

How to modernize the rail system in Buenos Aires

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The purpose of these case studies is for INE to share its work in the region, the problems and challenges it encountered, and the lessons it learned. *How to modernize the rail system in Buenos Aires* was written by Alejandro Tarre, consultant, and Julieta Abad, Transport Division.

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How to modernize the rail system in Buenos Aires

Identifying the problem:
The metropolitan rail crisis

Tragedy revealed the urgent need to improve the century-old system, whose service quality had been declining for decades.

**In 2017 the Buenos Aires
Metropolitan Region rail
system transported 387
million passengers.**

The initial results of the reform were positive. But in the late 1990s, things changed. The economic recession and resulting fiscal pressure affected service and the State's commitment to the network. Performance fell and some operators were embroiled in corporate disputes.

The RMBA rail network was the first in Latin America and it was among the largest and most modern in the world for many years. It is still the largest in the region. It has seven lines, covering 831 kilometers, that come together in the center of the City of Buenos Aires. [The system transported 387 million passengers in 2017, 8% more than in 2016.](#)

The country's political and economic situation worsened: the recession continued, the debt crisis led to default, and there was an unexpected change of government in late 2001. In 2002, the new government decided to freeze fares for several public services, including the railway. This put the system under enormous financial pressure and led to ever-increasing dependence on subsidies, which persist to this day.

The network was nationalized between 1946 and 1948 and was managed by the State for several decades. Between 1994 and 1995, the seven lines were handed over to private operators, and the State issued a mandatory plan for remodeling and adding infrastructure, which it partially subsidized.

On February 22, 2012, a tragedy shook Argentina. A train on the Sarmiento line in the Buenos Aires

Metropolitan Region (RMBA) crashed into the buffer stops at Once Station. 52 people died in the crash, known as the "Once Tragedy". It was the country's worst train accident in the last 40 years. The Once

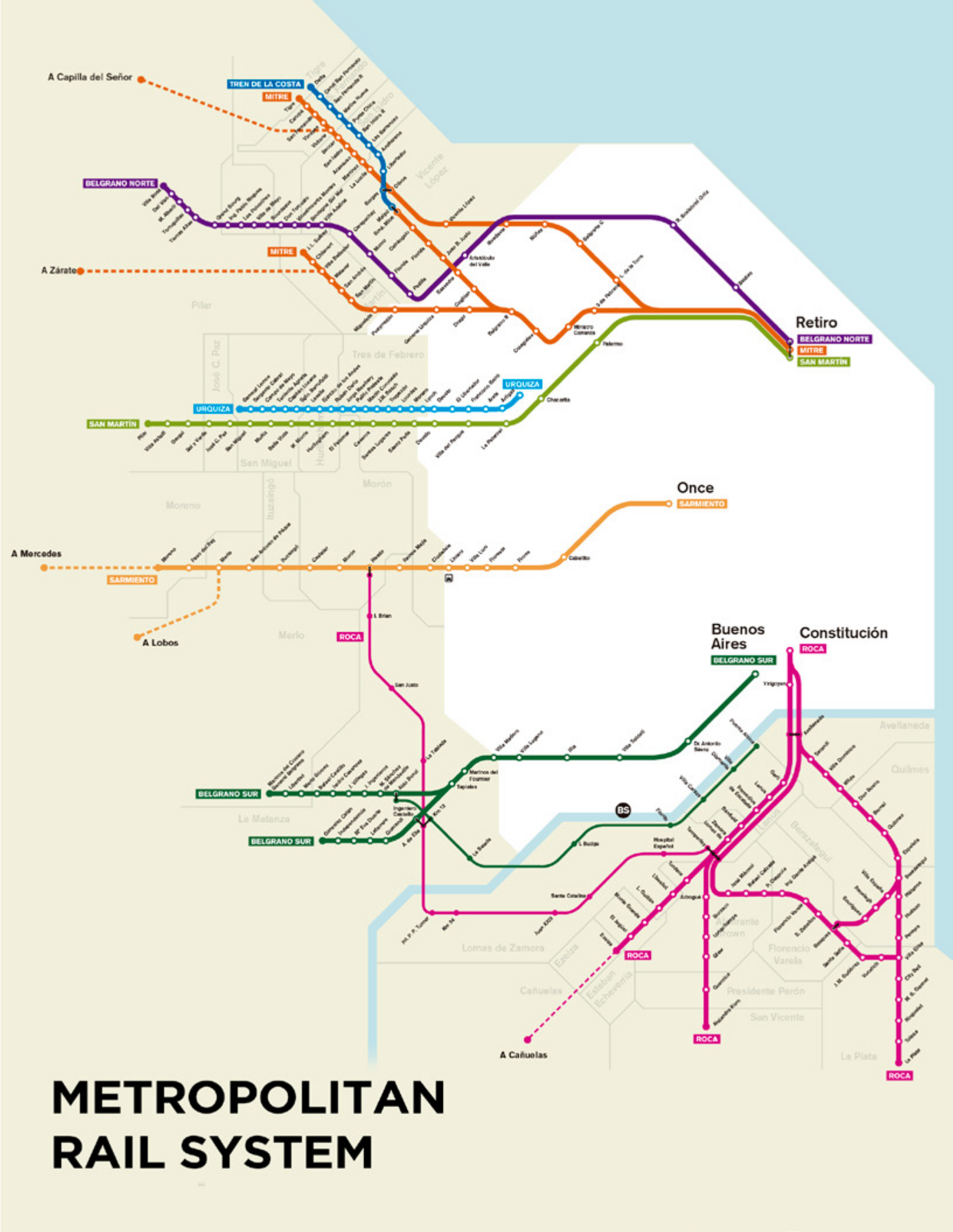
The economic crisis and the fare freeze exacerbated these problems. One by one, the concessions were canceled for non-performance and the State once again took over operations for nearly the whole network. Currently, only the Urquiza and Belgrano Norte lines have private operators and the rest are operated by the Operadora Ferroviaria Sociedad del Estado (SOFSE).

The decline in the quality of the passenger rail is evident. Ticket sales fell from 413 million in 2005 to 329.7 million in 2015, hitting a low of 236 million in 2013. The quality of service also declined: in 2009, almost 3% of scheduled trains were canceled, compared to 9% in 2015. The high was 15% in 2013. If the canceled trains are combined with the late ones, schedule adherence fell from 86% in 2009 to 75% in 2015, hitting a low of 63% in 2013. All of these numbers are much lower than the internationally accepted rate for efficient rail service, 95%.

Addressing the problem:
The Comprehensive Improvement Project for the General Roca Rail Line, Plaza Constitución-La Plata Branch

With 231 kilometers of rail and nine branches, the Roca line is the longest in the RMBA and the most important in terms of passengers transported: it had 151.4 million passengers in 2017. As with the rest of the system, the quality of service on the Roca line had been deteriorating for some time. By late 2014, only three of its nine branches were electrified, services were delayed, and users were forced to deal with high levels of overcrowding at peak hours.

**The RMBA rail system
needed an upgrade in order
to once again be an economic
and sustainable option for
hundreds of passengers.**



To improve the quality of its public transportation, the Government of Argentina asked the IDB for a US\$1.2 billion conditional credit line for infrastructure projects (CCLIP, AR-X1018) to rehabilitate the metropolitan rail lines. The CCLIP funding mechanism facilitates the financing of independent projects in the framework of a large-scale investment program while maintaining a shared vision. Given that the investment gap in the RMBA network will require continuous investment in the medium term to achieve tangible impacts on the population's quality of life, the CCLIP was considered the best mechanism to channel the Bank's support.

The Comprehensive Improvement Project for the General Roca Rail Line: Plaza Constitución-La Plata Branch is [the first CCLIP transaction](#), worth US\$300 million.

The Ministry of Transport, through the Central Executing Unit (CEU), is responsible for implementing the project. It maintains open and coordinated communication with multiple stakeholders, including Roca Line management, the Administracion de Infraestructuras Ferroviarias Sociedad del Estado (ADIFSE), and municipalities along the track.



The Comprehensive Improvement of the General Roca Rail Line: Plaza Constitución-La Plata is the first CCLIP transaction, worth US\$300 million.

Box 1

Program Information

Comprehensive Improvement Project for the General Roca Rail Line:

Plaza Constitución-La Plata Branch

Borrower

Republic of Argentina

Amount:

US\$500 million IDB: US\$300 million Argentina: US\$200 million

The loan is part of a Conditional Credit Line for Infrastructure Projects worth US\$1.2 billion

Project start date:

August 2014

Project Site:

City of Buenos Aires

Executing Agency:

Ministry of Transport, through its Central Executing Unit

Renovation and modernization

The objectives of the project are to reduce travel times, offer safer and more reliable rail service, and improve user comfort. This meant completing multiple, interrelated subprojects, hence the term “comprehensive” in the project name

Box II

Electrification:

Installation of an overhead 50 kV (kilowatt) primary power supply to power the electric trains by means of a 25 kV-overhead line with the corresponding supply lines, protection lines, and poles alongside the tracks with mobile and fixed brackets. Construction of a new 132 kV transformer substation powered by the public grid.

Installation of automatic block signaling and a new communications system for the branch.

Modifications to stations:

Improved design and functional performance of five stations, considering accessibility and improvements to the public space, integration with other modes of transport, and overall functionality. Elevation of platforms in 19 stations.

Updates to tracks and equipment:

Track improvements between the Avellaneda and La Plata stations.

Tolosa railway workshop:

Construction and outfitting of the Tolosa railway workshop for light train maintenance.

Ringuelet viaduct:

Construction of a 2.2 km viaduct in the town of Ringuelet.

Avenidas 1 and 32 underpass:

Construction of a new underpass at one of the main entrances to the city of La Plata

Fences:

Construction of perimeter fences along the tracks

The challenges of implementation

Finding the best solution for each project means looking at the technical justifications. Solutions are usually restricted by the physical world or by small budgets. Technical justifications consider these obstacles and determine the optimal objective—and generally find it. But a technical justification must be accompanied by more complex reasoning that puts each operation in context and goes beyond technical and budgetary restrictions to operational and institutional factors, feasibility, and urgency. There is no preexisting best outcome with this approach, but rather an objective or north star that gradually becomes a reality. This complex and realist perspective is necessary, even more so when existing infrastructure or an operational service is being improved or revitalized. This was the case with the electrification of the Constitución-La Plata line.



Assembling a complex puzzle

With an infrastructure project as complicated as refurbishing a rail line, one component will usually affect or be subordinate to another; the order of the components alters the final product. This is why coordination between the intervening parties is so important. The installation of overhead lines is tied to the remodeling of tracks and the installation of the transformer substation; remodeling of the tracks is tied to signaling. Several elements are interconnected.

One of the main challenges during the project was assembling this complex puzzle, as several different contractors were working on the rail improvements.

Forge consensus among multiple actors

The construction of the electrical substation in Quilmes

Placing an electrical substation requires balancing several technical and socioeconomic factors. These may conflict with one another. But even when the project team has considered all these points, their reasoning may not be clear or convincing to the people who are directly affected. It takes more than explaining the rationale behind a decision to generate consensus.

The debate over signaling

Other parts of the project experienced similar dilemmas. The railway's signaling system is antiquated. Just 10% of the network has automatic signaling systems, which leads to inefficiencies and risks to the trains' safety.

For the Plaza Constitución-La Plata substation, the CEU looked at potential sites and concluded that the best option from a technical standpoint was a section of railroad property in Quilmes, with the substation adjoining the tracks. But there were informal settlements on this property that would be affected during construction and operations. The project team opened a dialogue with the stakeholders. It took more time than anticipated during the initial planning stage, but the project could not move forward without it. After several meetings and consults with all the affected actors, compensation was allocated for the families affected by the project, and the substation site was moved a few meters to the interior of the property.



The proposal to implement ETCS on the La Plata branch led to a technical discussion among sector stakeholders. Underneath the advantages, there were some drawbacks to implementing the system that made the rail community wary. Trains that run with ETCS cannot operate on networks that don't use the standard, and vice versa. This was a problem on the Roca line, which has several interconnected branches. The system would have to be installed along the entire line, which would take a long time due to its size and the cost, leaving the network unprotected in the meantime.

Only 10% of the network

A European Train Control System (ETCS) was initially proposed for the Constitución-La Plata project. This is the most widely adopted version of the system known as automatic train protection (ATP, see Box 1). The ETCS not only makes the trains safer and more efficient, it is also a standardized system that has several global suppliers.



In the end, the group agreed to a hybrid standard that combines electronic interlocking (not electromechanical) from the modern ATP systems with ATS beacons. This will ease the transition to a modern ATP system, which is the expected medium-to-long-term plan. To improve the safety benefits of ATS, the team also plans to install devices to alert the operator due to the temporary absence of beacons in the field. The ATS system has another advantage. Since it is less complex than ETCS, it can be adopted more quickly, offering a basic guarantee of safety along the entire network in the short term. The idea to adopt a hybrid system instead of the ETCS came from combining the optimal, medium-to-long term goal with the feasible, short-term reality. It was a compromise between stakeholders.

Box III

Railroad signaling is the “collection of mechanical, electrical, and/or electronic devices intended to control, ensure, and protect the movement of the trains” *. These devices have come a long way technologically and have improved safety. Two signaling systems are important for the purposes of this case study.

The first is automatic train stop (ATS). ATS requires beacons on the track and equipment on board the train to work. With ATS, beacons emit intermittent and binary signals: intermittent because they only communicate with the train when it passes over them, and the information comes from a specific point on the track; binary because the beacon signal only indicates whether the train is allowed to pass this point on the track or not. Without ATS, the train will not brake for a “no go” signal unless the conductor obeys the signal order; with ATS, if the conductor misses the signal, the train will brake automatically.

As technology allowed more interaction between the three components of the signaling system (interlocking, track equipment, and onboard equipment), the systems became more valuable. Automatic train protection (ATP) creates continuous communication between the trains and the tracks. The signals can not only stop the train, but also regulate its speed. If a red signal flashes well ahead of a train, ATP can reduce its speed to maximum safety levels, which means that trains can run closer together without risk.

The trains have onboard equipment onboard that constantly monitors and calculates speed and compares it to the maximum speed allowed on each point of the track, whether this limit is permanent (a curve) or temporary (track maintenance).

***Horacio Faggiani’s preface to “Railroad Signaling and Safety” by Javier Gonzalez Fernandez**

Updating an operational line

A project to improve an operational rail line, without interrupting services, is more complicated than one where service is shut down or the line is not operational. The Plaza Constitución-La Plata branch project was supposed to move ahead while the line remained open, but the reality of the project posed a challenge. The team had to reconsider the plan and cut service to hang the overhead line.

The initial timeline underestimated the difficulty of building the overhead lines on the most urban section of the branch, between the Quilmes and Plaza Constitución stations. It was impossible to work during normal hours: the operation of such a busy rail service made it difficult to stick to the schedule. In many cases, the work could only be done at night, which made labor more expensive.

As the project continued, it became obvious that these limitations were hindering progress. So the government made the decision to temporarily suspend rail service in order to speed up the project. However, this also had its risks. What would happen to the passengers who depended on the train?

What alternatives could be offered while the train was out of service?

Free bus service was quickly set up so that users were affected as little as possible. This was supplemented by a communication plan to inform the affected communities about the buses and explain why rail service was suspended. Workshops and meetings were organized to talk with the relevant actors; fliers were distributed with information about the service suspension and the free buses; staff were hired to direct riders in the stations; customer service centers were created.



The free bus service was not part of the project plan. But it was crucial to ensure that users affected by the closure could still travel and to complete the project in the meantime.

Outcomes

The Comprehensive Improvement Project for the Roca Rail Line: Plaza Constitución-La Plata Branch is ongoing. But many users have noticed the progress. A preliminary evaluation by the CEU is already finding positive results about the project's impact. The survey, conducted in December 2016, included users of the La Plata branch and three other lines (Belgrano Sur, Urquiza, and the Constitución-Ezeiza branch of the Roca line).

According to the survey, average travel time on the La Plata branch has fallen by 20%. In contrast, average travel time was the same for the other branches. Similarly, 87% of the La Plata branch users said that their trip experience was better than in 2015. 64% of users on the other lines said the same.

The impact evaluation (in progress) has also recorded improvements in other important indicators, like satisfaction with the service's speed, frequency, on-time performance, and comfort. Users also perceive improved citizen security in the stations.

Important lessons

The cost of coordination: alternatives for the local context

The La Plata branch improvements were divided among several contractors, with each one responsible for one or more aspects of the project. This was just one possibility. Assigning the job to just one contractor or a consortium or association of companies would have been another option.

It's difficult to decide which route is better because both have advantages and disadvantages, and the best solution is the one that makes the most sense in the local contest. The best solution for one project may not be the best solution for another. The most important factors to consider are the cost of coordinating between the different subprojects and which actors have the capacity to handle this coordination most effectively.

If just one company or consortium is hired for the whole project, it's possible to find one with extensive experience in comprehensive rail infrastructure, i.e. experience assembling the pieces of a complicated rail project. A single contractor makes it easy for the State to communicate with project implementors. There is no speaking with several actors, but one, who is then responsible for coordinating the different components and subcontractors. But this approach also has its disadvantages. When so much responsibility is placed on one company, the risks of choosing poorly are greater.

Therefore, this option must have a counterweight: an entity that oversees the sole contractor's work. It is important to decide whether the State has the capacity to assume this role or if another company must be hired for this undertaking. Without good oversight, the argument for a single contractor falls flat. The convenience of one approach over another can't be generalized. Every case is different; each one should be adapted to the project circumstances, including the State's capacity to do certain tasks.



Discussion and dialogue as a means and prerequisite for progress

The plan to install the electrical substation in Quilmes was not initially well received by the residents of the property where the station was going to be built. The CEU started a dialogue to inform the residents about the project, tell them about the regulations, and listen to their opinions. The substation was relocated on the property to make space for claims from interested parties, while also maintaining the project's technical viability.

Something similar occurred with the updates to the signaling system. There were pros and cons to the ATS and the ETCS. Consulting other actors allowed the project team to reconcile everyone's views and achieve the best possible outcome for the local context.

Discussions and dialogue give interested parties a stake in the outcome. They are also an excellent way to take advantage of the knowledge of actors and beneficiaries who operate and use the service. They are one of the best sources of information for improving the system.

Short, medium, and long term at the same time

The debate over signaling began as a conversation about which system to use for the Plaza Constitución-La Plata branch. But it soon turned into a discussion about which one to use throughout the metropolitan area. For a complex system like a rail network, discussions about how one line operates inevitably lead to a conversation about the operations of the whole system.

All parties recognized the importance of taking a holistic view, as well as the need to move to a more advanced system. They also knew they had to focus on what was possible. They agreed on technical specifications for the signal update that will make a transition to a modern ATP system easier down the road.

For complex systems like a rail network, a comprehensive vision demands a medium- and long-term plan as well as concrete actions in the short term. These must be the technical foundations for future actions that provide an incentive to move the medium- and long-term visions out of the planning stage. The tangible benefits, here and now, are a terrific incentive to move projects beyond the short term.

A clearly defined, comprehensive plan helps to put steps in order and clarify how the parts of the systems depend on one another. It also facilitates, informs, and enriches communication between different actors and helps to forge consensus. The short-term view summarizes the tangible benefits for all parties, renews enthusiasm for the operation, and allows it to keep moving forward.



