



SYSTEMS ENGINEERING INNOVATIONS AND OPERATIONS



2018 Rail Conference



SÃO PAULO METROPOLITAN AREA



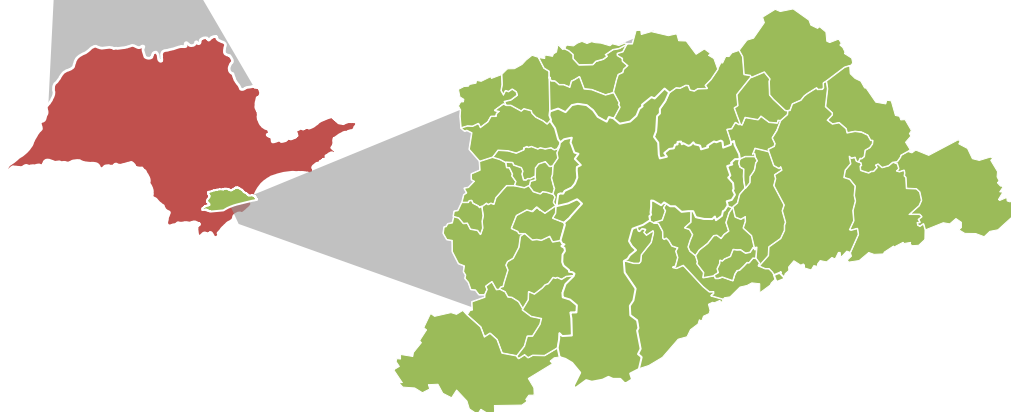
Municipalities **39**

Area **7,947 km²**

Approximately 0,1% of the country

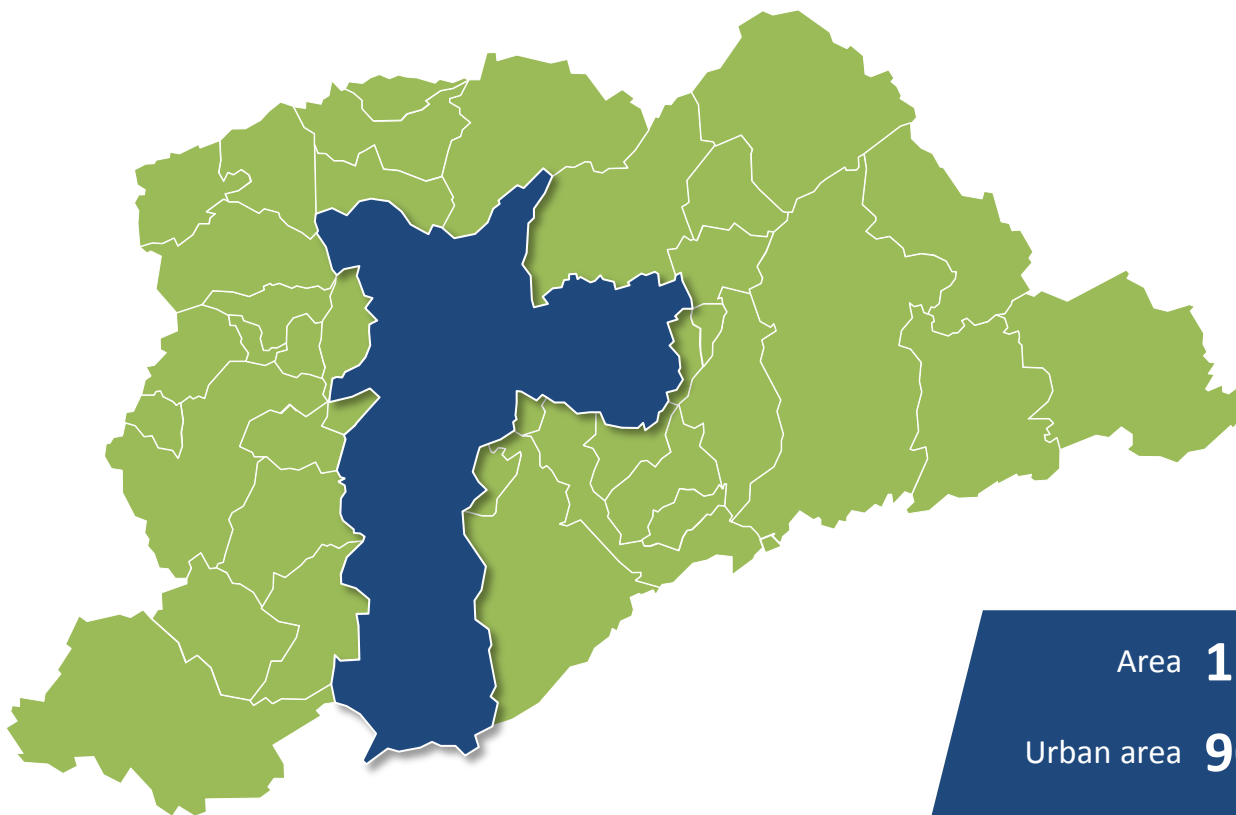
Population **21 million**

Approximately 11% of the country





SÃO PAULO CITY



Area **1.521 km²**

Urban area **900 km²**

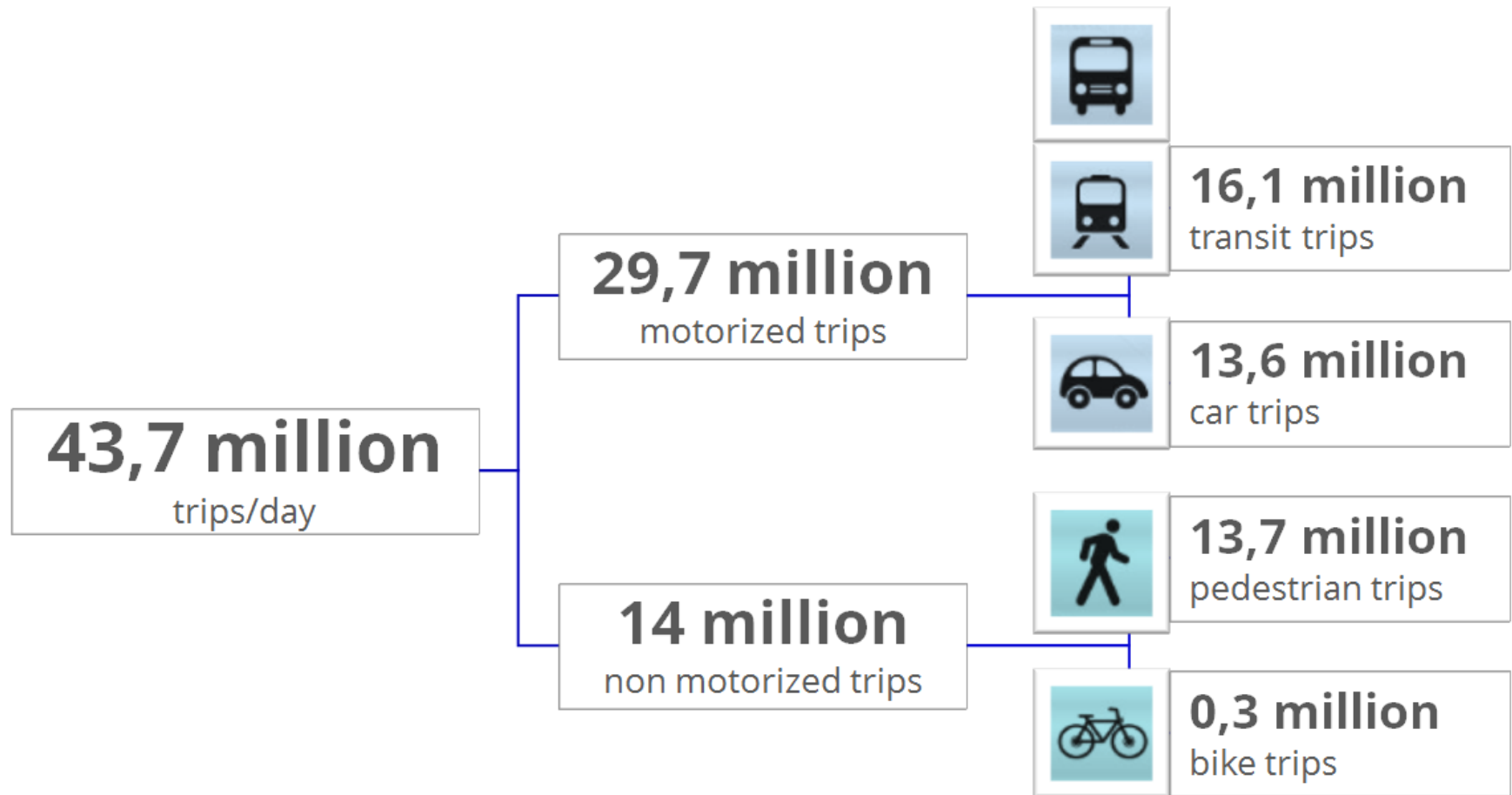
Population **12 million**

Approximately 6% of Brazil



MODAL SPLIT OF DAILY TRIPS

São Paulo Metropolitan Region





SÃO PAULO TRANSPORTATION INSTITUTIONAL STRUCTURE

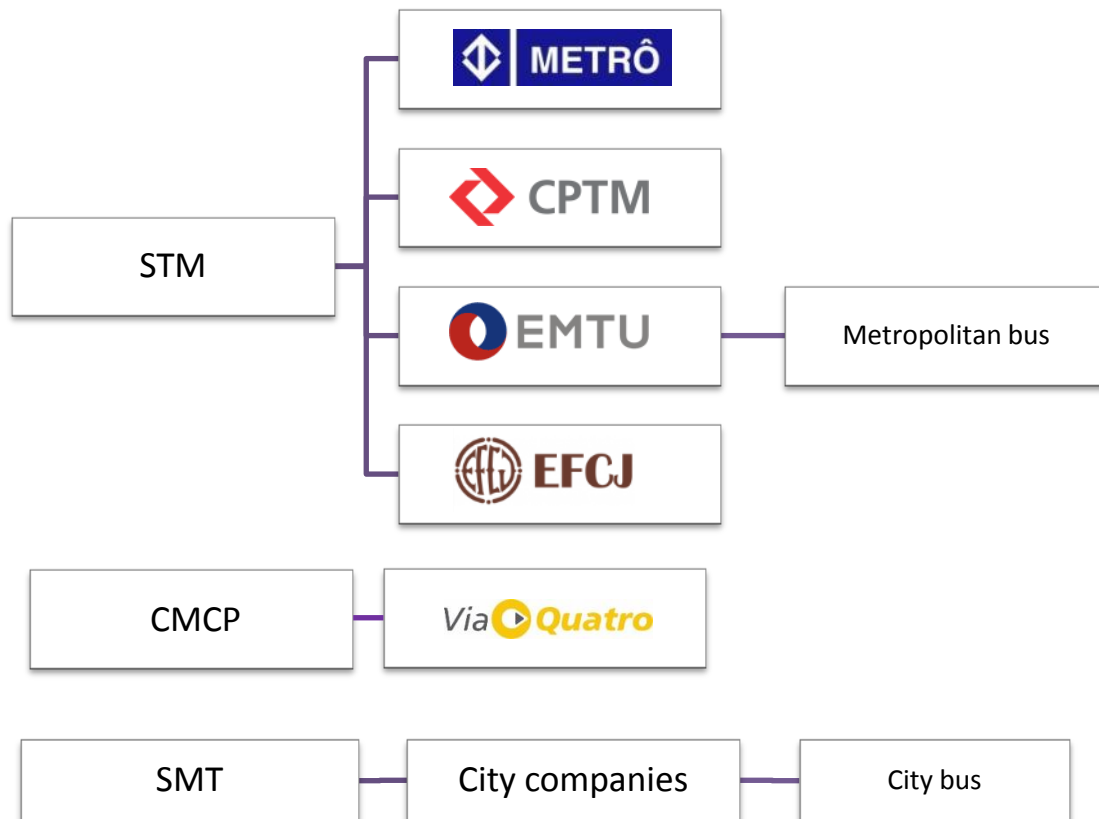


**Federal
Government**



**State
Government**

**City
Governments**



STM – Secretaria de Transportes Metropolitanos – *Metropolitan Transports Secretary*

CMCP – Comissão de Monitoramento de Concessões e Permissões – *Concessions and Permissions Monitoring Commission*

SMT – Secretaria Municipal de Mobilidade e Transportes – *Mobility and Transports Municipal Secretary*



METROPOLITAN TRANSPORT NETWORK





METRÔ SÃO PAULO NETWORK



- 5 lines
- 80.7 km of network extension
- 70 stations
- 111 s headway on peak
- 1,245 motorized cars
- 112.7 million car.km in 2017
- 1.1 billion passengers boarding in 2017
- 3.8 million passengers boarding in 2017 per weekday



MONITORING AND EVALUATIONS

For critical items like Way-side equipments:
responsible for turnovers at the end of the line.
Line 1- Blue: Jabaquara Station - 1100 movements

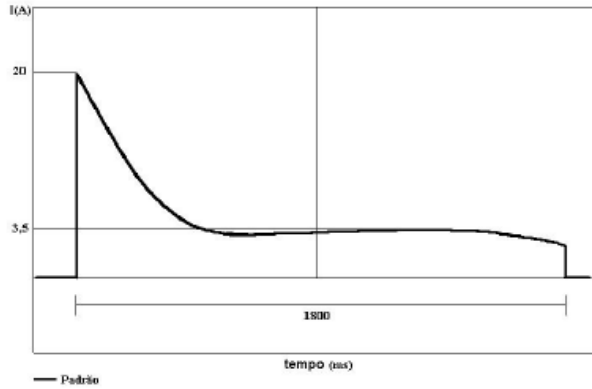


Fig 18 – Corrente Padrão

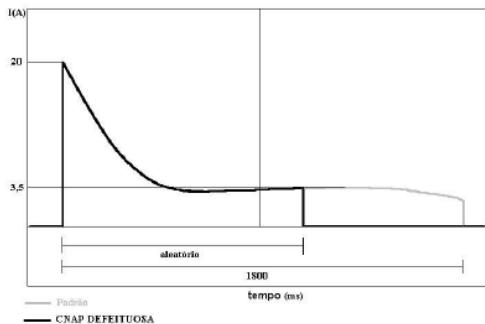
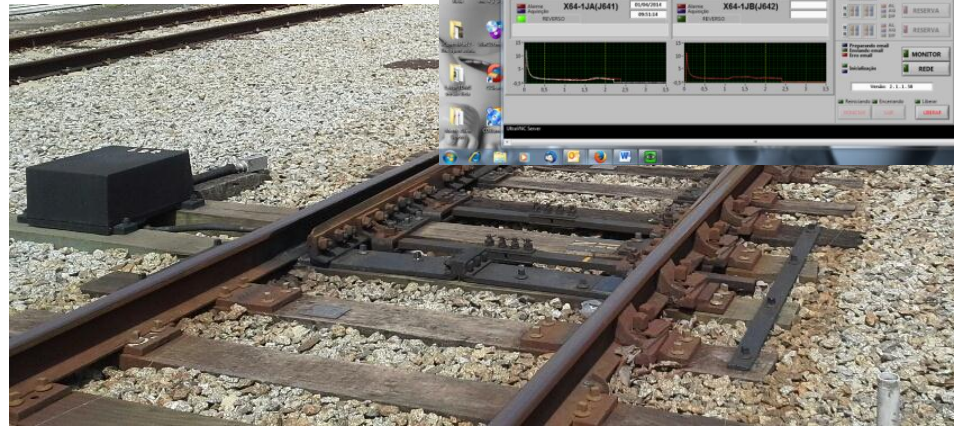


Fig 22 – Unidade Controladora "CNAP" Defeituosa

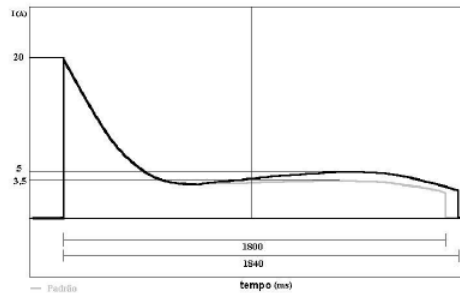


Fig 24 – Lubrificação Reduzida

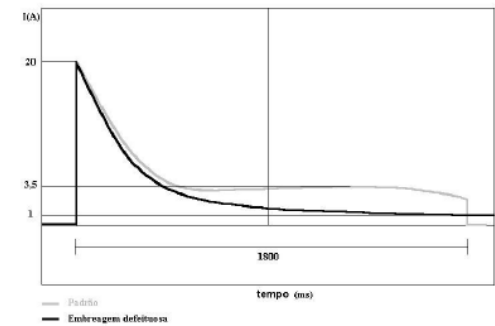
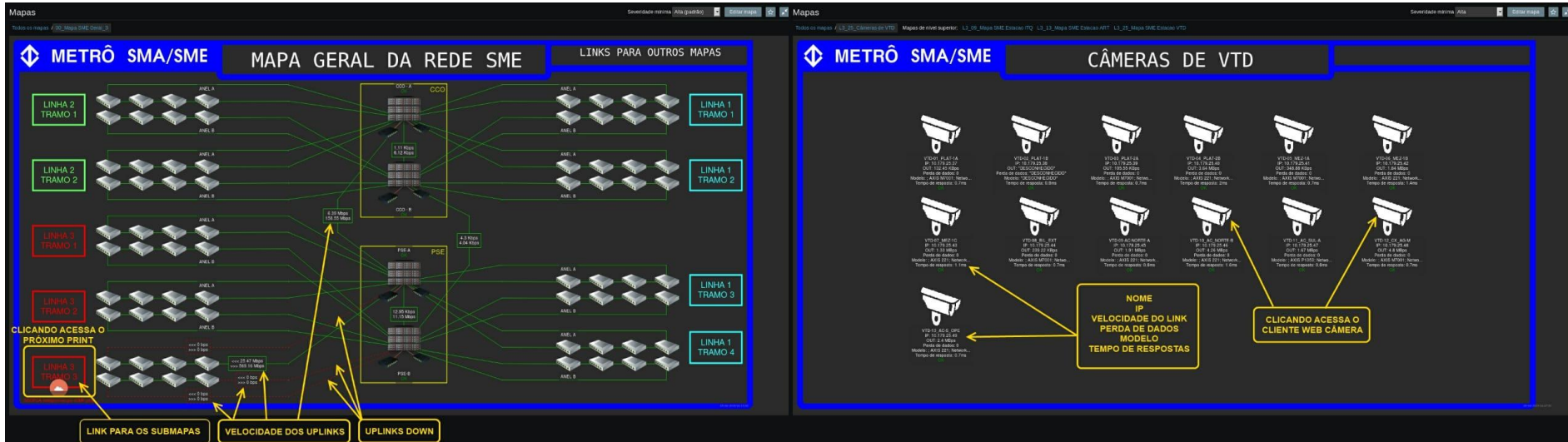


Fig 19 – Embreagem Defeituosa



MONITORING AND EVALUATIONS

Electronic Equipments based on SNMP, like Cameras (aprox. 1800 units)



- ✓ 155 interventions in 2 years → Action: only one reset
 - ✓ Average unavailability interval of 8 hours to each intervention
 - ✓ With monitoring implementation it is unnecessary to allocate a technician and about 10 minutes repair time.
- Results: Lower costs and higher availability



FLEET MODERNIZATION

The new and modernized 98 trains features:

- ✓ Air-conditioning;
- ✓ Traction and braking systems update;
- ✓ Communication and cameras systems update;
- ✓ New internal layout;
- ✓ Remote failure detection;
- ✓ Fire detection equipment;
- ✓ Doors system replacement .



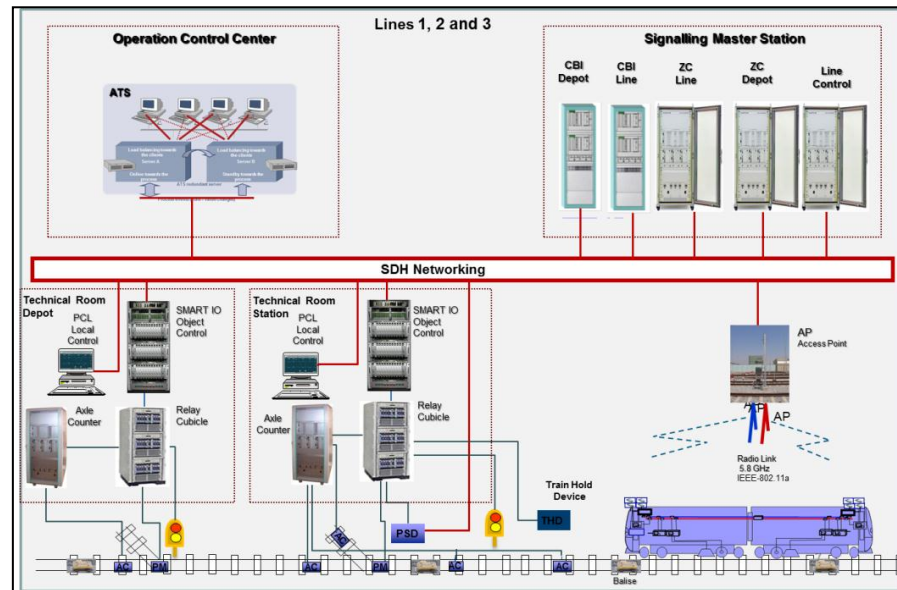
SIGNALING REPLACEMENT - CBTC

Metrô-SP has chosen the CBTC System to renew the Signaling System of lines 1 – Blue, 2 – Green and 3 – Red.

CBTC - Communication Based Train Control is a continuous and bidirectional train-to-wayside data communications system, utilizing high-resolution train location determination, independent of track circuits

Main Elements:

- ✓ Data communication system
- ✓ Radio communication networks
- ✓ Major use of servers and microcomputers





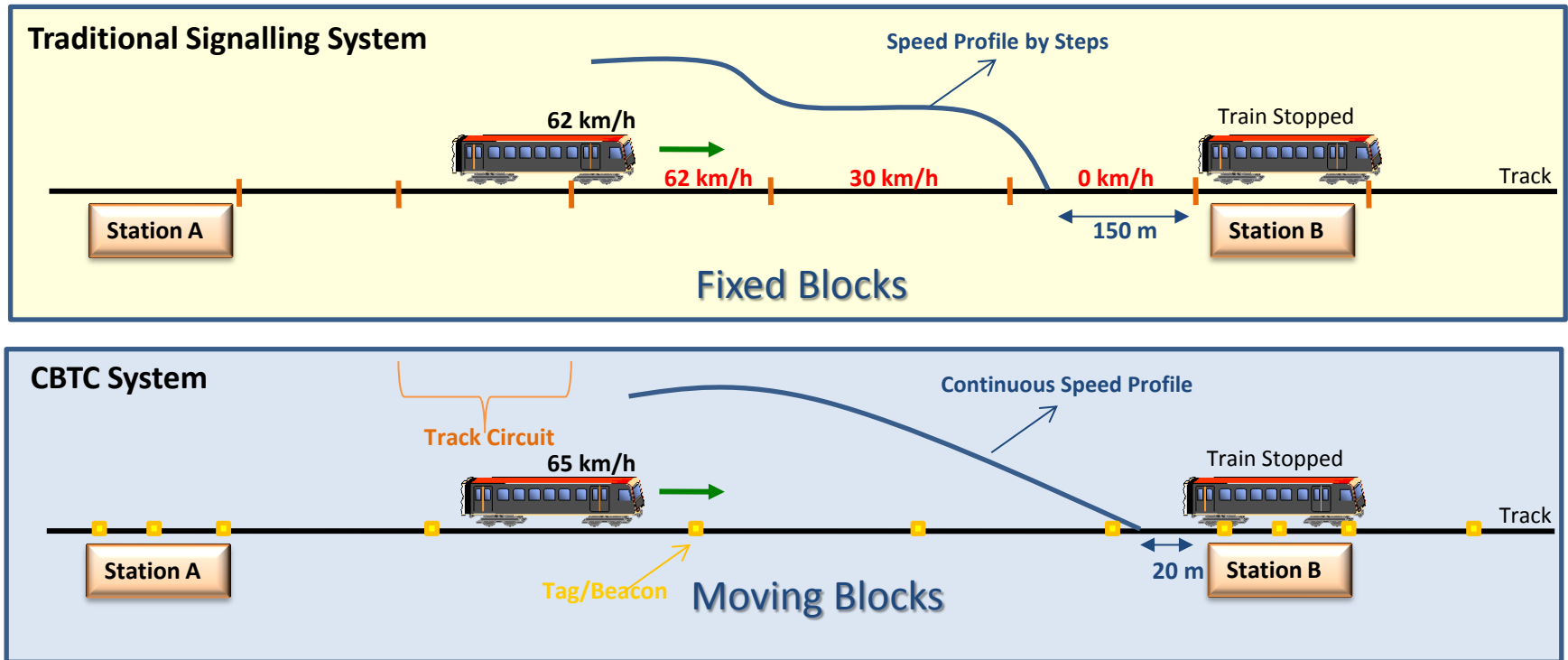
SIGNALING SYSTEM TECHNOLOGY

Main characteristics of CBTC system:

- ✓ Manage railway traffic and speed in a more efficient and safe way
- ✓ Precise position of a train at any given time
- ✓ Enable to maximize capacity and shorten the distance or time between trains
- ✓ Provide a transparent migration path from the legacy (traditional) system to the new system
- ✓ Monitor and manage electricity and energy use on the trains, reducing operating costs
- ✓ Allows to increase the Grade of Automation (GoA3 or GoA4)

SIGNALING SYSTEM TECHNOLOGY

Example: Less distance or time between trains





FARE COLLECTION SYSTEM

The subway system integration with other kinds of transports since the implementation of smartcard on December 2005, brought a positive impact on the mobility of users of the subway and public transport, especially for the segment of low-income population. The possibility of using the combination of more convenient ways to travel, for a fare within two hours, led to savings in expenditure on transport, greater mobility and gain time.





FARE COLLECTION SYSTEM

São Paulo Metro was built specifically to foster integration with other transportation modalities.

- ✓ **Integration between Metro and the São Paulo Metropolitan Rail System – CPTM;**
- ✓ **Integration in 7 stations;**
- ✓ **Free integration between the two rail modalities is available throughout commercial operating hours, seven days a week.**

- ✓ **Metro and inter-municipal bus lines of the Metropolitan Urban Transportation Company - EMTU system;**
- ✓ **Integration in 6 stations;**
- ✓ **Fare integration is available throughout commercial operating hours, seven days a week**



PLATFORM SCREEN DOOR - PSD



Characteristics:

- ✓ Semi Full Height
- ✓ PSD Facade: 2,50 m
- ✓ Height and width: 2,30 x 2,10 m
- ✓ Stainless steel frame with tempered glass panels

- ✓ PSDs were installed in platforms of some stations;
- ✓ Currently we have 7 stations with PSDs;
- ✓ We have begun the acquisition process of 88 PSDs for 44 stations.





SCMVD – TPD

Mobile Voice and Data Communications System – Portable Data Terminal

São Paulo Metro contracted a new mobile communication system designed to meet the mobility requirements - Mobile Voice and Data Communications System (Sistema de Comunicações Móveis de Voz e Dados – SCMVD).

- ✓ Transmission of recorded or real-time images collected from cameras;
- ✓ Direct two-way communications between the OCC and system users on train passenger compartments through intercom systems;
- ✓ VoIP radio communications;
- ✓ On-board telephony to enable communications between the OCC and train operators through the VoIP system;





SCMVD – TPD

Mobile Voice and Data Communications System – Portable Data Terminal

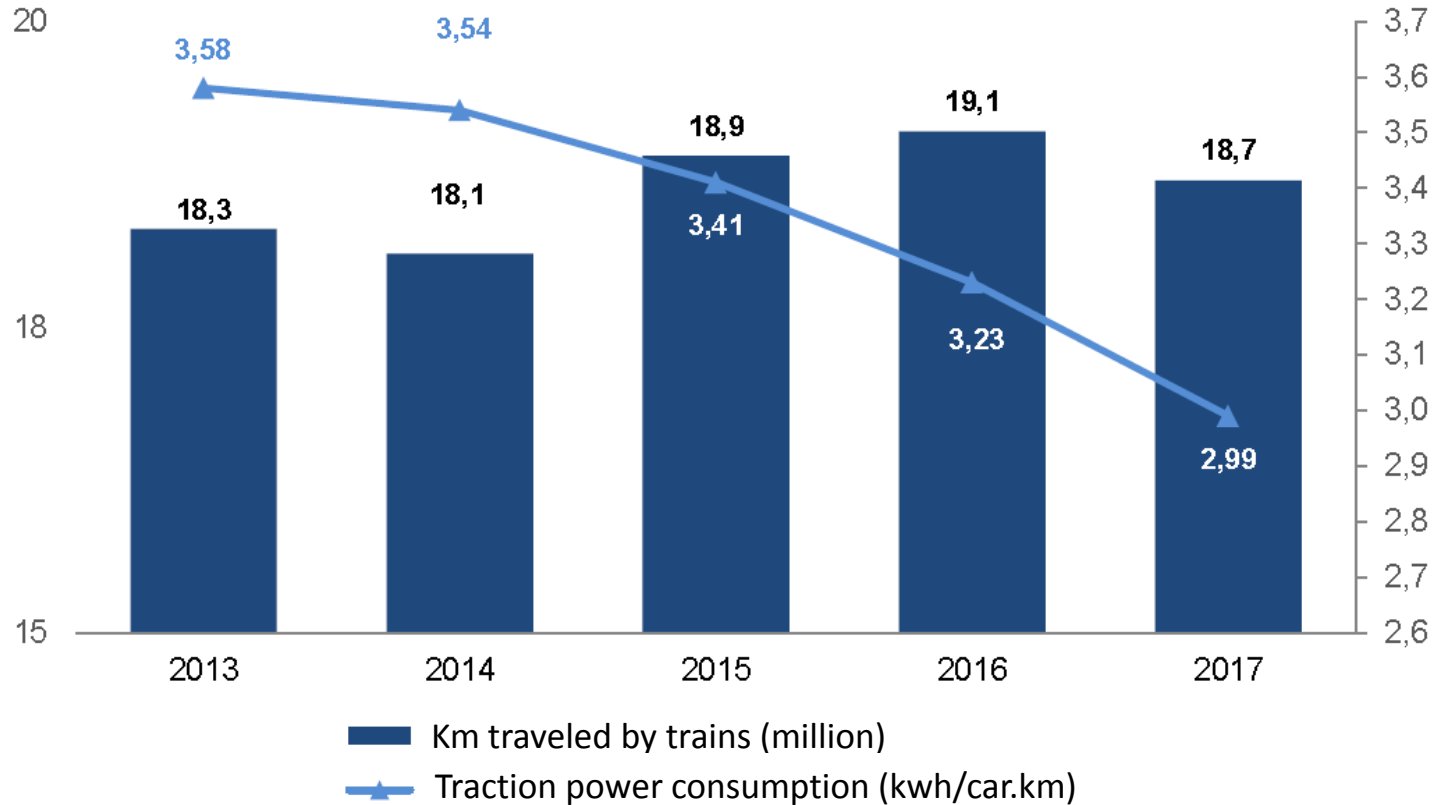
- ✓ Text, audio, and video message transmissions to passengers on trains and in stations;
- ✓ Remote intervention in train equipment by maintenance technicians;
- ✓ Interaction with the CCO for purposes of tracking and follow-up of persons with disabilities;
- ✓ Access authorization and control to station facilities through the access control system;
- ✓ Access to the public cellular telephone network within metro-rail facilities.





POWER EFFICIENCY

Km traveled x Traction power consumption

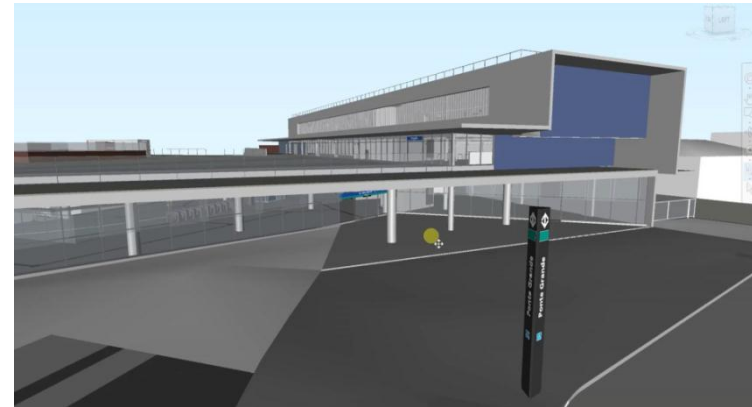
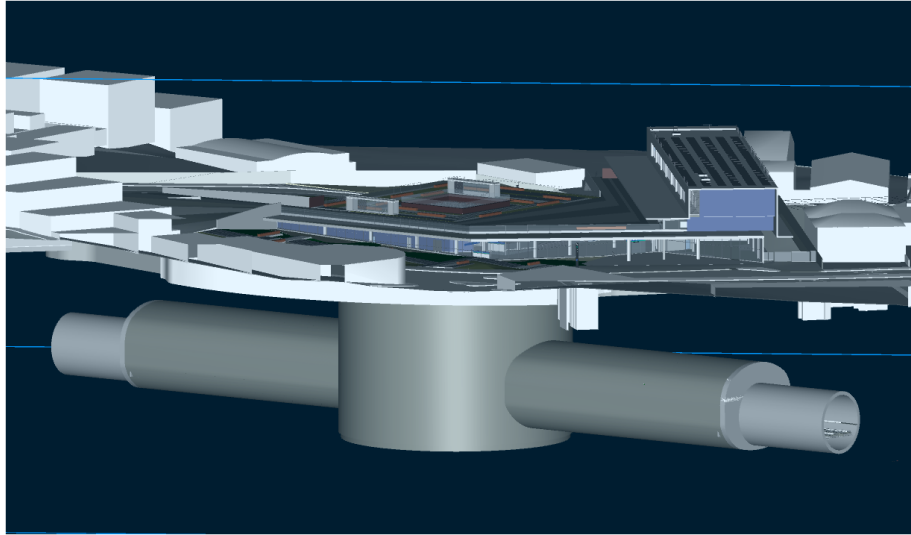


BIM Technology for new projects

Some Benefits:

- ✓ Reduction of design errors
- ✓ Prevents deployment issues
- ✓ Reduction of construction cost
- ✓ Reduction of workforce
- ✓ Reduction of design schedule
- ✓ Greater collaboration between operators and contractors
- ✓ Standardization of Projects

BIM Technology for new projects





SOLAR PHOTOVOLTAIC SYSTEM

Planned to be installed in some stations, operational control center and maintenance yards.



THANKS !

CARLOS EDUARDO GOMES DA SILVA
Metrô de São Paulo
cesilva@metrosp.com.br

