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## Velaro Turkey

### High-Speed Train for TCDD

The most recent addition to the Velaro platform is continuing a unique success story: following Spain, Russia, Germany and the UK, Velaro has now also been selected in Turkey.

The Turkish State Railways (TCDD) placed an order with Siemens in 2013 to deliver seven eight-car high-speed trains. The contract also contains a seven-year maintenance agreement, including spare parts and the delivery of a driving simulator.

The first train, still based on the Velaro D, was modified to TCDD's specifications in areas of the interior and the restaurant and was delivered to Turkey within 180 days.

The 6HST trains are also based on the current and globally most variable Velaro high-speed platform, and will be deployed on the Konya–Ankara–Eskisehir route by 2017. With an output of 8,000 kW, the 200 m long multiple unit trains reach a top speed of 300 km/h.

Thanks to Siemens' long experience with the Velaro, the company can draw on a large stock solution and characterized using a high level of proven technology. The 25 kV traction system is derived, for example, from multi-system traction of the Velaro platform.

The train layout offers three comfortable travel classes and a spacious restaurant and bistro area. Each train has 45 seats in First Class and 426 seats in Economy Class and Business Class in three compartments, each with four comfortable seats.

## Technical Data

Top speed	300 km/h
Train length	200 m
Electricity supply	AC 25 kV / 50 Hz
Traction performance	8,000 kW
Brakes	Generator, pneumatic
Track width	1,435 mm
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
Max. axle load	17 t
Number of cars / train	8
Number of seats	up to 519
Environmental temperature	-25 °C to +40 °C
Train control systems	ETCS Level 1 and Level 2

The new EMU's are fitted with innovative communications and entertainment systems which will provide on-board internet and video on demand to passengers in the future.

A CCTV system with outdoor and indoor cameras is used to monitor the passenger compartment, the train driver space, the distance in front of and behind the vehicle and entry areas. The galley has custom equipment to provide hot and cold meals on board, meeting the high standards of Turkish hospitality. Passengers' special requests can be met with the use of multifunctional devices.

## EMU's with amazing transport efficiency – flexible and comfortable

As with all its previous successful predecessors, the Velaro Turkey is a pure EMU in which the entire drive unit and equipment modules are distributed underfloor throughout the train. Thus the entire train is available to the passengers. As compared to conventional trains with locomotives, the Velaro platform vehicles have about 20% more useful space in the passenger areas with the same length, and thus a much higher number of seats.

The EMU design has now secured a high level of customer acceptance due to its advantages, and has been implemented globally. The Velaro has been continuously improved since the first generation in reliability and drivability.

Its advantages in daily operation include the following:

- High adhesion during acceleration because 50% of the axles are driven
- Capability to run steeper route sections of up to 40 ‰
- Due to equal weight distribution over the whole EMU, there is less weight on individual wheelsets. This protects the railroad embankment, lowers maintenance expenses to the chassis and provides excellent running performance.

The Velaro Turkey has four identical and independent traction units. If one traction unit fails, this can be switched off without affecting the remaining units. The train can reach its destination with 75% of maximum traction power.



### **Environmentally-friendly energy efficiency**

Knowledge about aerodynamics was systematically collected and evaluated from the Velaro fleets in operation in Spain, China, Russia, Germany and the UK. New aerodynamic measures were tested in the wind tunnel and on the Velaro in China. This led to a further development of the Velaro platform and thus to the fourth stage of evolution which can be seen on the outside with the new Velaro: The covers on roof equipment, bogies and vehicle transitions reduce energy consumption. A high roof from the middle portion of the end car reduces sonic boom in tunnels, improves the driving friction and reduces exterior noise. Roof structures such as pantographs and air conditioning systems are fully covered. Nose and front spoilers were aerodynamically optimized.

The Velaro demonstrates energy efficiency in its braking system: Since the first generation, its recovery of braking energy has returned energy to the grid. The effect: 10% energy saved, and reduced mechanical wear. The intelligent energy manager in the Velaro Turkey ensures that the rail systems are operated at optimum efficiency. This leads to reduced, saved CO<sub>2</sub> emissions of 14 g/passenger-km. In comparison, the average CO<sub>2</sub> emission of aircraft with the same payload is 136 g/passenger-km.

### **Top entertainment**

The attractiveness of high-speed trains is based in particular on providing a comprehensive entertainment and information program in addition to fast travel speeds and the centrally positioned railway stations. Passengers in Velaro Turkey trains receive e-books, online browser games, news tickers and IPTV (Internet Protocol Television) in addition to music, videos and travel information. Touch displays integrated in the seats in first and business class as well as the mobile devices brought by the passengers and working with WLAN (Wireless Local Area Network) provide access to these offerings and information. A satellite connection for data transmission to and from the land-side and UMTS (Universal Mobile Telecommunications System) are available in order to provide powerful and interruption-free communication.

### **Summary**

The Velaro Turkey is a further development which incorporates the findings from the operating fleet, integrating the current requirements of TCDD customers. It sets the current benchmark for high-speed trains with its benefits in capacity and comfort.





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