

# Building value with roughness data: Looking back to move forward



# NIRA Dynamics quick facts

software solutions for next level of mobility

Founded in 2001 as a spin-off from Linköping University

HQ in Sweden, global presence

- 120 employees
- Offices in US, Brazil, Germany, China, Japan

Software and virtual sensor pioneers

On the market since 2006, in all VW Group models

Annual turnover ~30M €

**100 million+**  
vehicles equipped with  
onboard analytics

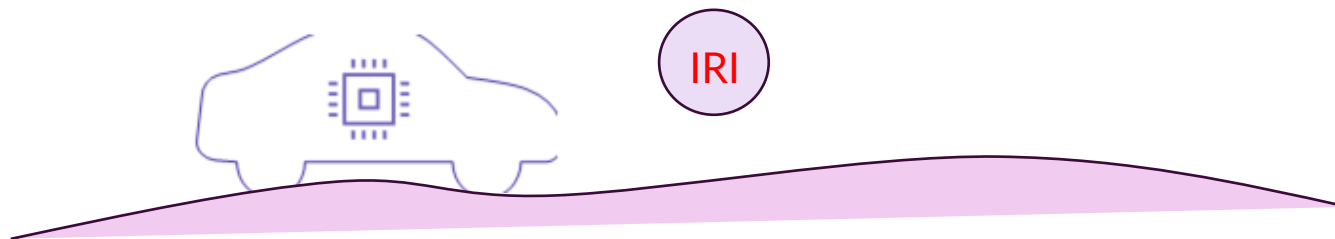
**2 million+**  
connected vehicles  
gathering  
road surface data

# Introduction

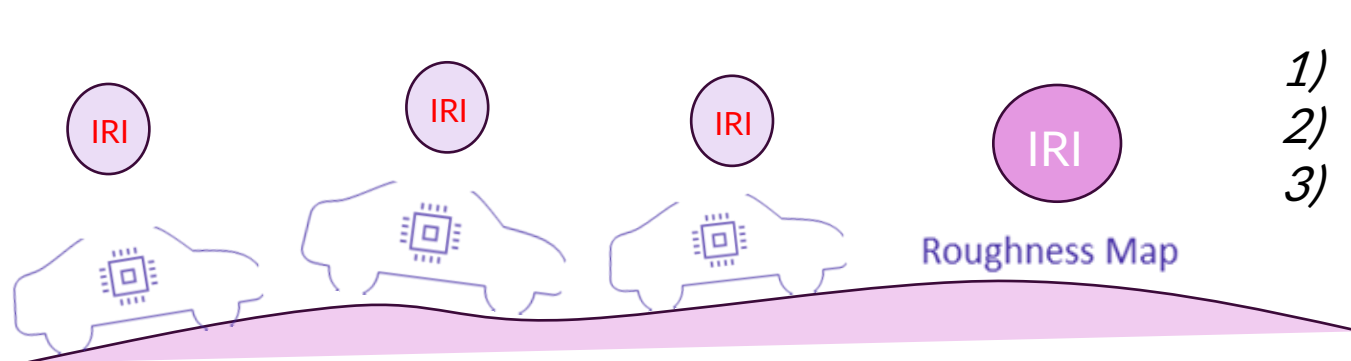
- 1) Tire - Pavement interaction**
- 2) Measures such as International Roughness Index and Grip data**
- 3) High Frequency Road Scanning**

# High Frequency Road Scanning

Any moment a “NIRA” car is driving on a road section, a new roughness value is measured.



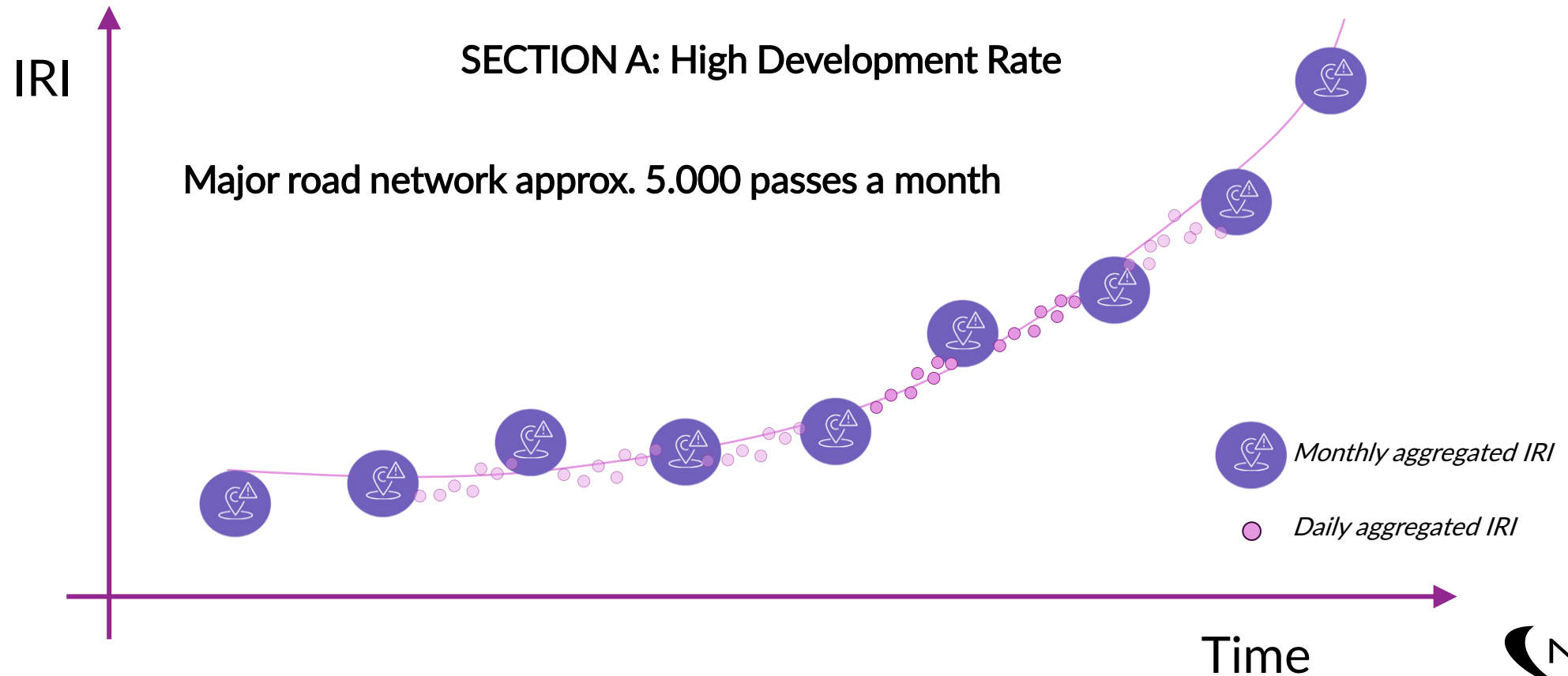
This value is then aggregated with all the other values produced in the same day by all the NIRA cars who crossed the same section



- 1) *Average Daily Roughness*
- 2) *Roughness Variance*
- 3) *Sum. of Passes*

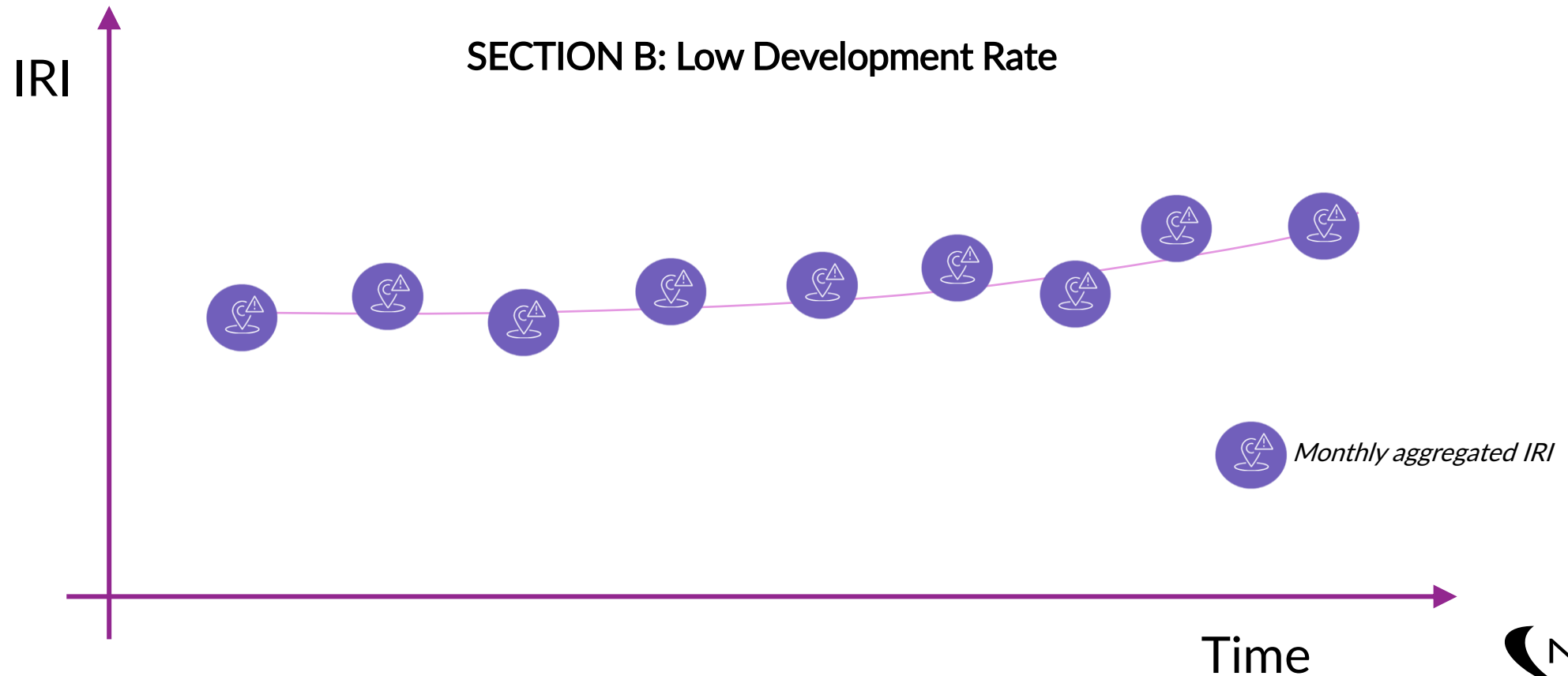
# High Frequency Road Scanning

Roughness develops over time at different rates, development rate is affected by pavement properties, traffic and climate.



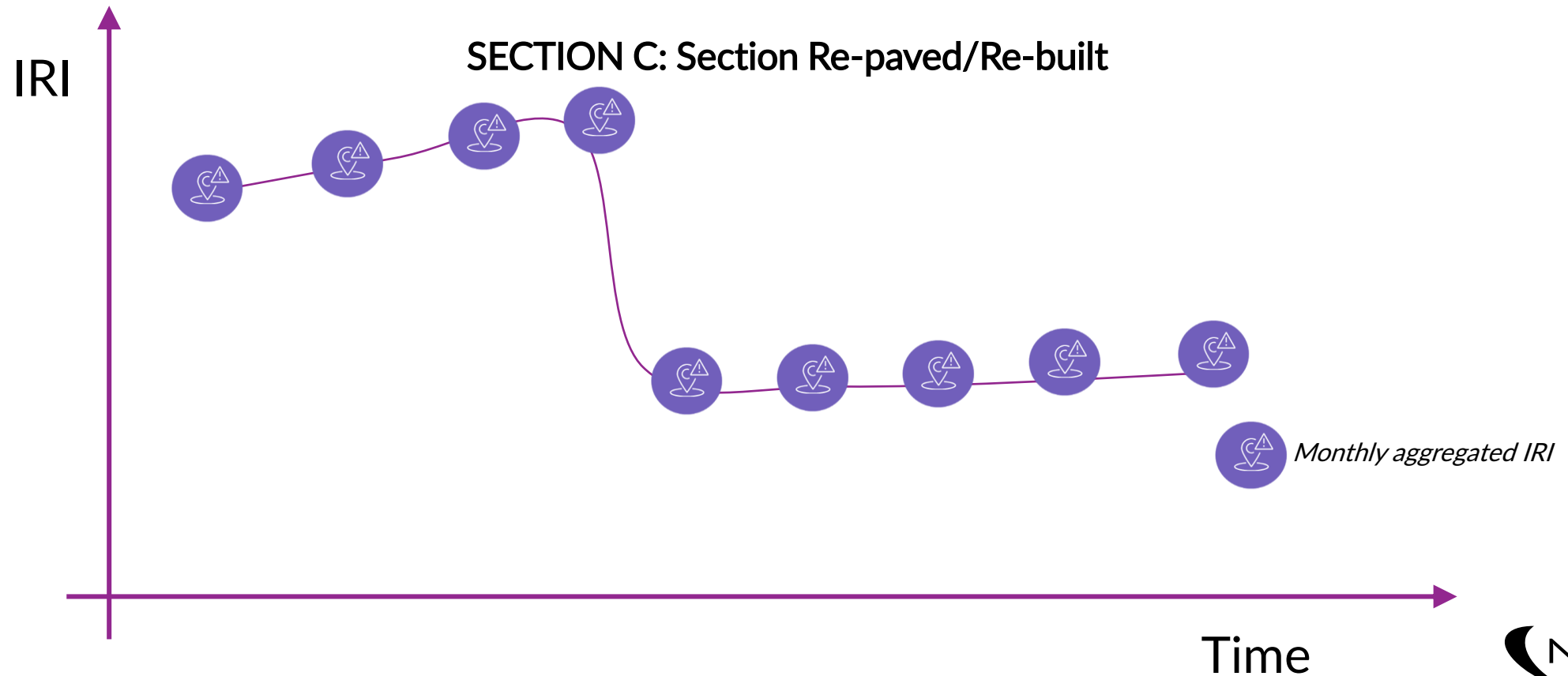
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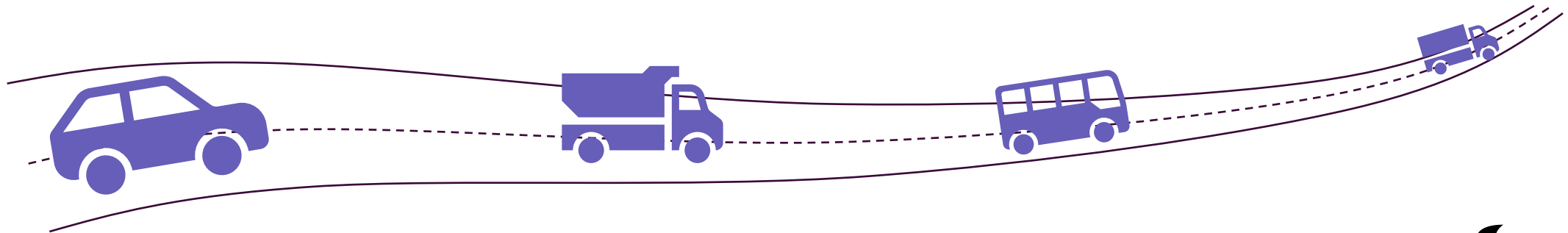
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# Inputs for Roughness historical data

Pavement properties, N. of lanes, etc. (maybe pavement type) *can be provided by the road agency* in a shape that we import it in our latest GUI

**IF NOT**, then we can assume that *on the same road type* (similar traffic) we should have similar structural design or pavements type (maybe different ages)





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Weather is collected by connected vehicle: *Temperature, Rain intensity and type of precipitation*



# New Features based on Roughness historical data

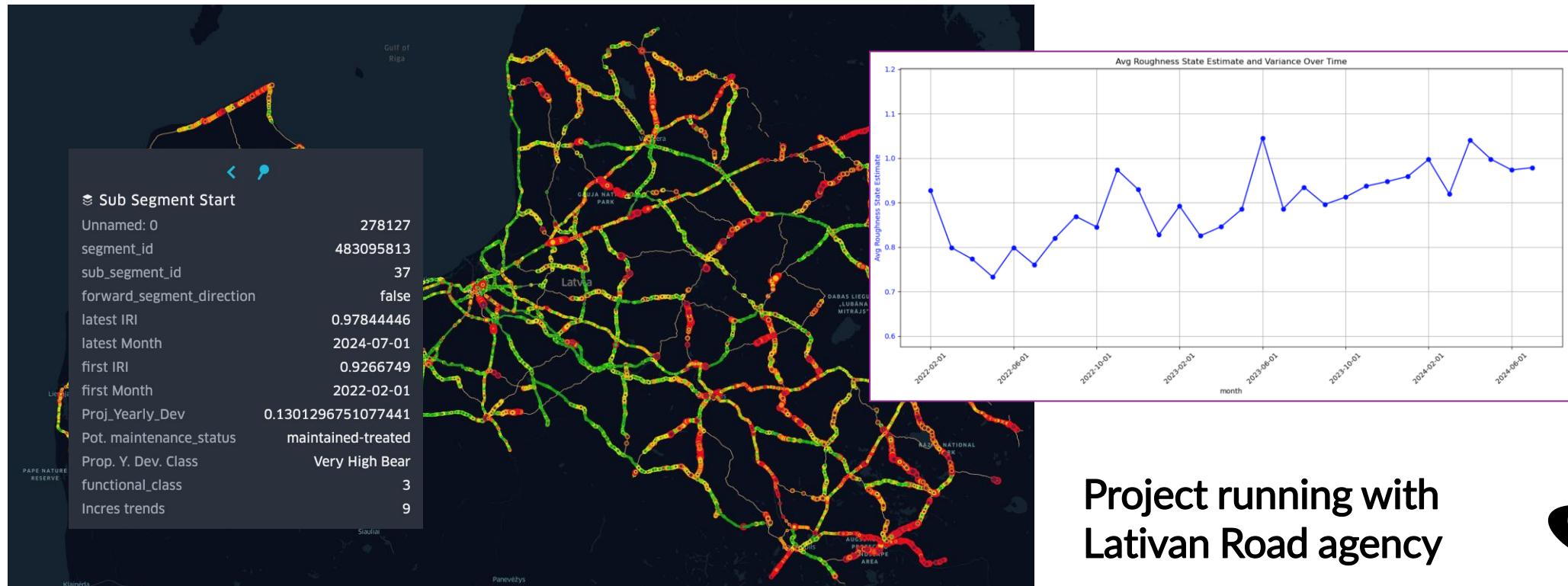
- 1. Bearing Capacity Label (according to a give road):** *we do not measure bearing capacity, but we can address locations where bearing analysis should be prioritized.*
- 2. Presence of Maintenance, Repairs and period**



Project running with  
Latvian Road agency

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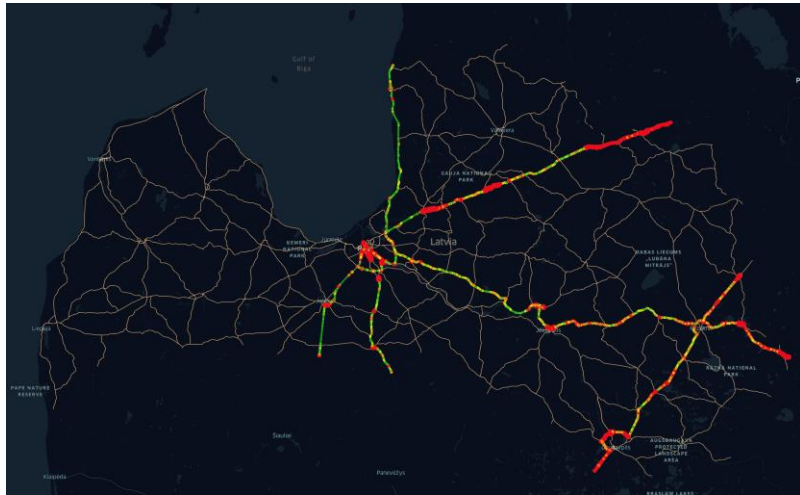
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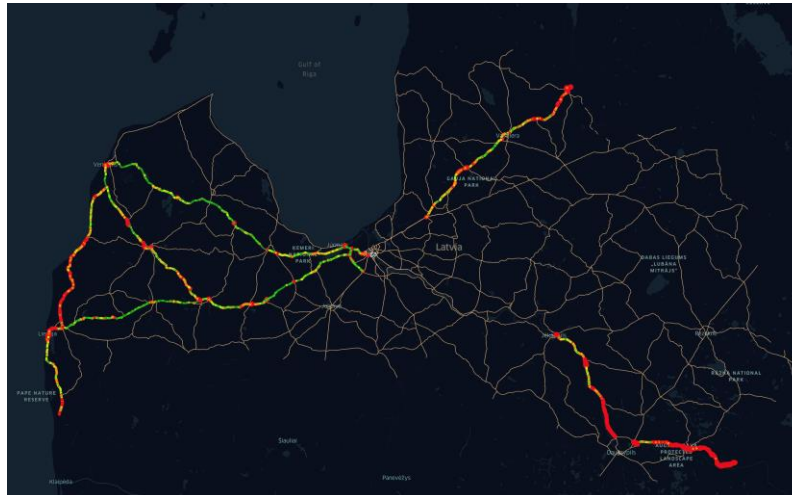
Different Bearing classes are defined, and the thresholds are given according to the Road Class.

Low bearing level in Class 1 is *different* from Low bearing in Class 3

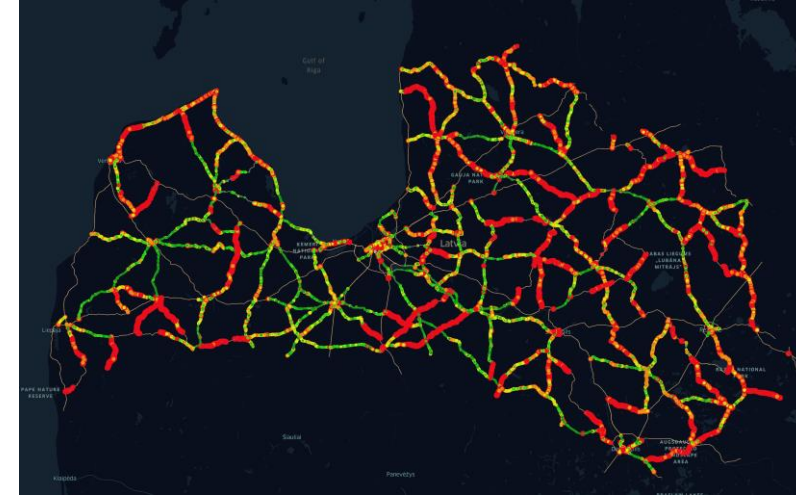
Class 1



Class 2

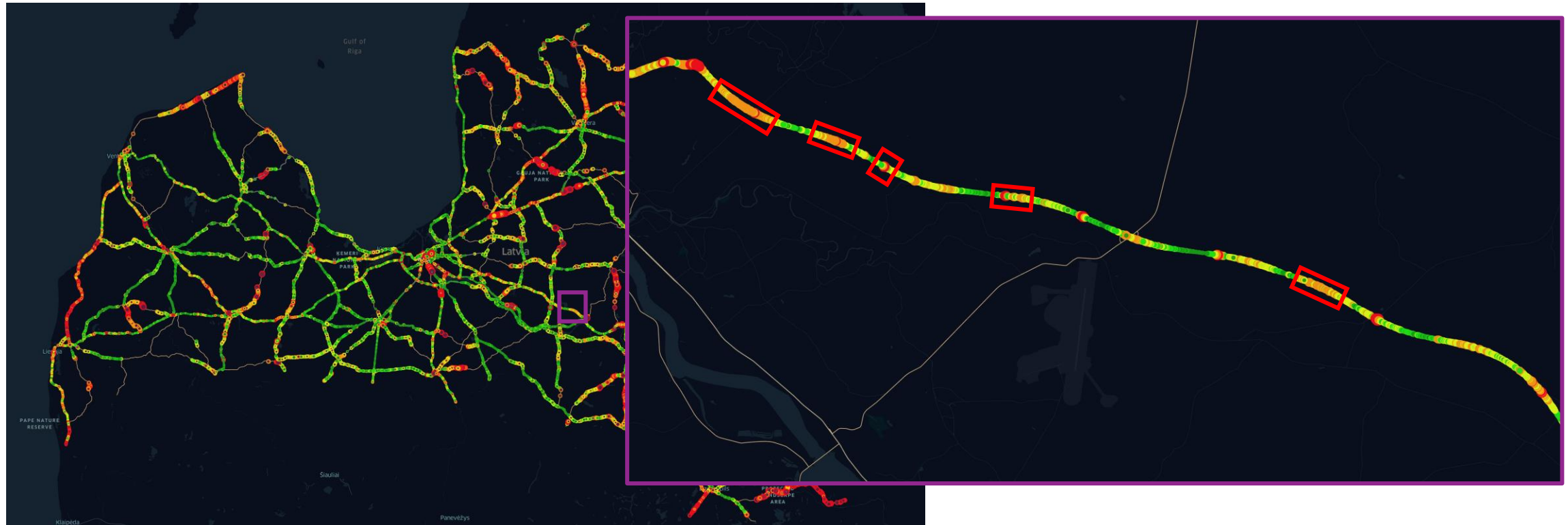


Class 3



# Usability and Customization

Use GPS data and Bearing Labels to coordinate FWD or any other type of inspection



# Conclusions

- NIRA Dynamics uses roughness historical data to design and customize new features.
- Features are based on:
  - I. Different time scale levels of aggregation (daily, weekly and monthly aggregation)*
  - II. Trend models (linear, exponential) – lead to different type of distress/strategy*
- These features can account for road properties (shape) or based on info we have available
- Bearing Label extracted from Linear analysis can be used to manage structural surveys
- Adding weather as well to estimate Climate impact