Safer Mobility with Artificial Intelligence

George Yannis,
Professor

Apostolos Ziakopoulos,
Research Associate

National Technical University of Athens

Alexandre Santacreu,
Policy Analyst

International Transport Forum
OECD
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Road Safety Background

- **1.2 million fatalities** annually from road crashes (WHO, 2021)

- U.N. set a target of **preventing at least 50%** of fatalities by 2030.

- However, with current/legacy tools this target is **unattainable**.

- As a result, **Vision Zero** is adopted by more policymakers

- Road/traffic safety is now approached **holistically** within the **Safe System** approach:

  All humans inevitably make **mistakes**. When they happen, all transport system elements must contribute to fatality **avoidance**

Reactive approaches vs. Proactive approaches

- Traditionally, we monitor crash locations and intervene in **areas** with increased risk
- This implies that crashes will continue to happen where they happened **before**
- **Underreporting** issues distort our understanding
- **Lower-income** regions and countries are even more susceptible
- **Crashes** need to happen for action to be taken

- A wealth of newly available data allows for examinations **before crashes** occur
- We can employ an array of **Surrogate Safety measures** (e.g. harsh brakings, speeding, time-to-collision) for analyses
- Crashes **do not need to happen** for action to be taken
- We can analyze road networks via newly available data to identify **systematic risks** & solutions
- **AI is a major tool** for proactive approaches

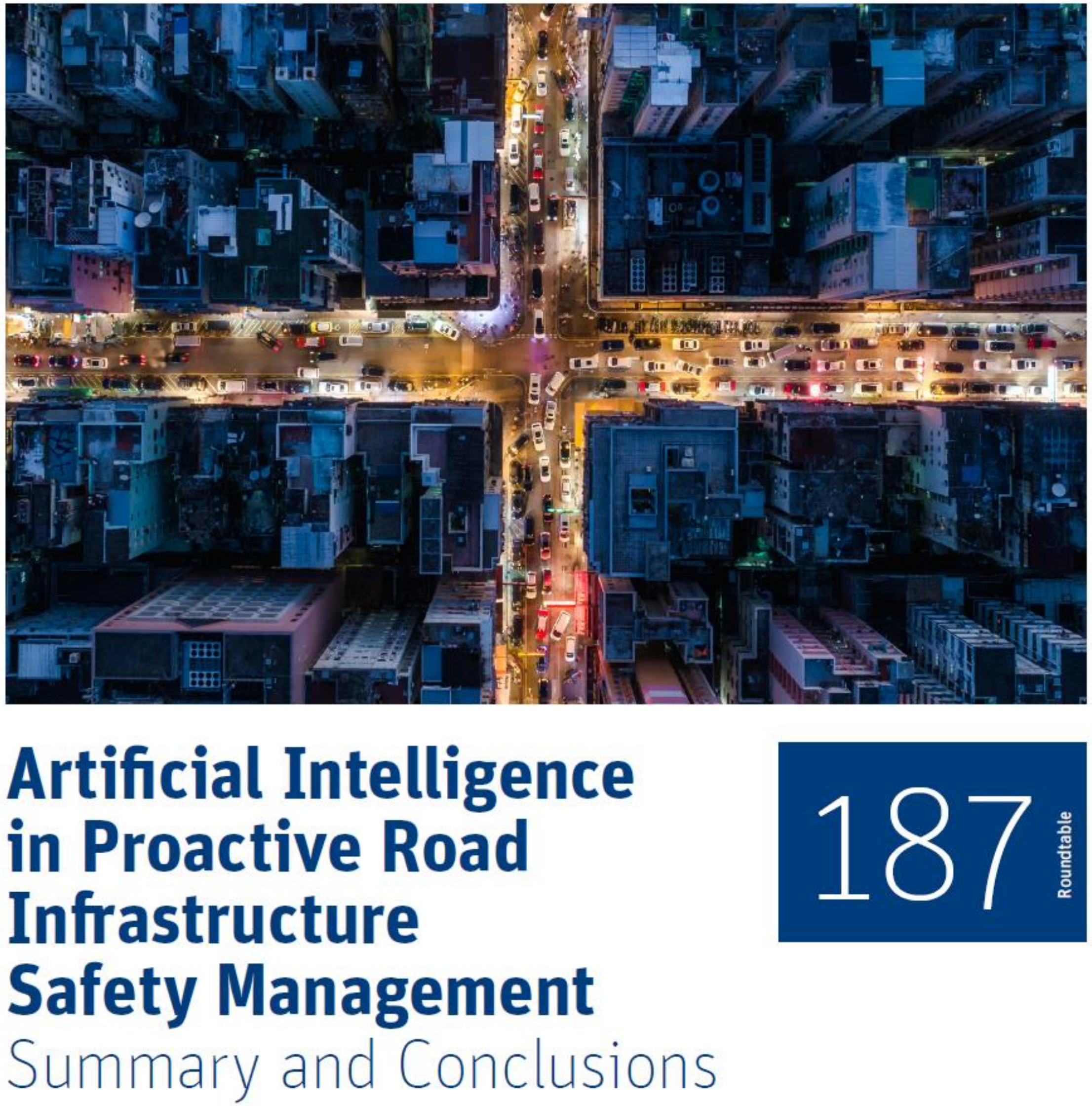
ITF Report AI-Road Safety

International Transport Forum

ITF (2021), Artificial Intelligence in Proactive Road Infrastructure Safety Management: Summary and Conclusions, ITF Roundtable Reports, No. 187, OECD Publishing, Paris.

Expert discussion held on 10-12 February 2021 at the **Roundtable** on Artificial Intelligence in Road Traffic Crash Prevention.

Experts from **33 organizations and 15 countries**, representing Public Authorities, Transport, Technology and Data Industries, Research and Academia and International Organizations.



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AI Advances in Road Risk Estimation

- An array of new AI methods and machine/deep learning or similar algorithmic models available to road safety researchers, stakeholders and authorities for **real-time crash risk estimates**.

- Big data on crash occurrence and road and traffic characteristics from infrastructure sensors are transformed into **multi-dimension static or dynamic maps** of road risk prediction and **road & driver star rating.**

- Crash datasets are imbalanced, **rare event cases** which find new approaches and venues of analysis through AI methods.

- Infrastructure assessment frameworks start embracing AI methodologies (e.g. the i-RAP **transition** to Ai-RAP).

- A large number of model configurations show **very promising performance**, albeit on specific datasets; **transferability** capabilities are yet uncertain.

AI Advances in Telematics & Driver Monitoring

- The **insurance industry** is heavily investing in telematics, offering **reduced premiums** for safer driving.

- **AI and data fusion** technologies used in all stages of road safety data collection, transmission, storage, harmonization, analysis and interpretation from **telematics**.

- **Personalized feedback** can be obtained almost instantaneously.

- Algorithm-based route analysis and **personalized hotspot** detection features are actively being examined.

- **During-trip and post-trip interventions** are enabled, best administered with gamification and reward systems.

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AI Advances in Vehicle Technology (1/2)

- Navigation of **complex road environments** becomes more attainable at an increasing rate, high-end RADAR/LIDAR and sensor technologies at the forefront of developments.

- Several traditional problems are eliminated by RADAR/LIDAR **(e.g. reliance on lighting/obstructions).**

- The decision making process is **improved** and **refined through deep learning.**

- **Purpose-made systems** receive purpose-made **tools** and algorithms, such as grocery delivery or fixed-route public transport.

- Most developers design their systems independently and are not reliant on **infrastructure adaptations**.

- **Over-the-air AI upgrades** become a new reality.

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AI Advances in Vehicle Technology (2/2)

- More **physical test areas** and **virtual testbeds** are provided and examined.
- Software **errors** are gradually contained, **reaction times** are minimized.
- Facial recognition technologies aid **commercial company claims** with insurance carriers (e.g. Nauto).
- **Vehicle cooperation algorithms**: traffic conflict reduction, efficient traffic management.
- **Additional connectivity byproducts**: increased parking availability, increased fuel efficiency, freight vehicle platooning.
- **Flying vehicles (VTOL)** concepts are co-considered.

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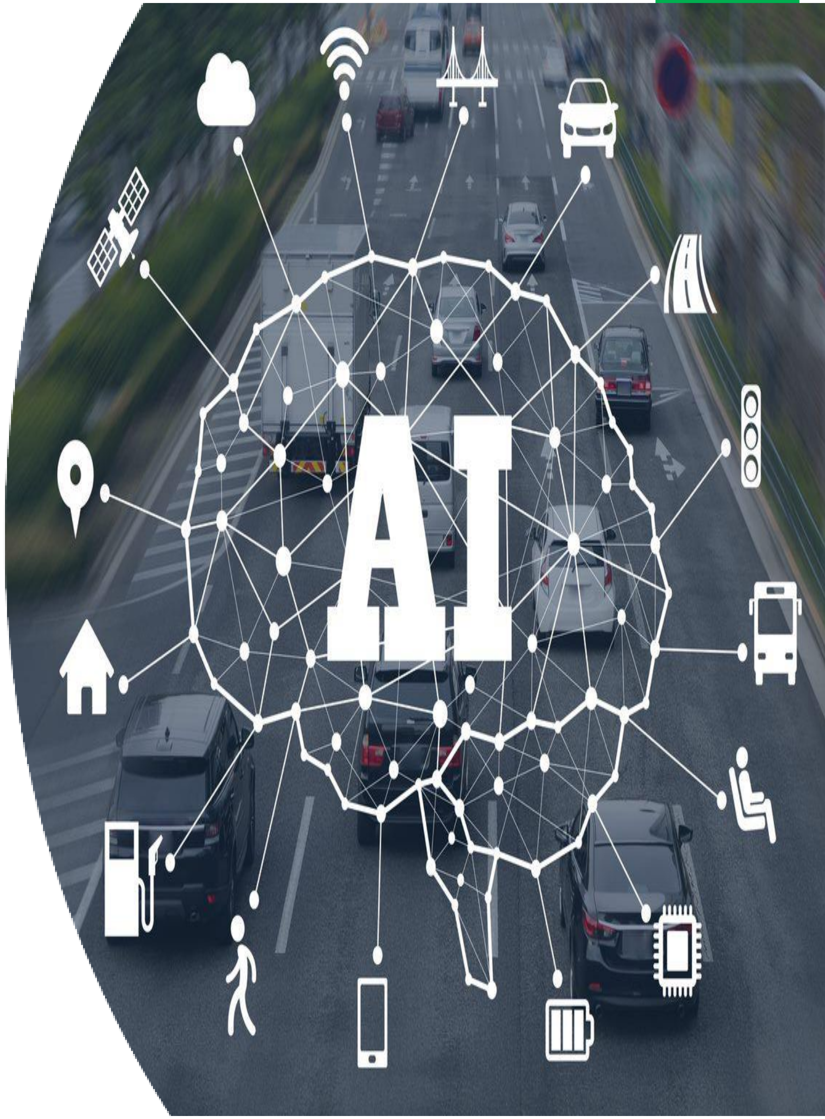
Can AI support policymaking?

AI facilitates **proactive** traffic safety management:

1. Through **data collection** via sensor systems
2. Through **hotspot identification** via predictive modelling

- AI is notoriously dependent on **large amounts of quality data**, which can be costly in time and budget
- Policymakers will have to define the most beneficial datasets and **prioritize** their acquisition
- Ultimately, AI will appear as **'black boxes'** to non-technical practitioners and politicians
- **Trust and public acceptance** will determine the adoption of AI-based techniques, actors need to promote the creation and operation of responsible AI systems.



Create responsible & trustworthy AI

The OECD calls on all AI actors to **promote**:

1. **Inclusive** growth, **sustainable** development and well-being:
   Pursue beneficial outcomes by reducing inequalities

2. **Human-centred** values and fairness:
   Respect rule of law and human rights, place safeguards to ensure this happens appropriately to context

3. **Transparency and explainability**:
   Clarify system operations, enable outcome disputes

4. **Robustness, security and safety**:
   Resilience against time & misuse, traceability, systemic risk management

5. **Accountability**:
   Individuals must remain accountable for AI decisions/actions

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AI data-related topics

AI operation and promotion of related policies can **already begin:**

Local and national governments have access to **a wealth of information** through roadside sensors and CCTV

However, industrial partners are typically **reluctant to share** their data due to:

- the **silo effect** – the lack of connections between organizations and between teams within organizations,
- **technical costs** (collecting, processing, hosting, etc.), which are not negligible,
- **privacy protection** imperatives and associated fears of litigation, often cited as the #1 barrier (e.g. GDPR),
- **competition** - commercial sensitivities.

AI in future transport networks

AI-piloted automated technologies will be adopted in a wide scale in the coming decades, with profound consequences.

Instead of a solely diagnostic tool, AI will become **an active element** of road transport and traffic safety

A multitude of **impacts** will emerge in the affected transport systems:

- **Direct**: changes that are noticed by each road user on each trip (e.g. travel time)
- **Systemic**: impacts within the transport system (e.g. modal split)
- **Wider**: impacts exceeding the transport system (e.g. road fatalities and injuries, emissions)

It is imperative to **anticipate** the advent of automation and to analyze the **impacts of automated-based policies proactively (e.g.** Levitate and SHOW projects).

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Synopsis of current knowledge

- AI facilitates **proactive** traffic safety management through (i) **data collection** via sensors and (ii) **hotspot identification**
- AI pushes the limits of **pattern recognition** beyond human capabilities and may discover **previously unknown** crash-prone road configurations
- AI can have black-box effects, which are now slowly overcome by **explainable AI** algorithms
- The main **limitation** now is (i) data, due to isolation 'silos' effects and (ii) lack of individuals with suitable modelling expertise
- Traditional (infrastructure) interventions still have **traditional problems** (e.g. regression-to-the-mean)

Future directions for AI-based policies (1/2)

- **Do not wait** for real-time/big data before developing risk maps and other diagnostic tools
- Design **user-friendly, risk-mapping tools** that justify and support road safety investments
- Develop a **competitive market** for the sharing and monetizing of traffic and mobility data
- **Mandate the sharing** of aggregate vehicle data, define a minimum standardized dataset that manufacturers should report
- **Align new tools** with precise policy objectives, and avoid distractions with side-goals

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Future directions for AI-based policies (2/2)

- **Develop new skills** and digital infrastructure within authorities both to demand accurate results and to interpret them correctly.

- **Support research** and innovation towards trusted and explainable AI in road safety, facilitating benchmarking and validation of methods for proactive road network safety management.

- **Clarify regulatory frameworks** for data protection and digital security.

- **Learn from other fields** (e.g. insurance, telecommunications etc.) and **integrate best practices** for data sharing and privacy protection

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