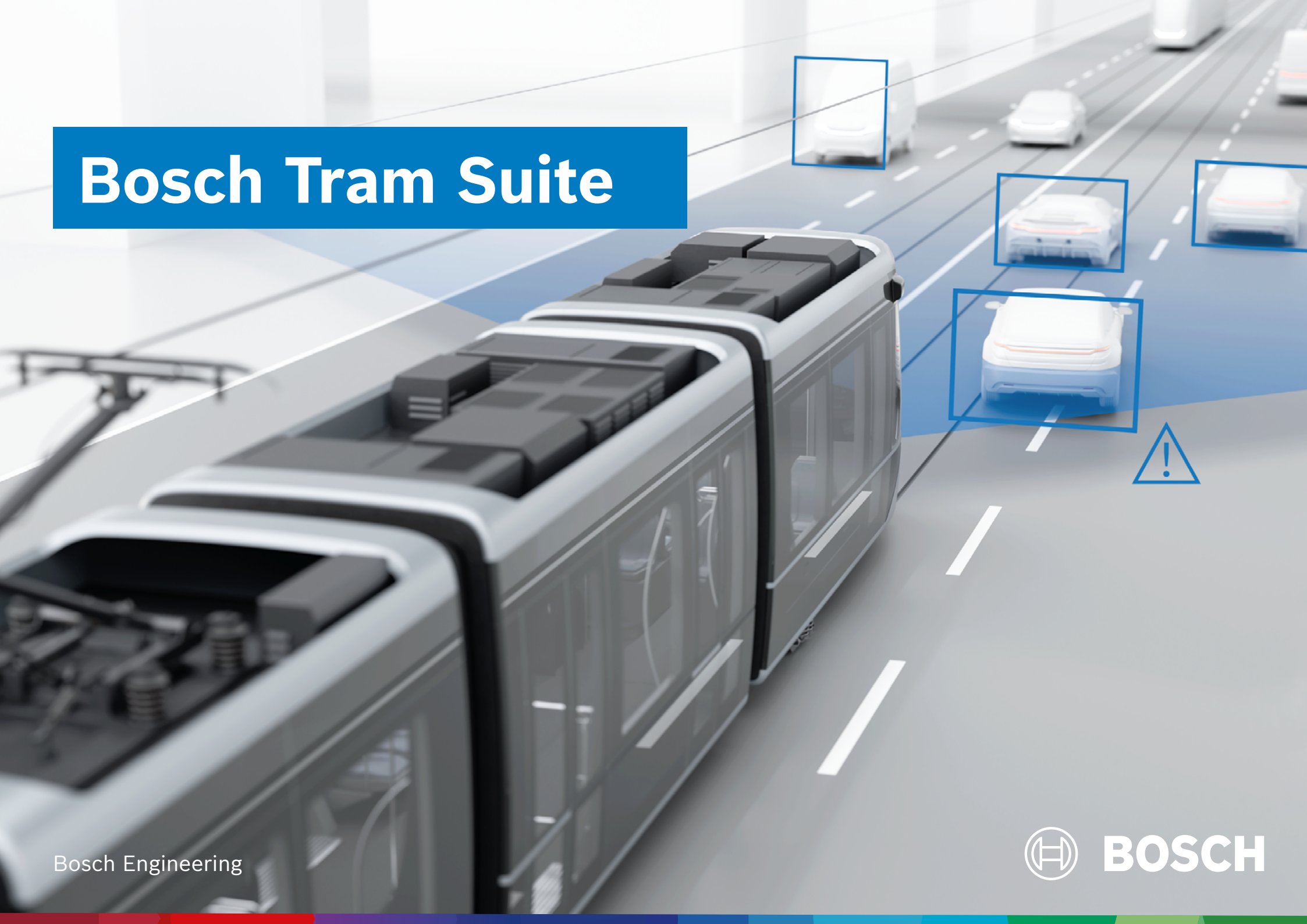


Bosch Tram Suite





Built on a proven foundation

Next-generation assistance systems for tram operators

Bosch Engineering leverages Bosch technology that has been tried-and-tested millions of times in vehicle manufacturing to develop assistance systems that are making rail transport safer. Since 2017, the Bosch tram forward collision warning (TFCW) system is worldwide in use and number one on the market, with several thousand systems delivered to customers.

Introduced in 2024 and in passenger service since 2026, the Bosch tram assist suite significantly enhances assistance system performance and reliably expands its range of applications.

The Bosch tram assist suite at a glance:

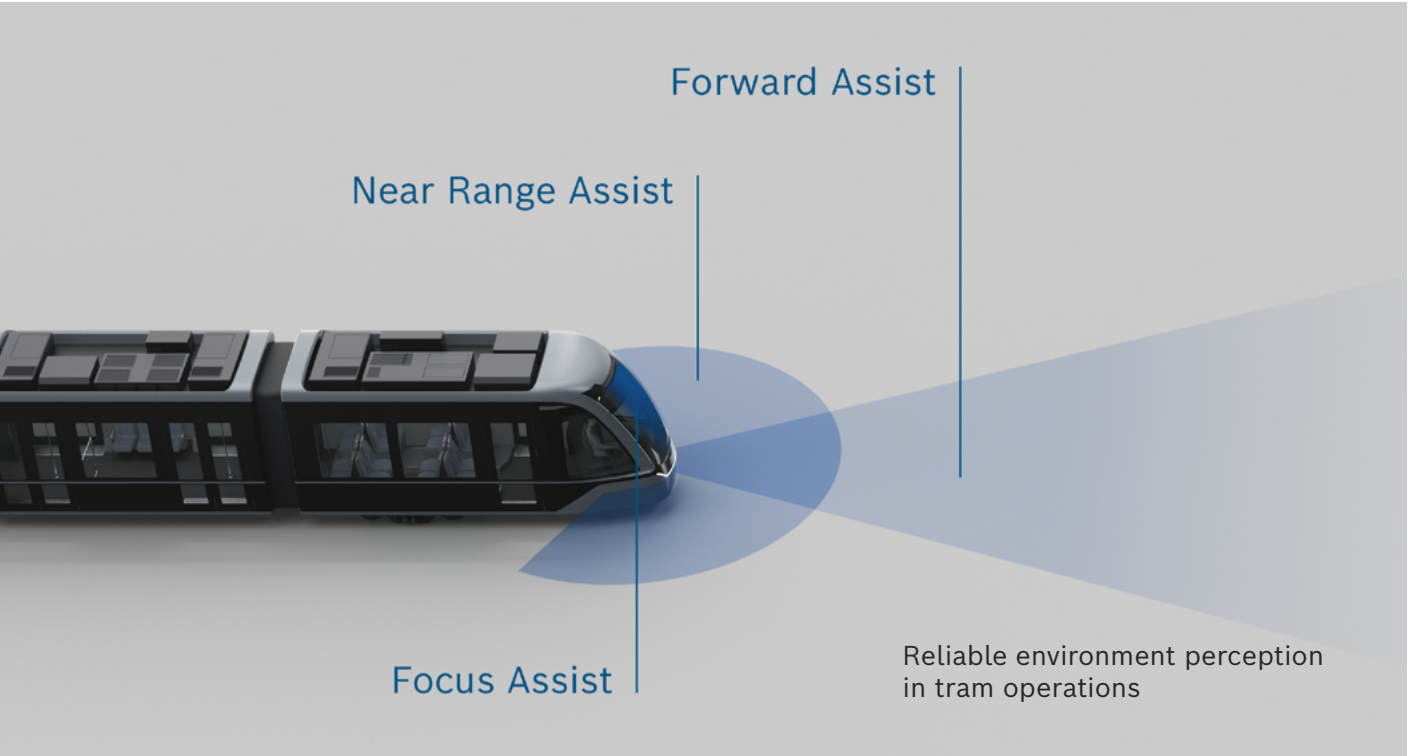
- Bosch technology tested and proven a million times
- Thousands of TFCW systems in daily use by tram operators worldwide
- Available for new built trams and retrofit
- Suitable for use in all weather conditions
- Latest generation of surround sensing technology
- High-resolution 4D radar
- Enabling seamless all-round monitoring for tram operation

Modular and scalable

The Bosch tram assist suite

The Bosch tram assist suite is designed as a modular building block system: each assistance module can be deployed flexibly as a stand-alone solution or seamlessly combined with other assistants in the suite – customized precisely to individual requirements.

Thanks to the integrated and cooperative system architecture, all sensors and assistance modules operate intelligently interconnected rather than as isolated stand-alone systems. This significantly boosts overall system efficiency and establishes an ideal, cost-effective foundation for phased future upgrades.



Your benefits



Improved safety
thanks to reduced risk of accidents



Higher availability
thanks to fewer accidents



Lower costs
thanks to fewer repair stops



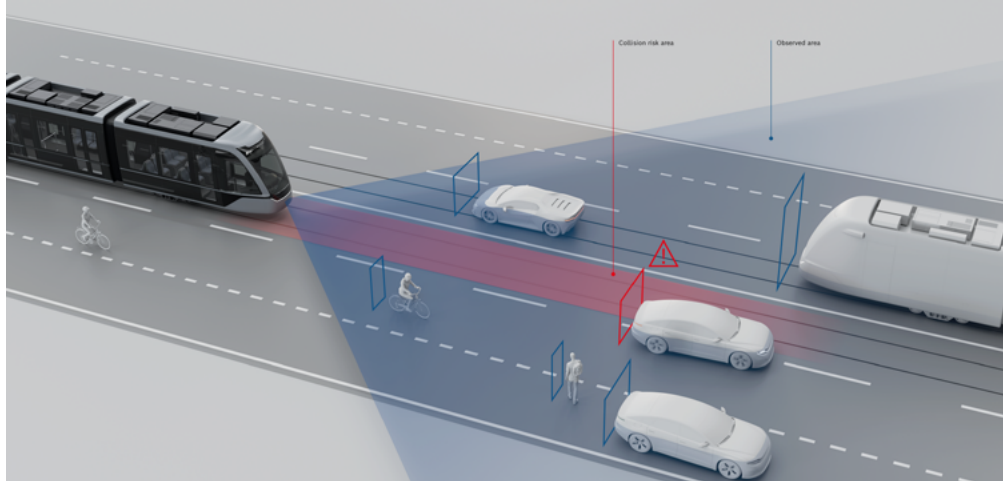
Simple integration
thanks to compact, standardized components



Suitable for retrofitting
in existing vehicle fleets



Suitable for world-wide use
thanks to approval to international standards



Latest-generation front camera and front radar

Forward assist

Functions

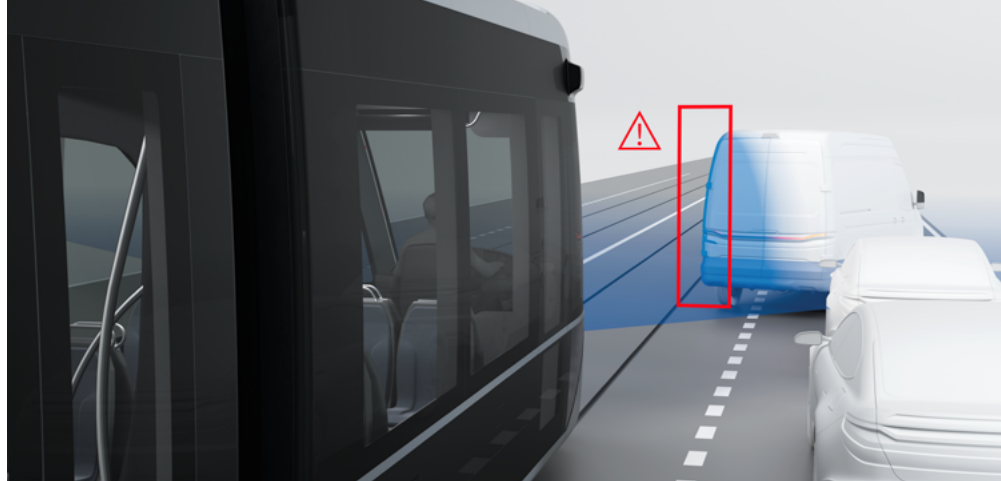
- Warning of head-on collisions up to 80 km/h
- Head-on collision avoidance up to 45 km/h
- Sign and signal recognition and speed limiter
- + Additional functions

User benefits

- Enhanced safety, fewer driver-related accidents
- Increased comfort and extra assistance for drivers
- Fewer delays, breakdowns, and repairs

Scope of supply

- Front radar premium gen5
- Multi-purpose camera gen3 (CV)
- High-performance processor
- + Optional add-ons



Complementary LiDAR sensor extends the functionality

Forward assist plus

Functions

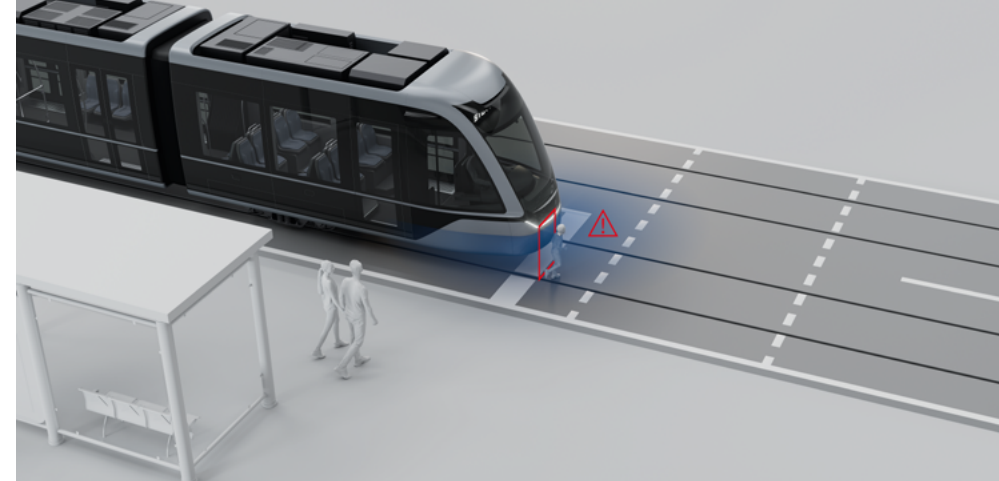
- Identical functions as tram forward assist, plus:
- Detection of obstacles protruding into the structure gauge, e.g. branches, parked vehicles
- Detection of damage to the catenary
- Detection of persons lying or sitting in the track area

User benefits

- Enhanced safety, fewer driver-related accidents
- Increased comfort and extra assistance for drivers
- Fewer delays, breakdowns, and repairs

Scope of supply

- Based on the tram forward assist system
- + LiDAR sensor



Ultrasonic sensor technology monitors close surroundings

Near range assist

Functions

- Detection of people between coupled tram cars, e.g. coupling surfers
- Warning in case of obstacles close to the front of the tram
- Coupling assistance
- Platform detection prevents doors from opening on the wrong side

User benefits

- Enhanced safety, fewer driver-related accidents
- Increased comfort and extra assistance for drivers
- Fewer delays, breakdowns, and repairs

Scope of supply

- Ultrasonic sensors with CAN interface
- Number and position of sensors can be varied to suit their purpose



Near-range camera detects driver distraction

Focus assist

Functions

- Detection of driver distraction
- Detection of microsleep and drowsiness
- Detection if the driver is no longer in the correct seated position (e.g. medical emergency)

User benefits

- Enhanced safety, fewer driver-related accidents
- Extra assistance for drivers from a virtual co-driver
- Fewer delays, breakdowns, and repairs

Scope of supply

- Near-range infrared camera + electronic control unit
- Range of warnings – visual, acoustic, and with or without braking intervention
- Suitable for combination with tram forward assist and tram flank assist



Continuous updates throughout the entire product service life

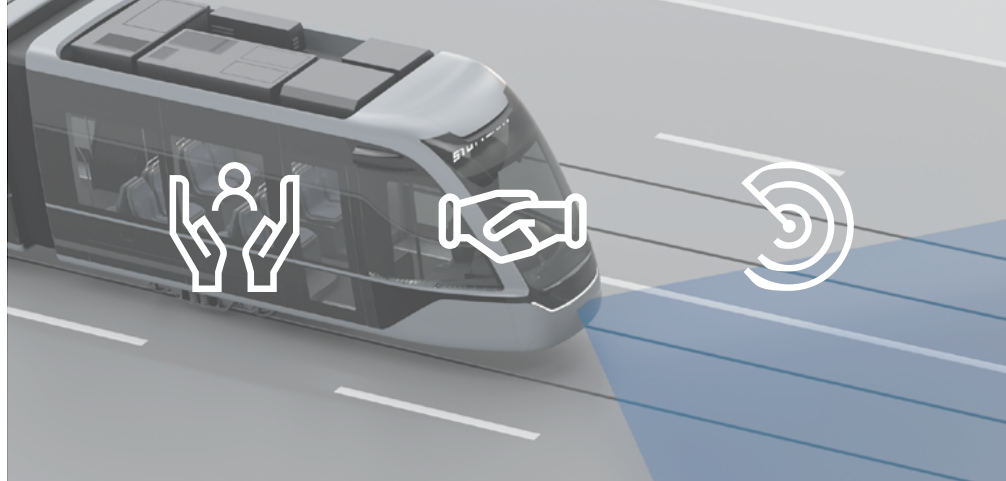
Connected services

Functions

- Wireless software updates and service releases
- Remote monitoring, diagnosis, and configuration
- Software solutions for system performance diagnostics, reports, and analysis

User benefits

- Product quality is enhanced because operating data from the tram assist suite can be analyzed continuously across all user operations
- Every user benefits from this operating data analysis in the form of product updates, distributed over the air
- Through this approach, Bosch Engineering is underscoring its commitment to quality throughout the entire product service life



All from a single source

Your dedicated partner for fleet modernization

As an OEM-independent solution, the tram assist suite is ideally suited for new vehicles as well as for retrofitting existing fleets of any age, manufacturer, or vehicle type. In mixed fleets, operators particularly benefit from a standardized technology platform that significantly reduces driver training efforts, spare parts logistics, and maintenance costs.

As an experienced technology partner, Bosch Engineering can also assume full responsibility as a turn-key general contractor for retrofitting your tram fleet. We manage the entire project lifecycle with a single point of contact:

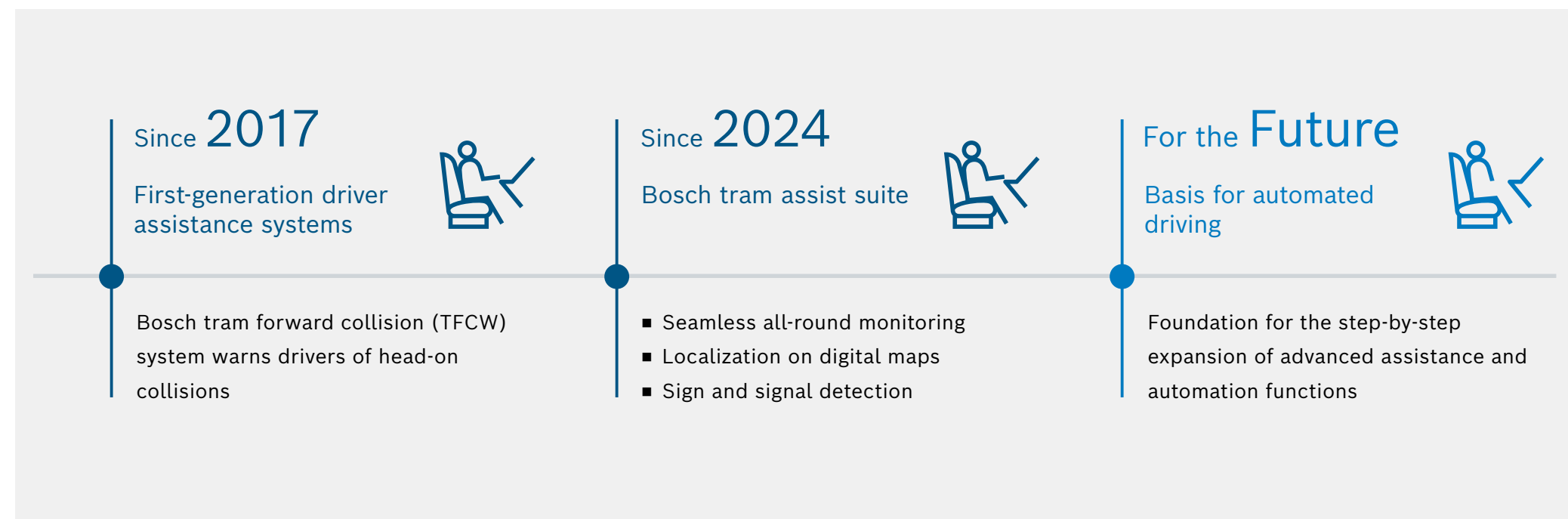
- System conception
- Turn-key integration
- Training
- Acceptance & homologation support

On track to the future

The future-ready system approach of the Bosch tram suite

Intelligent and automated systems represent the next evolutionary step for public transport operators by significantly enhancing operational safety while ensuring high vehicle availability.

The Bosch tram suite combines a modular system architecture with the latest sensor generation and years of deep domain expertise. With this platform, Bosch Engineering establishes the solid foundation for advanced automation capabilities. On the path toward automation, concepts for partial automation, such as adaptive cruise control, depot shunting or turning loop maneuvers are conceivable.



Do you have any questions?

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