



WEBINAR ON MICROSOFT TEAMS DECEMBER 9TH, 2020 ANNUAL SEMINAR

Future of pavement management systems based on big data
Usage of connected vehicles for road assessments

GreenMobility



sweco **送**





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GENERAL INSTRUCTIONS

- Make sure the microphone is muted (unless you should present) \bigcirc
- Q&A at the end of each session
- a) You can raise your hand if you make an oral question



- b) You write on the chat specifying to whom the question is referred (if needed)
- Seminar is recorded and video will be available ASAP
- PPT from the speakers will be downloadable from "https://liraproject.dk/publications/"





PROGRAM

OPENING

First Session CONNECTED VEHICLES and DATA

Second Session DATA INFRASTRUCTURE and MACHINE LEARNING

Third Session INFRASTRUCTURE and PAVEMENT MANAGEMENT SYSTEM (PMS)

GUESTS PRESENTATIONS

PANEL DISCUSSION





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LiRA project: Future of Pavement Management system PhD, Matteo Pettinari, map@vd.dk Special Consultant at DRD





OUTLINE



- What is LiRA?
- Project goal and Driving Vision
- Background
- Project organization
- Project status
- Conclusions





What is LiRA?



LiRA project (Live Road Assessment) is a collaborative effort between







Project Goal



Develop and demonstrate a new method for performing live road condition surveys based on data collected by a connected fleet of vehicles.

- create additional value for car sensors data
- deliver a prototype system demonstrated in Copenhagen









Background



Standard road measures have been introduced to optimize maintenance strategies focusing on:

- Safety
- Comfort
- Durability
- Environmental Emissions (noise and CO₂)



Limitations

- 1) Costs
- 2) Weather
- 3) Road Geometry
- 4) Not always objective
- 5) Frequency

between 1 to 3 years





Background

Is there any technology that can overcome these limitations?



Modern cars are equipped with many sensors and can also provide further data including energy consumption.

Can car sensors data be used to measure road conditions?



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Project Organization

CAR SENSING platform

STANDARD road measures

Data processing and Software engineering

1) Connected fleet of vehicles

2) Modern vehicles

3) Access to CAN bus data

4) Customized Additional hardware

- 1) Roughness & Rutting
- 2) Cracking and potholes

3) Friction

4) Noise and RR

1) BYG (Physical models)

- 2) Compute (software engineering)
- 3) Compute (machine learning)

Management system

Implement live road measures
Maintenance strategies



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CAR DATA

- Define the hardware to install in the cars
- Cars data validation
- Driving behavior

STANDARD DATA

- Select standard road measures

SECTIONS and ROUTES

- Selected sections (different types and conditions of pavements)



Data collection



Project Status STANDARD DATA



Data collection

ARAN9000 – LCMS 2.0

- Structural distress: Potholes, Ravelling (disintegration), Cracks (length, width and depth), Bleeding
- Serviceability: Roughness (IRI), Mean Profile Depth (surface macro texture), Rutting, Bleeding
- 10 m sub-sections

P79

- 3D road profile (m) / sampling rate ~1000 Hz
- Rutting and Mean Profile Depth / 10 m sub-sections

СРХ

Noise measurements (dB) / 10 m sub-sections

FRIKV

• Friction measurements (slip in %) / 5 m sub-sections

VISUAL INSPECTIONS

List of distresses and defects (similar to ARAN9000)





SECTIONS and ROUTES



Data collection

The Danish Road Directorate and Sweco have selected the road sections to monitor:

Section Type	Number or Direction	Length	Standard Meas. Vehicles	Visual Inspections
Trial 1 – DTU*	1 loop	4 km	P79*	Not needed
Trial 2 – M13	2 – North and South	22 km	P79, ARAN9000, Friction, CPX	Not needed
Motorways DRD	7 – North and South	179.6 km	P79, ARAN9000, Friction, CPX	Not planned
Copenhagen Mun.	7 routes - both Direct.	190.0 km	P79, ARAN9000, Friction, CPX	Completed







Data Pipeline

DATA FLOW

 List of processes that allows to transfer and structure data in the data warehouse

Data Warehouse

DATABASE

- Georeferenced Information and Road ID from OSM









MACHINE LEARNING Exploring methods focusing on accelerometer data and synthetic data towards hybrid modeling

Software development

INFRASTRUCTURE

 define an initial software architecture with focus on data visualization using Open Street Map





Conclusion



In the recent years, the *interest in using data from connected vehicles has increased* with the technological development of car sensors.

- New opportunities for road administrators
- New business for car industry and fleet operators
- New challenges

LiRA project explores this new scenario trying to suggest benchmarks and directions for the industry

