



# Indicator-based Criticality Analysis

development of criticality indicators and an evaluation approach to assess the criticality of road sections

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# Topics

## 1. Introduction

- Background and objective of the criticality analysis
- Criticality analysis as part of the climate impact assessment

## 2. Methodological approach

- Road network model and traffic data
- Indicator-based criticality analysis
- Criticality indicators and indicator groups
- Exemplary results

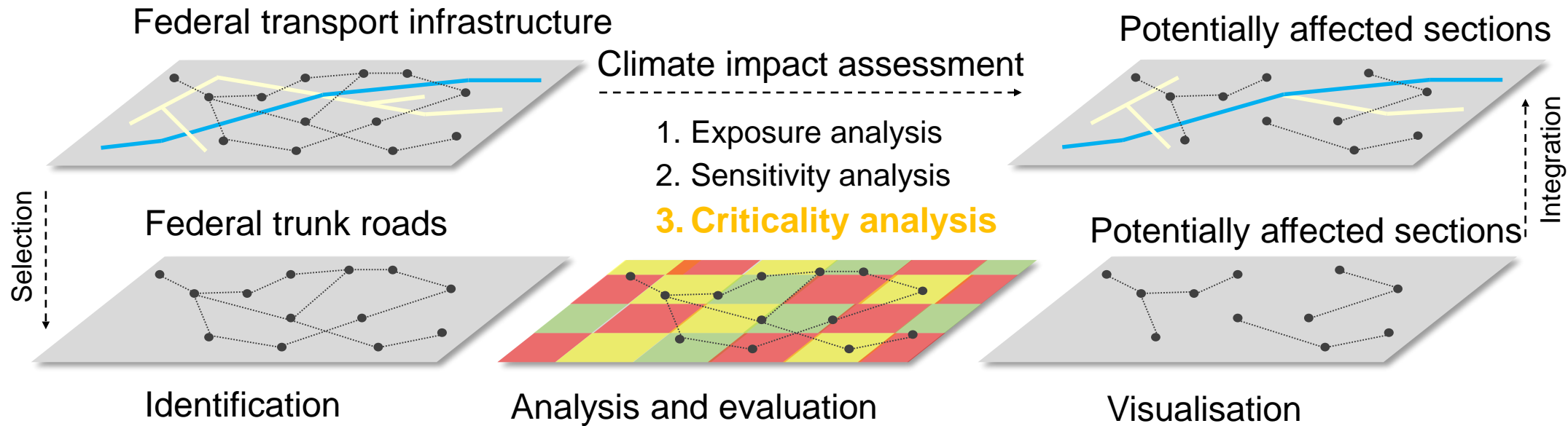
## 3. Summary and outlook

# 1. Introduction

# Background and objective of the criticality analysis

- The road network is essential to supply the society with important goods and services
- A longer disruption of network elements can have serious consequences
- Therefore, it is important to know the most critical road sections and objects
- ‘Criticality’ is defined here as significance of the consequences in case of a disruption
- The criticality analysis is conducted within the framework of Topic 1 “Adapting transport and infrastructure to climate change and extreme weather events” of the BMVI Network of Experts

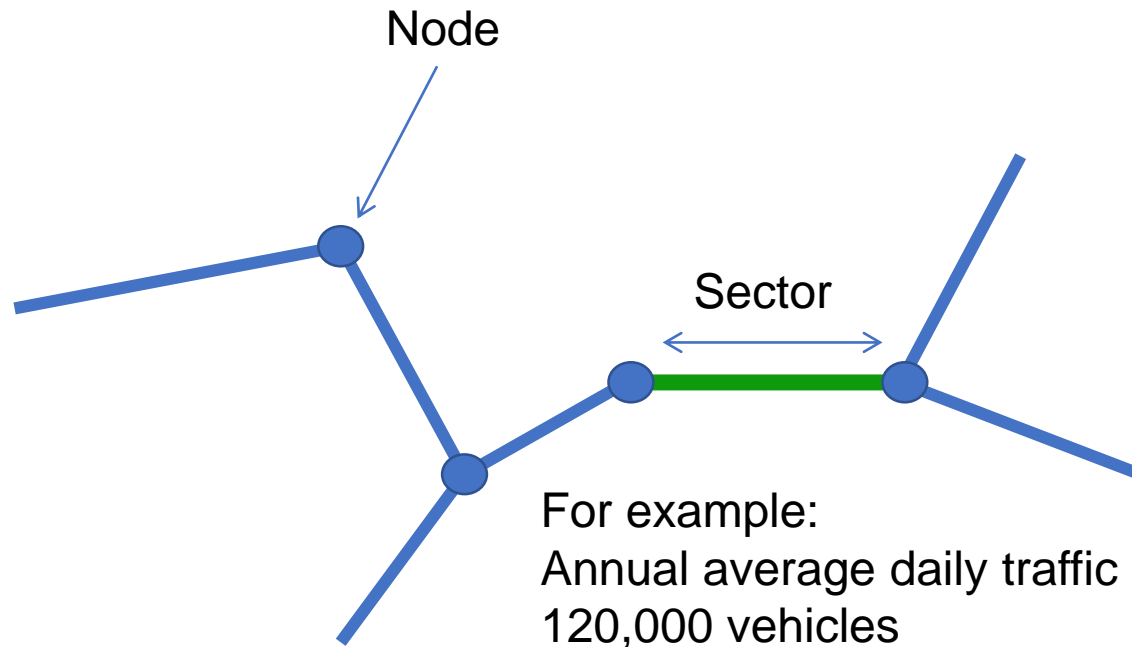
# Criticality analysis as part of the climate impact assessment



**Goal: Approach to climate impact assessment which facilitates the integration and comparison of the results for federal trunk roads, federal railway infrastructure and federal waterways**

## 2. Methodological approach

# Road network model and traffic data



- We use a **node-edge graph model** used in the „Federal Transport Infrastructure Plan“.
- Most of the road network data is available for the edges, called sectors.

# Indicator-based criticality analysis

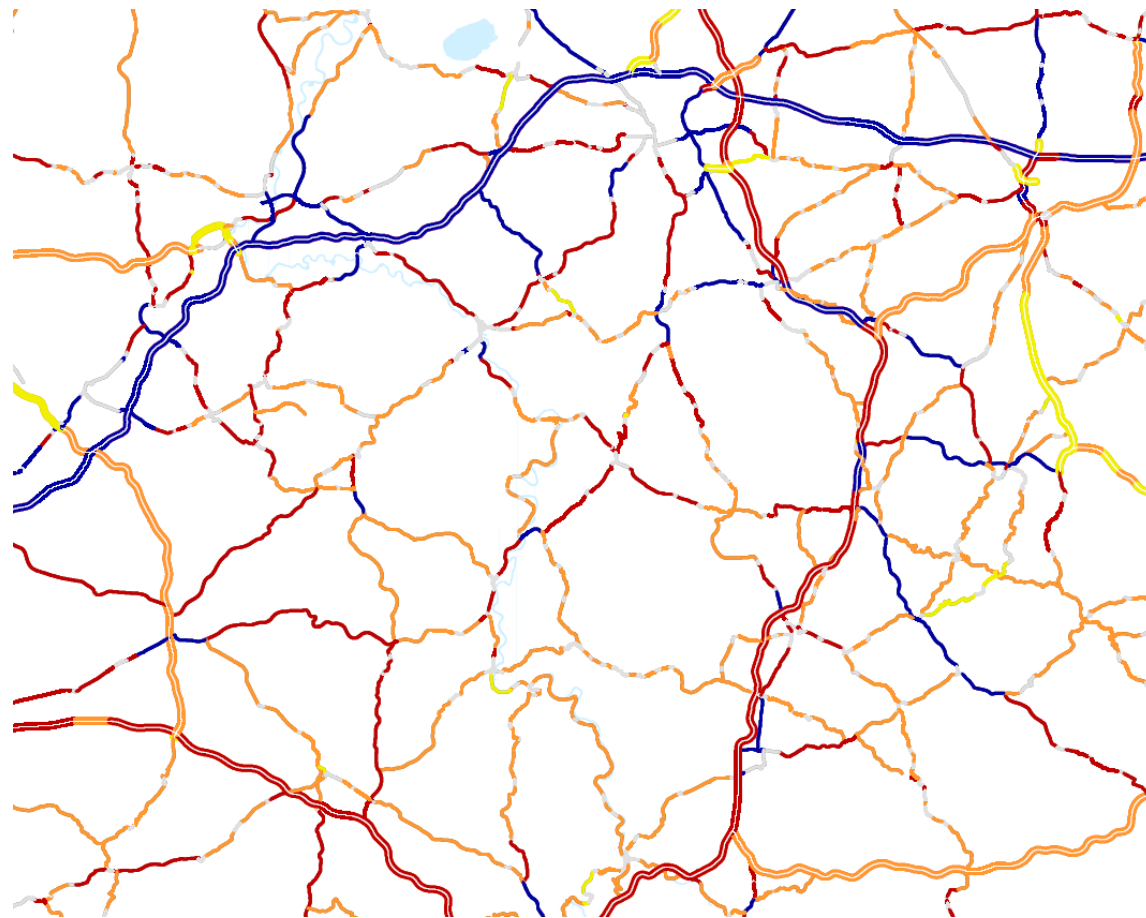
- **Step 1: Selection, classification and weighting of criticality indicators**
- **Step 2: Classification of criticality indicators to indicators groups**
  - Group 1: Traffic relevance
  - Group 2: Economic relevance
  - Group 3: Relevance according to spatial planning
  - Group 4: Geographic and infrastructural relevance
- **Step 3: Weighting of the indicator groups**
- **Step 4: Calculation of overall criticality and cartographic visualization**



# Criticality indicators and indicator groups

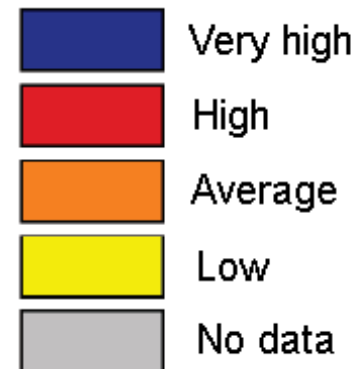
Indicator group	Weighting	Indicator
Traffic relevance	1.0	Annual average daily traffic for workdays
		Travel range for workdays
Economic relevance	0.5	Annual average daily heavy traffic for workdays
		Travel range heavy traffic for workdays
Relevance according to spatial planning	1.0	Links between metropolitan regions (Accessibility)
		Connections to metropolitan regions and links between higher-order centres (Accessibility)
Geographic and infrastructural relevance	1.0	Topography
		Network density

# Exemplary results

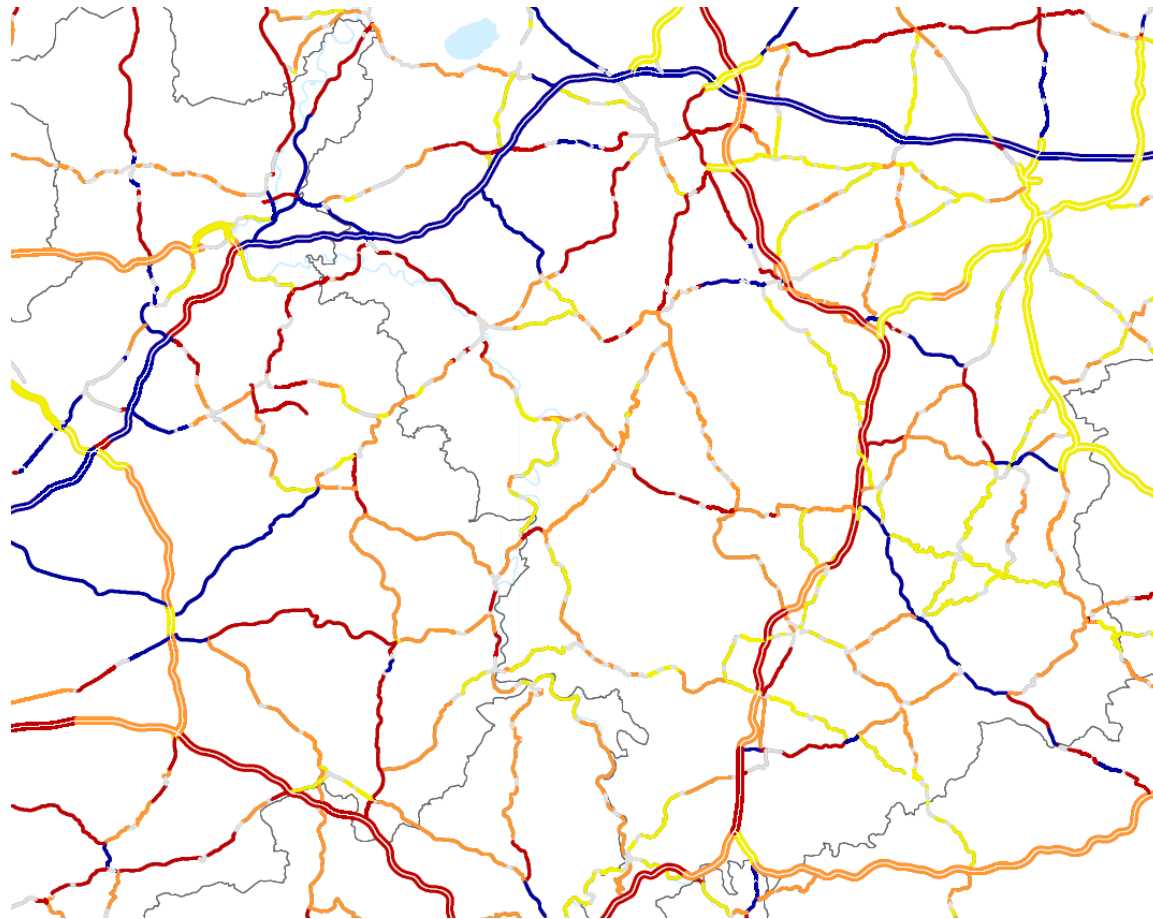


## Traffic relevance

- Annual average daily traffic per sector
- Annual average travel range in kilometers per sector

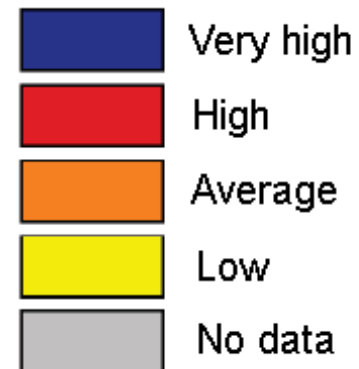


# Exemplary results



## Economic relevance

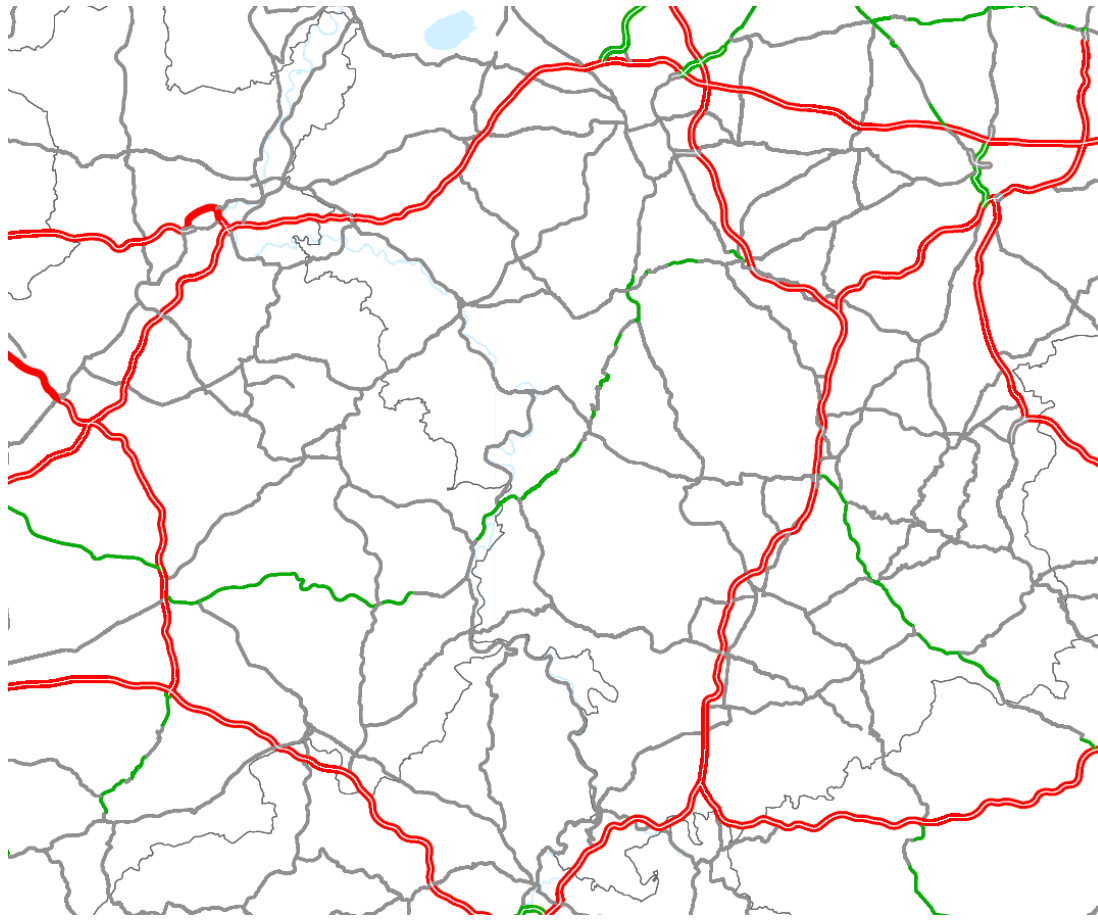
- Annual average daily heavy traffic
- Annual average travel range for heavy traffic





## Short excursion on the system of central places used in spatial planning in Germany

- **The Federal Transport Infrastructure Plan** has the aim to improve **accessibility** and the **quality of connections** and links against the background of the underlying demographic conditions
- The **system of central places** is one **instrument** to achieve this goal
- **Central places** are cities and municipalities and **are classified** depending on their relevance for their own population and the population of the surrounding area
- **Transport networks** support the **central places** in performing their **function** of providing goods and services for their area
- At the same time transport infrastructure makes it possible to **exchange goods** and **services** between central places in the sense of an exchange function

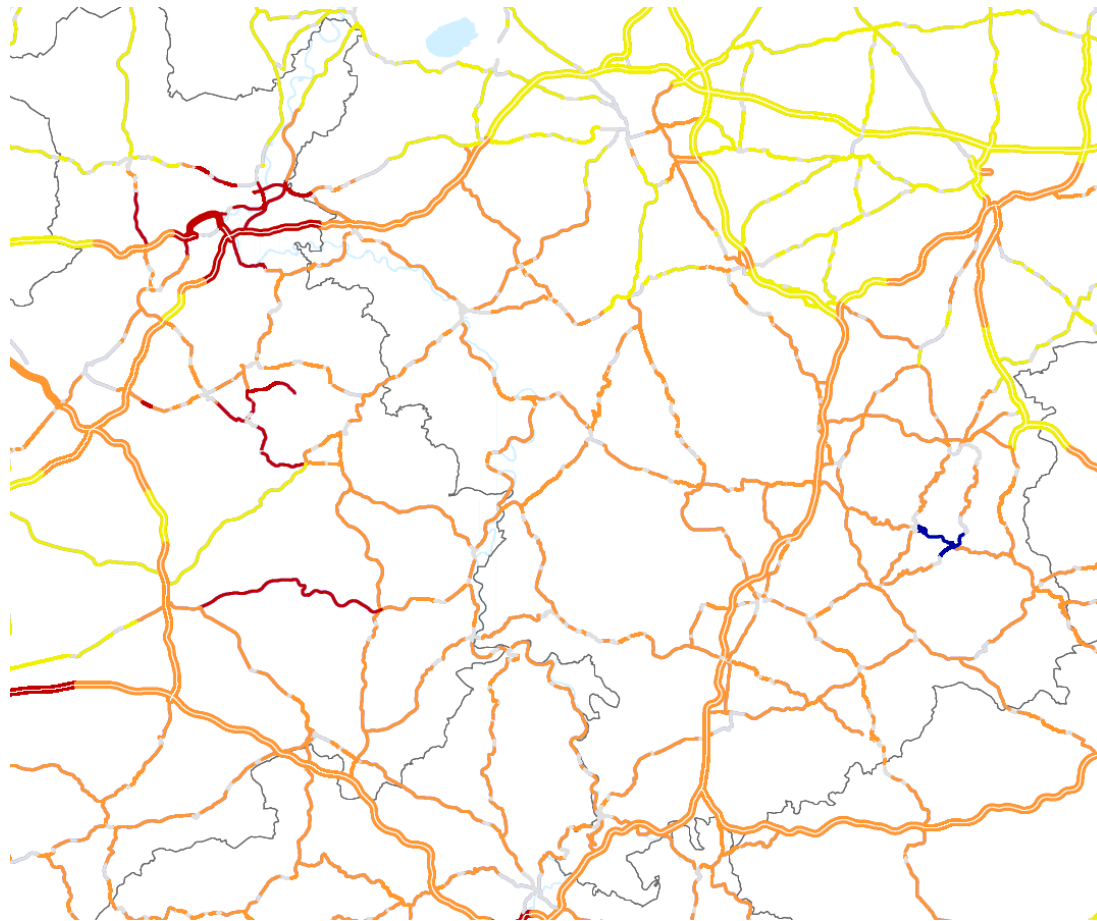
# Exemplary results



## Relevance according to spatial planning

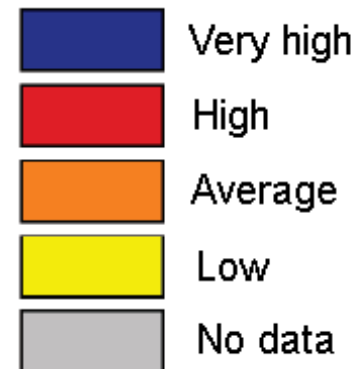
-  Links between metropolitan regions
-  Connections to metropolitan regions and links between higher-order centres

# Exemplary results

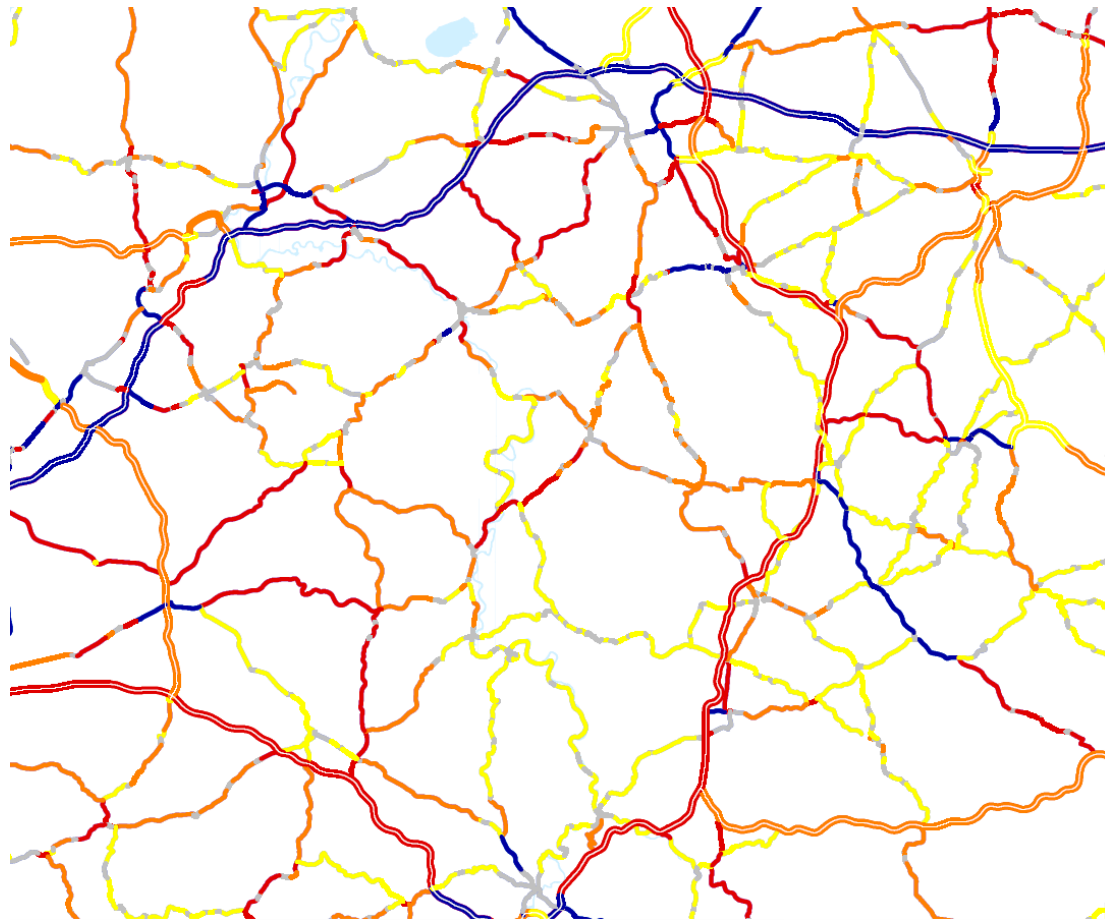


## Geographic and infrastructural relevance

- Average slope in a grid cell (500m x 500m)
- Average number of sectors in a grid cell (500m x 500m)

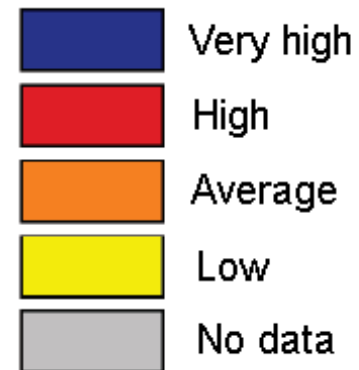


# Exemplary results



## Overall criticality

- Aggregation of all indicator groups



# 3. Summary and Outlook



# Summary

- We have shown you our approach to analyse the criticality of the federal trunk road network
- We have defined 4 indicator groups with 2 indicators per group
- The different indicator groups enable different views on the criticality of the federal trunk road network
- The methodological approach gives us the possibility to derive an overall criticality indicator

# Outlook

- The aggregation method needs further testing about sensitivity of the weightings
- We like to add further indicators to get even more different perspectives on the criticality
- In the context of the BMVI Network of Experts:
  - Integration of the criticality analysis in the process of climate impact assessment for the federal transport infrastructure
  - Further development to achieve an intermodal view on criticality

# Thank you for your attention!

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