



Hrvatsko asfaltno društvo

Croatian asphalt association

*Smanjenje zagađivanja zraka korištenjem
posebnog materijala za prskanje asfalta
Reduction of air pollution using special
spreading material for asphalt*

Kurt Graham

TPA Germany

Međunarodni seminar ASFALJNI KOLNICI 2018

International seminar ASPHALT PAVEMENTS 2018

Opatija, 12.-13. 04. 2018.

AGENDA



- ▶ Motivation and Objectives



- ▶ Sustainable High-Tech Asphalt



- ▶ Implementation in the Construction Practice



- ▶ Photocatalytic Activity



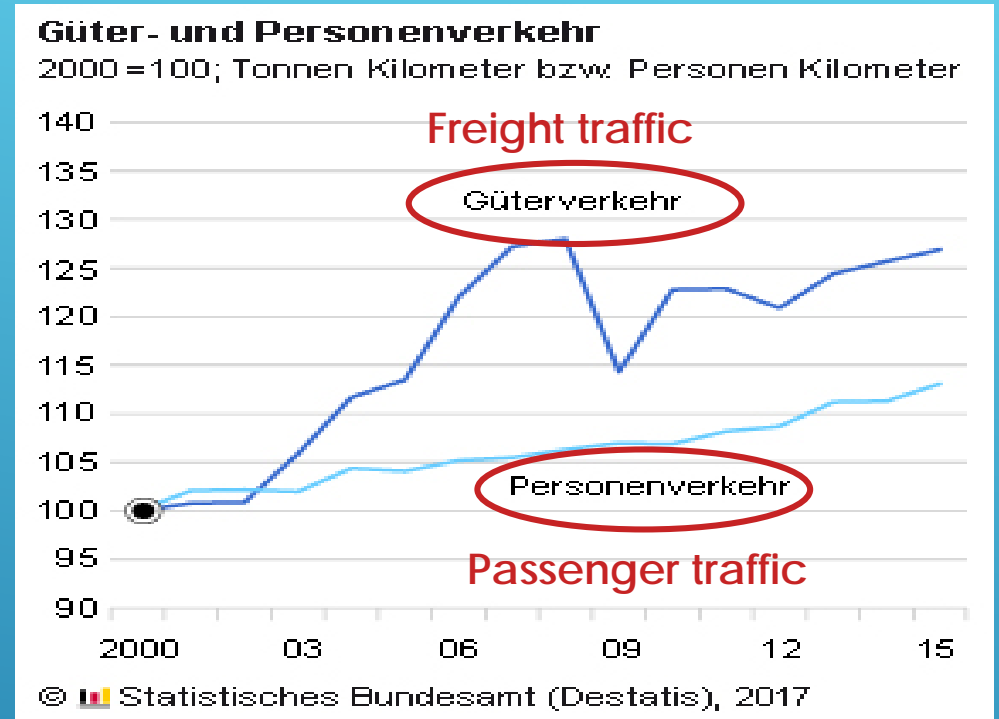
- ▶ Next Steps

MOTIVATION AND OBJECTIVES



MOTIVATION AND OBJECTIVES

Increasing Traffic Volumes



Due to growing traffic volumes, the burden on the environment and human health in German cities is increasing.

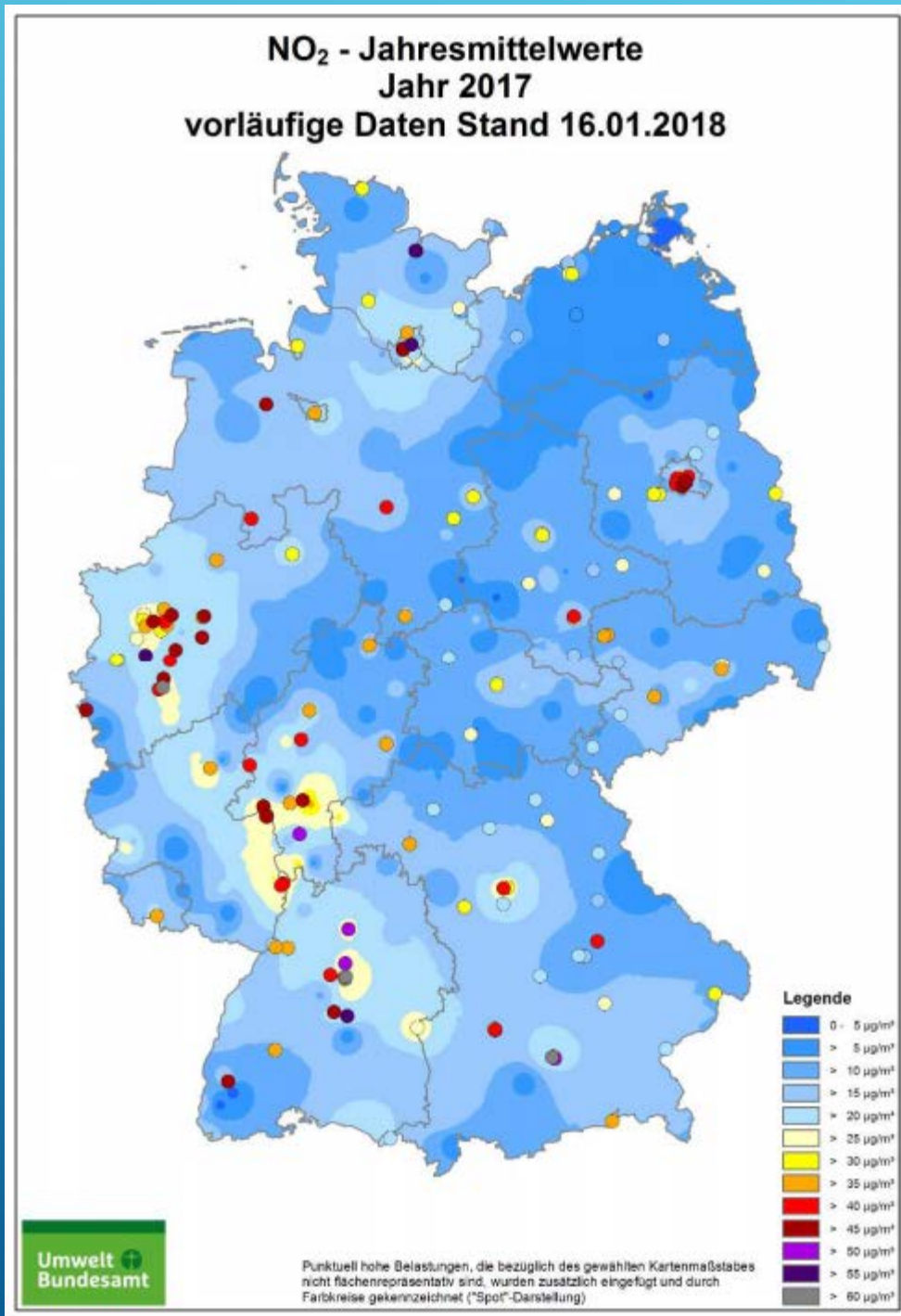
MOTIVATION AND OBJECTIVES

Nitrogen Oxide Limits



Since 01. January 2010 the annual limit of NO_x for the protection of human health in Germany has been $40 \mu\text{g}/\text{m}^3$

MOTIVATION AND OBJECTIVES



EXCEEDED ANNUAL LIMITS

- In 2017 the limit of 40 µg/m³ was exceeded in around 70 districts in Germany
- Exceeding the limits can result in fines of up to 50,000 € per day



SUSTAINABLE HIGH-TECH ASPHALT



SUSTAINABLE HIGH-TECH ASPHALT

NaHiTAs

Sustainable High-Tech Asphalt: Reducing Noise and Air Pollution

Project duration : 01.07.2015 – 31.12.2018

Funded by:



Bundesministerium
für Bildung
und Forschung

Project Consultants:

VDI

Technologiezentrum

Project Partners:

- Three University partners
- Seven Industry partners
- Two associated partners



STRABAG
TEAMS WORK.

SUSTAINABLE HIGH-TECH ASPHALT

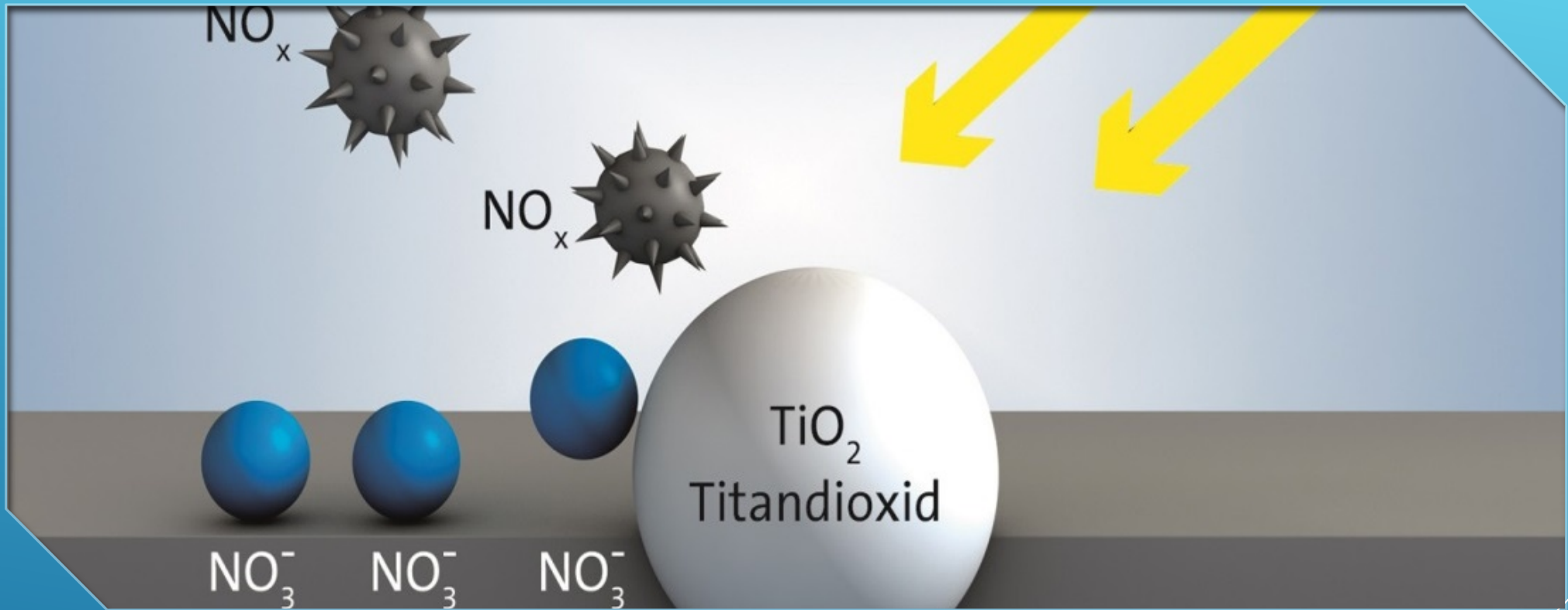
Titanium Dioxide – Origin and Function

- Titanium dioxide is a naturally occurring oxide of titanium, which is mined as an ore and converted to a usable form, through a refinery process.
- Within the EU approximately 1.5 Mio. tons of titanium dioxide is produced each year
- Used as a white pigment since 1908
- Applications as a whitening pigment in toothpastes, cosmetics, food, paper and paint industries etc.
- Active ingredient in sunscreen



SUSTAINABLE HIGH-TECH ASPHALT

Titanium Dioxide – Origin and Function



- The photocatalytic properties of the substance were discovered in 1972
- UV radiation stimulates the material, forming radicals. These radicals catalyze the reaction of nitrogen oxides in the air into harmless nitrates.

SUSTAINABLE HIGH-TECH ASPHALT

Titanium dioxide – Origin and Function

- Numerous trials using titanium dioxide to reduce pollution have been conducted
- Used on building facades, roofs, foot paths and noise barrier walls
- Utilization has been limited by the cost of titanium dioxide

**Disadvantages:
Costs + Reaction Location**



SUSTAINABLE HIGH-TECH ASPHALT

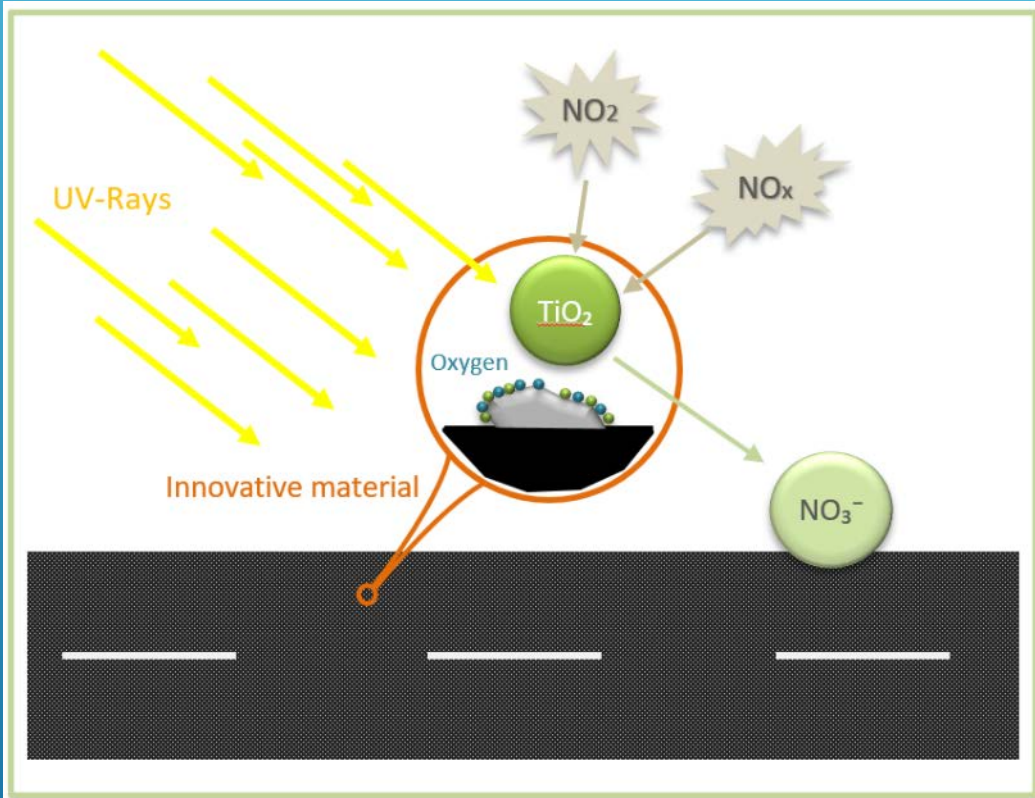
Pollution Reduction Directly at the Emission Source



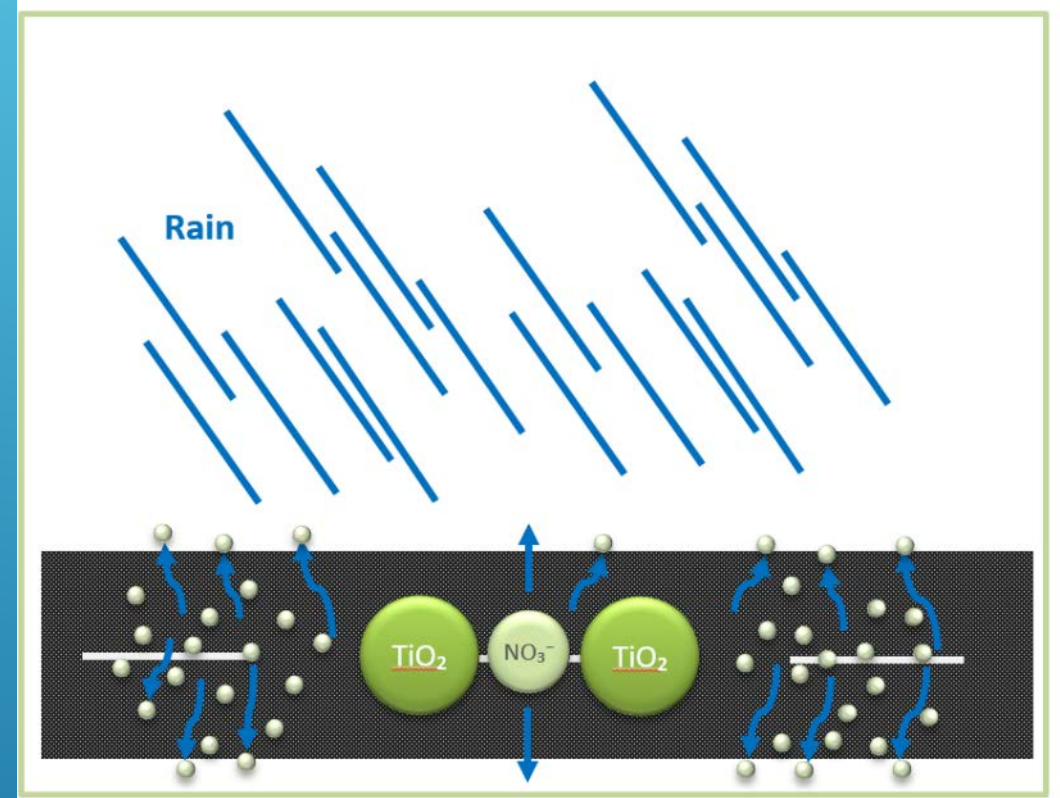
Economical and Constructible

SUSTAINABLE HIGH-TECH ASPHALT

Reduction of Nitrogen Oxides Through an Innovative Road Surface



With help from sunlight harmful nitrogen oxides will be converted to water soluble nitrate



The nitrates are the washed from the road by rain water

SUSTAINABLE HIGH-TECH ASPHALT

Innovative Chip Material



- Created from Ultra High Performance Concrete (UHPC)
- Targeted crushing of the UHPC to the desired aggregate size and form
- Research conducted: The innovative material is suitable for use on all road categories

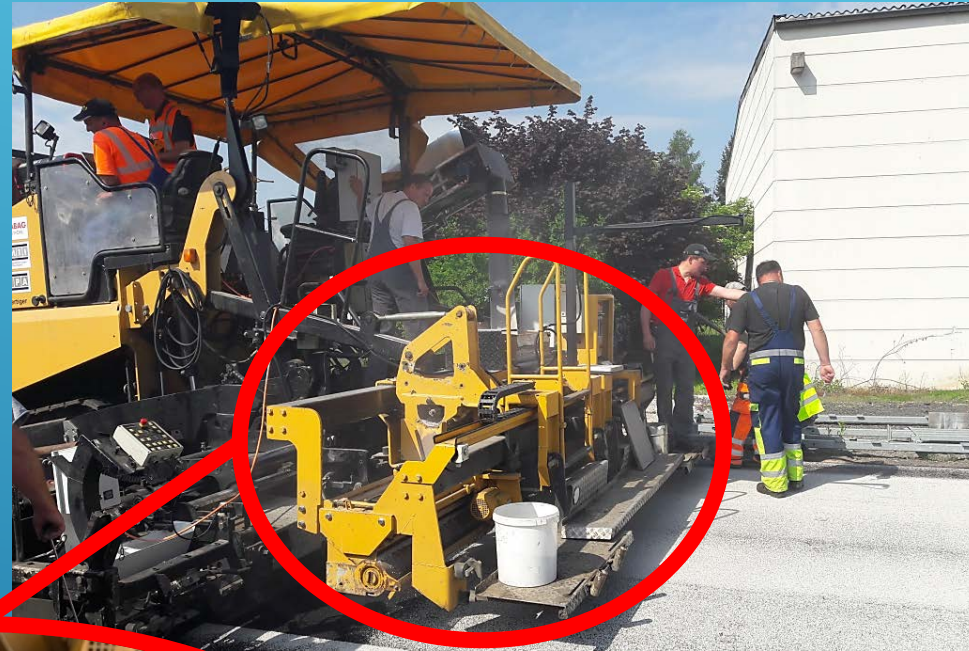


IMPLEMENTATION IN THE CONSTRUCTION PRACTICE



IMPLEMENTATION IN THE CONSTRUCTION PRACTICE

The paver integrated spreader from STRABAG (own development)



IMPLEMENTATION IN THE CONSTRUCTION PRACTICE

The paver integrated spreader from STRABAG (own development)

- Laying of asphalt and spreading of chip in a single process
- Durable bind between the materials due to the simultaneous construction
- Proven uniform and high skid resistance properties



How to deliver the chip material to the spreader at the back of the paver?

IMPLEMENTATION IN THE CONSTRUCTION PRACTICE



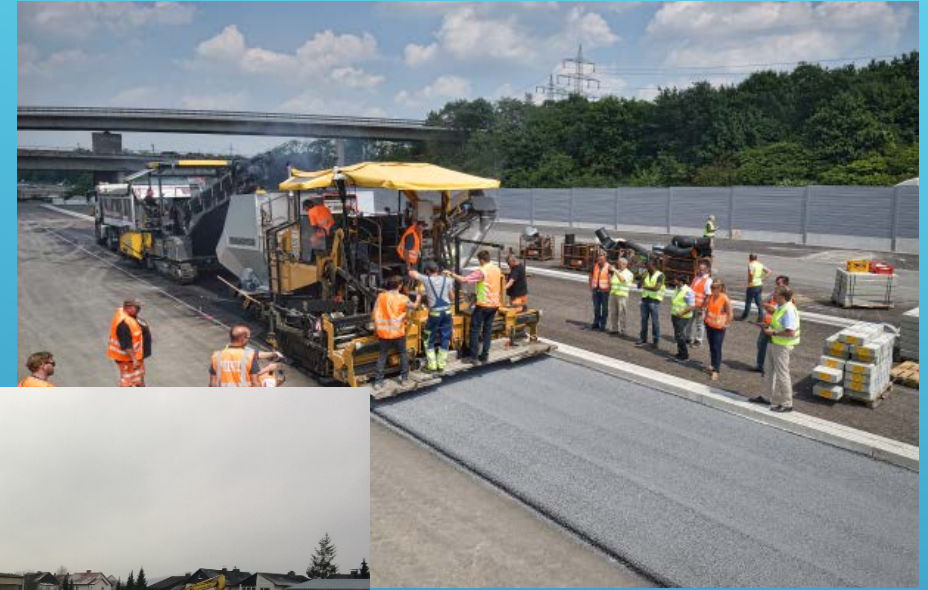
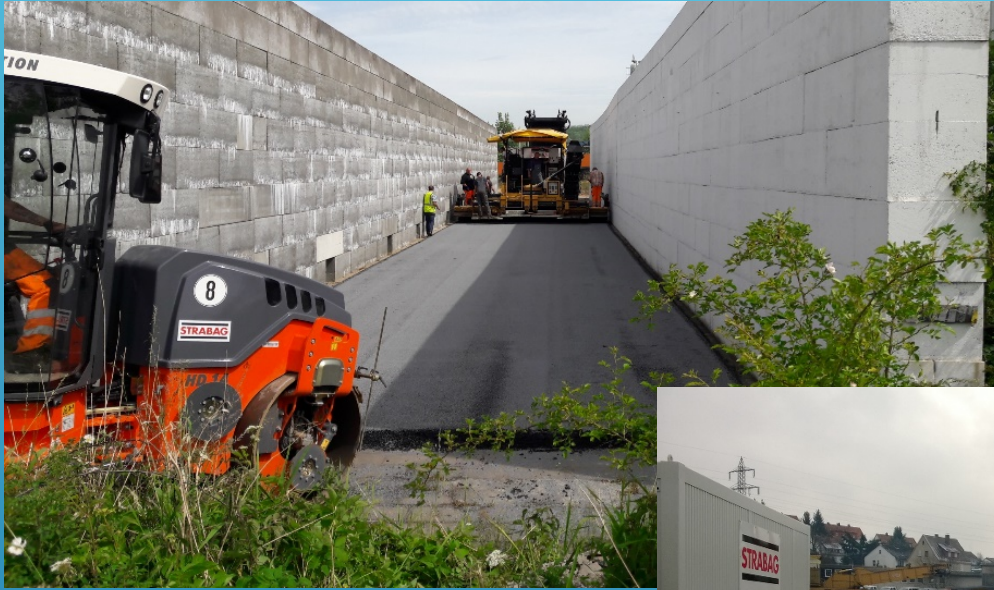
Hopper for chip material

Innovations Hopper



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TEAMS WORK.

IMPLEMENTATION IN THE CONSTRUCTION PRACTICE



Construction of six test sites since the project began in 2015

PHOTOCATALYTIC ACTIVITY



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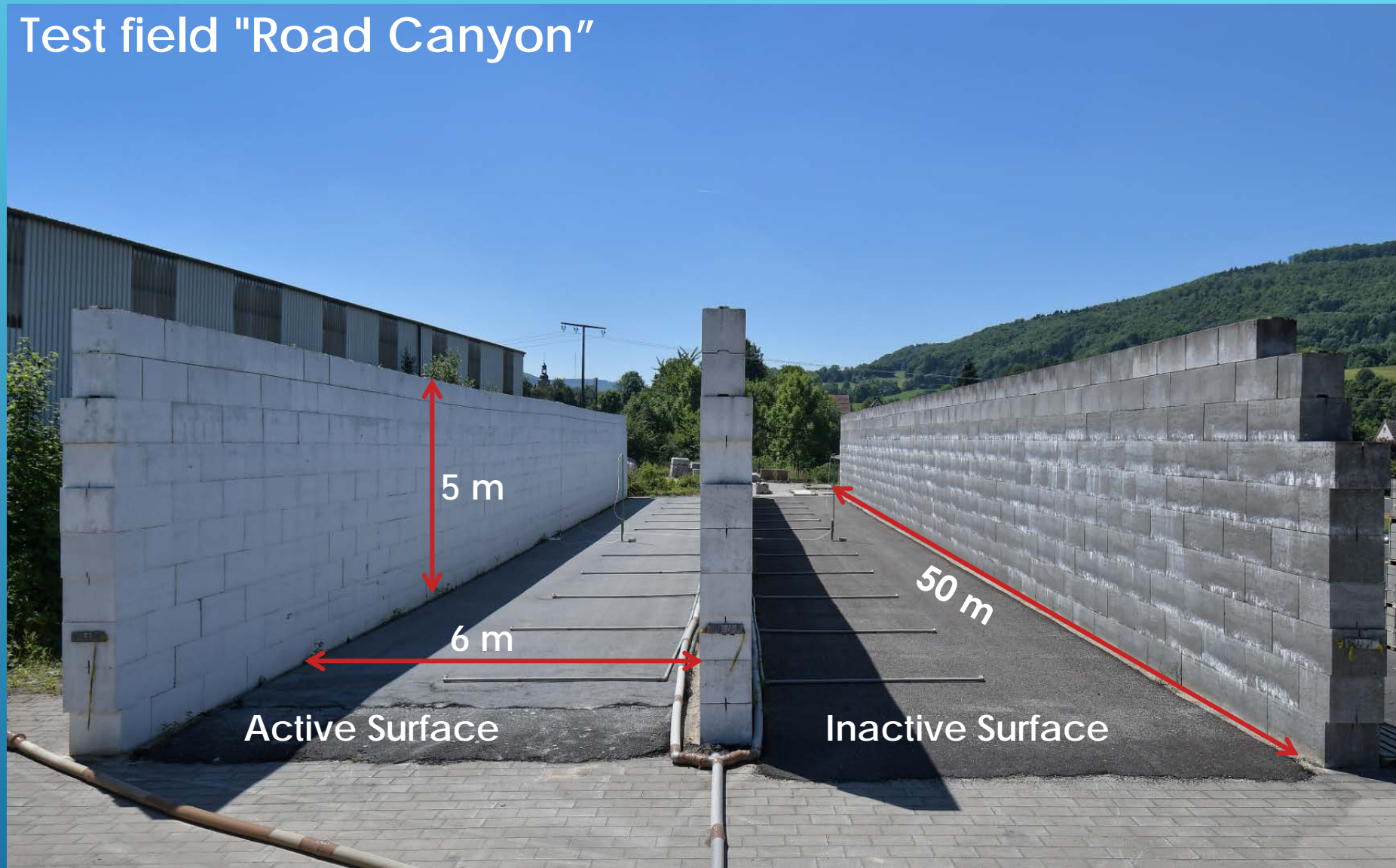
Determining the Photocatalytic Activity

- Determining the performance of the photocatalytic material for the reduction of pollutants
- Tested in the laboratory according to standard test procedures (DIN ISO 22197-1)
- Bore samples were taken from various trial sites
- Disadvantage: Not a good representation of performance in the field



PHOTOCATALYTIC ACTIVITY

Test field "Road Canyon"



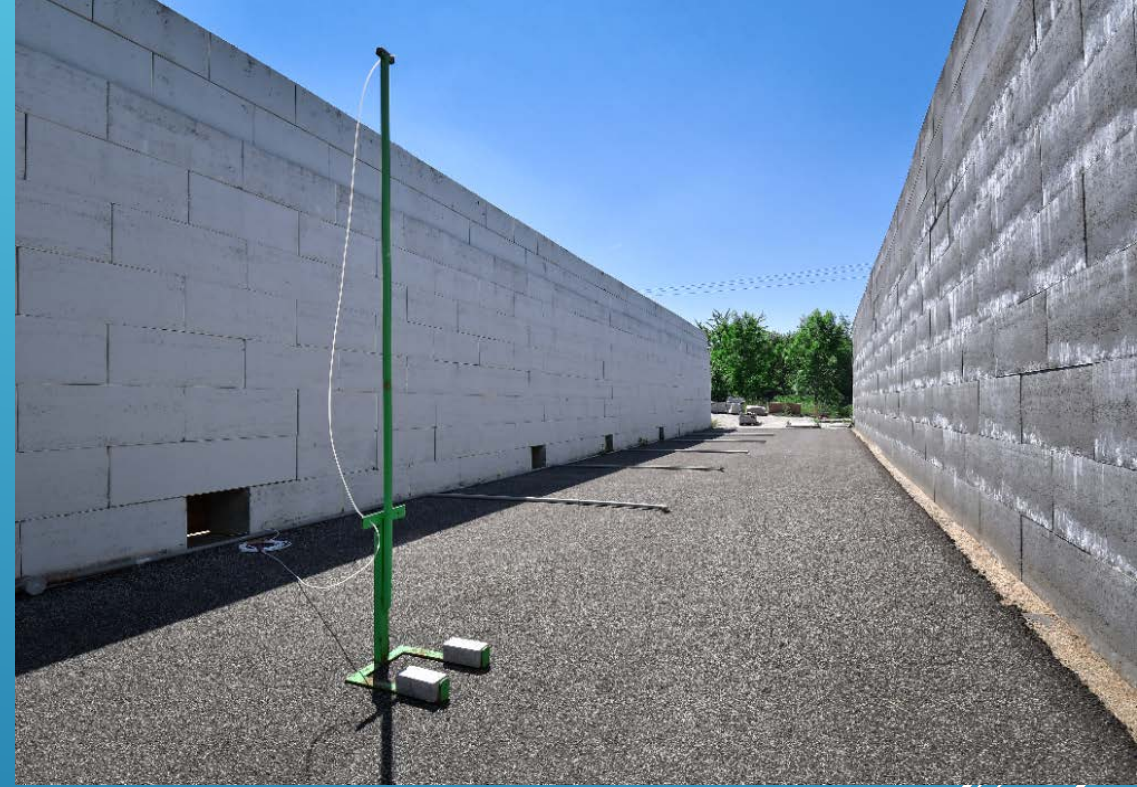
The "Road Canyon" enables measurements of the photocatalytic performance of the material under realistic conditions

PHOTOCATALYTIC ACTIVITY

Defining the Photocatalytic Activity



Continuous and identical emissions are released in each canyon during testing



Air measuring devices are placed in each canyon

PHOTOCATALYTIC ACTIVITY

Determining Reductions of Nitrogen Oxides

- Sampled air is fed into two measuring boxes which determine the concentrations of NO, NO₂ und NO_x
- Difference between the measured concentrations defines the effectiveness of the reduction



NEXT STEPS



NEXT STEPS

Pilot Road



Implementation of the innovative new technology on a pilot road as project conclusion

**THANK YOU FOR YOUR
ATTENTION**



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TEAMS WORK.