

# University of Stuttgart

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The project is funded by the Federal Ministry for Digital and Transport (BMDV) and supervised by the German Center for Rail Transport Research (DZSF)

## Introduction

In direct comparison to other modes of transport, rail transport has a lower release of pollutants, more favorable energy balance and lower land consumption.



Nevertheless, more than 180 years of operation and more than 33,000 km of federal railways (DB 2020) also has an impact on the environment.

The objectives of the project are:

- Record and evaluate gaseous and PM emissions and derivate indicator substances (tracers) from different sources or areas of rail transport.
- Calculate emission factors taking into account parameters such as type of train (passengers or freight), locomotion (electric or diesel) and infrastructure.
- Model the especial and temporal spread of pollutants for the entire nationwide rail network.
- Create a human-toxicological and environmental hazard classification and risk assessment and recommendations for handling the airborne pollutants from rail traffic.

## Methodology

The data were collected in different measurement campaigns including several infrastructures of the railway network such as:

- ✓ **Plain line**
- ✓ **Marshaling yard**
- ✓ (Aboveground) Train station
- ✓ Brake test bench
- Underground train station
- Tunnel

## Used Measurement Technology

Pollutants	
Parameter	Measurement Principle
PM	Gravimetry Light scattering
NO/ <u>NO</u> <sub>2</sub> /NO <sub>x</sub>	Chemiluminescence <u>Passive sampler</u>
Chemical Analysis	ICP-MS
Additional parameters	
Meteorology (rel. humidity, temperature, wind)	Image recording with video or photo camera

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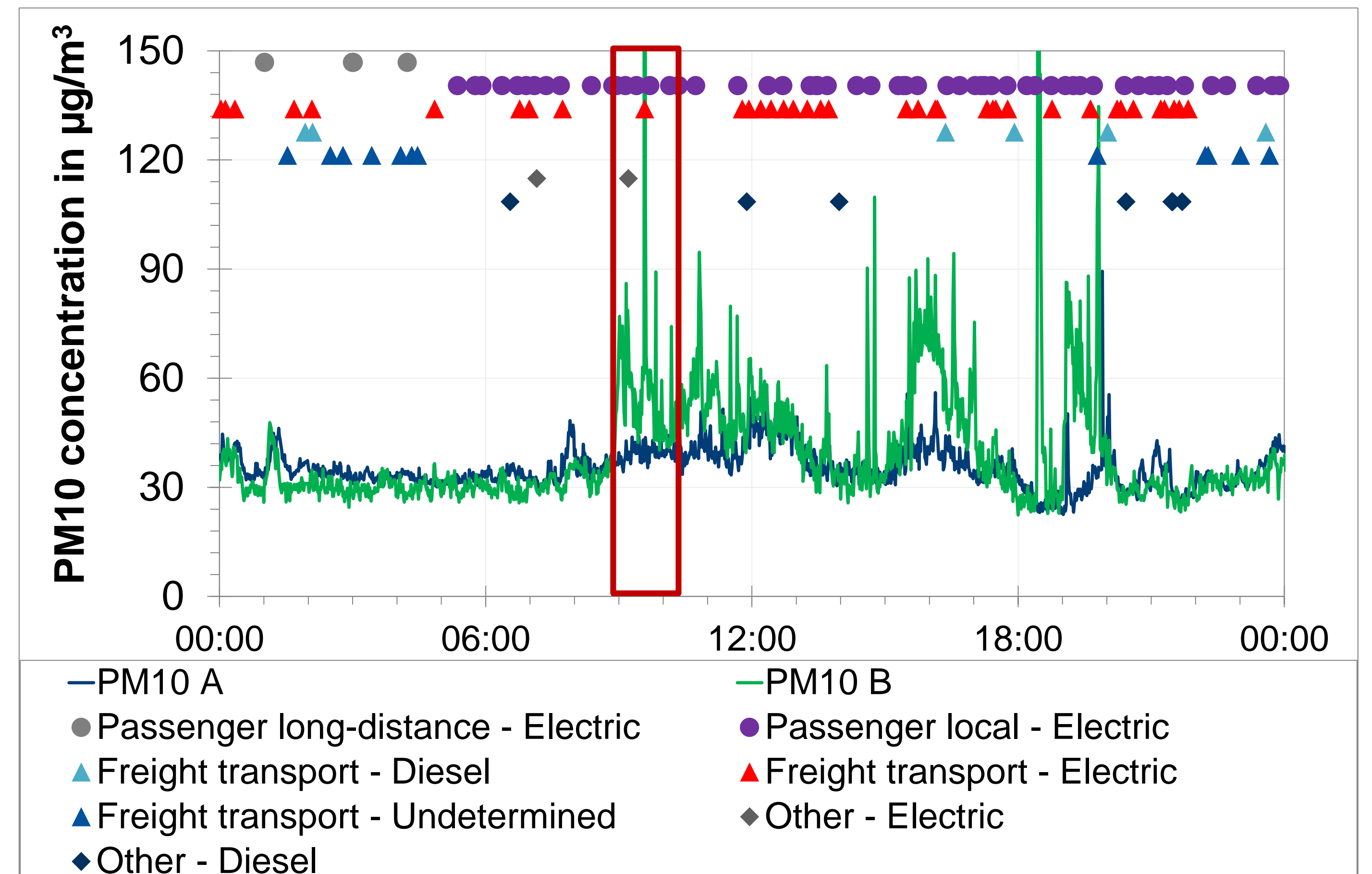


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## Contribution of railway traffic to the air pollution level nearby railroad tracks

## Results

Example of one event in the plain line on 02.03.2022



Measurement Point	Average PM10
A	37.1 µg/m³
B	38.9 µg/m³
C	38.2 µg/m³
D	36.7 µg/m³

When comparing the daily average of the PM10 concentration in background station (A) and the station next to the rails (B), the difference was only 2 µg/m³. However the additional load reached in the event marked in red was above 600 µg/m³ over several minutes.

The following elements were found in greater concentration on the plain line and in the marshaling yard, at the measurement stations near the railway:

Fe, Cu, Mn, Cr, Mo, Zn, Ba, Mg.

## Conclusions

- Similar results were found for the nitrogen oxides, however, the high concentrations tend to be around 5 minutes after the passing of the train, while for PM these events last around 2 minutes.
- By averaging the concentration, the additional load is relative little. However, when considering single events, this can be in the order of several hundred µg/m³.
- When analyzing the events, the freight transport shows, in general, an additional load higher than in the case of passenger trains.

### References:

Deutsche Bahn. Integrierter Bericht 2020.

