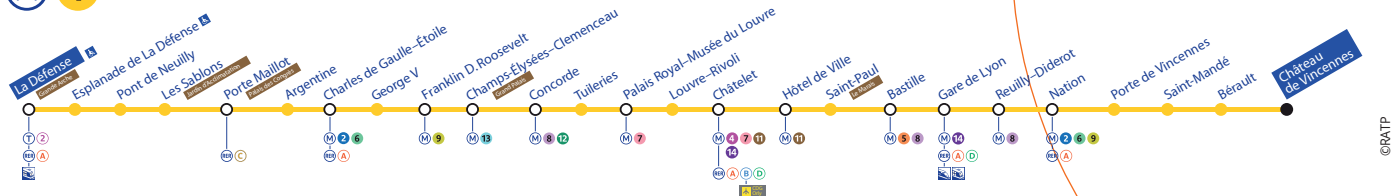




MORE DOORS, MORE RIDERS

Over a century old, Line 1 is the oldest line on the Paris metro network. And with over 200 million passengers per year, or an average of 725,000 passengers daily, it is the busiest too. Yet despite bearing such burdens, the line has remained at the forefront of advances in technology and operating systems, from installing tyres on the rolling stock to switching to automatic operations. To achieve this latter feat, the RATP faced a complex challenge in terms of technology and organisation: how to transform this 'old lady' of the Parisian metro into a fully automatic line without interrupting daily traffic.



This automation is part of the extensive programme of modernisation unveiled by the RATP, to be realised over the next twenty years. With more and more people using public transport, many of Paris' metro lines have reached saturation. At the same time, riders' expectations are evolving, and they have new demands, particularly when it comes to the frequency of trains, interior comfort and travel information.

The line is a key artery in the landscape of the Paris metro. It extends for 16.6km and crosses the entire width of the city, following the Seine from east to west, and makes many major connections: 16 of the 50 stations with the highest network traffic are found on Line 1, including 5 of the 15 multi-modal centres of the RATP network: La Défense [see Stations, p.110], Charles

de Gaulle-Etoile, Châtelet, Gare de Lyon, and Nation (see route map above).

Opened in July 1900, the line originally connected Porte Maillot to Porte de Vincennes, before being extended to Château de Vincennes in 1934, Pont de Neuilly in 1937 and finally La Défense in 1992. And today its role extends beyond the scope of the capital: 60% of its daily users do not live in Paris, but in outlying suburban communities.

Automatic status

Line 1 is clearly fundamental to the Parisian metroscape, and the watchword of the automation process, completed in early November 2011, is *optimisation*. Indeed much is riding on giving the line automatic status, namely:

- more riders thanks to the reduced headway between trains. The goal is to reach 85 seconds between two trains at peak hours, increasing the number of trains each day by 20%
- operational flexibility: it is indeed possible to re-inject trains into traffic if necessary based on passenger flow, which is highly unpredictable on this particular line (suburban



commuters, tourists, events on the Avenue des Champs-Élysées)

- sharp decrease in service disruptions due to traffic incidents and suicides (a real problem, with estimates of two suicides per week on the tracks)
- optimised security on board trains and on the platforms.

Screening

To help prevent intruders on the tracks and in the tunnels (a favourite place for dealers to hide

A Line of firsts

- 1900: the line is inaugurated
- 1963: infrastructure is completely overhauled; the rolling stock is outfitted with pneumatic tyres; and each train comprises six cars (instead of five)
- 1967: first Central Command Post (PCC)
- 1997: introduction of open-car trains
- 2011: first automatic trains



drugs), and to ensure the platforms remain a safe environment for passengers (there have been cases of passengers being pushed onto the rails in front of oncoming trains), the RATP completed the introduction of 972 x 1.7-metre half-height screen doors, custom-designed and patented by Swiss firm Gilgen Door Systems (previously Kaba Door Systems), at each station on the line in early 2011. The doors are built to last 30 years, says the company's marketing & sales director Robert Hug. "And during this period we keep the customer supplied with the latest generation technology as it comes to market," he adds. The door-builder has a maintenance contract with the RATP running up until 2013, during which time it will perform different corrective and preventive maintenance checks every first, third, and sixth month. Mr Hug is

For 2012 the RATP has upped its investment budget to €1,851 million, i.e. a 25% increase (+€370m) on 2011 (€1,481m). The priorities for this year are renewing rolling stock, developing spaces, opening new lines and modernising systems



The RATP stipulated screen doors "without a top edge"

quick to add, however, that Gilgen does not do cleaning. "This is up to the RATP," he says.

Adapting to the infrastructure

Fitting the screens meant reinforcing the existing platforms, which back in 1900 had not been built with such additions in mind! The doors were installed at night during out-of-service hours; hence the RATP's claim of "not interrupting services." Such a bold statement certainly succeeded in grabbing the attention of the mainstream media, who, until then, had been pretty oblivious to the huge undertaking such a conversion to a 'driverless' metro represents. Nevertheless this was not the whole truth: there were indeed periodic interruptions that lasted up to several months apiece, with whole sections of the line shut down (e.g. on Sunday mornings) and shuttle buses put in place instead.

During these works, the line was operated conventionally with drivers but also with the doors functioning (and overseen via a video monitoring device installed on the platforms) as they were in put in place.

Yo Kaminagai, head of design & cultural projects for the RATP, explains that he wanted screen doors without a defined top edge in order to maintain a perspective for metro riders. "We didn't want the eye to be blocked by anything," he told Mobility. Yet another constraint for the door manufacturer: "We had to find solutions with the client to meet their specific requirements in terms of safety and aesthetics," confirms Mr Hug. "We had to take great care to respect the existing appearance of stations, plus the RATP specifically requested no framing element over the doors for optimal transparency, to maintain a feeling of space. We responded with our 'half-height bijou' platform screen product," he concludes.

Spotlight: door security system

The SIL3 DOF1 security system, which functions independently from the automatic train operating system (SAET), controls the opening and closing of the platform screen doors along Line 1.

Supplied by systems engineering firm ClearSy, it allows the doors to function with the 'old' MP89 rolling stock still in service, as well being compatible with the MP05 trains being rolled out. The DOF1 system comprises on-board equipment that processes the requests from the driver to open and close the doors, and sends them to a calculator contained in a technical box in the station. Here the opening request is processed and sent to the screen doors, which open without the passengers experiencing the slightest delay. The train/ground link is provided by a mat installed on the rails that creates a magnetic loop with sensors fitted on the bogies of the trains.

This SIL3 security level system ensures the train doors can only open on the 'right' side, i.e. towards the platform, and only within the authorised area in the metro stations. The controls for opening the platform doors, also SIL3 level, guard against the risk of the doors opening unexpectedly (standards 61508, EN50126, EN50128 and EN50129). This means that there is a less than 1 in 10 million chance of the system causing a dangerous failure in an hour.

As project manager, ClearSy was responsible for studying and manufacturing the equipment to be installed on the line. ClearSy's partner TLT produced the mechanical and electronic components.

Controlling

Long-time RATP collaborator Siemens is also playing its part in the Line 1 story by providing its Trainguard MT automatic train protection system. Together with the new control centre, also delivered by Siemens, Trainguard allows:

- shorter headways and faster passenger service than conventional driver-operated systems; train headways can be adapted to ridership needs
- energy-efficient & environmentally friendly operations
- trains to operate within moving blocks of braking distance and not within fixed track sections



MP05 train at Alstom's site in Valenciennes

- the driverless line to carry 70,000 extra passengers every day compared to the driver-operated system.

New line, new trains

Although retro-fitting the existing MP89* (non-automatic) rolling stock in service on Line 1 was an option, the RATP chose to purchase 49 x 6-car MP05 trains by Alstom. The aim being to offer riders the benefits of, as the operator puts it: "a fresh interior design, air conditioning and latest-generation, on-board information systems." Meanwhile 'old' MP89s, which in fact have only been in service since 1997, will be gradually transferred to metro Line 4, whose own fleet has really reached the end of the line both in looks and performance.

The MP05s have been tested at the Petite-Forêt loop in Valenciennes, north France, handily located next to the Alstom production plant, plus at night on Line 1 itself, during out-of-service times.

In terms of power, the new rolling stock has a latest-generation, IGBT drive train, new static converters plus high- and medium-voltage battery



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New colour scheme

Facts & figures

- 3 seconds after the warning signal sounds, the platform screen doors close
- Lined up end-to-end, the platforms of the stations would extend for 5km
- Each train comprises 6 cars
- Line 1 makes 13 connections with other metro lines
- 16 of the 50 busiest metro stations are found on Line 1
- The tracks run for 16.6km
- The line serves 25 stations
- Commercial speed is 27.4km/hr
- 49 automatic MP05 trains were purchased to replace the old rolling stock
- Maximum speed is 80km/hr
- Each train measures 90.28 metres long
- Each platform screen door opens 428 times per day
- Each platform screen door weighs 480kg
- Each train holds 772 passengers
- There are 954 platform screen doors on the line
- 725,000 voyages are made daily
- 207 million voyages are made annually

packs. On the environmental side, recyclable materials have been used in their construction, the electric motor limits CO₂ emissions, and the braking system recovers energy. The trains are also lighter since the on-board equipment occupies just 1/3 of the space taken up by previous trains. And finally, the MP05s benefit from superior soundproofing (-2dB) and are fan-cooled. Thanks to cooperation between Alcatel-Lucent and the RATP, the fleet will be equipped with:

- a real-time video transmission system (twin cameras on the front and rear of the train)
- a remote monitoring system to boost on-board security
- a transmission system for sending operational data between trains and the control centre, allowing for both real-time monitoring of data flow while simultaneously providing information to travellers on screens.

The exterior design of the MP05s is not unlike that of the pneumatic rolling stock MP89 CA* running in service on Line 14 (also automatic) of the metro network. Designed to offer greater comfort, Mr Kaminagaï says that these new air-conditioned trains have been built to resemble “a living room space, open to the outside world.” The interiors have been rethought, with the reconfiguration of the seating aimed at creating smoother flow in the cars, plus enhanced accessibility for people with special needs (wheelchairs, strollers...). Furthermore the seating capacity has been increased from 120 to 128 per car. Mr Kaminagaï also chose a new colour scheme to mark the change of trains – brick red on the floor, off-white on the walls, and brightly striped fabric on the seats – plus the lighting has been studied to create a more pleasant atmosphere on board.

Downsizing

Eight automatic MP05s are already running in tandem with 37 x MP89s, with their deployment ongoing at a rate of two complete trains per month. Hence up until December 2012, when all 49 of the MP05s will be in commercial service, the RATP is juggling both automatic and manually-driven trains on a single line. The futures of its drivers are likewise up in the air: prior to automation, the MP89s were operated by a total of 260 drivers. To date, 220 of the latter have already either been retired or given duties on other lines in the network. And out of



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the remaining 40, those who have been driving for at least a decade have been “invited” to undertake training in order to switch jobs: the idea is that henceforth they will divide their working days between Line 1 on-the-ground activities (dealing with any technical problems and maintaining passenger relations) and desk duties at the control centre.

Of course, the automation of any process, in any sector of activity, often results in the loss of jobs. The RATP puts it this way: “Automation is about putting technology at the service of the service.”

Keeping up with the times

The total cost of this massive project amounts to €629 million, of which €479m is being spent on the rolling stock. But like many metro operators today, if it is to avoid further saturation the RATP simply had to come up with the cash to optimise its network in terms of capacity and reliability. With automatic metros in service or planned for Brussels, Barcelona, Berlin, Copenhagen, Brescia, Dubai, Hong Kong, Shanghai and Beijing... there is no doubt automatic is catching on ●

Séphora Haymann

All photos ©Mobility – unless marked

References

*MP = Matériel Pneu / Rubber-tired rolling stock; the figure following refers to the date the order was signed