



In December 2008, Deutsche Bahn awarded Siemens Mobility a contract for 15 interoperable eight-car high-speed trains.

The Velaro® train for Germany (Class 407) is based on the Velaro platform, which is currently the fastest operating high-speed train in the world. High-speed trains of this type are already operating reliably in Spain and in China. The Velaro RUS version was successfully put into service between Moscow and St. Petersburg in December 2009.

The Velaro D, a version that is the result of further development work, will be delivered to Deutsche Bahn in the third quarter of 2011. The trains are scheduled to commence serving their new area of operations when the winter timetable starts. As multi-system trains, they can be used in Belgium, Germany, France – on the new high-speed Rhine-Rhône line among others – and in Switzerland. The Velaro D can be coupled to the ICE 3, thus enabling flexible use of the vehicle in the German timetable as well.

#### Technical data

Maximum speed	320 km/h
Train length	200 m
Voltage system	15 / 25 kV AC and 1.5 / 3 kV DC
Traction power	8,000 kW
Brake systems	Regenerative, eddy-current brake, pneumatic
Number of axles	32 (16 driven)
Wheel arrangement	Bo'Bo'+2'2'+Bo'Bo'+2'2'+2'2'+Bo'Bo'+2'2'+Bo'Bo'
Number of bogies	16
Axle load	< 17 t
Number of cars per train	8
Gauge	1,435 mm
Carbody, end car	25.7 m
Carbody, intermediate car	24.2 m
Pantograph	2 x 3 kV DC / 2 x 15 kV AC 16.6 Hz / 2 x 25 kV AC 50 Hz
Service entry	12 / 2011
Number of seats	(total / 1st / 2nd / Bistro) 460 / 111 / 333 / 16

# High-Speed Trainset Velaro D (Class 407)



**Multiple-unit train with astounding transport efficiency – flexible and comfortable**

The Velaro D is a multiple-unit trainset in which the traction and all the technical modules are distributed underfloor over the length of the train. Thus, the full length of the train is available to the passengers, offering 20% more room than other train concepts.

The interior of the Velaro D has a modular design; its fixtures, fittings and equipment can be altered quickly and flexibly.

In future, it will be possible to integrate additional baggage racks or supplementary face-to-face table arrangements overnight. This enables compliance with any altered requirements resulting from the operating situation.

**Exemplary energy efficiency**

Knowledge about aerodynamics was collected and evaluated systematically from Velaro vehicles operating in Germany, Spain and China. New aerodynamic measures were tested in the wind tunnel and tried on the Velaro in China. Further development of the Velaro platform was a direct result of this work, which is visibly illustrated for the first time by the new Velaro D: namely, panel covers for the roof-mounted equipment, bogies and intercar gangways that reduce power consumption. A high roof that starts in the middle of the end car reduces the sonic boom



during movement through tunnels, improves running resistance and reduces exterior noise. Roof-mounted equipment, such as pantographs and air-conditioning units, are completely covered by panels. Spoiler, nose and front section have been aerodynamically optimized. The brake system of the Velaro is also energy-efficient: Since the beginning of the 1990s, its electric brake has made it possible to feed braking energy back into the supply network. The bottom line: 10% energy savings and reduced mechanical wear.

The intelligent energy manager in the Velaro D ensures that the train systems operate with optimum efficiency. This results in a reduced equivalent CO<sub>2</sub> emission of 14 g/person-km, whereas an airplane with similar operating grade has an average CO<sub>2</sub> emission of 136 g/person-km.

**The clear advantage:**

**Optimized performance characteristics**

The multiple-unit concept is characterized by the following operational advantages:

- Better leverage of the adhesion (coefficient) during acceleration as 50% of the axles are driven.
- Capability to run on steeper line sections with gradients of up to 40 per mille.
- The evenly distributed weight over the entire trainset leads to lower individual axle loads. Due to this uniform distribution (of weight) over the entire multiple-unit train, the individual wheelsets have to bear less weight. This reduces track wear and maintenance requirements of the running gear. The axle load per wheelset is below the internationally stipulated maximum of 17 t.

## Additional benefits:

### Comfortable ride

The evenly distributed weight also improves the running characteristics and, therefore, travel comfort.

- The selected train length of 200 m is perfect with regard to the regulations of the Technical Specification of Interoperability (TSI), since this allows for the train to be driven with double heading at a total length of 400 m.
- Positive effect: For example, the Velaro D can run on a section of track initially as a double train and then be split up into two trains for different final destinations.
- For optimum customer benefits, the Velaro D will be designed so that it can be coupled to Deutsche Bahn's existing fleet of ICE 3 vehicles. Therefore, the Velaro D will be integrated seamlessly in the operations of Deutsche Bahn.

### Impressive traction

The Velaro D has four identical, independent traction converter units. This principle generates clear advantages in continuous operation:

- Any failure of one converter will not affect the remaining units. This enables the train to safely reach its destination with 75% of its maximum rated traction power.
- Low-maintenance three-phase asynchronous motors with cage rotors ensure a high level of availability.

### The result

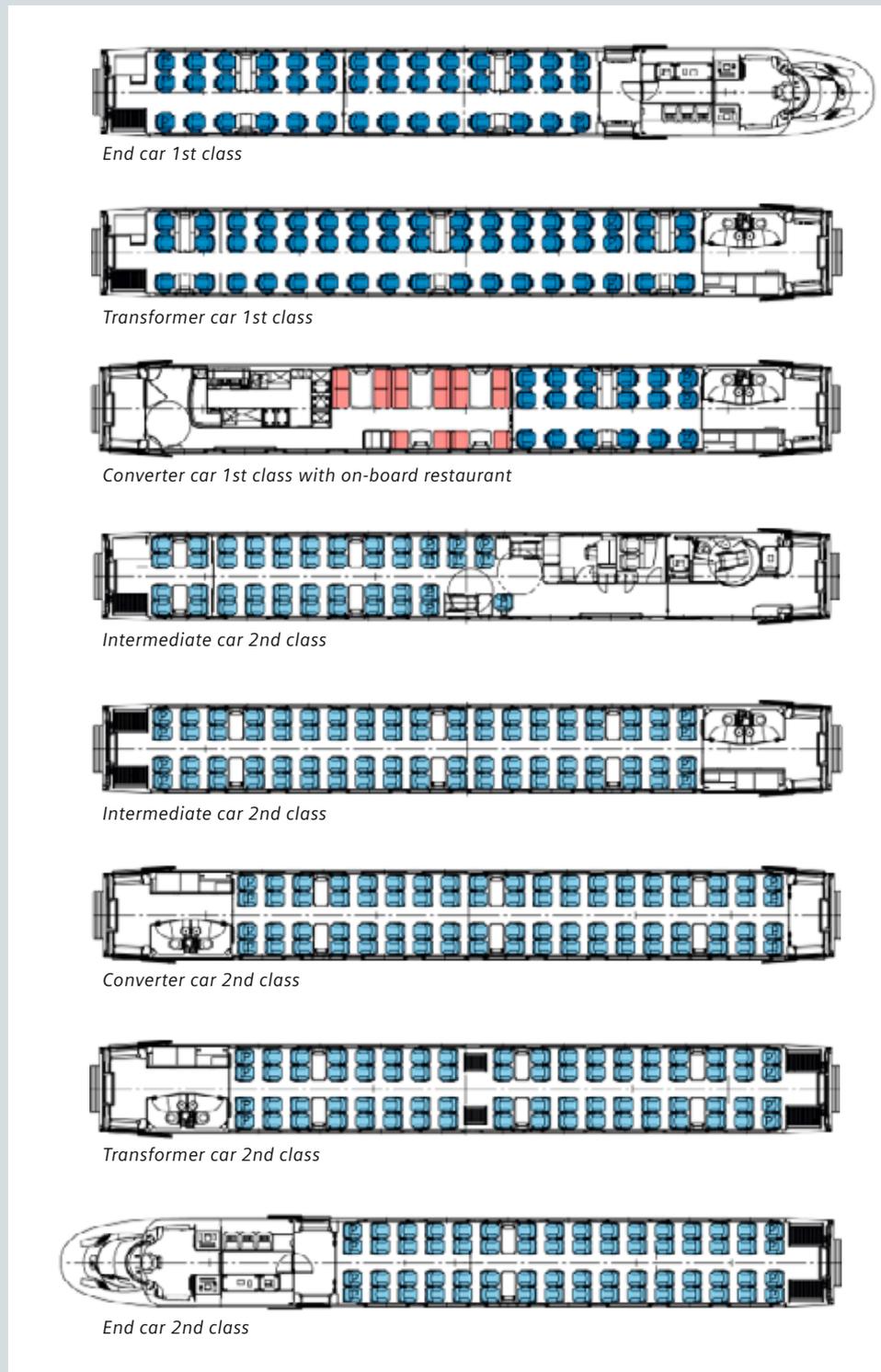
A concept of space economy that ensures pleasant traveling for the passengers and maximum freedom of movement at the same time – in all parts of the two car classes.

### Continuous provision of information

The passenger information system is based on all previous experiences and incorporates advanced technologies. All car classes feature video screens that are clearly visible from every seat and provide information on the train route.

### Perfect control

The Train Communication Network (TCN), consisting of the train bus (WTB) and the vehicle bus (MVB), ensures a smooth and reliable data transfer between the traction units of a train as well as between two coupled trains.



Layout example

The consistently redundant design of the TCN system provides additional advantages:

- Significant improvement of the availability of the communications paths
- Savings in respect of hardware, installation dimensions, weight and lifecycle costs

- Increased data transparency and shorter data propagation delays due to reduction in the number of interfaces and subsystems

### Efficient onboard power supply system

Maximum passenger comfort requires an especially efficient electric system. Bus-bars installed throughout the train ensure a reliable power supply of the loads:

- Air-conditioning, ventilation and heating
- Fans and pumps
- Restaurant operation
- Lighting

### Proven safety

Having been continuously advanced, the bogies from the ICE 3 of Deutsche Bahn AG contribute to the exemplary lateral guidance performance of the Velaro D. They also ensure maximum stability and, therefore, excellent running comfort.

Even more important than rapid acceleration is rapid deceleration. The electric brake of the Velaro D enables automatic distribution of the braking effort among the pneumatic and the regenerative brake systems.



In order to reduce lifecycle costs, preference of installation is given to the wear-free regenerative feedback system and the eddy-current brake. Experience gained from the ICE 3 and Velaro train-sets is directly taken into consideration and leads to quickly and reliably deployable systems.

Of course, the optimized bodyshell and train concept meets the latest standard EN 15227:2008 for collision safety.

### Summary

The Velaro D is the latest member of the Velaro family. In its advanced state of development, it unifies the knowledge gained from fleets presently in service, it integrates the current requirements of our customers and serves as a multiple-unit train that can be operated anywhere in Europe.

With its capacity advantages, the consistent maturation of its systems in terms of reliability and lifecycle costs, plus the experience of the people building it, it represents the state-of-the-art benchmark for high-speed trains with distributed traction.

**Siemens AG**  
Industry Sector  
Mobility Division  
Public Transit  
P.O. Box 3240  
91050 Erlangen  
Germany

[trains.mobility@siemens.com](mailto:trains.mobility@siemens.com)  
[www.siemens.com/mobility](http://www.siemens.com/mobility)



[www.siemens.com](http://www.siemens.com)

Printed in Germany / TH 166-100382 / 199860 / DA 04100.2 / Dispo 21704 / c4bs 3902 / Order No.: A19100-V800-B806-V1-7600

ICE® is a registered trademark of Deutsche Bahn AG.

Velaro® is a registered trademark of Siemens AG.

The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.