Siemens is one of the leading suppliers of integrated mobility solutions for the urban area (Complete Mobility) and of vehicles for local, regional, and main-line traffic. Munich’s municipal utility Stadtwerke München (SWM) has ordered eight trams from Siemens for the local line network in order to modernize and expand its existing vehicle fleet. The Avenio series of trams is based on the proven Combino Plus platform, which is already in service successfully in Lisbon and Budapest.

Each of the trams – delivered by February 2014 – consists of four modules, each with its own centrally installed bogie. The modules are interconnected to form an complete end-to-end passenger compartment filled with light. The trains are equipped for unidirectional operation with a driver’s cab and an auxiliary driver’s cab.

Technical data:

- Vehicle configuration: Four-section, low-floor articulated multiple unit for unidirectional operation
- Wheel arrangement: Bo’2’Bo’Bo’
- Line voltage: 750 V DC
- Track gauge: 1,435 mm
- Vehicle length over buffers: 36,850 mm
- Vehicle width: 2,300 mm
- Vehicle height: 3,550 mm
- Wheel diameter min./max.: 600/520 mm
- Low-floor area: 100 %
- Entrance height: 300 mm
- Capacity (4 pers./m²): 216, incl. 69 seats
- Maximum speed: 70 km/h
- Maximum gradient: 6 %
- Empty weight: approx. 47 t

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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.
Brake system
The Avenio has four individual, independent brake systems:
- Electrodynamic brake in the powered bogies with braking to standstill
- Hydraulic passive spring-loaded brake in the powered bogies
- Hydraulic active disk brake in the trailing bogies
- Electromagnetic rail brake in all bogies

Design and braking properties fully comply with EN 13452 and the directives of BOStrab (German regulation on the construction and operation of trams).

Bogies
The three powered bogies with their two longitudinally installed traction units feature a low center of gravity and minimal unsprung masses. The mechanical coupling of the wheels in a longitudinal direction results in significantly improved running characteristics compared with conventional 100 percent low-floor bogies without wheel coupling. Two suspension stages in the bogie together with rubber-sprung tires and vertical and horizontal dampers ensure optimal dynamic running characteristics.

Technical properties/special features
- Vehicle concept designed to meet highest aesthetic requirements to fit the environment in which it is operating
- Amply proportioned and bright interior design
- Perfect ride comfort and optimized wheel-rail wear
- Optimal load distribution
- Efficient air-conditioning systems for passenger compartment and driver’s cab
- Uniformly arranged double doors with spacious door areas
- Large multifunction rooms for baby buggies and wheelchairs
- Video-monitored lift for disabled-friendly access
- Large, easy-to-read train destination displays inside and out
- Infotainment monitors
- Interior video surveillance
- External video camera to supplement outside mirror

Coach body
The coach body structure is based on a welded steel construction consisting almost entirely of weatherproof structural steel (Corten). The entire body shell is also treated with a cathodic dip-paint coating (KTL) to provide optimal protection of the bodywork against corrosion.

Interior design
The Avenio trams built for Munich have an attractive, spacious interior design with two large multifunction areas for wheelchairs, baby buggies, and walkers/rollators accommodated in the end modules. Eight double doors on the entrance side with a clear width of 1.3 meters are arranged at uniform distance over the length of the tram, allowing passengers to board and disembark quickly and easily. The first door behind the driver’s cab also has a lift that allows disabled passengers to easily access the tram.

Seats and handrails designed according to ergonomic criteria increase travel comfort, as do the infotainment monitors and automatic ticket machines installed at the customer’s request. Air-conditioning systems guarantee a pleasant climate throughout the entire ultramodern interior of the vehicle, including the driver’s cab.

Traction equipment
The electrical equipment is accommodated in containers on the roof of the cars. The traction system consists of three modern pulse inverters using IGBT technology, six low-maintenance three-phase induction motors, and three traction control units (Sibas® 32). The vehicle control uses a bus transmission system in conjunction with a hardwired control system. This redundant design provides maximum reliability and fail-safe performance.

Project data
Customer: Stadtwerke München GmbH (SWM)
Operational area: Line network of the city of Munich, Germany
Delivery period: November 2013 to February 2014
Scope of delivery: Eight four-section vehicles, spare parts, special tools, documentation, driver and maintenance training
Tests: Static and dynamic testing of the vehicles will be performed at the Wildenrath test center and/or in Munich.

Technical properties/special features
- Vehicle concept designed to meet highest aesthetic requirements to fit the environment in which it is operating
- Amply proportioned and bright interior design
- Perfect ride comfort and optimized wheel-rail wear
- Optimal load distribution
- Efficient air-conditioning systems for passenger compartment and driver’s cab
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