

VELARO

# Top performance for high speed

[siemens.de/velaro](https://www.siemens.de/velaro)



**SIEMENS**



## **| Driving variety**

In the twenty-first century, rail transportation is more important than ever. Climate change is putting increasing pressure on transportation operators and political stakeholders. And this means that the focus is once again on sustainable transportation options. High-speed trains play a key role in the transformation of mobility. They are true everyday heroes: They enable environmentally friendly travel along with short travel times and maximum comfort. But only one high-speed platform combines proven technologies and future-oriented concepts like no other: Velaro!



### **Climate-friendliness in series**

Rail is the most environmentally friendly method of motorized transportation. But when it comes to sustainability, the Velaro sets even more standards. Thanks to its outstanding aerodynamics and an electric regenerative braking system, the Velaro's power consumption is kept to a minimum. The latest in maintenance concepts also makes this train a winner due to its unparalleled availability. The result is short operating intervals and optimized operational planning. Along with its high passenger capacity, this means maximum efficiency in high-speed transportation.

### **Genuine alternative to flying**

Compared with other forms of transportation, the Velaro scores with its ideal combination of speed and comfort. At up to 360 km/h, the Velaro range links major cities at record speeds.

And the trains meet diverse demands from large numbers of travelers, whether they're businesspeople, families, tour groups, seniors, or individuals with reduced mobility. On the Madrid-Barcelona route, the Velaro has long replaced airplanes as the preferred means of transportation. And thanks to the Eurotunnel, it not only offers travelers a swift connection to London, it also provides a unique travel experience.

### **Flexibility without compromise**

Whether it's your first venture into high-speed systems or a new backbone for an existing fleet, Velaro trains meet all the demands for state-of-the-art high-speed transportation, and they can be integrated into existing rail systems and infrastructure very quickly when required. Enjoy the benefits of a high-speed platform that's already proven its flexibility and reliability in practice worldwide.



## | Perfecting performance

When it comes to reliability, Velaro pulls no punches. Behind the highly aesthetic exterior lies rock-solid functionality. Pioneering innovations, first-class materials, and the intelligent integration of reliable electrical and mechanical systems pave the way for this superior integrated concept worldwide.



### **Performance – 24/7**

Meet a versatile top performer: The Velaro reaches speeds of up to 360 km/h. Two car body widths, two track gauges, and a flexible number of cars in various configurations have been built and – typical of Velaro – are already in service. Traveling well over 1,000,000 kilometers a year and with punctuality exceeding 99%, Velaro is far ahead of the rest.

### **Pioneering multiple-unit concept**

Velaro is strictly a multiple-unit trainset: The traction system is distributed over the entire train, and all traction components are arranged underfloor. Consequently, the entire length of up to 400 m above the floor is available for use without space being taken up by a power car. That means maximum room for your passengers. The multiple-unit concept also guarantees optimized performance, improved running characteristics, and a high degree of riding comfort. 50% of all the axles are driven. The result is safe operation under all outdoor conditions. Velaro isn't fazed by low-adhesion coefficients and can take gradients as steep as 40‰ in its stride. The even distribution of weight also reduces the load on individual axles. This lowers the burden on the track and reduces maintenance expenditure on the bogies.

### **Worked out down to the last detail**

Velaro's level of innovation is evident in the smallest detail: While passengers benefit from the extraordinarily comfortable bogie suspension, an autopilot helps the driver make an energy-saving journey.



A state-of-the-art diagnostic system reports data to preventive maintenance via a wireless link. Available options such as a high-performance eddy-current brake ensures for wear-free braking, permanent-magnet synchronous machines for higher energy efficiency and air-cycle air-conditioning for environmentally compatible and agreeable temperatures. And it goes without saying that Velaro complies with the European safety standards and regulations (TSI, EN, etc.).

### **Maximum freedom of design**

The "empty tube" principle means that the Velaro can be flexibly configured for different passenger and baggage volumes. Elements like control cabinets and control panels are positioned near the entrances and bathrooms. The resulting open space in the car interior can be equipped with an assortment of modules: Seats, tables, baggage racks, and partition walls are mounted on rails and are easy to rearrange. Bicycle storage areas, partitions, and restaurant areas are also easy to install or remove.

# | Shaping free spaces

Competition on the rails is picking up speed. More and more rail companies are competing to be their passengers' favorite. This means that travel comfort is playing a more and more important role. A high-speed train needs to meet multiple demands: Business travelers, for example, need a quiet environment to concentrate on work. Seniors want fast and easy access to their seats. Families need space. The Velaro has the right answer for every requirement: Thanks to the "empty tube" principle, it lets you respond flexibly to your passengers' many different needs.



A balanced combination of direct and indirect lighting provides a uniquely comfortable atmosphere. As an option, individual lighting conditions can be provided via LEDs.



Effective use of travel time: A spacious conference compartment with practical working surfaces give business travelers privacy to focus on work while en route.





Handholds on the seats, a tactile guidance system with seat numbering in Braille, and strips on the vehicle floor ensure passenger safety and guidance when boarding and while the train is underway.



Convenient catering on board: A timelessly contemporary bistro with snacks and beverages offers passengers relaxation and refreshment.

### **The most options**

Spacious, bright, and exceptionally comfortable: Want a benchmark for passenger satisfaction? Then take a journey on board the Velaro. It's in a class of its own. No annoying noise, no check-ins, no traffic congestion – but full air-conditioning in hot weather. The multiple-unit concept, with two bogies per car, offers maximum useful space in the interior in all train configurations. The results are clear advantages in terms of capacity and plenty of scope for designing interiors.

### **Sophisticated technology**

While a wide range of audio and video offerings keeps your passengers entertained, a state-of-the-art information system keeps them up to date. They can learn everything they need to know about their trip and services on the train via in-seat displays, monitors, or personal mobile devices. Naturally, outlets for laptops and other electronic devices are provided on board, along with WiFi access. Cellular repeaters and frequency-transparent windows also ensure uninterrupted cellphone service on the train. A CCTV surveillance system monitors security in passenger areas. As an operator, you benefit from new service offerings and localized ads. In addition, driver assistance systems improve punctuality and make operation energy- and cost-efficient.

### **Exceptional comfort**

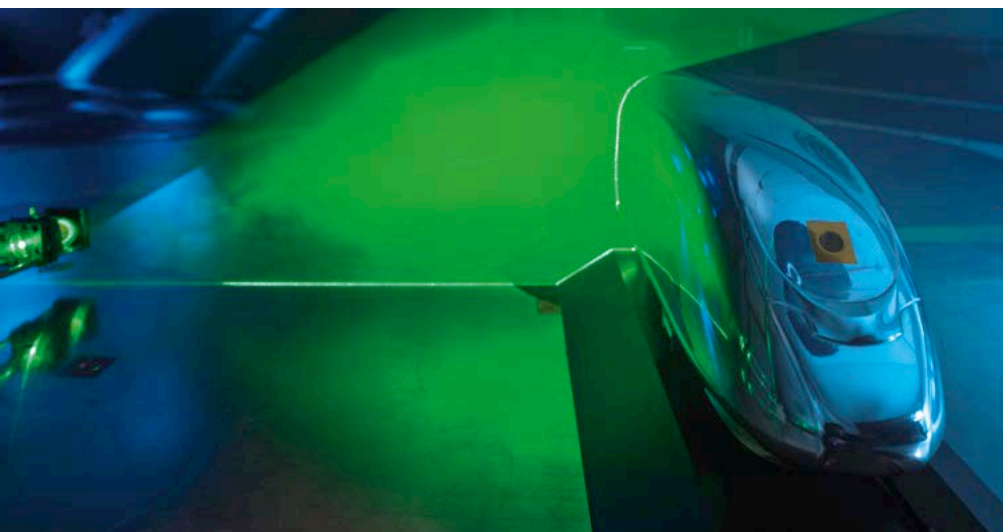
Comfort and capacity are not at odds in Velaro. Before the train leaves the station, you will notice the large vestibules and spacious baggage racks. Relax and enjoy your journey in very comfortable seats. Upholstery, armrests, and legroom can be customized to your needs. Even rotatable seats are available if required. This allows all passengers to enjoy the panoramic view while facing the direction of travel.

### **Changing flexibly with the seasons**

The vacation season is here – and with it lots of baggage. But where is it all going to be stowed? The answer is to adapt to seasonal changes and demands flexibly. The Velaro interior is modular in design: Its furnishings can be altered to suit your needs. Other modules, such as baggage racks, and small galleys with trolley storage space, are also available. You can upgrade to cars with shallower seat pitches, or change from first to second class with ease. We can supply Velaro with the UIC vehicle clearance envelope as well as with wider cars for higher seating capacity. Unlike double-deck designs with their stairs and low ceilings, Velaro retains its high degree of passenger comfort.

# | Preserving resources

An integral approach is essential when optimizing the cost efficiency of modern rail systems. In addition to next-generation technology and comfort, short amortization periods and environmental compatibility are among Velaro's top qualities. Minimum service and maintenance costs play a prominent role in vehicle design. So it is not surprising that life cycle costs are equally low.



Wind-tunnel-tested and aerodynamically optimized: Thanks to a 20% reduction in the equivalent air resistance surface, the most recent generation of Velaro trainsets saves even more energy

## **Optimized maintenance**

All Velaro's systems are subject to ongoing further development. Trains are monitored in daily service. Thanks to continuous monitoring and data evaluation in Railigent®, unplanned activities become plannable, which reduces any impact on operation and the associated delays and increases train reliability. Improved component accessibility, continually updated maintenance schedules reflecting experience gained in the field, and the ultra-reliability of the Velaro family all add up to reduced maintenance costs and high availability.

## **A model of energy efficiency**

ICE 3 and Velaro E already offered optimized aerodynamics. Masked roof-mounted equipment, the bogies, and the intercar gangways cut energy consumption. Further aerodynamic measures were tested for the Velaro CN.

Today's Velaro family integrates all acquired field knowledge and refines it. For example, a roof section elevated from the middle of the last car reduces sonic boom in tunnels. Roof-mounted equipment such as HVAC units and braking resistors are fully encased. Spoiler, nose and front section have been aerodynamically optimized. An energy-efficient brake system is also a priority for Velaro. Since the early 1990s, the train's electric brake has been feeding surplus braking energy back into the power grid. The result is a 10 % saving in energy, and a similar reduction in mechanical wear. All in all, this is equivalent to a gasoline consumption of 0.33 liters per seat and 100 kilometers. And that's impressive!

## **Significant transport efficiency**

Make room for your business expansion plans: Eight cars with two bogies each offer maximum seating capacity over a length of 200 m. Up to 510 seats are possible with classic 1+2 seating in first class, 2+2 seating in second class and a first-class component of approximately 20 %.





Equivalent gasoline consumption:  
only 0.33 l per seat and 100 km

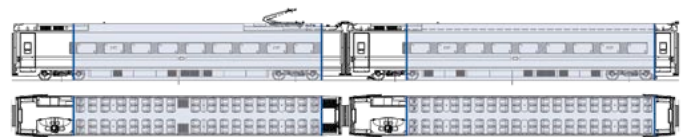
And there's enough room for around 600 passengers in the high-density arrangement with 2+2 seating and a reduced seat pitch also in first class. In contrast to articulated trains, Velaro with its 16 bogies has considerably more reserve capacity. Thus, two more persons per square meter standing room can be accommodated and carried during peak times.

### Intelligent energy management

Energy efficiency from all angles: The intelligent energy manager in the Velaro ensures that all train systems operate at optimal efficiency. The Velaro emits a calculated 14 g of CO<sub>2</sub> per person per kilometer. By comparison, the emissions from an airplane with the same capacity utilization are almost ten times as high, at 136 g per person per kilometer.

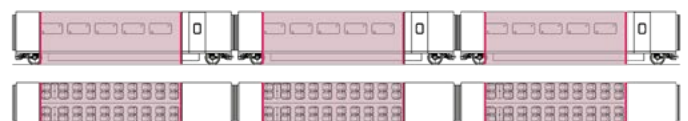
### Cost-effectiveness thanks to maximum seating capacity

Self-contained unit (e.g. Velaro)  
Maximum space



**100%** Usable free space

Articulated train Shorter cars –  
more intercar gangways, less space



**90%** Usable free space

# Advancing technology

## Bogies

The tried-and-tested SF 500 bogies of the Velaro family are put through their paces at speeds up to 404 km/h and are therefore suitable for running speeds up to 360 km/h. They provide perfect guidance, maximum stability, and outstanding riding comfort – all this has been verified on high-speed routes in Spain, Russia, China, France, Turkey, and the UK.

## Traction equipment

The Velaro family has a sophisticated drive system with scalable ratings from 8 to 11 MW. Four identical, independent traction units provide outstanding redundancy: The failure of one unit has no impact on the remaining units. And, while the bogie or axle-selective drive unit gives you clear benefits in terms of maintenance, maintenance-free, proven three-phase squirrel-cage asynchronous motors assure high availability. Or, as an alternative, a permanent-magnet synchronous machine combining a higher degree of efficiency with a better power-weight ratio can also be used. The latest IGBT technology allows easy operation in all power systems. The traction converters can be easily fitted with additional braking resistors, regenerative brake, or eddy-current brake.

## Vehicle control system

The safe and smooth exchange of data between traction units and between two coupled trains is made possible via the train communication network (TCN).

The TCN system is fully redundant and has a reduced number of interfaces and subsystems. This increases the availability of the data communication paths and data transparency, reduces data propagation delays, and saves not only hardware, installation dimensions, and weight but also life cycle costs.

## Low life cycle costs

- High energy efficiency
- Optimized service and maintenance costs
- Low refurbishment expenditures after 10-year or 20-year periods of operation thanks to its flexible and modular design

## Key vehicle features

- Trainset with distributed under-floor traction equipment
- Tested vehicle design with a high level of customization
- Internationally deployable, thanks to up to four current systems
- Variable configuration concept: 7-, 8-, 10-, 12- and 16-car
- Standard version: 8-car, 510 seats, 200 m long, capable of double-running with a total length of 400 m, coupling and separation in minimum time
- Variable passenger capacities and interior furnishings: 460 to 1,243 seats
- European standards (TSI, UIC, EN)

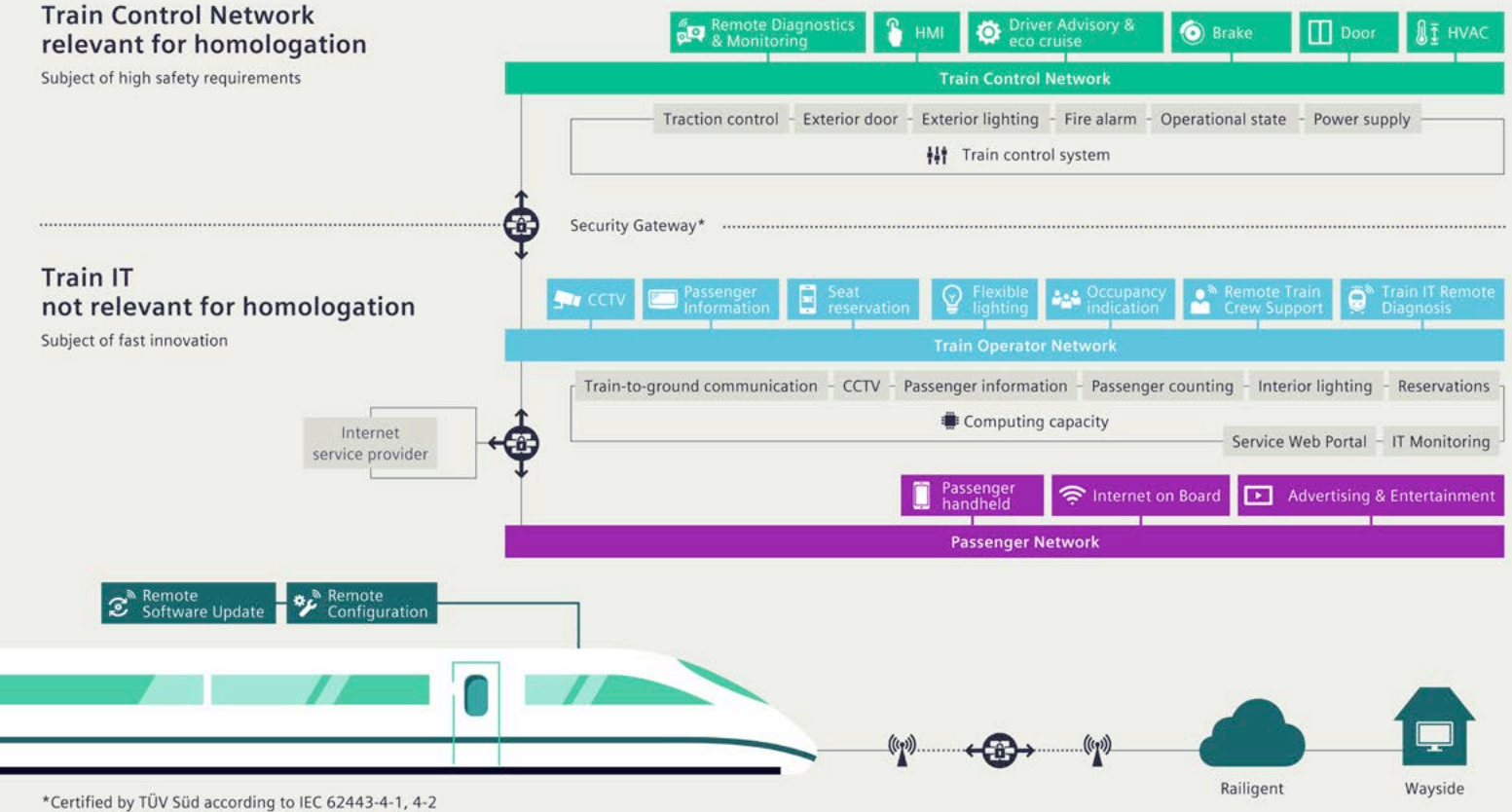
Technical data		
	Basis	Options
Number of cars	8-car	7-, 10-, 12-, 16-car
Passenger capacity	Standard: 510 seats/304 standing places	Additional first class, high-density 8-car: 596 seats, high-density 16-car: 1,243 seats, more possible
Maximum speed	320 km/h AC, 250 km/h DC	360 km/h AC
Train control system	ETCS and 1 national system	3 other national systems
Traction power	8 MW	Depends on configuration
Length	200 m	Depends on configuration
Bogies	16 (8 driven)	Depends on configuration
Line voltage	Two-system train: 1 x DC, 1 x AC	Four-system train: 1.5 kV DC, 3 kV DC, 15 kV AC, 25 kV AC
Brakes	Air brake with additional regenerative brake	Track brake as electromagnetic track brake or eddy-current brake; electric brake with braking resistor
Multiple running	Multiple unit operation of 2 Velaro 8-car trains	Functional coupling with existing fleets

## Train Control Network relevant for homologation

Subject of high safety requirements

## Train IT not relevant for homologation

Subject of fast innovation



# Driving IT further

## Reliable and efficient

In a world, that's increasingly digital and networked, powerful and future-proof IT systems in train fleets are a precondition for smooth, efficient rail operation. With Train IT – the industry's leading IT platform for rail vehicles – you can use our seamless IT solutions to monitor and manage your trains from the way-side, and optimize your operations based on comprehensive vehicle data. With its robust design and lean architecture, Train IT ensures maximum reliability, availability, and security for your fleet. Every Train IT vehicle profits from experience gained through dozens of customer projects. Of course, you can connect your Train IT vehicles with our powerful Railigent platform and benefit from our wide variety of Seamless IT Solutions.

## Integrated and modular

A powerful IT infrastructure saves money over the entire lifecycle of your train, enhances the passenger experience, and helps prevent damage. Train IT gives you a powerful system with a robust architecture, optimized applications, and comprehensive protection from cyber attacks.

The modular, fully integrated Train IT ecosystem is the backbone for innovative plug-in applications like iCCTV, Internet on Board, passenger assistance, entertainment, remote diagnostics, remote configuration, and remote software updates. Standard hardware, standard interfaces, and the software they use meet every requirement of rail operators, passengers, and regulators.

## Consistent and secure

The safety-critical train-control network, which is subject to homologation, is separated from the operator and passenger networks. This allows you to respond quickly to changes, or to expand your fleet's on-train IT functionalities. As a gatekeeper between the two networks, the Security Gateway, which is certified by TÜV SÜD in accordance with IEC 62443-4-1 and 4-2, allows diagnostic data and configuration commands to be transmitted securely. Train2Ground creates a robust and secure connection between trains and the traffic control center based on IEC 61375-2-6. Train IT offers a powerful API that provides a convenient and robust way to integrate applications and systems from third-party suppliers and customers. With support from the Train IT SDK (Software Development Kit), integrations from data exchange to application hosting can be implemented in a flash.

### Globally adaptable

The Velaro family was developed for the international market. It has the attributes of global versatility and a broad service spectrum. Reliable, configured to suit national and international requirements, and always based on a service-proven platform. So put your trust in our global experience.



## Building on success

The Velaro family was developed for the international market. It has the attributes of global versatility and a broad service spectrum. Reliable, configured to suit national and international requirements, and always based on a service-proven platform. So put your trust in our global experience – which extends far beyond the trains themselves: With our predictive services, we enable 100 percent system availability of your vehicles wherever they're operating.

### Powering across borders

Velaro is designed as a four-system trainset. This means that it can run on conventional line voltage systems. So you benefit from its border-crossing capability. In Spain, France, Germany, the UK, Switzerland, Belgium, the Netherlands, Russia, China and Turkey – you might as well say all over the world. As experts in the international certification of high-speed trains, we ensure compatibility with the infrastructure, global standards, and smooth integration of state-of-the-art and next-generation train protection and communication systems.

### Guaranteed ready for operation

System availability is the basis for powerful and reliable high-speed transport. With our modular services, we ensure that your Velaro fleet is always ready for operation throughout its entire lifecycle. Our service offerings include training, spare parts, repairs, and digital services. We also offer maintenance depending on your requirements: from technical support or full service to lifecycle care including workshop and our assumption of responsibility for preserving the value of your vehicles. If necessary, we also take care of improving and extending the lifecycle of your vehicles.





# I Velaro MS

## Unique travel experience

The Velaro MS is completely focused on optimized travel comfort. In the newly developed comfort seats with a tablet holder and socket at every seat, you can sit back and relax, whether you're traveling for business or a vacation. Frequency-transparent windows ensure the best possible wireless reception. Larger baggage racks mean that all travelers can stow their baggage conveniently, even at peak times. Families can use a larger family area with a partition for small children. And a dedicated area for bicycle storage means that the Velaro MS also provides enough space for cyclists.

## Optimized accessibility

Special attention was given to individuals with reduced mobility when the Velaro MS was designed. They benefit from dedicated PRM access with an improved lift system, which is now more intuitive for rail employees to operate. The result is much easier access to the train.

## Proven high technology

The technical aspects of the Velaro MS are based on the proven Velaro platform, which has been successfully used by Deutsche Bahn since 2013. Like its predecessors that offer space for up to 460 passengers, the Velaro MS comes with 440 seats and has a maximum speed of 320 km/h. The new train control system with ETCS Baseline 3 also makes the Velaro MS equipped for future applications and international operation. It goes without saying that the Velaro MS meets all current Technical Specifications for Interoperability (TSI 2019) and new standards of relevance like the fire protection standard EN 45545.



### 29 Velaro RUS

**Contracting party:**  
Russian Railways RZD

**Order placed:**  
May 2006, December 2011, June 2019

**Delivery:**  
2008, 2014, 2021

**Russian record:**  
281 km/h

**Greatest consistency:**  
99% operating availability

**Service offerings:**  
30-year Full Service agreement  
covering the entire lifecycle

# Velaro RUS

## High availability for Russia

Snow, ice and subzero temperatures: Russia has an extreme climate indeed. Nonetheless, as of 2009, Velaro RUS will start providing reliable service: 650 kilometers from Moscow to St. Petersburg in only 3.5 hours. It has specially adapted components and systems to cope with the harsh operating conditions in Russia and is backed up by a 30-year maintenance contract.

## Capacity meets flexibility

The ten-car trainset accommodates 556 passengers over a length of 250 m and a carbody that is 30 cm wider than the UIC profile.



With a traction power rating of 8,000 kW, it reaches a maximum speed of 250 km/h and can be upgraded to 300 km/h. Velaro RUS can be deployed universally. This is due to its two-variant design: as a single-system train for 3 kV DC and as a dual-system train for 3 kV DC and 25 kV AC. Train protection is based on the Russian operations control system Klub U.

## High performance at low temperatures

Velaro RUS is made for climatic challenges, such as temperatures ranging from minus 40°C to plus 40°C. This is evident from the extra insulation of the car and its specially adapted ventilation and cooling system. Its air intake is on the roof to avoid the hazards of drifting snow, and a more powerful heating system in the interior makes for agreeable temperatures. All the more reason to expand service to the Moscow – Nizhniy Novgorod line.



**19 Velaro TR**

<b>Contracting party:</b>	Turkish State Railways TCDD
<b>Orders placed:</b>	May 2013, March 2018, September 2019
<b>Delivery:</b>	2013, 2020, 2021
<b>Unusual design:</b>	population decided on the exterior in an online vote
<b>Service offerings:</b>	Full Service agreement for high train availability and reliability with 24/7 technical support

# Velaro TR

## High speed for Turkey

With a top speed of over 300 km/h, exclusive design and sustainable technology, the Velaro TR helping Turkey to take a massive step into the future. The country is planning to introduce over 100 new high-speed trains in the next few years and extend its network by more than 10,000 kilometers. To meet constantly increasing transportation needs in the shortest possible time, Siemens delivered the first of seven trains that have been ordered in record time: The first Velaro TR arrived in Turkey just 180 days after being commissioned.



## De luxe travel

In the newly designed Velaro TR, you can sit back and enjoy the ride. Choose between three classes of travel – Economy Class, First Class or Business-Class – and take advantage of the large on-board bistro and restaurant area, where dining meets the high standards you would expect from Turkish cuisine. Ultra-modern communication and information systems will keep passengers entertained and up to date using wireless technology, with WiFi, cellular and satellite connections offering a selection of music, videos, e-books, TV programs and news services.

## Amazing energy efficiency

The Velaro TR is all about sustainable travel. With its optimized aerodynamics and electric brakes that feed brake energy back into the network, energy usage can be reduced by up to 10 %.





#### 17 Velaro D

**Contracting party:**

Deutsche Bahn AG

**Order placed:**

December 2008

**Delivery**

2013

**Energy-saving aerodynamics:**

drag-generating surfaces decreased by 20 %

**Seamless integration:**

can be coupled to the existing ICE 3 fleet

**Service offerings:**

Performance of maintenance phase IS700 for 10 Series 407 multiple units 2019-2021

# Velaro D

### A competitive edge for Europe

Attractive reliability and low life cycle costs – for usage in Germany and France. The Velaro D is equipped for cross-border operation in Europe’s liberalized rail network. Designed as a four-system-capable, eight-unit trainset, it achieves a top speed of 320 km/h with a traction power rating of 8,000 kW.

### Attractive flexibility

The Velaro D optimally meets a wide range of mobility requirements. It has a capacity for 460 passengers over its 200-m length. During peak hours, there is a standing room capacity of two people per square meter. Supplementary baggage racks and face-to-face table arrangements can be integrated overnight. Naturally, Velaro takes the needs of passengers with reduced mobility fully into account. Not only can wheelchair users reach their locations safely and independently via wide entries and aisles, but they can also make their way to the adjacent dining car.

### Reliable frugality

An intelligent brake control unit distributes the braking power between the pneumatic and generator-type brake systems. As a result, the Velaro D can not only accelerate rapidly, but also decelerate just as quickly and safely. And while wear-free regenerative feedback systems and eddy-current brakes lower life cycle costs, the aerodynamic concept of the new generation reduces energy consumption. It was thus possible to reduce train resistance by around 8 percent despite the large amount of roof-mounted equipment.





**17 Eurostar e320**

**Contracting party:**

Eurostar International Ltd.

**Order placed:**

December 2010, February 2015

**Delivery:**

2014, 2017

**Tunneltauglichkeit**

optimiert für den Einsatz im Eurotunnel

**Customized design:**

Modern interior with a comfortable atmosphere designed by the Italian design studio Pininfarina

**Service offerings:**

Technical Support and Spares Supply (TSSSA) agreement with 24/7 technical support, optimization of maintenance regime

# Eurostar e320

**Expertise for the Eurotunnel**

A 50-km-long tunnel, of which 38 km are undersea and up to 75 m below sea level: The Eurostar e320 once again pushes our most configurable vehicle platform worldwide into new, challenging realms. Used on the London–Paris–Brussels route, the Eurostar e320 supplements the existing fleet that runs through the Channel Tunnel. With a traction power of 16,000 kW, the 400-m-long multi-system train reaches a top speed of 320 km/h.

**Trendsetting safety**

Resistant to both fire and water: The Eurostar e320 is especially tailored to meet the strict standards and design requirements for tunnel operations. In the event of a fire, the train can still be operated for an additional 30 minutes. Given the tunnel’s ambient conditions of up to 100 % humidity and 25 °C temperature throughout the year, all components are reliably protected against condensation.

**Appealing comfort**

Traveling on the Eurostar e320 is an extraordinarily luxurious experience. Trains accommodate up to 894 passengers, with 222 seats in first class and 672 seats in second class. In early 2015, Eurostar ordered an additional seven multi-unit train sets of 400 m based on an existing option





#### 60 Velaro CN

**Contracting partner:**  
Chinese Ministry of Railway MOR

**Order placed:**  
November 2005

**Delivery:**  
2008

**Follow-up:**  
component delivery for over 700 more trains

**Forerunner for more:**  
Ready for the 20,000 km of high-speed tracks

**Service offerings:**  
Fast and reliable spare parts supply and component repair

## Velaro CN

### New capacity for China

Highly comfortable ride, large seating capacities: Welcome to Velaro CN! The 8- and 16-car, 200- and 400-m-long trainsets are specially tailored for the large numbers of passengers in China. Velaro CN has 30-cm-wider cars and 2+3 seating arrangements to accommodate the transport capacity of 601 and 1,060 passengers respectively. With a traction power rating of 18,400 kW and at a maximum speed of 350 km/h, the Velaro CN is in operation on the Chinese high-speed network.

### En route in comfort

Two different classes with catering services are available on Velaro CN. First class has a lounge with rotatable seats facing the direction of travel at both ends of the train. There's lots to see here as well: A glass partition between the lounge and driver's cab offers an unobstructed view of the track ahead. First-class passengers can also enjoy exclusive entertainment via video and audio entertainment system.

### Tracking customization

Fancy a cup of tea? A hot water dispenser is available in every car. Or how about a bite to eat in the Bistro? The Bistro offers small snacks and beverages and also accommodates the customer service center. You can get the latest news: Information is provided in English or Chinese on LED screens both inside and outside. The automatic train control and signaling systems for Velaro CN are geared to meet the Chinese requirements. The operations control system specially developed by Siemens for the Chinese market is based on the European standard ETCS.





**26 Velaro E**

<b>Contracting party:</b>	Spanish National Railways RENFE
<b>Orders placed:</b>	July 2001, December 2005
<b>Delivery:</b>	2005–2006
<b>Made for the heat:</b>	Approx. 25% more powerful, redundant air-conditioning system for outside temperatures up to 50°C
<b>Service offerings:</b>	Full Service agreement for a high train availability of up to 100% carried out by NERTUS, a joint venture of Renfe and Siemens Mobility

# Velaro E

**Speed incarnate**

Breakfast in Madrid? Business lunch in Barcelona? The Velaro E will speed you to your designation in less than 2 ½ hours, and do so with maximum availability: There is only – at most – a delay of over 10 minutes per 1.5 million kilometers. That’s not surprising when you consider that the eight-section, 200 meter-long trains reach a top speed of 350 km/h with a traction power rating of 8,800 kW. The combination of speed and state-of-the-art, low-maintenance technology makes the Velaro E especially reliable. Thanks to high-quality equipment, which includes an especially powerful air-conditioning system, you cover the 625 km route in the shortest possible time and also in the greatest comfort.

**A true alternative to flying**

A trip by air pollutes the environment a lot more than traveling by rail. Using the Velaro E cuts CO2 by 88 percent compared to air travel, which corresponds to a reduction in carbon emissions of around 29,000 tons per year. A growing environmental awareness is also clearly noticeable among travelers. For example, passenger numbers using the high-speed rail service between Barcelona and Madrid increased from 2 million in 2008 to 4.3 million in 2018.

At the same time, use of the air route decreased significantly.

**Travel with class**

Whether you travel Club with premium class comfort, Preferente with a high-quality interior and individual service, or Turista, the Velaro E offers up to 405 passengers extreme travel comfort with lots of room to move around. Thanks to rotatable seats in all three classes, passengers in the Velaro E can always sit facing the direction of travel. And when they’ve seen enough of the passing panorama, they can relax and watch the large video screen from any seat. Passenger information is provided via multilingual LED screens inside and outside. The modern European signal system ETCS Level 2 and the reliable continuous ATC system (LZB) ensure a safe journey.



# | Ensuring availability

Future-oriented rolling stock is only as good as the maintenance strategies that ensure their availability. Our Rail Services cover every aspect of maintaining your rolling stock – from assuming full-service responsibility on a contractual basis, to customer-specific service packages, including technical support in the context of overhauls or repairs, up to demand-based individual services that you can call on when needed, such as customized spare parts packages: all so you can benefit from highly available trains and a smooth sequence of operations.

## **Global expert and service network**

With our more than 6,000 service employees from 35 countries, you can rely on many years of experience and know-how of our rail experts at any time. With our dedicated global expert pool of 800 employees, we also provide flexible support for all challenges. In addition, this expertise is complemented by a powerful, global, physical service infrastructure consisting of more than 100 workshops, depots, and repair centers. In our Alliance for Availability, we also bundle industry-specific knowledge in an open ecosystem. Manufacturers, rail operators, suppliers, partners, universities, and the world of science all share processes, technologies, and know-how using our Railigent and MoBase digital platforms. Our common goal is 100 percent system availability, optimized efficiency, and the protection of your investments.

## **Reliable partnership**

Relying on many years of experience in global maintenance projects and as manufacturer, owner, and operator of rail-based vehicles we have extensive knowledge and interfunctional skills – and we'll be happy to assist you as your trusted partner. By taking over the Entity in Charge of Maintenance (fully or functionally), we offer you a comprehensively developed solution concept that ensures the safety of technology and operation over the entire life cycle of your vehicles and components.

## **Digital expertise**

Based on decades of our practical experience, our digital services are key to guaranteed availability, maximized throughput, and new business models. From sensor systems to smart algorithms and precise analytics, we provide the basis for predictive maintenance, optimized asset management, and efficient operation. This results in significant increase of reliability, availability, and cost-effectiveness of your systems.

## **IoT platforms with added value**

With Railigent™, our mobility application suite, you'll enjoy all the benefits of our Digital Services – from full transparency of all events relating to your vehicle fleets and routes, to precise conclusions and recommendations thanks to AI-based smart data analyses. On our digital marketplace MoBase, we also offer an unparalleled variety of products and services. MoBase provides you with easy access to more than 800,000 web components from over 3,000 manufacturers. You benefit from efficient processes and short delivery times.

Shaping the future together





# | Moving people

Mobility operators need a partner that understands their business and shares their passion for mobility. A partner that offers solutions for the many challenges of the era and puts its customers 100 percent at the heart of its activities. A partner they can work with to shape the future of seamless, sustainable, secure, and reliable mobility. And we're that partner.

## **Our mission**

With our focus on digitalization and innovation, we're already finding the answers to the challenges of the future. Thanks to digitalization, we're enabling mobility operators worldwide to ...

- ... make trains and infrastructure intelligent,
- ... increase value sustainably over the entire lifecycle,
- ... enhance the passenger experience, and
- ... guarantee availability.

## **What drives us**

Mobility doesn't stand still. The way we move and travel is constantly changing and becoming more comfortable, personalized, intermodal, and networked. As mobility pioneers, we're spearheading this transformation – and we're conceiving of travel in holistic terms: moving away from individual means of transportation toward the seamless travel experience. That's why we're constantly updating our portfolio in our key areas of rail vehicles, rail automation and electrification solutions, and the associated services and turnkey systems – and are therefore able to offer our partners future-proof, technologically superior solutions for their mobility needs.

**Published by  
Siemens Mobility GmbH**

Siemens Mobility GmbH  
Otto-Hahn-Ring 6  
81739 Munich, Germany  
contact.mobility@siemens.com

Order No. MORS-B10065-00  
HL 21126785 WS 02220.0

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

**Image:**

ICE 3® is a registered trademark of German Rail (DB AG).

Velaro® is a registered trademark of Siemens AG.

