The Advance Transportation System

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Abstract—Paris metro is the ideal way to get around Paris fast and easily. There are 16 lines (Including 2 “bis”) traversing the city. Each line has a different color and number. So even if the abundance of lines appears overwhelming when you first look at a metro map, it quickly becomes easy when you understand how it works. Any given metro station each metro line will have 2 platforms, one for each direction. Each direction is marked by its terminus station, the last station on the line. Paris Metro Line no-14 as operated completely automatically, it was a driver less system.

Keywords—Metro line -14, driverless system, automatically, ideal, terminus station

1- INTRODUCTION

A. PARIS AND IT’S METRO SYSTEM

Paris is the capital and most-populous city of France. Situated on the Seine River, in the north of the country, it is in the center of the France region. The City of Paris has an area of 105.4 square kilometers (40.7 square miles). The Paris Region covers 12,012 square kilometers (4,638 square miles), and has its own regional council and president. It had a population of 12,005,077 as of January 2014. The Paris Region had a GDP of €624 billion (US $687 billion) in 2012, accounting for 30 percent of the GDP of France, and ranking it as one of the wealthiest five regions in Europe. It is the banking and financial center of France, and contains the headquarters of 29 of the 31 companies in France ranked in the 2015 Fortune Global 500.

The Paris Metro is a rapid transit system in the Paris Metropolitan Area. A symbol of the city, it is noted for its density within the city limits and its uniform architecture, influenced by Art Nouveau. It is mostly underground and 214 kilometers (133 mi) long. It has 303 stations, of which 62 have transfers between lines. There are 16 lines, numbered 1 to 14 with two lines, 3bis and 7bis, which are named because they started out as branches of lines 3 and 7; later they officially became separate lines; the Metro is still numbered as if these lines were absent. Lines are identified on maps by number and color, and direction of travel is indicated by the terminus.

It is the second-busiest subway system in Europe, after Moscow. It carried 1.541 billion passengers in 2012, (up from 1.524 billion in 2011), 4,210 million passengers a day. It is one of the densest metro systems in the world, with 245 stations within the 86.9 km² of the city of Paris. Chalet – Les Hales, with 5 Metro lines and three RER commuter rail lines, is the world's largest metro station.

The first line opened without ceremony on 19 July 1900, during the World’s Fair Paris Metro Lines. The system expanded quickly until the First World War and the core was complete by the 1920s. In the late 1990s, the automated line 14 was built to relieve RER line A.

Figure 1 Subway Station of Paris

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B. DRIVER LESS SYSTEM IN EUROPE:

Completely driverless systems and lines

Europe

- Copenhagen Metro - AnsaldoBreda Driverless Metro.
- Barcelona Metro line 9 and Barcelona Metro line 10 - Siemens CBTC
- Turin Metro - VAL type system.
- Paris Métro Line 14 - opened on 16 October 1988 - Siemens CBTC
- Paris Métro Line 1 - Driverless system started to operate in mixed mode (driver train and driverless train) on 3rd November 2011. Last manually driven train will be removed by end of 2012 - Siemens CBTC
- Rennes Metro - VAL type system.
- Toulouse Metro - VAL type system.
- Lille Metro - inaugurated on 25 April 1983, the first using the VAL system.
- Lyon Metro Line D: Rubber-tyred trains run automatically with no driver on board, controlled by a system known as MAGGALY (Métro Automatique à Grand Gabarit de l’Agglomération Lyonnaise) - Siemens CBTC
- Nuremberg U-Bahn - U3 and U2 lines (manned trains in case of need)
- Lausanne Metro - Line M2
II- DATA COLLECTION & OBSERVATION

A. Metro Line No – 14

a- Need of Metro Line No -14. The central section of the RER Line A, between Gare de Lyon and Auber, is a section with important passenger traffic. In rush hours, some 62,000 passengers commute on the line in one direction every hour. The main purpose of the Parisian metro line 14, or METRO (Metro Est-Ouest Rapider), was to offer a sustainable solution to the overloaded traffic. The METRO line runs parallel to the section of RER Line A between Gare de Lyon, Chalet and the Madeleine—Saint-Lazare district, therefore relieving Line A of about 8,000 passengers per hour in each direction. The METRO line also aims to promote the development of the urban hub around southeast Seine, with the creation of the François Mitterrand National Library.

b- Infrastructure. The section in operation from Bibliothèque François Mitterrand to Gare Saint-Lazare is entirely underground. Thanks to the lighting shafts, some stations are lit up by natural light. Specific work concerned: the terminal on the left bank of the Seine river: the Bibliothèque François Mitterrand station was built under the SNCF project management, partly underground and partly elevated, with fine-tuned phasing so as to maintain SNCF rail traffic at surface level at Boulevard Massena station. The Seine river crossing: from its left bank terminal, Line 14 crosses the river to the right bank by means of an underwater tunnel. The technique used was the one of submerged caissons. The section between the Boulevard de la Bastille and the Louis XVI Square: from the Madeleine station onwards, a two-track tunnel was built entirely below the water table. It is 4,550 m long with a 7.5 m inner diameter, and was drilled by a tunneling machine specially built for the project. Excavated earth was removed via barges on the river Seine. The rest of the line was built by classic tunneling methods.

B. STATION: The completed METRO project includes 18 stations, of which 13 are within Paris: 8 of them provide connections with 11 metro lines, 5 of them ensure connections with 5 RER lines. Furthermore, the line serves two main SNCF railway stations: Gare de Lyon (and its station in annex at Bercy) and Gare Saint-Lazare. The key words of the station design are comfort and safety to ensure the quality of daily travel. The stations are spacious, colored and well lit, as well as cater for physically disabled, visually or auditory impaired passengers.

III- ROUTE

Figure 2 Olympiad Station

Figure 3 Chatelet Station

Figure 4 Route of metro line 14 Paris
A. FEATURES:

Stations are audibly announced twice at each stop. Visible indicators near the doors alert the hearing-impaired of door closure. All trainsets on line 14 allow passengers to walk from one end of the train inside the train all stations are accessible to wheelchairs. Line 14 uses moving block signaling as opposed to fixed block signaling (This reduces “traffic jams” caused by traditional signaling). The line is the deepest of the regular Metro Lines.

B. SUPERSTRUCTURE:

From a technical point of view, Line 14 of the Parisian metro is fully automated. Originally, the headway between two trains was 105 seconds at peak hours. It has been reduced to reach 100 seconds. 4 new trainsets were purchased in 2012. This additional rolling stock enabled to reduce the headway to 85 seconds. It is possible to run mixed traffic on the line and operate conventional metro trains while the new fully automated system remains in operation. This facility, despite downgrading the overall operation with a lengthened headway, is used as back-up service or at slack hours for work trains.

C. ROLLING STOCK

The trains are driverless, rubber-tired rolling stock, MP 89 type. It has good suspension and is silent, causing no vibrations and thus no noise pollution to its neighborhood. The first train version for METRO comprised of 6-car train sets, measuring 90 m. Subsequently, it is made up of 8-car train sets, measuring 120 m. The first 6-car train sets could carry some 720 passengers at an average speed of 40 km/h. Journeys are fast, taking only 13.30 minutes between Olympiads and Gare Saint-Lazare.

D. PLATFORM SCREEN DOORS

The 'cutting-edge' safety feature in modern subways consists of transparent doors that separate rail tracks from platforms. Train doors and platform doors are aligned and open simultaneously after the train has stopped. Subway systems with platform screen doors are also called PSD, platform edge doors, or PED) or half-high platform gate doors (PGD).

These doors help to:

- Prevent accidental falls off the platform onto the lower track area, suicide attempts and homicides by pushing.
- Prevent or reduce wind felt by the passengers caused by the piston effect which could in some circumstances make people fall over
- Reduce the risk of accidents, especially from service trains passing through the station at high speeds.
- Improve climate control within the station (heating, ventilation, and air conditioning are more effective when the station is physically isolated from the tunnel).
- Improve security — access to the tracks and tunnels is restricted.
- Lower costs — eliminate the need for motormen or conductors when used in conjunction with Automatic Train Operation, thereby reducing manpower costs.
- Prevent litter build up on the track, which can be a fire risk.
- Improve the sound quality of platform announcements, as background noise from the tunnels and trains that are entering or exiting is reduced.

Their primary disadvantage is their cost; installing a system typically costs several million USD per station. When used to retrofit older systems, they limit the kind of rolling stock that may be used on a line, as train doors must have the same spacing as the platform doors; this results in additional costs due to depot upgrades and otherwise unnecessary purchases of rolling stock. They also impede natural ventilation, increasing climate control costs.

The doors also pose their own safety risks. The primary risk is that people may be trapped between the platform doors and the train carriage, and be subsequently crushed when the train begins to move. Cases of this happening are rare, and may depend upon door design.
E. OPERATING SYSTEMS

METRO is highly safe, thanks to its highly sophisticated equipment capable of: train control for the entire line, particularly at the terminal stations; automatic train operation with permanent safety speed control; at stations, control of train stopping and departure, opening and closing of train doors and platform screen doors; monitoring traction power supply in total security and the various alarm systems linked to train movements, ensuring the audio-video surveillance in platforms and train interiors by CCR operator.

F. SIGNALLING SYSTEM:

Metro as a CBTC (Communication Based Train Control) system was supplied by Siemens Transportation Systems including monitoring from an operations control centre, equipment for 7 stations and equipment for 19 six-car trains, resulting in a headway of 85 seconds.

a. CBTC:

- Communications-Based Train Control (CBTC) is a railway signaling system that makes use of the telecommunications between the train and track equipment for the traffic management and infrastructure control.
- By means of the CBTC systems, the exact position of a train is known more accurately than with the traditional signaling systems. This results in a more efficient and safe way to manage the railway traffic.
- Metros (and other railway systems) are able to improve headways while maintaining or even improving also the safety.

![Figure 6 CBTC](image)

IV- CONCLUSION

1. Since the metro is totally automatic and driverless, the metro runs daily and the problem caused in transportation in Paris due to the strikes of driver is eliminated.
2. The opening of platform screen doors only when the train arrives results in the prevention of suicide or people falling on the tracks.
3. The metro has an improved headway of 85 second due to the moving block signaling system as compared to the conventional fixed block signaling system having headway of 105 second.
4. The metro can be operated at a faster rate.
5. The metro has an enhanced reliability of as much as 99%.
6. Since the manpower required is less and the trains run at uniform speed, the operating cost is less.
7. This automatic metro is a convenient mode of travel that can be used by all; even the hearing impaired can board the train safely by the visible indicators on the doors when the doors are about to close.
8. However, the electronic system is the key and the failure in this system may result in the indefinite delay of such metro.
V- REFERENCE

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