



SIGNALLING

Innovative solutions
for all railways

STADLER

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01 – A solid basis for the future

Since 2017, Stadler has been building an international competence center for signalling technology in Wallisellen that offers comprehensive solutions in the fields of automated driving, ATO, ETCS and CBTC, for example for the operation of driverless metro trains.

We are continuously expanding our signalling competences in order to offer our customers added.

Today, Stadler also has a comprehensive range of railway safety systems.

Switzerland

Wallisellen, Alte Winterthurerstrasse 14b

Fehraltorf, Luppenstrasse 3

Oensingen, Garwidenstrasse 17

Olten, Riggerbachstrasse 6

Vufflens-la-Ville, Rte de la Venoge 3

Germany

Braunschweig, Pillastrasse 1e

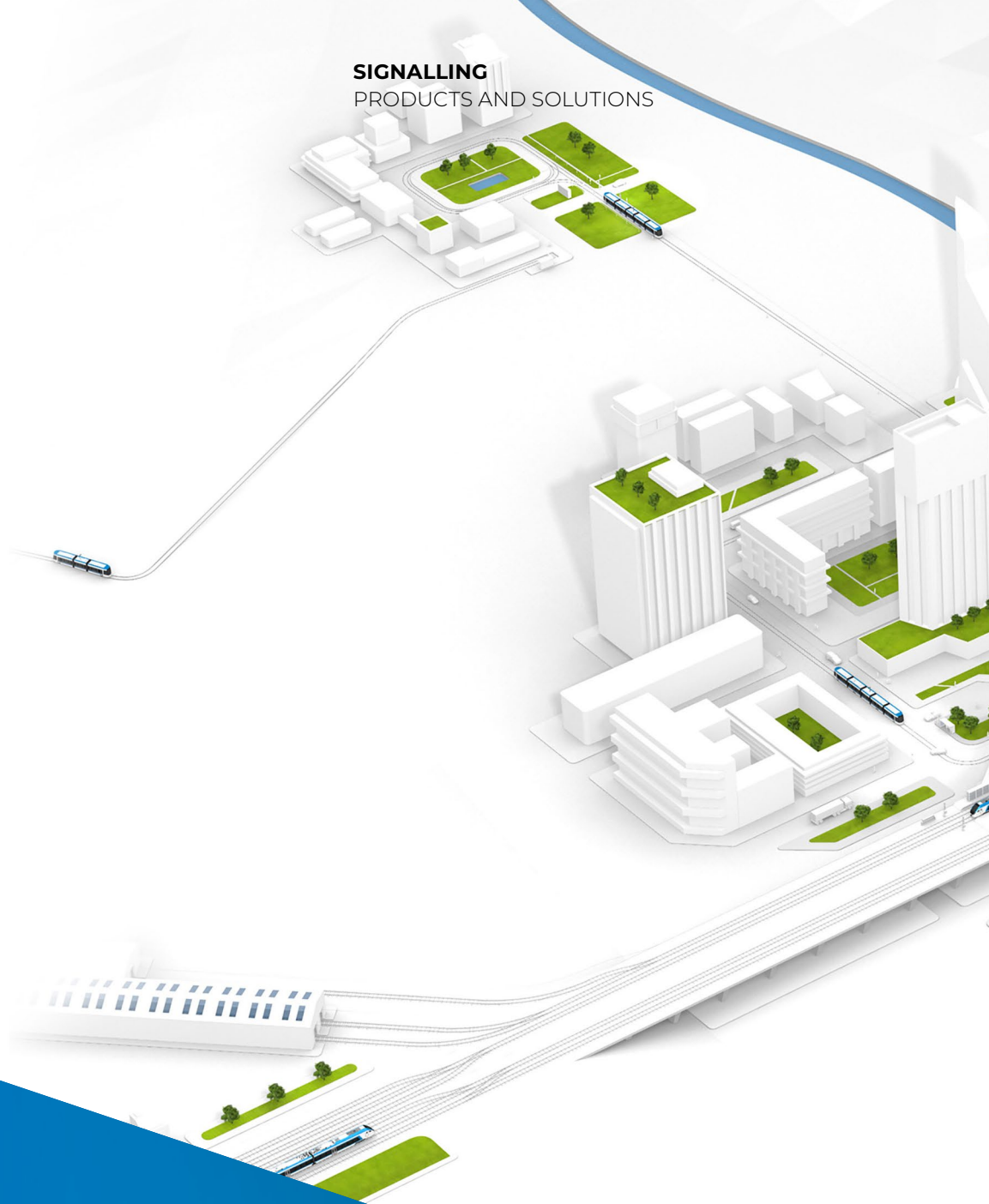
Mannheim, Boehringerstrasse 17

Italy

Mola di Bari, Via San Sabino 21

AngelStar (joint venture with MERMEC)

Locations in Germany, Switzerland, and Italy



02 – From signal to full automation

We offer our customers tailored signalling solutions in the main line, branch line, LRV, metro, and depot segments to ensure efficient, digital, and sustainable rail operations. The broad signalling portfolio includes solutions in the areas of automated train operation (ATO), train protection (ETCS, Class B), CBTC for safe assisted operation up to driverless operation, as well as conventional and modern infrastructure technology, including interlocking technology (relay and electronic interlocking).



Mainline

- Train protection system ETCS
- Electronic interlocking SIL 4

Branchline and LRV

- Relay interlockings
- Electronic interlockings with remote control
- Intermittent train protection
- Communication-based train protection

Metro

- Automated operation – CBTC
- Migration

Depot

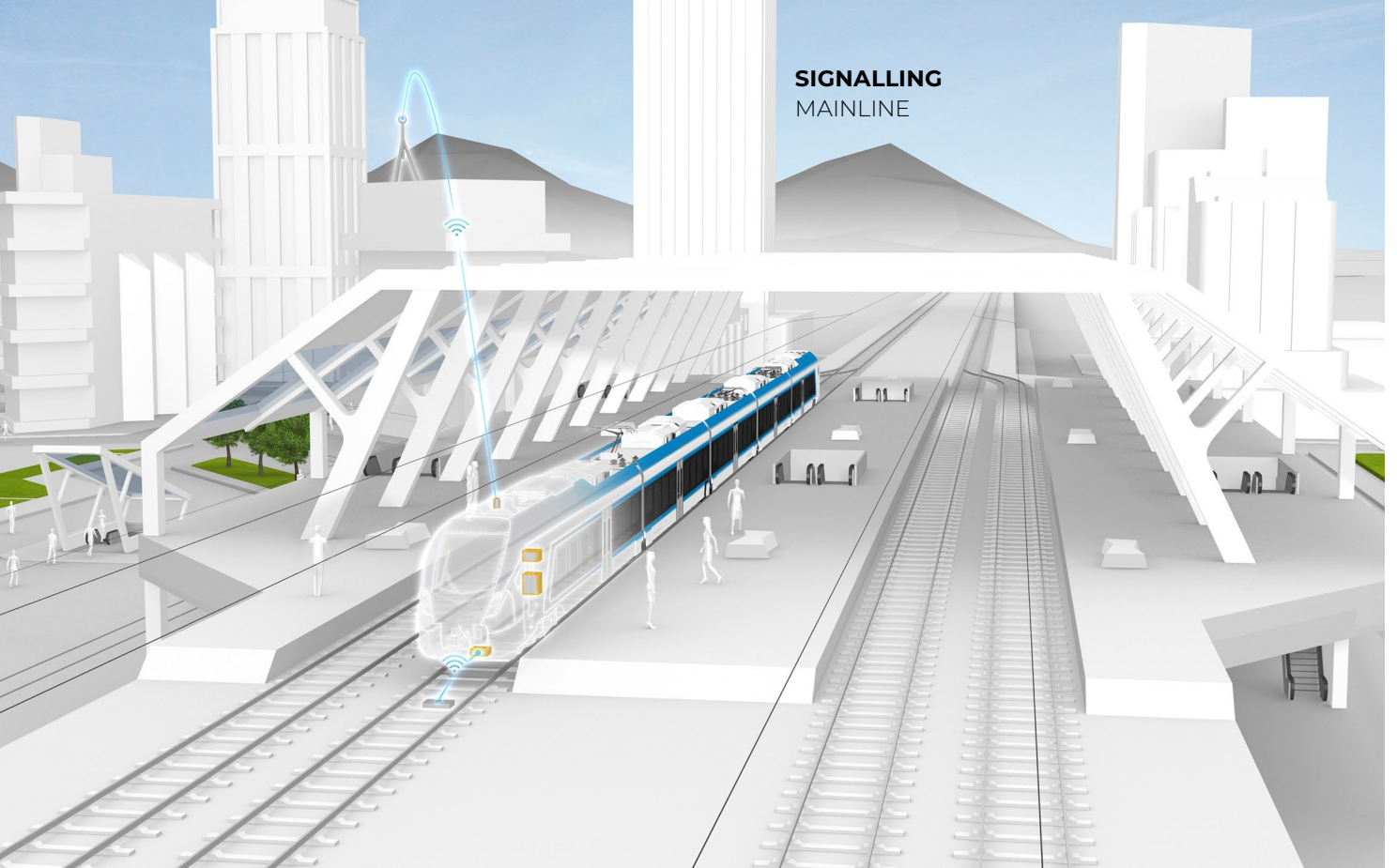
- Depot automation
- Shunting systems

Components of the signalling technology

- Level crossings
- Signals

Digital solutions

- Digital twins
- ATO and driver assistance systems
- Collision warning system
- Passenger information systems



Train protection system ETCS

GUARDIA

Tried-and-tested SIL 4 technology

Authorized and in commercial operation in ten European countries

Cost-efficient, even for small series

Experience with retrofit projects on third-party vehicles

The powerful and proven ETCS on-board system is already successfully being implemented in projects in more than ten countries.

The increasing demands in rail transport are forcing operators to focus on specific strategic objectives: Increasing travel speed, interoperability, continued use of existing infrastructures, and cost efficiency while maintaining existing safety levels.

We are responding to this with the development and delivery of ETCS on-board solutions that are being created in cooperation with the technology company AngelStar.

AngelStar is a joint venture between Stadler and the MERMEC Group. The partnership unites complementary strengths and a clear commitment to customer-focused innovation.

Electronic interlocking SIL 4

EUROLOCKING

The hardware is based on a modular structure and can be adapted as required.

The scalable Stadler electronic interlocking system that employs industry-standard products and is ready to use in the shortest possible time. The interlocking system can be used for all railways that require a safety installation.

The generic system architecture enables customized solutions to be planned and implemented with an architecture of existing software and industry components.

The consistent use of an IP-based system offers a high degree of flexibility, enabling centralized and decentralized interlocking architectures to be created. This interlocking system can be easily adapted to changing conditions.

Commercial off-the-shelf hardware

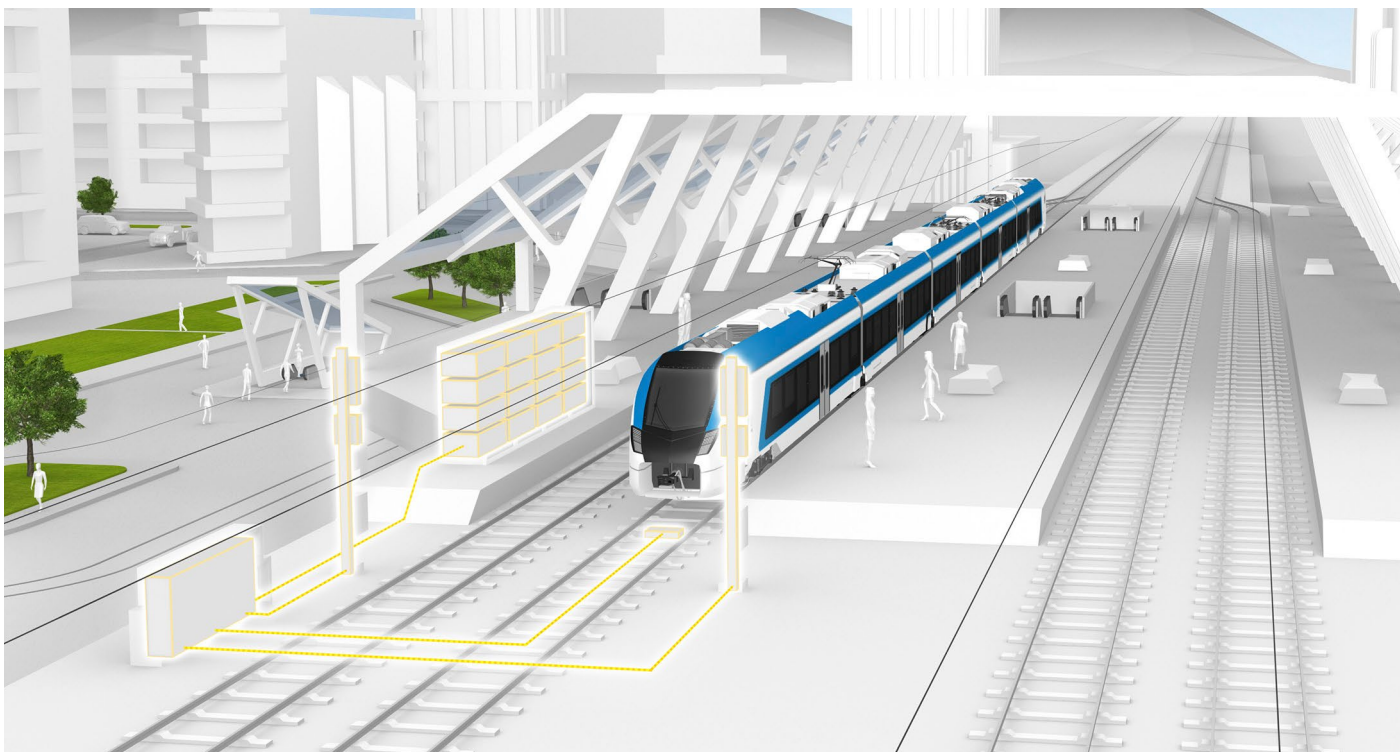
Life cycle of at least 25 years

Generic, CENELEC SIL 4 approved system

High availability of the whole system

Easy replacement of all assemblies (hot plug & play)

Minimum maintenance



Relay interlockings

Domino type

We offer new constructions, conversions, and extensions of railway safety installations of any size to the customer's specifications.

We have vast experience not only in the construction of new interlocking and the conversion of existing ones. We are gearing our skills and activities toward the future.

We are just as familiar with connections to electronic systems and the associated interfaces as we are with PLC technology for automatic functions in Domino interlocking systems.

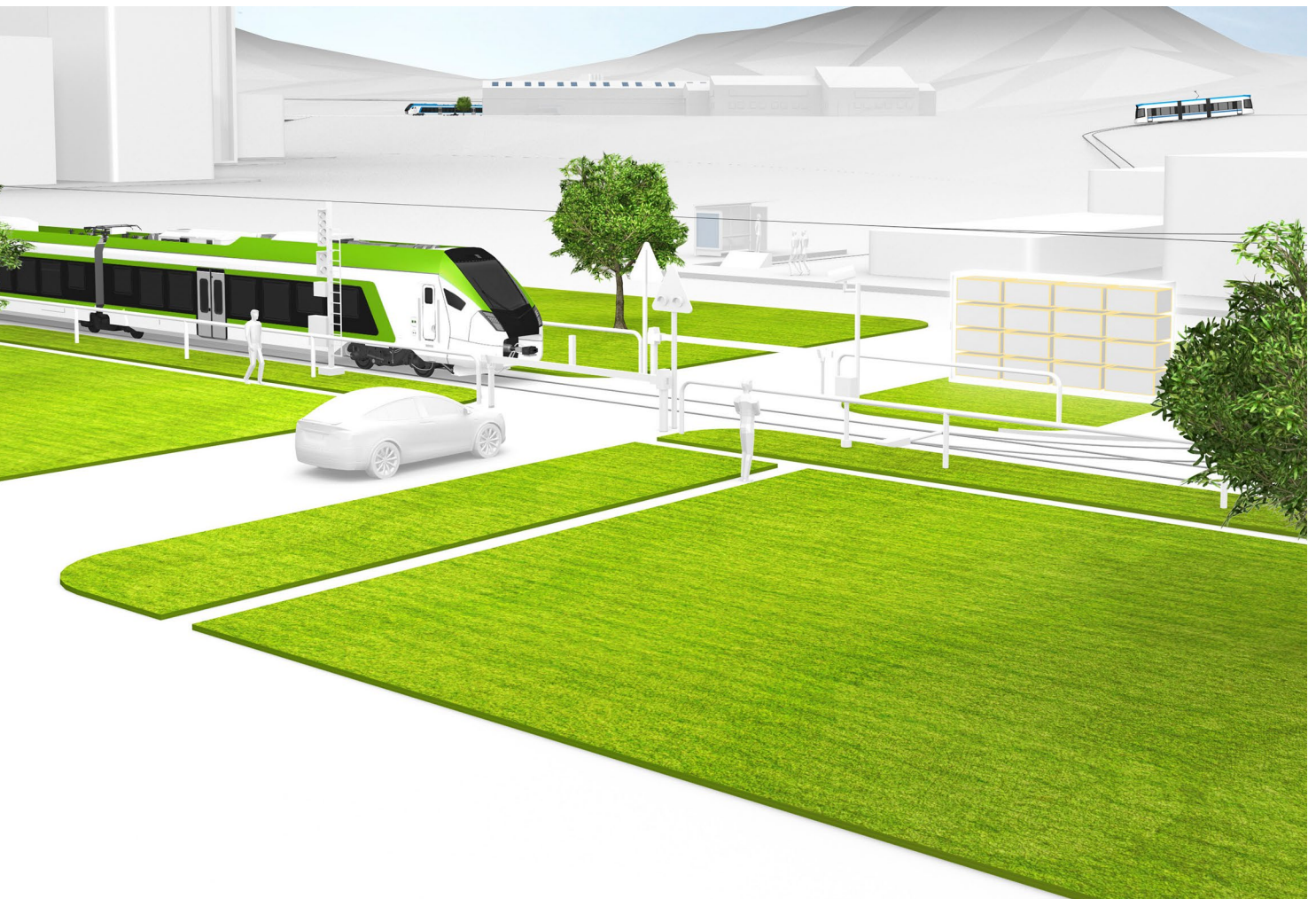
Detailed project planning for Domino and switch interlockings

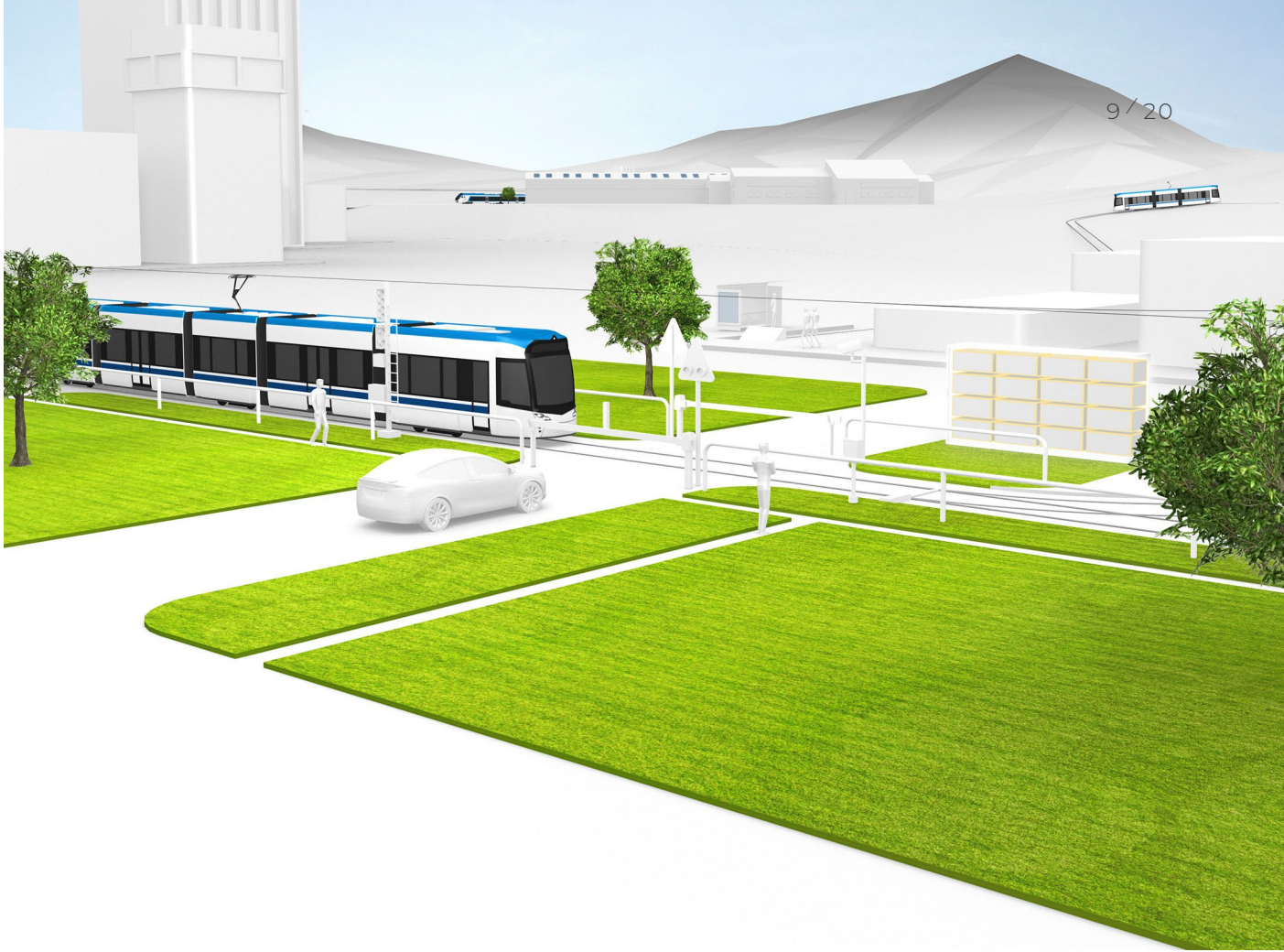
Preservation and further development of Domino know-how

Electric circuit and control development according to safety standards

Safety verification

Shop tests (validation)





Electronic interlockings with remote control

SIL.VIA

The interaction of different technologies is the key to an efficient daily operation.

Local public transport is a central part of daily life. At the same time, daily operations must not only be carried out with maximum safety, but also efficiently and reliably.

The Stadler electronic interlocking allows the whole operation of branch lines, trams, light railways, and depots to be safeguarded and centrally monitored.

Electronic interlockings and points operating equipment

Depot control systems

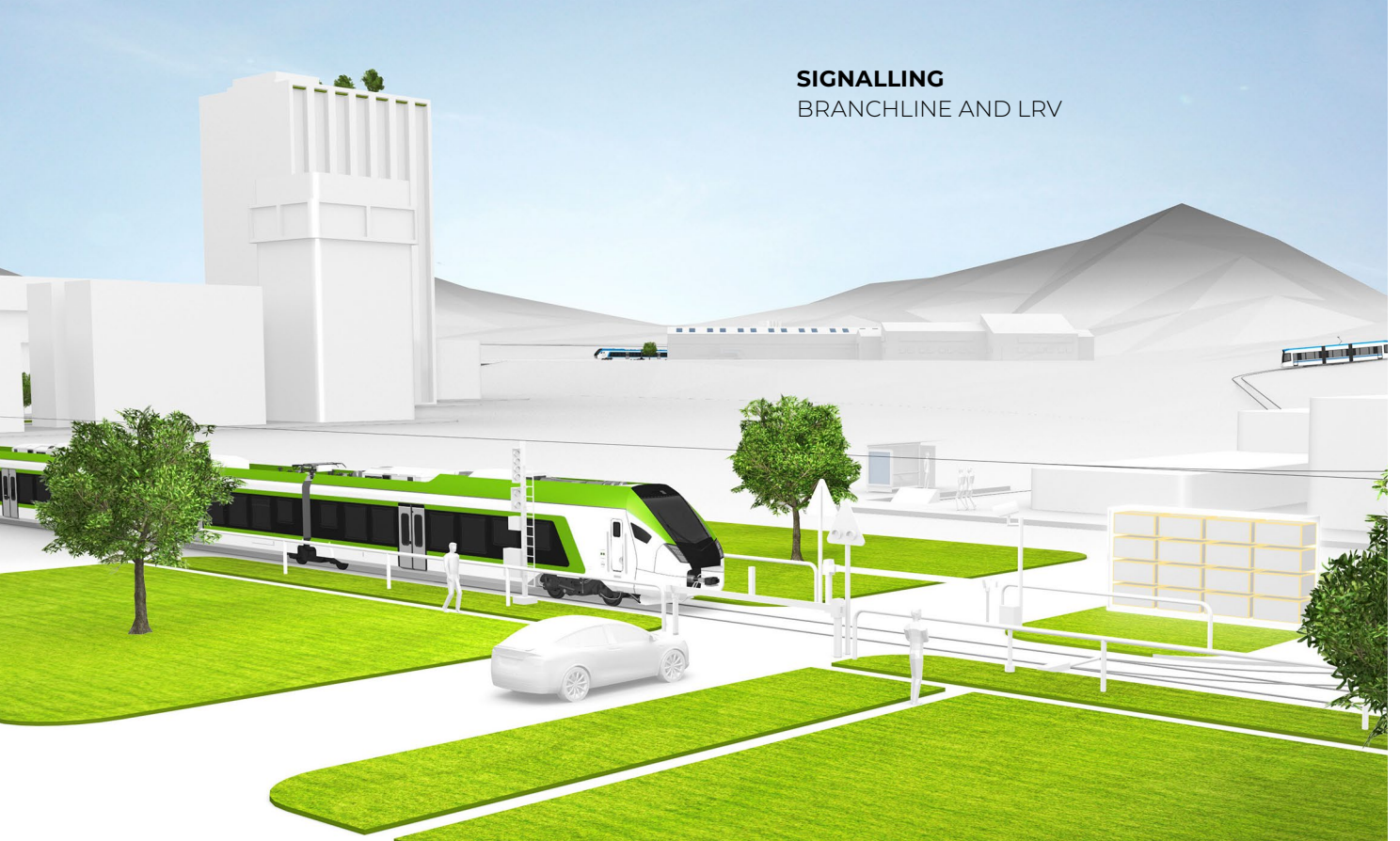
Inductive message transmission

Train detection

LED signal solutions

For tram operators, our solution is a convenient way to monitor and control their operations along the entire route.

Short block sections allow for close tram sequences, secured by highly efficient signals with LED technology, axle counters, or DC circuits.



Intermittent train protection

PZB

Permanent monitoring of permitted speeds

Reaction in the event of the maximum permitted speed being exceeded

Compliance with signal-dependent driving situations

Visualization of the permitted speed

Display of the remaining distance

Triggering of emergency braking if a red light is ignored

Used for speed monitoring and intervenes if the maximum permitted speed is exceeded.

Our train protection system that ensures automatic compliance with high safety standards during train journeys and takes over a number of tasks to provide the operator with continuous up-to-date information, is used for continuous safe operation.

In order to achieve a forced dependency between a signaled stop command and safe braking of the train, Stadler has developed the train protection system as magnetic or inductive train protection.

The system triggers emergency braking in the event of a stop signal being ignored.

Communication-based train protection

Stadler NOVA Pro

Automated operation of branch lines and LRVs becomes possible.

With its own communication-based train control (CBTC) solution (Stadler NOVA Pro), Stadler ensures that challenging goals regarding safety, availability, and increased line capacity can be achieved.

With the innovative system, Stadler offers a technologically high-quality solution to meet the ever-growing needs of travelers, operators, and authorities.

The modular design of the system offers customers individual options, whether for greenfield projects or migration into an existing system. Customer-specific solutions ranging from the existing technology to the desired automated target state are possible. In addition,

Lean and scalable system design (GoA1 to GoA4)

Optimization of capacity and energy consumption

Highly available system with full redundancy

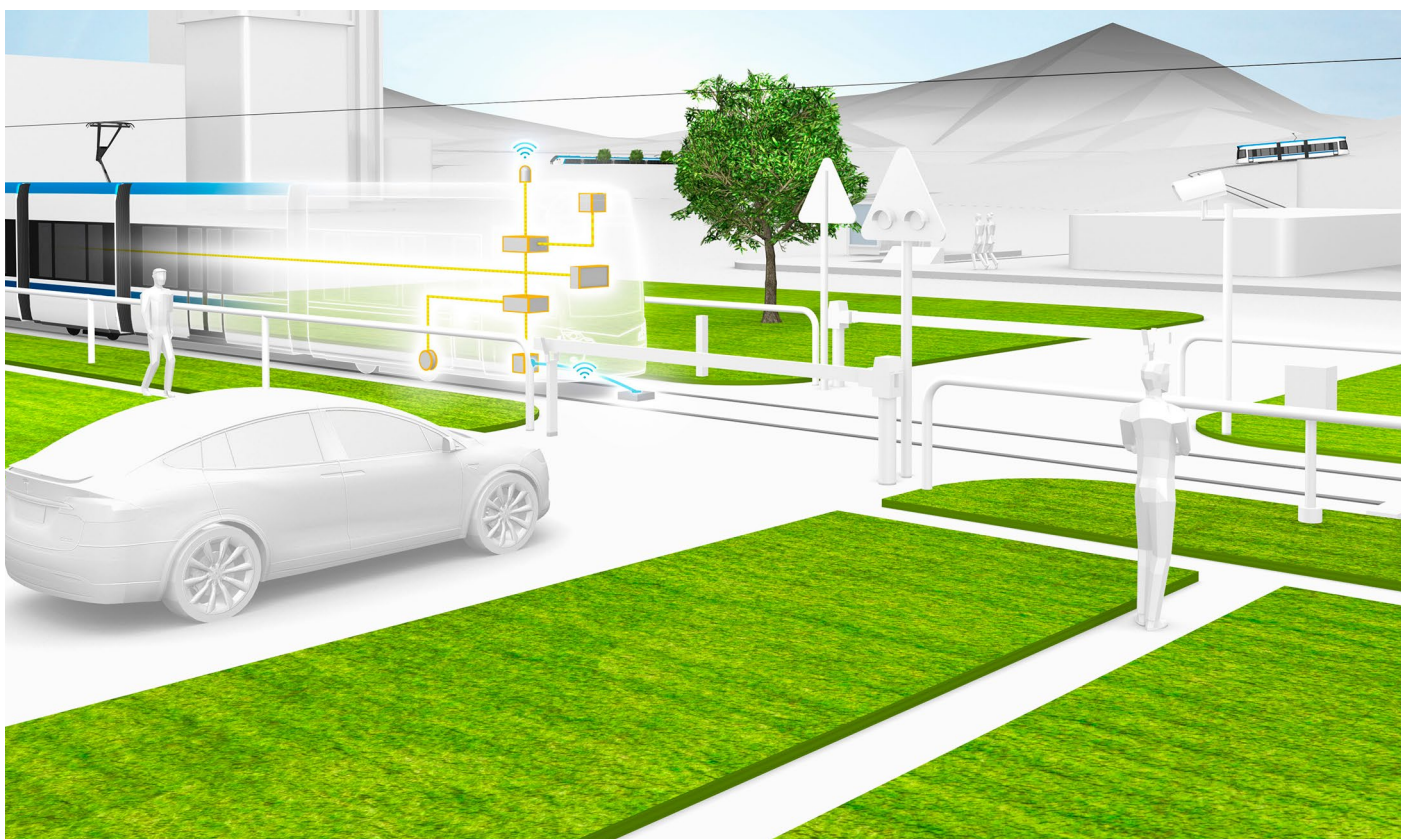
Reduction of infrastructure and maintenance costs

Standard wayside and onboard SIL 4-hardware

Compatible with any wireless and communication network

tion, the economic and technical complexity of classic route signalling is reduced.

The Stadler NOVA Pro system is lean, modular, scalable and offers open interfaces to third-party systems.



Automated operation CBTC

Stadler NOVA Pro

Automated operation of driverless metro trains becomes possible.

Communication-based train control (CBTC) systems are the most widely used solutions for high-efficiency metro lines all over the world.

With its own CBTC solution NOVA Pro, Stadler ensures that challenging goals regarding safety, availability, scalability, modularity, and increased line capacity on traffic-intensive metro lines can be achieved.

With Nova Pro, Stadler offers a technologically high-quality solution to meet the ever-growing needs of travelers, operators and authorities. In particular, the economic and technical complexity of classic interlocking solutions is drastically reduced.

Lean and scalable system design (GoA1 to GoA4)

Optimization of capacity and energy consumption

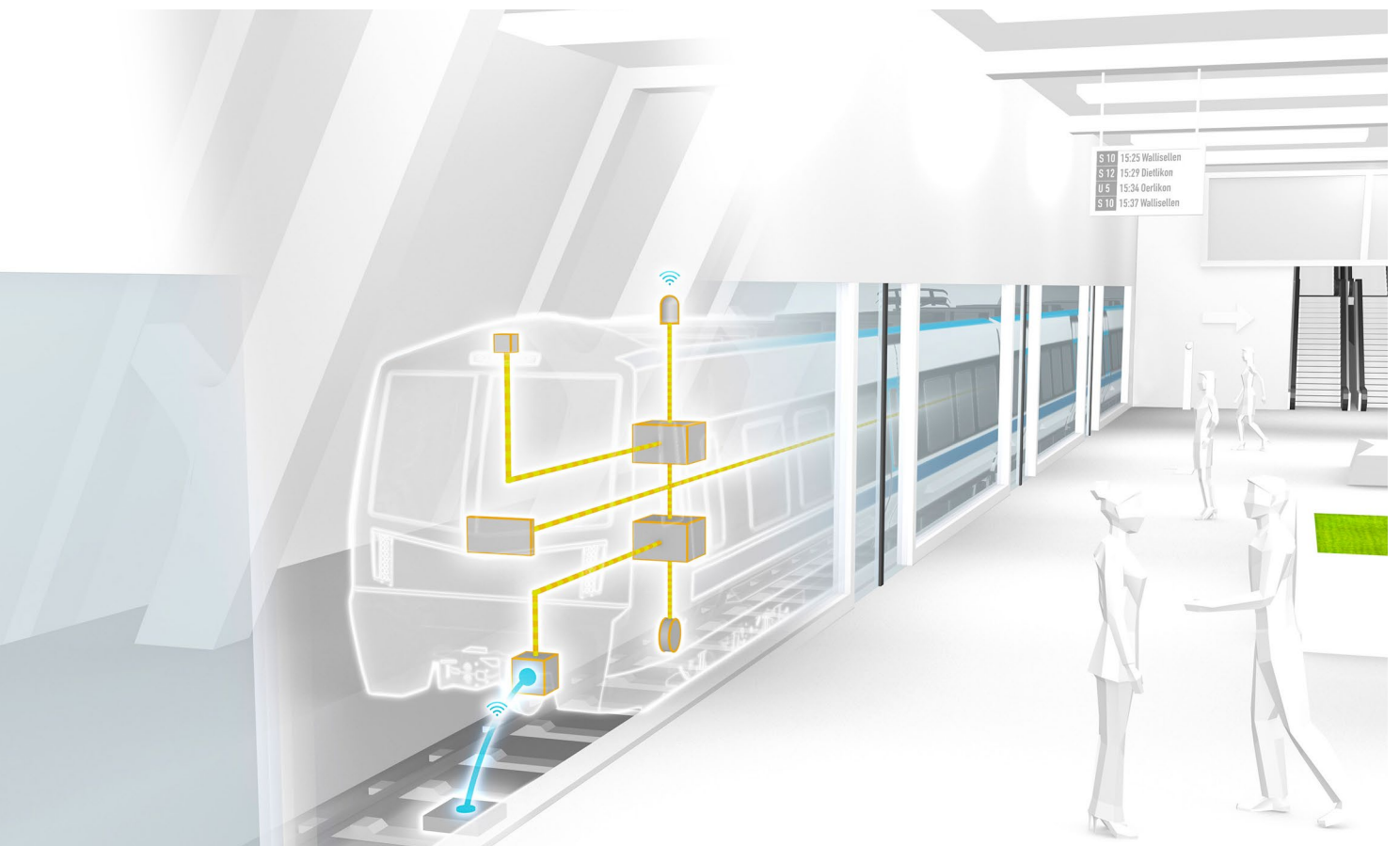
Highly available system with full redundancy

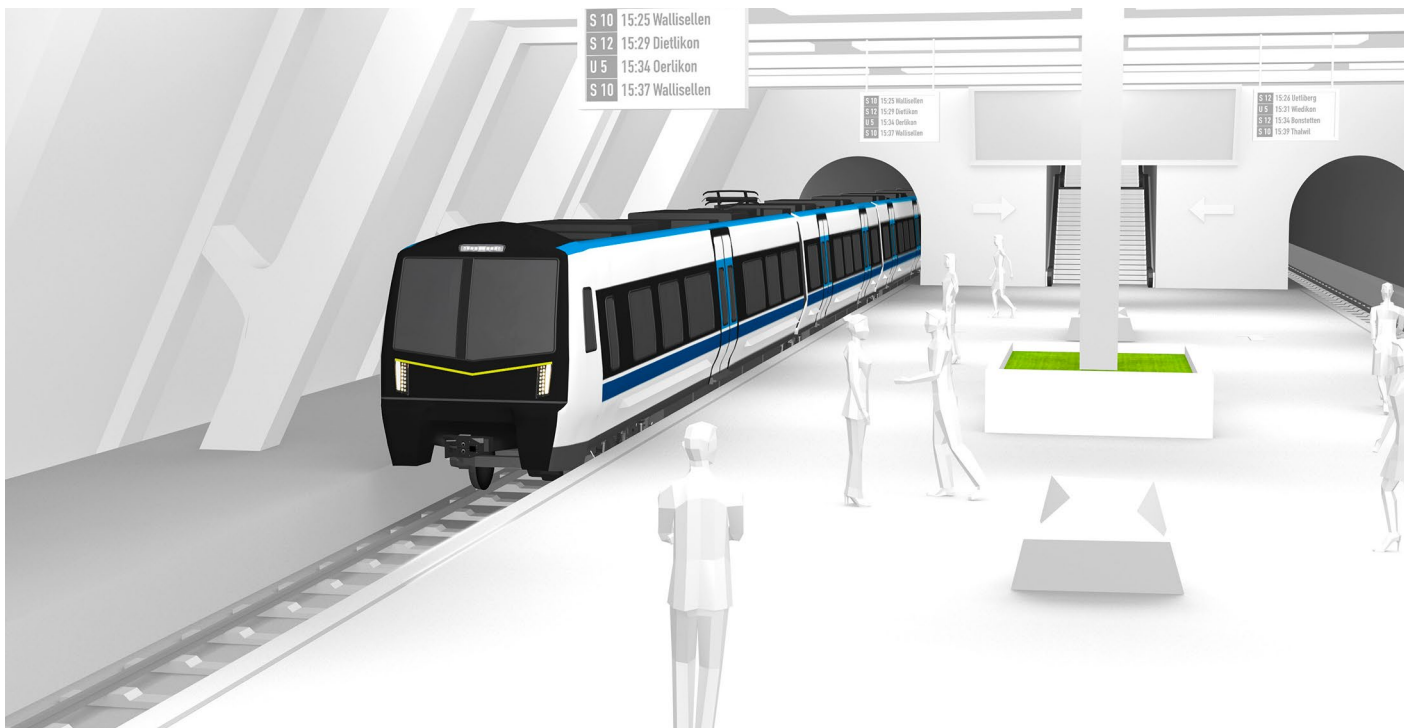
Reduction of infrastructure and maintenance costs

Headway can be reduced to 90 seconds

Cyber security

Stadler NOVA Pro is lean, modular and offers Pure Moving Block functionality, adjustable headway times, and open interfaces to third-party systems.





Migration

Competence and service

Operational processes can be adapted to and integrated into the new environment.

Every migration is customer-specific. The symbiosis of customer/operator information and supplier system knowledge is the key to success.

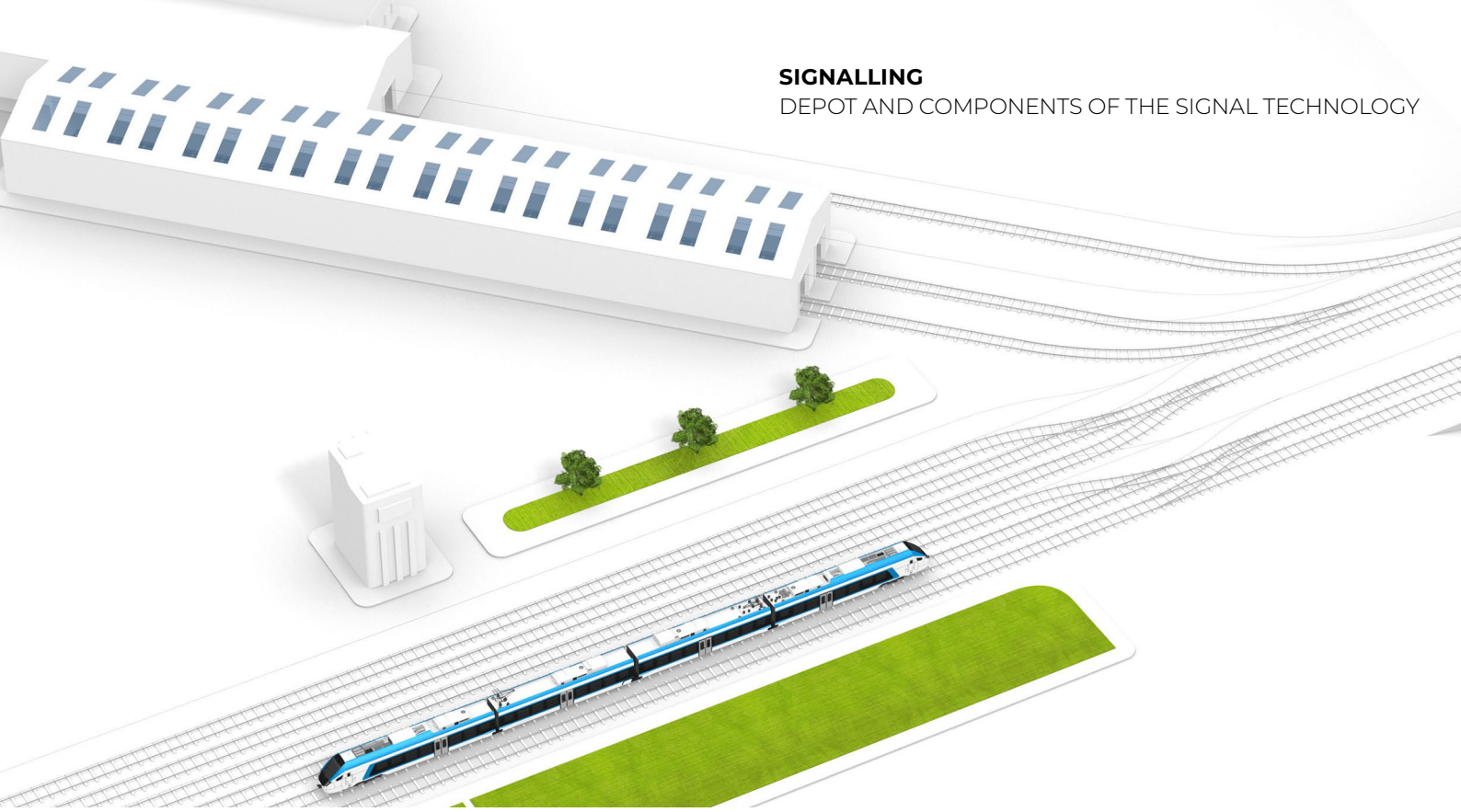
With our know-how and expertise, we bring together the relevant information and guarantee a successful migration, with as little impact on the operation and passengers as possible. Customer needs are thus considered and integrated into the migration concept.

Constant security is ensured during the migration process

Minimized disruption of traffic

Reduced trackside activities

Smooth migration of processes and changed operational routines



Flexible depot solutions

Depot automation which can be adjusted to all requirements and segments, such as mainline, branchline, LRV, and metro.

Stadler NOVA Pro for depots with automation up to GoA4

Stadler offers a communication-based signalling solution that seamlessly integrates into vehicles and infrastructure. The system brings together remote control, interlocking functions, and train protection, enabling comprehensive monitoring and control even in complex depot environments.

External signals and train detection systems are not required. The GoA4 operating mode allows vehicles to be shunted with no operator between different depot tracks and platforms. This allows valuable train driver resources to be efficiently saved.

Lean and scalable system design (GoA1 to GoA4)

Tailored solutions

Increased efficiency through driverless operations

Modular expandability

Migration into existing infrastructures possible

SIL.VIA shunting interlocking system with automation up to GoA1

Stadler also offers reliable shunting interlocking systems that are suitable for controlling individual switches as well as comprehensive depot facilities. These systems can be seamlessly integrated into existing infrastructures and provide efficient control of depot operations. Since the systems are modular, they can be expanded at any time, which makes it possible to adjust them to future operational requirements.



Signals

Whether for use in local public transport or shunting yards – we adapt the signals individually to your wishes.

You can choose from a wide range of designs. Single and combination signals as well as a variety of special signals are available for traffic signal systems and single point controls. Our point position indicators and blocking signals also impress with high reliability and availability in shunting facilities.

We have both lattice masts and hollow masts on offer with various sophisticated climbing systems and fall protection devices and are happy to cater to individual customer requirements during manufacture.

After a detailed and documented function test, the signals are transported by rail or truck to their required destination.

Level crossings

Level crossing protection systems serve to protect individual traffic such as motor vehicles, cyclists, and pedestrians against collisions with railway vehicles at crossings.

This is done on the individual traffic side with light signals and, if necessary, cabinets, on the rail traffic side with monitoring signals which indicate that the level crossing has been secured.

Requests such as the clearance message can be made directly from the track, for example, via frequency switching points, wheel detectors, or other message receiving devices. Alternatively, such data can also be received from superordinate systems such as traffic signal systems or electronic signal boxes.

If shunting operations over a level crossing are planned, corresponding manual switching means can also be provided on the track. The presence detection of the railway vehicle on the level crossing can be done by common means of train detection such as wheel detectors, track locking circuits, or other devices.



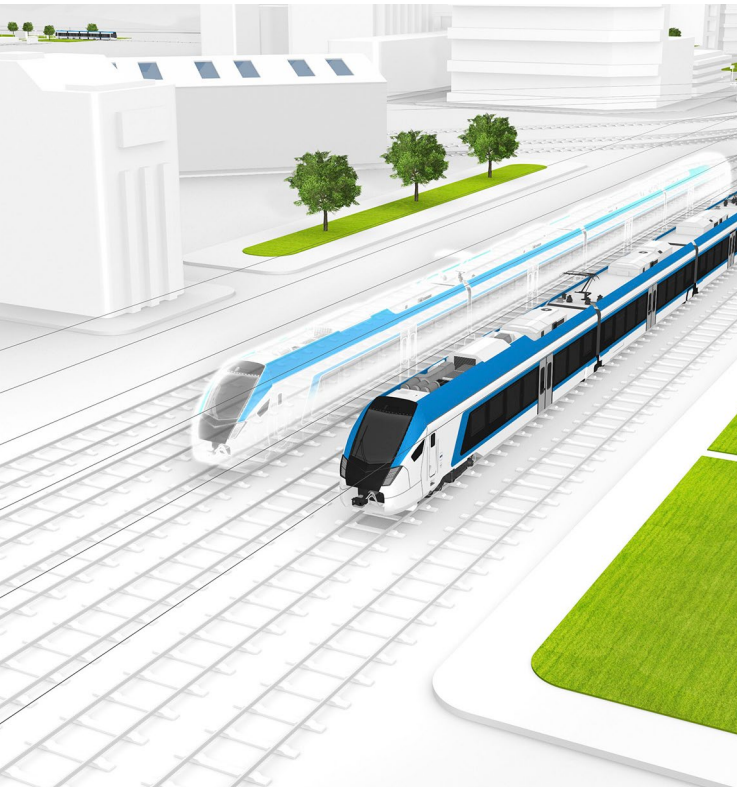
ATO and driver advisory systems

ATO stands for Automatic Train Operation and is a collection of different applications for partial and full automation of train operation.

To maximize the efficiency of the existing infrastructure, the Stadler ATO solution can be implemented on existing train protection systems, control systems, and rolling stock. Using the underlying train protection system, Stadler is able to significantly improve minimum train sequence times, energy consumption, and passenger comfort as well as punctuality and capacity.

The different algorithms can be adapted to customer needs. The modularity of the ATO applications, in particular, ensures that specific customer solutions are possible using the existing infrastructure and rolling stock.

Depending on the existing infrastructure and rolling stock, Stadler is able to present an adapted concept and offer a complete solution, including installation and retrofitting of the rolling stock.

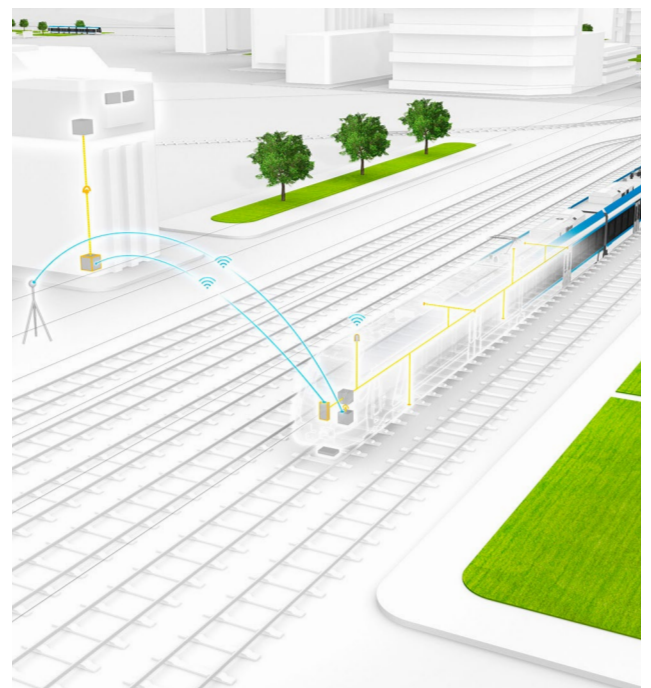


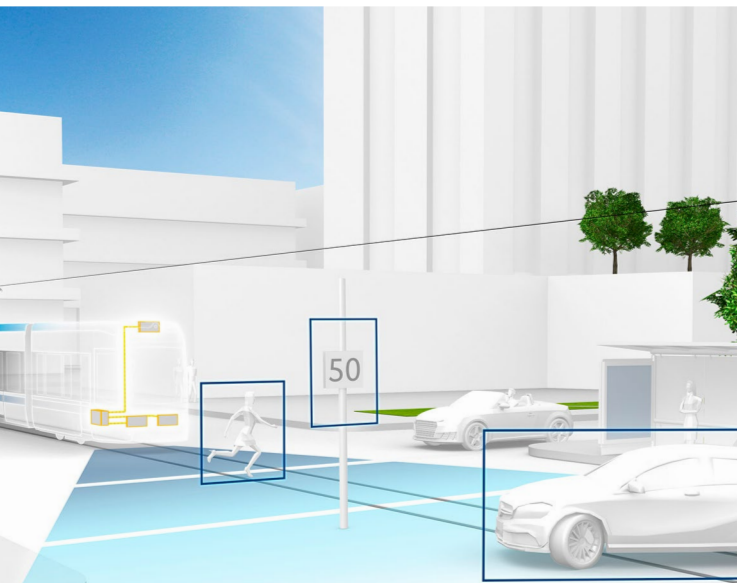
Digital twins

A digital twin is a detailed virtual image of a vehicle fleet and networks different systems to develop digital solutions for different applications.

Using the digital twin, it is possible to monitor the operation of the vehicles and counteract disruptions at an early stage and to send trains for maintenance only when it is really necessary. This increases the availability and economic efficiency of the vehicles and optimizes the operation of the vehicles for the customer.

This makes rail transport more punctual and attractive and supports the climate-friendly mobility transition.





Collision warning system

The Stadler NOVA Smartsense collision warning system ensures reliable object detection and enhances operating safety through high-quality sensors such as radar, camera, and lidar.

This composition leads to high reliability and real-time detection of classified obstacles (e.g. cars and pedestrians) and provides timely warnings to the driver about potential collisions. The system operates reliably both at night and in tunnels or under challenging weather conditions.

In order to meet the requirements of different operators, Stadler is developing a customized concept based on the modularity approach. The solution guarantees a scalable and cost-effective system for different vehicles which can be adapted to different customer needs and future requirements.

Stadler can quickly adapt the solution or create a customized concept depending on the infrastructure and technology.

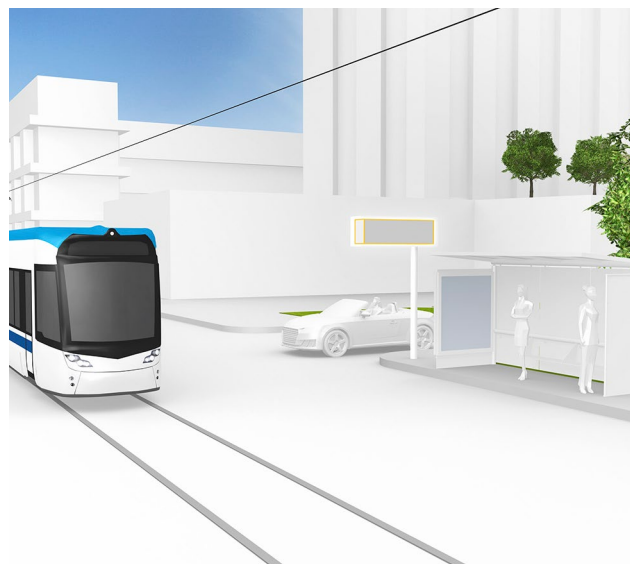
Passenger information systems

Our passenger information system is a modular solution that provides dynamic passenger information in vehicles and on routes at bus stops and on train platforms.

The passenger receives information about the forecast actual departure times and special information. The scheduled departure times from the timetable are displayed as a fallback level, e.g. in the event of disruptions or unlocated vehicles.

Configured accordingly, it can additionally support the operator in their operational optimization, e.g. by offering the possibility of handling and optimizing connections. By notifying the driver of a vehicle, it is also possible to prevent a connection from being missed by a few seconds or minutes.

Thanks to numerous interfaces to third-party systems, existing data can generally be used for passenger information without any additional work. Importing timetable data and line information is just as easy as exporting operational and display data.





03 – Competence and service

Customer proximity is not just a buzzword for Stadler. Our expertise and services ensure overall perfect operation.



Migration

- No platform solutions
- Customer-specific migration and strategy
- Parallel equipment onboard and wayside
- Tailored solutions
- Applicable on a large product portfolio

Planning and project development

- Pre-project
- Construction project
- Train protection system rollout
- Planning approval procedure
- Site management
- Client representation

Installation

- Installation and site management
- Material procurement and logistics
- Control cabinet production for electronic interlocking
- Interior of electronic interlocking
- Interior of relay-based interlocking
- External installation

Safety inspection

- Expert inspection
- Commissioning
- Shop test
- Type tests
- Verification and validation of new developments

Education

- General principles of train protection
- Electronic interlocking
- Relay interlocking
- Train protection and control systems

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