

Green light with 5G

The City of Hamburg is testing digital solutions for intelligent traffic management



Picture generated with AI

“20 percent less fuel consumption – the data recorded by 5G-LOGINNOV clearly show that the use of platoons, GLOSA, and V2I communication based on 5G is making Hamburg and its port more sustainable.”

Ralf Willenbrock, Project Manager, T-Systems

Traffic in major cities doesn't only harm the environment; it also reduces the efficiency of logistical processes. Road users, residents, and businesses alike suffer from traffic jams and poor air quality. In 2016, Hamburg's senate approved its ITS Strategy 2030, a strategic initiative intended to make lasting improvements to the traffic situation. ITS is short for "Intelligent Transport Systems".

Hamburg wants to become a showcase for the mobility of tomorrow. The city's transport institutions - the office for traffic and transition to sustainable mobility ; the state enterprise for roads, bridges, and waterways (LSBG), the Hamburg Port Authority (HPA), and Hamburg traffic facilities – want to demonstrate how digitalization can make traffic safer, more efficient, more convenient, and more environmentally friendly.

With support from the EU (Horizon 2020, Connected Europe Facility) and Germany's Federal Ministry of Transport and Digital Infrastructure (BMDV), Hamburg built a test area more than 12 kilometers long for automated, connected driving. This has involved fitting more than 50 traffic lights and one bridge with smart control technology since 2018. The technology can communicate with appropriately equipped vehicles, directly via the 802.11p standard (ITS-G5) and via 5G wireless communications. The test area gives project partners the opportunity to trial innovative mobility services in the actual road traffic of a major city and develop solutions for future mobility. This includes the use of autonomous shuttles as well as the integration of cyclists, among other elements.

There is also another component that plays an important role in Hamburg's mobility, however: the "hinterland traffic" to and from the port – a particular challenge, given that the various loading and unloading points are spread out throughout the city. In total, Hamburg sees an average of 40,000 truck journeys daily in the port area south of the Elbe river, with a focus on container transport; north of the Elbe, additional trucks travel to serve city logistics, for instance, for the large cruise ship terminals.

Together with the LBSW, the HPA, and partners Continental, Swarco, and tec4U, T-Systems decided to test a variety of digital solutions based on the public 5G network for hinterland traffic and quantify its sustainability effects. The solutions were intended to do more than simply create a foundation for collecting data: the aim was to directly reduce the carbon footprint of heavy truck traffic. To this end, the team launched the "5G-LOGINNOV" project as part of Hamburg's ITS initiative.

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At a glance

- Reduction of harmful emissions from truck traffic around the Port of Hamburg
- Quantified examination of environmental impacts in accordance with ISO 23795:2022 with Low Carbon Mobility Management (LCMM) as the decision model for the next steps
- Test area for automated, connected driving (TAVF): rollout of intelligent traffic lights (with hybrid V2I functionality)
- Utilization of the public 5G infrastructure
- Example of use by T-Systems: digital solutions for platooning, Green Light Optimum Speed Advisory (GLOSA), Low Carbon Mobility Management (LCMM)
- Data from 400,000 test trips in real Hamburg traffic
- Analysis supported by machine learning/artificial intelligence
- Proof: Digitalization creates intelligent mobility and helps to achieve climate targets
- Optimized flow of heavy truck traffic: times spent in traffic jams were reduced by 59 percent
- Reduction of fuel consumption by 20 percent and reduction of carbon footprint by 17 percent
- Transferable logistics innovation – confirmed in sister projects in Koper (Slovenia) and Athens-Piraeus (Greece)
- Contributes toward Hamburg's sustainability targets

Reference in detail



Customer pain points

“Intelligent mobility doesn’t mean less traffic; it means better traffic,” explains Ralf Willenbrock, 5G-LOGINNOV project manager at T-Systems. “To achieve this, we need solutions that optimize the flow of traffic.” The necessary prerequisites, intelligent traffic lights and the 5G infrastructure, have been met. “In addition to contributing to the city’s sustainability strategy, we also want to highlight the relevance of 5G as a technology for realizing the use cases.”

The 5G-LOGINNOV team established two subprojects to explore the use of 5G technologies for the port area, one under the responsibility of the city (for the LSBG) and one under the responsibility of the HPA. The logistics processes on the roads and in the hinterland need to become more climate-friendly in the long term. The first project, “Floating truck and emission data”, used a method for recording fuel consumption through Low Carbon Mobility Management (LCMM) that was developed by T-Systems. The second project, “GLOSA (Green Light Optimum Speed Advisory) and automated truck platooning” examined the possibilities and effects of platooning, in which two or more vehicles are connected in convoy to act as a single, virtual vehicle. Real-time communication with minimized latency plays a decisive role in this scenario.



How T-Systems solved it

5G-LOGINNOV merely equipped the vehicles with smart devices, the necessary apps, and the features for V2I/I2V via 5G. The project utilized the city’s public 5G network.

The vehicles in a convoy were equipped with 5G-GLOSA, an application that coordinates the platoon’s driving speed and behavior with the green phases of the traffic lights. In addition to the tests on the TAVF, the trucks could also use special on-board units to send signals to the intelligent traffic lights at selected intersections of the Kattwyk Bridge to extend the green phases, another measure aimed at ensuring that truck traffic flows smoothly.

To record the relevant data, the test vehicles were equipped with the T-Systems LCMM app, which measures energy consumption and calculates the corresponding CO2 emissions in accordance with the ISO 23795:2022 standard. LCMM also enables detailed analysis of driving patterns, such as times spent in traffic jams and acceleration and braking behavior. LCMM also enables comparisons with conventional trips that do not use GLOSA. After a total of 400,000 trips, robust results are now available (as of late 2023) that illustrate the benefits of 5G and GLOSA for hinterland traffic. T-Systems also relied on machine learning/artificial intelligence to analyze the results.

Reference in detail



Business impact

The results of 5G-LOGINNOV speak for themselves: Average time of GLOSA vehicles spent in traffic jams were reduced by 59 percent(!). The average speed of the trucks increased from 13.9 to 19.3 km/h, an increase of 38 percent. At the bottom line, fuel consumption was reduced by 20 percent, in turn reducing CO² emissions by 17 percent. What's more, the reduced traffic jams and resulting reduction in acceleration and braking events also lowered fine dust pollution caused by tire abrasion.

The project team also answered the question as to whether scenarios like this could also be realized with conventional cellular technology (4G). The answer is a clear no. The low latency of 5G (<50 ms) and possibilities for precise positioning are essential for automating rolling convoys, as well as autonomous e-shuttles. These results were confirmed in sister projects at the Port of Koper (Slovenia) and Athens-Piraeus (Greece) in similar scenarios.

When heavy truck traffic flows more smoothly, everyone benefits: shipping companies save on fuel costs, air quality is improved, and the port's overall carbon footprint is reduced. As such, the city and port are making important contributions to global environmental targets. What's more, with the project results in hand, decision-makers now have a clear, data-driven foundation for taking the next steps. Hamburg is now well on its way toward becoming a sustainable, smart city and achieving the targeted CO² neutrality for port operations by the year 2030. In 2023, the city took the top spot in the Bitkom Smart City Index for mobility - by a wide margin.

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