



**SIEMENS**

*Ingenuity for life*

Avenio – fits your city.

Our 100% low-floor trams,  
made especially for you.

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# Avenio – fits your city. Made for where you live.

Your city is unique – and so are your requirements for public transportation. The Avenio family with its two lines, Avenio and Avenio M, offers you custom solutions that are designed just for your city. All this is based on a common, modular toolkit of proven systems and components representing more than 135 years of unique experience: Siemens built the world's first electric tram in 1881 and also has 25 years of experience in 100% low-floor technology.

Whether you need innovative single-articulated or flexible multi-articulated trams, the members of the Avenio family will fit harmoniously into your cityscape and adapt to your existing infrastructure and your requirements for capacity, interior layout, and exterior design.



**Avenio – innovative single-articulated tram with 100% low floor**  
The outstandingly comfortable Avenio single-articulated tram with light rail character redefines trams – and combines the benefits of the single-articulated concept with the proven modular elements of the Avenio family. Modules of about nine meters in length are supported on a centrally positioned pivoting bogie unit.



**Avenio M – highly flexible multi-articulated tram with 100% low floor**  
 The Avenio M is a multi-articulated tram with outstanding curve-negotiating characteristics. It builds on the experience gained with the Combino, the world's first modular tram platform, together with the success of the Avenio generation. Intermediate modules are suspended between short bogie modules, enabling the Avenio M to maneuver even through twisted sections.

## Your advantages with the Avenio family

### Excellent ride comfort

- Continuous, 100% low floor
- Spacious and bright interior layout
- Large, full-glass doors and panoramic windows
- Air-conditioning in passenger compartment and driver's cab with different power settings
- Outstanding ride performance both on straights and when cornering

### Noise abatement measures

- Low wheel/rail load keeps noise emissions down
- Auxiliary units throttle back or switch off completely when vehicle is at a standstill
- "Noiseless" electric brakes slow tram down to a stop

### Environmental bonus

- More than 95% recyclable
- No air pollution from brake abrasion
- Small quantity of biodegradable lubricants needed
- Minimized electromagnetic radiation

### Up to 30% energy savings

- Weight-optimized construction
- Intelligent energy management
- Traction converter and control with 98% efficiency
- Air-conditioning unit controlled via CO<sub>2</sub> sensor depending on passenger numbers
- Optional on-board energy-storage unit

### High maintenance-friendliness

- Greatly extended tire life
- Easy on track infrastructure
- Extremely wear-resistant mechanical brakes
- All key components easy to access and replace

### Operation without overhead contact lines (optional)

- Modular on-board energy-storage unit consisting of battery and ultra-caps
- Catenary-free operation possible over long distances





### High passenger capacities with the Avenio

A choice of three vehicle widths and trams with two to eight modules – the graphic shows how many people can be transported in the various combinations. The calculation is based on a bidirectional vehicle with standing space for four passengers/m<sup>2</sup>.

# Avenio – for fast tram and light rail services.

## Made for universal deployment and high capacities

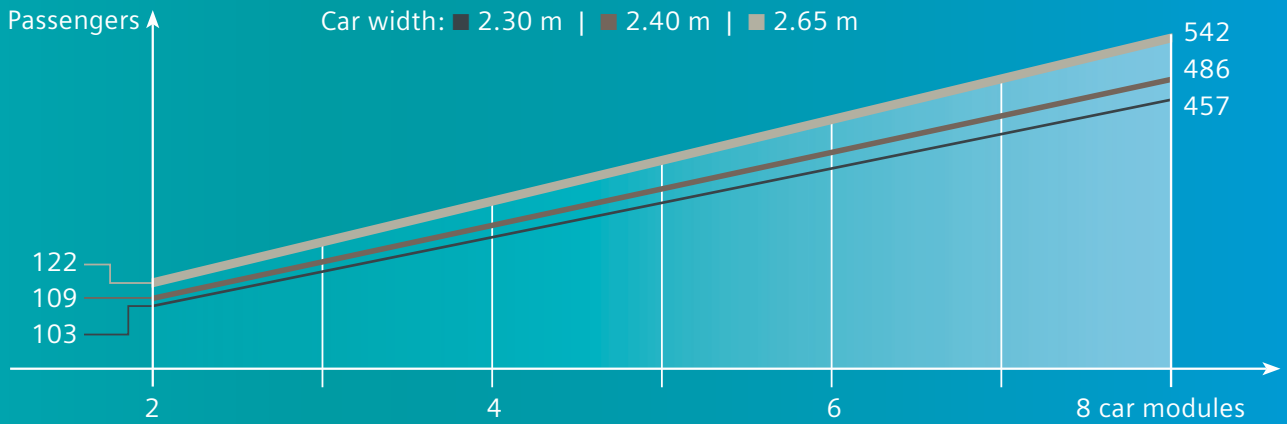
The innovative single-articulated Avenio tram offers a safe and secure ride thanks to its symmetrical load distribution, harmonic track guidance, and balanced play of forces, even on “old” routes and challenging infrastructure. The modular concept lets you choose exactly the right vehicle for your needs: from the compact 18-meter composition to the longest tram in the world, up to 72 meters long.

- Pivoting bogies and evenly distributed, low axle loads mean minimal loading on the vehicle structure and track
- Best possible use of space, with 16 high-quality seats in the bogie area
- More than 540 passengers in eight-section “maxi” version
- Up to 700 passengers at full capacity
- Wide double doors cover up to 30% of the vehicle length, including directly behind the driver’s cab, making for quick boarding and alighting

## Made for extraordinary comfort and low maintenance costs

The single-articulated Avenio concept – the unique combination of articulating joint, bogie, and traction unit – is an overall attractive option, thanks in particular to its great ride comfort, minimal noise emission, low wheel and rail wear, and low maintenance outlay.

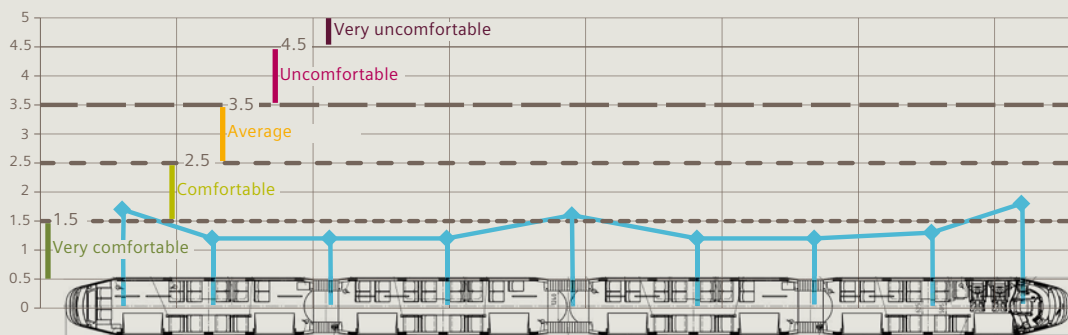
- Fast, quiet travel at 80 km/h on straights for light rail use
- Smooth cornering performance with no squeaking
- Minimized rolling noise and ground-borne vibration
- Tire life up to three times longer than with traditional low-floor vehicles
- Lower rail wear
- Low-maintenance, low-wear components for auxiliary systems



Avenio Education City, Doha, Qatar



Avenio The Hague, Netherlands



**Excellent ride comfort on the SWM network:**  
 NMV comfort parameters for Siemens Avenio Munich – vehicle at VDV 3/3 load – based on NMV “grades” in accordance with EN 12299

# Avenio single-articulated tram: Details of tram and technology.



## ① Vehicle

- Vehicle length from 18 m to 72 m (2–8 modules)
- Vehicle width of 2.3 m, 2.4 m, 2.55 m, or 2.65 m
- Car body of lightweight steel construction
- Optimal corrosion protection from weather-resistant structural steel (COR-TEN) and cathodic dip coating
- Track gauge of 1,435 mm for standard gauge networks
- Maximum axle load of only 10.5 t with car width of 2.65 m: lowest axle load of all 100% low-floor vehicles
- Maximum speed: 80 km/h

## ② Single-articulated concept

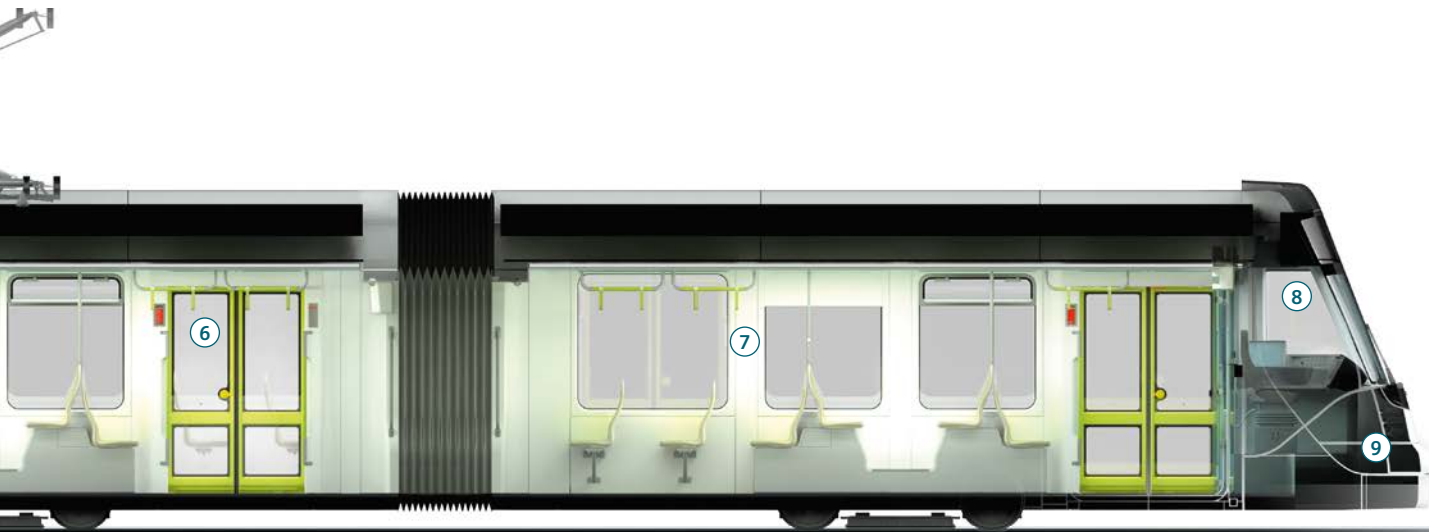
- Single-articulated tram with modules of approximately 9 m in length supported on a centrally positioned bogie unit
- Pivoting bogies and articulation joints between modules make narrow curve radii possible
- Low-wear and ride-comfort-optimized combination of articulation design, bogie, and traction unit, with no need for additional articulation dampers

## ③ Bogies

- Bogies with up to 4.5° rotation and triple suspension
- Connection to car body with an innovative rubber–metal secondary spring and a combination of vertical and horizontal dampers
- Proven longitudinal wheelset technology with outboard traction units mechanically coupling the wheels on one side of the bogie
- Low center of gravity and minimized unsprung mass

## ④ Drive equipment and vehicle control

- Latest generation of traction inverters and control
- Low-maintenance, air-cooled three-phase asynchronous motors
- Highly reliable redundant vehicle control with bus transmission system backed by an additional hardwired control system
- Electrical equipment housed in containers on the vehicle roof and in the driver's console
- No equipment housings in the passenger compartment



#### ⑤ Power supply

- Low-loss regenerative-braking energy feedback
- Optional: On-board energy-storage unit for storing braking energy through to catenary-free operation

#### ⑥ Doors

- Evenly distributed, wide double doors – up to 30% of the vehicle's length
- Double doors also directly behind the driver's cab
- One- and two-sided door configurations possible
- State-of-the-art full-glass design allows unimpeded view from inside
- Platform illumination in the door area when the doors are open

#### ⑦ Passenger compartment

- Entrance/floor height of 300/350 mm (435 mm the bogies)
- Spacious compartment with low-floor passage from end to end
- Room for more than 540 passengers in maximum-capacity configuration
- Large multifunction areas for strollers, wheelchairs, bikes, etc.
- Choice of colors, seating arrangements, seat types, and hand rails in many configurations

- Efficient heating and air-conditioning system with comfort airflow down to the floor area for optimal interior climate

- Other options include infotainment screens, ticket vending and canceling machines, video monitoring, and access assistance for passengers with limited mobility (e.g., lifts)

#### ⑧ Driver's cab

- Ergonomic design
- Individual air-conditioning control
- Modern console design, clearly arranged control panels, large display
- Comfortable, variably adjustable seat
- Optional external video system

#### ⑨ Vehicle front

- Custom design options
- Crash concept with two-stage energy-absorbing elements for collision scenarios in accordance with EN 15227
- Passive safety, thanks to great all-around visibility and special front design
- Quick to repair after an accident
- Can be fitted on optional basis with collision warning system (ADAS) to avoid accidents



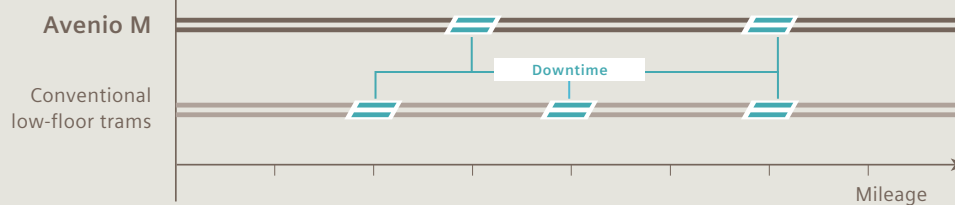


### Flexible passenger capacities with the Avenio M

Three vehicle widths, trams with three, five, or seven modules, intermediate vehicle modules in two lengths – the graphic shows how many passengers can be transported in the various combinations. The calculation is based on a bidirectional vehicle with standing space for four passengers/m<sup>2</sup>.



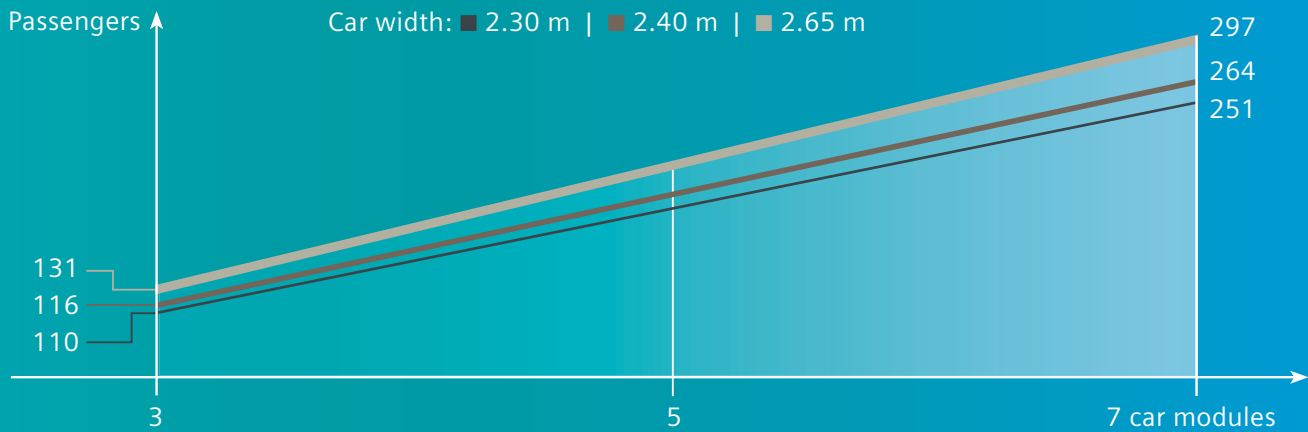
Avenio M, Ulm, Germany



### Reduced maintenance effort with the Avenio M

The bogie-unit construction increases the durability of the tires and reduces downtime for maintenance by as much as 35%. The graphic shows the maximum mileage until the next workshop service compared with other multi-articulated vehicles.





# Avenio M – drive on through even the tightest curves.

## Made for narrow tracks and complex alignment

On track gauges of either 1,000 or 1,435 mm, the flexible, multi-articulated tram Avenio M can handle even difficult routes safely, smoothly, and quietly – thanks to its combination of short bogie-unit modules with intermediate vehicle modules suspended between them. The dynamic envelope is optimized so that it never interferes with infrastructure, not even in tight curves. With the typical Avenio bogies and drive configuration, it still offers the best driving characteristics that can be achieved with a multi-articulated vehicle.

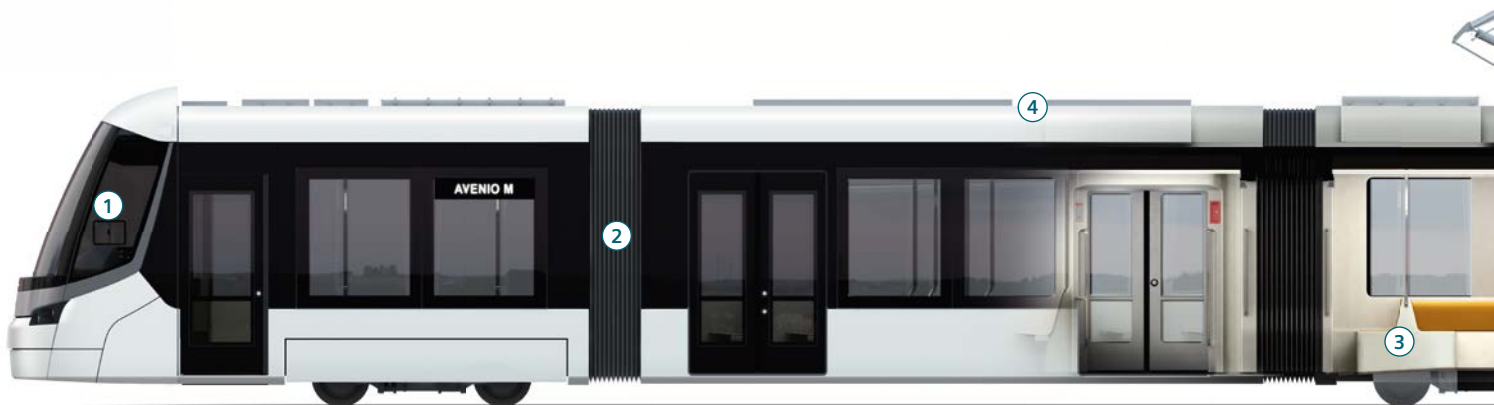
- Deployable in meter- or standard-gauge networks
- Great maneuverability
- Best suited for inner-city use on existing narrow and curving networks
- No rumbling or squeaking
- Best driving stability and smoothest cornering among multi-articulated trams

## Made for high flexibility and efficiency

The Avenio M offers the right solution for every requirement, thanks to its modular design. In the long intermediate modules, doors and interior layout can be arranged to suit and can be ideally adapted to accommodate expected passenger numbers. However, the Avenio M is not just flexible; it's also efficient, typically featuring long maintenance intervals and low energy consumption.

- Intermediate modules available in different lengths and door arrangements
- Intermediate modules freely configurable with seats, standing room, or multifunctional areas
- Reduced wear-inducing longitudinal slip when traveling through curves protects wheels and rails
- Much longer tire life compared to traditional multi-articulated vehicles
- Low-maintenance, low-wear components for auxiliary systems
- Low energy consumption thanks to weight-optimized aluminum car bodies and state-of-the-art electrical systems

# Multi-articulated tram Avenio M: Details of tram and technology.



## ① Vehicle

- Vehicle length from 21 m to 43 m (3, 5, or 7 modules)
- Vehicle width of 2.3 m, 2.4 m, or 2.65 m
- Welded, weight-optimized aluminum car body
- Track gauge of 1,000 mm for meter-gauge networks or 1,435 mm for standard-gauge networks
- Maximum speed: 80 km/h (70 km/h for 1 meter gauge)

## ② Multi-articulated concept

- Combination of short bogie-mounted modules with intermediate bogieless modules suspended between them
- Intermediate vehicle modules available in two lengths, with either one or two doors per side
- High maneuverability for complex track geometries

## ③ Bogie

- Bogies with triple suspension and two outboard traction units
- Proven longitudinal wheelset technology with outboard traction units mechanically coupling the wheels on one side of the bogie
- Optimized connection to car body with a combination of vertical and horizontal dampers allows limited rotation
- Low center of gravity and minimized unsprung mass

## ④ Drive equipment and vehicle control

- Latest generation of traction inverters and control
- Low-maintenance, air-cooled three-phase asynchronous motors
- Highly reliable redundant vehicle control with bus transmission system backed by an additional hardwired control system
- Electrical equipment housed in containers on the vehicle roof and in the driver's console
- No equipment housings in the passenger compartment

## ⑤ Power supply

- Low-loss regenerative-braking energy feedback
- Optional: On-board energy storage-unit for storing braking energy through to catenary-free operation

## ⑥ Doors

- 800 mm extra-wide single doors on both sides at the ends of the vehicle behind the driver's cab
- Wide double doors in the intermediate vehicle modules
- State-of-the-art full-glass design allows unimpeded view from inside
- Platform illumination in the door area when the doors are open





### ⑦ Passenger compartment

- Entrance/floor height of 305 mm (380 mm above the bogies)
- Generous amount of space for more than 297 passengers in maximum-capacity configuration
- Multifunction areas for strollers, wheelchairs, bikes, etc.
- Choice of colors, seating arrangements, seat types, and hand rails in many configurations
- Efficient heating and air-conditioning system with comfort airflow down to the floor area for optimal interior climate
- Other options include infotainment screens, ticket vending and canceling machines, video monitoring, and access assistance for passengers with limited mobility (e.g., sliding steps or electric ramps)

### ⑧ Driver's cab

- Ergonomic design
- Individual air-conditioning control
- Modern console design, clearly arranged control panels, large display
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- Optional external video system

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- Custom design options
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