

SIEMENS

Ingenuity for life



Digitalizing the road

Sittraffic Vehicle2x

[siemens.com/traffic](https://www.siemens.com/traffic)

With Sitrtraffic Vehicle2X, cooperative traffic systems become reality. Already today, Siemens Mobility is paving the way for the autonomous driving experience of the future.



Solutions from the global market leader – tomorrow's transport will be fully connected.

Receiving incident alerts directly in the car, always riding the green wave, being blocked less often in traffic jams.... The digitalization of the road helps enhance everybody's quality of life, generates economic growth and contributes to climate protection. To this end, Siemens Mobility has developed Sitrtraffic Vehicle2x technology: a secure, cooperative communications technology that connects vehicles of all kinds with the infrastructure.

Mobility solutions from Siemens Mobility
Municipal requirements vary as widely as the cities and towns themselves. This is why Siemens has created a uniquely wide range of urban applications: Connected Mobility Solutions. Whether priority for public transport and emergency vehicles or intelligent road digitalization – there is an optimal solution for every requirement.

The "Internet of Things" on the road
Today, the situation on the roads is often made difficult by congestion, stop-and-go traffic and accidents. In many cases, poor infrastructure connectivity and limited communication options make it impossible to proactively guide and control traffic. With Vehicle2x technology from Siemens Mobility the road can now be connected to the Internet of Things, providing the infrastructure with the necessary "intelligence". This means that not only the vehicles can communicate with each other, but also infrastructure and road users are connected. Vehicle2x technology from the global market leader already covers many applications that pave the way to full connectivity as required for autonomous driving.

Vehicle2x – sophisticated solutions from Siemens Mobility
Trains, cars, ships and other means of transport travel on routes that cross in many places. For Siemens Mobility, visions of future traffic based on the "Internet of Things" include permanent real-time

communication between infrastructure and conveyances. Road users will be warned in good time of potential dangers – such as accidents or black ice – and informed of construction sites so they can act accordingly.

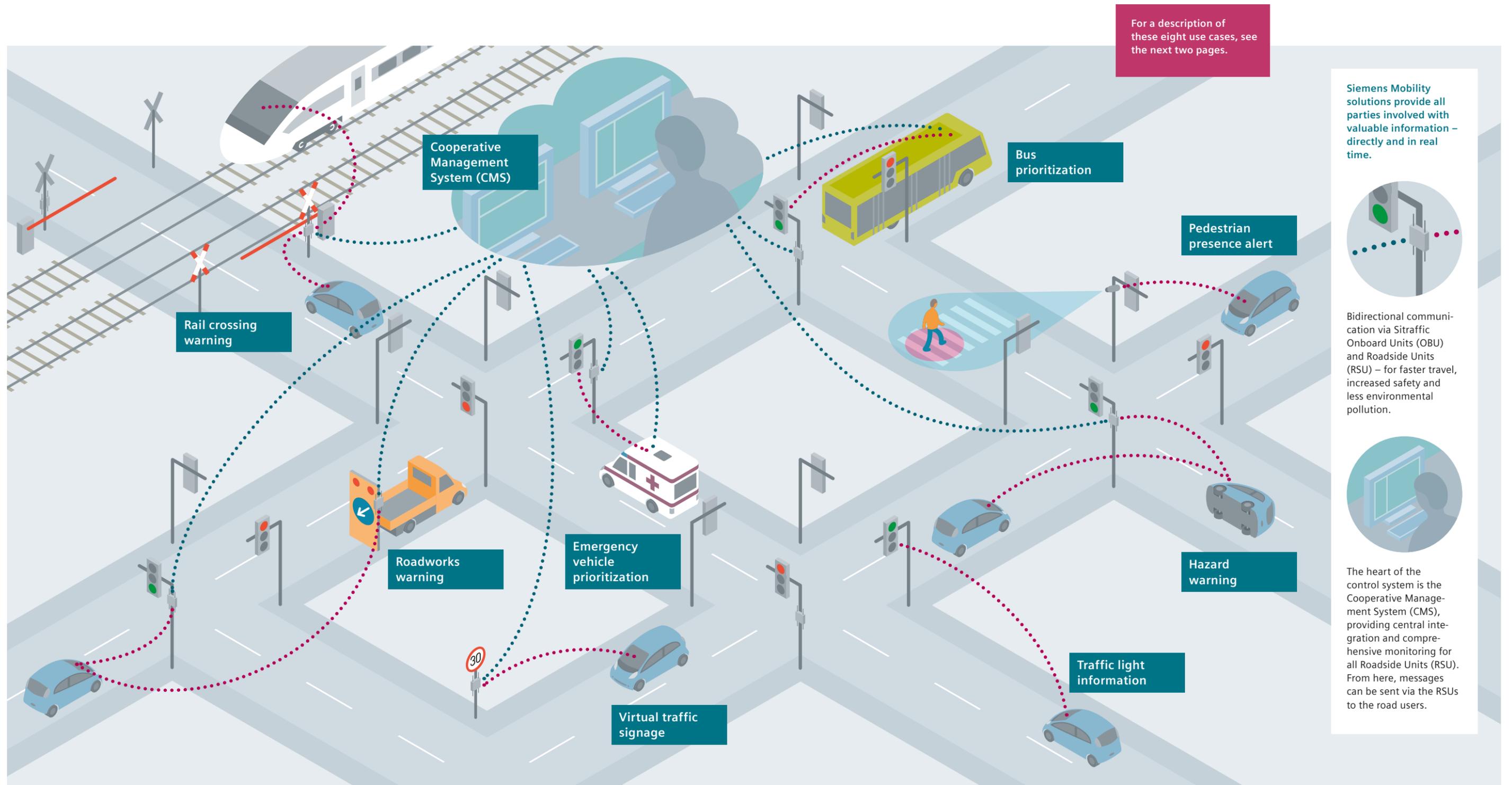
The "Green City" of the future
The combination of Siemens Mobility's Sitrtraffic Roadside Units and the Cooperative Management System (CMS) makes it possible to monitor the traffic situation in precise detail and control it proactively. In practice this translates into a smoother flow of traffic, fewer accidents, more safety and a significant reduction of pollutant emissions. Leverage this technology to increase the safety on your city's streets by reducing congestion and optimizing traffic flow – for a substantial contribution to climate protection and lasting improvements in the quality of life across entire conurbations. Make your city fit for the future and transform it into an environment-friendly "Green City"!



The vision of autonomous driving: "We share our information with everyone"

Ever more tightly meshed connectivity and comprehensive data exchange between road users and the infrastructure is the way forward. The infrastructure automatically "talks" to the road users and informs them of any obstacles, dangers and potential disruptions. This intelligent connectivity is also the optimum basis for the implementation of autonomous driving. The vision of "shared and autonomous mobility" involves not only permanent communication between individual vehicles, but also for example the capability of infrastructure systems and car sensors to detect pedestrians. Such technologies significantly increase safety for all road users.

Sittraffic Vehicle2x: Eight use cases.



Cooperative applications: For improved traffic flow, increased safety and fewer accidents.



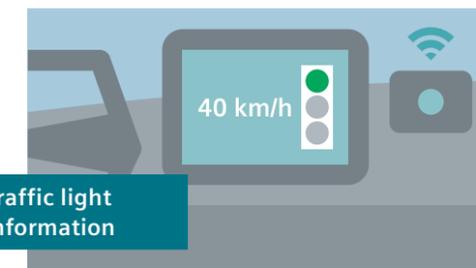
Bus prioritization

More efficient, more punctual, more convenient: Systematic priority in the street network makes public transport more attractive for users. At signalized intersections, bus prioritization technology from Siemens Mobility can be used to give the right of way to public transport vehicles by shortening the “red phases” and extending the “green phases” in the corresponding direction of travel. This will minimize the delay for the bus at the stop line, and the traffic light control can switch back to normal operation as soon as the vehicle has crossed the intersection.



Pedestrian presence alert

More safety for the most vulnerable road users – pedestrians, wheelchair users and children are often hard to detect from the car because they are hidden by buses or other obstacles. This increases the risk of accidents. Here modern detectors that register pedestrians and send the information to approaching vehicles prove highly beneficial. The drivers are warned in advance and can adjust their speed and driving behavior. This reduces the risk of accidents and significantly increases pedestrian safety.



Traffic light information

Coordinated traffic light switching – “green wave” – makes driving less stressful, more energy-efficient and more environment-friendly. The traffic light information function tells road users approaching an intersection at what speed they should continue if they want to cross the upcoming signalized intersection(s) without stopping. Fewer stops or deceleration and acceleration processes make traffic flow more smoothly.



Virtual traffic signage

More convenience for road users and improved compliance with speed limits: The applicable signage is displayed also in the vehicle. For example, upon entering a 30 miles/h zone, the drivers are alerted to this important information right in the vehicle, enabling them to reduce their speed immediately and avoid needless acceleration and braking processes. Also, in the case of information that is only relevant for certain vehicle types, the corresponding sign can be displayed exclusively in those vehicles.



Emergency vehicle prioritization

Faster passage in an emergency: This application gives emergency vehicles priority at signalized intersections. When an ambulance is on its way from the scene of an accident to the hospital, every minute counts. To minimize the time needed, the traffic light switching times along the entire route are adapted so that the ambulance can pass without ever having to stop. This allows faster arrival for emergency vehicles and prevents additional accidents involving other road users.



Hazard warning

Continuous provision of information and timely notification of traffic disruptions: In-vehicle hazard warnings help improve road safety. As a complement to conventional signposting, they provide drivers with information on unforeseeable events such as accidents, wet or icy roads or congestion, enabling them to adapt their driving behavior to the dangerous situation. When road users approach the scene of an accident, for example, a timely warning message sent to their vehicles will allow them to reduce their speed, stop in time or even choose an alternative route to prevent subsequent accidents.



Roadworks warning

Increased vigilance and shorter reaction times: When road users receive advance information about a mobile roadworks site ahead or some other condition blocking their lane, they can prepare for the situation in good time. Roadworks are a frequent source of accidents. In case of excessive speed, for instance, vehicles may touch protective fences or other roadwork equipment, and sudden braking may provoke rear-end collisions. Timely messages warn the drivers and allow them to adjust their speed and also change lanes, if necessary.



Rail crossing warning

Knowing what lies ahead: When a vehicle approaches a level railroad crossing (whether gate-protected or not), an early warning is displayed right in the vehicle. This enables the driver to prepare for the situation to come. As the system integrates timetable information, it knows when the crossing gate will close and can provide the driver with speed recommendations in advance. This minimizes stops as well as the need for acceleration and deceleration and improves overall driving experience.

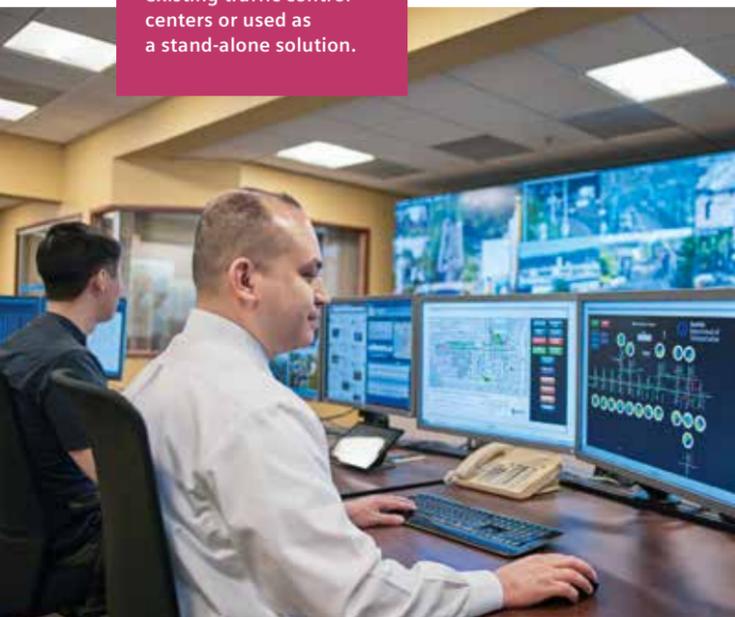
Sittraffic CMS, RSU and OBU: The real-time link between road, infrastructure and vehicles.

Intelligent communication technologies such as Vehicle2x from Siemens Mobility establish connectivity between infrastructure systems and vehicles. The core element for controlling the Roadside Units (RSU) is the Cooperative Management System (CMS). It can be integrated in existing Siemens traffic control centers, e.g. Sittraffic Scala and Sittraffic Concert, or deployed as stand-alone solution. The CMS provides the central link-up of the Sittraffic RSUs and manages basic functionality such as equipment monitoring, remote support functions or hazard warnings and general information.

Easy operation via the intuitive CMS user interface

Different visualization modes such as map, list, detail and problem management make the technician's job easy. The CMS can communicate with the RSUs "over the air" or via existing cabling – for flexible monitoring and hassle-free configuration of the RSUs, anytime and anywhere.

The CMS is the heart of the control system – it can be integrated into existing traffic control centers or used as a stand-alone solution.



Wide range of functions

The CMS delivers real-time information directly to all parties involved and offers comprehensive technical functions such as RSU management, a geo-map view or the display of traffic messages and data. Access to status information and analyses is quick and easy. The messenger function makes it a breeze to notify the competent service technician. Technology-wise, the CMS scores with cutting-edge features such as Datex II interface, service/debug tools and Map2x.

Sittraffic RSU, the central gateway

The Roadside Unit (RSU) is the central interface for wireless communication between the roadside infrastructure and the Onboard Unit (OBU). The RSUs are radio modules that can be mounted on sign gantries, mobile roadworks trailers or traffic light masts. Every RSU works as both a transmitter and a receiver, enabling bi-directional communication. Hence the RSU can send notifications such as speed limits or traffic jam warnings to the road users and receive real-time messages from any vehicle equipped with an OBU. The RSU operates in the 5.9 GHz frequency band, which is reserved for traffic applications. The very short latency times are an essential requirement for efficient accident prevention and an important prerequisite for safe automated driving in the future.

Stand-alone or integrated

Besides stand-alone operation, the RSU can also be used in conjunction with a traffic controller. This allows the transmission of current signal status and remaining phase times to road users as well as the flexible prioritization of any vehicles with the corresponding authorization. In addition, it is possible to record traffic data such as average speed and traffic volumes.

Robust und powerful

The Roadside Unit has a weatherproof housing. A powerful dual-core CPU and a wide range of interfaces – such as WiFi for remote maintenance purposes or travel time applications as well as LTE for fast connection to back-end systems – make the Sittraffic RSU a flexibly deployable edge-computing unit. The RSU supports both Vehicle2x protocol standards in global use: ITS-G5 and WAVE. The unit's modular design allows extension with additional radio modules such as C-V2x or 5G.

High IT security level

The Sittraffic RSU has been developed in line with the very high Siemens Mobility security standards. This involves, among other things, regular threat and risk analyses as well as effective hardening measures, including stronger passwords, secure boots, and the use of encrypted and authenticated TLS interfaces to protect your network infrastructure.

Sittraffic Onboard Unit (OBU)

The Onboard Unit has a transceiver that ensures smooth communication with the RSUs. This enables the integration of vehicles into cooperative ITS systems (C-ITS) and the use of infrastructure-controlled C-ITS services and applications.

Hazard alerts can be sent to service vehicles, and public transport or emergency vehicles can be prioritized. Safety for pedestrians or cyclists increases as approaching drivers are warned in time and can adapt their driving behavior. Their easy and quick installation (plug and play) and intuitive operation make the OBUs very user-friendly. Thanks to a sophisticated security module and a robust, durable design, the Sittraffic Onboard Unit is a high-performance GNSS receiver and offers navigation by dead reckoning as an option. With the Sittraffic Onboard Unit, you benefit from an all-in-one device and lay the basis for the integration of future service options and cooperative applications.

New functions

Map2x is a new tool that allows the creation of Vehicle2x messages containing information about the topology of the lanes and signal groups at an intersection.

The Roadside Unit can send the MAP and SpaT messages to the vehicles, allowing the implementation of use cases such as traffic light information. Via the Sittraffic Map Export tool, traffic data from Sittraffic Office can be transmitted to the Map2x tool.

Durable, powerful and secure: The Sittraffic Roadside and Onboard Units are the basis for wireless communication between roadside infrastructure and vehicles.



Sittraffic Vehicle2x technology in practical use: Connected driving in cities like Düsseldorf and New York

What is known in the industrial sector as the “Internet of Things” has its traffic equivalent in the digitalization of the road. Cooperative systems are already in service in numerous places. In large-scale (research) projects, systems from Siemens Mobility are currently proving their suitability for everyday use. Hence we can achieve already today what used to look like visions of the future: accident prevention, free flow of traffic and improved fuel efficiency ... and create the livable and green cities that we all want to live in.

Test field in Florida

In cooperation with Tampa Hillsborough Expressway Authority (THEA), innovative Vehicle2x applications are being tested in downtown Tampa. Vehicle2x-equipped cars and buses communicate wirelessly with other vehicles and infrastructure elements. As a system integrator and infrastructure supplier, Siemens Mobility plays a key role in this Vehicle2x lighthouse project: 10 buses, 8 trams and the cars of over 1,000 volunteers have been equipped with DSRC-enabled devices and Siemens Mobility has installed a total of 46 Roadside Units, which are used for communication between the connected vehicles and the Concert CMS traffic management system.

Implementation pioneer Austria: ECo-AT

Within the European Union, Austria has established itself as a constructive implementation pioneer in the field of C-ITS applications. In the scope of the ECo-AT (European Corridor – Austrian Testbed for Cooperative Systems) project, harmonized and standardized cooperative ITS applications (C-ITS) are being developed together with German and Dutch partners. The aim is the ultimate technical and organizational alignment between industrial partners and road operators before the installation is finalized and the services are started. ECo-AT includes in particular the use cases Road Works Warning (RWW), In-Vehicle Information (IVI) as well as CAM and DENM aggregations. As a basis for the implementation of these use cases, project partner Siemens Mobility has installed the required RSUs as well as the CMS on the test field and played a major role in drawing up the system specifications.

Extreme conditions in New York

Improved safety on New York’s streets is the objective of this project. To this end, Onboard Units have been installed in around 8,000 vehicles, including 700 buses, 5,000 municipal vehicles and 1,000 taxis. In addition, over 500 Siemens Mobility Roadside Units are in use on the streets of Manhattan. Various pedestrian associations are involved and the project scope includes tests of services designed to support visually impaired persons when crossing the street.

Here Vehicle2x communication is being put to the test in one of the world’s most challenging urban traffic settings: Manhattan. For communications technology, New York is a very demanding environment due to high traffic volumes and the difficult signal transmission conditions in those “urban canyons”.

Test environment in the UK

The aim of the UK Connected Intelligent Transport Environment (UK CITE) program is to create a test environment in which connected and autonomous vehicles can communicate with the infrastructure. The test vehicles will be used to determine the impact of Vehicle2x technology on traffic safety and traffic flow. To this end, more than 50 Roadside Units from Siemens Mobility have been installed in Coventry and Warwickshire on around 60 kilometers of road to test applications for connected vehicles under real-life conditions.

Future-oriented technologies in Düsseldorf

Siemens Mobility is testing pioneering technologies for the automated and autonomous traffic of the future on the Düsseldorf test field “KoMoD”. Among other things, the focus is on intersections as a safety-critical element of the traffic network. Another object of investigation is public transport prioritization: Siemens Mobility is testing a telematics unit for vehicle-to-infrastructure communication for public transport prioritization based on satellite positioning. This involves the installation of stand-alone units in 16 vehicles of the transport provider Rheinbahn AG.

Cutting-edge systems from Siemens Mobility are proving their suitability for everyday use in numerous innovative projects around the world.



Sittraffic CMS: Functions

- **RSU management:** Monitoring the status of the RSUs, information on errors, parameters, etc.
- **Geographic view:** Overview of all RSUs, including events and active messages.
- **Traffic information:** Display of active and creation of new DENM and IVI traffic notifications, selection of predefined messages according to ECo-AT specification standard 4.0, reception and conversion of TLS numbers from external traffic management via Datex II into an IVI message, which allows the CMS for instance to send virtual signs and gantry content to the vehicles.
- **Traffic data:** The RSUs can function as detectors collecting information such as traffic volume, average speed or occupancy rate.
- **Condition monitoring:** Overview of all objects that are in critical condition.
- **Notification:** Dispatch of messages to service technicians and definition of the conditions under which service technicians should be notified.
- **Analysis:** The operational message archive provides an overview of events, actions and statistics.
- **Datex II interface:** Bi-directional exchange of messages (DENM) with 3rd-party traffic management center.
- **Service/debug tools:** These allow to check the connection between CMS and RSU and create data logs.
- **Map2x:** A new tool for the creation of V2x messages. Provides information about the topology of the lanes and the signal groups of an intersection for use cases such as traffic light information.

Sittraffic RSU: Technical data

- IEEE 802.11 p 5.9 GHz Dual-Radio (ITS-G5/DSRC-C-V2x on request)
- Receiver sensitivity: -97 dBm (802.11 p)
- Max. output power: 23 dBm (mask C)
- Hardware security module for secure signing and storage of private keys
- 2.4 GHz WIFI/BT hotspot for travel-time applications and remote maintenance
- LTE for fast back-end connection
- Browser-based web GUI for remote diagnosis and configuration
- Range of up to 2500 m (free field, line of sight)
- Supports ITS-G5 and WAVE in line with the latest standards
- Message types ITS-G5: CAM, DENM, SPATEM, MAPEM, IVIM, SSEM, SREM
- Message types DSRC: BSM, TIM, SPAT, MAP, SRM, SSM, PSM, RTCM

CPU/memory

- 800 MHz Dual-Core CPU for edge computing
- 1 GB RAM

Interfaces

- 2 × ITS-G5/DSRC
- 2 × RJ45 10/100 Mbit Ethernet
- 1 × 802.11 b/g/n WiFi & Bluetooth 4.0
- 1 × GNSS with positioning accuracy of 2.0 m
- 1 × R5232
- 1 × LTE Cat4

Mechanical features

- Dimensions: 27 × 31 × 8 cm (W × H × D)
- Weight: 4.1 kg
- Installation: on mast or wall
- Material: cast aluminum, anodized

Ambient conditions

- Operating temperature: -40 °C to +74 °C
- Protection class: IP67/NEMA 6P

Power supply

- 48 V PoE+ (802.3at)
- Typically 12 W

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Siemens Mobility GmbH
Otto-Hahn-Ring 6
81739 Munich
Germany
siemens.com

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