XCYCLE's innovative measures to increase cycling safety:

Infrastructure and human factors

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22-23 November 2018, Manchester

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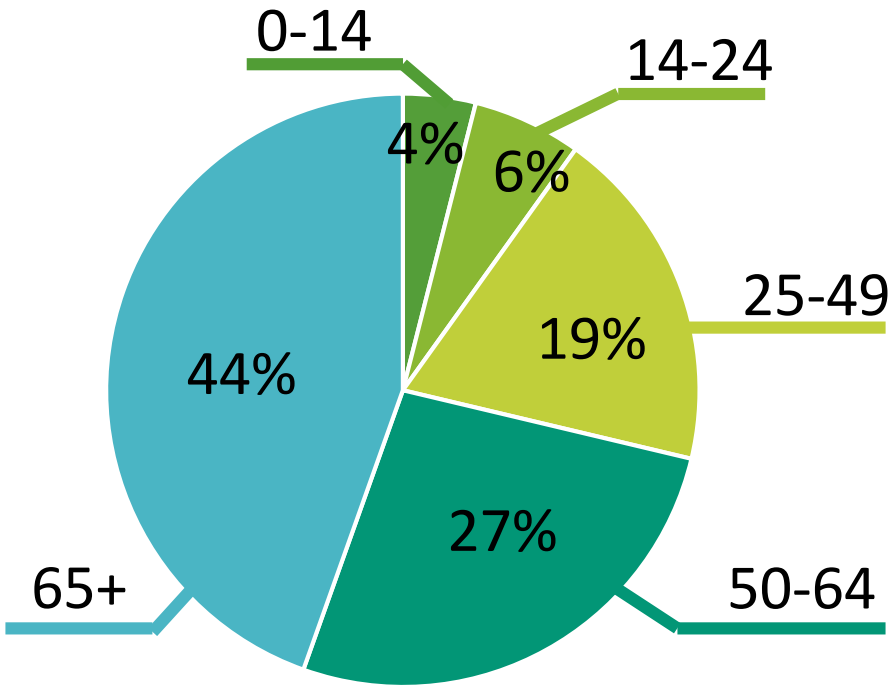
Outline

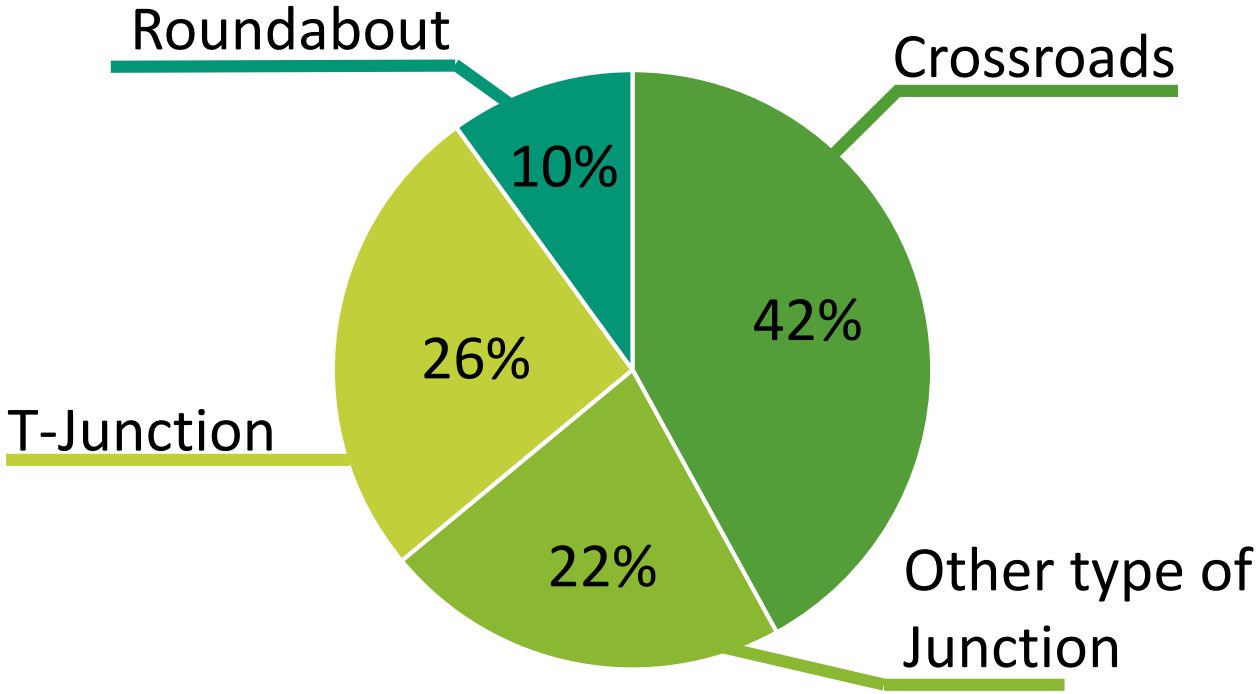
- Cyclists fatalities in Europe
- The **XCYCLE** project
- **XCYCLE** results
- Conclusions and open issues

Cyclists' fatalities in Europe

- **2.015 cyclists fatalities** on EU roads in 2016 (+0,3% in respect to 2015)
- 58% inside **urban areas**
- 20% **F** and 80% **M**



28% of all bicycle fatalities happens at **junctions**



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XCYCLE:

Advanced measures to reduce cyclists' fatalities and increase their comfort in the interaction with motorised vehicles

U.K.

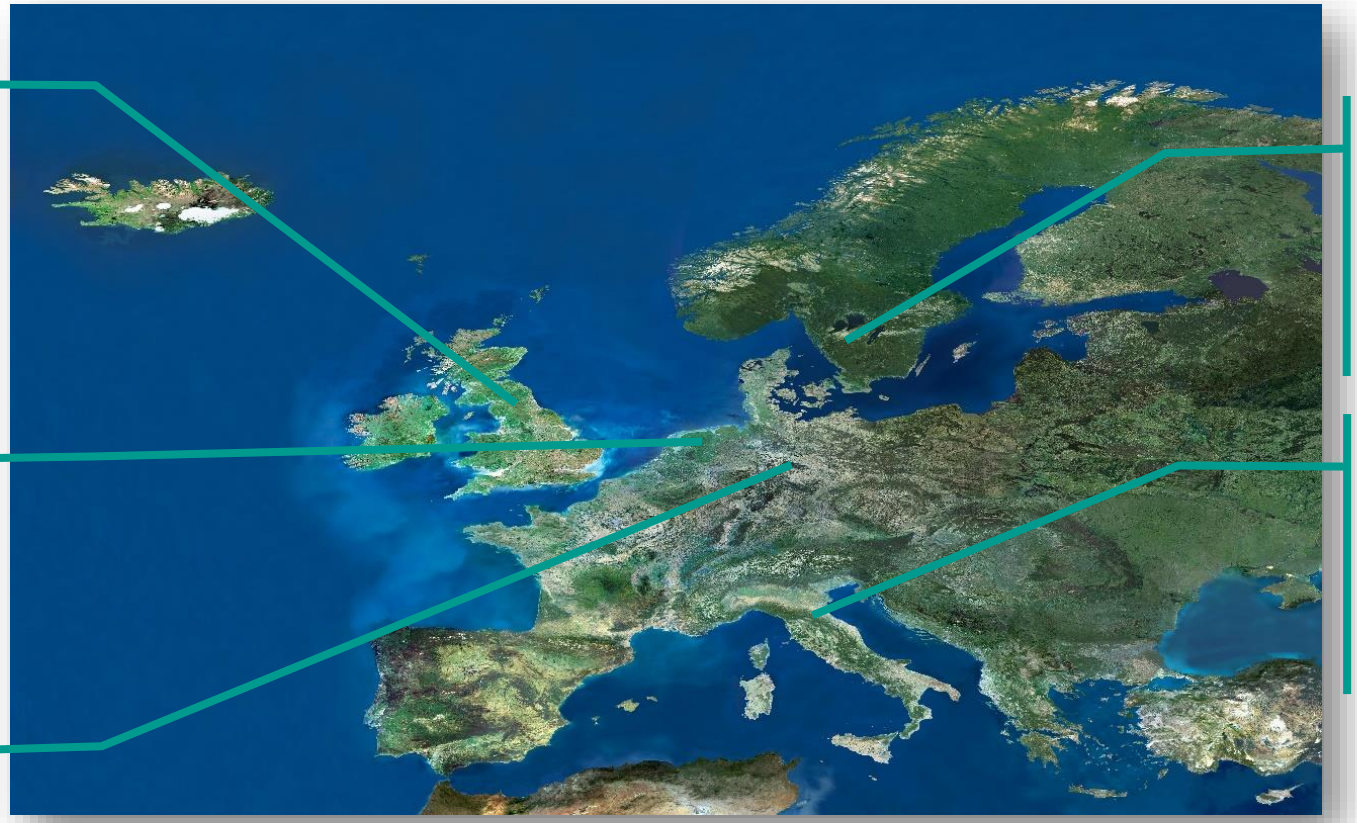
UNIVERSITY OF LEEDS
Institute for Transport Studies (ITS)

The Netherlands

dynniq
energising mobility

Germany

DLR
JENOPTIK



Sweden

vti
VOLVO

Italy

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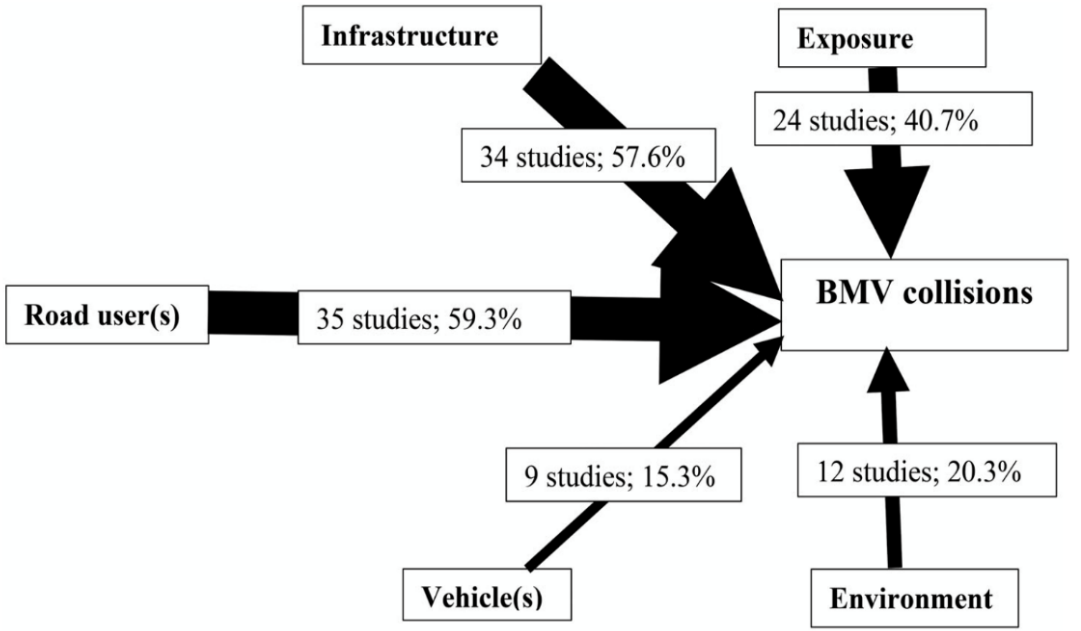
KITE SOLUTIONS

This project has received funding from the [European Union's Horizon 2020 research and innovation programme under grant agreement No 723970

#1: Traffic safety analysis

- Analysed **main factors contributing to Bicycle-Motorised Vehicle (B-MV) collisions.**
- Identified **key features of cyclist crashes** using latent class analysis and association rule mining (data on B-MV crashes from 10 European Countries)
- Employed decision tree technique to assess the relationship between **severity of bicycle crashes** and specific factors



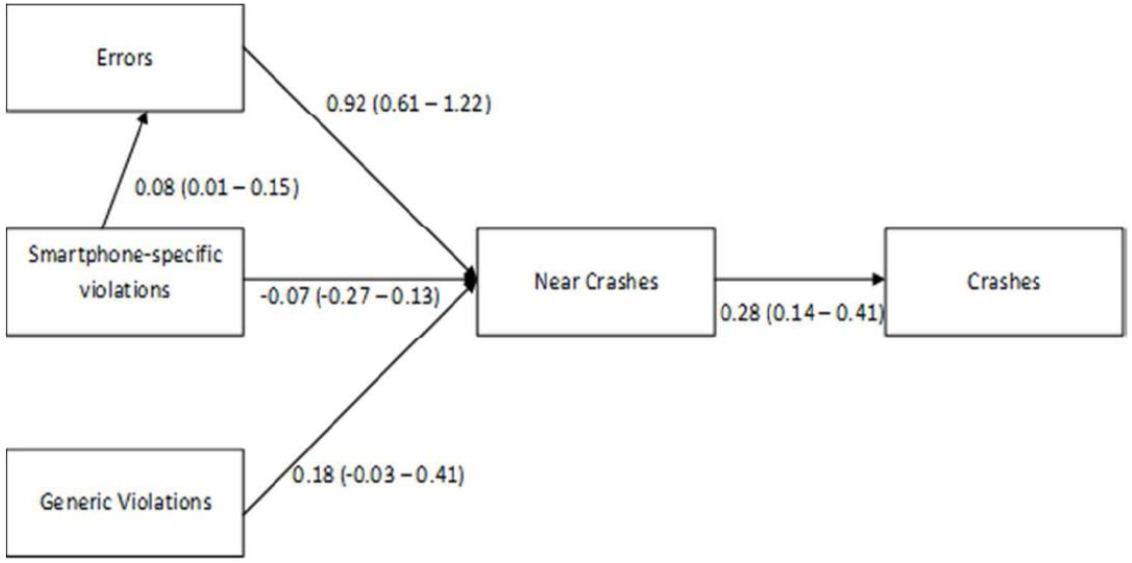
Prati, G., Marín Puchades, V., De Angelis, M., Fraboni, F., & Pietrantoni, L. (2017). Factors contributing to bicycle–motorised vehicle collisions: a systematic literature review. *Transport Reviews*, 1-25

Prati, G., De Angelis, M., Puchades, V. M., Fraboni, F., & Pietrantoni, L. (2017). Characteristics of cyclist crashes in Italy using latent class analysis and association rule mining. *PLoS one*, 12(2), e0171484.

Prati, G., Pietrantoni, L., & Fraboni, F. (2017). Using data mining techniques to predict the severity of bicycle crashes. *Accident Analysis & Prevention*, *101*, 44-54.

#2: Road users' behaviour analysis

- Analysed **errors and violations** among cyclists and how traffic **infrastructures** might reduce unsafe behaviours
- The role of **perceived competence**, **risk perception**, **unsafe behaviours** and **cyclists' anger** in cycling near misses
- How **journey attributes** and the **evaluation of motorists' behavior** affect crash occurrence and severity



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Marín Puchades, V., Prati, G., Rondinella, G., De Angelis, M., Fassina, F., Fraboni, F., & Pietrantoni, L. (2017). Cyclists' Anger As Determinant of Near Misses Involving Different Road Users. Frontiers in psychology, 8, 2203.

#3: HMI and acceptance of ITS

- A **driving simulator** in Leeds has been programmed with common cycle-to-truck conflict scenarios.
- A set of **HMI recommendations** has been derived covering both visual and acoustic aspects.
- We identified **major determinants of acceptance** of PCDS + EBR and On-bike collision warning system with prototypes

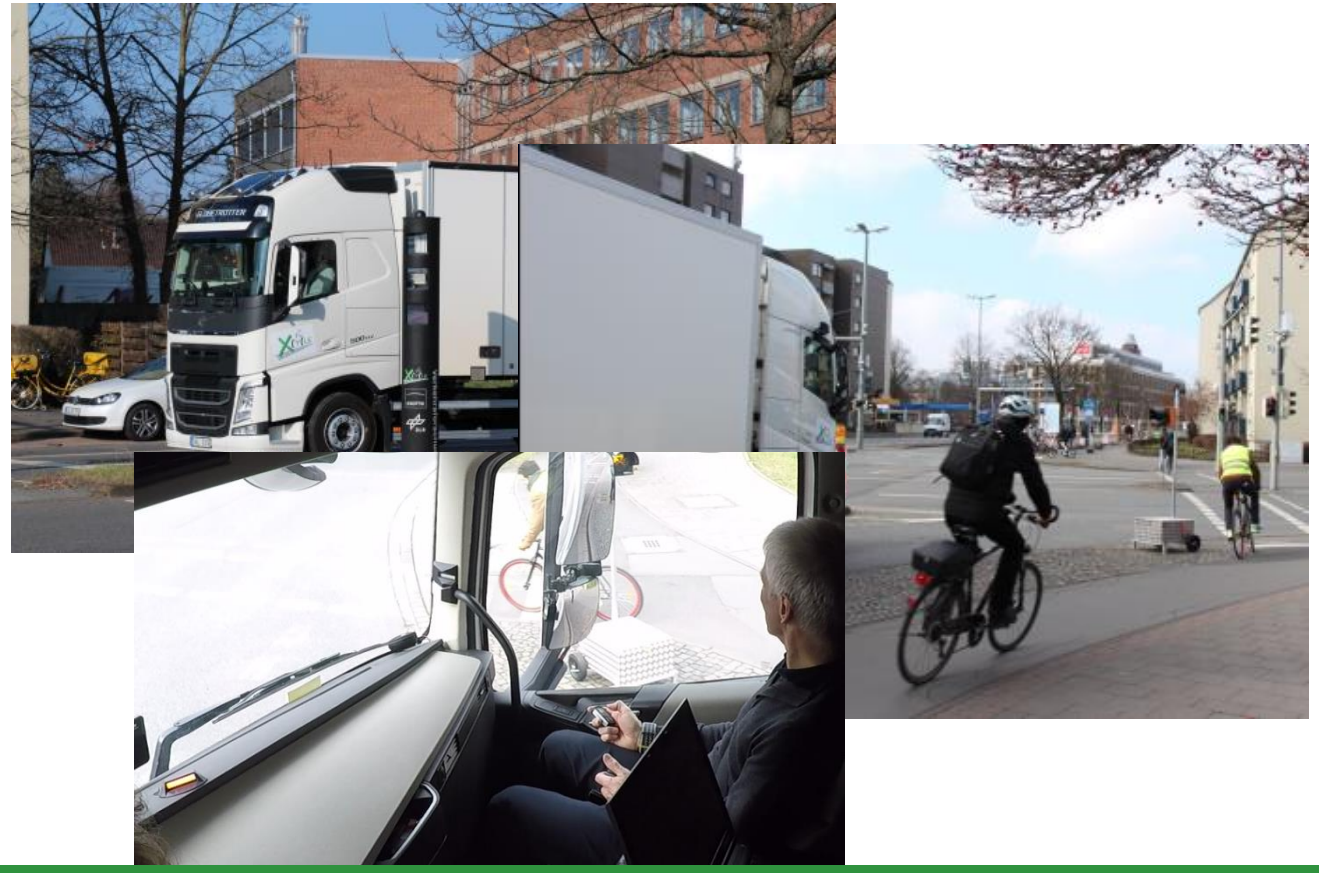
Negative impact on the potential safety effect of a ITS system by **overreliance, distraction or annoyance of the system**

De Angelis, M., Puchades, V. M., Fraboni, F., Pietrantoni, L., & Prati, G. (2017). Negative attitudes towards cyclists influence the acceptance of an in-vehicle cyclist detection system. Transportation Research Part F: Traffic Psychology and Behaviour, 49, 244-256.

Prati, G., Puchades, V. M., De Angelis, M., Pietrantoni, L., Fraboni, F., Decarli, N., ... & Dardari, D. (2018). Evaluation of user behavior and acceptance of an on-bike system. Transportation research part F: traffic psychology and behaviour, 58, 145-155.

#4: in-vehicle and on-bike system

- **In-truck** Cyclists blind spot detection and collision warning



- **On-bike** UWB localization and collision warning system

#5: Infrastructure-based systems

- **Adaptive traffic controller** algorithm in ”green wave for cyclists” in Groningen
- **TraffiTowers** in Braunschweig, extracting video recordings and trajectory data with real time risk assessment.
- **Amber light**: We predict critical situations between right-turning motorists and crossing cyclists then send signal with different level of criticality

Knake-Langhorst, S., Gimm, K., Frankiewicz, T., & Köster, F. (2016). Test Site AIM–Toolbox and enabler for applied research and development in traffic and mobility. Transportation Research Procedia, 14, 2197-2206.

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Gimm, Kay., Knake-Langhorst, S., Dotzauer, M., Urban, U., Arndt, R. (2016) Increasing cyclist safety with infrastructural supported cooperative ADAS in EU XCYCLE by extending test site AIM Research Intersection. International Cycling Safety Conference 2016, 03.-04. Nov. 2016, Bologna, Italy.

#6: Integration and evaluation of the systems

- **Braunschweig**: behavioural evaluation at the AIM intersection with different users
- **Groningen**: observation of cyclists behaviour, assessment of gaze behaviour
- **Multi-country study on "Willingness to pay"** among European cyclists (N = 2381)
- **Qualitative study with truck drivers and cyclists** on XCYCLE systems (using VR)
- **Cost-benefit analysis** to give a broad perspective of the project impact

Successful integration and testing activities in Braunschweig!

Conclusions

- **Innovative and cost-effective solutions**
  → to promote sustainable mobility
  → Need to find way to support large scale deployment (business cases, new vehicle standards, …)
- **Complete segregation** (expensive and unfeasible) < **Social integration and inclusion** (e. g. urban shared spaces). Technology can support it.
- **Grouping and platooning** cyclists through traffic control systems (e.g., green waves)
  → increase safety and reduce unsafe behaviours.
- **Trust, perceived safety, and attitude toward technology** → most important correlates of behavioral intention to use the systems

Open issues and next steps

- **A constantly evolving road environment:**

- New vehicles (PMV, electric, connected and automated, …)
- Need to pro-actively define new interactions between road users (e.g. VRUs and AVs) →VRUs risks to be neglected.
- Address underreported and under-investigated dangerous traffic situations (e.g. near-misses)

- **Adopting a pro-active strategy** → measures and not counter-measures.

Need to adopt **"evidence-based" SPI** (safety performance indicators) to:
→ Increase transparancy

Need to **strenghten co-operation between all stakeholders** (asset-management, municipalities, police, schools, ...)

Thanks for your attention!

www.xcycle-h2020.eu

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