



International Conference on + Transportation & Development ◦ 2024

3A – Airports III



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June 15-18, 2024 | Hilton Atlanta | Atlanta, Georgia

A Major APM Connection at the Largest South American Airport

Rev 01



Aeromovel's Working Principle



The system uses pneumatic energy for propulsion generated by stationary centrifugal blowers that feed and/or evacuate air from a duct. The vehicles travel guided by conventional running rails. Acceleration is determined by the combination of pressure and airflow within the propulsion duct, controlled by adjusting the blower rotation speed and positioning valves.

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Porto Alegre Airport People Mover

- Opening – 2013
- Owned and operated by the Federal Government
- Connection between the International Porto Alegre Airport and commuter rail
- Over 7.4 million passengers transported
- 580,000 trips
- 2,300 boardings per business day

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GRUAIRPORT

AEROPORTO
INTERNACIONAL
DE SÃO PAULO

São Paulo International Airport (GRU Airport)

- Largest airport in Brazil and the busiest in Latin America.
- In freight transport, it is the second after the El Dorado International Airport in Bogota, Colombia.
- The Federal Government has managed the airport since its opening in 1985 until 2012, when the GRU Airport Consortium won the concession auction.
- 41,307,915 passengers in 2013
- Total daily population of ~190,000 people
- 25 km (15 mi) away from São Paulo downtown



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Line 13 – Jade (CPTM)

- Connection to São Paulo downtown (Luz Station)
- Operated by São Paulo Metropolitan Trains Company (CPTM)
- Travel time to the airport: 36 min
- Integrated with three metro lines
- Fare: ~ \$1.00 USD



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GRU Airport Bus Shuttle System

- 15 – 20 minute-headway, mixed-traffic, with route sections inside the airport and in the local roadway
- Connection of three airport terminals and Line 13 of CPTM (rapid transit and commuter rail)
- Free-of-charge service
- Diesel powered



GRU Airport People Mover Bid

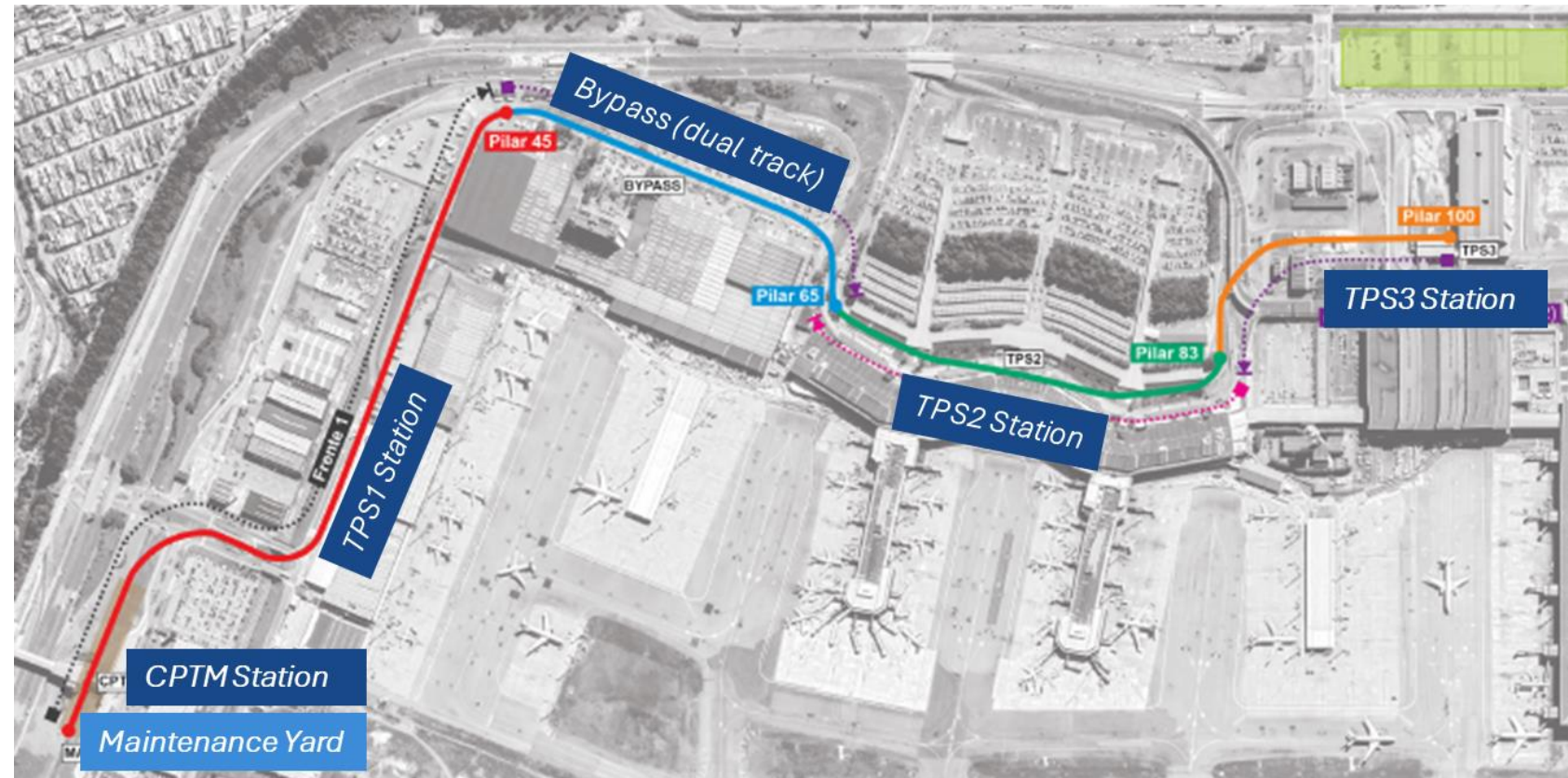
- International RFP for DBOM of a world-class ASCE-compliant land side airport APM to replace the bus shuttle service
- 10-yr O&M
- 13 suppliers interested, short-listed to five
- ARUP acting as APM consultant
- Brazilian *AeroGRU Consortium* had the winning bid
- Contract was signed on September 06, 2021



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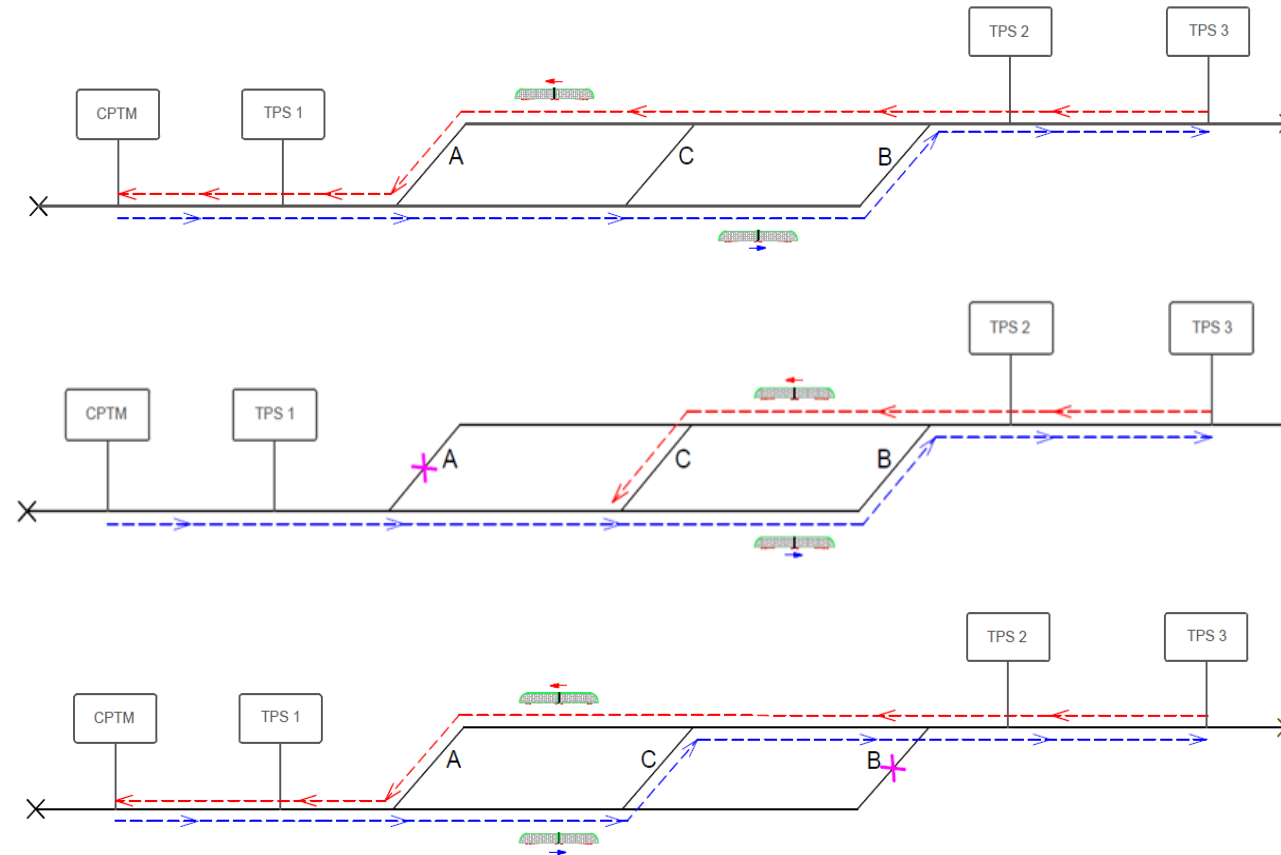
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GRU Airport APM Datasheet



- Configuration: shuttle bypass
- Length: 2,647 m (1.6 mi)
- Number of stations: four
- Fleet: three (one hot stand-by)
- Five switches
- Five power propulsion units (PPU)
- Grades up to 4,1%
- Speeds up to 72 km/h (45 mph)
- Capacity: 2,000 pphpd
- Headway: 6 min
- Travel time: 6 min
- Dwell time: 25 sec

Bypass Redundancy Concept



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Civil Works

- 2 mm (0.08") of tolerance for the 1.2 x 1.2 m (4 ft x 4 ft) propulsion duct
- Use of point clouds for regulating the molds and checking the final geometry of the manufactured beams
- Widespread use of BIM technology for the civil works, mechanical and electrical design





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Elevated Guideway



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Elevated Guideway

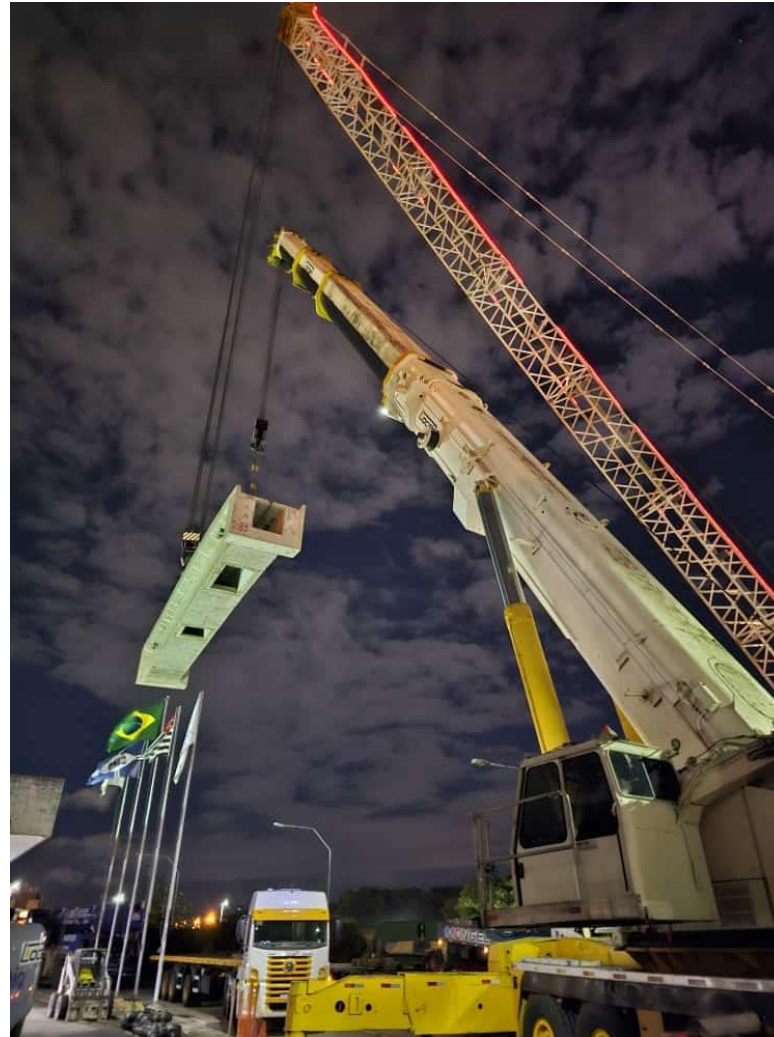


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Elevated Guideway – TPS2

Brazil's largest crane (1,200 metric tons) used for positioning the beams at TPS2 directly from the main park lot without disrupting the terminal operations and vehicles traffic.



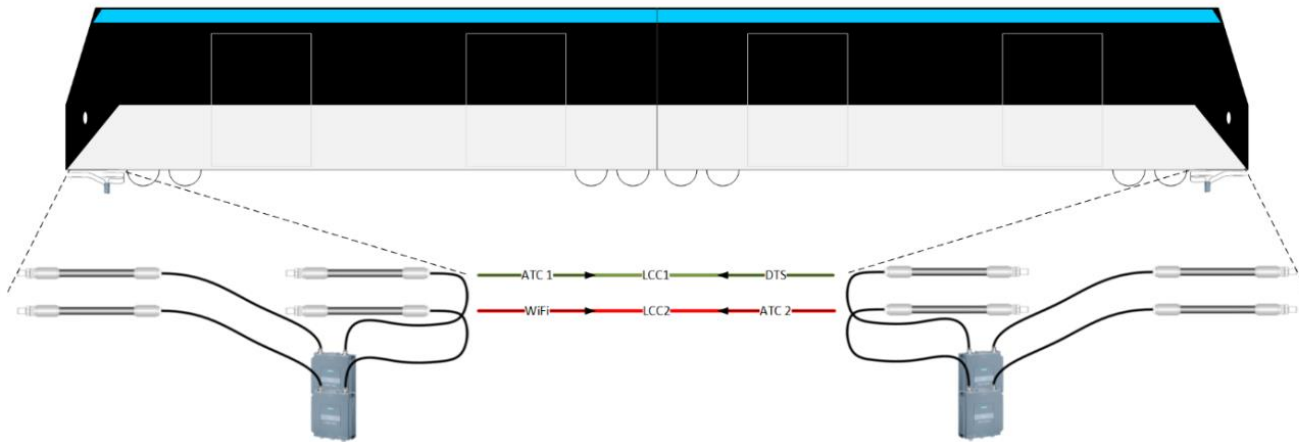
INNOMOTICS

A Siemens Business

SIEMENS

Control System

- Supplied by Siemens Innomotics (Sw & Hw)
- Rugged industrial off-the-shelf
- Partnership between Brazil and Austria
- SIL4 certification fulfilling CENELEC standards
- Service-proven redundant leaky cable iWLAN radio communication
- Two central control rooms (main CCR and mirror CCR)



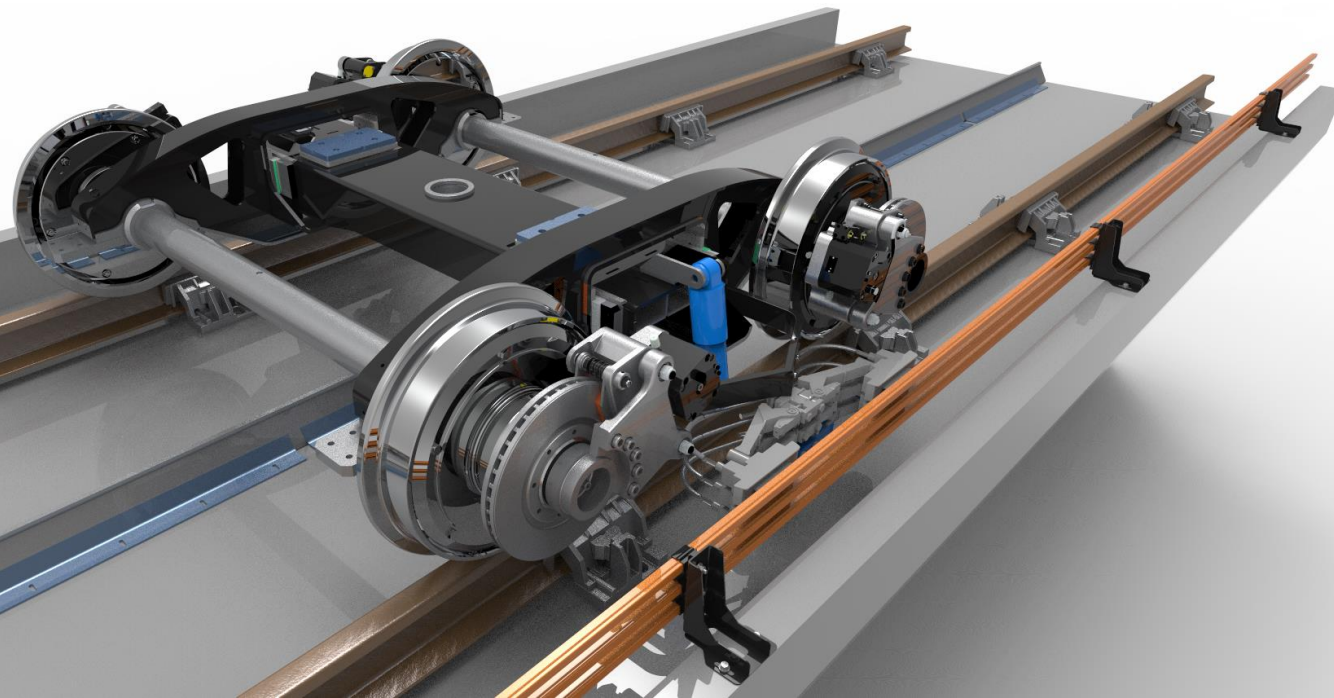


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Power Distribution System

- PDS supplied by Siemens Innomotics
- 13.8 kV power bus
- The electrification of vehicles (HVAC and other) is accomplished by low-current 380 Vac power rails
- Protection relays with communication protocols compliant with IEC 61850
- VFDs with dual DC power modules operated with a single control unit
- Energy management system (EMS)
- Diesel generators power back-up



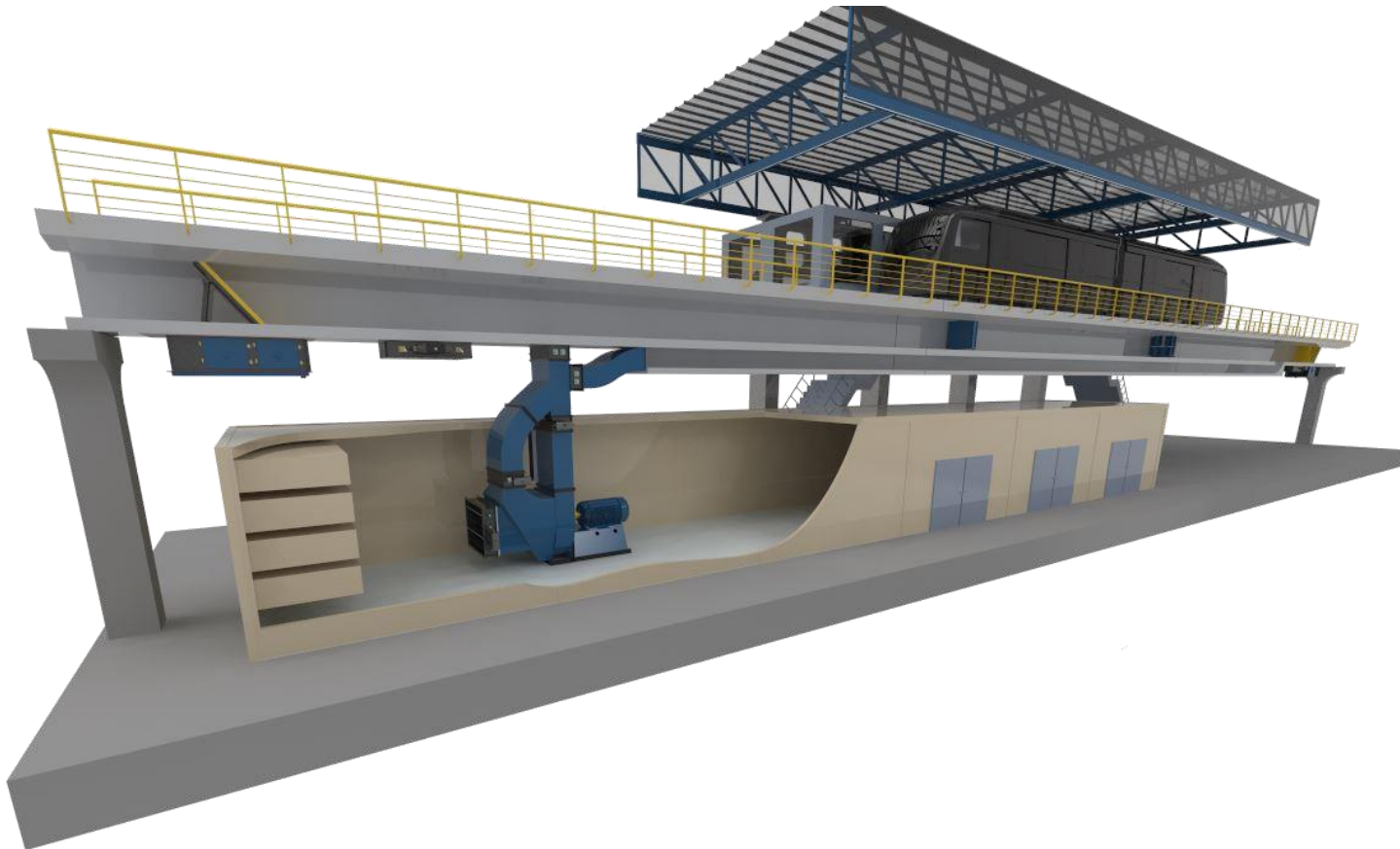
PDS Technical Rooms



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Propulsion System



- Manufactured by a Brazilian licensee of Chicago Blower/SOMAX at Rio de Janeiro
- Blower max pressure of ± 20 kPa (3 PSI)
- Max power of 500 kW (680 cv)
- 55 dBA noise @1.5 m away from the PPU room
- Spring-return fail safe pneumatic actuators

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Vehicle

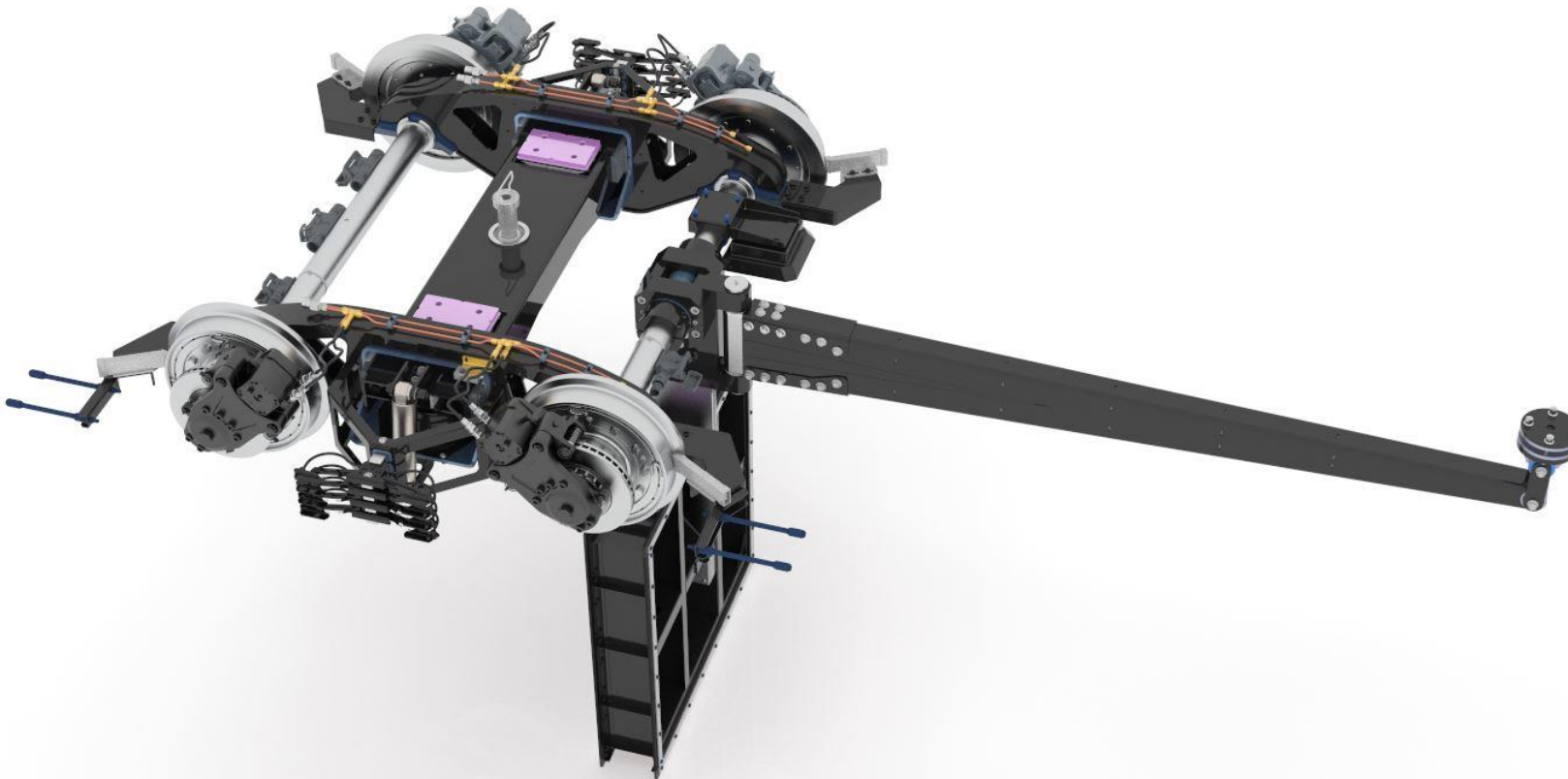


- Carbody manufactured and integrated by rail division of Marcopolo, a Brazilian multinational and world's largest bus body and component manufacturer
- Capacity for 200 pax @4 pax/m²
- High-speed onboard wi-fi
- Integration to the airport EVIDS

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Vehicle Bogies



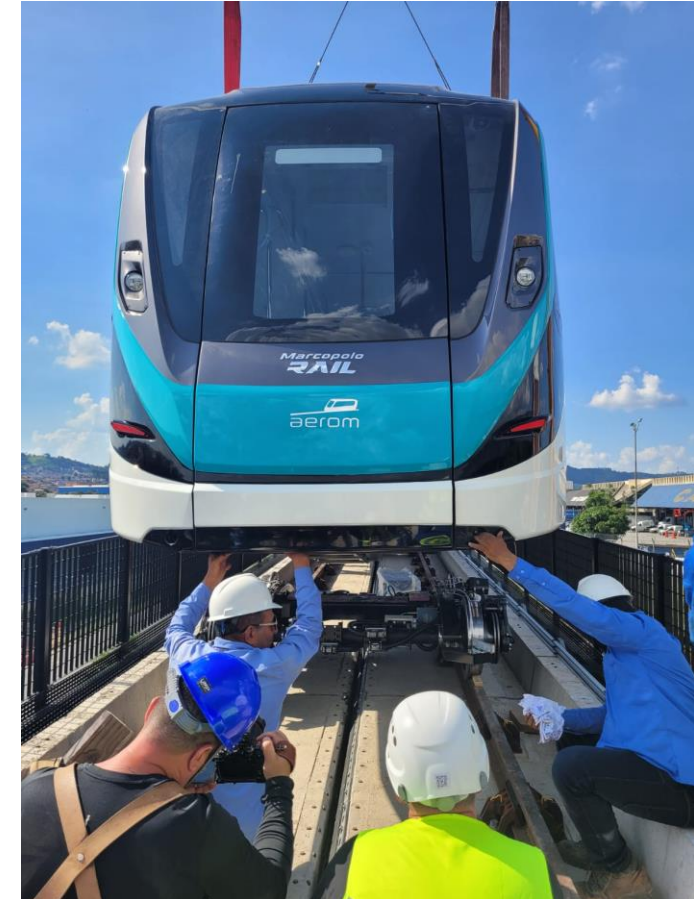
- Propulsion plate as an anti-derailment device
- Independent Rotation Wheel (no hunting effect)
- Rail industry SIL-certified hydraulic brake
- Equipped with leaky cable readers, RFID antennas, proxy switches, dual encoders, pressure and load sensors



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Blue Vehicle Installation Onto the Guideway



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Blue Vehicle and Shuttle Bus



Green Vehicle & Maintenance Facility





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Vehicle Interior

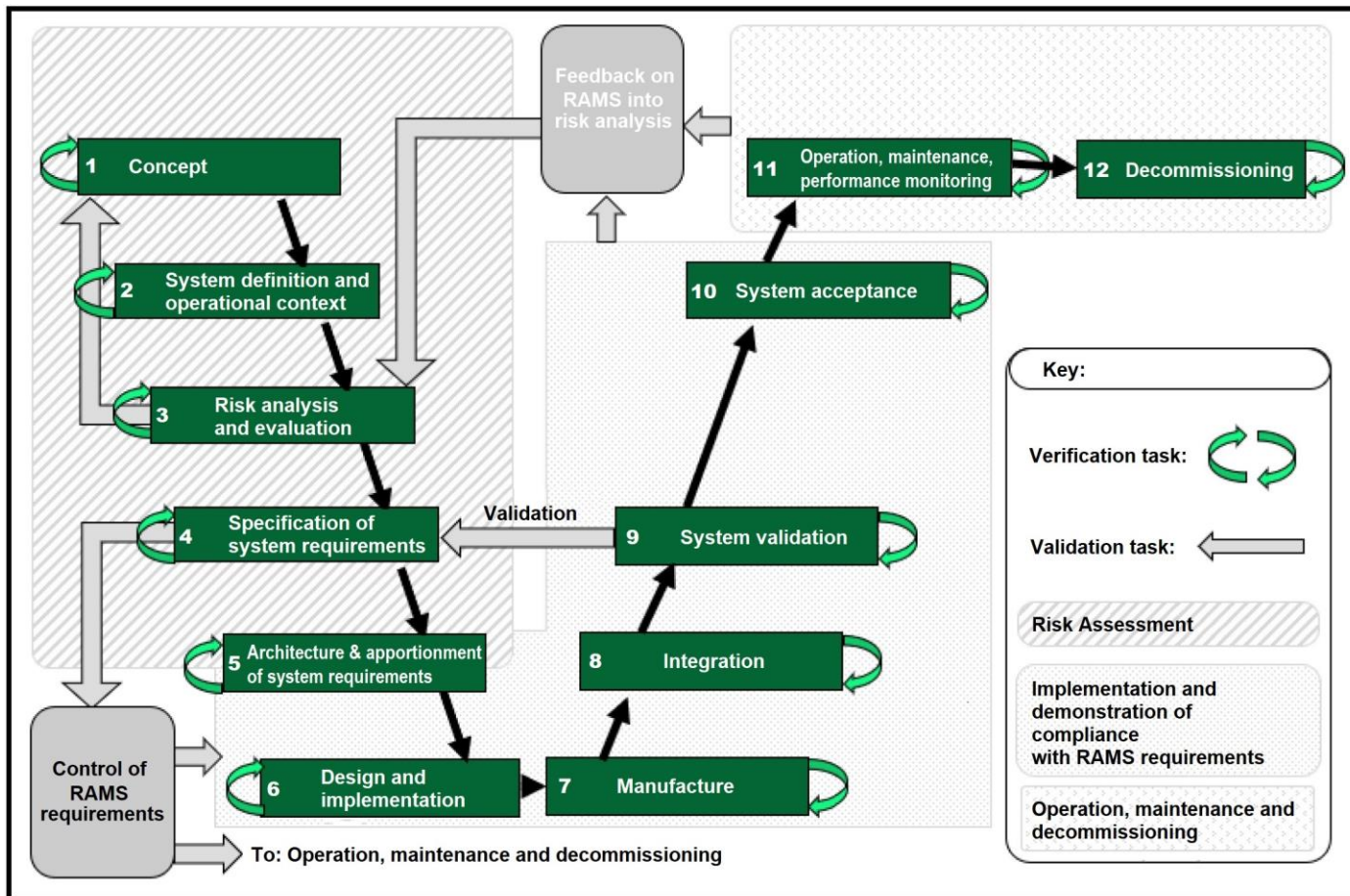


Standards Compliance & Certification

- ASCE 21 (2013)
- Safety level SIL4 (one critical or catastrophic failure each 11,415 to 114,155 years) to be certified according to European standards EN 50126, 50128 and 50129
- EN 50155
- EN 50129

Safety integrity level (SIL)	Average frequency of a dangerous failure of the safety function [h ⁻¹] (PFH)
4	$\geq 10^{-9}$ to $< 10^{-8}$
3	$\geq 10^{-8}$ to $< 10^{-7}$
2	$\geq 10^{-7}$ to $< 10^{-6}$
1	$\geq 10^{-6}$ to $< 10^{-5}$

ASCE 21 Automatic Train Control MTBHE requirement of one failure in (1×10^8) hours, or one failure in 11,415 years





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