Driverless metro Paris

Facts and figures on Line 1

- Line 1, which runs between Chateau de Vincennes and La Defense, was inaugurated in July 1900 and is the oldest and most heavily frequented metro line in Paris.
- Linking the east and west of the city along 17 kilometers of track, it carries as many as 725,000 passengers every day.
- The line serves 25 stations, among them such sightseeing highlights as the Hôtel de Ville, the Louvre, the Place de la Concorde, the Champs-Élysée, the Arc de Triomphe, and the city’s business district La Défense.
- The 52 metro trains with six cars are equipped with rubber wheels. Thanks to automation, only 49 trains will be needed in 2013.
- RATP, the Paris transit operator, is planning and carrying out the conversion from conventional to fully automated, driverless operation (UTO: Unattended Train Operation). Among other tasks, this conversion calls for integration of the different systems responsible for the safety of the tracks and station platforms, for the computer-controlled signaling (including points), and for automatic train and operations control.

Conversion of a heavily frequented metro line to full automation without disrupting service

- The order to convert Metro Line 1 for fully automated operation was awarded to the transportation unit at Siemens by RATP (Régie Autonome des Transports Parisiens) in November 2005.
- The scope of supply and services included the equipment for the operations control center, the trackside control equipment, the equipment of the 49 metro vehicles used on Line 1, and the complete telecommunications system.
- After design studies, work on the entire line began in 2008.
- So as not to disrupt passenger service, the construction phases were scheduled at night between 1:30 and 5:30 a.m. So only 3.5 hours of effective work were possible.
- The modernized operations control center for Line 1 was commissioned in May 2010 and took over all monitoring and control functions for vehicle movements on the line, as well as traction power control functions.
- Since November 3, the first eight driverless trains have been running in mixed operation with the driver-operated trains. All remaining 41 metro vehicles are to be integrated into the driverless system one after the other by end of 2012.
- To limit tests on the line to the absolute minimum, the trains and their control system are to undergo trials in the railway testing center in Valenciennes.
From a technical point of view, the commissioning of the first fully automated trains is in certain respects a world premiere. This is the first time that such a heavily frequented metro line, which carries 725,000 passengers every day, is being converted for driverless operation without disrupting regular service.

And, after the recently built Line 14 it marks the second metro line in Paris that Siemens has fitted out for driverless operation. For lines 3, 5, 9 10 and 12, Siemens supplies significant components and systems for the signal system.

Siemens: Conversion of Metro Line 1 from driver-controlled to driverless operation

Trainguard MT for automatic train control using the moving block system

- Use of the Trainguard MT train control system enables the trains on Metro Line 1 to operate within moving blocks of braking distance and not within fixed track sections.
- In a single system, however, Trainguard MT can also be operated both in a fixed and in a moving distance block. This is necessary because the trains on Line 1 are to run in mixed traffic until end of 2012. In off-peak periods, 100 percent driverless operation will be possible from beginning of 2012.
- With the moving block system, train headways are reduced from the previous 105-second interval to 85 seconds.
- The capacity of the line during driverless operation increases by around 70,000 passengers every day.

Vicos CBTC system for equipping the operations control center of line 1

- In May 2010 the operations control center went into action with the Vicos control system, which, together with Automatic Train Operation (ATO), allows driverless train operation.
- The operations control center governs the entire operational process of the metro. The center sends commands to the interlocking to set the points, issues the drive command to the trains and issues the command to switch the traction power off if necessary.
- In case of a sudden rise in ridership, additional trains can be deployed quickly and independently of the regular timetable. They can be sent into operation automatically straight from the depot at the push of a button.
- The traffic on Line 1 is not only heavy, but also very difficult to forecast because of the high number of connections on the route and the masses of tourists that use them.
- Thanks to automatic train control, around 20 percent more passengers can be carried during peak periods.
- Thanks to the automatic train control system, energy consumption on Line 1 in Paris will be cut by about 15 percent. This corresponds to a CO2 reduction of about 4,600 metric tons.

Airlink CBTC radio transmission system for communication between the vehicle and the trackside equipment

- The driving and control commands are no longer indicated to the driver by signals, but transmitted to the control computer on board the train by means of electronic data communication between trackside and trains.
- This two-way communication takes place via the automatic radio-based system Airlink.
- The information is transmitted wirelessly - and with Communication Based Train Control (CBTC). A special radio-based system with name “Airlink” is used for transmission purposes. This system operates with small stationary antennas instead of with a slotline which is laid along the side of the
track and emits radio waves. Airlink offers advantages in the range of the radio waves. In addition, it eliminates the trackside cabling.

- Consequently, around 70 radio stations are installed along the track for Line 1 in Paris.
- The bidirectional communication channel used for the train-to-trackside dialog on Line 1 enhances the level of service for the passengers: The public-address announcements are visually displayed in real time on four screens in each car, offering supplementary information on the travel time, time of arrival and possible connections.
- Security cameras in the trains enable the control center to make the necessary operating decisions in real time. Passengers can use PA stations provided on the trains in order to contact a service employee in the operations control center at any time.

The Digiloc train locating system shows the current position of the train

- The balise-based locating system Digiloc has the task of supplying the trains and the operations control center with information on the position of the train.
- This data transmission is based on the magnetic coupling between a trackside balise and a train-borne antenna. The location is determined when the vehicle, which is fitted with 2 antennas in the undercarriage, passes by a balise.
- Approximately 700 fixed-data balises are positioned along Line 1 in order to register the movements of the fully automated trains.