



# Improving road infrastructure monitoring and resilience with Big Data collected from in-vehicle sensors

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VIRTUAL | VIRTUEL

XVI WORLD WINTER SERVICE AND ROAD RESILIENCE CONGRESS  
XVI<sup>e</sup> CONGRÈS MONDIAL DE LA VIABILITÉ HIVERNALE ET DE LA RÉSILIENCE ROUTIÈRE  
XVI CONGRESO MUNDIAL DE VIALIDAD INVERNAL Y RESILIENCIA DE LA CARRETERA



# Resilience

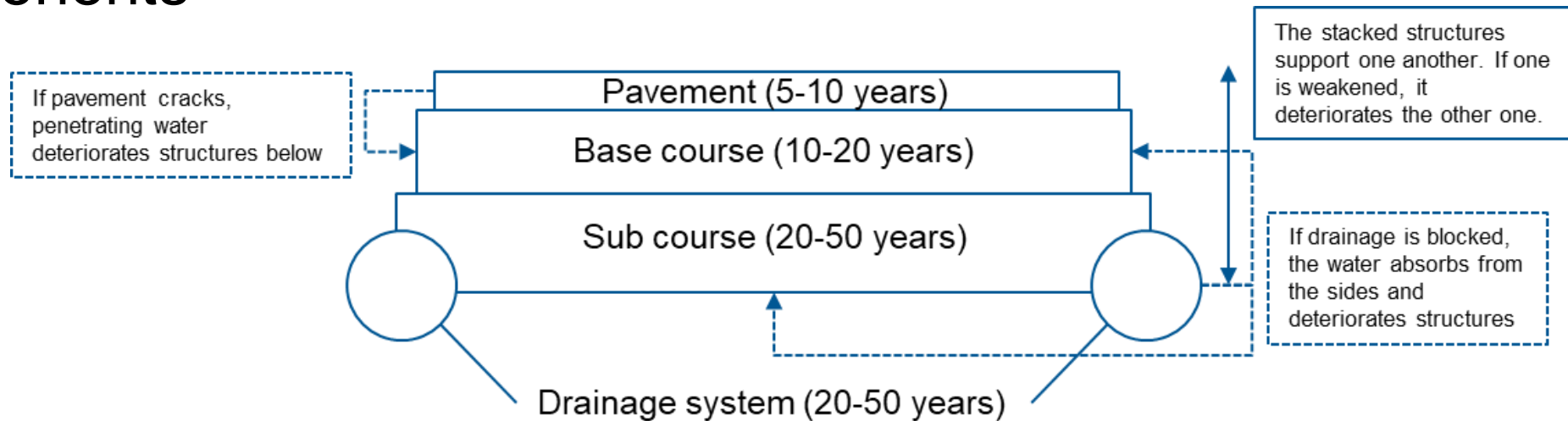
- Resilience has highest importance **before the risk occurs** and during the risk event
- Thus, the most important factors in road infrastructure resilience **are the components of road assets and their current condition**
- Proactive maintenance and management of road assets is essential

# Road assets in European Union

- 5,5 million kilometres of publicly governed roads
    - Valued over 8 000 billion euros
  - Road assets are one of the most important public properties
  - EU has estimated that infrastructure assets will need more funding in the future
    - However, funding seems to be declining
- **How to make right upkeep and investment solutions throughout the life-cycle of the road assets?**

# Components of the road assets

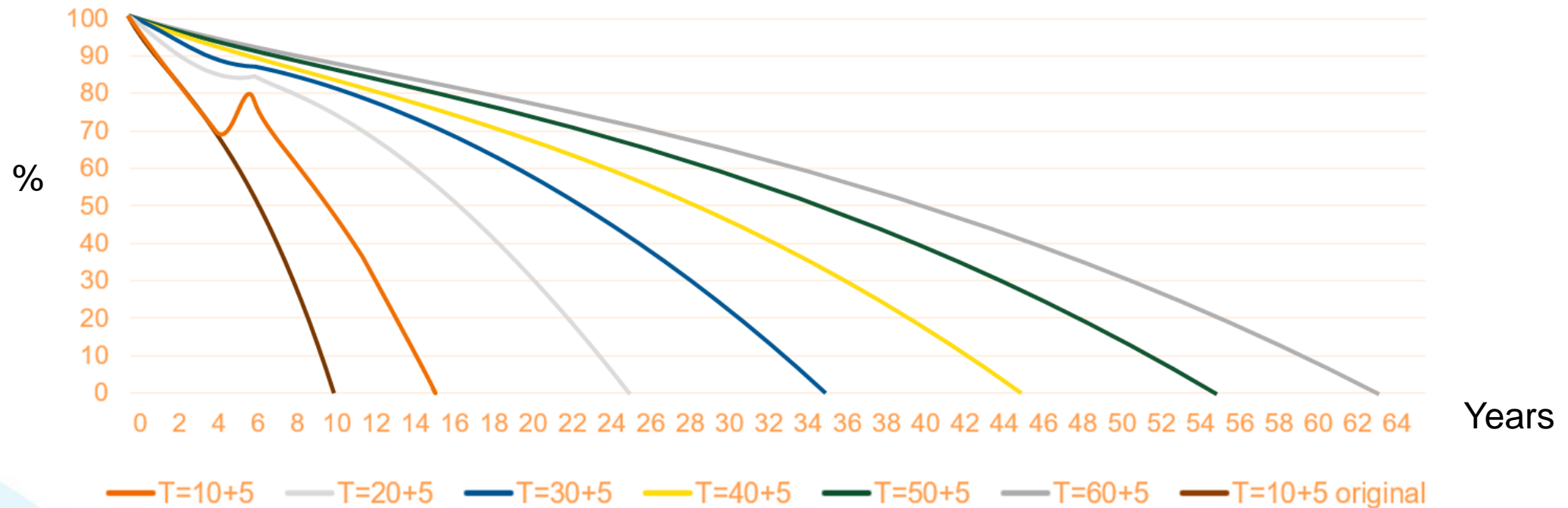
- Road system consists of different components
- Each component has different life-cycle expectancy
- The whole system's lifecycle is dependent on these components



*Adapted from: Leviäkangas et al. 2019.*

# Components of the road assets

- Lengthening the life-cycle of one component through proactive maintenance, the life-cycle of the whole system is expanded.

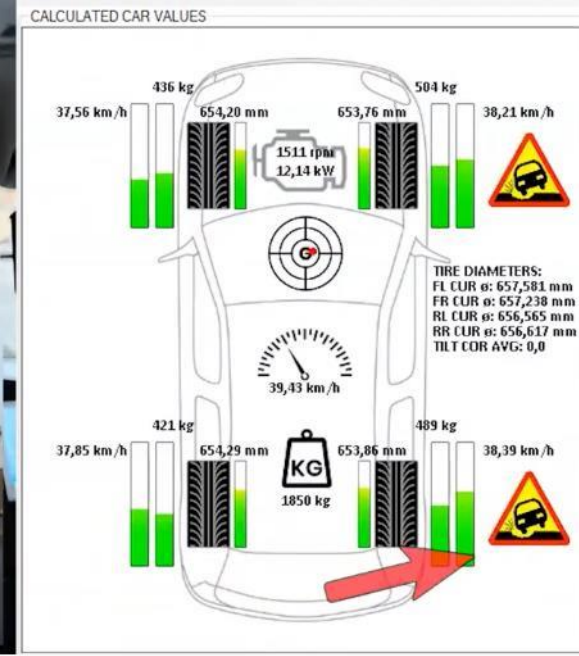
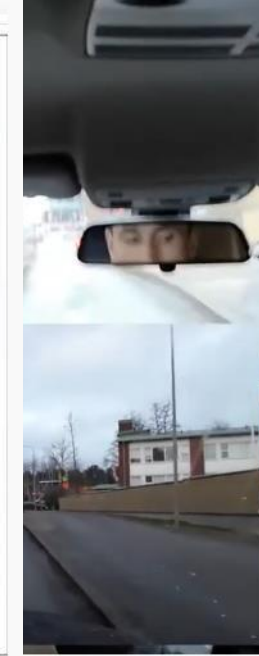
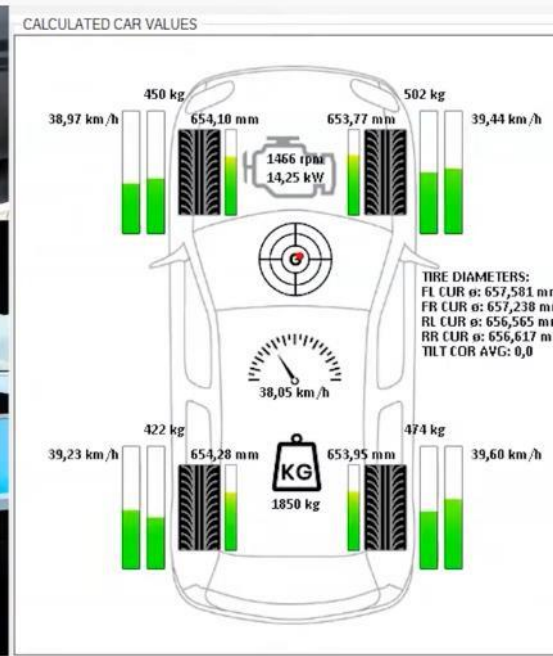
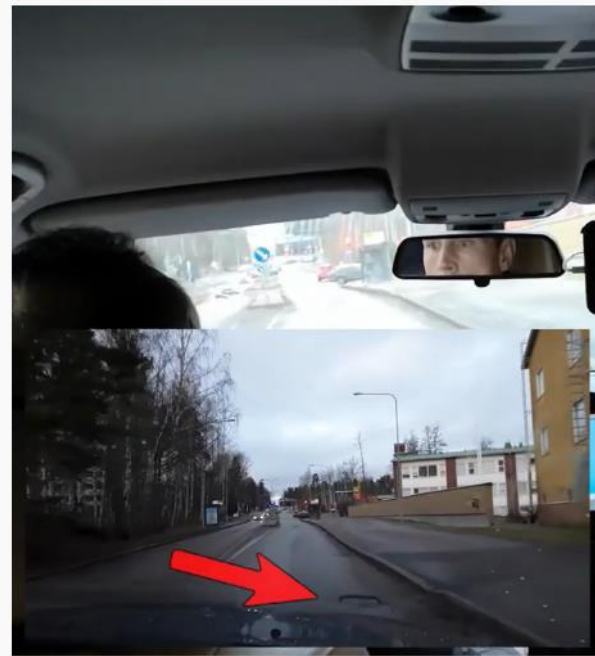
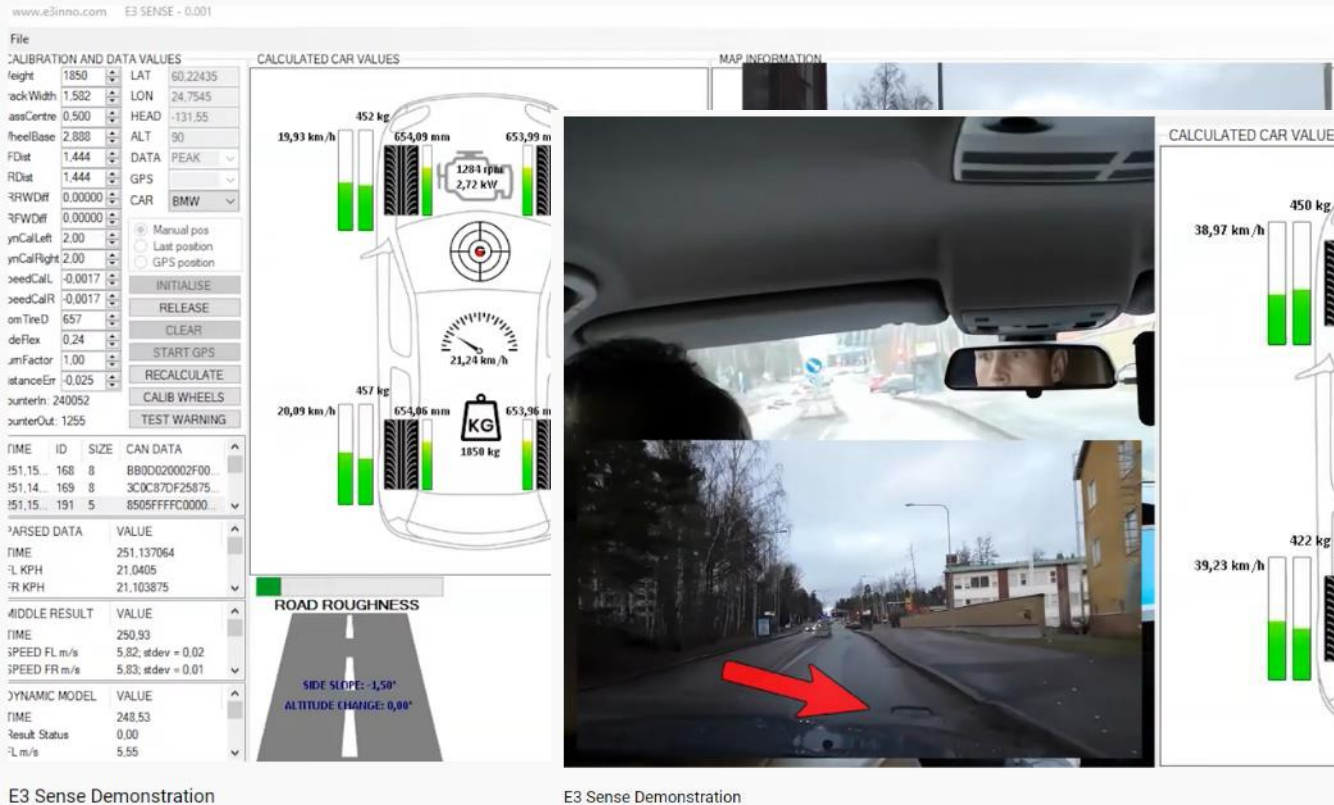


Adapted from: Leviäkangas et al. 2019.

# Assessing the condition of the assets

- Currently condition assessments are separate processes
  - Requires remarkable amount of time and resources
- Tools and practices used to manage assets efficiently and sustainably are often simplified
  - Focus is only on specific parts or certain components of the asset
- No ideal solution yet!
- Why?
  - **The lack and incompleteness of data!**

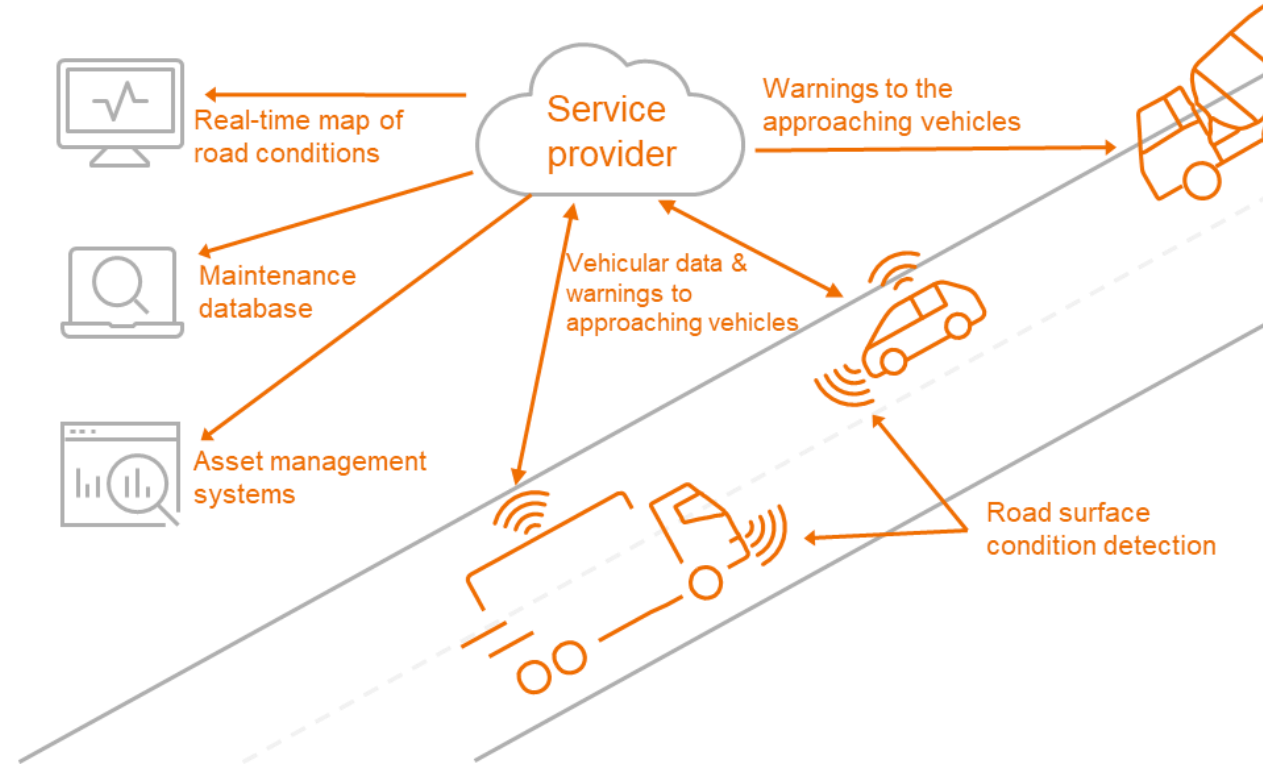
# Monitoring of road conditions with in-vehicle sensors



Source: EEE Innovations Oy. 2020.

# Opportunities

- Continuous monitoring of the road condition
  - New technical and financial assessment tools
  - Proactive asset management systems
- Cost and life-cycle savings
- Improved resilience of road infrastructure



*Lusikka et al. 2020.*



# Pontetial benefits

- For example pavement costs in Finland:
  - Savings of 50-100 million euros can be saved annually (12-30% of total costs)
    - Finnish road assets value 15 billion euros vs. EU 8 000 billion euros
- Other impacts: road users' costs and accidents
  - For example in U.S., potholes cause costs of ca. 3 billion dollars to vehicles → remarkable savings potential
  - Road condition has also impacts to comfortability and travelling times
  - Costs and benefits of the related impacts are not yet clear

# References

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2. EEE Innovations Oy. 2020. E3 Demonstration. Available: <https://e3inno.com/e3-sense-demonstration/>
3. Lusikka, T., Mononen, P., & Leviäkangas, P. (2020). Road condition detection technology: A benefit analysis. VTT Technical Research Centre of Finland. VTT Technology No. 374 <https://doi.org/10.32040/2242-122X.2020.T374>