

# HAMBURG CITY EXPERIENCE IN URBAN TRAFFIC MANAGEMENT



# INVOLVED PUBLIC BODIES



Hamburg | Ministry of Transport  
and Mobility Transition

Department for Transport  
~130 employees

- Funding & Financing
- Administration



**LSBG**  
Landesbetrieb Straßen,  
Brücken und Gewässer  
Hamburg

Linked Third Party of  
the city of Hamburg  
~630 employees

- Project Management
- Project Planning
- Engineering

**BVM**

Ministry of  
Transport and  
Mobility Transition

**LSBG**

Country  
Operation of  
Urban Streets,  
Bridges and  
Waters

**HHVA**

Hamburg  
Transportation  
facilities



Hamburg  
Verkehrsanlagen

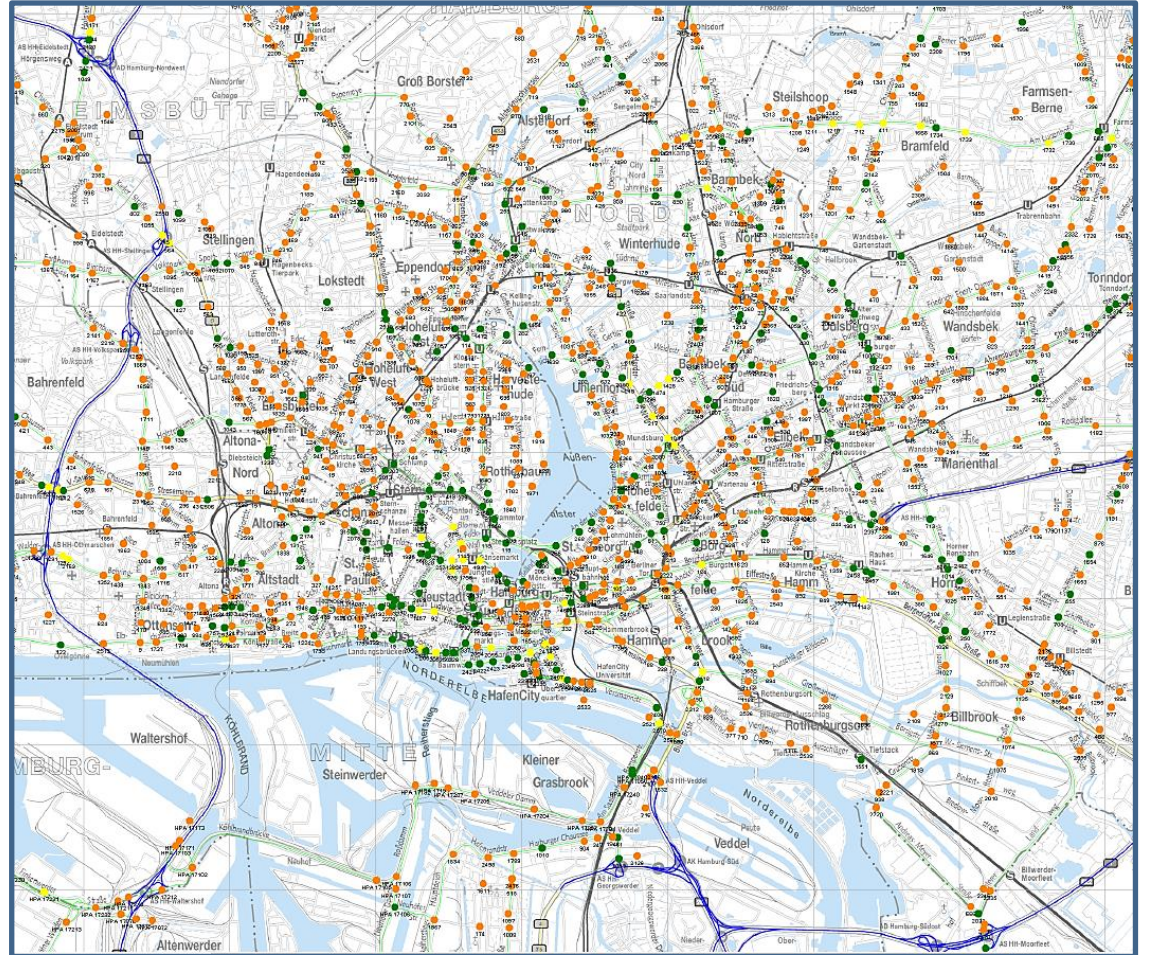
100% subsidiary of the Free and  
Hanseatic City of Hamburg (FHH)  
~230 employees

- Operation
- Procurement
- Programming
- Implementation
- Construction supervision



# EXISTING ROAD TRAFFIC TECHNOLOGY

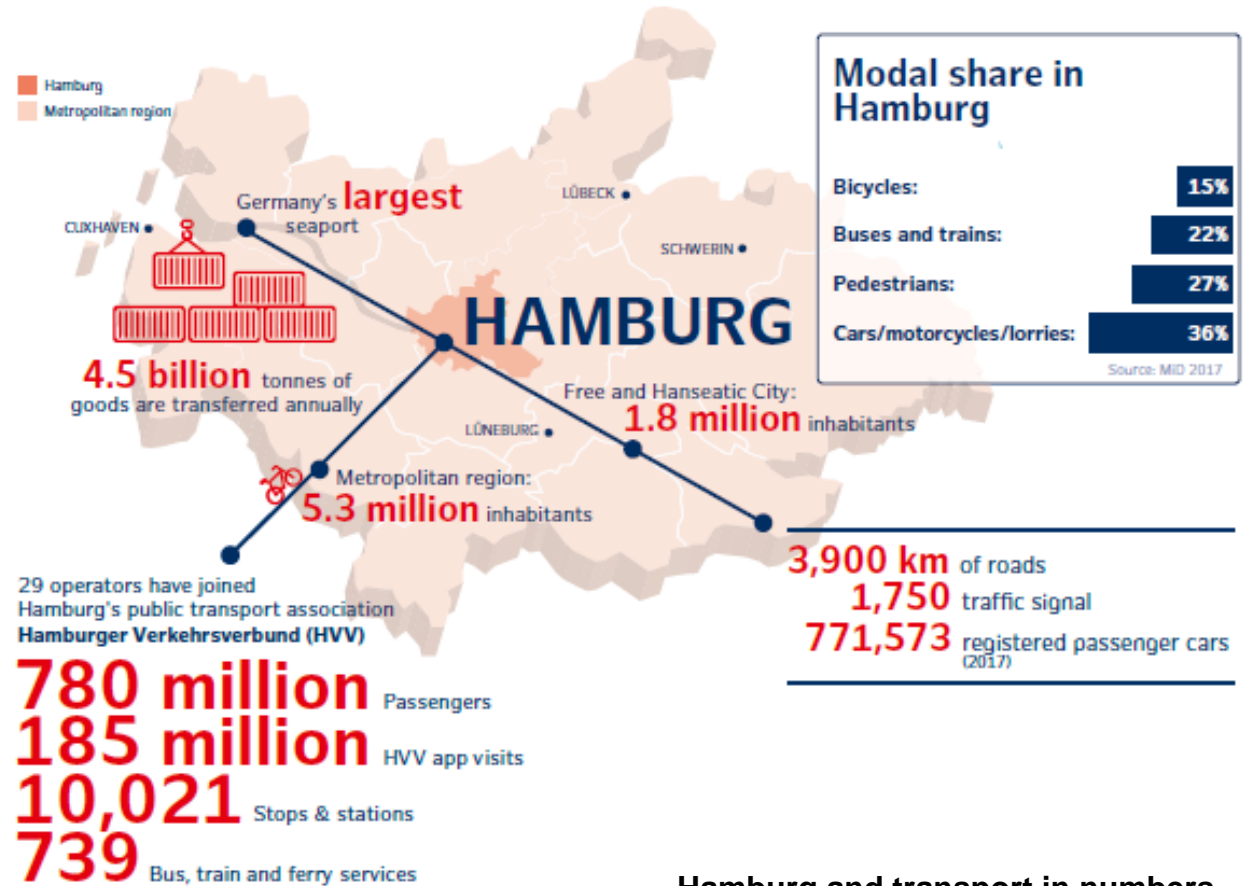
- ~1750 traffic light controllers
- 10 traffic computers
- 1 traffic control / management center



# SOLVING THE MOBILITY CHALLENGE

## Challenges:

- Growing city and ageing population
- Increase in commercial, commuter and tourist traffic
- Environmental impact of transport
- Shortage of space
- Air and noise pollution
- Unstructured and illegal parking
- Sidewalks shared with bikes and parked cars
- Poor or insufficient infrastructure for cyclists



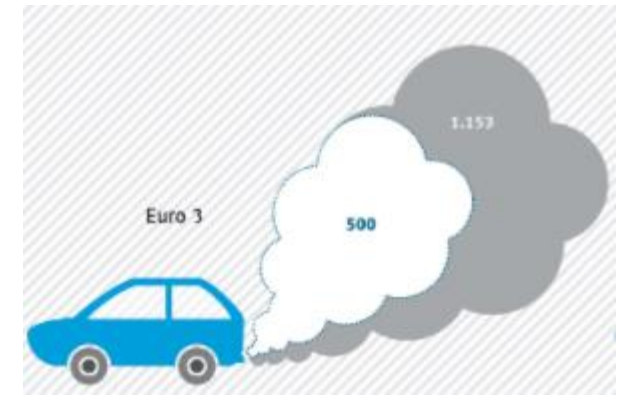
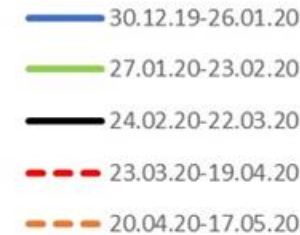
Hamburg and transport in numbers



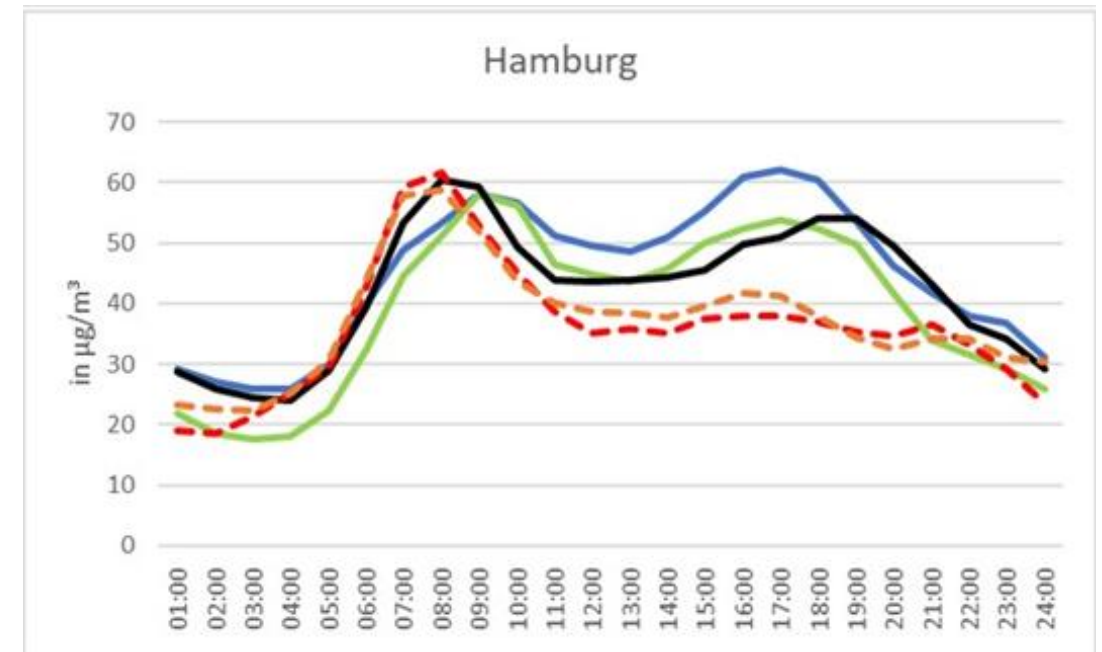
# HAMBURG GREEN CITY PLAN

- Challenge: Hamburg exceeds the legal limits set by the EU for the emission of nitrogen dioxide (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub>)
- Objective: Measurable and sustainable contributions to reducing pollutant emissions
- A "master plan for the design of sustainable and emission-free mobility" (Green City Plan) has been drafted
- Green City Plan:
  - serves as basis for the implementation of the planned emission-reducing measures
  - is the precondition for federal funding

Sources: <https://www.hamburg.de/bvm/greencityplanhamburg/> | <https://www.umweltbundesamt.de/>



Threshold value and real emissions in NO<sub>x</sub>/km

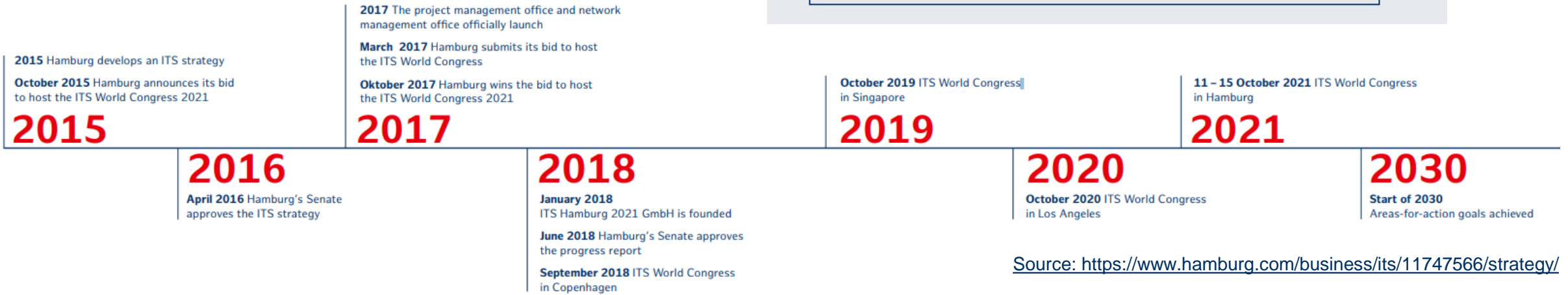
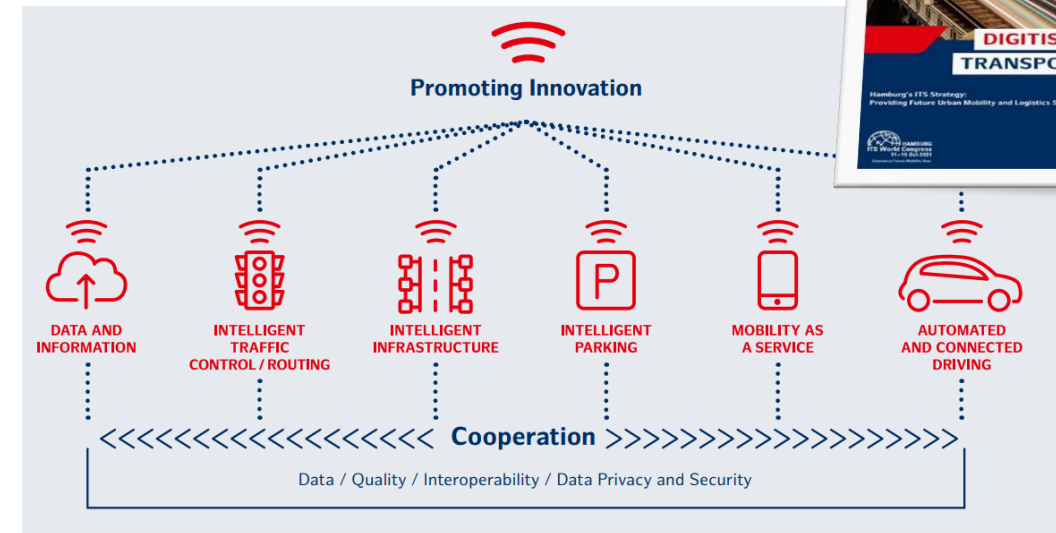
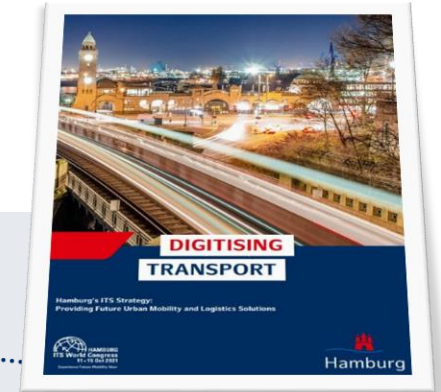


Mean traffic-related NO<sub>2</sub> daily hydrographs weekdays

# ITS STRATEGY 2030 - DIGITISING TRANSPORT

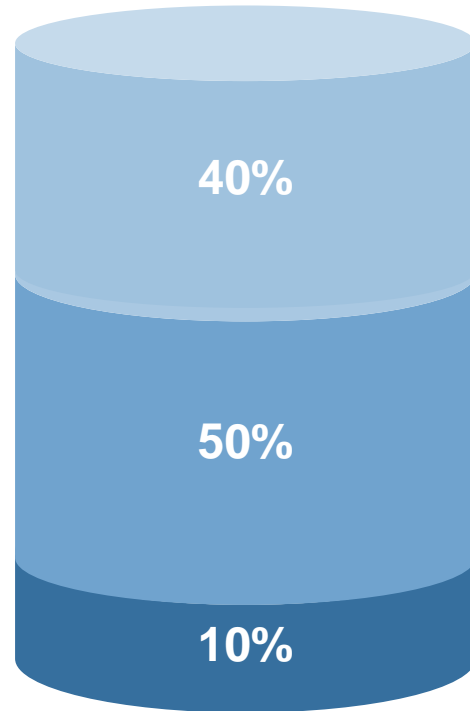
## Objectives:

- Improving transport safety
- Reducing transport-related impacts on the environment
- Increasing reliability and efficiency
- Supporting accurate and secure data collection
- Promoting innovation



Source: <https://www.hamburg.com/business/its/11747566/strategy/>

# FINANCING AND FUNDING OF ITS PROJECTS



- EU C-ITS pilot project “C-ROADS Germany Urban Nodes” enable deployment of C-ITS in urban areas
- Federal Funding program: “Digitization of municipal transport systems - Clean Air 2017 - 2020“
- General budget for modernization of the Free Hanseatic City of Hamburg

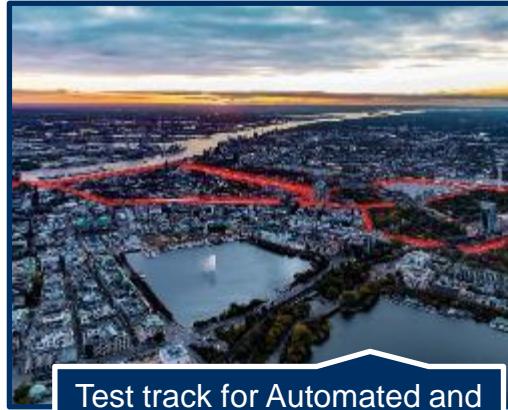


Co-financed by the Connecting Europe Facility of the European Union



Federal Ministry  
of Transport and  
Digital Infrastructure

# SELECTION OF ITS PROJECTS IN HAMBURG



Test track for Automated and Connected Driving (TAVF)



Hamburg Electric Autonomous Transportation (HEAT)



Bidirectional multimodal connectivity (BiDiMoVe)



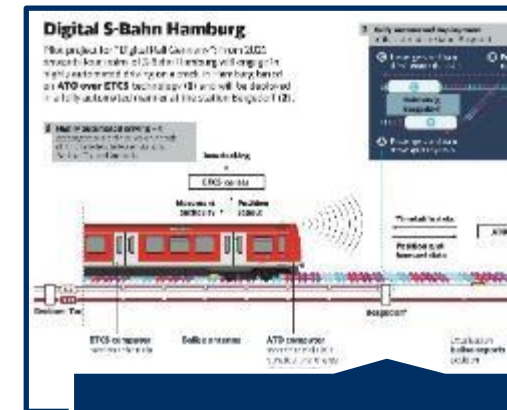
Green4Transport



Traffic Light Forecast (TLF)



Driverless new Underground line 5



Digital Regional Trains Operation



# TAVF

TEST TRACK FOR AUTOMATED AND CONNECTED DRIVING



# TAVF – SETUP

- Located in the city centre of Hamburg
- Connecting Hamburg exhibition halls (ITS World Congress 2021) with different points of interest
- Approximately 9 km long
- Consisting of 37 traffic lights and one bascule bridge
- User-open and manufacturer-independent
- Implementation phase from January 2018 till March 2021
- Co-financed by EU and funded by German Government



Co-financed by the Connecting Europe  
Facility of the European Union



Federal Ministry  
of Transport and  
Digital Infrastructure

# TAVF – OBJECTIVES

- Gain experiences in design, implementation and operation of V2X-infrastructure
- Implementation of Day 1 Services for Signalized Intersections (SI)
  - Signal Phase and Timing Information (SPTI)
  - Green Light Optimal Speed Advisory (GLOSA)
  - Traffic Light Prioritisation (TLP)
  - Emergency Vehicle Priority (EVP)
- Identify technical requirements for further roll out
- Cost-benefit analysis





# TAVF – STATUS QUO

- Today, 32 traffic lights equipped with R-ITS-S according to ETSI ITS-G5 standard
- All R-ITS-S provide SPaT and MAP messages (~30% with traffic light forecast)
- R-ITS-S Dashboard for monitoring and quality analysis
- Certified C-ITS messages enable trusted exchanges of information between different parties
- Customized Public Key Infrastructure (PKI, V 1.3.1)



# TAVF - SELECTION OF USERS

**VOLKSWAGEN**  
AKTIENGESELLSCHAFT

Automated driving  
(SAE level 4) in  
urban space

**Neusoft**  
Automotives

Traffic light based  
optimizations

**HAW**  
HAMBURG

Urban Mobility Lab  
@ HAW Hamburg

**NXP**

PedelACC (Pedal  
electric cycle and  
Adaptive Cruise  
Control)

**ibeo**  
automotive

Automated and  
connected driving  
with 4D LiDAR  
technology

**Continental**

**T...**

◀MobilEdge▶

Collision Warning for  
vulnerable road  
users based on 5G  
technology

**DLR**

Scientific  
development of the  
VITAL traffic light  
control method

Technische  
Universität  
Braunschweig

**NFF** NIEDERSÄCHSISCHES  
FORSCHUNGSZENTRUM  
FAHRZEUGTECHNIK

Automated driving  
and parking

**Pilot**  
Driving Automation

European Car  
Manufacturers testing  
Automated Driving of  
SAE level 3 and 4

**VITRONIC**  
the machine vision people

Optimizing traffic  
control and  
detecting vulnerable  
road users

# TAVF – GAINED EXPERIENCE

## Implementation processes

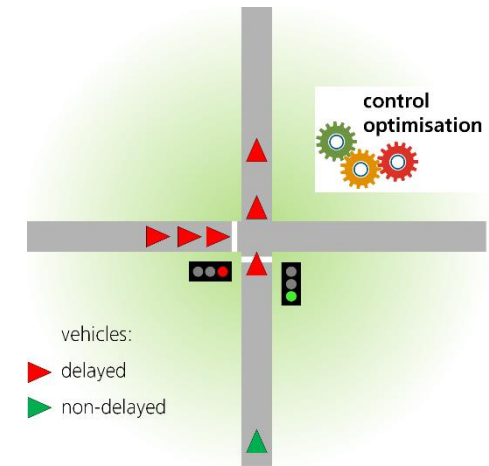
- Active participation in national and Europe-wide harmonisation in C-ROADS
- Successful processing of MAP and SPaT messages by test track users
- Novel cooperative control methods were successful evaluated in the field

## Coordination of users and their requirements and needs

- Successful establishment of the TAVF coordination centre
- High satisfaction among the users of the test track
- Continuous requests for the implementation of new use cases

## Cost-benefit analysis by simulation

- Impact analysis of different scenarios using microscopic traffic simulation (SUMO)
- Connected and automated mobility increases average speed by up to 12%
- Only marginal reduction in emissions from Connected and automated mobility

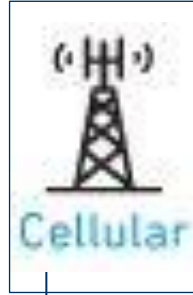




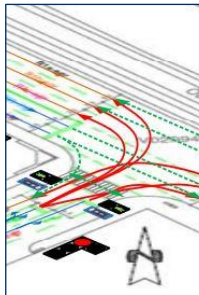
# TAVF – FURTHER DEVELOPMENT



Evaluating of cooperative awareness messages (CAM) in terms of data protection



Implementing C-V2X by using 4G LTE or 5G mobile cellular connectivity



Implementing splitting algorithms for MAPEM, due to maximum file size limitations



Introducing services for Probe Vehicle Data (PVD)



Introducing services for Vulnerable Road Users (VRU)

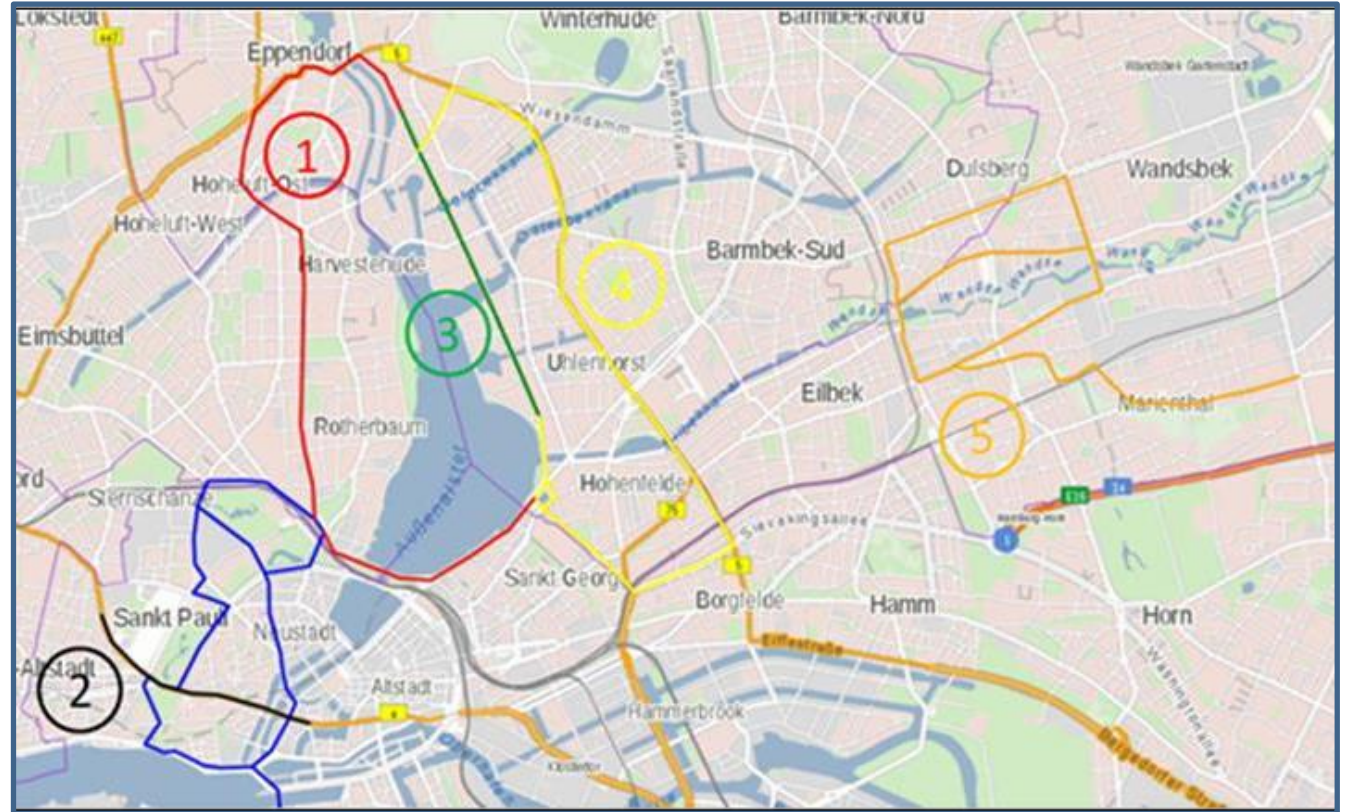


Analysing of consequences of operator liability with regard to the legal validity of data

# ROKS – ROLL OUT COOPERATIVE SYSTEMS

## Project ROKS:

- Equipment of five additional areas with more than 100 traffic lights
- Based on gained experiences
- Implement tried-and-tested C-ITS services for Signalized Intersections
- Introducing and establishing (standard) operating processes (maintenance, etc.)
- Duration: April 2020 until December 2024
- Total budget: ~31 Mil. EUR





An aerial photograph of Hamburg, Germany, taken at sunset. The city is densely packed with buildings, and the Elbe River winds through it. Overlaid on the city is a network of thick red lines, representing a transit or mobility network. The lines form a complex web connecting various parts of the city, including the harbor area and the city center. The sky is filled with soft, orange and yellow light from the setting sun, with some clouds catching the light.

**FOR FURTHER INFORMATION VISIT OUR WEBSITE**

<https://www.tavf.hamburg/>

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