= AnsaldoBreda Driverless Metro =

The AnsaldoBreda -Ansaldo STS Driverless Metro is a class of driverless electric multiple units and corresponding signaling system . Manufactured by AnsaldoBreda and Ansaldo STS in Italy , it is or will be used on the Copenhagen Metro , Princess Nora bint Abdul Rahman University , the Brescia Metro , the Thessaloniki Metro , Line 5 of the Milan Metro , Line C of the Rome Metro and the Yellow Line of the Taipei Rapid Transit System . The first system to use this class of driverless electric multiple units was the Copenhagen Metro which opened in 2002 .

The rolling stock consists of two to six articulated cars . All trains are 2 @.@ 65 meters (8 @.@ 7 ft) wide , except those used on the Rome Metro which are 2 @.@ 85 meters (9 @.@ 4 ft) wide . All operate on standard gauge . Each car has a power output of 210 or 256 kilowatts (282 or 343 hp) , fed from a third rail at 750 volts (except in Rome where it is 1 @,@ 500 V overhead line) . The systems are fully automated , consisting of automatic train protection (ATP) , automatic train operation (ATO) and automatic train supervision .

= = Rolling stock = =

The rolling stock uses standardized car bodies , articulated together . The number of cars varies across the different systems where they are used . The trains used on the Princess Nora bint Abdul Rahman University system are two car units . For the other systems , the units vary between three and six cars , making the trains from 39 to 109 meters (128 to 358 ft) long . They are 2 @.@ 65 meters (8 @.@ 7 ft) wide , except the Rome Metro units , which are 2 @.@ 85 meters (9 @.@ 4 ft) . The units vary from 3 @.@ 4 to 3 @.@ 85 meters (11 ft 2 in to 12 ft 8 in) tall . Each car has two doors on each side , which are 1 @.@ 3 meters (4 ft 3 in) wide and 1 @.@ 945 meters (6 ft 4 @.@ 6 in) tall . The vehicles are designed by Giugiaro Design .

The three and four @-@ car trains have six three @-@ phase asynchronous motors per train , with each motor giving a power output of 105 and 128 kilowatts (141 and 172 hp) , giving each train a power output of 630 or 764 kilowatts (845 or 1 @,@ 025 hp) . In each car , the two motors are fed by the car 's own insulated @-@ gate bipolar transistor . They transform the 750 @-@ volt (1 @,@ 500 V in Rome) direct current collected from the third rail shoe to the three @-@ phase alternating current used in the motors . The trains ' top speeds are 80 or 90 km / h (50 or 56 mph) , with an acceleration and deceleration capacity of 1 @.@ 3 m / s2 (4 @.@ 3 ft / s2) . Trains are fully compatible with platform screen doors , which are found at all stations in Brescia , Rome and Milan , and at underground stations in Copenhagen .

= = Automation = =

The systems are controlled by a fully automated computer system , located at the control and maintenance center . The automatic train control (ATC) consists of three subsystems : automatic train protection (ATP) , automatic train operation (ATO) and automatic train supervision (ATS) . The ATP is responsible for managing the trains ' speed , insuring that doors are closed before departure and insuring that switches are correctly set . The system uses fixed block signaling , except around stations , where moving block signaling is used . The system has been designed and built by Union Switch & Signal .

The ATO is the autopilot that drives the trains in line with a pre @-@ defined schedule , ensures that the train stop at stations and operates the doors . The ATS monitors all components of the network , including the rails and all trains on the system , and displays a live schematic at the control center . The ATC is designed so that only the ATP is safety @-@ critical , and will halt trains if the other systems have faults . Other aspects of the system , such a power supply , ventilation , security alarms , cameras and pumps , are controlled by a system called " control , regulating and surveillance " .

The most common repairs are the grinding of the wheels ; more complicated repairs are made by replacing entire components that are sent to the manufacturer . By having components in reserve ,

trains can have shorter maintenance times . The center also has the system 's work trains , including a diesel locomotive that can fetch broken trains . At any time , there are four people working at the control center . Two monitor the ATC system , one monitors passenger information , while the last is responsible for secondary systems , such as power supply . In case of technical problems , there is always a team of technicians who can be sent to perform repairs . Although the trains are not equipped with drivers , there are stewards that help passengers , perform ticket controls and assist in emergency situations .

= = Systems = =

= = = Brescia = = =

The Brescia Metro is a system which opened in March 2013 in Brescia , Italy . The 18 @-@ kilometer (11 mi) system is being built in three stages and will have 23 stations . The system will feature a 90 @-@ second headway . ASM Brescia ordered 18 trains which are now being used on the Metro .

= = = Copenhagen = = =

The Copenhagen Metro , Denmark , consists of two lines , M1 and M2 , that run 20 @.@ 5 kilometers (12 @.@ 7 mi) serving 22 stations . The system opened between 2002 and 2007 , and connects the city center to the areas of Frederiksberg and Amager , and Copenhagen Airport . The next extension , the City Circle Line is under construction and is planned to open in 2018 . Metroselskabet took delivery of 34 three @-@ car units between 2002 and 2007 , and operates with a headway of between two and twenty minutes , including an all @-@ night service . In April 2008 , the Copenhagen Metro won the award at MetroRail 2008 for the world 's best metro .

= = = Honolulu = = =

The Honolulu Rail Transit project will be a 20 mi (32 km) elevated rail route which will connect the city of Honolulu on the island of Oahu in Hawaii with outlying suburbs . The project is planned to open in phases starting in 2018 with the entire 21 station route to be completed in 2019 . AnsaldoBreda Driverless Metro rolling stock will be used for the system . Honolulu politicians and construction crews broke ground on the project on February 22 , 2011 in Kapolei , Hawaii . As of October 2012 , construction of the columns and foundations have been completed for the first 0 @.@ 5 mi (0 @.@ 80 km) mile of the route . Future extensions to the route have been planned , which include spurs to the route and 15 additional stations . Construction of the project is currently on hold as litigation resulting from Kaleikini v. Yoshioka court case bars continuation of the project until the City and County submits a complete archeological survey to the State Historic Preservation Division for the entire line .

= = = Lima = = =

It is currently under construction in Lima the Line 2 of Lima Metro and a branch of Line 4 , which will connect the city of east to west in the first case and the portion of line 4 linking the Jorge Chavez International Airport with the line 2 @.@ the line will be built in two phases , the first of which is scheduled to open in 2017 and the second in 2020 @.@ the total of the 2 lines will cost US $ 5 @,@ 346 @,@ 000

= = = Milan = = =

The Milan Metro 's Line 5 first section between Bignami and the interconnection with M3 at Zara

opened on 10 February 2013 . The second stage opened on 1 March 2014 , and runs from Zara to Porta Garibaldi station . The third and fourth sections are under construction and are both planned to open in 2015 , and will run from Garibaldi to San Siro stadium and from Bignami to Monza . Further extensions are planned . The first stage of 5 @.@ 6 kilometres (3 @.@ 5 mi) was estimated to cost ? 500 million .

= = = Riyadh = = =

An 11 · 5 km metro serving the Princess Nora Bint Abdulrahman University on the outskirts of Riyadh opened in 2012 .

= = = Rome = = =

Rome Metro 's Line C , currently under construction , will be 25 @.@ 5 kilometers (15 @.@ 8 mi) long , of which 17 @.@ 6 kilometers (10 @.@ 9 mi) will be underground . The line will have 30 stations , of which 21 will be underground , and carry up to 24 @,@ 000 passengers per hour in each direction . Metropolitana di Roma has ordered thirty six @-@ car units , which are 20 centimeters (7 @.@ 9 in) wider than the other systems ' vehicles , and capable of carrying 1 @,@ 200 passengers per train . Average speed on the system will be 35 km / h (22 mph) , with the headway varying from three to twelve minutes . Construction of the system is estimated to cost ? 3 billion and will open in four stages ; in addition to the section opened in 2014 , other sections will open in 2015 , 2016 and 2020 .

= = = Taipei = = =

The Yellow Line or Circular Line of the Taipei Rapid Transit System , Taiwan , will serve as a cross @-@ link between existing lines . The 52 @-@ kilometer (32 mi) system will feature 46 stations . The 15 @.@ 4 kilometers (9 @.@ 6 mi) phase 1 will have 14 stations and is planned for completion in June 2018 . The Taipei Rapid Transit Corporation has ordered 17 trains for this phase .

= = = Thessaloniki = = =

The new Thessaloniki Metro in Greece has been under construction since 2006 , and is scheduled to open in 2018 after costing ? 800 million . The 9 @.@ 5 @-@ kilometer (5 @.@ 9 mi) line will be entirely underground and feature 13 stations . Attiko Metro will use 18 three @-@ car units on the new line . The system will afterwards begin constructions of two 5 @-@ kilometer (3 @.@ 1 mi) five @-@ station extensions , creating a two @-@ line metro .