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President

Technical Article

Opinion

best  
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practices  
on the railway

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## Best Practices

## Innovation on the Railway

### Best Innovation Practices in Railways



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**WORD FROM THE PRESIDENT**

4 Railway Best Practices

**TECHNICAL ARTICLE**

6 Technology in Metro Railway Operation Simulators

**OPINION**

10 The Railway of the Future must be Digital, Sustainable and Customer-Centric

**BEST INNOVATION PRACTICES IN THE RAILWAY**

12 The customer's shoe

14 Best Practices in CPTM Operation

17 Control Center – Management and Technological Evolution

21 How can we innovate in a Metro Rail System

**IS HAPPENING**

24 Innovation management in firefighting

**STAY TUNED**

26 Innovation and LGPD: how to establish a competitive advantage

28 Engo Vocational Training Center Integrated System James C. Stewart

**NEW TECHNOLOGICAL TRENDS**

32 The future of Railway Project Management with the use of Artificial Intelligence

**INFORMA ASSOCIATION**

34 Partnership: AEEFSJ x JICA

**LOOKING TO THE FUTURE**

36 Passenger Counting and Control Devices in Integrations Operational

**MY STORY**

38 Four decades of railway

# Best Practices Railways

**Wellington  
Berganton**  
President of  
AEFSJ



The history of the railway, a pioneering initiative The company was responsible for boosting the wealth of the State of São Paulo by allowing coffee to leave farms in the interior of São Paulo towards the port of Santos, also being a milestone in the adoption of best practices in the railway universe. This theme, which will permeate several articles in this edition of Ferrovias magazine, shows how investment in new technologies, the adoption of sustainable actions and the training of highly specialized professionals have become the tripod for the sector's advancement, positively impacting the provision of services offered in both passenger and cargo transport.

A protagonist in the country's economic development, the railway has always carried in its DNA the culture of best practices. In a more in-depth analysis, it is possible to see how it served and still serves as an inducer for the progress of society. In the case of the capital of São Paulo, it contributed to consolidating it as one of the largest financial hubs on the continent, with a consistent industrial park and a wide commercial network, also responsible for supplying neighboring states. Just observe how, in its surroundings, many cities were born and grew, highways were designed and consequently jobs flourished, to the point where stations were named after factories located in their vicinity, such as Pirelli and Cimenrita.

Metro rail companies have always needed to adapt to new realities to overcome countless daily challenges, focusing on the needs of passengers, or on the logistics of cargo transport.

An example of the difficulty common to the sector is the lack of qualified labor. Reason that forces companies to invest in new technical training of their staff, offering courses for machinists, CCO controllers – Operational Control Center and maintenance specialists, among many other functions that require know-how not included in university curricula. , thus guaranteeing an essential service with operational and traffic safety for passengers and products.

From the urgent innovation, many different practices emerged on the railway, which, as it is a high-capacity system, provides an essential service for society, thus verifying the size of the operation of the São Paulo railway system, which operates around 20 hours a day, using trains that have the capacity to transport more than 1,800 people. Increasing technology has made it possible to acquire more modern trains equipped with air conditioning, accessibility items, wider doors, traffic safety devices, etc.

Another notable initiative was the entry into operation of new restored cars to serve the public in

Expresso Turístico, a successful service that attracts hundreds of people on weekends for one-day tourist trips to Parana-piacaba, Jundiaí and Mogi das Cruzes/SP.

Freight trains have a strong impact on exports, transporting agricultural commodities and iron ores, which are the raw materials that contribute most to the increase in Brazilian GDP.

The railway reinvents itself by discovering new ways of carrying out maintenance and different operational strategies, using technology. It is a school for all of us, offering solutions and good practices for more than a century, keeping São Paulo at the forefront of the sector.

And, to celebrate the 70th anniversary of AE-EFSJ and the 32nd anniversary of CPTM, the first edition of the InovaRail Summit will be held in May 2024, a meeting that will bring together the major players in the market, valuing the expertise of the main metro rail professionals.

All this success achieved is mainly due to the dedication of the railway workers, who have always praised their engagement, valuing their tasks.

Finally, encouraging the use of best practices is the surest way to guarantee the growth of the railway modal, and its beneficial influence on society, by encouraging the development of sustainable actions for the planet, enables population greater quality of life and right to mobility.




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# TECHNOLOGY IN SIMULATORS

## SUBWAY OPERATION



Command-control exchange

Rail transport plays a fundamental role in the global economy, moving goods and passengers efficiently and sustainably. At the heart of this sector are train driving professionals, whose training and improvement are crucial to ensuring the safety and effectiveness of operations. However, training on real trains presents significant challenges, such as high costs and associated risks. That's where train driving simulators come in, an innovation that revolutionized the training process.

Two decades ago, they were a reality, but they were far from the versatility and efficiency we see today. These simulators used to consist of replicas of train cabins with giant projector-based viewing systems. This technology had a number of notable challenges and limitations:

- **Space and Cost:** The replica cabins took up significant space, which required expensive physical infrastructure. Projectors and display systems were expensive to maintain and upgrade.
- **Complex Maintenance:** The simulations

20 years ago required expensive and regular maintenance. The computer systems used were far from robust and often required a considerable amount of time and resources to remain operational.

- **Specific Programming Environments:** The simulators used specialized programming languages and generally had an approach similar to the military environment. This made its development and customization expensive and unconventional.



However, over the last two decades, train driving simulators have undergone remarkable evolution in several aspects:

**1. Versatility:** Modern simulators

They stand out for their versatility.

They have overcome the limitations of replica cabins and adapted to offer full training on a wide range of trains. This is achieved by incorporating real and virtual controls into the same simulator, enabling operators to practice on different types of trains with a single device.

**2. Exchange of Real Controls:** Solutions

were created to allow the exchange of real controls within the same simulator. This not only makes training more efficient and versatile, but also reduces costs associated with needing multiple replica booths. Currently, this command exchange can be executed in a few minutes.

**3. Advances in Information Technology:**

Today's simulators use commercial, robust and reliable equipment. The evolution of operating systems and the adoption of more accessible technologies have simplified maintenance and reduced costs associated with the technology used in simulators.

**4. Focus on User Experience:** As simulators have become more accessible and versatile, there has been a strong focus on the experience of the primary user, who is the instructor. Current systems seek to offer a realistic training environment that allows instructors to simulate training situations in a simple and comfortable way.

**5. Data and Analysis:** Another important evolution in train driving simulators is the ability to collect and analyze data in real time. Modern simulators are equipped with advanced tracking and analysis systems that record the



operator performance. This allows instructors and railway companies to accurately assess students' skills, identify areas for improvement and provide specific feedback for professional development. Additionally, they can be used to track progress over time and ensure operators keep their skills at an optimal level.

**6. Integration with Emerging Technologies:**

Simulators are also integrating with emerging technologies, such as virtual reality (VR). This technology offers even greater immersion and a more realistic training environment. VR allows operators to train in highly realistic virtual environments, which is especially useful for emergency situations and critical procedures such as train failures.

**7. Personalized Training:** The evolution of simulators has also made more personalized training possible. Training programs can be adapted to the specific needs of each operator. This means

that students can focus on areas where they need more practice, improving training efficiency.

**8. Mobile and Portable Simulators:**

In addition to fixed simulators in training centers, there are now mobile and portable simulator options. These devices enable operators to practice anywhere and at any time, facilitating ongoing training and skill development without the need to travel to a specific location.

**9. Feedback on Energy Efficiency:** Train

driving simulators have advanced in the ability to calculate in detail the train's energy consumption by the operator. Simulation systems can assess energy use in real time, providing accurate data on how driver actions affect train energy consumption. This functionality is essential to promote more efficient driving practices, which can result in significant savings in operating costs.



High degree of immersion – Training Booth



The ability to assess energy expenditure allows operators to learn how to adjust their behavior, such as speed, braking and acceleration, to minimize energy consumption while adhering to schedules and safety standards. This real-time feedback is a valuable tool for training and improving driving skills.

#### 10. Motion Platforms for Realistic

**Feels:** In most modern train driving simulators, motion platform technology has been implemented under the seats or under the entire cabin. These platforms generate extremely realistic train driving sensations.

By simulating movements, vibrations and sway, operators experience the same “G” forces and track conditions as they would encounter in real situations.

In summary, the evolution of train driving simulators over the last two decades has been impressive. Since the limitations of expensive replica booths and projection systems, simulators

have advanced to more versatile and efficient devices, significantly transforming the way railway professionals are trained. This evolution ensures more accessible, economical and effective training, thus contributing to improving safety and efficiency in the railway sector.

It is worth highlighting the great benefits arising from the use of Train Driving Simulators:

#### 1. Enhanced Safety and Training Quality

Train driving simulators provide a controlled and safe environment for training, reducing the stress often associated with learning on real/operational trains.

The student can practice and repeat exercises as many times as necessary, improving driving skills, safety protocols and standardized operating procedures.

#### 2. Intensive Training in Critical and Emergency Situations

Simulators make it easy to create realistic scenarios, including critical and emergency situations, that are difficult to safely simulate on real trains.

This prepares professionals to respond effectively to unexpected events, ensuring the safety of passengers and cargo.

#### 3. Reduced Training Time and Costs

The use of simulators results in a significant reduction in training time and costs associated with the use of real trains. It is estimated that training costs can be reduced by up to 70% with the adoption of these technologies.

#### 4. Features of Pro Simulators

professionals

Professional simulators offer a high degree of immersion and realism, providing an authentic training experience. Furthermore, they are highly configurable and scalable, adapting to the specific training needs of each railway company.

Train driving simulators are a revolution in the railway sector, offering numerous advantages in terms of safety, training quality, time and cost savings. Incorporating them into training programs not only increases efficiency in training professionals, but also contributes to a





Instructor console and trainee consoles

safer, more sustainable and more efficient railway sector.

They are a versatile tool in the training of railway professionals. They can be used in different phases of the training process:

• **Training of New Professionals:**

Simulators are ideal for training new team members, providing a safe and effective introduction to train operation. This includes learning standard operating procedures, safety protocols and handling train systems.

• **Continuous Training and Retraining:**

Experienced professionals benefit from continuous training, allowing them to improve their skills and update themselves with the latest regulations and prepare for new challenges that may arise.

• **Development of Skills**

**specific:** Simulators can be used to improve driving skills, knowledge of train systems, management of service failures and training in adverse situations, such as bad weather conditions, technical failures and obstacles on the track.

• **Interactive Student/Instructor Training:**

Simulators offer the opportunity to correct errors in real time, promoting effective interaction between the student and the instructor. Instructors can assess student performance, provide immediate feedback, and adjust training according to individual needs.

• **Anytime Training:** One of the great

advantages of simulators is that training can occur at any time, regardless of the availability of the train fleet. This allows flexibility and ease of access to training.

As railway companies continue to invest in innovative technologies, train driving simulators play a key role in training professionals to meet the challenges of modern rail transport. The adoption of these technologies is a crucial step towards a more efficient and competitive railway sector.

Note 1: A LANDER Simulation & Training SOLUTIONS from Spain and CORYS Simulation from France are examples of companies

that manufacture equipment for simulation with cutting-edge technology.

Note 2: In Brazil, we can cite as an example the following operators: CPTM, Metrô SP, ViaQuatro, VLT Baixada Santista, Metrô RIO that have modern generation simulators.

**Henry Munhoz**

Electrical-electronic Engineer with a Postgraduate degree in Railway Engineering from the University of Buenos Aires; Specialization in Rolling Stock Modernization – Japan; Specialist in Passenger Train Design and Railway Maintenance. Consultant in the railway area.



# The Railway of the Future must be Digital, Sustainable and Customer-Centric



The railway industry is going through a new “golden era”, in light of the current environmental emergency scenario – passenger rail transport is a great choice. It goes beyond offering fast, reliable and economical trips.

There's a lot of buzz around ESG these days – and a lot of questions. Firstly, what is ESG? Is it different from sustainability? When creating infrastructure, what climate change concerns need to be addressed? What is the social impact on stakeholders while the infrastructure is being developed and how will they use it once it is built? Who ultimately decides which standards need to be met?

While the Fourth Industrial Revolution is about technological development and convergence, the Fifth Industrial Revolution is said to

Industrial lution is seizing human-centered opportunities to make the world better. As we become more dependent on technology and connectivity, we are changing the way we live, work and travel.

Mass transit operations are becoming smarter and some changes are happening in the mobility sector. Digitization is gaining speed and providing greater availability, greater automation, infinite connectivity and greater sustainability

– a change not only necessary in the sector, but welcome.

Passenger expectations are changing, and technology, while an incredibly useful tool for improving the passenger experience, is not

and it all. Fundamentally, passengers expect to get added value for what they pay for, a convenient and punctual service that is sustainable and for issues to be resolved quickly and effectively if they arise.

This presents a pressing need to identify innovations that can bring improvements to people's quality of life. But crucially, these innovations must be managed and planned strategically, focusing on customer-centric priorities and creating a roadmap for their development and implementation. But adopting a structured approach to managing innovation is not easy, especially in a traditional sector like rail, with legacy standards and ways of working. And that's where ESG comes in.



ESG and innovation go hand in hand, because, while the first concerns the adoption of sustainable practices, innovation refers to the growth of companies without failing to consider all aspects involved in this process. This is where the concept **of an ambidextrous company comes in:** it is one that continues to operate its processes in a traditional way, but without ceasing to invest in continuous improvement and innovation.

Technology and innovation are changing the once-stable public transport sector, and we hope this is a positive thing. We believe that innovation ecosystems are a complex process that encompasses the generation of ideas, their translation into products and the commercialization of these products on a large scale. The success of this progression depends on several factors, such as a business culture that permeates entrepreneurship, risk-taking and the willingness to embrace change, a set of regulations and administrative standards that encourage this attitude, aligned with the knowledge generation sectors (universities, research centers, startups, etc.) and collaboration between these knowledge centers and commercial businesses will improve mobility options and lead to a better quality of life for everyone.

As the public transport sector becomes more digitized, customer data is available, offering valuable insights to operators and government authorities. Likewise, the trains themselves are increasingly part of the Internet of Things (IoT), making it possible to collect data almost constantly.

The basis for smarter mobility is big data. Every day, trillions of terabytes of data are generated through countless sensors, not just in mobility modes like cars or trains, but also in streets, tunnels and buildings – even on people and their smartphones and gadgets. This arrival of the world of “information everywhere” is transforming the railway sector, as connectivity and the Internet of Things

offer new opportunities and transform the existing railway infrastructure into a much more efficient, intelligent infrastructure aligned with good ESG practices.

Good Environmental, Social and Governance Strategies can help railways to better manage costs, for example by reducing energy and water consumption, optimizing wastewater disposal processes and moving towards a circular economy model that promotes reuse, the repair and recycling of existing materials, instead of the consumption and waste of resources.

We add that data available on trains enables predictive analytics to help operators combat problems before they occur, which reduces service disruptions and keeps passengers happy. From the passenger's perspective, the new data sources mentioned above are helping operators understand who their customers are and the type of journey they are taking, revealing enormous potential to develop much more efficient, door-to-door transport networks.

But as the floodgates of innovation and technology open in this once-stable ecosystem, many transportation operators are likely to feel overwhelmed and confused by so many possibilities. To fulfill this potential, however, this data must be transformed into an open resource and shared across modes, respecting general data protection law.

Furthermore, it is important to highlight that ESG initiatives can also be a driver of innovation, such as the search for cleaner and more sustainable technologies or the need for new business models that meet the needs of local communities.

Railway digitalization also re-presents a challenge. As highlighted by some experts, the switch from electromechanical devices to electrical and then digital components or the implementation of automated systems is not

will be the most difficult aspect. Developing a new mindset is by far the trickiest challenge for rail operators and authorities, who will have to share data and consolidate business resources.

This change in cultural mentality must be anticipated, highlighting the added value of Innovation and Diversity. Just like society, the corporate environment is highly diverse. When we consider a company that has innovation in its core business, diversity is an element of great relevance. Therefore, the more diverse your team is, the more ideas that represent different social groups will emerge and, consequently, the impact generated on society will be greater.

This new economy has changed the dynamics of relationships between businesses and consumers, communities and organizations or people and their work. Before, the focus was on creating products. Today, the focus is on having an organizational culture centered on people, be it the customer, employees or communities.

“100% of customers are people. 100% of employees are people. If you don't understand people, you don't understand business.” Simon Sinek

The Railway of the Future must be digital, sustainable and customer-centric. In the coming years, ESG, innovation and railway digitalization itself, together, must modify the business model, which must evolve from a very rigid model to a more dynamic network that unites suppliers, technological platforms, mobility providers and customers.





CPTM's iconic Estação da Luz seen from above



Relationship with the CPTM passenger



Presentation of CPTM's social media experience, Alamy 2023, Barcelona

## The customer's shoe

Identify customer needs now

It's a cliché among companies that provide services to the population, whether public or not. Understanding what he needs and putting it into practice in the Company may be a great idea in theory, but in practice much more is needed: it is essential to observe his perceptions, his opinion, his complaints and his good surprises.

CPTM has 57 stations spread across 18 municipalities in the metropolitan regions of São Paulo and Jundiaí. There are around 1.6 million people who, every day, use its five lines to work, study, go to the doctor, and have leisure time.

Understanding why each of these individuals use trains, how they choose our mode, how they feel during the trip, whether there is comfort and speed and how they end their journey is practically an obligation for a company

so big and whose decisions can interfere in people's lives.

It was with planning the trip to our passenger's final destination in mind that we launched, in 2020, the CPTM Customer Journey. The name is noble and so is the objective: to improve and deepen customer service, targeting new business

opportunities and improving the Company's image. It is important to keep in mind that this customer already uses other companies to get around, consuming not only transport, but technology and other added services during their journey. The priority is to collect information and think about actions that are within everyone's reach, develop and take advantage of employees' knowledge and internally enhance the human capital available in the Company.

One of the most effective ways to understand customer needs is, of course,

te, the contact he makes with us. CPTM has several communication channels with its passengers – Website, WhatsApp, 0800 Service and even our stations, where employees are able to help in the best possible way or indicate someone who can do so. The demands of passengers, around 15 thousand every month, guide the Passenger Relations Department, bringing the customer's reality into the Company.

All these demands are the basis for producing the Monthly Service Report, which shows the main complaints of passengers who contacted us, their doubts, their concerns and what pleased them about the Company's day-to-day operations. This compilation of extremely valuable data is available to our more than 6 thousand employees on the company's intranet. Areas such as Operation, Maintenance, Planning and Works have access to complaints, making it possible to know where the passenger would like to see a new station, a specific store within the system,





among other subjects. In addition to enabling managers to act quickly, creating action plans aimed at correcting the main points of dissatisfaction highlighted by customers.

If we have to summarize what this work represents, we can say that it is the passenger's perception being translated and represented in a single report. It means explaining in detail what the numbers obtained indicate, interpreting the meaning of each piece of information in a clear way.

It is a world of information that can never be wasted and that must be increasingly improved. In this way, CPTM Passenger Relations innovated and began adapting its approach to the demands that are registered monthly in its relationship channels. After some tests, the manifestations began to be classified according to the Customer Journey, communicating this new perspective to the company through this report. This assessment tool came with the aim of being a relevant reference to contribute to CPTM's strategic objectives – improving the passenger experience within the railway system managed by us.

Without understanding passenger needs, CPTM would not be the company it is today. The open channels to listen and help them meant that expectations were aligned. Dialogue with our customers made the Company grow. It's a partnership, a two-way street, in which everyone wins.

And that's the real reason to meet us-

passengers: it is necessary to wear the customer's shoes, understand where the calluses pinch and how these shoes can be increasingly comfortable and functional.

For CPTM, the new look at this report was providential. We are currently implementing a new CRM – which means new technology and new processes to manage your contacts, both external and internal. A new path towards achieving the company's strategic objectives. Furthermore, the launch of the new report in May, with data for April and after just two months of testing, marked the Company's 31st anniversary and the 24th anniversary of the Customer Relations Department itself.

And how can this report help the Company's areas and passengers in practice? For example: if the number of complaints about air conditioning has increased on a certain line, the General Maintenance Management identifies the problem and can act precisely and directly to make adjustments to this solution. If the lighting at a station leaves passengers unsafe, Station Management must understand whether the problem is the lack of a lamp or the system in general needs to be changed. The Monthly Service Report is a beacon to guide CPTM towards excellent service, linking passenger demands to the contact points defined by the journey.

Furthermore, we need to remember that this report has been around for more than two decades.

ced, which can often generate just a "glance" by some managers. Therefore, it is necessary to renew the interest of these people in information that has been known for many years. Numbers can be consolidated in new ways to generate other insights and, consequently, ways to advance, innovate and solve problems.

Another essential tool was recently created to optimize our passenger perception: the Customer Committee. Composed of employees from different areas of CPTM, it is committed to understanding the needs and expectations of our customers, accepting recurrent demands, analyzing experiences, creating an environment conducive to active listening and closer relationships. In addition to looking for innovative solutions to not only serve, but also delight our customers.

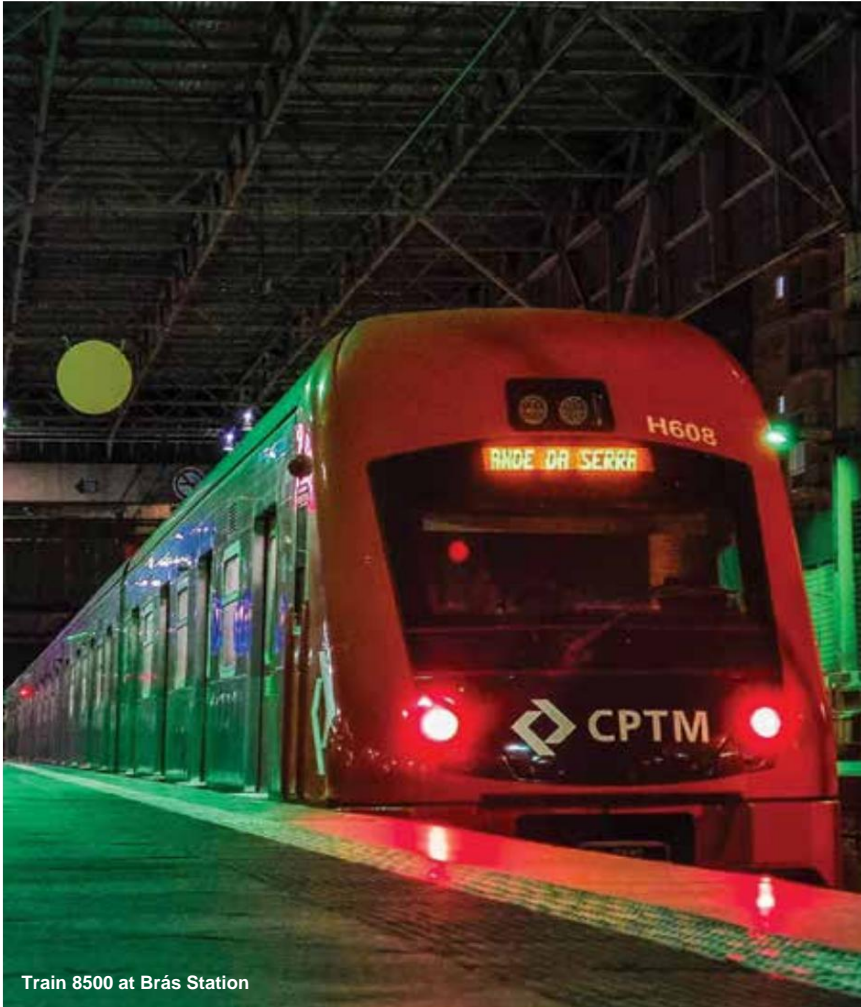
CPTM also seeks to always be up to date on good customer relationship practices practiced by train operators in Brazil and around the world, actively participating in the Communication Committee of ANPTrihos (National Association of Rail Passenger Transporters), which he even coordinates, and the Technical Marketing Group of Alamyms (Latin American Subway and Underground Association).

There are different types of shoes that 1.6 million people can wear every day. We are proud to be their choice and work daily to accompany passengers in the safest and most comfortable way possible.



**Rodrigo Pontes dos Santos**  
Administrator and Sports Manager graduated from Universidade São Marcos/SP, postgraduate in MBA in Strategic Marketing Management with a Focus on Supply Chain and Transport from ESPM, R.J. Marketing and Communications Manager at CPTM.

# Best Practices in CPTM Operation



Train 8500 at Brás Station

Currently, continuous improvement and excellence and the provision of services to customers are the main focus. Together with the GOM – General Maintenance Management and the DOPC – Department of companies that operate in various Planning, are part of the DO – Operation and Maintenance passenger transport services. These principles, Management, Directorate.

When well applied, they can bring direct and indirect benefits to those who use them. In line with the objectives of CPTM and DO, GOO and its consolidate the image of CPTM as an important management in the rail transport mode and They made several efforts to provide services to the population.

GOO – General Operations Management is the management responsible for service improvement in operation and passenger service would provide effective gains in time, convenience and comfort.

It is worth highlighting that seven management departments of the Operation and Maintenance Department officially received the ISO 9001 certification, granted by the Vanzolini Foundation, through the CPTM Quality Management System, in the year 2023. Specifically the General Operation Management (GOO), the Circulation and Operational Control (GOC), Stations and Services (GOE), Operations Engineering (GOG) and Safety (GOS) departments were certified.

Among the best practices and achievements, we can highlight:

## Reduction in travel times and train intervals (headway)

At the beginning of the year, between the months of January and April, Work Groups were formed with the aim of reducing the interval between trains (headway) on Line 11-Coral and Line 12-Safira. A task force of operations and maintenance employees identified situations and points for improvement, including: road registration, existence of precautions on the road, measurement of travel times, measurement of boarding/disembarking times, analysis of opening/closing doors, performance of compositions, etc. Results:

- On Line 11: headway reduction from 4 to 3.5 minutes between Luz and Guaianazes Stations, and from 8 to 7 minutes between Guaianazes and Estudantes Stations, during peak hours. In addition, there was a reduction of 2 minutes in the total travel time of a trip; On Line 12, the headway went from 5.5 to 5 minutes between the Brás and Engenheiro Manoel Feio Stations, and from 11 to 10 minutes between the Engenheiro Manoel Feio and Calmon Via-na Stations, during peak hours.
- On Line 13, it was possible to reduce travel time from 12 to 10 minutes between Aeroporto-Guarulhos and Engenheiro Goulart Stations.





Train 9500 at Mooca Station

transfer at Estação da Luz, in addition to the Line 13 service, which is provided between Engenheiro Goulart Stations and Guarulhos Airport.

These strategies significantly reduced the need for transfers at stations, thus increasing passenger comfort and reducing travel time.

### Start of Expresso Aeroporto operation to Palmeiras-Barra Funda

The Airport Express Starting Point, on platform 10 at Palmeiras-Barra Funda Station, opened on 8/31.

The first trips took place on 1/9. The extension of the service creates new connections for those using Guarulhos Airport and facilitates the boarding of passengers coming from other lines. A DOGI Service Instruction defined, in September, the guidelines and procedures for carrying out train circulation between Barra Funda and Aeroporto-Guarulhos Stations, on Line 13-Jade, with an average of sends 20 thousand passengers/day.

### Reduction of transshipments at Stations

During the last administration, new operational strategies were implemented:

- Direct looping on Lines 7-10, when Service 710 is implemented, avoiding the transfer of passengers on Brás and Francisco Morato stations;
- Line 11 looping directly from Luz to Estudantes, with no need to transfer at Guaia Station. nazes;
- Line 13, Palmeiras-Barra loop Founds Guarulhos Airport, offering passengers the convenience of traveling without the need for



Train 2500 Expresso Aeroporto at Barra Funda Station



Train 2500 Expresso at Barra Funda Station

**CPTM was winner of the 10th Metroferroviários Technology & Development Award**

The article “Fablab implementation at CPTM and maker culture in the metro-rail sector – CPTM”, by Sarah de Sá Fernandes, Rodrigo dos Santos Nóbrega and Maicon Satiro de Oliveira, was the winner of one of the three categories of the 10th Technology & Development Award Metroferroviários, delivered at the opening of the 29th Metrorail Technology Week, promoted by the Association of Metro Engineers and Architects (AEAMESP). The work addressed the first FabLab (Manufacturing Laboratory) in the railway sector in Brazil, a space intended for professionals from different areas of the Company to carry out projects aimed at digitalization and digital transformation. In addition to the article about Fablab, William Bossas Paulino competed in another category, being among the finalists with the article “EWMA Control Charts for headway monitoring organized by CPTM lines”.

**Train x Train Trailer**

Previously, when a train suffered

If any damage prevented its movement by its own means, a trailer was activated using diesel-powered locomotives, which did not always occur with the necessary agility, due to the different distances between the sections and the fact that the locomotives were located at predefined strategic points. With the adoption of the Train

**Renewal of APs on trains and stations**

The SPAS (Personalized Sound Warning System), which emits audible warnings, was installed in 54 Stations. This year, after reviewing the Public Notice Manual for Stations, new texts were included to offer options for manually issuing notices by stations, when necessary. Other news:

organized by CPTM lines” temporary campaigns, interdictions and scheduled breaks) through Artificial Intelligence, an initiative that speeded up

the process of implementing public communications and standardized the voice that transmits information.

- In a joint action with Marketing, some of the routine APs were re-recorded with children’s voices and implemented in the period from 12/10 to 31/10 in stations and trains.

We can highlight that, with this aim of focusing on passenger well-being, CPTM seeks to continuously improve processes, which provides the Operation with a much more satisfactory service, thanks to an engaged team that is always dedicated to achieving its operational objectives.

**Vagner Rodrigues**  
 Production engineer  
 Mechanic by FEI;  
 Business Administrator from Mackenzie; MBA  
 Excellence in Management by FIA USP; and General Manager of CPTM Operation





# Control Center – Evolution Management and Technological



CET Operational Control Center

As systems operations of high-capacity passenger transport were expanding, centralized management action evolved to meet the requirements of agility in decision-making, with the objective of acting quickly so that, in the face of an abnormality in the process, actions contouring and correction are carried out, increasingly minimizing the impact on passengers.

This evolution brought integrated action between the various entities involved in the process, operators of connected systems in a city, security agencies, fire departments and the press. The increasing use of high technology has been a predominant factor in monitoring and assisting in operational control.

Several Operational and Maintenance Control Centers of operators of high-capacity transport systems were considered as references for this article, various managerial and technological stages and in different temporal references: Operational and Maintenance Control Centers of the Metro de Santiago de Chile, São Paulo Metro, CPTM de

São Paulo, CECOM of the ABD corridor, São Paulo Traffic Engineering Company, New York Metro, Rio de Janeiro Supervia, Porto Alegre Trensurb, Rio de Janeiro Metro, Pennsylvania rail system, Metro Madrid, Barcelona Metro, Huston Aerospace Museum, Porto rail system in Portugal, Medellin Metro, Salvador Metro and Recife Metro.

The description aims to show this advancement in management and technology, until we reach the most modern concepts and good practices used.

## Traffic Control Center in the city of São Paulo

Until the mid-1980s, the operation of the traffic system in the city of São Paulo was monitored by professionals located on top of buildings, where it was possible to have a view of critical locations. These professionals carried binoculars and a radio transceiver to inform a radio listening center where information was centralized at defined times, called "peak hours". The information described

it was the length of the congestion, taking as a reference a notable point and the end of the queue of vehicles. The information was compiled at the radio center, allowing engineers and field technicians to take the necessary workarounds to reduce the impact of congestion and unblock the road system when there was an incident. The information was also passed on to commercial radio stations that broadcast news about traffic conditions, allowing drivers to use alternative routes. All this information was later used as an important subsidy to the study base for contouring and solving bottlenecks and traffic alternatives developed by Traffic Engineering.

## Implementation of Coordinated Traffic Lights

From the second half of the 1980s, the São Paulo Traffic Engineering Company – CET began implementing the traffic light control system called SEMCO – Coordinated Traffic Lights.

Inductive loops were also implemented on the roads, in order to control the number of cars and the time spent on the loop, a measure that indicates the traffic condition. These parameters were used to calibrate the opening time of traffic lights at a network of road intersections, reducing or eliminating congestion. During this period, the Operational Control Center was installed in the city, which indicated streets and intersections with traffic visualization resources.

In the software called Transit, after entering parameters, the opening times for the traffic lights at each intersection were programmed. The implementation of the computerized Control Center brought a leap in agility and precision in control, which

## Best Innovation Practices in Railways

it replaced human visualization with the action of sensors installed on the road that provide real-time traffic information and traffic conditions, 24 hours a day.

Furthermore, it allowed the possibility of adjusting traffic lights remotely.

As a complement, cameras were installed at strategic points to visualize the traffic situation.

### ABD Bus Corridor Control Center – CECOM The

ABD corridor that connects Jabaquara Station, Ferrazópolis and São Mateus by bus was designed to be controlled by CECOM. The buses are tracked and the vehicle position information is a parameter for traffic light programming so that the traffic light, receiving information about the bus's approach, remains in the "green" or "open" position for the bus to pass, ensuring reduction of travel time.

### São Paulo Metro Control Center

The São Paulo Metro Control Center was implemented during construction work on Line 1-Blue, the first metro line in São Paulo. During the implementation period, the power panels



First CCO of the São Paulo Metro

train positioning were metal plates with a line diagram design, on which the position of the trains, indicated by a marker with a magnet, was updated by the console operator through information from radio transceiver communication with the train operator. With the implementation of train tracking through the signaling system, the panels evolved into Line diagrams and incandescent microlamps that define the train's positioning. For the electrical power system of trains and stations, in the same way, the panels indicate the status (on or off) of the equipment.

The Control Center panels gradually evolved to retro-projected LED, plasma and LCD technology.

Integrated into the control room is the passenger console installed, which has image monitors on the passenger circulation route for action at the Stations, with the centralized emission of sound messages, search for people and activation of the Firefighters and Ambulance.

Over the years, innovations were incorporated based on the teams' experience. One of them was the press interface console that was incorporated into the



NASA, Houston (2017)

control room, issuing relevant information to the press internal and external to the Company.

Likewise, the security console was incorporated into the control room, streamlining actions and interface with bodies such as, for example, the Military Police.

The Strategy Room, which, in the past, in some Centers was called the Crisis Room or Situation Room, was an important advance for articulating Operation and Maintenance in special events such as the Pope's visit, the World Cup, New Year's Eve, popular demonstrations, between others.

### Historic Houston Space Control Center – NASA

The São Paulo Metro Control Center, in its implementation, had a project very similar to NASA's historic Houston Control Center, with several joint companies responsible for implementation.

### Unification of the Control Centers of the CPTM

In 2002, with the aim of allowing integrated operation of the seven CPTM lines and management optimization and technological updating, the three old Control Centers of Presidente Altino, Luz and Brás were unified into the new Brás Control Center.

A new building was constructed housing, in addition to the Operational Control Centers – CCO and the Maintenance Control Center – CCM, an auditorium, strategy room, training room, changing rooms, restrooms and technical rooms.



São Paulo Metro Strategy Room  
Paulo (2017)





the entities that participate in the management of the city's transport system with consoles for the Police, Maintenance, Passenger Communication and the Press Center, all within the Control Center environment. Configurable panels allow the presentation of various information to support operators. This action brought greater agility in integrated action, reducing or eliminating the consequences of an occu

**The concept of integration of the Pennsylvania Operational Control**

Example of a Control Center where the intercity train network and Light Rail Vehicle (TRAM) services are shared. This concept of inter-modal CCO was already used in the 2000s.



CCO Pennsylvania

**Evolution of the New York Control Center**

Until the early 2000s, the New York Subway Control Center only operated the Subway lines, without interaction with other city management bodies in the Center space.

In 2001, during the September 11 attack on the Twin Towers, the New York Subway had great difficulty operating in an integrated manner with other entities in the city. Communications were interrupted for security reasons and coordination between systems was severely hampered.

In 2023, completely restyled, the New York Subway Control Center now works fully integrated with

**Continuous Monitoring integrated with Operation and Maintenance Control**

**Centers** Continuous integration of monitoring with Operation and Maintenance Control Centers is essential to assist in decision making. In the same way that practices for monitoring congested traffic, overcrowding on platforms or shortages of trains on a carousel are valuable for dealing with operational situations, the rapprochement between operational sectors and control systems led to the conclusion that unifying the centers information and maintenance control with operational. As a result of this approach, technological resources were implemented that allow monitoring the status of asse



New York Subway (2004)



New York Subway (2023)

Best Innovation Practices in Railways



London Underground CCO with Monitoring Ongoing (2013)



Elevators controlled by CCO Barcelona



Barcelona Operation Control Center

not only to react quickly to operational failures, but also to predict and avoid problems, anticipating actions that reduce the impact on operations

This predictive maintenance and decision-making feature is also known as Continuous Monitoring. With the use of information technology resources such as IoT, sensors, cloud computing and others, we can concentrate data received directly from equipment and, through algorithms, produce customized panels and alarms that are used by teams to monitor systems, anticipating undesirable behaviors that may affect train circulation.

Barcelona Metro has implemented comprehensive monitoring strategies, which include, in addition to the systems mentioned, control of the operation of important building systems such as the air supply and exhaust system inside the tunnels, which play a critical role in management. airflow and smoke mitigation during fire situations. Additionally, isolated chambers located in the tunnels function as refuge areas for passengers, and these chambers are equipped with high-capacity elevators to ensure the safe evacuation of people. These elevators are monitored and remote-controlled from the CCO.

At Companhia Paulista de Trens Metropolitanos – CPTM, in addition to the strong integration between the Operation and Maintenance Control Center, the adoption of Continuous Monitoring systems for the Airline Network and Rolling Stock is underway. Sensors and strategic information

They are sent from the trains to a Center that serve as input for immediate corrective action. A database is created with the history to serve as input for studies on process improvements and corrections.

**Future of Operation and Maintenance Control**

**Centers** Combined with Continuous Monitoring, assertive asset management recommends that we can see the real performance of systems in a systemic and practical way and project a realistic curve on their performance, in order to take measures in advance. Therefore, many resources can still be incorporated into the Operation and Maintenance Control Center so that it is possible to intervene with the support of visual and statistical data. Among them we have social networks, radio and television. In addition to meeting immediate demands, the data collected are valuable sources for analysis and statistics, which provide essential insights to improve projects and guidelines for future implementations. This real-time monitoring of public opinion in relation to the system, with the possibility of segmentation and analysis, serves as a basis for immediate actions and future strategies

In the security console, it is recommended to provide information covering the areas of stations, tracks and train interiors. This monitoring must be active, aiming to provide statistics that identify risk areas. This is achieved through the use of movement-sensitive cameras, as well as the application of computer vision technology to monitor unsafe behavior that could compromise passenger safety or in cases of incidents. In more serious situations, live transmission via portable cameras or drones also becomes an indispensable resource for a technical team of Operation and Maintenance specialists at the Control Center, providing real-time information that can contribute to agile and accurate decision-making by field teams.

Thus, managerial maturity together with the development of technologies, combined with the Control Centers model, allow for countless possibilities for innovation and greater effectiveness in the quality of services provided, increasingly bringing comfort and attractiveness to the large-capacity transport, which is the sustainable means of mobility

**Wilson Nagy**  
General  
Maintenance Manager at CPTM,  
Executive Secretary of  
ANTP Metro Railway  
Committee and Coordinator  
of Maintenance of the  
ALAMYS International  
Maintenance Committee.  
Electrical/Electronic Engineer



**Felipe Ribeiro Naves**  
General Maintenance  
Supervisor at CPTM.  
Electrical Engineer and  
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Postgraduate Degree in  
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## HOW CAN WE INNOVATE A SYSTEM SUBWAY RAILWAY

How can we innovate in a system metro railway?

I think that combining the following concepts: “knowledge, creativity and implementation”.

- Practical, technical or scientific “knowledge” serves as the basis for the problem-solving process. • “Creativity” is transforming ideas into solution.
- “Implementation” is a decisive component to conceptualize innovation, as it is what implements and is co-

leased in use. It must be written and applied.

Based on these definitions, below I report my entire professional trajectory over 41 years and, certainly, these concepts were applied, even unconsciously, in the other phases described in this article and which, recently, led me to accept a new challenge in

Cearense Metropolitan Transport Company, Metrofor.

In 1978, I was admitted to the Federal Railway Network – RFFSA. At that time,

On the Trunk and Variante Lines, in the east zone of São Paulo, freight trains, long-distance trains and suburban trains ran. These circulated with open doors, some pulled by locomotives, pendants and surfers, with train, wagon and locomotive maintenance workshops in precarious conditions of flooring, lighting, equipment, etc. The technical knowledge acquired at college, a lot of creativity to solve the various problems and the implementation of solutions were essential. Afterwards, in

## Best Innovation Practices in Railways

1984, at the Companhia Brasileira de Trens Urbanos – CBTU, with the acquired experience, many investments and innovative technologies, other challenges came to the Operational Control Center – CCO, making it necessary to adapt to the new activity and concepts. In 1996, Companhia Paulista de Trens Metropolitanos – CPTM was created, with a new mentality, with the dynamism of updated management, with expansion of the railway network.

It was a huge impact on culture and ways of working, which required a lot of creativity and knowledge to face this new challenge. Throughout this period, innovations, changes in habits, the need to create something new, improve processes, etc. were essential.

4 years after my retirement, I received an invitation to work at Metrofor, the Cearense Metropolitan Transport Company. Going through these phases strengthened us and gave us the confidence to face the endeavor. It was in this sense and in this spirit that we accepted the attribution.

### TIMELINE – CREATION OF METROFOR

Currently, Metrofor consists of 5 lines in operation, 1 line under implementation, 84 kilometers long, 63 stations with 7 municipalities served and 60 thousand passengers transported per day.

Of the 5 lines in operation, only the South Line is electrified and served by TUEs – Electric Unit Trains. The rest

lines are served by Light Rail Vehicles – VLT. From October 2014, the Metrofor Southern Line replaced diesel locomotives and Pid-ner cars with TUEs, modernizing metrorail operation. As of February 2015, the Metrofor West Line replaced diesel locomotives and Pid-ner cars with VLTs, modernizing the operation of this line.

### MAP OF SUBWAY NETWORK LINES – METROFOR

Next, we will detail the characteristics of each line that make up Metrofor.

#### SOUTH LINE - RED

The only line electrified at 3,000 volts in direct current, metric gauge, two tracks, with signaling that was implemented and as a result of frequent acts of vandalism such as cable theft and is partially deactivated. In it, Parangaba Station is integrated with the Northeast Line. The Vila das Flores Maintenance Center – CMVF is located close to Carlito Benevides Station and is responsible for the maintenance of the entire fleet of Metrofor trains -TUEs and VLTs. On this line, we have 4 underground stations, 2 elevated and the rest on the surface.

#### WEST LINE – GREEN

The Oeste line is a simple line, serving two municipalities (Fortaleza and Caucaia), without signage and with licensing.

This is carried out through the station-to-station CCO.

#### NORTHEAST LINE – BLUE

The Nordeste line has two routes and serves the city of Fortaleza. Its signaling is in the process of being implemented, and the movement of VLTs is carried out without signaling, running in sight. Licensing is done by the CCO via station-to-station radio.

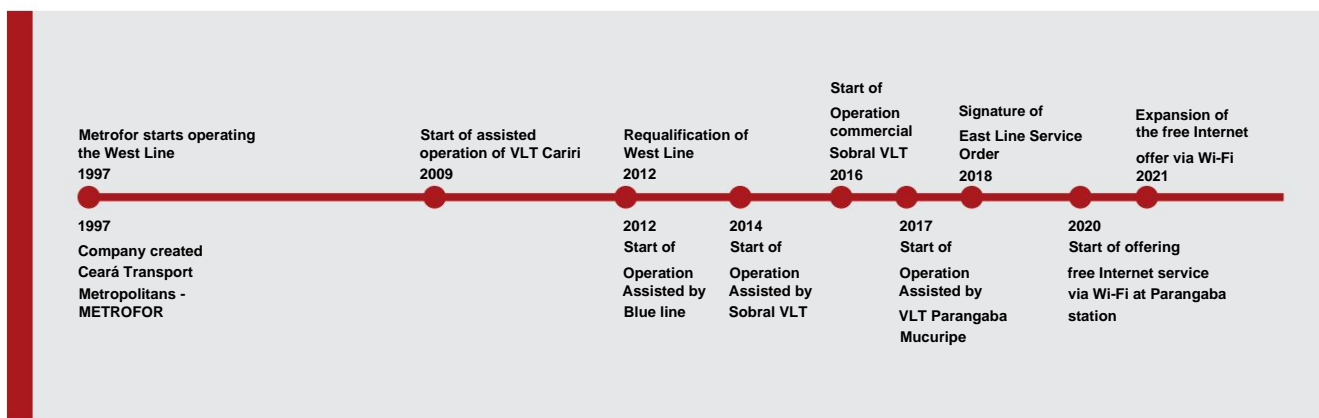
Parangaba Station is integrated with the South line. At the expeditionary station there will be integration with the future Airport Station, whose branch is being built connecting it to Pinto Martins International Airport, in Fortaleza.

The Vila União Maintenance Center is in the implementation phase and will allow for preventive and corrective maintenance of VLTs.

#### SOBRAL LINE – NORTH

**AND SOUTH** The Sobral Line is formed by two sections North and South and serves the municipality of Sobral, 222 kilometers from Fortaleza. Circulation is carried out by VLTs, without signage, with station-to-station licensing on a single line in both sections. At Campo dos Ve-lhos station, the lines are integrated.

The Maintenance Center, responsible for maintaining the VLTs that circulate in Sobral, is located close to the Novo Recanto station.





Características Linhas						
	Linha Sul	Linha Oeste	Linha Nordeste	Linha Sobral		Linha Cariri
				Norte	Sul	
EXTENSÃO (km)	24	19,5	13,4	6,2	5,8	13,9
ESTAÇÕES	20	10	11	6	5	9
TEMPO DE PERCURSO (min)	37	41	34	22	20	34
HEAD WAY (min)	16	45/90	40	48	48	45/90
FROTA OPERACIONAL	12	4	5	2	2	3
FROTA PATRIMONIAL	25	6	7	3	2	2
SUB-ESTAÇÕES/PASSAGEM DE NIVEL	3	12	10	19	14	19
TARIFA (R\$)	R\$ 3,60	1	0	1	1	1
HORÁRIO DE OPERAÇÃO	05:30 às 23:14	5:30 às 21:00	05:30 às 22:35	05:27 às 23:00	05:30 às 22:15	06:00 às 19:00

## CARIRI LINE

The Cariri line is a simple one, made up of vehicles called TRAM and is part of the Cariri Region, 490 kilometers from Fortaleza. These vehicles circulate without signage and with station licensing. The VLT serves important cities such as Juazeiro do Norte and Crato.

Metrofor is a system in formation, which carries out 60,000 trips/day, distributed along its 5 lines, covering seven municipalities.

In these first months of management at Metrofor, we encountered some difficulties. The reduced number of employees at the CCO, train drivers, stations and maintenance makes it difficult to carry out shifts, training, medical examinations, inspection and monitoring of services, combined with the agreed 6-hour working day. The low fare value and lines with free passage, the lack of physical and fare integration between modes and the lack of signage impose operational restrictions, with 74 level crossings, increasing the possibility of accidents, vandalism and robberies at stations. The precarious conditions of the road

maintenance, the opening of holes in the walls, the lack of materials, the lack of operation and maintenance engineering and, mainly, the scarcity of financial resources become a challenge for our management.

In the face of these adversities and with a small but competent and committed technical team, we created a committee to develop new operational procedures and review existing ones.

As a result, we had a significant reduction in the number of vandalism related to cable theft, in addition to giving new dynamics to access requests for maintenance services.

Other processes are underway, the results of which will come over time and with the financial resources that will be released.

The actions are as follows: • Control contract deadlines; • Start bidding processes; • Reactivate the CCO communication system with the stations; •

Implement signaling on the South Line and on the Northeast Line; • Remodel the West line, remobilize the Sobral North and South Line and remobilized sail the Cariri Line;

- Install passive security on the Line South with surveillance cameras and lighting in places most susceptible to vandalism; • Recover and demobilize VLTs and immobilized TUEs;
- Develop partnerships with the Security Secretariat and City Halls; • Revitalize visual communication by installing stickers inside trains and panels at stations; • Develop agreements with other operators; and • Change Metrofor's organizational structure.

In this way, the concepts of innovation and the processes being implemented will make Metrofor grow and become a reference company, respected and recognized for its services on the national scene.

### Victor Wilson Garcia

Electrical engineer -  
Electrical technician; Health  
and Safety Engineer  
Work

He worked at RFFSA,  
CBTU and CPTM; Works at  
Metrofor as Director of  
Operation and Maintenance  
since June/2023



## INNOVATION MANAGEMENT IN FIGHTING FIRE

The railway map, both in Brazil and throughout the world, it has undergone a technological evolution, becoming increasingly important in various economies, not only in the transport of people, but also in terms of cargo.

A fundamental vector in this context concerns security. We have even observed an increase in innovative initiatives with an increase in new fire-fighting technologies, increasing competitiveness.

Many concession contracts are being lined up, and CPTM itself has already stopped operating two lines that currently belong to the private company. But, at the same time, privatizations never stopped the evolution of CPTM, demonstrating its ability to serve the population and obtaining a lot of prestige with demonstrations of effort and professionalism in competitiveness processes, which is evident in surveys of the company's customers. .

A typical example of the modernizations achieved by CPTM occurs in the areas of fire prevention and fighting, with the development of courses, lectures, simulated exercises, fire brigade training, regularization of buildings and the incessant search for modern equipment, always aiming at necessary safety for millions of customers who use the compositions daily.

We can highlight that today our Operations Control Center – CCO, located in Brás and considered the “heart” of the company, has modern fire prevention and firefighting systems as active and passive protections in the building.

Fixed CO2 systems, using a battery of cylinders installed on the technical floor, are automatically activated in the event of a fire, flooding the rooms

existing fires, extinguishing fires and, at the same time, causing the least possible impact on equipment used in train operations.

In addition, the building has a generator, emergency lighting, smoke detectors, fire reserve, hydrant system, portable equipment for use in fire outbreaks, alarm system and employee training with fire brigades. , not to mention that a hired civil firefighter remains on site for 24 hours a day and carries out periodic inspections of the CCO's facilities.

When we shift the focus to our Stations, we can state that all of them are extremely safe in terms of fire load as they have wide exits and, thanks to the existing physical configuration, normally at the same level as the streets, they do not run the risk of concentration of smoke in the premises, in addition to enabling rapid evacuation of the location in the event of a probable accident.

But CPTM continues to always seek advances in the area of preventing and fighting fires, being attentive to new technologies and innovations with regard to the protection of lives and property, in addition to implementing everything that exists best on the market.

Proposals for new technologies are constantly presented by industries, aiming to reinforce the safety of people, goods, services and physical installations. It is important to analyze these new proposals in order to further improve our Railway Stations.

The European Commission, in particular, launches several research projects that are of interest to railway companies.

Two aspects to consider:

• **Station Protection** – which includes all aspects related to CCTV, analysis of suspicious abandoned objects and security risks regarding planned spaces and materials used in physical constructions. • **Rail protection** – with a special focus on the identification and detection of suspicious objects placed close to the permanent route. Another preponderant factor to be commented on are the fires along stretches of railway lines with the concentration of easily combustible materials, such as the concentration of sleepers, both new and replaced, which can cause accidents , hitting the air network and interrupting train circulation.

In these cases, we observe that any accident, located on stretches of line where there is no access for Fire Department vehicles, can pose a very high risk of train stoppages.

To this end, among the innovations to be highlighted, there is the project to use a platform adapted for fighting fires, along the stretch of roads, with circulation on the lines, thus covering blind spots where previously it was not allowed to operate. combat with Fire Department vehicles.

This platform, strategically located at some point on the railway network, could hold a water tank measuring approximately 10m<sup>3</sup>, with a fire pump powered by a generator, cabinets containing equipment such as hoses, nozzles, wrenches, shovels, hoes, equipment personal protective equipment, flashlights, fire extinguishers on wheels, trailer type, etc.



Contact has already been made with the Rolling Stock and Workshop Maintenance Management to provide support in the implementation of this embryonic project.

On the other hand, we are always attentive to what is best on the market so that we can equip our facilities with cutting-edge equipment.

In order to improve the conditions of our Stations in terms of fire safety, we must necessarily seek innovations in technology, such as:

### Mixed Water Extinguishers

These are relatively new and use a fine spray of "deionized" water to cool and smother fires. They are effective in class A, B fires and can be used in class C (electrical equipment), as water in spray form does not conduct electricity, in addition to causing less damage and impact on the environment.

### Sound Wave Extinguishers

This is an innovative concept that uses low-frequency "sound waves" to disrupt the combustion process and extinguish the flames.

Still in the experimental stage, they promise to be effective in any class of fire without the need for the use of chemicals or water. It is very effective in confined spaces.

### Aerosol Fire Extinguishers

Another piece of equipment that uses a fine mist of particles composed of potassium to interfere with the chain reaction of the fire. They are easy to use and require little maintenance, not requiring regular pressure inspections.

### Smart Fire Extinguishers

These are extinguishers equipped with sensors, cameras and wireless communication to monitor and report conditions and location. They can also alert our passengers and emergency services in the event of a fire.

### Colored Extinguishers

Sometimes, difficulties arise on the part of those who use extinguishers and cause confusion, as the equipment has the same color (red), and these "colored" extinguishers can greatly facilitate the selection for the purpose of each type of fire.

### Ecological Fire Extinguishers

These are extinguishers that use "environmentally friendly" materials and focus on reducing harmful effects on human health and the environment, such as the ozone layer, global warming, toxicity and pollution.

### Ecofire Fire Extinguisher

Ecofire is a dissolution of natural products in water, intended for extinguishing and preventing fires, with an effectiveness between 30 and 40 times greater than water with an almost zero reduction in risk to firefighters and accident victims.

- ÿ It is 100% ecological;
- ÿ Its main virtues are safety, respect for Nature and being very effective.

### Security

- ÿ Lower risk for those fighting fires;
- ÿ Immediate reduction in temperature, which allows you to act closer to the fire outbreaks;
- ÿ Composition of 100% natural products;

- ÿ Cuts smoke immediately, thus preventing operator poisoning; ÿ Harmless to people nearby, not irritating the skin, eyes or nasal passages. Reduces risks for those who apply and protects injured people; ÿ Does not generate toxic gases;

- ÿ It is not a corrosive product, thus protecting equipment.

### Efficiency and speed

- ÿ Acts 30 times faster than water and other agents to extinguish fires;

- ÿ Completely extinguishes the fire, preventing reignition;
- ÿ It is easy to adhere to all surfaces, maintaining its properties and making it easy to clean with water;
- ÿ It is effective in electrical fires;
- ÿ Specially created for quick intervention, reducing losses and deterioration;
- ÿ Does not require maintenance;
- ÿ Has a long warranty period (5 years);
- ÿ Uses a small amount of extinguishing agent to put out fires (1 liter of Ecofire equivalent to 40/50 liters of water);
- ÿ 100% effectiveness in high combustion materials;

### Prevention

- ÿ Acts as a fire barrier;
- ÿ Thermal insulation;
- ÿ Ideal for spaces that are difficult to evacuate, because it quickly "suffocates" toxic gases;
- ÿ Prevents the spread of fires, being perfect in the presence of winds and climate changes.

### Extinction

- ÿ Between 6 and 10 times faster than water and other combat agents;
- ÿ Total extinguishment of the fire, avoiding reactivation;
- ÿ Direct and easy application;
- ÿ Does not transmit heat;

### Ecological

- ÿ 100% ecological, 100% organic and 100% biodegradable;
- ÿ Harmless to animals, people and plants.

#### Cel. Leopoldo Augusto Corrêa Filho

Studied Fatec; Firefighter Course for Officers; Police Supp. Course; Bachelor of Business Administration - Mackenzie; MBA - Strategic Management - Anhembi Morumbi; He held a Management and Technical Advisor position at CPTM since 2004.



# Innovation and LGPD: how to establish a competitive advantage

The General Personal Data Protection Law soais (Federal Law 13,709/2018) enters its fourth year of validity, presenting a data protection culture that is still young, compared to the European trajectory, but in a constant process of development.

The addition of the protection of personal data to the list of fundamental rights and guarantees of the Federal Constitution in 2022, through the insertion of section LXXIX in its Article 5, corroborates the latest advances perceived. The fact represents a milestone, especially given the current context of society's inclusion in the universe digital.

As a legal parameter, it can be said that there has been an accelerated maturation of the country's Courts. A number of relevant decisions on the LGPD were observed, opposing projections constructed at the emergence of the Law, which understated the issue of personal data protection, characterizing it as a "passenger" issue with no prospects for concreteness. , What is not true. This is why a legal security

scenario in compliance with legislation, with good practice policies and rules, together with the implementation of data governance programs, reflects the commitment of leaders in a comprehensive and transparent way.

It is worth mentioning two concepts arising from tes of the Law for the development of a culture of data protection and for the adaptation of new paradigms to privacy rules: **(i)** the need to incorporate privacy as a standard (Privacy by Default); and **(ii)** privacy by design, at all stages of a given system,

## PROTEÇÃO DE DADOS: ACOMPANHANDO IDEIAS INOVADORAS DO INÍCIO AO FIM



project, business, process and activity (modeling, operation, management and closure).

One of the advantages arising from the adoption of the Privacy by Design and Privacy by Default concepts is the trust that the organization will gain from its stakeholders. Practices are essential components, especially to avoid future legal problems, as the adoption of concepts minimizes the impacts resulting from possible security incidents.

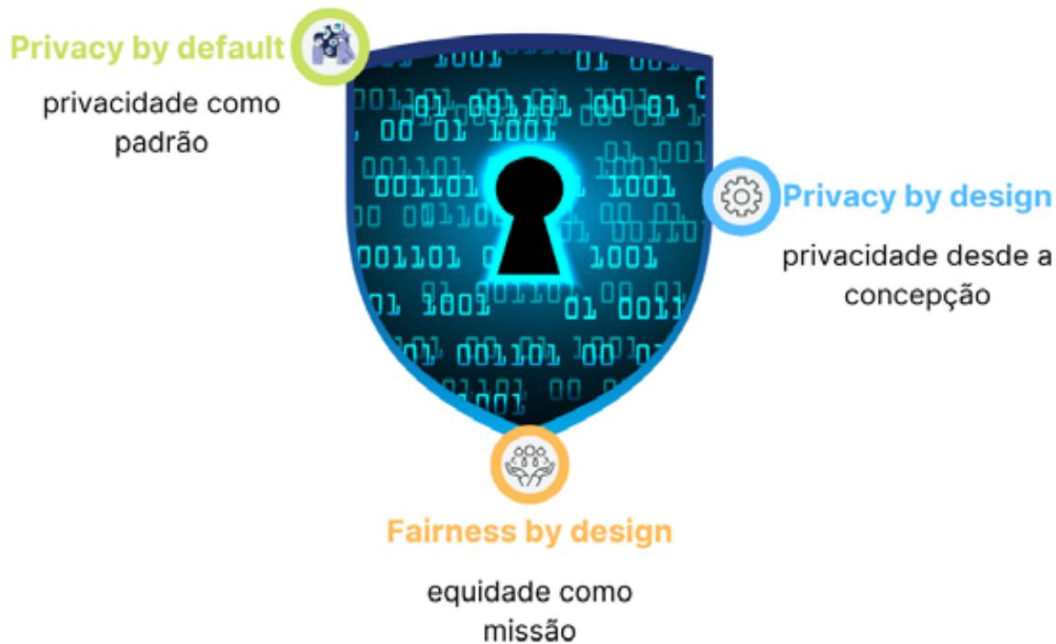
In relation to new projects, the LGPD brought a new legislative paradigm,

tailored to processing activities, whose personal data are input for new business models and potential investments in innovation. In this sense, Privacy by Design must not absolutely impede innovative activities and ideas. It must ensure compliance with laws, allowing the reduction of conflicts and also becoming an effective differentiator

competitive.

As an example, the use of Artificial Intelligence (AI) to use facial recognition and machine learning, among others, can generate positive externalities in the provision of public services. It's worth it





consider another essential concept resulting from these advances: Fairness by Design, which is equity from the beginning and as a mission to be pursued to mitigate discrimination. The application of Fairness by Design ensures respect for equity, in other words, equal opportunities.

The creation of a Privacy and Data Protection Department at CPTM demonstrates senior management's commitment to fostering innovation, while at the same time seeking to guarantee citizens' fundamental rights. Furthermore, the engagement of everyone in the Company is vital for the successful implementation of the three concepts, as well as for the consolidation of an organizational culture of privacy and equity.

In a recent event promoted by the Ministry of Science, Technology and Innovation, in partnership with the German government – “Brazil-Germany Digital Dialogues”, a statement by Waldemar Gonçalves, director-president of the National Data Protection Authority – ANPD, on the development of the Artificial Intelligence regulatory sandbox, meets the deconstruction of this dichotomy between LGPD and innovation – “LGPD cannot be

disrespected, but we must not hinder innovation.”

When we analyze the current panorama, it appears that the protection of personal data and innovation are complementary and indispensable for the advancement of society. And more! This conjunction is the guarantee that we continue to develop respect for the privacy of individuals.

It is essential to understand that, with the advent of the law, continuous monitoring of both the evolution of regulations and the harmful sophistication of numerous threats became a true imperative for corporate management. We are increasingly observing discussions about the position of information security and cybernetics in corporations, considering a scope that goes far beyond Information Technology (IT) and with more focus on risk management.

Therefore, the processes defined by processing agents related to innovation must be grouped with internal Governance rules, so that the personal data cycle can be imbued with total security, transparency and, no less important, accountability.

The ability to innovate is important today

missionable to organizations from the most different segments, in an increasingly digital world. And a customer aware of the protection of their personal data, combined with innovation processes guided by ethics, are ingredients for the full development of companies that seek excellent management.

The scenario shown is clearly that of a demand for the intensification of a culture of data protection which, by bringing immense challenges to legal operators, public and private companies and their managers, transfers countless benefits to society as a whole.

<p><b>Olivia Shibata Nishiyama</b> Studied Public Administration at FGV/SP; MBA in Public Management at FGV/SP; postgraduate degree in Innovation Management and Digital Law from FIA; He has EXIN DPO certification. Head of Department Privacy and Data Protection and DPO of CPTM.</p>	
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# INTEGRATED SYSTEM OF PROFESSIONAL TRAINING CENTER ENGINEER JAMES C. STEWART

The first railways in Brazil appeared in the mid-19th century. During this period, professional education was still in its infancy and was closely linked to practical learning and trades. Often, railway workers themselves (many of them immigrants with experience in their countries of origin) were responsible for training and training new professionals. It was “in-practice” training, in the workplace.

At the end of the 19th century and beginning of the 20th century, the first professional schools emerged in Brazil, such as the Liceu de Artes e Ofícios and the Escolas de Aprendizes Artífices, whose objective was to train qualified labor to meet the growing industrialization of the country, still in its initial phase.

With the creation of the National Industrial Learning Service – Senai in 1942, professional education gained a significant boost. During this period, which encompasses just over fifty years of our history, it is possible to verify how much the creation of structures that still exist today in Brazilian professional education, such as SENAI, were nourished by the good experiences of professional training for railways.

Roberto Mange himself, creator of Senai, highlighted, while still alive, how much the educational foundations of this body owed to professional education on Brazilian railways.

Railway professional training in its most modern aspect began in 1943, in the workshops of the São Paulo Railway – SPR and, later, with appropriate facilities, it was transformed into the Escola Profissional Ferroviária de Paranapiacaba (1951).

In 1954, another institution began its activities, called Escola Profissional Ferroviária da Lapa. With the creation of the Federal Railway Network – RFFSA and the event of the Rede/Senai Agreement (1961), they were renamed: Escola Senai Ferroviária de Paranapiacaba and Escola Senai Ferroviária da Lapa.

Gradually, after a boom in road transport in Brazil and with the recognition of the strategic importance of railways for sustainable development and national logistics, especially when it comes to intermodal connections and urban transport, there was a resumption of investments in sector.

This generated an increasing demand for trained professionals. Technical and vocational education institutions reinforced actions aimed at the railway sector, resuming and renewing the interconnection between professional education and the railway.

From this trend, emerges the unification of the two schools, Paranapiacaba and Lapa, into a single Learning Center, with the founding of the São Paulo Professional Training Center (1972), which was later named the Professional Training Center.” Engineer James C. Stewart” (1975).

The choice of name is a tribute to gift to engineer James Cleghorn Stewart, born in Edinburgh, Scotland, on 11/23/1890. He was hired in London to work on the former São Paulo Railway – SPR and came to Brazil in 1913, standing out for his ability and dedication.

Stewart reached prominent positions in the company and died on 8/4/1973, when

was still active.

Since 1994, the “Engenheiro James C. Stewart” Professional Training Center has been maintained by the Companhia Paulista de Trens Metropolitanos – CPTM, through a technical cooperation agreement with the National Industrial Learning Service – Senai, and aims to The main objective is to provide **professional qualifications to young apprentices**, training **capable and qualified professionals** for the job market in the metro-ferro-metal sector.

The Training Center trained, trained and qualified more than 10,000 people, including students and employees, using the concept of simulation as a teaching resource. Simulated learning resources are fictional or virtual representations of real-world situations, environments, or tasks designed to create a hands-on learning experience.

The use of simulators facilitates the teaching and learning process and promotes early experience of the most relevant professional situations that the student, future professional, will face in their daily lives. Furthermore, interactive and dynamic teaching resources, such as simulators, made learning more engaging and interesting

for students.

Among the advantages of this resource in workforce training, the following stand out:

- **Controlled practical experience:** Simulated teaching resources allow apprentices to practice their skills in a controlled environment and safe, in which errors have no real consequences.



- **Realism:** Good simulations are designed to resemble as closely as possible the real situations that workers will face. This helps create an engaging and immersive learning environment.
- **Complex scenario training:** On the railway, scenarios can be complex, dangerous or expensive to reproduce in reality. Simulations allow students to practice in these scenarios in an economical and safe way.
- **Immediate feedback:** Simulations can provide immediate feedback to learners, allowing them to identify errors and areas for improvement immediately. This speeds up the learning process.
- **Active learning:** Active participation in simulations engages learners on a deeper level than simply reading or listening. This can result in better information retention and understanding.
- **Adaptation of challenges:** Simulations can be adapted to meet each learner's skill level. This ensures that training is effective for individuals at different stages of development.
- **Saving resources:** Applying simulations can save time and resources, especially when it comes to avoiding the use of real equipment or resources for training.

Over time, the courses offered by the Training Center were gradually directed towards more specific areas, in response to market demands:

UNTIL THE 1990s	FROM 1990 TO 2010	AFTER 2010
<ul style="list-style-type: none"> <li>• <b>Electrician</b></li> <li>• <b>Turner</b> <ul style="list-style-type: none"> <li>• Milling machine</li> </ul> </li> <li>• <b>Mechanical adjuster</b></li> <li>• <b>Locksmith</b></li> <li>• <b>Boilermaker</b></li> <li>• <b>General Mechanic</b></li> <li>• <b>Locomotive Electrician</b> Electric Diesel and TUE</li> <li>• <b>Engine Mechanic</b> Electric Diesel Locomotives</li> <li>• <b>Maintenance Mechanic</b> Pneumatic Equipment</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Systems Technician</b> Rail Transport Mechanics</li> <li>• <b>Systems Technician</b> Electronics from Rail Transport</li> <li>• <b>Transport Technician on Trails</b></li> <li>• <b>Administrative assistant</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Maintenance Technician</b> Metrorail Systems</li> <li>• <b>CAI - Electrician</b> Electronic Maintenance</li> <li>• <b>CAI - Train Driver</b> Metropolitans</li> <li>• <b>Administration Technician</b></li> </ul>

The Training Center has received several awards over the years, with emphasis on:

- **2004** – Winner of the FAT award – Technological Support Foundation – Project: Simulation as a Teaching Resource in Professional Railway Technical Education;
- **2005** – INOVA SENAI Award – Bronze Medal – “Semper On” Project (Category – Equipment);
- **2006** – INOVA SENAI Award – Gold Medal – “Always Light” Project (Category – Equipment); III Prize Alstom Metrorail Technology - Honorable mention;
- **2007** – IV Alstom Metrorail Technology Award – Honorary Mention sa;
- **2008** – Revista Ferroviária – Best Educational Institution – INOVA Award SENAI – Gold Medal – Project SEPTRO – Electronic System for Wheelset Lock Prevention (Category – Maintenance) – V Award Alstom Metrorail Technology - Honorable mention;
- **2009** – Winner of the FAT award – Technological Support Foundation – Award: Didactic Railway Station Project; SAW Alstom Metro-Rail Technology Award; Honorable mentions for CPTM, 4 projects by CFP students;
- **2010** – 1st place – VII Alstom Award for Metrorail Technology – • “Easy Glass” Project (Category – Maintenance);
- **2011** – SILVER MEDAL AT “INO-VA SENAI” 2011 – SLAT Project – Lock Release and Hinged Windows System (Category – Maintenance) – Mario Covas Award – FUNDAP
- **2012** – GOLD MEDAL AT PAN-TOLUB – UBM Technology Award
- **2013** – GOLD MEDAL AT “INO-VA SENAI” 2013 – SAAT Project – Approaching Train Warning System (Category – Maintenance).

## Stay tuned

The Training Center also consists of the following learning environments:

- Classroom;
  - Library;
  - Auditorium;
  - Technical Design Laboratory;
  - Electrical Commands Laboratory;
  - Computer lab;
  - Digital and Analog Electronics;
  - Hydraulics and Pneumatics;
  - Metal Mechanics;
  - Logical and Programmable Command;
  - Metrology / CNC;
  - Electricity;
- **Specific Laboratories:**
- Operational Control Center Simulator;
  - Train Simulator;
  - Didactic Railway – Signaling;
  - Didactic Railway – Permanent Way (AMV);
  - Didactic Railway – Aerial network;
  - Didactic Railway Station;
  - CPTM workshops, shelters and laboratories.

Periodically, CPTM makes public the opening of registrations for the Selection Process **with a fixed deadline**, to fill vacancies for the position of Student Apprentice, in the CAI Courses – Metropolitan Train Driver and Technicians in Administration and Maintenance Senai Metro Railway Systems – National Industrial Learning Service. The selection process is carried out by Senai-SP.

During the duration of the course, the apprentice student receives an aid grant corresponding to 1 (one) minimum wage in the first 12 months and 1.5 (one and a half) minimum wage from the 13th month. In addition, apprentices receive benefits such as health and dental plans, food vouchers, transport vouchers and meal vouchers.

The courses last 8 hours a day and take place in the morning, from 7:30 am to 11:30 am, and in the afternoon, from 1 pm to 5 pm.



Didactic Railway – Aerial network



Didactic Railway Station



CPTM workshops, shelters and laboratories

The basic requirements for registration are:

- **Education:** having completed high school.
- **Age:** be at least 18 years old on the start date of the course and, at most, be able to complete the course before turning 24 years.

The professional training period comprises two phases:

- **School phase:** taught at Senai, in which the apprentice receives technical-professional qualifications;
- **Professional/administrative practical phase**

**Tractive:** carried out on CPTM premises, in administrative activities or professional practice, according to the course in which you are enrolled.

**Professor Ivan  
Aparecido de Souza  
Moreno**

Pedagogue from Nove de Julho University and postgraduate degree in Administration from Fundação Getúlio Vargas – FGV. Manager of Organizational Development and Human Resources at CPTM since 2019.





# CONSTRUMAX

## 14 years Getting On Track

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Accessibility from Student Station

Accessibility from Gianetti Station

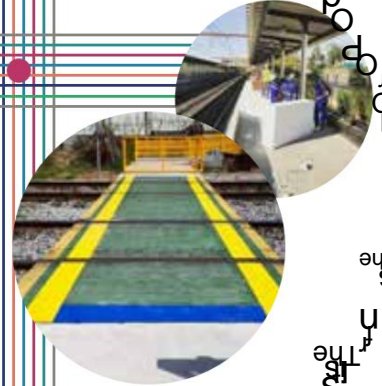
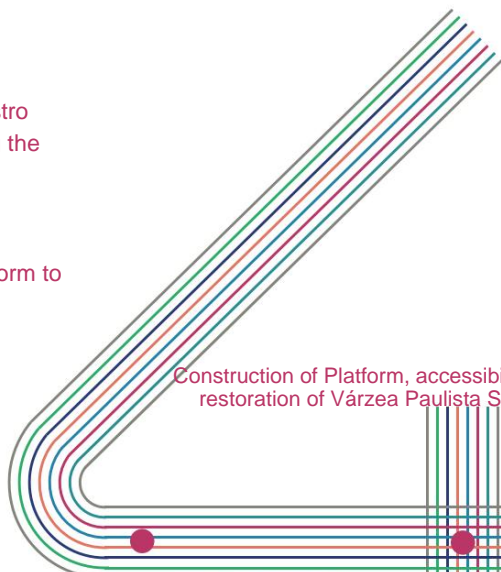


Construction of Boulevard Maestro João Carlos Martins, connecting the Luz Station to Sala São Paulo

Walkway from the Central Platform to Rua José Paulino



Infrastructure Works in Construction of Platform, accessibility and restoration of Várzea Paulista Station



Engineer Ivan Alberto  
CEO

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+55 11 98529-7494





## THE FUTURE OF PROJECT MANAGEMENT RAILWAYS WITH USE ARTIFICIAL INTELLIGENCE

Since the beginning of the installation of railways, echoes the rhetoric that machines will replace men, redefining the industry scenario and, consequently, the direction of railway project management. However, the topic has never been as much on the agenda as in recent times, driven by the advancement of Artificial Intelligence (AI) and its innovative applications in the scope of project management.

The search for machines capable of performing tasks that require human intelligence dates back centuries. It was during the Dartmouth Conference, held in 1956 in New Hampshire, in the United States, that the term Artificial Intelligence was officially coined, marking the beginning of the field as a discipline.

dedicated research plan. Since then, AI has gone through several phases of development, evolving from systems based on rules and logic to more advanced approaches, with the creation of neural networks, the emergence of machine learning and innovations. recent developments using deep neural networks for complex tasks (deep learning). The exponential growth of data and the substantial increase in computing power in recent decades have driven the progress of AI, enabling disruptive applications in several sectors, including project management.

The intrinsic complexity of railway projects requires detailed management, as failures in any part can impact the entire system. Furthermore,

The territorial extension and continuous flow of cargo or passengers accentuate logistical and scheduling challenges.

It is estimated that approximately 70% to 80% of a project manager's tasks are classified as operational. Such responsibilities cover a wide range of activities critical to successful project management. This includes coordinating teams, constantly monitoring project progress, allocating resources to improve productivity and delivering high-quality results. Furthermore, the project manager is in charge of managing changes and risks, ensuring a continuous flow of information between all interested parties, resolving conflicts when they arise and

maintain strict quality control to ensure that established standards are maintained. In this context, AI performs a fundamental role, providing advanced tools for automating these demands with real-time information and proactive risk identification. This empowers the project manager to make decisions based on data, allowing for better management of complex projects.

When it comes to managing railway projects, AI plays a multifaceted and valuable role. It facilitates the optimization of resources, allocating teams and materials efficiently and identifying potential bottlenecks. It contributes to the analysis and prediction of risks, providing project managers with critical information to take preventive actions. Additionally, AI automates repetitive tasks such as data collection and reporting, saving time and resources. With the ability to analyze large volumes of data, AI offers insights important to support strategic decision-making and improve the project schedule, including for the preparation of the Project Analytical Structure (EAP). It adds value to quality management, continuously monitoring compliance with established standards, and can be applied to agile methodologies, automating processes.

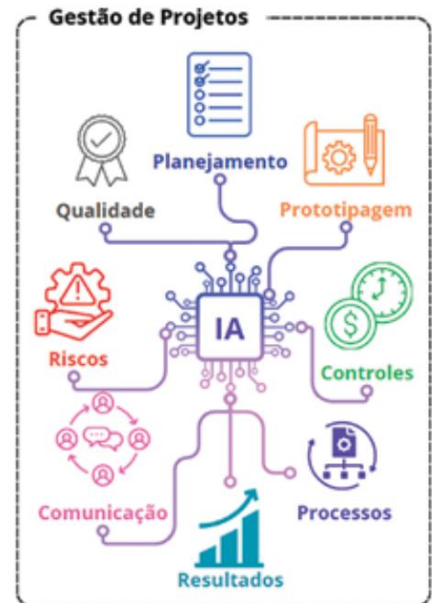
With the rise of Artificial Intelligence, the role of project managers is undergoing an inexorable transformation. In addition to traditional, hard and soft skills, these professionals must acquire so-called fusion skills, which include the ability to integrate AI and advanced technologies into project management. These skills involve a deep understanding of how AI can improve processes, as well as the ability to collaborate with AI systems. Project managers, by mastering these skills, become facilitators of interaction between humans and machines, ensuring that technology is an effective ally in project management

railways. This paradigm shift, moving from the search model (search for information) to prompt (the ability to obtain answers using AI), becomes essential for high performance in project management.

Despite the significant benefits that AI brings to the management of railway projects, its implementation is not free from challenges and ethical issues. Managing large volumes of data and ensuring their quality and integrity are complex challenges in railway environments that generate a huge amount of information. Data privacy concerns are a priority as AI collects and can use personal information to improve operation and security. Algorithmic transparency is another critical issue, as it is critical to understand how AI algorithms make decisions to ensure trust and compliance with regulations. Furthermore, liability in case of failure or incorrect choices made by the AI is a relevant topic to be addressed. The complexity of implementation, including integration with existing systems and customization to meet the specific needs of the rail sector, is an additional challenge.

Therefore, the rail industry must adopt a balanced approach to realizing the benefits of AI while addressing these ethical concerns and challenges to ensure the safety and reliability of operations.

It is worth highlighting that AI encompasses different technologies and is not limited to a chatbot. Very soon, organizations will have robust corporate tools at their disposal to certify the confidentiality and integrity of data. These powerful tools will not only enable project teams to make the most of the potential of AI by learning from the organization's own experience, but will also ensure information security by addressing concerns.



confidentiality tions in a personalized AI context.

The big revolution is to think about collaboration and not substitution. Artificial Intelligence is shaping tomorrow and, very soon, it will be an indispensable tool in the management of railway projects. The future of railways is undoubtedly intertwined with Artificial Intelligence, and this partnership promises to open new paths for mobility and innovation around the world. AI will not replace human talents, but it will expand their capabilities and enable effective collaboration between humans and technology, enhancing what we have to offer: creativity and adaptability. This synergy represents the next frontier in railway project management, promoting innovation and success in building a more connected

**Cibele Alves da Silva**

Civil Engineer and Master in Computational Technologies for Civil Construction by POLI-USP; Executive Advisor to DE/CPTM. Cultural Director of AEEFSJ.



## One of the largest sports, entertainment, culture and education spaces in São Paulo



The National Club was founded on February 16, 1919, initially organized by employees of the SPR – São Paulo Railway, and also becoming known as the “Clube dos Ingleses” and “Clube Ferroviário”. The history of Nacional AC is closely linked to the beginning of football in Brazil. The most illustrious employee of the SPR - São Paulo Railway, Mr. Charles Miller, returned from England in 1894 with footballs, uniform, rules of the sport and a great desire to teach and play football.



Today's Nacional AC is going through a profound process of transformation. There are more than 80,000 m2 of area that are currently being occupied, with emphasis on: Football Stadium, Sports Gym, 3 Football Fields, Society Football Courts, Beach Sports Courts, Padel Courts, Bars, Education Center, among other sports spaces, coordinated by President Ayrton Franco Santia-go.

Among the players revealed are Deco, Dodô, Kahê, Paulo César, José Carlos de Al-meida, Magrão, Cacau, Jair Picerni, Índio, Rubens Mi-nelli and the world champions, Félix "three-time champion" and the "five-time champion" " world championship in 2002 Cafu.

Come and be part of this important and historic Sports Club. Nacional Atlético Clube | São Paulo Football Heritage (nacionalac.org.br)



Fumtran – Fundação Memória do Transporte was founded in 1996 by the CNT – National Transport Confederation with the mission of preserving the memory, history and culture of Brazilian transport in all forms.

With the creation of the virtual museum Memória do Transporte Brasileiro, Fumtran found an agile and interactive format for communicating with society and an efficient way to disseminate values and precepts for the preservation and conservation of historical records in the transport sector.

One of the platform's objectives is to make items available in contexts that help visitors to better understand how essential the mobility of goods and people is for the evolution of society and the competitiveness of the economy. The virtual museum is a dynamic and continuous project, it is an open work, a never-ending work.

And to this end, Fumtran and AEEFSJ – Association of Engineers of the Santos to Jundiaí Railway, signed an important agreement on the collaboration of collections. An extremely important partnership that aims to make the history of rail transport everlasting.

“When you know where you come from, you begin to discover where you are going”



Access and discover our projects

### in memoriam

In July 2023, we had the irreparable loss of a great associate friend, Dr. Telmo Giolito Porto, who contributed a lot to the railway, always seeking benefits for the development of transport. The Association had the honor of honoring him by presenting the Fúlvio Grossmann Award (award before his death).

Dr. Telmo left it to transport on rails, especially in human development, welcoming and enhancing professional careers.





## Partnership: AEEFSJ x JICA



From left to right, Benedito Yamaguti, Ryunosuke Kataoka, Wellington Berganton, Masayuki Eguchi and Pedro Sugai.



TECHNICAL MEETING WITH THE JAPANESE COMPANY SAKAEGUMI CORPORATION | from left to right: Tsukasa Hirano, Tamotsu Kambé, Wellington Berganton, Yoshihiro Sasaki, Pedro Sugai and Takayuki Miyamoto.

At the end of the 1980s and beginning of the Permanent Roads and another in Signaling, each from 1990, sensitized by the needs of professionals who remained in Brazil to develop better solutions by studying and guiding the teams at STU/ for passenger transport over SP for two consecutive years. For a railway for Lines 7, 10, 11 and 12, services for a period of three months, there was also the allocation at the time under the responsibility of the CBTU – cation of three engineers with specialization. in Telecommunications, to support the then STU – Superintendent of Trains studies being developed by the Urban teams in the State of São Paulo, Dr. Telmo from STU/SP, since, at the time, we were Giolito Porto, signed an agreement with JICA specifying new Teleco technologies – Japan International Cooperation Agency, communications for Railway Systems, the scope of which included technical exchange, remembering that, at the time, we did not enjoy technological updates between railway engineers at CBTU and today available JR – Japan Railway Company, as well as that bilized by internet access.

carrying out training for engineers Many lessons were learned from CBTU – STU/ SP, in the specialties of carrying out these trainings via Permanent Roads, Signaling, Systems bilized by JICA, which offered these Energy and Rolling Stock.

same training models to others. Several courses were taught at JR – JAPAN rails Training Centers in Brazil, disseminating the knowledge of RAILWAY COMPANY in Japan, where the pro-ments offered by Brazilian and professional engineers. other Spanish countries for railway engineers had hosted for uninterrupted periods several countries.

from 90 to 120 days, to learn the technologies and procedures applied to JICA in Brazil, a training program in rail transport systems to train professionals in that country.

sions in the metro area, with a focus on management, to meet a request for operational system and specific strengthening of STU/SP technical teams, technology for operation and maintenance. JICA agreed with JR the allocation of two In the period in question, at the request of specialist engineers, one of which was from the Director of Operations and Maintenance of the

CPTM, Engineer Vitor Wilson Garcia, we have resumed consultation with the JICA team regarding the possibility of providing new training to railway engineers, following the example of those carried out in the past.

Through AEEFSJ – Association of Engineers of the Santos to Jundiaí Railway, supported by the management of CPTM and the JICA team, we followed the work carried out at the Luz station and on Line 13 by the company SAKAEGUMI Corporation, which carries out the recovery of concrete structures for the “Bala Train – Japan”, with the release of train traffic within 3.5 hours of the start of repairs.

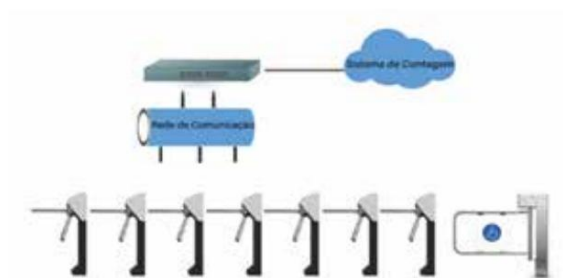
Within the established program, we participated in some technical meetings to publicize the solutions developed by SAKAEGUMI Corporation (low-cost solution and zero waste emissions), when the benefits of the technology developed were demonstrated to representatives of the São Paulo City Hall. Paulo/ SPObras, ARTESP – Transport Agency of the State of São Paulo, DER – Department of Roads and Roads, DAEE – Department of Water and Electric Energy, CCR – Via Mobilidade, IE - Institute of Engineering and IBRACON – Institute Brazilian Concrete and others.

In a meeting held at the JICA office on June 28, 2023, we received confirmation that it would be possible to include CPTM – Companhia Paulista de Trens Metropolitanos and STM – Secretaria dos Transportes Metropolitanos do Estado de São Paulo as possible participants in the project, formalized by the Protocol of Intentions – SERI-PRC-2022/00020 signed between the Government of the State of São Paulo and the Japan International Cooperation Agency, a project that aims to implement joint actions of mutual interest.

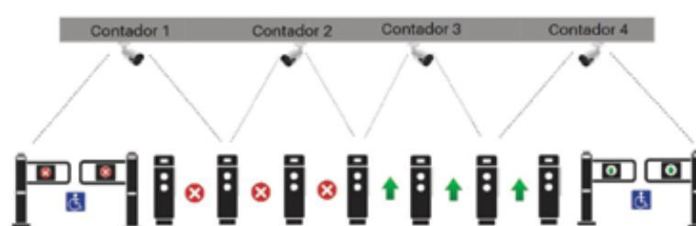
This document clarifies that the development of projects will be promoted based on work presented by the Working Groups, among them, GT1 – Environmental Management and Infrastructure, in which CPTM and STM were invited to participate by the Secretariat of International Business of São Paulo, whose first meeting was held on August 2, 2023.

# Control and Counting Devices

## Passengers in Operational Integrations



Conventional Counting System



Hybrid Counting System – Photosensor and Cameras

Among the various projects aimed at improving Urban Mobility, we have the necessary integration between public/rail transport operators, integrations that allow the transfer of passengers between different companies and systems, most of the time without charging a supplementary fare.

These transfers must be quantified, whether to control the flow of passengers or for reimbursement between different operators.

In this context, the systems traditionally used provided for the use of blocking lines similar to those intended for payment of travel rights, but without the need to present magnetic tickets (Ed-monson) or smart card devices (smart cards with or without contact) to release the ticket.

Due to the typology of this type of solution that imposes an impediment to the free passage of passengers, other alternatives were developed that enable the transfer of users without the placement of physical barriers caused by the tripod, a component used to count transfers.

Around 2015 and 2016, there was a proposal for a solution, with the installation of

video cameras, which would detect and count people moving through a previously delimited area, using specific software that detects the passage of people using computer vision/artificial intelligence and detection. At the time, this proposal was not well evaluated, due to the high implementation costs and low assertiveness in ticket counting.

In recent years, other options have been developed, among them we can mention the DCE – Electronic Counting Device, whose quantitative verification of the transfers of people from one system to another is done through the installation of photosensors positioned and distributed at two different heights on small totems, which identify the presence of passengers and/or objects within a corridor formed by the installation of these totems, which count passenger passages in both directions, in addition to storage and communication of this data to the station's supervisory software, which controls the operation and functionalities of the devices/totems.

These devices have visual indications that guide which path passengers should follow to

carrying out the transfers, however, the installation of these totems still represent an impedance/barrier to the free movement of passengers and still present an error in the counting of these tickets.

Another proposal is being evaluated by transport operators, a solution that proposes the integrated use of the implementation of video cameras and totems on the same counting line, a proposal that results in greater assertiveness in counting, however, it imposes an impediment to free movement and presents a higher implementation cost.

It is important to highlight that, as new needs arise, new technological solutions are developed by engineering, whose biggest challenge is to present planned and feasible solutions from a technical, economic and social point of view.

**Pedro Kenje Sugai**

Engineer  
Electrician and Technical Director of  
AEFJSJ Management 2023/2025







**Ligando Pessoas,  
Trilhando Caminhos**

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### **Referência no Setor Metro-ferroviário**

No desenvolvimento de projetos, Consultoria, Planejamento e Gerenciamento em Sistemas de Energia Catenária de Tração Rígida e Convencional. Em implantação e manutenção de obras de Via Permanente, Sinalização, Material Rodante e Telecom. Utilizando os melhores equipamentos, Desenvolvimento e implantação de Softwares de Manutenção e Controle.





# Four decades of railway

With 41 years of professional experience, and 12. Already at CPTM, he created the railway dicated system, the electrical engineer-Access Request (SSA), which began at Edson Barbeiro Artibani collects many on Lines E and F, moved to Lines A and stories, mainly about challenges D and then lines B and C, current 8 and 9. O overcome over these four decades. procedure streamlined access management. In 1982, he joined the railway network, retiring the Telex machines, the Federal (RFFSA) as an electronics technician who facilitated the process between the CCO and the signaling area. preventive maintenance and construction areas.

The following year, he married Stella, In 1998, as Tração coordinator, the companion who always supported him. "It was Lines E and F that actively participated in the launch of Expresso Leste, an inno-caring service for our family, that reduced the distance between the area and studying, as I began to study central engineering. and the East zone, which had the famous industrial electric train at Faculdade Santa Cecília and the Spanish train fleet. dos Bandeirantes, in Santos, a year before he was transferred to the Engineering Department to join the railway", he reveals, excited. In the Operations department, in 2001, Artibani started as a technical assistant, then became head of the department and, later, management, remaining in

It was a heavy journey, as, in addition to working all day, Artibani traveled to Santos every night. At that time, his first daughter, Fernanda, had been born, and he says he was only able to see her on weekends. Even with all this sacrifice, he continued on and had the opportunity to be hired as an engineer at CBTU in 1987. Two years later, Roberta, the youngest in the family, was born.

"At CBTU, I had the honor of working with the engineer Eduardo de Arouca, who has now passed away", says Artibani. Arouca was a reference consultant in railway transport, advisor to the presidency and had a lot of faith in the young engineer. At that time, the CBTU transported around 700 thousand passengers per day, but it was already estimated that this number would jump to three million in the following decades.

With the aim of enabling the system to serve this volume of people, the company developed some projects. So, Artibani ended up working on the study to implement the third route on Lines A and D, currently 7 and 10. In addition to the great added knowledge, the project sparked his interest in working in the Operation.

This is how, in 1990, he debuted as coordinator of the Operational Control Center – CCO of Lines E and F, currently 11

the area for 18 years. In parallel, he managed the agreement with MRS Logística SA

The engineer also specialized in PECE/ USP Metro Railway Technology and served as an advisor at CREA for three terms.

Between 2018 and 2022, Artibani presided over the Association of Engineers of the Santos to Jundiaí Railway – AEEFSJ, twice consecutively.

In his first term, he launched the special edition of the 150th anniversary of Ferrovia Paulista, at Sala São Paulo. The commemorative event for Ferrovia magazine nº 174 brought together numerous authorities. As president of the Association, he also presented the study on the impact of freight trains on the circulation of metropolitan trains, at the Parliamentary Front for Metro-Rail Transport (FTRAM), in Alesp. However, the biggest challenge was keeping the association active during its second term, which was highly impacted by the Co-vid-19 pandemic. "For me, it was essential to keep the Association in operation, as, in addition to being an important channel for disseminating railway engineering practice, the entity has always been very active in the sector and it was a delicate moment for society as a whole".

One of the engineer's greatest prides is the fact that he has been at CPTM since its creation. The Company inherited numerous obsolete systems and degraded rolling stock, which consequently had an impact on the service provided, with many incidents negatively impacting its image. "However, faced with this desolate scenario, our team did not weaken. On the contrary, everyone went looking for solutions to problems, with a huge willpower to change and look for alternatives to mitigate the problems".

"I followed the entire transition from 1992 onwards. So, it's been 31 years of this stable union", he laughs. "Today I see my contribution, even if small, in this process of modernizing CPTM, which has become a strong company and a reference in the metro rail sector". Currently, he works in the area of Concessions and Partnerships – ARC.

After actively working on the concession process for Lines 8 and 9, it is now participating in the concession process for Line 7 through a Public-Private Partnership – PPP, scheduled to be opened in February next year.

Artibani says he is happy with the opportunity to add new learning to his professional experience. "I'm getting ready to end my career, be able to travel more and 'enjoy' my granddaughter, Lorena, 3 years old, daughter of my firstborn, Fer-nanda. I am very grateful for CPTM and proud of my trajectory, but now it is the turn of young talents to bring new ideas, technologies and innovation. I am optimistic for what lies ahead", he concludes.

**Edson Barbeiro Artibani**  
Electrical engineer



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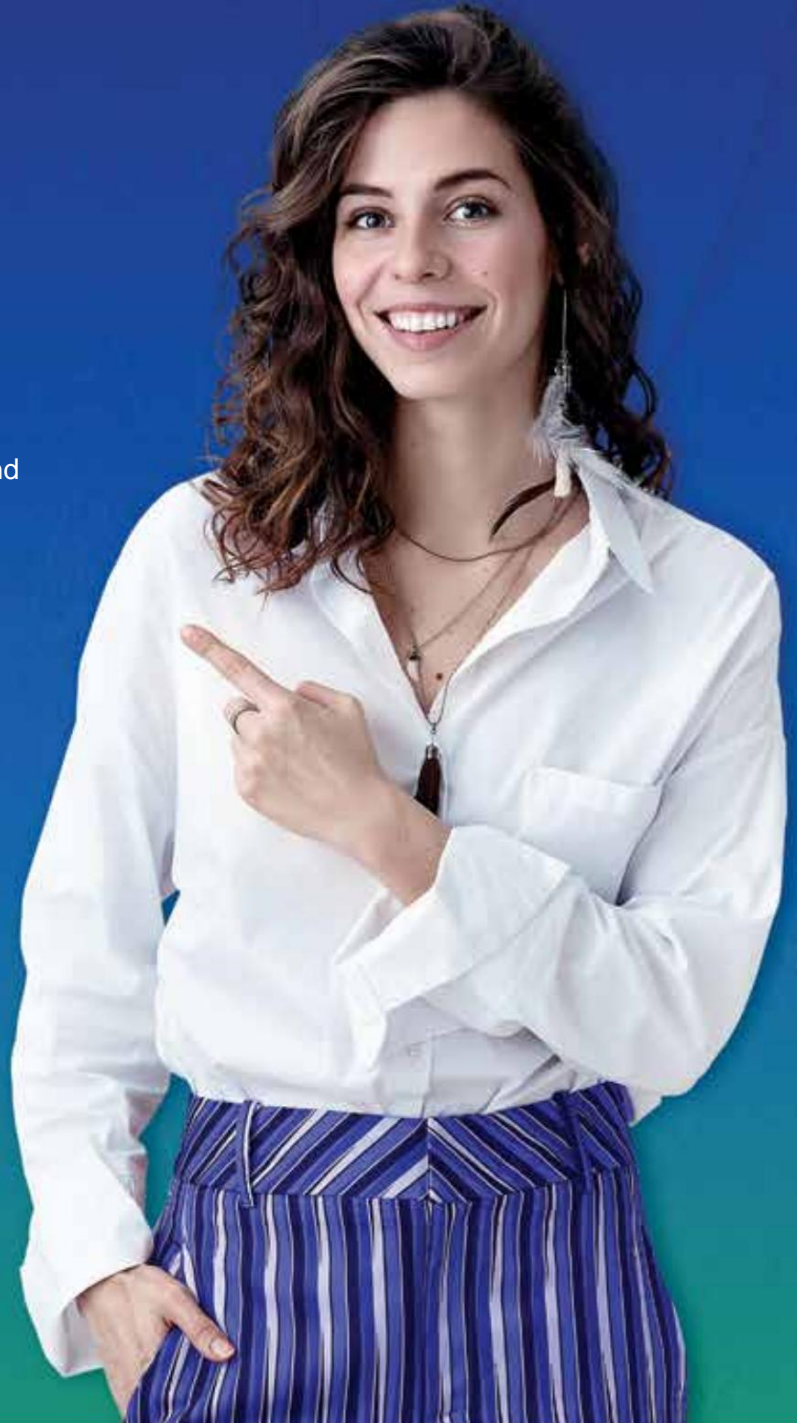
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