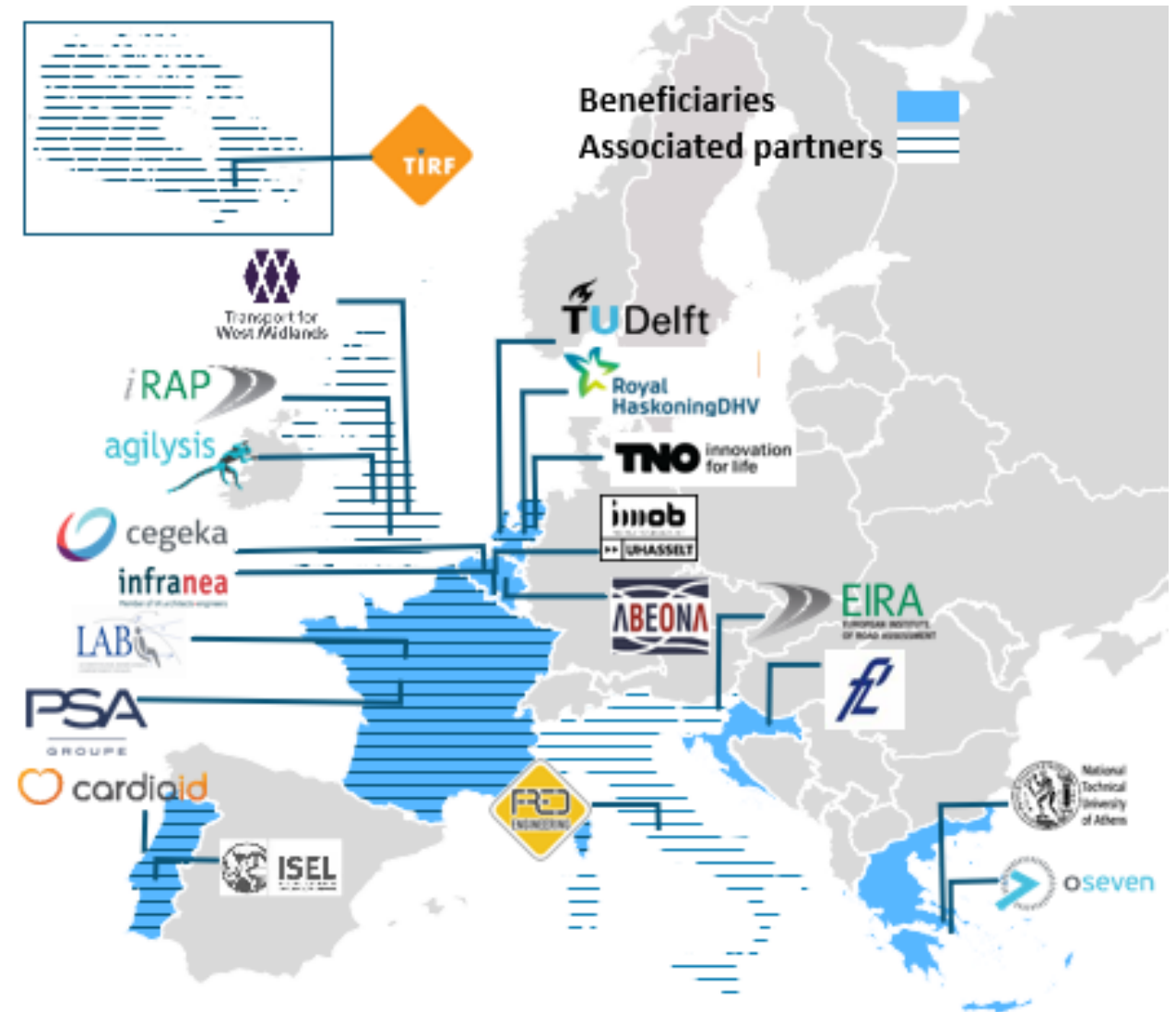
How to make it happen?

- ❖ The AI cannot do the thinking for us
- ❖ The AI does not know *how* to be 'responsible' (fair, private,)
- ❖ AI without steering can result in bias
- ❖ The AI can only learn from existing data, lacks the critical thinking and inspiration needed for making a 'breakthrough'

IVORY has the opportunity to develop new knowledge and expertise on AI for road safety, and use it in a meaningful and context-sensitive way

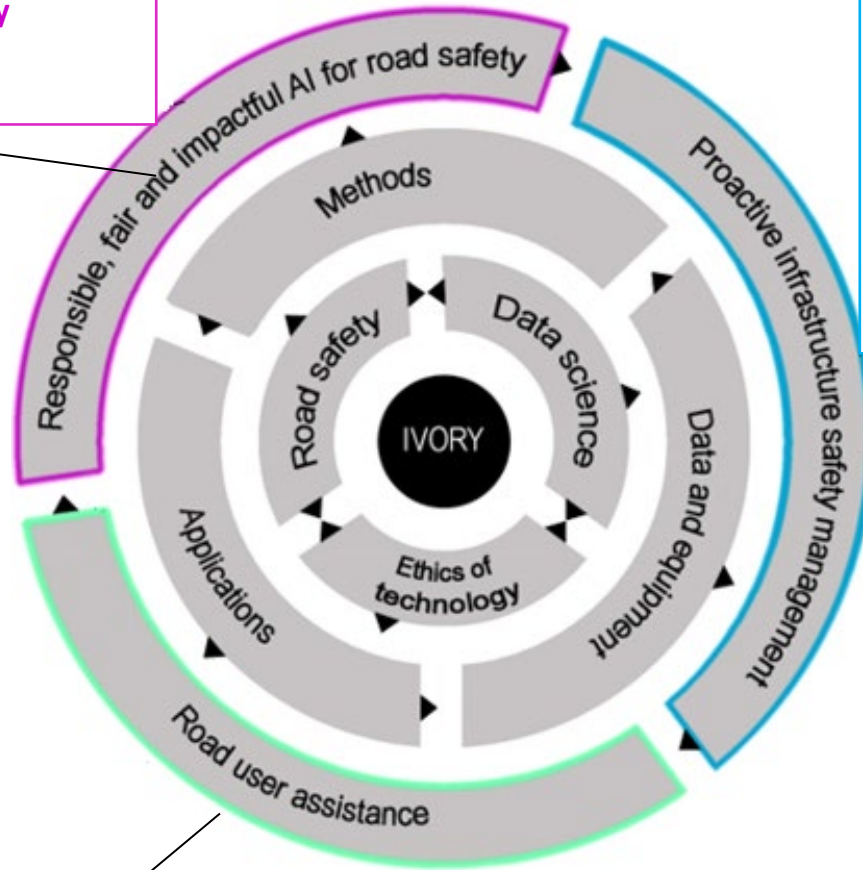
Our consortium

- ❖ 4 Universities
- ❖ 8 non-academic partners
- ❖ 13 Associated Partners
- ❖ 10 countries
 - Research Institutes
 - Engineering & IT firms
 - SMEs
 - International NGOs
 - Vehicle Industry



IVORY concept & PhD topics

- #1: Fairness / justice in AI for road safety
- #2: Explainable AI for road safety
- #3: AI for road safety in LMIC



- #8: Risk mapping
- #9: Road safety prediction from micro to macro levels
- #10: Self-learning safe routes
- #11: Proactive safety detection
- #12: Harmonization and hybrid application of AI datasets
- #13: AI-Aided BIM-Based Design for Road Infrastructure
- #15: AI Chat models for advising road authorities on VRU safety improvements

- #4: Driver Profiling using naturalistic data
- #5: Human factors at different levels of automation
- #6: Learning from the whole spectrum of driver behaviour
- #7: Data fusion for holistic driver assistance
- #14: Road safety prediction on the basis of ethically sound physiological measurements



Methodology & data

Data

- Literature
- Crash data
- Weather data
- Road attributes (iRAP, SLAIN, Vida)
- Aerial videos
- Naturalistic driving data (UDRIVE, iDreams)
- Driver telematics (OSEVEN)
- Conflict video data (UH, CARDIO)
- Urban routing (ABEONA)
- Automated vehicles routing (Infra4SV)

Disciplines

Ethics
Road safety
Data science

Type of research

Theoretical
Methodological
Technological

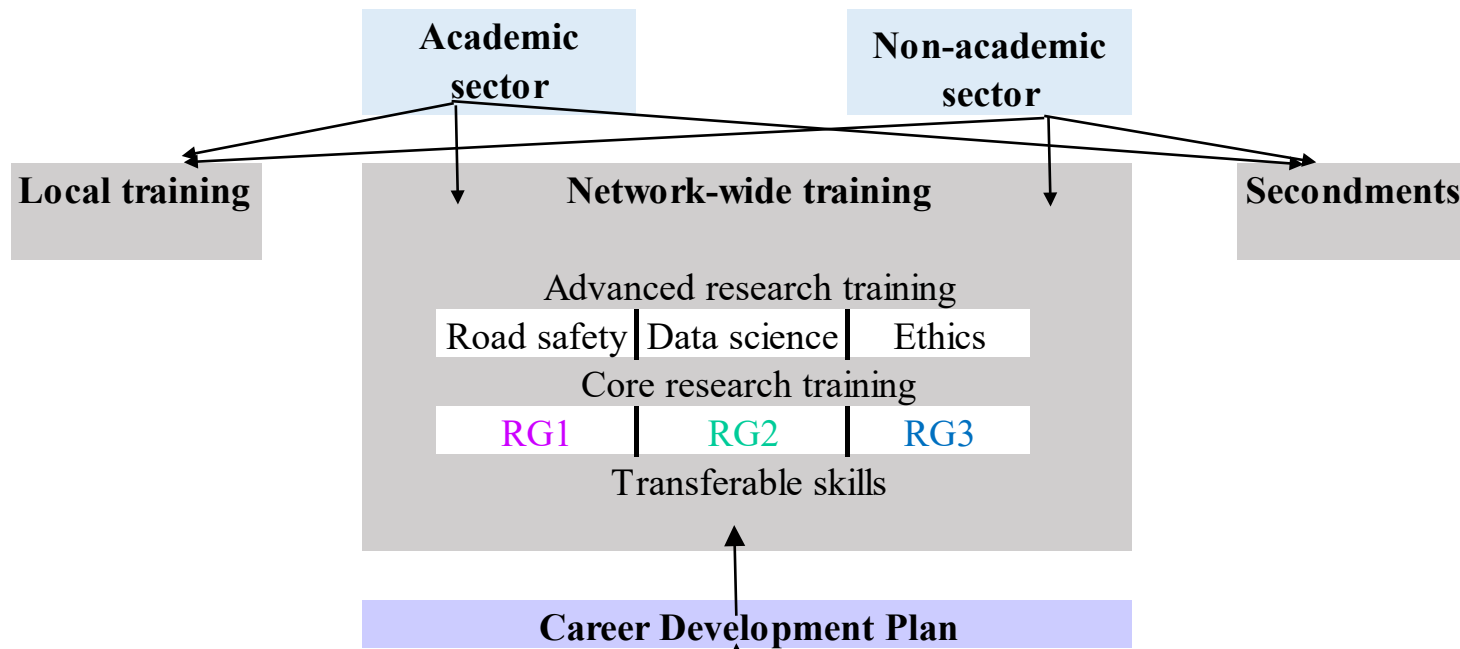
Methods

- Ethical research
- Validation & re-calibration
 - Econometric models
 - Neural networks
- Support Vector Machines
 - ML imputation
 - Image processing
- Dynamic Structural Equation Models
 - Bayesian Networks
 - BIM modelling
- Reinforcement Learning
- Natural Language Processing

Application areas

- ✓ Road safety ecosystem
 - ✓ LMICs
 - ✓ VRUs
 - ✓ Women
 - ✓ Children
- ✓ Professional Drivers
- ✓ Road infrastructure
- ✓ SAE 1,2,3+

Training & supervision



Supervisors



Prof. F. van Gelder
TUDelft



Dr. K. Maheshwari
TUDelft



Dr. E. Papadimitriou
TUDelft



Dr. A.P. Afghari
TUDelft



Prof. Dr. Ir. B. Tasbi
TUDelft



O. Ovideo
Trespalacios
TUDelft



Prof. G. Yannis
NTUA



Prof. E. Vlahoglanni
NTUA



Dr. A. Ziaopoulos
NTUA



Prof. T. Brijs
UHasselt



Prof. A. Pirdevani
UHasselt



Prof. G. Wets
UHasselt



Dr. E. Polders
UHasselt



Prof. W. ECTORs
UHasselt



Prof. T. BELLEMANs
UHasselt



Dr. M. Ševrovič
FPZ



Dr. M. Božanić
FPZ



Dario Babić
FPZ



J. Bradford
IRAP



M. Olyslagers
IRAP



R. Owen
Aglysis



Dr. B. Buffat
LAB



Dr. P. Fortsakis
OSeven



Dr. T. Jacobs
Cegoka



K. Casler
Cegoka



Dr. A. Lourenço
Cardioid



P. Morsink
RHDHV



N. Princ
RHDHV



M. van der Linde
RHDHV



Dr. D. Janssens
Abeona






Impact: Expected outputs

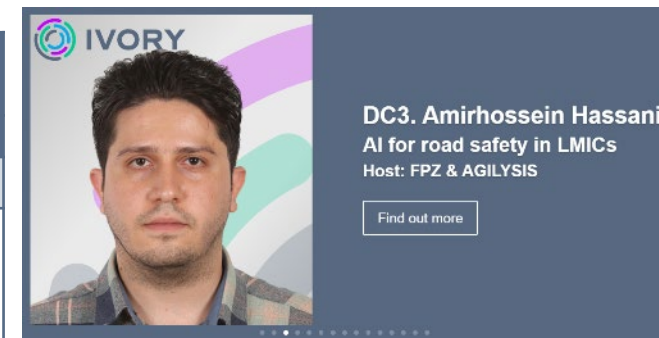
The final outputs of IVORY will be:

- I. **15 highly skilled researchers** meeting industry and policy stakeholders' needs;
- II. **an online learning and networking platform on AI for road safety**, including open, interdisciplinary and interactive training material, as well as a 'social network' of researchers;
- III. **new applications of AI for road safety**, including data protocols and cutting-edge analytical models, scalable and applicable to key risk factors and use cases; and
- IV. **recommendations** / taxonomies for designing responsible, equitable and efficient AI for road safety and its application for road user support and infrastructure safety management.



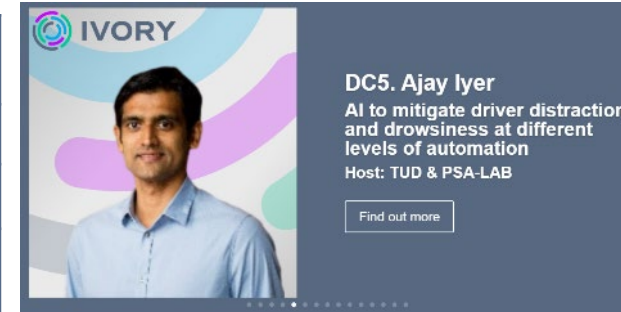
PhD projects on the spotlight (1/3)

Fellow	Host institution(s)	
DC 3		  
AI for road safety in LMICs		
Objectives: <ul style="list-style-type: none"> Define a framework for exploiting available data sources and adapting existing road survey databases (e.g., SLAIN) in LMICs Perform AI-supported knowledge discovery in databases utilising extraction of implicit, previously unknown, and potentially useful information from data collected for other purposes Facilitate transport modelling with AI deep learning to establish predictive crash models to support transport infrastructure investment decisions in LMIC on road networks where traditional data is non-existing or unreliable 		
Expected results: <ul style="list-style-type: none"> Identification and classification of potential structured and unstructured big data sources for the development of road safety performance assessments and predictive crash modelling Innovative and cost-effective data acquisition, processing and analysis methods to support road safety management in LMIC A taxonomy of data, methods and tools tailored for AI road safety support to less resourced countries 		
Planned secondment(s): <ul style="list-style-type: none"> EIRA-SI 		







PhD projects on the spotlight (2/3)

Fellow	Host institutions	TU Delft	PSA GROUPE	LAB
DC 5				
AI to mitigate driver distraction and drowsiness at different levels of automation				
<p>Objectives:</p> <ul style="list-style-type: none"> To understand factors contributing to driver distraction and drowsiness in different levels of automation (e.g., ADAS, maintaining driver's readiness in SAE level 2 vs levels 0 & 1) To develop AI-based models to detect, monitor and predict the precursors of distraction and drowsiness among drivers To understand the relationship between distraction/drowsiness and other risky driving behaviours such as speeding, short headways, delayed reaction time etc. 				
<p>Expected results:</p> <ul style="list-style-type: none"> A list of factors as precursors (or predictors) of drowsiness and distraction Analytical models for predicting distraction and drowsiness and their impact on road safety Recommendations about distraction and drowsiness in the presence of technology, AI, and automation 				
Planned secondment(s): LAB (FR)				



PhD projects on the spotlight (3/3)

Fellow DC 8	Host institution(s)  National Technical University of Athens  iRAP  FRED ENGINEERING  oseven
Proactive risk mapping and infrastructure safety management	
Objectives: <ul style="list-style-type: none"> To create an AI framework to process, harmonise, analyse and model an array of different available datasets and provide outputs in the form of risk mapping and network-level evaluations To develop new AI algorithms for road attribute collection, along with methodologies to assess and quantify their accuracies, suitable for network applications and including hybrid, e.g., manually collected data To use the AI-augmented dataset creation effort for a suitable working methodology for the generation of hybrid road attribute data and enhanced proactive risk mapping 	
Expected results: <ul style="list-style-type: none"> A functional framework with the use of AI to exploit road risk information in a meaningful manner, transferable between networks Assessment and quantification of the influence of each examined factor on the output of AI algorithms for safety management A case study with actionable results, compatible with the mission and activities of IRAP 	
Planned secondment(s): <ul style="list-style-type: none"> OSEVEN - GR FRED-IT 	



Progress and next steps

- ❖ 15 PhD students recruited
 - 830 applications, >150 interviews
 - Start dates: from August 1st to November 1st
- ❖ Setting up an on-line Learning Management System
- ❖ Data Management Plans and sharing protocols
 - 3 years of research and innovation to come!





Thank you!

Eleonora Papadimitriou, TU Delft

Contact: e.papadimitriou@tudelft.nl

For more information: <https://ivory-network.eu/>



This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101119590. The opinions expressed in this document reflect only the authors' view and in no way reflect the European Commission's opinions. The European Commission is not responsible for any use that may be made of the information it contains.

