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Report No: PAD4956

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US\$600 MILLION

TO THE

ARGENTINE REPUBLIC

FOR A

BUENOS AIRES – BELGRANO SUR PASSENGER RAILWAY LINE MODERNIZATION PROJECT

MAY 9, 2022

Transport Global Practice
Latin America And Caribbean Region

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CURRENCY EQUIVALENTS

Exchange Rate Effective May 2, 2022

Currency Unit = AR\$

AR\$115.75 = US\$1

US\$0.01 = AR\$1

FISCAL YEAR

January 1 – December 31

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ABBREVIATIONS AND ACRONYMS

ADIF	Argentina State Railway Infrastructure Company (<i>Administración de Infraestructuras Ferroviarias Sociedad del Estado</i>)
AMBA	Buenos Aires Metropolitan Area (<i>Área Metropolitana de Buenos Aires</i>)
BNA	Bank of the Argentine Nation (<i>Banco de la Nación Argentina</i>)
CABA	Autonomous City of Buenos Aires (<i>Ciudad Autónoma de Buenos Aires</i>)
CAF	Development Bank of Latin America (<i>Banco de Desarrollo de América Latina</i>)
CAPEX	Capital expenditures
CERC	Contingent Emergency Response Component
DGPPSE	General Directorate of Sectoral and Special Programs and Projects (<i>Dirección General de Programas y Proyectos Sectoriales y Especiales</i>)
EIRR	Economic internal rate of return
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
FIDIC	International Federation of Consulting Engineers
FM	Financial management
GDP	Gross domestic product
GHG	Greenhouse gas
GTFS	General Transit Feed Specification
IBRD	International Bank for Reconstruction and Development
IFR	Interim financial report
INTRUPUBA	Urban Transport Survey of Buenos Aires (<i>Investigación de Transporte Urbano Público de Buenos Aires</i>)
IPF	Investment Project Financing
M&E	Monitoring and evaluation
MTR	Ministry of Transport of Argentina
NDC	Nationally determined contribution
NPV	Net present value
O&M	Operations and maintenance
OM	Operational Manual
OPEX	Operating expenses
PDO	Project development objective
PPSD	Project Procurement Strategy for Development
SAE	Argentina's Secretariat of Strategic Affairs of the Presidency of the Nation (<i>Secretaría de Asuntos Estratégicos de la Presidencia de la Nación</i>)
SOFSE	Argentina State Railway Operator (<i>Operadora Ferroviaria Sociedad del Estado</i>)
tCO ₂ eq	Tons of CO ₂ equivalent
UEPEX	External Financing Executing Units (<i>Unidades Ejecutoras de Proyectos con Financiamiento Externo</i>)

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DATASHEET

BASIC INFORMATION

Country(ies)	Project Name	
Argentina	Buenos Aires – Belgrano Sur Passenger Railway Line Modernization Project	
Project ID	Financing Instrument	Environmental and Social Risk Classification
P178067	Investment Project Financing	Moderate

Financing & Implementation Modalities

<input type="checkbox"/> Multiphase Programmatic Approach (MPA)	<input checked="" type="checkbox"/> Contingent Emergency Response Component (CERC)
<input type="checkbox"/> Series of Projects (SOP)	<input type="checkbox"/> Fragile State(s)
<input type="checkbox"/> Performance-Based Conditions (PBCs)	<input type="checkbox"/> Small State(s)
<input type="checkbox"/> Financial Intermediaries (FI)	<input type="checkbox"/> Fragile within a non-fragile Country
<input type="checkbox"/> Project-Based Guarantee	<input type="checkbox"/> Conflict
<input type="checkbox"/> Deferred Drawdown	<input type="checkbox"/> Responding to Natural or Man-made Disaster
<input type="checkbox"/> Alternate Procurement Arrangements (APA)	<input type="checkbox"/> Hands-on Enhanced Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
31-May-2022	31-Dec-2027

Bank/IFC Collaboration

No

Proposed Development Objective(s)

To improve accessibility in the area of influence of the Belgrano Sur Line in an inclusive, safe, and environmentally sustainable manner; and to respond effectively in case of an Eligible Crisis or Emergency.

Components

Component Name	Cost (US\$, millions)
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1. Railway Works	655.00
2. Institutional Strengthening and Project Management	18.50
3. Contingent Emergency Response Component - CERC	0.00

Organizations

Borrower:	Argentine Republic
Implementing Agency:	Ministry of Transport of Argentina

PROJECT FINANCING DATA (US\$, Millions)

SUMMARY

Total Project Cost	675.00
Total Financing	675.00
of which IBRD/IDA	600.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	600.00
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Non-World Bank Group Financing

Counterpart Funding	75.00
Borrower/Recipient	75.00

Expected Disbursements (in US\$, Millions)

WB Fiscal Year	2022	2023	2024	2025	2026	2027	2028
Annual	0.00	11.00	74.64	172.60	175.76	139.00	27.00
Cumulative	0.00	11.00	85.64	258.24	434.00	573.00	600.00



INSTITUTIONAL DATA

Practice Area (Lead)

Transport

Contributing Practice Areas

Urban, Resilience and Land

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	Moderate
2. Macroeconomic	Substantial
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Low
9. Other	
10. Overall	Substantial

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

☐ Yes ☒ No

Does the project require any waivers of Bank policies?

☐ Yes ☒ No



Environmental and Social Standards Relevance Given its Context at the Time of Appraisal

E & S Standards	Relevance
Assessment and Management of Environmental and Social Risks and Impacts	Relevant
Stakeholder Engagement and Information Disclosure	Relevant
Labor and Working Conditions	Relevant
Resource Efficiency and Pollution Prevention and Management	Relevant
Community Health and Safety	Relevant
Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Not Currently Relevant
Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
Cultural Heritage	Relevant
Financial Intermediaries	Not Currently Relevant

NOTE: For further information regarding the World Bank’s due diligence assessment of the Project’s potential environmental and social risks and impacts, please refer to the Project’s Appraisal Environmental and Social Review Summary (ESRS).

Legal Covenants

Sections and Description

Section I.A.1 of Schedule 2 to the Loan Agreement. The Borrower, through the MTR, shall operate and maintain at all times during Project implementation, the DGPPSE, with structure, functions, and responsibilities acceptable to the Bank, as set forth in the Operational Manual.

Sections and Description

Section I.A.2 of Schedule 2 to the Loan Agreement. The Borrower, through the MTR, shall ensure that the DGPPSE is at all times during Project implementation adequately staffed with professionals necessary to fulfill its functions.

Sections and Description

Section I.B of Schedule 2 to the Loan Agreement. The Borrower, through the MTR, shall make part of the proceeds of the Loan available to ADIF on a non-reimbursable basis, under an assistance and execution agreement between the Borrower, through the MTR and ADIF, under terms and conditions approved by the Bank.

**Conditions**

Type Effectiveness	Financing source IBRD/IDA	Description Article 5.01 (a) of the Loan Agreement. That the Assistance and Execution agreement has been signed and delivered by the Borrower, through the MTR, and ADIF, and any conditions precedent to its effectiveness have been fulfilled.
Type Effectiveness	Financing source IBRD/IDA	Description Article 5.01 (b) of the Loan Agreement. That the Operational Manual, in form and substance satisfactory to the Bank, has been adopted by the Borrower, through the MTR.
Type Disbursement	Financing source IBRD/IDA	Description Section III.B.1 (a) of Schedule 2 to the Loan Agreement. No withdrawal shall be made for payments made prior to the Signature Date, except that withdrawals up to an aggregate amount not to exceed \$120,000,000 may be made for payments made prior to this date but on or after January 1, 2022 (but in no case more than one year prior to the Signature Date), for Eligible Expenditures under Category 1.
Type Disbursement	Financing source IBRD/IDA	Description Section III.B.1 (b) of Schedule 2 to the Loan Agreement. No withdrawal shall be made for Emergency Expenditures under Categories (3), unless and until all of the following conditions have been met in respect of said expenditures: (i) the Borrower, through MTR, has determined that an Eligible Crisis or Emergency has occurred, and has furnished to the Bank a request to withdraw Loan amounts under Category (3); and the Bank has agreed with such determination, accepted said request and notified the Borrower thereof; and (ii) the Borrower, through MTR, has adopted the CERC Manual and Emergency Action Plan, in form and substance acceptable to the Bank.



I. STRATEGIC CONTEXT

A. Country Context¹

1. **Argentina, with a gross domestic product (GDP) of US\$491 billion, was the third-largest economy in Latin America in 2021.** The country has a large territory of 2.8 million square kilometers, and its population of about 45 million inhabitants is highly urbanized with 89 percent of the total population living in cities. The Buenos Aires Metropolitan Area (AMBA) alone constitutes 33 percent of the national population and generates more than 40 percent of Argentina's GDP.
2. **The middle class has historically been large and strong, with social indicators generally above the regional average; however, persistent social inequalities, economic volatility, and underinvestment have limited the country's development.** The rate of urban poverty reached 37.3 percent in the second semester of 2021, and 8.2 percent of Argentines live in extreme poverty. Childhood poverty, for those under 15 years old, is at 51.4 percent. The high frequency of economic crises in recent decades—the economy has been in recessions during 21 of the past 50 years—has resulted in an average annual growth rate of 1.8 percent, well below the world average of 3.6 percent and the region's average of 3.2 percent. Decades of chronic underinvestment have led to sizeable gaps in capital stock relative to comparable countries, with public capital expenditures as a share of GDP declining amid the large increase in public spending.
3. **The COVID-19 outbreak hit Argentina at a time of significant macroeconomic imbalances and a highly uncertain economic outlook.** Following a two-year recession, high inflation, and lack of access to capital markets, the strict lockdown imposed to contain the spread of the pandemic triggered a GDP loss of 9.9 percent in 2020, the largest decline since 2002. In response, the country has prioritized social spending through various programs, including the Universal Child Allowance, a cash transfer that reaches approximately four million children and adolescents up to age 18, equivalent to 9.3 percent of the population. Because of restricted market access, financing the response to the pandemic has required monetization of the deficit. This has exacerbated macroeconomic imbalances, notably by exerting pressures on reserves and the persistently large gap between the official and parallel exchange rates.
4. **Bolstered by favorable external conditions, the economy recovered from the COVID-19 crisis at a fast pace, reaching pre-pandemic activity levels by mid-2021.** Argentina's economy grew by 10.3 percent in 2021, reaching pre-pandemic activity levels in July 2021 but remaining four percent below the previous cyclical peak attained in the last quarter of 2017. Higher commodity prices and trading partners' growth, notably Brazil's, combined with public investment and acquisition of goods and services led to a robust growth recovery. The primary deficit was partially reversed in 2021 because of the removal of COVID-19 emergency support package and extraordinary resources from the increase in international commodity prices and an exception tax on large fortunes. However, the domestic economy continues to show macroeconomic imbalances. Annual inflation stood at 50.9 percent in 2021. The Government of Argentina (Government) has concluded the process of restructuring its debt in foreign currency (both local and external) with private creditors, significantly improving the maturity profile for the next five to eight years. However, debt service obligations as of 2028 are projected to be equivalent to those that triggered the debt swap in 2020–2021.
5. **Argentine authorities have reached an agreement with the International Monetary Fund, on an**

¹Source for estimates and projections in this section (unless otherwise stated): INDEC National Income Accounts and World Bank.



Extended Fund Facility (EFF) program for a period of 30 months and an amount of US\$45 billion, to address the economy's macroeconomic imbalances and set the basis for sustainable growth. This amount will cover the remaining obligations under the 2018 Stand-By Arrangement (US\$40.5 billion) and provide a small net financing support for reserves accumulation (US\$4.5 billion). According to the memorandum of economic and financial policies, the EFF will support the government's objectives of (i) improving public finances in a gradual and sustainable manner to ensure debt sustainability without jeopardizing the economic recovery, (ii) durably reduce persistent high inflation, through a multi-pronged strategy, (iii) strengthening the balance of payments, and (iv) improving the sustainability and resilience of growth. Accordingly, the memorandum sets a gradual fiscal consolidation path toward a zero primary deficit in 2025 (2.5 percent of GDP in 2022, 1.9 percent in 2023, and 0.9 percent in 2024), a reduction of monetary financing of the deficit (eliminated by 2024), and the framework for monetary policy involving positive real interest rates, as part of a multipronged strategy to fight inflation.

6. **As one of the early signatories of the Paris Climate Agreement, Argentina has adopted nationally determined contributions (NDCs), which include the transport sector.** The latest NDCs for Argentina, submitted in December 2020 and updated in October 2021, highlight the transport sector as a critical component for the country's climate mitigation and adaptation agenda. One of the priority areas is the development of low-carbon sustainable mobility. Argentina's NDCs call for ensuring the resilience of transport infrastructure by improving design criteria, maintenance and adapting existing constructions. Accordingly, the economic recovery needs to consider policies that contribute to decouple emissions from economic growth and build economies and societies that are more resilient and less vulnerable to the observed and anticipated impacts of climate change, considering that climate change effects may push many into poverty over the next 15 years (especially the most vulnerable).²

7. **Climate change is posing additional threats to Argentina's development: observed and anticipated climate change impacts coupled with changing precipitation patterns are expected to lead to more frequent extreme climate events, such as floods, droughts, tropical storms, and heat waves.** The effects of climate change in AMBA are noticeable in the increased cases and risks of flash or surface flooding, heatwave events, and wind gusts accompanied by precipitation. Climate analyses indicate that these events and impacts are associated with the evolution of global greenhouse gas (GHG) emissions and are therefore exacerbated by climate change. Annual average precipitation in AMBA has increased by 29 percent from the period between 1961-1970 and the period between 2011-2014. Rainfall intensity and the number of days with extreme rainfall levels (over 30 millimeters per event) have also increased over time. Similarly, average annual temperature within the city boundaries has increased by 0.14 degrees Celsius per decade between 1961 and 2014.

B. Sectoral and Institutional Context

8. **Despite the large and far-reaching public transport network, AMBA's urban mobility has been shaped by traditional road network investments and rising motorization accompanying and facilitating urban sprawl.** The rise of developments in the periphery, including high-income gated communities and low-income informal settlements, as well as the expansion of the road network rather than investments in sustainable, low-carbon and climate resilient public transport has resulted in increasing dependence on motorized transport, poorer accessibility to public transport and escalated travel times and external costs (congestion, air pollution, GHG emissions, noise, and road accidents). This has particularly taxed poor people, who are largely reliant on public transport or non-motorized transport modes for access to employment and socioeconomic services and are more

² Hallegatte, S. et al., Shock Waves: Managing the Impacts of Climate Change on Poverty. Climate Change and Development Series (Washington, DC: World Bank, 2016).



vulnerable to climate change impacts.³ For example, most job opportunities in AMBA are concentrated in the central business district of the Autonomous City of Buenos Aires (CABA), which entail long commutes from the periphery. The average amount of time spent daily on public transport in AMBA is 56 minutes, and about 31 percent of travelers spend more than two hours on public transport.⁴

9. **Prior to the COVID-19 pandemic, 43 percent of all trips in AMBA were on public transport, 35 percent were walking or bicycle trips, and 20 percent were automobile or motorcycle trips.**⁵ Buses carried 11 million passengers daily (80 percent of public transport trips), while the suburban railways system carried 1.4 million (11 percent), and the subway system 1.0 million (9 percent). Although public transport accounts for most trips, its modal share has been declining in the last decade. Although household travel surveys indicate that less than 50 percent of households own a private vehicle (automobile or motorcycle), the private vehicle fleet has been growing at an estimated annual rate of five percent, higher than the AMBA population growth of about one percent.⁶

10. **Public transport demand partially recovered after hitting historically low levels during the pandemic, but in March 2022 it continued to be below pre-pandemic levels, while automobile travel had fully rebounded.** Lower-income residents have continued to be greatly dependent on the public transit system. The total share of social fare users increased by seven percentage points, primarily because poor people are not able to work from home like higher-income workers and had fewer opportunities to shift to private mobility. Even so, as of March 2022, the number of unique users in the public transport system in AMBA were still 19 percent below pre-pandemic levels. Ridership on the suburban railway system was 28 percent below 2019 levels, and ridership on the Belgrano Sur Line, heavily used by low-income passengers, was 22 percent below 2019 levels.⁷

11. **Periods of underinvestment in passenger rail in AMBA have degraded the quality and reliability of the public transport system.** The rail network consists of more than 800 kilometers of suburban rail tracks (making it one of the largest systems in the world) and 63 kilometers of subway tracks (the subway system is the oldest in Latin America). Annual investments, which were on average US\$110 million between 1995 and 2001, declined to US\$70 million between 2003 and 2011, and were insufficient for upgrading the aging system. From 2013 to 2019, the level of investments in urban transport grew fourfold, reaching an average of around US\$357 million across a wide range of interventions.⁸ In an effort to attract new investments, suburban railway concessions were granted during the mid-90s. These contracts included small-scale interventions by the concessionaire and were funded by the Government. Unfortunately, most of them were not carried out because the resources were used to subsidize

³ www.worldbank.org/en/topic/climatechange/overview#1

⁴ Moovit Insights.

⁵ The remaining two percent includes taxi, charters, school buses, or company buses. Data from *Análisis de Encuestas de Origen Destino en 8 ciudades de América Latina para avanzar hacia la armonización regional de indicadores de movilidad urbana*, available at www.cepal.org/sites/default/files/presentations/buenos-aires-hugo-terrele.pdf.

⁶ Anapolsky, S., *¿Cómo nos movemos en el AMBA? Conclusiones de la evidencia empírica y alternativas post-COVID-19* (2020).

⁷ Data from the National Commission for Transport Regulation, available at www.argentina.gob.ar/transporte/cnrt/estadisticas-automotor and from the CABA Mobility and Road Safety observatory. Data for the public transport system and the suburban railway is for the fourth week of March 2022. Data for the Belgrano Sur line is for December 2021.

⁸ Interventions considered included: rolling stock (around US\$1.1 billion to replace more than 700 cars on the Sarmiento, Mitre, and Roca lines as well as the renewal of the entire diesel fleet of the San Martín and Belgrano Sur lines); track renewals; new viaducts (3.9 kilometers for the Mitre Line, 5 kilometers for the San Martín Line, and 6 kilometers for the Belgrano Sur Line); electrification of a corridor of the Roca Line (53 kilometers and 19 stations—about US\$600 million); improvements in signaling systems; enhancement of four main terminals and other stations; and incorporation of new technologies for automatic train braking systems. World Bank estimations with data from *Informes de Ejecución Físico Financiera* from Argentina's National Budget Office.



operational costs. Between 2012 and 2015, most passenger railway concessions were revoked because of growing concerns about safety and efficiency. Currently, only the Belgrano Norte and Urquiza lines (representing 15 percent of the system's ridership) are operated under concession contracts.

12. **The suburban rail system is characterized by long-distance trips connecting the periphery to downtown and lower fares than other public transport modes.** The average distance traveled by passengers is 20 kilometers for suburban rail, compared to 7 kilometers for bus users and 5 kilometers for subway users. Suburban rail fares vary between US\$0.08 and US\$0.19 per trip, whereas bus fares vary between US\$0.18 and US\$0.23 and subway fares vary between US\$0.18 and US\$0.30. Suburban rail fares are relatively low relative to suburban rail systems in Mexico, Chile, and Brazil, where fares are between US\$0.45 and US\$0.90. Finally, there is a high, albeit decreasing, level of fare evasion in the railway system in AMBA compared with other modes of public transport; this reached a peak of 42 percent for 2012 but subsequently gradually decreased to 18 percent in 2018.⁹

13. **Argentina subsidizes its public transport system to ensure affordable mobility and reduce externalities, especially in urban agglomerations like AMBA.** The subsidies were introduced as a social policy during the economic crisis of the 2000s, and over the past 20 years they have grown to about 0.72 percent of GDP, equivalent to US\$3.1 billion in 2021.¹⁰ The subsidy system includes supply-side outlays that support affordable fares for all, supplemented by demand-side subsidies to users, such as beneficiaries of cash transfer and other social programs, small contributors to social security, students, retirees, and pensioners, who receive a discount of at least 55 percent. As a result, in 2019, about 95 percent of operating expenses (OPEX) of the suburban railway system were covered by transfers from the national government. The pandemic has aggravated the financial situation of the public transport system, with decreased demand and limited operational costs saving but mostly stable service levels to satisfy the social-distancing requirements. Fares have not changed despite high inflation to keep mobility affordable for lower-income users.

14. **Gender gaps in the public transport sector are evident in terms of differing mobility patterns, intensities of use, perceived lack of safety, social norms, and harassment that limit mobility, especially for women in vulnerable neighborhoods.** Although Argentina has made progress on bridging gender gaps, there are still persistent differentials in terms of access to economic opportunities. Labor force participation in CABA for women is 57.1 percent, compared with 70.6 percent for men. Based on recent data from the Survey on Labor Indicators, 71 percent of men and 29 percent of women have a leadership position in the transport and communication sectors, and there is a wage gender gap in the same sectors.¹¹ Of the people employed in the urban railway, 13 percent are women.¹² A recent study¹³ documented that gender patterns of mobility in AMBA coincide with those in other Latin-American cities: (i) women travel less, generating 42 percent of total trips; (ii) women engage more in non-work travel, as 27 percent of women's trips are for caregiving-related activities compared with 13 percent

⁹ Data from the National Commission for Transport Regulation's *Informe Estadístico Anual 2018 – Red Ferroviaria de Pasajeros del Area Metropolitana de Buenos Aires*, available at www.argentina.gob.ar/sites/default/files/infoest2018_ffccamba_00-red.pdf.

¹⁰ World Bank estimations. The following datasets and documents were used: resolutions 313/2020 and 355/2021 from the Ministry of Transport, the annual allocation per line available at <https://servicios.transporte.gob.ar/compensaciones/> and the funding allocation from the City of Buenos Aires available at www.buenosaires.gob.ar/economiafinanzas/contaduria/informacion-contable. For rail costs, data was obtained from Metrovias and SOFSE balances sheets, as well as the allocation to the Integrated Railway System (SIFER), which is available at <https://servicios.transporte.gob.ar/compensaciones/>. Demand data on rail and subway services were compiled from the National Commission for Transport Regulation's annual reports and the unit of statistics at CABA Government.

¹¹ Ministerio de Trabajo, Empleo y Seguridad Social at www.argentina.gob.ar/sites/default/files/informe_ctio_documento detrabajo.pdf

¹² <https://blogs.iadb.org/transporte/es/moviendose-por-la-igualdad-las-trabajadoras-del-transporte/>

¹³ *Why Does She Move? A Study of Women's Mobility in Latin American Cities* (Washington: World Bank, 2020).



for men; and (iii) women rely more heavily on informal and public transport— 50 percent versus 37 percent—and walk more—16 percent versus 10 percent. In addition, about 72 percent of women in AMBA reported feeling unsafe when commuting on public transport (14 percentage points more than men) in 2018, and more than 40 percent reported having experienced harassment on public transport¹⁴. There are also underlying constraints for women to access employment opportunities and decision-making positions in the transport sector, as women represent less than 10 percent of the sector’s workforce nationally.

15. The transport sector in AMBA is a major contributor to GHG emissions, and its infrastructure is at significant risk from the effects of climate change. In 2020, the transport sector accounted for 32 percent of the GHG emissions in CABA, for an estimated total of nine million metric tons of CO₂ equivalent in 2020.¹⁵ In response, the government has supported investments in sustainable mobility solutions to support a modal shift toward low-carbon transport. Natural hazards associated with climate change, such as flooding, heatwaves, and variable precipitation affect the transport system, requiring climate-resilience measures including new design standards, revised operations and maintenance, and contingency programming to mitigate damages, losses, and disruptions. Building resilient infrastructure may require marginal additional costs upfront, but, for many assets, the benefits outweigh the costs, as macroeconomic losses make up a significant proportion of total losses because of climate-induced extreme weather events.¹⁶

16. The electrification of transport will support climate change mitigation objectives, and the expected transition toward more renewable energy sources will amplify its climate benefits. The Government is seeking to enact new legislation supporting ambitious policies—on the demand and supply sides—to promote the electrification of transport, having set a target to end the sale of new vehicles with internal combustion engines by 2041. The draft bill acknowledges that additional measures to support the energy transition are crucial to achieve decarbonization. In 2020, the energy mix in the interconnected national grid included 67 percent fossil fuels, mostly natural gas, with hydro power at 17 percent, nuclear power at 7 percent, wind power at 6 percent, biomass at 2 percent, and solar at 1 percent. Argentina’s NDC have given priority to renewable energy and increasing the efficiency of fossil fuel energy generation. Official scenarios for 2030 have fossil fuel energy sources declining to between 30 and 40 percent of total energy generation and non-hydro renewable energy increasing to 20 to 30 percent.¹⁷ Electrified railway lines would directly benefit from this shift to renewables given that they source electricity from the interconnected national grid.

17. In April 2020, the World Bank approved a US\$347 million loan for the Buenos Aires—Mitre Passenger Railway Line Modernization Project (P175138), which is the third-most-used line among suburban railways in AMBA. The Mitre Line project finances Retiro rail yard upgrades and track renovations as well as Retiro–Tigre Branch electrical system upgrades, station and transfer infrastructure construction and upgrades between branches, and an extension of the line’s electrification. The project also supports institutional strengthening for the Ministry of Transport (MTR), the National Administrator of Railway Infrastructure (ADIF); and the State Passenger Rail Operator Company (SOFSE). Such institutional strengthening activities will improve the reliability and efficiency of AMBA’s urban rail network, user safety and personal security, and access for women.

¹⁴ Ella se mueve Segura – Un estudio sobre la seguridad personal de las mujeres y el transporte público en tres ciudades de América Latina (Caracas: CAF and FIA Foundation, 2018).

¹⁵ Plan de Movilidad Limpia de la Ciudad de Buenos Aires.

¹⁶ Kesete et al. Climate Change Risk Analysis of Argentina’s Land Transport Network (Washington: World Bank, 2021).

¹⁷ Lineamientos para un Plan de Transición Energética al 2030 (2021). www.boletinoficial.gob.ar/detalleAviso/primera/252092/20211101



18. **The Belgrano Sur Line delivers public transport accessibility to areas with the lowest socioeconomic status in AMBA and has a potential for increased demand due to the highly populated areas it serves and the absence of quality public transport alternatives.**¹⁸ In 2019, the line reached its highest ridership yet, carrying 17.5 million passengers, equivalent to four percent of paying passengers of the suburban railway system.¹⁹ Demand trends are positive as the average annual growth rate for ridership on the Belgrano Sur Line was 3.9 percent (between 2009 and 2019), considerably higher than the 0.1 percent increase for the suburban railway system and 1.2 percent for the subway system. This may be explained by the above-average annual population growth of 2.4 percent in La Matanza, the most-populated municipality in the Province of Buenos Aires, with 1.77 million inhabitants, compared with 0.95 percent growth in AMBA.²⁰ Despite increasing demand and the potential for further significant increases, Belgrano Sur remains the least used among the eight lines in the suburban railway system. The municipalities crossed by the Belgrano Sur Line are among those with the highest vulnerability in AMBA, for example, 12 percent of the households in La Matanza have at least one unmet basic need (figure A6-3Figure in annex 6). Additional maps of the Belgrano Sur Line are provided in Figure A6-1 and figure A6-2 in annex 6.

19. **The Belgrano Sur Line requires much needed upgrades given its aging track infrastructure and signaling systems, deteriorated railway stations and surroundings, numerous level crossings posing significant risks of collision with pedestrians and road vehicles, and vulnerability to climate change.** The line operates with six-car diesel trains on two passenger branches over 51 kilometers of track. The railway currently connects the Sáenz Station in CABA to the Marinos del Crucero General Belgrano Station (Marinos, henceforth) in the municipality of Merlo on one branch and the González Catán Station in the municipality of La Matanza on the other branch. The line has 22 stations, four are in CABA, with the remaining in the densest areas of the municipalities of La Matanza, Morón, and Merlo in the Province of Buenos Aires. The signaling system is not very efficient, as it mixes different technologies and, in some track sections, includes mechanical levers that are over 100 years old. The system is manually operated, with few improvements implemented over time to maintain a minimum level of service and safety. The track's significant degradation along some segments affects the line's performance and pose safety risks. The line's numerous level crossings also constrain speeds and service frequency, increase traffic congestion and present significant risk of collisions with vehicle traffic and pedestrians. There have been 13 fatalities and 24 injuries at crossings between 2009 and 2018.²¹ Finally, the line is vulnerable to climate change-induced flooding, heatwaves, and variable precipitation, which could impact ridership and the line's long-term viability.

20. **Recent and ongoing interventions to modernize the Belgrano Sur Line have been funded with national resources and Development Bank of Latin America (CAF) financing (see figure A6-5 in annex 6).** The World Bank financed the Urban Transport in Metropolitan Areas Project (P095485), which closed in December 2019, that built the emblematic elevated Sáenz Station on the Belgrano Sur Line and eliminated a dangerous level crossing on Sáenz Avenue. CAF approved two loans totaling US\$205 million in 2017 and 2018 for track and platform upgrades in the Marinos branch, including signaling, a new viaduct next to the Tapias Station, upgrade to double-track in

¹⁸ Calculated using buffers of 2k kilometers from stations located within the first ring of AMBA (stations in CABA, Morón and some stations in La Matanza) and 3k kilometers from stations located in the second ring (Merlo and the remaining stations in La Matanza). This takes into account mobility survey results in AMBA that show more willingness to walk to rail stations in the outer rings of the metropolitan area.

¹⁹ Actual ridership is higher than reported because of fare evasion, which was estimated at 16 percent in 2018, below the 18 percent for the suburban railway system.

²⁰ Compound Annual Growth Rate between 2010–2020. Data from the National Institute for Statistics and Census, *Proyecciones de población por Municipio provincia de Buenos Aires 2010–2025*.

²¹ In the 10 level crossings to be transformed into below-grade crossings by the project.



some sections, and a 4.2 kilometers extension from Sáenz to Plaza Constitución Station (Constitución, henceforth) with a new viaduct, to be completed by 2023, that will provide a much-needed direct transfer to the Subway system as well as the Roca suburban railway line.²² In parallel, the Government has also invested in track, station, and platform upgrades on the segment between Sáenz and Tapiales. The Belgrano Sur Line requires additional interventions to complete its modernization and increase its service level and attract new passengers.

C. Relevance to Higher Level Objectives

21. The proposed project is aligned with the World Bank Group's FY19–FY22 Country Partnership Framework (CPF)²³ for Argentina, (Report No. 131971–AR), discussed by the Board of Executive Directors on April 25, 2019, with the World Bank's Green, Resilient and Inclusive Development (GRID) framework, and supports Argentina's transport sector objectives. The project supports Focus Area 3 of the CPF: "Supporting Argentina to implement its NDC," by addressing the negative externalities of congestion and high-carbon mobility in AMBA by fostering multimodality and a modal shift to less carbon-intensive alternatives for its citizens. The project's climate adaptive infrastructure approach, reflected in the resilience-proofed engineering designs and capacity building on railway climate resilience, ensures that climate adaptation is integrated in railway infrastructure management. As such, it contributes to objective 3.10: "Building resilient and low-carbon cities," The project directly improves the service efficiency on the Belgrano Sur Line and citizens' quality of life in the line's area of influence, and it will improve access to public transport, tackle traffic congestion, and strengthen key infrastructure to curb automobile use and promote sustainable, low-carbon, and climate-resilient public transit. In addition, the proposed project supports Focus Area 2: "Addressing key institutional constraints for better governance and service delivery." The institutional strengthening component will enhance the productivity of railway operations, increase efficiency of the state operating agencies, and improve accessibility for women and increase their labor-market participation in the transport sector. The project also supports Argentina's Passenger Railway Transport Modernization Plan, which has the objective of modernizing the country's rail system by means of track renovation, line extensions, station upgrades, and transformation of level crossings to improve service and raise the population's living standard from an environmentally and socially sustainable perspective.²⁴

II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

To improve accessibility in the area of influence of the Belgrano Sur Line in an inclusive, safe and environmentally sustainable manner; and to respond effectively in case of an Eligible Crisis or Emergency.

PDO Level Indicators

22. The outcomes specified in the project development objective (PDO) statement will be measured with the following PDO-level indicators:

²² In January 2022, physical progress of the line extension to Constitución was 12.5 percent with completion of the works estimated by 2023. The Marinos branch track upgrade has not yet started, but the planned completion date is also 2023.

²³ The project is also aligned with the Performance and Learning Review for Argentina, which is currently being prepared.

²⁴ www.argentina.gob.ar/transporte/trenes/plan-modernizacion/pasajeros



- (i) *Accessibility*: Jobs in AMBA accessible by public transport from the area of influence of the Belgrano Sur Line in less than 90 minutes (percentage).
- (ii) *Inclusivity*: Passengers per day on the Belgrano Sur Line (number), including sub-indicators on female passengers per day on the Belgrano Sur Line, and social fare passengers per day on the Belgrano Sur Line.
- (iii) *Safety*: Railway incidents and accidents per million train-km linked to safety issues on the Belgrano Sur Line (number).
- (iv) *Environmental sustainability*: Annual GHG emissions savings (metric tons/year).

B. Project Components

23. **Component 1: Railway works (US\$655 million, of which US\$580 million IBRD financing)** for the modernization of the Belgrano Sur Line, including tracks, signaling, grade separation of railway crossings, pedestrian bridges, stations and their surroundings, railway electrification, and supervision. Interventions will be carried out on all three sections of the line: Constitución–Tapiales, Tapiales–González Catán, and Tapiales–Marinos. Works will be implemented with the line in operation, with different phases to allow for a smooth execution of tasks and safe operation of the line at the same time. Aspects of climate change resilience, universal accessibility to persons with disabilities, urban design, and gender-sensitive design will be embedded into the detailed project designs and engineering.²⁵ A map with the geographical scope of the interventions under Component 1 is available in figure A6-5 in annex 6.

24. **Subcomponent 1.1: Track and infrastructure renovation, signaling and telecommunications (US\$243 million, of which US\$215.2 million IBRD financing)**. The full renovation of tracks between González Catán and Tapiales stations, renovation of level crossings, renovation of tracks in sections between Tapiales and Sáenz, and rail yard track construction and renovation on the Belgrano Sur Line.²⁶ Structural and hydrological verification and upgrade of railway bridges on the Belgrano Sur Line, and renovation of the drainage system up to climate-resilient standards. The installation of a new signaling and telecommunication system in the section between González Catán and Sáenz stations supported by an optical fiber network.²⁷ Signaling at level crossings will be improved with automatic gates, warning beacons and pedestrian-crossing protections.

25. **Subcomponent 1.2: Grade separation of railway crossings (US\$100 million, of which US\$88.55 million IBRD financing)**. Below grade separation of about 10 railway level crossings between Sáenz and Tapiales stations. Works will consider an urban design perspective and are sensitive to safety and security issues in adjacent areas, with a special focus on signaling and visibility to avoid separating or enclosing spaces in communities where safety concerns are significant, including gender-based violence risks. Specific safety and accessibility measures include adding illuminated stairways and pedestrian crosswalks and ramps; wide access for people with disabilities who use mobility devices or technical aids, inter alia. Climate-resilient designs will be incorporated with the construction of a hydraulic system, the installation of pumping stations equipped with generators to provide for

²⁵ For example, civil works will be designed with climate resilient materials and technology to enhance the capacity of the railway system to withstand and adapt to climate change impacts.

²⁶ Track renovations include 32 km of track between González Catán and Tapiales and 6 km of track between Sáenz and Tapiales, in addition to auxiliary track renovation. Rail yard track will be divided into tracks within railway workshops and tracks for parking the rolling stock.

²⁷ The signaling system will be consistent with the system to be installed in the Marinos Branch and the extension between Sáenz and Constitución.



power outages, new rainwater conduits with their corresponding drains, a more efficient lighting system, and green spaces with rainwater collection.

26. **Subcomponent 1.3: Civil works, upgrade of stations and surroundings, construction of railway workshops and operational buildings (US\$119 million, of which US\$105.37 million IBRD financing).** Upgrade of stations and station surroundings when needed including disability-inclusive and gender-sensitive accessibility and conforming to climate resilience and road safety standards on the Belgrano Sur Line. Construction of pedestrian overpasses to allow uninterrupted flow of pedestrian movement separate from train traffic across the Belgrano Sur Line. Railway fencing for pedestrian safety and track demarcation and protection, precluding access to the track areas of the Belgrano Sur Line. Construction of railway workshops for electric train maintenance and construction of operational buildings.

- (i) *Station upgrades* will include verification of compliance with accessibility regulations for persons with disabilities, such as implementation of regulatory ramps, new restrooms, and building adaptations for people with reduced mobility. Additional interventions include improvement of station signaling, installation of CCTV cameras, and provision and distribution of new furniture to improve comfort. Drainage infrastructure to prevent flooding will be installed in stations and their surroundings. Upgraded stations will address specific needs and priorities for women, such as including security call boxes that are clearly marked, to provide a direct line of communication to quickly report incidents, including sexual harassment. Gender offices will be installed in at least five upgraded stations to provide municipal-government-managed facilities to conduct workshops and trainings on gender-related issues as well as facilitate registration for government-sponsored gender-related programs, among others. Other gender-sensitive design aspects in stations include gender-neutral signage, well-lit public spaces, and facilities oriented toward comfort and caregiving, such as breastfeeding areas, multifunctional equipment, and baby-changing stations in restrooms.
- (ii) *Station surrounding upgrades* will improve the quality of public spaces, including upgraded sidewalks, street curbs, pedestrian crossings, bus bays and transfer facilities, and street lighting on streets parallel to the railways, to enhance the relationship between the urban fabric and the railway. Bicycle parking and storage facilities will be provided at stations where demand exists, which will enhance accessibility for cyclists. The upgrade of station surroundings will follow an urban design perspective seeking to prevent maintenance needs, given the challenges of maintaining public spaces in the neighborhoods in the area of influence of the stations.
- (iii) *Pedestrian overpasses* will allow uninterrupted flow of pedestrian movement, separate from train traffic, for communities that are divided by the railway. Pedestrian overpasses will be constructed with a special attention to urban design, safety and security, and user satisfaction concerns. Overpasses will be accessible to persons with disabilities, with ramps or elevator access, and wide access for people who use mobility devices or technical aids, among other features.

27. **Subcomponent 1.4: Electrification of the Belgrano Sur Line (US\$170 million, of which US\$150.53 million IBRD financing).** Installation of electrical traction and distribution systems, including: (i) a main transformer substation at Tapiales; (ii) autotransformer stations; (ii) autotransformer sectioning stations; (iii) power centers at all passenger stations; and (iv) laying catenary over the Belgrano Sur Line, and the installation of the necessary accessories.



28. **Subcomponent 1.5: Supervision of railway works (US\$23 million, of which US\$20.37 million IBRD financing).** Procurement of the technical, environmental, and social supervision activities related to the railway works under Component 1 of the project.

29. **Component 2: Institutional strengthening and project management (US\$18.5 million, all IBRD financing).** This component includes activities to improve urban railway planning and investment preparation, advance technological innovation, increase climate resilience, reinforce gender and universal access actions, and support project management and evaluation.

30. **Subcomponent 2.1: Railway planning and investment preparation (US\$7.3 million, all IBRD financing).** This subcomponent will finance the improvement of railway planning capacities within MTR and ADIF through the following activities, inter alia: (i) project preparation studies, including preparation studies for a future railway link connecting the south, east, and west areas of AMBA; (ii) a study on transit-oriented development (TOD) for the Belgrano Sur Line corridor to evaluate alternatives for strengthening multimodal transport, including buses and active mobility such as walking and biking, and integrating the railway system into the urban space; (iii) a study to inform efforts toward improving the financial sustainability of the railway system, including willingness-to-pay survey for understanding how users value various aspects of railway service quality, assessing fare affordability and fare schemes to improve subsidy targeting to low-income populations, and assessing alternatives to maximize secondary sources of revenue; (iv) a study to inform bus service rationalization in the area of influence of the Belgrano Sur Line to support the role of buses as feeders of the railway; (v) a study to support the implementation of an open-access strategy in the freight railway sector in Argentina; (vi) the development and implementation of a new mobility survey, construction of a new origin and destination (OD) matrix, and updating of the transport demand model for AMBA; (vii) support to the operationalization and institutional strengthening of the Metropolitan Transport Agency for AMBA; (viii) the development of guidance documents for the evaluation of transport projects, supporting project appraisals, and quantification of transport projects benefits, including environmental externalities; and (ix) provision of training to MRT and ADIF staff on the use of technical software for transport modeling and statistical analysis and the acquisition of computer equipment, software, furniture, bibliographic material, as well as the contracting of consulting and training services.

31. **Subcomponent 2.2: Climate change resilience and technological innovation (US\$6.3 million, all IBRD financing).** This subcomponent will finance studies on climate adaptive infrastructure related to railway assets, including technological innovations for the development of new railway materials and support for sustainable local materials production. Considering the key climate change risks threatening urban railways, activities will focus on increasing the adaptability of railway infrastructure to extreme temperatures, rainfall, perhumid periods, droughts, and strong winds. Innovations to integrate use of renewable energy—photovoltaic panels, solar water heaters and rainfall water utilization—to be included in railway stations will be studied. Provision of Training, acquisition, and development of new methodologies and software related to the analysis and development of innovative railway operating.

32. **Subcomponent 2.3: Gender perspective and universal access strengthening (US\$2.1 million, all IBRD financing).** This subcomponent will include (i) support to collaboration between universities and other professional platforms with ADIF and SOFSE, introducing a training plan and an internship program for women engineers and related professions aiming to attract female talent to the transport sector and create conditions to increase women's participation in technical and decision-making positions; (ii) a study to assess the impact of existing sexual harassment prevention and response protocols, aiming to strengthen the response to cases of sexual harassment against women and sexual minorities; (iii) a study of the expected impact of the project on



women's mobility, informing project implementation and future operation; (iv) a study on the labor gap in railway works, with recommendations of positive actions to be considered during project implementation; (v) an update of harassment prevention and response protocols in railway works and for railway operations; and (vi) campaigns to raise awareness about safe spaces, protocols and reporting mechanisms, and the differentiated mobility needs of women, inter alia. In addition, this subcomponent will finance studies on how to ensure universal access for people with disabilities in the entire AMBA transport network, and promote employment opportunities for people with disabilities in the railway sector.

33. **Subcomponent 2.4: Project management (US\$2.59 million, all IBRD financing).** Support for planning, management, and monitoring of the physical and financial execution of the project, as well as its results, financing MTR and ADIF individual consultancies for management support assistance and the operational costs necessary for the functioning of the administrative structure of the project (provision of computer equipment, technological equipment and software, supplies and office expenses, and the provision of training, if required). If necessary, contracting of an independent entity of recognized technical capacity to carry out the project external audits.

34. **Subcomponent 2.5: Strategic evaluation (US\$0.21 million, all IBRD financing).** Carrying out of project strategic evaluation activities in coordination with Secretariat for Strategic Affairs (SAE), under the Presidency, as responsible for technical methodological advice. The evaluation activities will focus on generating evidence on the contribution of the international financing strategy to (i) the achievement of the Sustainable Development Goals, (ii) the definition of priority guidelines of the Government's management, and (iii) the achievements in terms of institutional strengthening of the Government and other public sector institutions.

35. **Component 3: Contingent Emergency Response (CERC) (US\$0 million).** This component is a contingent financing mechanism available to Argentina to have immediate access to Bank financing to respond to an eligible crisis or emergency, defined as “an event that has caused, or is likely to imminently cause, a major adverse economic and/or social impact associated with natural or man-made crises or disasters.” The mechanism for the triggering of the CERC would be established in the CERC Manual, detailing the applicable fiduciary, environmental and social, monitoring, reporting, and any other implementation arrangements necessary for the implementation of the proposed activities to be financed. In case of an event triggering the component, a reallocation of funds would be introduced to loan disbursement categories, to be able to fund the proposed activities under this component in order to be able to respond to the emergency. The implementation agency for this CERC would be determined in accordance with a CERC Manual.

36. **Project costs by subcomponent are shown in Table 1.** The implementation timeline of railway works under component 1 is shown in Table A3-1 of annex 3.



Table 1: Project Components and Costs (US dollars)

Components and subcomponents	IBRD financing	Counterpart financing ²⁸	Total financing
Component 1: Railway works	580,000,000	75,000,000	655,000,000
1.1. Track and infrastructure renovation, signaling and telecommunications	215,175,000	27,825,000	243,000,000
1.2. Grade separation of railway crossings	88,550,000	11,450,000	100,000,000
1.3. Civil works, upgrade of stations and surroundings, construction of workshops and operating buildings	105,375,000	13,625,000	119,000,000
1.4. Electrification of the Belgrano Sur Line	150,534,000	19,466,000	170,000,000
1.5. Supervision of railway works	20,366,000	2,634,000	23,000,000
Component 2: Institutional strengthening and project management	18,500,000	0	18,500,000
2.1. Railway planning and investment preparation	7,300,000	0	7,300,000
2.2. Climate change resilience and technological innovation	6,300,000	0	6,300,000
2.3. Gender perspective and universal access strengthening	2,100,000	0	2,100,000
2.4. Project management	2,593,750	0	2,593,750
2.5. Strategic evaluation	206,250	0	206,250
Component 3: Contingent emergency response (CERC)	0	0	0
Front-end fee	1,500,000	0	1,500,000
TOTAL	600,000,000	75,000,000	675,000,000

Source: MTR and ADIF.

C. Project Beneficiaries

37. The project is expected to directly benefit about 1.9 million people, corresponding to the population living in the area of influence of the Belgrano Sur Line, of which 51.3 percent are women.²⁹ Beneficiaries of the institutional strengthening and project management component of this project are primarily the MTR and ADIF. Directly and indirectly, the project is expected to benefit 3.2 million people in the municipalities of the Province of Buenos Aires and communes in CABA served by the Belgrano Sur Line.³⁰ Ultimately, the entire population of about 15 million in AMBA will benefit from improvements in accessibility, mobility, and safety and reduced road traffic congestion, air pollution, GHG emissions, noise, and road crashes. Figure A6-4 in annex 6 shows the area of influence of the Belgrano Sur Line overlayed with the proportion of households with unmet basic needs, showing a high concentration of vulnerable households.

²⁸ The Government is exploring the possibility of applying French Development Agency (AFD) co-financing in lieu of counterpart financing.

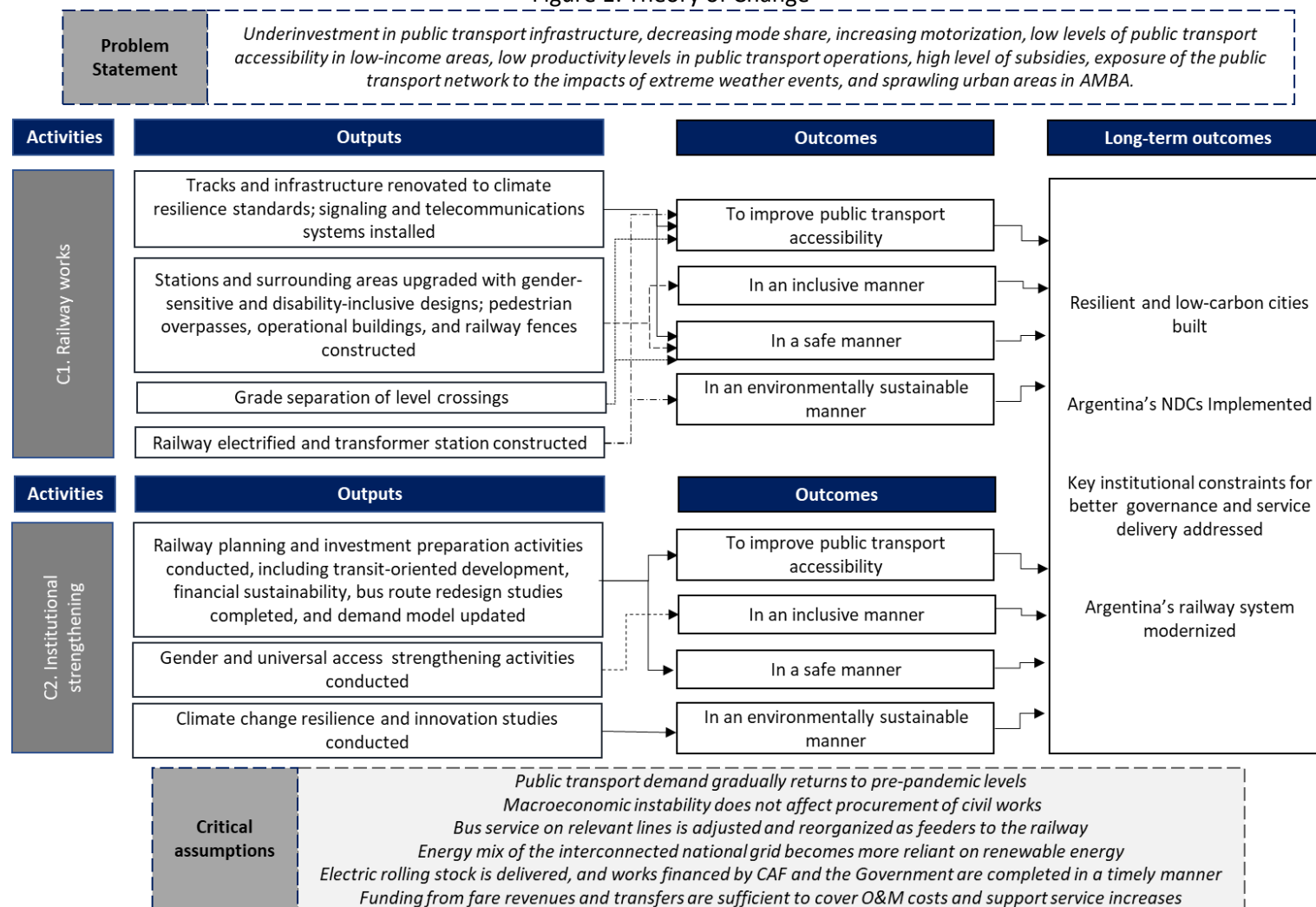
²⁹ The criteria used to determine the number of beneficiaries is based on data from the Urban Transport Survey of Buenos Aires (INTRUPUBA) that determines the buffer zone of stations (maximum distance travelers are willing to travel to access stations): (i) 1,200m for stations in CABA, (ii) 2,000m for stations within the first ring of AMBA, outside CABA, (iii) 3,000m for stations within the second ring of AMBA, and (iv) 3,500m for stations within the third ring of AMBA. As one moves away from CABA, the rail mode is more desirable and travelers are willing to walk more or transfer from other modes.

³⁰ The stations of the Belgrano Sur Line are located in the CABA communes of Barracas, Villa Pompeya, Villa Soldati and Villa Lugano and in the municipalities of La Matanza, Morón and Merlo, in the Province of Buenos Aires.



D. Results Chain

Figure 1: Theory of Change



Source: World Bank. Note: CAF = Development Bank of Latin America; NDCs = nationally determined contributions; O&M = Operations and Maintenance.



E. Rationale for Bank Involvement and Role of Partners

38. **The World Bank is well positioned to add value to urban rail projects.** As a provider of global knowledge, innovation, and technical advice, and through its extensive track record of transport engagement in Argentina, the World Bank supports a platform of trust for the project's design and implementation, bundling together both financial and technical assistance to generate synergies. The World Bank has provided critical support to Argentina to improve urban mobility by financing investments such as rehabilitation of subway lines, road-rail transfer facilities, road-rail grade separations, and Bus Rapid Transit. It has also supported a process of institutional strengthening with planning instruments, capacity building and training, and metropolitan coordination, including the launch of the smartcard for public transport and the development of a transport demand model for AMBA.

39. **The World Bank's Environmental and Social Framework (ESF) also adds value to project preparation, implementation, and sustainability by helping Argentina to better manage risks and impacts throughout the life cycle of the project.** The Bank will bring in international best practices related to environmental and social sustainability, fulfilling the project's national and international environmental and social obligations. Finally, the World Bank's involvement also contributes to strengthening the financial sustainability of the public transport system, which is critical in considering alternative policies and investments that improve the overall efficiency of the network.

40. **Development partners such as the Inter-American Development Bank and CAF have contributed to the modernization of passenger railway infrastructure in AMBA, and CAF is supporting interventions on the Belgrano Sur Line.** The Inter-American Development Bank is financing the modernization of the Roca Line and the General San Martín Line of the suburban railway system (see annex 6 for map of the system). CAF is financing other interventions on the Belgrano Sur railway line through two loans approved in 2017 and 2018, for track upgrades and signaling in the Marinos branch and the extension of the viaduct between Sáenz, Buenos Aires, and Constitución stations in CABA.³¹ The latter two interventions are expected to be completed by the end of 2023 with no joint procurement with the project.

41. **The Government has also funded the acquisition of new rolling stock for AMBA's suburban railway system with bilateral financing, and the new electric rolling stock for the Belgrano Sur Line will be acquired in the same manner.** Around thirty-one trainsets with eight cars each will be necessary to support the future operations of the Belgrano Sur Line, for an estimated total of 248 cars. For the electrical train service, electrical multiple units (EMU) will be used. Train acquisition, delivery, and testing must take place before the electrification of the line is completed.

F. Lessons Learned and Reflected in the Project Design

42. **As a follow up to the Mitre Line project, the Belgrano Sur Line project supports a building-block approach that is critical to ensure continuity of engagement in a strategic sector.** The lending program undertaken by the World Bank vis-à-vis the urban transport sector in Argentina, and specifically in AMBA, through linked operations, has enabled the World Bank to become a key partner on policy reforms and improve public transport service provision.³² Institutional strengthening aspects of the Mitre Line project, currently being

³¹ See paragraph 51 on how they have been considered in setting the targets and Annex 6 for a map of the interventions financed by the proposed project, CAF and the Government.

³² *Argentina Metropolitan Areas Urban Transport Project, Implementation Completion Report* (World Bank, 2021).



implemented, are expected to have impacts that will enhance the result of the Belgrano Sur project. One example of these is the introduction of key performance indicators (KPI) for SOFSE, which will improve operational efficiency in terms of passenger services demand, quantity and quality of supply, and the performance of the infrastructure and rolling stock.

43. **The proposed Belgrano Sur Line project builds on the strong foundations laid by previous operations and analytical work relating to urban transport.** Analytical work conducted by the World Bank globally and in Argentina includes aspects of subsidy targeting, land use planning, transit-oriented development, mode integration and intermodality, the integration of marginalized neighborhoods, and the expansion of nonmotorized mobility, among others. The Belgrano Sur Line project builds on recommendations related to gender-sensitive station designs, universal accessibility, and integration with other transport modes. Recommendations from completed operations have also been considered, for example, the Implementation Completion and Results Report for the São Paulo Metro Line 5 Project (P116170) has stressed the importance of metropolitan coordination, which in AMBA would require coordination at the municipal, provincial and national levels with a strengthened role for the Metropolitan Transport Agency for AMBA, and the importance of managing risks of schedule mismatches between project components, which in the case of the Belgrano Sur Line project is important in the sequencing of track rehabilitation, installation of signaling systems, electrification works and acquisition of rolling stock.

44. **Recommendations emerging from Independent Evaluation Group (IEG) reviews of the transport sector³³ have been considered.** This includes building up the sector's monitoring and evaluation (M&E) efforts by (i) adding indicators that connect the urban and transport agendas (for example, by using accessibility to jobs, which encompass urban format and transport); (ii) emphasizing inclusive, multimodal transport, and climate change-oriented approaches; and (iii) highlighting the importance of integrating innovative aspects into project design and, in the area of new technologies (use of big data sources for informing the development of origin-destination matrices, mode integration, and so on). Further recommendations include an increased focus within transport projects on sustained support to enhance institutional capabilities to plan and carry out maintenance. Component 2 of the project includes the provision of tools and capacity building to further improve ADIF's ability to consider climate resilience, expanding on the activities currently under implementation in the Mitre Line project. In alignment with international good practices and the World Bank's commitments to gender and disability inclusiveness, the project will ensure that infrastructure is fully accessible for people with disabilities and incorporates innovative gender design criteria.

45. **Lessons learned by ADIF in relation to the current implementation of projects financed with international loans (CAF and World Bank) has led to the recent creation of a special projects management unit.** This unit incorporates engineering and construction staff dedicated exclusively to externally financed projects. At the same time, the planning unit has been strengthened with the incorporation of specialists in the preparation of technical designs and specifications and in contractual and procurement aspects with external financing, coordinating the experience with other technical, procurement, and contracting areas within the organization.

³³ World Bank, *Mobile Metropolises: Urban Transport Matters*. An IEG Evaluation of the World Bank Group's Support for Urban Transport (Washington: World Bank, 2017); IEG, *Improving Institutional Capability and Financial Viability to Sustain Transport* (IEG, 2013); World Bank, *A Decade of Action in Transport: An Evaluation of World Bank Assistance to the Transport Sector, 1995–2005* (Washington: World Bank, 2007).



III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

46. **The Argentine Republic will be the borrower of the loan, and the MTR, through the General Directorate for Sectoral and Special Programs and Projects (DGPPSE), will be the main implementing agency for this project.** MTR will be responsible for overall project coordination and management, financial management (FM), procurement, contract management, and payment of some of the activities in Component 2. The Ministry has considerable experience in implementing World Bank financed projects, most recently the Mitre Line modernization project, and it has highly experienced FM and procurement staff who have performed fiduciary functions for other World Bank-financed projects with satisfactory performance.

47. **The project will include ADIF as the sub-implementing entity for infrastructure construction and operation (Component 1), as well as institutional strengthening and project management (Component 2).** ADIF is the state-owned enterprise responsible for the approval, construction, and rehabilitation of railway projects in Argentina³⁴. The MTR and ADIF will coordinate strategic evaluation activities under Component 2 with SAE, which prioritizes and supervises projects financed with international sources, including multilateral organizations. ADIF will be responsible for the procurement, contract management, and payment of the civil works under Component 1, as well as for some of the activities of Component 2, with MTR oversight and supervision.

48. **The World Bank assessed the borrower's fiduciary, environmental, and social management capacities and deemed it adequate for this project.** The MTR has experience developing moderately complex projects and a track record regarding the management of environmental and social issues under the World Bank's safeguard operational policies, as well as under other multilateral development bank standards. ADIF has a strong and well-developed environmental and social management system, as well as a dedicated unit responsible for the management of such issues, integrated by qualified and experienced multidisciplinary staff in adequate numbers. Additionally, ADIF has very recently prepared the Mitre Line project under the World Bank's environmental and social standards. However, the additional workload from the implementation of this new operation means their teams might need to be expanded.

49. **The implementing agencies are preparing an Operational Manual (OM) that will be a condition of effectiveness of the project.** As both the MTR and ADIF have experience working together, most recently for the Mitre Line modernization project, best practices and lessons learned will be incorporated in the project's design.

50. **An assistance and execution agreement will be signed between the MTR and ADIF to transfer funds from the MTR to ADIF and is a condition of effectiveness to ensure these transfers are carried out in accordance with all the provisions of the loan agreement,** including the OM, the anti-corruption guidelines, and the Environmental and Social Commitment Plan (ESCP).

³⁴ ADIF is one of the three subsidiaries of the state company's Argentina Railways (Ferrocarriles Argentinos), along with SOFSE (the passenger railway services operator) and Trenes Argentinos Cargas y Logística, the Argentina Freight rail services manager.



B. Results Monitoring and Evaluation Arrangements

51. **The M&E plan is detailed in section VII.** The Plan is designed to ensure proper monitoring of outcomes as stated in the results framework. ADIF will be responsible for collecting data, with assistance from the MTR and DGPPSE, on outcome and intermediate indicators. Data sources will be numerous, but the source for most operational indicators the source will be SOFSE, as the rail operator, as detailed in the M&E plan. The DGPPSE will coordinate data collection from various sources and agencies, consolidate the information, prepare the M&E reports, and ensure the findings are used to improve the project's management and performance. In addition, the semiannual reports will include the updated annual plan of works and activities including physical progress of works, ESF aspects, and fiduciary reports, as stipulated in the OM.

52. **The results framework is designed to monitor the results of activities financed by the project; however, other interventions on the Belgrano Sur Line will also impact some indicators positively, which has been taken into account when setting targets.** The additional interventions carried out on the Belgrano Sur Line—namely the extension from Sáenz to Constitución, track upgrades on the Marinos branch, and track upgrades between Tapiales and Sáenz—are expected to be completed by 2023, as will be the acquisition of electric rolling stock, which will have an impact on the project results because of their synergistic effects with the project-financed interventions. The impacts cannot be disentangled from the following outcome indicators (and sub-indicators): job accessibility, passengers per day, GHG emissions savings, and railway incidents and accidents per million train-km. Intermediate indicators such as OPEX per car-kilometers (car-km), average travel time between terminal stations (and sub-indicators), services per peak hour (and sub-indicators), and share of users satisfied (and sub-indicators) will also be positively impacted by CAF- and Government-financed interventions. Targets have been set considering the overall expected impact. Most importantly, the project results framework has an adequate number of intermediate outcome indicators to track and demonstrate the project's contribution to each of the above indicators.

53. **Targets for outcome indicators and intermediate indicators were agreed to be based on their expected values as of December 2027, at project closing; however, for some indicators, the full impact of the project will be observed only in 2028.** This includes, for example, the outcome indicator “Passengers per day on the Belgrano Sur Line” and the intermediate indicator “OPEX on the Belgrano Sur Line per car-km.” Aligned with the economic analysis, these indicators will reach the expected values only once the Belgrano Sur Line is fully operating with modernized and electrified infrastructure in 2028, after project closing. Therefore, target-setting was based on estimates considered achievable at the end of the year before the line begins operating fully with the new infrastructure and service levels. More details are provided in the M&E plan. It is important to highlight that the impact of the project on narrowing gender gaps can be observed in the increase in the share of female passengers on the Belgrano Sur Line as a result of higher demand growth rates for females than males.

54. **The project will strengthen technical supervision.** The World Bank will review detailed designs during implementation and participate in the technical supervision of works, with a focus on environmental and social management, based on lessons learned from recent urban rail projects in Latin America. A mid-term review will be scheduled within 24 months of loan effectiveness and/or before disbursements reach 40 percent, to assess project implementation and ensure it is on track to achieve outcomes and objectives, and to restructure the project if needed. Key World Bank specialists will work closely with counterparts and conduct field visits whenever required, allowing for a continuous exchange of information and implementation support in addition to the regular missions. Should field visits not be allowed because of pandemic related issues, virtual meetings will be



scheduled, and the implementation teams will provide the necessary information to ensure detailed supervision (presentations, audiovisual material, drone images, and so on).

C. Sustainability

55. **The project builds on the World Bank’s commitment to Argentina’s strategy for the railway recovery, aimed at improving the quality of service, environmental sustainability, competitiveness, and the population’s standard of living.** A long-term railway plan is being implemented with a series of strategic pillars, including the optimization of various systems (for example, suburban rail, subway, and links to other transport modes), institutional reorganization, and the development of new legal frameworks. The creation of ADIF is part of this agenda.³⁵ The strategic objective is to build and rehabilitate new rail infrastructure within an integrated multimodal transport system, making national development more sustainable and optimizing the development and improvement of passenger transport services while supporting upward social mobility. The improvement of public passenger transport service of AMBA is fully aligned with these objectives. This is achieved through the development of plans, programs, and projects in different areas: human development, territorial and productive integration, and infrastructure investments. The long-term railway plan also fosters the development of local suppliers and basic and state-of-the-art industries to support railway development through technology transfer, creating multiple sources of employment.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic, and Financial Analysis

56. **Technical design.** The modernization of urban rail infrastructure supported by the project conforms to current international and national standards for railway engineering designs. These include up-to-date automated signaling and central controls for enhanced operational safety, catenary system, sustainable railway station designs, and modern railway tracks (concrete sleepers, elastic fastening systems, and welded rails). Based on the assessment of potential climate change-induced and disaster risks, the project incorporates state-of-the-art designs, emergency management systems, and other aspects to increase resilience against climate-induced hazards such as extreme precipitation, flooding, and high temperatures. The stations’ designs include provisions to improve energy efficiency, personal safety, gender equality, and access for people with disabilities. The costs of subcomponents 1.1 to 1.5 were assessed and compared with the costs of similar projects in Argentina, revealing that the estimated costs are reasonable for the scope. Actual costs may vary within reason based on the results of preliminary studies (including topographic, hydrological, and hydraulic surveys, and geotechnical investigations, among others) and on the final designs.

57. **Development impact.** The project supports Argentina’s Passenger Railway Transport Modernization Plan, with an objective to modernize the country’s rail system by means of interventions for track renovation, station upgrades, and grade separation of railway crossings aimed at improving the quality of service, and raising the population’s standard of living from an environmentally and socially sustainable perspective. It addresses a high-priority public transport corridor that has inadequate public transport service, which serves low-income and vulnerable communities.

³⁵ The applicable legal framework includes the General Law for National Railways (Law 2873) and the subsequent modifications, the Railways General Regulation (Decree 90325), with its updates, appendix and supplements, and other specific technical norms, which can be accessed at www.argentina.gob.ar/transporte/cnrt/normativa/transporte-ferroviario.



58. **Rationale for public sector support.** Financing for passenger rail infrastructure is, with very few exceptions, provided by the public sector in developed and developing countries, given the inherent economic characteristics of such assets and the market failures associated with urban transport. There are also important equity considerations and wider economic benefits provided by improved transport systems.³⁶ Fare revenues in most urban railways around the world are unable to fully cover operations and maintenance (O&M) costs, let alone capital expenditures. Therefore, public sector financing and implementation in railway systems is the norm. Since automobile use is not priced at its marginal social cost, governments support public transport to reduce the negative externalities associated with automobile use, such as traffic congestion, air pollution, GHG emissions, crashes, and noise. The public sector also finances public transport for equity reasons, aiming at providing affordable mobility for lower-income populations that often have no other means of mobility. In AMBA, the cost-recovery ratio (fare revenues to O&M costs) of the public transport system was 27 percent in 2019, prior to the impact of the COVID-19 pandemic. Government subsidies ensure the attractiveness and affordability of the system to all income levels. In addition, railway systems play a role in shaping cities, especially in large and dense metropolitan areas such as AMBA, creating wider economic benefits in the long-term, including firm productivity growth driven by agglomeration economies (urban density), increased competition, and economic multipliers from induced spending and local job creation.

59. **An economic analysis was carried out for the interventions on the Belgrano Sur Line.** The base estimation for the cost-benefit analysis considers a with-project scenario, including the interventions to be financed by the project as well as the Belgrano Sur extension to Constitución, the track upgrades on the Marinos branch, partial track upgrades between Tapiales and Sáenz, and acquisition of rolling stock (interventions on the Belgrano Sur Line, henceforth), due to their synergistic impacts, compared with a without-project scenario reflecting current infrastructure and train service levels. A second estimation considers incremental costs and benefits of project-financed interventions only, compared with a without-project scenario in which the Belgrano Sur extension to Constitución, track upgrades on the Marinos branch, and partial track upgrades between Tapiales and Sáenz are finalized.³⁷

60. **The estimation shows that the modernization and electrification of the Belgrano Sur Line is economically justified, with an economic internal rate of return (EIRR) of 13 percent, net present value (NPV) of US\$1.3 billion, and a benefit cost ratio of 2.41.** The benefits in order from greatest to least are: (i) travel time savings for current passengers of the Belgrano Sur Line; (ii) travel time savings for passengers diverted from other modes of public transport and automobiles and users making trips they previously would not have made; (iii) avoided costs of maintenance and repair of the deteriorated railway and rolling stock; (iv) bus operational cost savings triggered by mode shift; (v) automobile operational cost savings triggered by mode shift; (vi) benefits from lives saved and injuries and crashes avoided; (vii) travel time benefits as a result of grade separation of railway crossings; (viii) GHG and air pollution emissions reduction; (ix) reduced road congestion; and (x) road safety benefits from mode shift from automobiles and bus trips to rail. Costs considered for the combined interventions total US\$951 million in market prices. The analysis considers the stream of expected benefits, capital costs and O&M costs over a 45-year horizon (5 years of construction and 40 years of operation). The costs and benefits are

³⁶ Pulido et al. (eds.), *The Urban Rail Development Handbook* (World Bank, 2018).

³⁷ The “incremental” estimation also takes into account the cost differential for the acquisition of electric rolling stock in the with-project scenario and for the acquisition of additional diesel rolling stock to support train service in a without-project scenario.



discounted at a rate of 4 percent.³⁸ The sensitivity analysis shows that the project remains economically viable with discount rates of 6 and 12 percent, and in a stress scenario with a 25 percent increase in capital and operational costs, 50 percent lower demand generation, and a 25 percent decrease in value of time. A scenario in which the costs of diesel double (the energy source of trains in a without-project scenario) increases the EIRR of the project to 14 percent, reflecting an additional benefit of reduced exposure to oil price fluctuations. Furthermore, the incremental analysis considering project financed interventions only is also economically viable, with an EIRR of 14 percent, an NPV of US\$956 million, and a benefit cost ratio of 3.83. Details are presented in annex 2.

61. **Interventions on the Belgrano Sur Line will generate 111,000 additional daily trips on the line.** This 213 percent increase will be achieved mainly by mode shift from other modes of public transport and automobiles but also by users choosing to make trips they previously would not have made. From the total, about 91,000 trips will be diverted from other modes of public transport, including 73 percent from buses, 21 percent from other suburban railway lines, notably the Sarmiento Line, and 6 percent from the subway. About 8,000 additional daily trips on the Belgrano Sur Line will come from mode shift from automobiles. Finally, about 12,000 totally new daily trips will be generated by users choosing to make new trips as a result of the improvements in the public transport system. Demand over the horizon of analysis was projected to grow at a conservative annual rate of 1.33 percent, equivalent to the average population growth in the localities of CABA and the municipalities of La Matanza, Morón, and Merlo, weighted by the number of passengers in each municipality. The projection assumes that by 2024 public transport demand will return to the pre-COVID-19 levels of 2019, based on the sluggish but steady recovery of public transport demand.³⁹

62. **An increase in service frequencies and average speeds will be made possible.** The interventions on the Belgrano Sur Line will increase average speed on the line by 10 percent, to an average of 33 and 34 kilometers/hour on the Marinos and the González Catán branches, respectively. The interventions will allow trains to run every 14 minutes from each of the two branches, sustaining frequencies of about 7 minutes between Tapiales (where the two branches connect) to the future station of Constitución. The new daily frequencies will lead to a 77 percent increase in the number of trains run per year. Travel times from González Catán to Sáenz will decrease from 54 to 50 minutes and from Marinos to Sáenz from 69 to 62 minutes. The new transfer alternative to the subway (Line C) in the new station Constitución will lead to a decrease in travel time from González Catán to the central area of CABA from 1 hour and 31 minutes to 1 hour and 9 minutes, attributable not only to project interventions that will reduce travel time such as electrification, track renovation, and grade separation, but also to the CAF-financed line extension.⁴⁰

63. **A financial analysis was carried out for the interventions on the Belgrano Sur Line.** From the perspective

³⁸ The horizon of the analysis and the discount rates are aligned with World Bank guidance *Discounting Costs and Benefits in Economic Analysis of World Bank Projects*. Regarding the time horizon, the cost-benefit analysis relies on reasonable estimates of the full lifetime costs and benefits associated with a project. Forty years was considered the life span for this project, acknowledging that rail systems may in fact be operational for a longer period. Regarding the discount rate, the World Bank guidance is based on the Ramsey formula, which depends on three elements: (i) estimated economic growth, (ii) elasticity of marginal utility of consumption (θ) assumed to be 2.0 following World Bank guidance, and (iii) inter-temporal elasticity of substitution (ρ) of 0 also following World Bank guidance. The World Bank forecasts a 2.1 percent real GDP growth rate for Argentina in 2023. As a result, a rounded 4 percent discount rate was applied in the base scenario, and sensitivity analysis was carried out with alternative rates.

³⁹ Sensitivity analysis is carried out for scenarios in which ridership does not fully recover at the pre-pandemic levels.

⁴⁰ This takes into account a transfer in Constitución station with a five-minute transfer time from the Belgrano Sur Line and subway line C to Avenida de Mayo station.



of the railway operator, O&M costs per car-km will decrease to US\$4.95 from US\$9.69 on the Belgrano Sur Line. This is due to lower track and electric rolling stock maintenance costs, the adoption of new technologies such as a new signaling system, lower energy costs—diesel compared with electricity—and fixed costs spread over a higher level of service. Another result is the reduction in subsidy per passenger on the Belgrano Sur Line, which is estimated to decline to US\$2.51 from US\$5.64 in 2028, as a result of a higher increase in demand (213 percent) than the increase in O&M costs (46 percent). From the perspective of the Government, which covers the operational deficit of passenger railway operations and bus operations under national jurisdiction in AMBA, the financial benefits are (i) additional fare revenue and commercial revenue on the Belgrano Sur Line, (ii) avoided incremental costs of track and train maintenance and repair, and (iii) avoided bus operational costs from adjusted service levels in lines under national jurisdiction. The financial costs are (i) additional O&M costs on the Belgrano Sur Line and (ii) fare revenue loss from mode shift of passengers from other railways and buses.

64. **Financial benefits amount to 56 percent of financial costs over a 40-year project horizon (in NPV).**⁴¹ An average increase in Government transfers of US\$32.3 million per year will be necessary⁴², which is equivalent to about 3 percent of the transfers to SOFSE or about 1 percent of transfers to support public transport in AMBA, given the current level of subsidies for the suburban railway system in AMBA. Prior to the pandemic, SOFSE's cost-recovery ratio was 9 percent in 2019, up from 4 percent in 2014, supported by fare increases above inflation and a significant reduction in fare evasion.⁴³ With the decline in demand due to COVID-19 and unchanged fares since March 2019, cost-recovery levels dropped to an estimated 3 percent in 2021. Keeping fares affordable has been a priority for the Government, which has a consistent track record of covering SOFSE's operational deficit, which in 2019 was 0.18 percent of GDP and 0.82 percent of national government expenditures. Finally, it is important to highlight that the result of this financial analysis does not include the impact of institutional strengthening activities to inform fare policy, such as an assessment of fare affordability and subsidy targeting, willingness to pay, potential to increase of commercial revenue, and efforts to reduce fare evasion.⁴⁴

65. **An estimated reduction of GHG emissions of 758,000 metric tons of carbon dioxide equivalent (tCO_{2eq}) is expected.** GHG emissions accounting was carried out based on the demand and operational models and follows the methodology developed by the World Bank for railway projects. Baseline GHG emissions from the Belgrano Sur Line without the project over a 40-year horizon were estimated as 1,335,000 tCO_{2eq}, which would drop to a gross GHG emissions of 577,000 tCO_{2eq} in a with-project scenario. The GHG emissions savings with the interventions on the Belgrano Sur Line result from two main sources: (i) mode shift to rail from more GHG-intensive travel modes, with a direct reduction in gasoline and diesel emissions from automobiles and buses, and (ii) shift from diesel to electric trains with a direct reduction in diesel emissions, which is net of the increase in indirect emissions from added electricity requirements.⁴⁵

⁴¹ Mode shift from other railway lines and bus lines will lead to a loss in fare revenue in affected lines, and this has been accounted for in the financial analysis.

⁴² Calculated for the period from 2028 to 2038.

⁴³ The cost recovery ratio is calculated as the ratio of fare revenue to O&M cost.

⁴⁴ A 4 percent discount rate was used in the financial analysis (Annex 2).

⁴⁵ The GHG emissions associated with electric trains are estimated to be 45 percent lower per train-km compared with diesel trains



B. Fiduciary

(i) Financial Management

66. **An FM assessment was carried out to assess the adequacy of the arrangements⁴⁶ in place at the DGPPSE within the Ministry of Transport and ADIF to support project implementation.** This assessment was completed in March 2022. It was determined that the FM arrangements in place are acceptable to the World Bank because they: (i) are capable of correctly and completely recording project transactions; (ii) are able to facilitate production of the requisite financial reporting on timely manner; (iii) safeguard the project's assets; and (iv) are subject to auditing arrangements acceptable to the World Bank. The project will also include retroactive financing as part of Component 1 for payments incurred on or after January 1, 2022, but in no case more than 12 months prior to the loan agreement signing. Further FM details are presented in annex 5.

(ii) Procurement

67. **Procurement will be conducted using the World Bank's *Procurement Regulations for IPF Borrowers*, dated November 2020, for the supply of works, goods, and non-consulting and consulting services.** World Bank's standard procurement documents will govern the procurement of World Bank-financed open international competitive procurement. For procurement involving national open competitive procurement, the borrower will use standard procurement documents acceptable to the World Bank that will be included in the OM. Further details regarding procurement are included in annex 5.

68. **The procurement capacity assessment of the MTR and ADIF was updated by the World Bank's procurement team in February 2022.** The assessment mainly reviewed the organizational structure for implementing the project and the experience of the existing procurement staff. The assessment concluded that the MTR has considerable experience in implementing World Bank-funded projects, including urban transport operations and the recent Mitre Line project. The MTR has highly experienced procurement staff with knowledge of World Bank procedures who performed the function for another World Bank-financed project. However, the MTR staff has limited experience in executing International Federation of Consulting Engineers (FIDIC) contracts. ADIF has no experience with FIDIC contracts and its experience under World Bank's procurement procedures is limited to the two processes of the Mitre Line project that are currently under execution.

C. Legal Operational Policies

	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

D. Environmental and Social

69. **The social risks and potential impacts are not likely to be significant.** Potential social risks and impacts are low to moderate and mostly include sexual exploitation, abuse and harassment risks during construction,

⁴⁶ The financial management assessment is conducted in accordance with FM directives and in line with the World Bank's *Guidelines Manual for World Bank-Financed Investment Operations*.



occupational health and safety risks, inadequate stakeholder engagement (particularly of vulnerable populations in the project vicinity, of women, or of persons with disabilities), or missing opportunities for social inclusion of vulnerable groups (women, persons with disabilities, the elderly, and very poor communities living along the Belgrano Sur Line) in the project.

70. **Social opportunities are related to the promotion of social inclusion**, such as access to benefits for the whole beneficiary population, including full consideration of (i) universal access for persons with disabilities, (ii) gender aspects and mitigation of sexual exploitation, abuse and harassment risks for women workers and other service users, such as LGBTI+ communities, and (iii) increased accessibility for female users and taking positive measures to enhance the participation of women, LGBTI+ and persons with disabilities in the workforce. Thus, the project is expected to have positive impacts in terms of service delivery and inclusion of poor people, gender equality in both transport service and employment, and universal accessibility for persons with disabilities. The project will also explore opportunities to include labor performed by persons with disabilities.

71. **The environmental risks and impacts are not expected to be significant.** The preliminarily identified environmental risks and impacts, which occur mainly during the construction stage of Component 1, are temporary, predictable, and/or reversible, of low to medium magnitude, and located predominantly within the right-of-way zone and state-owned railway areas. These can be mitigated through readily available measures. As the project location corresponds to a densely populated area, it is already highly transformed, and most of the environmental impacts related to the railway's infrastructure to be upgraded by the project have already occurred (railways are fully constructed and have been in operation for more than one hundred years)—with a few possible exceptions. The exceptions correspond, on one side, to those arising from the construction of underpasses and, on the other side, the Central Electrical Transformer Substation required for the electrification of the track to be built on a railroad-used space in the Tapiales area. In principle, there is a low probability of serious adverse impacts in relation to occupational health and safety or community health and safety. The main risks relate to potential electromagnetic pollution,⁴⁷ traffic management, noise, and dust nuisance as well as possible outbreaks associated with civil works of the current COVID-19 pandemic and the recurrent dengue epidemic, in addition to standard occupational health and safety risks, usually present in this kind of infrastructure project.

72. **Impacts on natural habitats are not expected.** Concerning valuable ecosystems or habitats, the Tapiales to González Catán branch borders the Ciudad Evita reserve, which is a municipal nature reserve created in 2015 on its western border (approximately 2 kilometers long). It is expected that there will be no impacts on such a nature reserve, and its ecological functions or biodiversity will not be affected because the upgrade will not change the dimension and structure of the already existing railway. In any case, as part of the project's environmental and social assessment process and for the preparation of relevant ESMPs during project implementation, in line with the approved terms of reference for such instruments, specific mitigation measures for the construction of the new catenaries will be considered. No other valuable ecosystems or habitats have been identified in the project area. The use of concrete sleepers avoids the traditional use of wood that was historically extracted from the country's forests (except in a few specific cases where this impact will be managed through mitigation measures ensuring the provision of wooden sleepers follows the requirements of ESS6 with regard to the sustainable management of living natural resources and primary suppliers).

73. **Environmental benefits are expected from the project.** The track renovation works and their

⁴⁷ Other equivalent electrical installations have been operating for a long time on other AMBA railroad branches with no information of significant adverse impacts.



electrification under the project are expected to lead to a reduction of environmental pollution by gases, noise, and vibrations produced by the operation of the electrified railway system and better technology compared with the current conditions from operating a diesel system using deteriorated tracks. This reduction is also expected to further increase when the supply of the electrified system meets the demand for passengers who currently use automotive modes. It is expected that this process will reduce the presence of buses and cars and their consequent emissions of gases, particulate matter, noise, and vibrations. GHG emissions reduction is one of the expected positive environmental impacts and outcomes of the project. The gross GHG emissions are 577,000 tCO₂eq. The concentration of most of the works within the right of way minimizes the risks of affecting cultural heritage.

74. **It is proposed to use the borrower's framework in connection to labor and working conditions (ESS2).** The World Bank environmental and social team has conducted a project-specific assessment (Assessment) on the use of borrower framework for ESS2. A draft Assessment was disclosed on March 18, 2022, to enable a robust and comprehensive stakeholder consultation with governmental and nongovernmental organizations, which followed preliminary consultations with key authorities between December 2021 and January 2022. The whole consultation process has involved relevant governmental authorities at national and province levels (including the Ministry of Labor, Employment and Social Security and the Province of Buenos Aires and CABA Directorates and Secretariats for Labor Inspection; the MTR, the Ministry of Women, Gender and Diversity; and the National Agency for Disability, among others) as well as trade unions and other nongovernmental organizations. The feedback received from several of these organizations was incorporated in a revised Assessment, which recommended using the borrower's labor framework instead of ESS2 for this project. The Assessment identified one discrepancy between the Borrower's framework and ESS2 as well as a few opportunities to build upon and strengthen the country and ADIF's own framework for the management of the labor risks, which will be addressed through agreed corrective and capacity building actions, respectively, set out in the ESCP. On this basis, the use of borrower framework to manage labor and working conditions risks has been approved by the World Bank, in line with the World Bank's ES Directive.

75. **To manage the environmental and social risks and potential impacts of the project, ADIF developed a stakeholder engagement plan (SEP) and prepared terms of reference for the development of environmental impact and social impact assessments and associated management plans (ESIA/ESMPs)** and drafts of these documents were disclosed in ADIF's website for purposes of stakeholder engagement in March and April 2022, as further detailed in the ESRS. Several organizations and other stakeholders were also notified and invited to participate in these public consultations. The outcome of such public consultations will be used to revise and finalize the stakeholder engagement plan and terms of reference within the time frames set out in the ESCP. The ESCP was disclosed on the Bank's website on April 27, 2022. The SEP was disclosed on the Bank's website on April 10, 2022. The ESIA/ESMP was disclosed on the Bank's website on March 21, 2022.

76. **CAF and Government-financed works on the Belgrano Sur Line are not Associated Facilities, per ESS1.** CAF has approved two loans in 2017 and 2018 for the Belgrano Sur railway, for a total of US\$205 million, which are currently under execution, including: (i) for the railway line between Tapiales and Marinos stations: full track renovation and signaling, renovation of level crossings, conversion of a single-track segment between Marinos and Libertad stations to double-track, renovation of Marinos station, civil works for a new viaduct between Tapiales and Aldo Bonzi stations; and (ii) extension of the railway line through a viaduct between Sáenz and Constitución stations in CABA. Additionally, there are other interventions currently under implementation financed by the Government, which include: track renovations, renovation of level crossings, and renovation of railway culverts in the segment between Sáenz and Tapiales stations, and complementary works in stations



intervened by ADIF. During project preparation, the World Bank environmental and social team conducted a due diligence on each of these interventions, based on the document review and consultations made with the MTR, ADIF, and CAF, and it was concluded that these works are not considered “Associated Facilities” per ESS1 as they do not meet all three cumulative criteria set out in para 11 of ESS1. It was concluded that all these works are directly and significantly related to the proposed project (criterion a) since they are physically developed on the Belgrano Sur Line and are functionally related to the different works foreseen under Component 1. Most of them are carried out contemporaneously with the project (criterion b) since they are currently under execution and their completion dates extend, depending on the case, until 2024. Beyond this, it was concluded that none of the works financed by CAF and the Government fully meet criterion (c) of para 11 of ESS1. This is based on the fact that (i) from the technical point of view of transport, they are not necessary for the proposed World Bank-financed project to be viable, since it can be implemented and be operational without those works being carried out (with the exception of the works to be performed on the extension of the railway line between Sáenz and Constitución), and (ii) importantly, the CAF and Government works have been undertaken even when the proposed Project did not exist, which is based on the fact that the objectives and functionality of each of these works are maintained, regardless of whether the works of the proposed World Bank-financed project are carried out.

Citizen engagement

77. **Both project beneficiaries and the general population will be proactively involved to enhance project implementation and the quality and outcomes of project activities.** ADIF has developed a specific stakeholder engagement program to create a sustained connection with the community and to monitor and manage all types of concerns and requests. This program involves a series of activities, for which ADIF will prepare several communication and dissemination tools, such as flyers and posters, multimedia material, social network content, announcements in selected digital platforms, and direct contact with relevant stakeholders and media. These communication tools and messages will be adapted to the various target audiences, context and type of information to be disseminated.

78. **A consultation strategy is being developed through formal channels, enabling the general public to communicate their queries and remarks, beyond the legally mandated public consultation that is conducted prior to tender processes for civil works.** ADIF has received feedback through a dedicated section of their website, either by a contact form, an email, or written requests in virtual or physical meetings. This channel will stay open through the project lifetime. All feedback will be compiled and forwarded to the competent departments or entities which will provide timely answers to be published in the dedicated section and sent to the interested parties. This way, a record of the successive exchanges between ADIF and the interested parties will be publicly available on their website. These consultation mechanisms will be managed by ADIF and will complement those implemented by the contractors.

79. **In addition, several regular engagement activities, at least biannually, will be organized with stakeholders and the community.** First, these engagement activities will include information update and outreach. ADIF will periodically disseminate information on the status of the project, detailing the execution rate for each component, the grievances and inquiries received, and the corresponding responses. ADIF will also publicly share the progress toward the achievement of the project’s development objectives, using relevant indicators. ADIF will conduct the required monitoring activities, including surveys to assess users’ satisfaction with the railway service and the perceived level of security and comfort of the system, differentiating by gender. Second, follow-up on previous engagements. These engagements will be periodically reviewed, with respect to both the initial consultation activities conducted virtually during project preparation and the feedback and



requests received during implementation. This will allow the incorporation of mitigation measures, changes to the project or construction methods, or any other modifications that may be pertinent. The proponents will be duly informed of the status of their requests and their resolution.

80. **Citizen collaboration will also be encouraged through participatory planning of the interventions to be developed, including the involvement of selected civil society organizations and representatives of vulnerable groups.** At least two thematic areas have been identified, as a result of stakeholder engagement and public consultation activities carried out during preparation: (i) access for people with disabilities and reduced mobility in the railway stations and their surroundings, which will be discussed with the National Disability Agency (ANDIS), and (ii) concerns and access constraints related to minorities, rights vulnerability, discrimination, and previous segregation, such as Afrodescendant citizens or ethnic and sexual minorities. All dissemination materials will have formats adapted for hearing impaired people.

81. **In all of its interventions involving civil works, ADIF will implement platforms for citizen and community engagements as part of its grievance redress mechanisms, both physically and virtually.** ADIF has its own institutional website and a specific webpage for the project, both accessible at www.argentina.gob.ar/transporte/trenes-argentinos-infraestructura, where citizens can access details about the project or submit their inquiries through a digital form. In addition, ADIF has several social media profiles and a phone line through which it regularly answers inquiries, complaints, and comments related to this and other projects. ADIF has a physical registration desk in its head office and suggestion boxes and/or books at every project worksite, the latter managed by the contractors. The contractors' social teams will be responsible for handling these suggestions, which are to receive a formal response within five working days. ADIF will prepare a monthly report consolidating all inquiries to the contractors and their responses. The proposed actions will be monitored using the following indicators in the Results Framework: (i) Intervened stations on the Belgrano Sur Line that involved stakeholder consultations and incorporated feedback (percentage); and (ii) Belgrano Sur Line users satisfied with overall railway service (percentage).

V. GRIEVANCE REDRESS SERVICES

82. **Communities and individuals who believe that they are adversely affected by a World Bank supported project may submit complaints to existing project-level grievance redress mechanisms or the World Bank's Grievance Redress Service (GRS).** The service ensures that complaints received are promptly reviewed to address project-related concerns. Project-affected communities and individuals may submit their complaints to the World Bank's independent inspection panel which determines whether harm occurred, or could occur, as a result of noncompliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention and World Bank management has been given an opportunity to respond. For information on how to submit complaints to the GRS, please visit www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

VI. KEY RISKS

83. **The overall risk rating of the project is assessed as Substantial.** Residual risks that are substantial include: (i) macroeconomic risks affecting project performance, (ii) project's technical design, including demand risk, and (iii) fiduciary risks. The discussion in the paragraphs below is limited to inherent risks that are substantial,



jeopardizing the ability of the project to achieve project outcomes or causing harm or unintended consequences. For each substantial inherent risk, the mitigation measures and the residual risk are presented.

84. **The Macroeconomic risk is Substantial.** Macroeconomic risk includes high foreign exchange volatility and high inflation, which may lead to price adjustment disputes with contractors, and the risk of constrained counterpart financing due to the fragile fiscal situation of Argentina. The project proposes a low share of counterpart financing of 10 percent to mitigate the risks associated with the availability of fiscal resources and budgetary allocations during project implementation.⁴⁸ In terms of the impact of macroeconomic instability and high inflation on civil works implementation, the project will include well-tested polynomic price adjustment formulae in all civil works contracts, to mitigate low performance and delays from contractors due to controversies in price adjustments. To mitigate the risk of foreign exchange volatility, the certification and payment of imported materials used in Component 1 will be paid upon delivery and stockpiling and not upon completion of the contract item. Residual risk is substantial given the moderate likelihood of occurrence and the significant shortcomings in the PDO expected if risk materializes.

85. **The Technical Design of Project risk is Substantial.** The risks identified under this category are described below. Overall, residual risk is considered substantial given its significant potential impact and moderate likelihood of occurrence.

- a. *Demand.* Uncertainty about future demand on the Belgrano Sur Line is a source of risk that may lead to significant shortcomings to PDO achievement and has a moderate likelihood of occurring. Passenger railway demand in AMBA has partially recovered from the impact of COVID-19, but there is uncertainty over the levels of demand that can be achieved in the long-term as mobility patterns may change. In addition, the travel-demand model results for the project, including demand shift from bus and automobile users, are subject to a degree of estimation error. To mitigate the impact of this uncertainty, the well-established and reliable travel demand model for AMBA was utilized, and a sensitivity analysis with different demand forecast scenarios was carried out in the socioeconomic evaluation. To enhance the potential demand on the line, the project will finance a transit-oriented development study and a bus-line optimization study aimed at contributing to new rail demand generation.
- b. *Line operations during project implementation.* The project will be implemented for a railway line that will continue to operate during railway works, which may generate project delays and pose safety risks. As a mitigation, a sequencing of work phases will be established by ADIF to coordinate operation and construction by different contractors. ADIF has vast experience in executing track renovations on operating lines (including the Mitre Line project), so the proposed mitigation is expected to be effective.
- c. *Phasing of different works.* There is a risk of delays in the completion of works required before the beginning of track electrification, including track renovations as well as other interventions financed by CAF and the Government. Coordination between the MTR, ADIF, CAF and the World Bank will take place during missions to ensure works are being conducted at the expected pace and to anticipate any potential delays. Close supervision and a prompt initiation of the relevant procurement processes after project effectiveness will further mitigate this risk. Furthermore, in the project design, there is a margin of at least one year for

⁴⁸ In addition, the Government is exploring the possibility of applying French Development Agency (AFD) co-financing *in lieu* of counterpart financing, which would reduce the macroeconomic risk.



possible delays between expected completion of the works financed by CAF and the Government and before the start of railway electrification works.

- d. *Timing of rolling stock acquisition.* There is a risk related to the timing of the acquisition, delivery and testing of the electric rolling stock, to be separately procured by the Government. Trains will be necessary only when the tracks are electrified, which is expected by the end of 2027. Trains should not be made available significantly before completion of the electrification of the line, as this would require rail yard space availability which would lead to additional costs of rolling stock storage. Delays in the acquisition of the rolling stock would postpone the beginning of the electric service on the line. This risk is mitigated by early preparation of bidding documents and close monitoring by the MTR.

86. **The combined Fiduciary (FM and Procurement) risk is Substantial.** Based on the procurement capacity of MTR and ADIF and the procurement activities envisaged in this project, the following procurement risks were identified: (i) complex and high value contracts under Component 1; (ii) segregation of procurement functions in two implementing agencies, under the oversight and supervision in charge of one of them; (iii) ADIF has only incipient experience under World Bank procurement procedures and no experience in FIDIC contracts, and the MTR has limited experience executing FIDIC contracts. Taking into consideration the risks mentioned above and the specific needs identified to take the responsibility for the procurement functions of this project, the following actions are recommended to reduce risk and facilitate project implementation: (i) the Project Procurement Strategy for Development (PPSD) addresses how procurement activities will support the PDO and deliver the best value for money under a risk-based approach; (ii) the OM will include a detailed description of the roles and responsibilities of the MTR and ADIF as well as ADIF's interaction with its technical units, spelling out the technical, administrative, and contract management tasks and responsibilities of each; (iii) the MTR's and ADIF's procurement specialists and technical staff should attend procurement training within six month of loan approval; and (iv) the World Bank's procurement team will closely assist the project implementation unit and sub-implementing agency based on the specific needs identified to take responsibility for the procurement function. The financial management residual risk is considered moderate. The FM residual risk is considered moderate. Considering the above and the expected workload, the overall fiduciary risk is defined as Substantial.



VII. RESULTS FRAMEWORK AND MONITORING

Results Framework

COUNTRY: Argentina

Buenos Aires – Belgrano Sur Passenger Railway Line Modernization Project

Project Development Objectives(s)

To improve accessibility in the area of influence of the Belgrano Sur Line in an inclusive, safe, and environmentally sustainable manner; and to respond effectively in case of an Eligible Crisis or Emergency.

Project Development Objective Indicators

Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
To improve accessibility in the area of influence of the Belgrano Sur Line							
Jobs in AMBA accessible by public transport from the area of influence of the Belgrano Sur Line in less than 90 minutes (Percentage)		48.20					52.20
Passengers per day on the Belgrano Sur Line (Number)		51,740.00	51,740.00	52,431.00	53,131.00	54,559.00	83,557.00
Female passengers per day on the Belgrano Sur Line (Number)		18,109.00	18,109.00	18,351.00	18,596.00	19,096.00	32,609.00
Social fare passengers per day on the Belgrano Sur Line (Number)		15,522.00	15,522.00	15,729.00	15,939.00	16,368.00	25,067.00
Railway incidents and accidents per million train-km		58.00	43.00	42.00	37.00	35.00	25.00



Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
linked to safety issues on the Belgrano Sur Line (Number)							
Annual GHG emissions savings (Metric tons/year)		0.00					19,000.00

Intermediate Results Indicators by Components

Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
1. Belgrano Sur Upgrade							
Average travel time between terminal stations on the Belgrano Sur Line, differentiated by branch (Minutes)		0.00					0.00
Average travel time between González Catán and Sáenz stations (Minutes)		54.00					50.00
Average travel time between Marinos del Crucero General Belgrano and Sáenz stations (Minutes)		69.00					62.00
Trains per peak hour on the Belgrano Sur line (trunk line) (Number)		4.40					8.60
Trains per peak hour on the		3.00					4.30



Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
González Catán branch (Number)							
Trains per peak hour on the Marinos del Crucero branch (Number)		1.40					4.30
OPEX on the Belgrano Sur Line per car-km (Number)		9.80					6.30
Direct and indirect beneficiaries having enhanced access to railway transport services as a result of interventions supported by the World Bank Group (Number (Thousand))		0.00					3,237.00
Intervened stations on the Belgrano Sur Line that involved stakeholder consultation and incorporated feedback (Percentage)		0.00	19.00	100.00	100.00	100.00	100.00
Physical Progress of track and signaling works in the segment Tapiales-Gonzalez Catán (Percentage)		0.00	5.00	30.00	85.00	100.00	100.00
Length of rail track on the Belgrano Sur Line reconditioned to climate resilience standards (Kilometers)		0.00	2.00	23.00	38.00	38.00	38.00
Stations and station surroundings upgraded on the Belgrano Sur Line (Number)		0.00	0.00	0.00	4.00	14.00	21.00
Stations intervened with		0.00	0.00	0.00	15.00	50.00	100.00



Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
gender sensitive designs on the Belgrano Sur Line (Percentage)							
Intervened stations on the Belgrano Sur Line with accessibility for persons with disabilities (Percentage)		0.00	0.00	0.00	15.00	50.00	100.00
Upgraded stations on the Belgrano Sur Line which benefited from a road safety audit (Percentage)		0.00	0.00	100.00	100.00	100.00	100.00
Grade separation of railway crossings completed (Number)		0.00	0.00	2.00	6.00	8.00	10.00
Physical progress of railway electrification, including transformer station (Percentage)		0.00	0.00	0.00	15.00	75.00	100.00
2. Institutional strengthening for urban mobility and railway operations							
Belgrano Sur Line users satisfied with overall railway service (Percentage)		90.00	90.00	90.00	92.00	95.00	97.00
Female Belgrano Sur Line users satisfied with overall railway (Percentage)		92.00	92.00	92.00	94.00	95.00	97.00
Male Belgrano Sur Line users satisfied with overall railway (Percentage)		89.00	89.00	89.00	90.00	93.00	97.00
Transport demand model updated (Yes/No)		No	No	No	No	No	Yes
Transit-oriented development concepts incorporated in the design of intervened stations		0.00	19.00	52.00	52.00	52.00	52.00



Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
on the Belgrano Sur Line (Percentage)							
Methodological guidelines on railway infrastructure climate resilience developed (Yes/No)		No	No	Yes	Yes	Yes	Yes
Technical internship program targeting female professionals implemented (Yes/No)		No					Yes

Monitoring & Evaluation Plan: PDO Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Jobs in AMBA accessible by public transport from the area of influence of the Belgrano Sur Line in less than 90 minutes	Indicator shows the percentage of total jobs in the Metropolitan Area of Buenos Aires that are reachable with a travel time in public transport in less than 90 minutes. Accessibility is calculated for each zone in AMBA, and a weighted average is calculated for zones located within 1km of existing project stations, using	Calculated at project appraisal and closing.	Public Transport Accessibility Model developed by the World Bank, based on Open Source tools UrbanAccess and Pandana.	Publicly available official General Transit Feed Specification, with frequencies, stop times and trajectories of public transit routes to create the transit network (Dec 2021). Job and population data from census shapefile with total number of jobs, persons, households,	ADIF.



	population per zone as weight. Walking times to stations and expected waiting times is considered. Indicator will be impacted by project financed interventions and by the interventions on the Belgrano Sur line financed by CAF and the Government.			and households with at least one unmet basic need per census tract per census tract (2010). Expected project improvements in terms of travel time savings, headways and line extensions provided by ADIF.	
Passengers per day on the Belgrano Sur Line	Passengers per day on the Belgrano Sur Line, number (in thousands), on both branches. The average for working days is considered for the calculation. Indicator will be impacted by project financed interventions and by the interventions on the Belgrano Sur line financed by CAF and the Government. Target reflects expected result by 2027 but indicator is expected to increase further in 2028 after project completion.	Annual	SOFSE and MTR	SOFSE operational report and database and SUBE card database.	ADIF
Female passengers per day on the Belgrano Sur Line	Description available in parent indicator. Project induced travel was assumed to attract more female passengers (46.6 percent,	Annual	SOFSE and MTR	SOFSE operational report and database and SUBE card database.	ADIF



	the average for the railway system) than the proportion of women as passengers in the baseline for the Belgrano Sur line.				
Social fare passengers per day on the Belgrano Sur Line	Description available in parent indicator. Social fare users are a proxy for low-income users, any change to the program eligibility must be recorded.	Annual	SOFSE and MTR	SOFSE operational report and database and SUBE card database.	ADIF
Railway incidents and accidents per million train-km linked to safety issues on the Belgrano Sur Line	Measures railway incidents (without material or personal damage) and accidents (material and/or personal damage) on the entire Belgrano Sur Line, including both electric and diesel services. The total number of incidents and accidents is normalized per million train-km to ensure comparable values. Indicator will be impacted by project financed interventions and by the interventions on the Belgrano Sur line financed by CAF and the Government.	Annual	SOFSE	SOFSE - Belgrano Sur line - operational report and database.	ADIF
Annual GHG emissions savings	Estimation based on the carbon accounting exercise	Calculated at project	Transport Demand	At baseline, key inputs are derived from the	ADIF.



	over the 40-year operations horizon of project. Takes into account the following sources of GHG emissions savings: (i) mode shift from cars and buses (reduced frequencies) to rail, (ii) shift from diesel to electric service. GHG equivalent emissions are considered. Calculation is carried out under the scope of the socioeconomic evaluation. Indicator will be impacted by project financed interventions and by the interventions on the Belgrano Sur line financed by CAF and the Government.	appraisal and project closing.	Model for AMBA (MTR), operational data (ADIF), shadow prices of GHG emissions (World Bank), official Government scenarios for energy mix/emissions factors (publicly available, World Bank calculations).	demand model and operational model. At closing, annual GHG emission savings over the 40-year operations horizon of the project operations will be recalculated. The with-project scenario will have updated data and new forecasts for demand, train-km of electric service, and bus-km of service. With a re-estimation of the travel demand model, mode shift can be updated.	
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Monitoring & Evaluation Plan: Intermediate Results Indicators					
Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Average travel time between terminal stations on the Belgrano Sur Line, differentiated by branch	Baseline and targets are provided for each sub-indicator, not for the main indicator. Indicator will be impacted by project financed interventions and	Annual	SOFSE	Applicable for sub-indicators.	ADIF



	by the interventions on the Belgrano Sur line financed by CAF and the Government.				
Average travel time between González Catán and Sáenz stations	Actual travel time (minutes) for users of the Sáenz - G. Catán service measured at the end of the year. Saenz station is considered as terminal station for both the baseline and the future situation to ensure consistency.	Project closing.	SOFSE	Train management system information and SOFSE (Belgrano Sur line) operational report. Intermediate targets are not set given that travel time might fluctuate with service interruptions during construction.	ADIF
Average travel time between Marinos del Crucero General Belgrano and Sáenz stations	Actual travel time (minutes) for users of the Sáenz - Marinos del Crucero G. Belgrano service measured at the end of the year. Saenz station is considered as terminal station for both the baseline and the future situation to ensure consistency.	Annual	SOFSE	Train management system information and SOFSE (Belgrano Sur line) operational report. Intermediate targets are not set given that travel time might fluctuate with service interruptions during construction.	ADIF
Trains per peak hour on the Belgrano Sur line (trunk line)	Number of services per hour per direction in trunk section between Tapiales and Constitución measured at the end of the year. Indicator will be impacted	Annual	SOFSE	Train management system information and SOFSE (Belgrano Sur line) operational report. Intermediate targets are not set	ADIF



	by project financed interventions and by the interventions on the Belgrano Sur line financed by CAF and the Government.			given that travel time might fluctuate with service interruptions during construction.	
Trains per peak hour on the González Catán branch	Number of services per peak hour per direction of the services to G. Catán measured at the end of the year.	Annual	SOFSE	Train management system information and SOFSE (Belgrano Sur line) operational report. Intermediate targets are not set given that travel time might fluctuate with service interruptions during construction.	ADIF
Trains per peak hour on the Marinos del Crucero branch	Number of services per peak hour per direction of the services to Marinos del Crucero G. Belgrano measured at the end of the year.	Annual	SOFSE	Train management system information and SOFSE (Belgrano Sur line) operational report. Intermediate targets are not set given that travel time might fluctuate with service interruptions during construction.	ADIF
OPEX on the Belgrano Sur Line per car-km	Evolution of annual SOFSE O&M expenditures for the entire Belgrano Sur Line per car-kilometer expressed in	Project closing	SOFSE	SOFSE internal reports. Average 2021 OPEX was used as baseline. Target reflects	ADIF



	constant pesos of 2021 and converted to dollars of 2021. Indicator will be impacted by project financed interventions and by the interventions on the Belgrano Sur line financed by CAF and the Government.			expected result by 2027 but indicator is expected to improve further in 2028 after project completion.	
Direct and indirect beneficiaries having enhanced access to railway transport services as a result of interventions supported by the World Bank Group	Direct and indirect beneficiaries with improved their access to rail transport services as a result of World Bank Group-supported interventions (in thousands), corresponding to the population in the districts served by the Belgrano Sur Line.	Project closing	ADIF	Demographic estimates in the area of influence are provided by INDEC. Districts considered are the CABA communes of Barracas, Villa Pompeya, Villa Soldati and Villa Lugano and in the municipalities of La Matanza, Morón and Merlo, in the Province of Buenos Aires.	ADIF
Intervened stations on the Belgrano Sur Line that involved stakeholder consultation and incorporated feedback	Consultations with beneficiaries and stakeholders and effective incorporation of relevant feedback generated during the process.	Annual	ADIF	Public consultation report completed, technical specifications and contractor progress reports.	ADIF
Physical Progress of track and signaling works in the segment Tapiales-Gonzalez Catán	Measures the progress of the track work between Tapiales and G. Catán.	Semester	ADIF	Contractor's Progress Report and certification of works. Percentage is	ADIF



				obtained by applying the progress curve to the costs at base values of each activity, divided by the total cost of the work at base values.	
Length of rail track on the Belgrano Sur Line reconditioned to climate resilience standards	Measures the total length of railroad track (32km of single track in the González Catán-Tapiales branch and 6km of single track in the Tapiales-Saenz branch) in which track renovation works were based on a climate resilient design.	Annual	ADIF	Contractor's Progress Report. Values are for track kilometers, not the length of the section. In case of double track, section kilometers are counted twice (equivalent tot single track).	ADIF
Stations and station surroundings upgraded on the Belgrano Sur Line	Number of Belgrano Sur Line railway stations and surroundings intervened	Annual	ADIF	Contractor's Progress Report	ADIF
Stations intervened with gender sensitive designs on the Belgrano Sur Line	A gender-sensitive design must incorporate at least two of the following interventions: gender-neutral signage with information on transit routes, transfers and maps, well-illuminated spaces, enhanced visibility and spaciousness of transit spaces, surveilled areas and access to security totems,	Annual	ADIF	Approved Technical Specifications. Gender criteria is considered applicable when the project design includes a technical solution to improve it.	ADIF



	furniture oriented toward comfort and caregiving, such as bathrooms with changing tables, waiting areas, breastfeeding areas or multifunctional equipment.				
Intervened stations on the Belgrano Sur Line with accessibility for persons with disabilities	Percentage of intervened stations that incorporate accessibility designs for people with disabilities, taking into account the following infrastructure: pedestrian routes, stairs and ramps, parks, gardens, squares and open spaces, parking lots, vertical signs and various urban elements, buildings for public use, transport stations.	Annual	ADIF	Contractor's progress reports	ADIF
Upgraded stations on the Belgrano Sur Line which benefited from a road safety audit	Percentage of railway stations on the Belgrano Sur Line with a road safety audit performed during design stage and/or executive project of the intervention.	Annual	ADIF and World Bank.	Approved Technical Specifications and/or Contractor's Progress Reports	ADIF
Grade separation of railway crossings completed	Measures the number of grade-separated crossings completed with provisional acceptance certificates.	Semester	ADIF	Contractor's progress reports, certification and document of provisional acceptance of the work.	ADIF



Physical progress of railway electrification, including transformer station	Progress of the electrification works of the Constitución - Sáenz - Tapiales - G. Catán and Tapiales - Marinos del Crucero General Belgrano branches.	Semester	ADIF	Contractor's Progress Report and certification of works. Percentage is obtained by applying the progress curve to the costs at base values of each activity, divided by the total cost of the work at base values.	ADIF
Belgrano Sur Line users satisfied with overall railway service	Percentage of users satisfied with overall rail service. Surveys measure the quality of service on a scale of 1 to 10; satisfied users rate overall service between 7 and 10.	Annual	SOFSE	SOFSE reports based on existing survey for Belgrano Sur users.	ADIF
Female Belgrano Sur Line users satisfied with overall railway	Description available in parent indicator. The indicator considers sense of security at stations and sense of security on trains as elements of overall satisfaction, among others.	Annual	SOFSE	SOFSE reports based on surveys	ADIF
Male Belgrano Sur Line users satisfied with overall railway	Description available in parent indicator.	Annual	SOFSE	SOFSE reports based on surveys	ADIF
Transport demand model updated	Completion of the consultancy to be contracted as part of the institutional strengthening component.	Annual	MTR	Approval report.	MTR



Transit-oriented development concepts incorporated in the design of intervened stations on the Belgrano Sur Line	Measures whether concepts of transit-oriented development influenced the design and were incorporated into the designs to upgrade stations and surroundings, including construction of bicycle storage facilities, bicycle docks, pedestrian crossings and bus bay renovations.	Annual	ADIF	Approved Technical Specifications	ADIF
Methodological guidelines on railway infrastructure climate resilience developed	Completion of the consultancy under the institutional strengthening component.	Annual	ADIF	Approval report	ADIF
Technical internship program targeting female professionals implemented	Implementation of a technical internship program for female engineers and professionals from related areas within ADIF and SOFSE.	Annual	ADIF	Female engineers and professionals from related areas hired as interns in ADIF and SOFSE through the internship program.	ADIF



ANNEX 1: Implementation Arrangements and Support Plan

1. **The Argentine Republic will be the borrower of the IBRD loan for the Buenos Aires – Belgrano Sur Passenger Railway Line Modernization Project.** This will be defined in the loan agreement to be signed between the Argentine Republic and World Bank.
2. **The implementing agencies are preparing a OM that will be a condition of effectiveness of the project.** As both the MTR and ADIF have experience working together, most recently on the Mitre Line modernization project, best practices and lessons learned will be incorporated in this project's design.
3. **An assistance and execution agreement will be signed between MTR and ADIF to transfer funds from MTR to ADIF for components 1 and 2 and will be a condition of effectiveness** to ensure it is carried out in accordance with all the provisions of the loan agreement, including the OM, the anti-corruption guidelines, and the ESCP.
4. **The DGPPSE within the MTR will be the national entity responsible for the coordination and supervision of the project, its financial management, and the direct execution of parts of Component 2** (joint execution with ADIF of subcomponents 2.1, 2.2, 2.3, and 2.4). The main competencies and duties of the DGPPSE for the project include: (i) general management and administration of the project, including oversight of ADIF; (ii) budget formulation and execution; (iii) managing the designated account and submitting disbursement requests and documentation of expenditures to the World Bank; (iv) maintaining the project's accounting records and preparing the requisite financial reports; (v) preparing and submitting interim financial reports (IFRs) to the World Bank (including for the activities related to ADIF) and monitoring and reviewing progress estimates and projections prepared by ADIF; (vi) preparing and providing all financial documentation and project reports/information requested by external auditors and World Bank staff (including those related to ADIF); (vii) preparing and updating the OM and ensuring that ADIF follows it; and (viii) verifying compliance with relevant regulatory instruments and procedures; and (ix) elaboration of an execution agreement between SAE and the MTR for strategic evaluation activities under Subcomponent 2.5.
5. **ADIF will be the sub-implementing agency for Component 1 and part of Component 2** (joint execution with the MTR of subcomponents 2.1, 2.2, 2.3 and 2.4). Specifically, ADIF will perform the following tasks and activities: (i) execute civil works in accordance with the technical, procurement, financial, administrative, social, and environmental standards in the loan agreement; (ii) carry out the required monitoring and supervision actions; (iii) monitor the relevant results indicators defined for the project; (iv) verify compliance with the contractual clauses included in the loan agreement and the OM; (v) prepare the required technical and procurement documents; (vi) supervise procurement processes for the relevant components and subcomponents, carry out contract management, evaluate progress and results, and ensure compliance with contractual requirements of the services provided, goods acquired, and works carried out; (vii) approve work certificates; (viii) coordinate and manage relevant agreements with different public entities for the resolution of any obstacles; (ix) coordinate and supervise the management of the social and environmental aspects of the project; (x) coordinate the reception and processing of complaints and suggestions from the general public through the different mechanisms for citizen engagement and grievance redress, reporting them to the World Bank every six months or at its request on specific cases; (xi) propose actions to resolve contractual conflicts that may arise; (xii) compile and store files with technical information on all project activities under its responsibility; (xiii) manage the financial



accounts for all project activities under its responsibility; (xiv) prepare requests to the DGPPSE for funds advances and process payments for all contracts, registering these operations in the accounting system; (xv) prepare the reports required by the IBRD and the DGPPSE, as specified in the loan agreement and the OM, as well as the annual projections of project expenses, to be reviewed and consolidated by the DGPPSE; (xvi) implement an internal control system for project activities under its responsibility; and (xvii) comply with the audit requirements, considering any possible recommendations.



ANNEX 2: Economic and Financial Analysis

Economic Analysis

1. **An economic analysis of the proposed interventions on the Belgrano Sur Line was undertaken.** The cost-benefit analysis estimates the following benefits: travel time savings for existing passengers and passengers diverted from automobiles and from other means of public transport; consumer surplus from users making trips they previously would not have made; reduced vehicle operational costs for automobiles and buses and travel time savings from reduced traffic congestion and road safety benefits, as a result of mode shift; travel time and safety benefits from grade separation; reductions in GHG and local pollutant emissions; and avoided costs from incremental track and train maintenance and repair. The cost-benefit analysis takes into account the stream of expected benefits over a 45-year horizon (five years of construction and 40 years of operation) together with the project's total capital costs and annual O&M costs. The costs and benefits are discounted at a rate of 4 percent in the base scenario, and the feasibility is assessed with the NPV, EIRR, and benefit-cost ratio.⁴⁹ All values used in this analysis are in constant US dollars after adjusting all prices in Argentine pesos to December 2021 values and converting to US dollars based on the exchange rate of 102.66 in December 2021.⁵⁰

Base scenario considering all interventions on the Belgrano Sur Line

2. **The base scenario for the economic analysis considers all interventions on the Belgrano Sur Line regardless of source of financing, and an alternative scenario that considers only the interventions financed by the project is presented subsequently.** All interventions include Component 1 of the project, in addition to track renovations on the Marinos branch and a line extension to Constitución (CAF financed), partial track renovations on the Sáenz to Tapiales segment (Government financed) and rolling stock acquisition (interventions on the Belgrano Sur Line, henceforth), and does not consider costs already executed before 2021. The scenario with all interventions on the Belgrano Sur Line was chosen as base because the benefits are synergistic across interventions, generating a stream of benefits that would not be possible to be achieved separately. The project's expenditures for Component 2, which are 2.7 percent of the project's costs, including training, and capacity building were not evaluated in the economic analysis.

3. **The demand model reveals that interventions on the Belgrano Sur Line will generate 111,000 additional daily trips within the Belgrano Sur Line, an increase of 213 percent.** About 91,000 will be diverted from other modes of public transport, of which about 73 percent from buses, 21 percent from other suburban railway lines, mostly the Sarmiento Line, and 6 percent from the subway.⁵¹ About 8,000 additional daily trips on the Belgrano Sur Line will come from mode shift from cars. Finally, about 12,000 new daily trips will be generated because of improvements in the public transport system, as users choose to make trips they previously would not have made

⁴⁹ The horizon of the analysis and the discount rates are aligned with World Bank guidance Discounting Costs and Benefits in Economic Analysis of World Bank Projects. Regarding the time horizon, the cost-benefit analysis relies on reasonable estimates of the full lifetime costs and benefits associated with a project. Forty years was considered the life span for this project, acknowledging that rail systems may in fact be operational for a longer period. Regarding the discount rate, the World Bank guidance is based on the Ramsey formula, which depends on three elements: (i) estimated economic growth, (ii) elasticity of marginal utility of consumption (θ) assumed to be 2.0 following World Bank guidance, and (iii) inter-temporal elasticity of substitution (ρ) of 0 also following World Bank guidance. The World Bank forecasts a 2.1 percent real GDP growth rate for Argentina in 2023. As a result, a rounded 4 percent discount rate was applied in the base scenario, and sensitivity analysis was carried out with alternative rates.

⁵⁰ This economic analysis builds upon the demand model inputs from the MTR and a cost-benefit analysis carried out by ADIF.

⁵¹ The project will increase the ridership of some lines of other public transport modes because of new transfer opportunities, especially for subway Line C, with 25,000 new daily trips expected on that line.



because travel time costs are lower.⁵²

4. **Demand projections assume that railway ridership will return to the 2019 pre-pandemic levels by year 2024, followed by demand growth which will be equivalent to population growth from 2025 onward.** An annual demand growth rate of 1.33 percent was assumed over the horizon of analysis, based on the population growth rates for the municipalities in AMBA and the communes in CABA served by the Belgrano Sur Line, according to data from the National Institute of Statistics and Census of Argentina. Using population growth rates is a conservative approach since long-term economic growth rates as a determinant of ridership are not being considered in the projection.⁵³

5. **The capital costs of the interventions on the Belgrano Sur Line considered in the cost-benefit analysis amount to US\$951.2 million in market prices.** Capital expenditures are expected to be fully disbursed by 2027, including US\$767.7 million for civil works, US\$160.5 for rolling stock, and US\$23 million for project supervision. Shadow price coefficients were used for the conversion of market prices into economic prices. The estimated coefficients are 0.6195 for labor costs in the construction industry, 0.702 for labor costs in the service industry, 0.685 for operation costs, 0.84 for fuel costs, 0.73 for electricity, 0.77 for imports in CIF prices, and 1.00 for the acquisition of rolling stock.⁵⁴ The useful life of the project was estimated at 40 years, and 10 percent of the capital investment was considered as residual value at the end of the horizon of analysis.

6. **Additional O&M costs for the Belgrano Sur Line to allow service expansion were estimated at US\$46.8 million annually in market prices.** The O&M costs considered in the analysis include electricity, fuel, lubricants, labor, train control center, and cleaning and security, among others. The maintenance costs considered included rolling stock, power lines, signaling, tracks, station maintenance and repair, and machinery and tools.⁵⁵

7. **A total disbenefit of disruptions caused by construction of US\$0.7 million was estimated for two years on the Belgrano Sur Line.** Disbenefits in terms of added travel delay are expected only on the Sáenz-Tapiales segment, which operates with much shorter headways compared with the segment between Tapiales and Marinos and Tapiales and González Catán, so track interruptions can cause significant disruptions. Therefore, an increase of 10 percent in all travel times on the Sáenz-Tapiales segment was estimated for 2025–2026, which is the approximate duration of the expected disruptions from construction on this branch.

8. **The interventions on the Belgrano Sur Line will save existing Belgrano Sur passengers an average of 20 minutes of travel time in their trips, while passengers diverted from other modes of public transport will save an average of 11 minutes.** These savings are valued at US\$9.07 per hour for business and work trips and US\$2.77 for other trips, and they amount to a total of US\$84 million in travel time savings in year 2028, when they are first accrued. Travel time savings for business and work trips (67.9 percent of all trips) are valued at the average wage (calculated as the cost to employer), with a weight of 29 percent for wages for residents in CABA and a weight of

⁵² The Urban Transport Planning Model for AMBA was used for the demand forecasts and evaluates the impacts of policies and investment projects on urban transport, land use and the environment.

⁵³ Demand growth for new trip generation was assumed at 1.53 percent, which is the population growth rate for the municipalities in AMBA where the new demand will originate, excluding CABA.

⁵⁴ Shadow prices do not account for taxes and transfers, and they only reflect the actual resource costs to society. Shadow price coefficients for this project were developed by ADIF and validated by the World Bank, based on the 2020 Dirección Nacional de Inversión Pública publication *Guía General de Evaluación de Proyectos de Inversión*. Shadow price coefficient for domestically sourced materials was estimated conservatively as 1.00.

⁵⁵ Additional OPEX savings may be achieved with the reduction in manual activities through the adoption of new technologies, such as flagmen at railway crossings.



71 percent for wages for residents in other areas of AMBA.⁵⁶ The average gross wage in the private sector for formal workers was adjusted to represent the cost to employers with a coefficient of 1.24.⁵⁷ Travel time savings for education-related, leisure, and other trips (28.5 percent of all trips) are valued at the average per capita income in CABA and other areas in AMBA, weighted by their corresponding proportion of users.^{58,59}

9. **Savings in automobile operational costs for motorists diverted to the Belgrano Sur Line was estimated to be US\$7.28 million in 2028 from 5,600 cars.** The quantified operational cost savings were estimated using data on the marginal operational cost to society of automobiles on a paved road at 40 kilometers/hour.⁶⁰ These include mileage-dependent costs such as fuel, lubricants, tires, washing, vehicle depreciation, amortization and interest and are valued at US\$0.28 per kilometer. The benefits are expected to grow (compared with a without-project scenario) at a rate of 1.33 percent per year, similar to the population growth in the districts directly affected by the project. This is considered a conservative estimate since congestion increases at a faster rate than population.

10. **Mode shift from buses is expected to lead to service level adjustments for the bus lines that will be most affected, generating a total of US\$9.5 million savings in bus operational costs in 2028.** In a conservative calculation that takes into account the rigidities of the bus sector, it was assumed that the occupation rate of bus lines affected by the project and under national jurisdiction would not drop below the 10th percentile of current occupation rates for buses operating in the area of influence of the Belgrano Sur Line. The results show that three bus lines will be affected, and under this assumption, for each, 28, 18, and 1 percent, respectively, of the current service levels would be discontinued. This is equivalent to a total of 52 buses or 12,000 kilometers of service per day. The operational cost savings associated with these reductions are valued at US\$2.28 per kilometer, based on the cost structure that determines compensation to bus operators in AMBA.⁶¹

11. **Because of mode shift from automobiles and bus to rail, traffic congestion relief will be achieved by lowering the number of vehicles on the road, resulting in a reduction on the delay these vehicles would impose on other motorists and bus riders.** Traffic congestion and travel delay data in the morning and afternoon peak hours were used to calculate the number of hours of travel delay caused by traffic congestion in AMBA.⁶² An elasticity between vehicle-kilometers traveled and travel delay of 3.0 was applied to calculate the number of hours of delay that will be saved by motorists (that is, for every additional percentage of cars on the road, travel delay would increase by 3 percent).⁶³ To adjust the results for the potential car backfill induced by faster travel along these roads, a 50 percent backfill rate was assumed. Finally, applying the same value of time as in the travel time savings estimation, travel delay savings of about US\$1.7 million were estimated for year 2028.

12. **Benefits in terms of GHG emissions and air pollution reduction were also calculated as a result of railway electrification and modal shift from automobiles and buses.** The interventions on the Belgrano Sur Line are expected to save 758,000 metric tons of carbon dioxide equivalent (tCO_{2eq}) over the 40-year benefit evaluation

⁵⁶ Values for types of trips calculated by INTRUPUBA, the National Observatory of Transport Data, specific for the Belgrano Sur Line.

⁵⁷ Data and coefficient from the Integrated Social Security System.

⁵⁸ The source is the Continuous Household Survey.

⁵⁹ Methodology follows Gwilliam, K. M., *The Value of Time in Economic Evaluation of Transport Projects: Lessons from Recent Research*. (Washington: World Bank, 2007).

⁶⁰ Estimated by Vialidad Nacional (National Highway Administration).

⁶¹ Costs for SGI lines were considered, given that the affected lines belong to this type of service.

⁶² Tomtom was the source of this information.

⁶³ Elasticity was calculated with historical values in all major urban areas in the United States using data from the Federal Highway Administration and the Texas Transportation Institute. No comparable data is available for Argentina. According to Tomtom delay data, traffic congestion is worse in AMBA compared with major US metropolitan areas, so this is a conservative approach.



horizon from 2028 and 2067. The economic benefits related to GHG emissions savings are expected to amount to US\$61 million (in a low value scenario for the shadow price of carbon) and up to US\$117 million (in a high value scenario). The emissions of methane, nitrogen oxides, sulfur dioxide, PM 2.5, and PM 10, all of which affect local air quality, were converted to CO₂-equivalent emissions (to compare the emissions from various GHG gases based on their global-warming potential). This analysis is further explained in the section on GHG accounting.⁶⁴

13. **Road safety benefits are expected as a result of diverting automobile and bus trips to the Belgrano Sur Line and will total US\$0.3 million in 2028.** The calculation of road safety benefits is based on the external costs of injuries and fatalities, which exist because every additional automobile on the road increases the probability of a road crash. The cost savings were estimated based on the numbers of fatalities, severe injuries and other injuries per vehicle-kilometer in AMBA in 2018, and were quantified using the social costs, as calculated by the National Road Safety Agency, of US\$1,359,000 per fatality, US\$12,600 per severe injury, and US\$1,500 per other injuries.⁶⁵ The costs include medical costs, productivity costs, human costs, property costs, and administrative costs.

14. **Grade separation in 10 railway crossings will generate additional transport safety benefits by avoiding deaths, injuries and crashes, with a benefit of US\$3.0 million in 2028.** The number of deaths over 2009–18 in these 10 railway crossings amounted to 13, the number of injuries 24—all of which considered severe—and the number of crashes, 40, all of them involving train crossings. Since no train-vehicle or train-pedestrian collisions would take place after grade separation, benefits were quantified based on the annual average number of deaths, injuries and crashes in the 10 intersections and on the social costs calculated by the National Road Safety Agency, as described above.

15. **Grade separation will reduce road traffic delays occurring during each train crossing, with respective time savings of US\$2.4 million in 2028.** The average time road traffic is disrupted during each train crossing is two minutes and 40 seconds. For each of the 10 intersections, total road traffic delay was estimated based on vehicle arrival rates (calculated from the annual average daily traffic information from traffic counts), vehicle departure rates, and the duration of the road traffic closures. For each train crossing, the total vehicle delay across the 10 crossings is 136 minutes. Considering the number of train crossings in the scenario without a project, road traffic delays to vehicles would total 132,000 hours per year, which would be avoided in a scenario with project. Total delay was converted to time costs based on a weighted average of the time costs to cars (93 percent of vehicles), considering the value of time for rail passengers multiplied by average car occupancy, to buses (5 percent), and to trucks (2 percent), using marginal operational cost to society of buses and trucks on a paved road at five kilometers/hour.

16. **Cost savings from avoided track and rolling stock incremental maintenance and repair are expected as a result the continuing deterioration that would take place in a without project scenario.** The model assumes a 3 percent annual increase in infrastructure and rolling stock maintenance costs for the Belgrano Sur Line from 2022 and over the horizon of the analysis, reflecting the rate at which the assets would deteriorate in the future without any intervention. It represents the associated maintenance costs necessary to sustain the current status quo. These are estimated at about US\$1.6 million in 2028 and grow over time.⁶⁶

⁶⁴ The shadow price of carbon in the base scenario was calculated using the low estimate from the World Bank's *Guidance Note on Shadow Price of Carbon in Economic Analysis*.

⁶⁵ Costs were calculated in 2017 Argentine pesos and adjusted to 2020 pesos and then converted to US dollars.

⁶⁶ The annual increase in maintenance costs due to the infrastructure deterioration has been validated with SOFSE, which provided evidence



17. **The analysis shows that the modernization of the Belgrano Sur Line is economically justified with an EIRR of 13 percent, an NPV of US\$1.302 billion, and a benefit cost ratio of 2.43.** The largest benefit comes overwhelmingly from travel time savings for both existing users of the system and new users of the system, followed by avoided costs of incremental maintenance and repair, GHG emissions reduction, automobile operational cost savings, traffic congestion relief, and, lastly, road safety benefits from mode shift (Table A2).

Table A2-1: Benefits in the Base Scenario (NPV, discount rate of 4 percent, 40-year horizon, million US dollars)

Benefit category	Benefit value
Travel time savings for current users	\$797.8
Travel time savings for new users	\$754.1
Avoided costs of incremental maintenance	\$192.7
Buses operational cost savings	\$182.3
Automobile operational cost savings	\$138.7
Safety benefits from grade separation	\$56.8
Avoided road traffic delays from grade separation	\$45.3
GHG _{eq} emission savings	\$38.0
Road traffic congestion relief from mode shift	\$33.0
Road safety benefits from mode shift	\$5.8
Total benefits	\$2,244.5

Source: World Bank. Note: GHG_{eq} = greenhouse gas equivalent.

18. **Sensitivity analysis shows that the project continues to be economically justified when considering large reductions in demand generation, cost overruns, and higher discount rates, and also in the case of a stress “all-goes-wrong” scenario (Table A2-2).** Using a 6 percent discount rate results in an NPV of US\$332 million. A 12 percent discount rate produces an NPV for the project of US\$35 million. A 20-year horizon for service operations changes the NPV of the project to US\$615 million. The change in parameter that reduces the project’s EIRR most significantly is a 50 percent decrease in the value of time, with the EIRR dropping from 13 to 8 percent.⁶⁷ A 50 percent increase in costs (capital and O&M costs) was also calculated, resulting in an EIRR of 8 percent. Scenarios that do not significantly alter the results relative to the base scenario are a 50 percent reduction in avoided costs of incremental maintenance, a 50 percent reduction in the operational cost savings of automobiles or buses, and a 50 percent reduction in the benefits from grade separation. A stress scenario in which “all-goes-wrong,” with a 25 percent increase in capital expenditures (CAPEX) and OPEX, a 25 percent decrease in the value of time and 50 percent lower demand generation changes results in an EIRR of 5 percent and NPV of US\$87 million. Furthermore, other sensitivity calculations lead to an increase in the economic viability of the project, for example, using the high shadow price of carbon or a scenario in which diesel prices increase—which would imply that OPEX in the without-project situation increase and the operational cost savings from bus transport would increase.

based on historical figures that about 50 percent of their current maintenance costs are due to infrastructure conditions and the costs are increasing over time. An independent railway engineer was also consulted on the estimation of this benefit. This assumption was considered more realistic compared with an alternative in which service must be halted because of railway conditions or an alternative in which the railway is not maintained as required, leading to serious safety risks.

⁶⁷ A lower value of time could be considered if estimations are based on wages for informal workers and the differentiation of value of time by income.



Table A2-2: Sensitivity of the Cost-Benefit Analysis in the Base Scenario

Scenario	EIRR	NPV (US\$ million)	Benefit cost ratio
4 percent discount rate (base scenario)	13%	\$1,302	2.41
6 percent discount rate	13%	\$702	1.93
12 percent discount rate	13%	\$35	1.07
20-year horizon	12%	\$615	1.80
50 percent increase in CAPEX and OPEX	8%	\$841	1.61
50 percent lower demand generation	10%	\$756	1.82
50 percent lower value of time	8%	\$497	1.54
50 percent decrease in bus cost savings	12%	\$1,211	2.31
50 percent decrease in maintenance savings	12%	\$1,188	2.29
Demand level recovers to only 80 percent of pre-pandemic levels by 2024	11%	\$992	2.08
50 percent decrease in time and safety benefits from grade separation	12%	\$1,155	2.25
100 percent increase in diesel costs	14%	\$1,423	2.71
High shadow price of carbon dioxide	13%	\$1,320	2.43
25 percent increase in CAPEX and OPEX, 50 percent lower demand generation, 25 percent decrease in value of time	5%	\$87	1.08

Source: World Bank. Note: EIRR = economic internal rate of return; NPV = net present value; CAPEX = capital expenditures; OPEX = operating expenses.

Scenario considering only project financed interventions on the Belgrano Sur Line

19. **In addition to the economic analysis for all interventions on the Belgrano Sur Line, a second cost-benefit analysis was estimated for the interventions financed by the project only.** A without-project scenario is such that the interventions financed by CAF and the Government are assumed completed by 2027—that is, the extension from Sáenz to Constitución as well as the track upgrades in the Marinos branch—but the interventions financed by the project are not. While the CAF-financed extension to Constitución will attract many new users because of the new trip transfer alternatives, the system would still have capacity restrictions in the scenario without World Bank-financed interventions, and the line would not be able to provide the required service frequency and would not benefit from increased speeds associated with electrification, track rehabilitation, and signaling upgrades.

20. **The demand model results show that project financed interventions will generate 64,000 additional daily trips within the Belgrano Sur Line, an increase of 65 percent with respect to a scenario with CAF and Government financed interventions only.** In this scenario, it is assumed that the synergistic impacts from the combination of all interventions on the Belgrano Sur Line results in travelers making trips they previously would not have made, and to the mode shift from automobile travel. These two types of demand generation represent a total of 31 percent of the total demand increase in a scenario with all interventions.

21. **The costs and benefits were quantified following the same assumptions as the assumptions adopted in the base scenarios, with the changes described below:**

- (i) Capital costs amount to US\$679.1 million. Capital expenditures are expected to be fully disbursed by 2027,



including US\$632.0 million for civil works, US\$24.1 for rolling stock,⁶⁸ and US\$23 million for project supervision.

- (ii) Additional OPEX costs amount to US\$10.8 million.
- (iii) The interventions financed by the project will save existing Belgrano Sur passengers an additional 8 minutes of travel time and new users 10 minutes of travel time.
- (iv) Bus operational cost savings are generated only when all interventions on the Belgrano Sur Line are considered.
- (v) In this scenario GHG emissions savings are larger compared with the base scenario because the without-project situation has more daily diesel trains running compared.
- (vi) In this scenario the reduction of road traffic delays as a result of grade separation is higher compared with the base scenario because the without-project situation has more daily trains running.
- (vii) Cost savings from avoided track and rolling stock incremental maintenance and repair apply only to the track and rolling stock serving the González Catán branch, since Marinos branch infrastructure would have just been upgraded with the CAF-financed works.

22. **The results shows that the project under this scenario is economically justified with an EIRR of 14 percent, an NPV of US\$956 million, and a benefit cost ratio of 3.89.** Table A2-3 shows the quantification of each type of benefit, with travel time savings representing the largest share. The same sensitivity analysis of the base scenario was conducted, with the lowest EIRR of 9 percent observed in the situation with a 50 percent lower demand generation. The stress scenario for which “all-goes-wrong,” with a 25 percent increase in CAPEX and OPEX, a 25 percent decrease in the value of time, and 50 percent lower demand generation, leads to an EIRR of 7 percent and an NPV of US\$256 million.

Table A2-3: Benefits in the Scenario with Project-Financed Interventions Only (NPV, discount rate of 4 percent, 40-year horizon, million US dollars)

Benefit category	Benefit value
Travel time savings for current users	\$416.4
Travel time savings for new users	\$332.2
Bus operational cost savings	\$182.3
Avoided costs of incremental maintenance	\$112.6
Avoided road traffic delays from grade separation	\$71.5
Automobile operational cost savings	\$65.7
Safety benefits from grade separation	\$56.8
GHG _{eq} emission savings	\$31.0
Road traffic congestion relief from mode shift	\$21.3
Road safety benefits from mode shift	\$3.7
Total benefits	\$1,293.5

Source: World Bank. Note: GHG_{eq} = greenhouse gas equivalent.

Additional Benefits

23. **In addition to the benefits estimated in the cost-benefit analysis for both scenarios, it is important to discuss qualitatively additional benefits that were not quantified.** Benefits associated with reduced congestion

⁶⁸ The estimation of rolling stock acquisition costs in this scenario is for the differential between electric and diesel rolling stock acquisition in a without project scenario, which would be needed for the level of service expansion in that scenario.



due to fewer cars on the road would also generate reduced fuel consumption and decreased wear and tear from less stop-and-go traffic for motorists who continue to use their automobiles. Fewer cars on the road would also lead to some noise reduction. Grade separation also leads to time savings for pedestrians and for cars that would reroute to the grade separated crossings (road network effects). In turn, a reduced number of crashes in former at-grade crossings will also lead to fewer service disruptions on the Belgrano Sur Line. Finally, railway electrification would significantly reduce noise levels around the railway line. Other benefits that would bring a positive impact are related to passenger comfort.

24. **The modernization of the Belgrano Sur Line will also drive economic development impacts, such as productivity, employment, property values, investment, and tax revenues.** The project is expected to improve accessibility (that is, people’s ability to access education, employment and services and businesses’ abilities to hire from a wider pool of workers), which tends to increase worker productivity, income, and welfare and create gains in terms economic growth in AMBA. These economic development impacts are considered as wider economic benefits and originate from the direct benefits considered in the cost-benefit analysis.

Financial Analysis

25. **A financial analysis of the impact of the interventions on the Belgrano Sur Line was conducted from the point of view of the railroad operator and the Government.** While the economic analysis evaluates the project from a social point of view, considering benefits to users and externalities, the financial analysis focuses solely on the financial flows. The analysis was based on a review of SOFSE’s recent audited financial statements, a state-owned enterprise which began to operate urban rail services in AMBA in 2014. The financial statements include SOFSE’s urban passenger service operations and also medium- and long-distance passenger services in Argentina; however, the latter represent less than 3 percent of its costs.^{69,70}

26. **SOFSE’s estimated O&M costs amounted to US\$923 million in 2019.** O&M costs between have varied between a maximum of US\$1.2 billion in 2015 and a minimum of US\$0.93 million in constant 2019 US dollars. Labor costs represented 69 percent of total O&M costs in 2019, while energy and fuel costs represented 5 percent and materials and maintenance 6 percent. In comparison, labor costs in comparable commuter railway systems in Brazil and the United States varied between 45 and 73 percent—namely, Rio de Janeiro (45 percent), São Paulo (50 percent), New York (73 percent), Chicago (63 percent), and Boston (60 percent).^{71,72}

27. **SOFSE’s cost recovery ratio—operational revenues compared with O&M costs—increased from 4 percent in 2014 to 9 percent in 2019; however, given the impacts of COVID-19, cost recovery declined to 3 percent in 2020 and 2021 (figure A2-1Figure A).** To cover the operational deficit, transfers from the National Treasury and transfers from the Integrated Railway System (SIFER) supplement SOFSE’s revenue. The gap between

⁶⁹ In AMBA, SOFSE operates the Roca, San Martín, Sarmiento, Tren de la Costa, Mitre and Belgrano Sur lines.

⁷⁰ For the period 2014–2018, publicly available audited financial statements were analyzed. The operations of the Roca, San Martín, Mitre, and Belgrano Sur lines were transferred to SOFSE at the end of 2013, so for the years 2014 and 2015, compensations for the operation and management of these services by the Mitre Sarmiento Railways Operation Management Unit, Emergency Railways Operation Management Unit, Argentren, and Corredores Ferroviarios were included in the costs. The salaries and labor costs of some of the staff assigned to SOFSE’s railway lines were accounted for by Trenes Argentinos Capital Humano and were therefore not directly counted as costs in SOFSE’s financial statements. The audited financial statements were adjusted to reflect these labor costs. Staff from Trenes Argentinos Capital Humano progressively migrated to SOFSE starting in 2018. For 2019, the financial data are from the 2019 savings, investment, and financing (AIF) accounts, also adjusting labor costs with the AIF accounts for Trenes Argentinos Capital Humano.

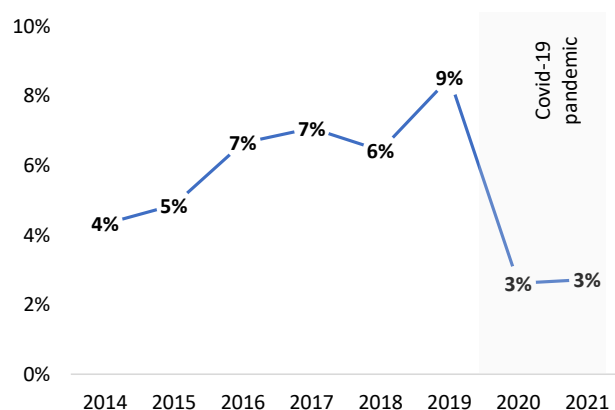
⁷¹ This excludes amortization in the total O&M costs.

⁷² Systems considered were SuperVia (Rio de Janeiro), São Paulo Metropolitan Rail Company (São Paulo), Long Island Rail Road (New York), METRA (Chicago), and MBTA Commuter Rail (Boston).



O&M costs and operational revenues was US\$845 million in 2019, which increased to an estimated US\$967 million in 2021 given the decline in ridership and operational cost increase per car-km. The average fare for the Belgrano Sur Line increased five times from 2016 to 2019 in current prices (figure A2-2Figure), but it has been constant since March 2019. Fares on the Belgrano Sur railway vary between US\$0.07 and US\$0.11, depending on the length of the trip and before any social fare or transfer discounts. The subsidy per passenger-trip in SOFSE was estimated to be US\$2.20 in 2019 before the pandemic, which compares to US\$4.68 in Boston, US\$6.46 in New York, US\$6.77 in Chicago, and US\$0.15 in São Paulo.^{73,74}

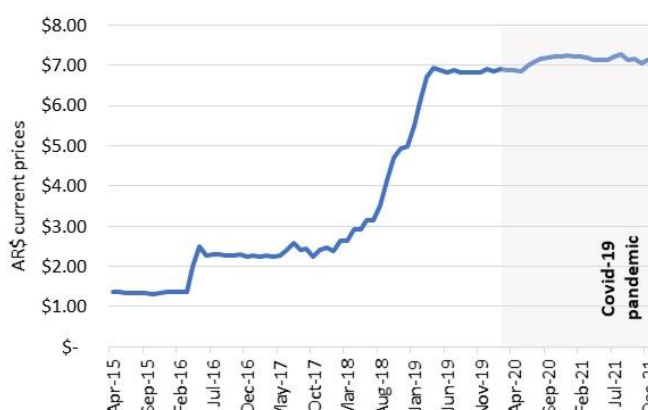
Figure A2-1: SOFSE's Cost Recovery Ratio (percentage)



Source: World Bank estimates.

Note: From 2020–2021 based on preliminary information and from 2014–2019 based on audited financial results.

Figure A2-2: Average Fare on the Belgrano Sur Line (Argentine pesos in current prices)



Source: Data from the National Commission for Transport Regulation.

Note: Corresponds to the average ticket paid, considering fare segmentation by distance traveled, social fare and student discounts.

28. **To support a public transport system with affordable fares, the Government provides transfers to cover SOFSE's operational deficit.** AMBA's railway system does not generate enough operational revenue from fares to cover O&M costs, let alone capital costs.⁷⁵ The Government has a consistent track record of covering SOFSE's operational deficit with transfers, which amounted to 0.18 percent of GDP and 0.82 percent of expenditures of the national government in 2019. Accordingly, capital investments for the project are not recovered with fare revenue.

29. **From the point of view of the rail operator, the interventions on the Belgrano Sur Line will contribute to a decrease in the subsidy per passenger and will reduce the operational cost per car-km.** The subsidy per passenger on the Belgrano Sur Line is estimated to decrease to US\$2.51 in 2028 with the project, down from US\$5.64 without the project, as a result of a higher increase in demand (213 percent) relative to the increase in O&M costs (46 percent). Another result that follows is the improvement in the operational efficiency, with a reduction in O&M costs per car-km on the Belgrano Sur Line. With the project, O&M costs per car-km in 2028 are expected to be US\$4.95 compared with US\$9.69 without the project. This analysis considers the projected cashflow of the rail operator, taking into account the forecast O&M costs and the forecast fare and commercial

⁷³ Systems considered were the São Paulo Metropolitan Rail Company (São Paulo), Long Island Rail Road (New York), METRA (Chicago), and MBTA Commuter Rail (Boston). SuperVia (Rio de Janeiro) has full cost recovery.

⁷⁴ With the impact of the pandemic, subsidy per passenger-trip increased US\$5.77 in 2021 for SOFSE.

⁷⁵ Pulido et al. (eds.). Urban Rail Development Handbook.



revenue with and without the project, assuming constant fares in real terms.

30. **From the point of view of the Government, the revenue to be generated by the interventions on the Belgrano Sur Line will cover 56 percent of the additional operational costs over the 40-year horizon of the project (in NPV).** This analysis considers that the Government will continue to cover the financial deficit of the railway system and the bus system.⁷⁶ The financial benefits include fare revenue, commercial revenue, and savings from avoided repair of track and trains (on the rail operations side), and operational cost savings from bus service adjustment (on the bus operations side). Additional fare revenue in 2028 is expected to amount to US\$3.0 million, non-fare revenue to US\$1.2 million, avoided track and train repair to US\$1.5 million, and bus operational cost savings to US\$9.5 million for lines operated under national jurisdiction. On the cost side, in addition to the O&M cost increase of US\$46.8 million, mode shift from other railway lines, mainly the Sarmiento Line, will represent a fare revenue loss of US\$0.6 million, and mode shift from bus transport will represent a fare revenue loss of US\$3.2.⁷⁷

31. **The interventions on the Belgrano Sur Line will lead to an increase in Government transfers to cover public transport O&M costs, which is estimated to be on average US\$32.3 million annually.**⁷⁸ In 2028, additional transfers represent about 3 percent of the current amount received by SOFSE from the national government and about 1 percent of the transfers to public transport in AMBA from all levels of government. The annual transfer amount lowers over time as the avoided costs of track and train maintenance and repair become more significant.

32. **Institutional strengthening activities will inform the MTR and ADIF on actions to support financial sustainability, such as studies on subsidy targeting, willingness to pay, increasing commercial revenue potential, and management of fare evasion.** The benefits associated with the institutional strengthening component, however, are not quantified. First, an assessment of willingness to pay for higher level of service as a result from the project to inform acceptable and affordable fare levels. Second, studies on subsidy targeting could provide technical inputs to support decisions on the fare structure and targeting system. Third, an analysis of the potential to maximize non-fare revenues in the railway system, currently 29 percent, is key, as the project will generate significant increase in passenger traffic in stations. Finally, the project is expected to contribute to a reduction of fare evasion, with CCTV cameras and turnstiles.

GHG Emissions Analysis

33. **The project is expected to save 758,000 metric tons of carbon dioxide equivalent (tCO_{2eq}) over the 40-year evaluation horizon (table A2-4).** The project's impact is defined as the difference in GHG emissions between the baseline emissions scenario without-project (1,335,000 tCO_{2eq}) and the gross emissions scenario with-project (578,000 tCO_{2eq}). The reductions in GHG emissions result from two main sources: (i) modal shift to rail from more GHG-intensive travel modes with a direct reduction in gasoline and diesel emissions, as a result of the changes in travel demand, and (ii) shift from diesel trains to electric trains with a direct reduction in diesel emissions, net of the increase in indirect emissions from electricity use. The economic benefits related to GHG emissions savings are expected to amount to US\$61 million (in a low value scenario for the shadow price of carbon) and up to US\$117 million (in a high value scenario).

⁷⁶ Bus lines under national government jurisdiction.

⁷⁷ Non-fare revenue was estimated based on the average ratio of revenue from commissions from charging smartcards, advertisements, and other services, to fare revenue between 2015 and 2019, which was 32 percent.

⁷⁸ Calculated for the period from 2028 to 2038.



Table A2-4: GHG Emissions Calculation

Time frame	Baseline GHG emissions without project (tCO _{2eq})	Gross GHG emissions with project (tCO _{2eq})	Net GHG emissions* (tCO _{2eq})	Annual net GHG emissions* (tCO _{2eq})
2028-2067	1,335,000	577,000	-758,000	-19,000

Source: World Bank. Note: GHG = greenhouse gas; tCO_{2eq} = tons of CO₂ equivalent. * Negative net emissions indicate that the project saves GHG emissions, that is, the GHG emissions with project are lower than the GHG emissions in the baseline scenario without project.

34. **The calculation of the GHG emissions is based on the World Bank guidance note.** The analysis uses as main inputs the demand scenarios for the socioeconomic evaluation provided by the MRT, combined with World Bank data for the shadow price of carbon, emissions factors, and publicly available information on the energy mix in Argentina, including energy mix scenarios for 2030. There are two policy scenarios that the Government has adopted for 2030, with either 20 percent of renewable energy or 30 percent. The less ambitious scenario for 2030 is considered as the base for the emissions factor projection, and the more ambitious scenario for 2030, with 30 percent of renewable energy, is considered achieved only by 2040. All other assumptions are aligned with those made in the economic analysis.

35. **Changes in GHG emissions that result from this urban rail project come from three main sources:**

- Modal shift to rail from more GHG-intensive travel modes, as the project intervention leads to changes in travel demand.** Modal shift will account for positive GHG emissions savings of 674,000 tCO_{2eq}, 56 percent of which derives from mode shift from private automobiles and 44 percent from bus to rail.
- Phasing out diesel consumption for train traction given the electrification of the line.** Diesel trains will no longer be operational on the Belgrano Sur Line, leading to emissions savings of 661,000 tCO_{2eq}.
- Changes in electricity consumption due the electrification.** With the expanded service levels, associated emissions from electric trains represent negative emissions savings of -577,000 tCO_{2eq}. On average, GHG emissions associated with electric trains are about 59 percent lower per train-km compared with diesel trains in Argentina in the project.

36. **Savings from electrification consider the phasing out of diesel fuel trains, the additional electricity generation emissions, the average emissions factor reflecting the forecast electricity mix in Argentina.** The GHG emissions related to the project's use of electricity reflect the source of energy in the grid. In Argentina, the national interconnected grid is managed by the Electricity Market Management Company (Compañía Administradora del Mercado Mayorista Eléctrico).⁷⁹ Therefore, the national average electricity factor can be used to assess the GHG emissions resulting from project's electricity use. The estimated emissions factor for 2020 is 0.300 tCO₂/MWh of electricity consumed, considering a weighted average of renewable and fossil fuel sources. Under the assumptions explained in Paragraph 34, the emissions factor is expected to decrease to 0.198 tCO₂/MWh by 2030 and to 0.152 tCO₂/MWh by 2040.

37. **To quantify GHG emissions externalities, the shadow price of carbon (US\$/tCO_{2eq}) is multiplied by the annual GHG emissions (tCO_{2eq}) over the project horizon.** The 2028 price per tCO_{2eq} was set to US\$48/tCO_{2eq} (low value scenario) and US\$96/tCO_{2eq} (high value scenario), with an annual growth in accordance with the 2017 World Bank guidance note on the shadow price of carbon. The shadow price of carbon is derived from three measures: (i) social cost of carbon, (ii) marginal abatement costs, and (iii) carbon market prices.

⁷⁹ <https://portalweb.cammesa.com/default.aspx>



ANNEX 3: Detailed Description of the Infrastructure Investments on the Belgrano Sur Line (Component 1)

1. **The project will modernize the Belgrano Sur Line through a series of interventions under Component 1**, including civil works and institutional strengthening activities, and has been divided into three components. This annex details the modernization activities.

Component 1: Railway works (US\$655 million; of which US\$580 million IBRD)

Sub-component 1.1: Track and infrastructure renovation, signaling and telecommunications (US\$243 million, of which US\$215.2 million IBRD financing).

Sub-component 1.1.1: Track renovation

Current situation

2. **Trains currently depart Sáenz station in CABA heading toward two destinations: Marinos station in the municipality of Merlo, on one branch, and González Catán station in the municipality of La Matanza, on the other.** The line has 22 stations, four are in CABA and the others are in the densest areas of the municipalities of La Matanza, Morón, and Merlo, Province of Buenos Aires.

3. **An initial set of interventions to modernize the Belgrano Sur railway have taken place in recent years, with resources from the national government or financed by CAF and the World Bank.** Through the Urban Transport in Metropolitan Areas Project (P095485), which closed in December 2019, the World Bank financed the emblematic, elevated Sáenz station. CAF has approved two loans for the Belgrano Sur railway, for a total of US\$205 million, including track upgrades, signaling and platform upgrades on the branch between Tapiales and Marinos, civil works for a new viaduct next to the Tapiales station on the Marinos branch, conversion of a single-track segment between Marinos and Libertad station to double-track, and the extension of the viaduct between Sáenz, Buenos Aires, and Constitución stations in CABA. The national government has also invested in track, station, and platform upgrades to the segment between the Sáenz and Tapiales stations.

4. **The Belgrano Sur Line still requires essential upgrades to reach its full potential.** In addition to the initial interventions being undertaken, other crucial interventions are required to fully modernize both branches. Track upgrades to the Tapiales–González Catán segment and the remaining track upgrades between Sáenz and Tapiales must take place, as many of these tracks have deteriorated and concluded their lifespan. Moreover, the currently implemented technology (wood sleepers, rigid fastening systems, and so on) needs to be modernized.

Description of the works to be performed

5. **The works comprise the full renovation of the existing double-track between Tapiales and González Catán, partial renovation of track between Saénz and Tapiales, renewal of level crossings, and installation of switches.** The project will provide new track infrastructure between Tapiales and González Catán stations (about 50 kilometers) and 37 kilometers of construction and renovation of rail yard and auxiliary tracks. Moreover, the existing level crossing will be renewed, and new switches will be installed as part of the line upgrade.

6. **The contractor will be responsible for the preparation of the detailed engineering designs.** These civil works will include 54E1 R260 rails for straight tracks and 54E1 R350 rails for curved tracks with prestressed concrete mono-block sleepers, elastic fastening systems, welded joints, Grade A1 ballast, and geotextile mats. The design parameters will be (i) track gauge: 1,000 millimeters; (ii) maximum load: 22 tons/axis; (iii) maximum speed: 90 kilometers/hour; (iv) sleepers' density: 1,556 sleepers/kilometer; and (v) track-sleeper angle: 1:40.



7. **The following tasks will be executed:** (i) preliminary studies and preparation of the detailed designs, including topographic, hydrological, and hydraulic surveys, geotechnical investigations, redesign of existing level crossings, alignment design, and the restoration plan for existing railway bridges and relocation of interferences; (ii) cleaning of railway track zone; (iii) removal of existing tracks, with classification, transportation, and disposal of materials; (iv) preparation of the subgrade; (v) civil works related to the tracks; (vi) civil works related to switches; (vii) installation of buffer stops; (viii) renovation and improvement of level crossings, including pedestrian crossings; and (ix) renovation of drainage systems.

Sub-component 1.1.2: Railway bridges and other civil engineering structures

Current situation

8. **Railway bridges and culverts of the Belgrano Sur Line were constructed between 1909 and 1930.**

9. **From a hydrological point of view, the morphology of the surrounding areas and the natural water runoff has changed significantly since then.** Because of that, hydrological and hydraulic surveys are crucial to ensure climate resilience and reduce vulnerability of the infrastructure to flooding.

10. **Regarding structural aspects, there are different types of existing bridges and culverts with a variety of span lengths along the line.** Depending on their characteristics, different types of structural interventions may be needed (small structure interventions or structural strengthening works). The contractor will define the restoration plan of existing railway bridges and culverts.

Description of the works to be performed

11. **The works comprise the structural and hydrological verification of all bridges and culverts between Saénz and Tapiales and between Tapiales and González Catán.** Depending on the type of structure, interventions may include: (i) cleaning and vegetation removal; (ii) crack injection and sealing; (iii) repair of reinforced concrete; (iv) replacement of damaged or missing elements and bolts; (v) cleaning and maintenance of bearings; (vi) non-destructive testing; (vii) structural strengthening (design and works); and (viii) load testing.

12. **In the process of preparing specific technical specifications for project design, the following assumptions will be evaluated and incorporated in relation to climate change resilience.** For the hydraulic design of engineering structures and drainage systems, the intensity/duration/frequency curves of the base scenario are considered in return periods of 25, 50, and 100 years, depending on the type of structure. Flow rates are determined by the national meteorological authorities. The goal is to adapt the return period of the design flow to the infrastructure lifetime

Sub-component 1.1.3: Signaling and telecommunications

Current situation

13. **Different types of signaling systems and technologies are used along the Belgrano Sur Line, leading to a non-unified system.** Moreover, some were installed more than 100 years ago. Operation and maintenance of the system is complex and laborious, leading to an inefficient operation of railway services.

14. **The interlocking is electromechanical and the general railway signal on the Sáenz–Tapiales branch, while the Tapiales–González Catán branch has a mechanical interlocking system and a relay interlocking system to prevent conflicting movements through the arrangement of tracks.** It is important to consider that the abovementioned signaling system technologies cannot be used with electrified lines.



Description of the works to be performed

15. **The works comprise the installation of a new signaling system compatible with electrified lines,** including LED signals, a centralized traffic control center in Tapiales, local traffic control cabins in stations, and an optical fiber network to support all the new installations. Trains will be detected with audio-frequency track circuits. The electromechanical interlocking will comply with high standards and be installed in buildings located at stations, equipped with facilities for the operations staff. The renewal of the signaling systems will cover both branches.

16. **Automatic barriers and level crossing signals with lights and sound will be installed at level crossings for vehicles and pedestrians.**

17. **Electromechanical or electrohydraulic switching machines will be used for the operation of switches.**

18. **The signaling system that will be installed between Tapiales and Marinos stations has the same characteristics as the one described for the present project.** In this way, it will need to be connected to the central traffic control center in Tapiales station to also control this branch from Tapiales.

Sub-component 1.2: Grade separation of railway crossings (US\$100 million, of which US\$88.55 million IBRD).

Current situation

19. **There are several operational level crossings along the Belgrano Sur Line.** Some of them, especially the ones located in the most congested zones of CABA, frequently cause road travel delays, and, in many cases, they represent accident-prone points. Moreover, level crossings have a direct impact in the commercial speed of railway services and may considerably reduce their frequency.

Description of the works to be performed

20. **The works comprise the construction of vehicular underpasses (grade separation).** The design of these interventions will comply with national standards and ensure safety in nearby areas to avoid separating or enclosing certain spaces in communities where safety concerns are considerable. The planned change from vehicular level crossings to underpasses on the main roads crossing the rail network improves vehicular flows and reduces travel times, making the use of energy for local transport more efficient. In addition, GHG emissions are reduced as a result.

Sub-component 1.3: Civil works, upgrade of stations and surroundings, construction of railway workshops and operational buildings (US\$119 million; of which US\$105.37 million IBRD).

Sub-component 1.3.1: Stations and surrounding areas

Current situation

21. **The national government has invested in Belgrano Sur stations upgrades.** The situation was critical: many stations showed lack of maintenance, especially regarding security and comfort aspects. Moreover, connections with other transport modes were not properly planned, leading to inefficient and complex transfer routes. In addition, COVID-19 shed light on aspects that need to be considered when waiting areas and public places are designed at stations and surrounding areas.

22. **The Belgrano Sur Line still requires many upgrades.** In addition to the initial interventions being undertaken, other crucial interventions are required to fully modernize the Belgrano Sur Line. Some stations have:

- a. Surrounding areas in bad condition, including pedestrian paths, pedestrian bridges, parking spaces, streets lighting, and so on;



- b. A lack of security monitoring;
- c. Poorly performing rainwater evacuation systems;
- d. Public spaces of bad quality, such as stairs, ticket offices, and toilets;
- e. A lack of level crossing signals and signage;
- f. Inefficient platform and access designs; and
- g. Complex multimodal transfer routes.

Description of the works to be performed

23. **Works will complement the interventions financed by the national government.** The internal spaces of several stations will be renovated, improving them with safer, climate-resilient, and more inclusive environments. Those stations are Marinos del Crucero General Belgrano, Libertad, Merlo Gomez, Rafael Castillo, Isidro Casanova, Villegas, José Ingenieros, Mendeville, Aldo Bonzi, González Catán, Independencia, María Eva Duarte, Gregorio De Laferrere, Querandí, Ing. Castello, Tapiales, Marinos del Fournier, Villa Madero, Villa Lugano, Presidente Illia, and Villa Soldati.

24. **The upgrades will include the following, as needed, in each station:** (a) verification of compliance with universal accessibility laws, by constructing access ramps, elevators, haptic surfaces, and new bathrooms or adaptations to the existing ones; (b) improvements in the quality of public spaces, including walkways and platforms, stairs, toilets and changing rooms, where needed; (c) infrastructure designs that have passenger safety as their most critical aspect; (d) design of efficient, simple, and enjoyable multimodal transfer routes; (e) rethought platforms at each station to better communicate transfer options, main streets nearby and exits, and other places of interest nearby; (f) increased energy efficiency by replacing the current lighting equipment with LED devices; (g) updated communication systems and protocols, through new visual material and images as well as improved audiovisual equipment, generating a direct communication channel with users; (h) improvements in passenger flows inside the stations through the provision of new furniture and repositioned existing furniture; (i) construction and/or refurbishment works in stations to create adapted spaces, especially for women and LGBTI+ (lesbian, gay, bisexual, transgender, intersex, and other sexual orientations) passengers, including bathrooms with female hygiene products dispensers (with payments online or associated with the train tickets), baby changing equipment (to increase co-responsibility), and so on; (j) installation of security call boxes connected to and coordinated with the different security and emergency response networks, namely local teams in the municipalities of the Belgrano Sur Line; the National Institute against Discrimination, Xenophobia and Racism; the 144 phoneline (monitored by the Ministry of Women, Gender and Diversity); and 911 in case of serious emergencies. These call boxes will be specifically designed so that female users can anonymously report sexual exploitation, abuse and harassment episodes for an immediate response by the authorities. The location of these call boxes will be safe and strategic, with reinforced lighting and accessibility. Women and the LGBTI+ community will be consulted to evaluate the adequacy of these locations and their perceptions of security.

25. **These interventions will also include the renovation of the surrounding and public areas of selected stations where deficiencies that negatively impact user experience have been identified.** The following areas of action will be covered:

- a. Creation of spaces for public social programs
- b. Renovation and improvement of the surrounding urban equipment and green spaces
- c. Creation of safe spaces with security cameras, open accesses, and appropriate lighting and personnel
- d. Implementation of programs to promote energy efficiency through sustainable technologies
- e. Reduction of acoustic impact through mitigation measures such as acoustical barriers and panels
- f. Actions to optimize multimodal transfers, such as dedicated bicycle parking storage systems and spaces,



in coordination with municipalities to identify safe access points and streets for cyclists

26. **In terms of building and infrastructure design, priority will be given to natural lighting through roof windows that are not oriented directly in the direction of the sun's rays, so as not to enhance the temperature rise effect.** The implementation of passive design strategies is intended: stations should be designed according to solar orientation, with openings that allow air currents to pass through. Building materials that offer good thermal insulation should be used. In this way, it is possible to make good use of bioclimatic design in both summer and winter, limiting the use of thermal conditioning to what is strictly necessary and providing comfort for those who work at the stations. In the interventions for buildings and environments, LED technology will be incorporated in all new lighting fixtures, and outdoor luminaires will have photocell systems so they operate only when necessary. Solar thermal tanks are to be installed in the station areas intended for operational personnel to supply them with hot water. Photovoltaic panels will be installed on roofs with sufficient sunlight and where their use can have a positive impact on energy generation.

27. **For the interventions of stations' surroundings, the use of public space and vacant areas is used to add landscaped areas and tree species, which will contribute to reducing CO₂ emissions throughout the system.** The incorporation of rainwater collectors in the covered surfaces facilitates the management of runoff by reducing flow velocity as well as taking advantage of this resource for other functions such as hygiene or cleaning and irrigation. The metropolitan transport system is incorporating infrastructures that facilitate bicycle-train intramodality and encourage the use of nonmotorized means of access to the railway. These interventions reduce the use of private vehicles and motorized public transport, helping to reduce emissions, as well as tending to reduce traffic congestion in the vicinity of railway stations. These infrastructures are mainly bicycle storage spaces and bicycle path/cycleway corridors.

Sub-component 1.3.2: Railway walls and enclosure

Current situation

28. **The Belgrano Sur Line is currently partially enclosed.**

Description of the works to be performed

29. **The track area needs to be restricted, especially when tracks go through an urban area.** As a consequence, wall enclosure along segments next to level crossings and urbanized areas will be constructed.

Sub-component 1.3.3: Tapiales workshop and operational buildings

Current situation

30. **Renewal and adaptation of existing operational buildings to support service expansion and electrification are needed to achieve the complete upgrade of the line.**

Description of the works to be performed

31. **The Tapiales workshop and rail yard will be restored and used to operate the electric rolling stock.** The design of the building may consider (i) rolling stock maintenance facilities, (ii) rolling stock washing facilities, (iii) space for underfloor wheel lathes, and (iv) a sector for daily rolling stock inspections.

Sub-component 1.4: Electrification of the Belgrano Sur Line (US\$170 million; of which US\$150.53 million IBRD)

Current situation

32. **The Belgrano Sur railway operates with diesel multiple units.**



Description of the works to be performed

33. **The works entail construction of electrical substations, traction systems, and overhead lines.** The central electrical transformer substation, part of the operational buildings, will be in Tapiales. To ensure climate resilience and reduce vulnerability to flooding, all electronic equipment (especially substations) will be permanently raised well above past flood standards, and rail cars will have a dry place to park during flooding events.

34. **Substations and traction system:** The traction system (2x25 kV) alternative current and the distribution line (13.2 kV) will receive energy from a principal transformer substation (132/50/13.2 kV) in Tapiales. Autotransformers will be installed approximately every 10 kilometers. Sectionalizing switches will be installed to isolate faulted sections of the distribution circuit, preventing the failure of the whole line. The work comprises (i) construction of civil works, (ii) supply and installation of electromechanical materials, and (iii) supply and installation of overhead lines.

35. **Catenary system:** The system will be supplied by a 2 x 25kV alternative current power supply and will include, among others, the following elements: (i) masts or gantries, (ii) stays and steady arms, (iii) contact wire and messenger wire, (iv) distribution cable, (v) return wire, and (vi) fixed termination equipment. The work comprises (i) civil works for construction of masts or gantries along the line, (ii) civil works for electrical connections, and (iii) supply and installation of all mentioned elements of the catenary.

Sub-component 1.5: Supervision of railway works (US\$23 million; of which US\$20.37 million IBRD).

36. This sub-component will finance all the technical, social, and environmental supervision activities related to the civil works in components 1 and 2, with the option to procure or sign agreements with both public and private sector organizations. A key team will be required to include all the qualified specialists needed to supervise the full range of technical, social, and environmental aspects.

Project Timeline

37. Table shows the estimated project timeline of interventions under Component 1.

Table A3-1: Estimated Timeline of Project Interventions under Component 1

Subcomponent	Estimated initiation of works	Estimated completion of works
Subcomponent 1.1: Track and infrastructure renovation, signaling and telecommunications	Oct. 2023	Sep. 2026
Subcomponent 1.2: Grade separation of railway crossings	Oct. 2023	Dec. 2027
Subcomponent 1.3: Civil works, upgrade of stations and surroundings, construction of railway workshops and operational buildings	Jul. 2024	Jun. 2027
Subcomponent 1.4: Electrification of the Belgrano Sur Line	Jan. 2025	Dec. 2027

Source: ADIF. *Note:* Works financed by CAF (track renovation of the Marinos branch and the Sáenz–Constitución extension) are expected to be completed by December 2023. This completion date is necessary for electrification work to begin in January 2025, but it is not a pre-condition for starting works under components 1.1 to 1.3. Track upgrades to the Sáenz–Tapiales section on the Belgrano Sur Line funded by the Government, which are currently in progress, will be concluded by March 2023.



ANNEX 4: Job Accessibility Assessment

1. **This assessment estimates changes in job accessibility that will result from frequency and travel time improvements from the modernization of the Belgrano Sur train line.** It describes the methodology and data sources used to calculate job accessibility by public transit, summarizes the expected changes considered in the accessibility model, and presents the changes that could be expected once the project is fully implemented.

2. **Different indicators have been used in the academic literature to quantify access to job opportunities and account for job accessibility improvements as part of the expected benefits of transportation projects.** In this analysis, job accessibility for each zone in a region is defined as the percentage of jobs from the entire region that can be reached from each zone i within a time budget t :

$$\text{job accessibility}_i = \frac{\text{jobs reachable from zone } i \text{ within } t \text{ min}}{\text{total jobs in region}} \quad (4.1)$$

3. **The region considered in the denominator for job accessibility is the AMBA.** This region was split into equally sized hexagons of approximately one-half a kilometer squared to avoid introducing any type of bias in the calculation of accessibility due to the different sizes of census tracts. Jobs and population were distributed from census tracts to the hexagonal zones assuming a uniform distribution of jobs and population within each tract. Ninety minutes were used as the upper limit for the maximum time that households are willing to spend commuting to work, given that many stations along the project are currently located more than 90 minutes away from the CBD.

4. **While the accessibility definition presented above compares the number of jobs reachable from each origin with the total number of jobs in the region, the average accessibility for zones neighboring the project was calculated.** To get this more general measure, a population weighted average of job accessibility for the zones around the project was calculated, where N is the total number of zones (hexagons) in AMBA:

$$\text{average job accessibility} = \frac{\sum_{i=1}^N (P_i * \text{job acc}_i)}{\sum_{i=1}^N P_i} \quad (4.2)$$

(i) **Population-weighted job accessibility for the affected area was measured for the baseline and with-project scenarios, and the difference between these two values was considered as an estimate of the improvement in accessibility attributed to the modernization and electrification of the line.** This change in accessibility was calculated using two different definitions of the affected area: (i) zones intersected by a buffer of 1 kilometer around the project stations, and (ii) shapefile provided by ADIF that defines the affected area as zones intersected by a buffer of 1.5 kilometers around the project stations located within CABA plus zones intersected by a buffer of 2 kilometers around the project stations located outside of CABA. In addition to calculating the impact in population weighted accessibility, the impact in poverty weighted accessibility was also calculated, using the number of households with at least one unmet basic need as the weight to get an average value in the affected zones.



5. **A script that uses the opensource tools UrbanAccess⁸⁰ and Pandana⁸¹ to calculate shortest-route travel times by public transit between all possible origin-destination pairs of zones and then compute job accessibility for each zone in the region.** The UrbanAccess tool is used to create an integrated pedestrian and transit network using General Transit Feed Specification (GTFS) and OpenStreetMap data. In this integrated network, walking times are added as an impedance measure that must be travelled to get out from zone centroids into the transit network. Connectors between the pedestrian and transit networks are added at transit stops, where an impedance of headway divided by two is assigned to represent the expected wait time that passengers will experience in each transit stop. Finally, the transit network edges have impedances equal to the travel times between stops. The Pandana tool is then used in combination with the integrated network to assign the nearest pedestrian network node to each zone centroid, and the shortest travel time for each origin-destination pair is calculated. To calculate the total number of jobs accessible from each zone within a given travel time budget, the table of minimum travel time between all possible origin-destination pairs is taken. Add a column with the total number of jobs at each destination, then filter out all pairs with a travel time greater than a travel time budget and group the filtered table by zone of origin.
6. **The Belgrano Sur modernization project includes travel time and headway reductions, as well as the addition of new stops.** To represent these changes and calculate their impact on job accessibility, a routine that reads from .csv files that summarize the proposed changes, edits the baseline GTFS files, and generates a new GTFS dataset with operational conditions after the project was developed. After this new GTFS dataset has been generated, the accessibility routine is run twice, one with the baseline GTFS dataset and a second one with the edited version that represents the situation with project.
7. **A census shapefile with the total number of jobs, with the number of persons, number of households, and number of households with at least one unmet basic need per census tract was provided.** This dataset also included the number of low-income jobs per tract (jobs in categories typically occupied by low-income households). The data is assumed to be constant throughout the analysis period. Information about baseline frequencies, stop times and trajectories of public transit routes required to create the transit network with UrbanAccess were obtained from publicly available GTFS datasets⁸² for trains, subways and buses. Information about travel time, frequency, and stop changes that will take place once the Belgrano Sur project is fully implemented are summarized in table A4-1.

Table A4-1: Changes in Travel Time, Frequencies and Stations

Line extensions	Description of the extension
González Catán—Sáenz	Two extra stops after Sáenz station: Buenos Aires and Constitución
MCG Belgrano—Sáenz	Two extra stops after Sáenz station: Buenos Aires and Constitución

⁸⁰ Opensource tool available at <https://github.com/UDST/urbanaccess>. The methodology was developed as part of the following paper: Blanchard, S. D., and P. Waddell, "UrbanAccess: Generalized Methodology for Measuring Regional Accessibility with an Integrated Pedestrian and Transit Network," *Transportation Research Record* 2653 (2017), no. 1: 35–44, doi:10.3141/2653-05..

⁸¹ Opensource tool available at <https://github.com/UDST/pandana>. The methodology was developed as part of the following paper: Foti, F., P. Waddell, and D. Luxen, A Generalized Computational Framework for Accessibility: From the Pedestrian to the Metropolitan Scale (2012).

⁸² The GTFS files are available at Buenos Aires open data portal: <https://data.buenosaires.gob.ar>.



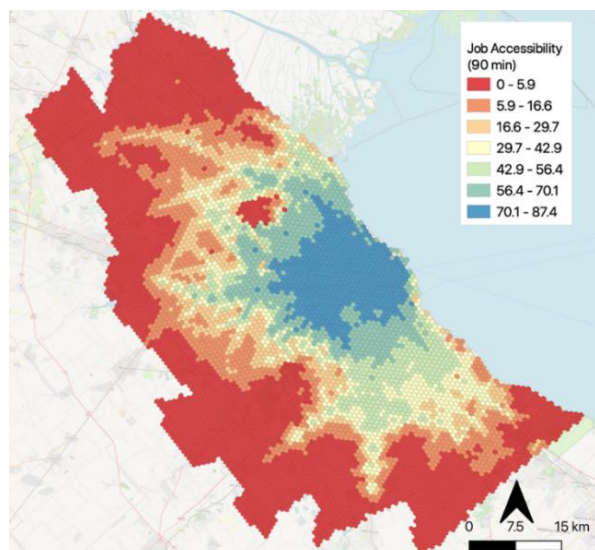
Headway reductions	Baseline headway	Project headway	Headway change
González Catán—Sáenz	20 min	14 min	-6 min
MCG Belgrano—Sáenz	42 min	14 min	-28 min

Travel time changes	Baseline travel time	Project travel time	Travel time savings
González Catán—Sáenz	54 min	49 min	5 min
MCG Belgrano—Sáenz	65 min	62 min	3 min

Source: Data from ADIF.

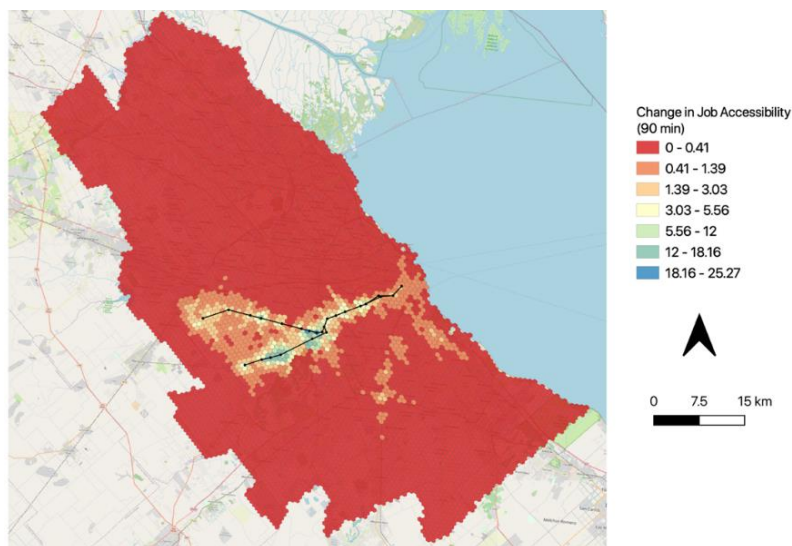
8. **Baseline job accessibility was estimated for each zone in the region, defined as the percentage of jobs accessible from each zone within 90 minutes by public transit (figure A4-1).** Job accessibility values vary between 0 and 87 percent, with the highest accessibility values are located around CABA.

Figure A4-1: Baseline Percentage of Total Jobs Accessible by Public Transport within 90 Minutes



Source: World Bank calculations.

Figure A4-2: Belgrano Sur - Change in Total Jobs Accessible by Public Transport within 90min



Source: World Bank calculations.

9. **The average accessibility changes⁸³ for the affected zones was calculated using two types of weights: total population and households with unmet basic needs (poverty weighted) and the results are presented in TableA4-2 and TableA4-3.** The Belgrano Sur Modernization project is likely to generate an increase of 8.25 percent in the average number of jobs accessible per zone within 90 minutes of travel by transit (population-weighted, for population living within 1 kilometer of the project stations). Figure A4-2 shows the special distribution of job accessibility gains. Table A4-3Table shows the percentage change in average number of jobs accessible within 90 minutes from each zone. The idea is to highlight that even if the percentage of total region jobs reachable within 90 minutes changed only by a small amount given the very large size of the region, affected zones do experience

⁸³ The new stops added by the Belgrano Sur project (Buenos Aires and Constitución) were excluded from the calculation of average job accessibility for the affected area.



significant increases in the number of accessible jobs (around 230,000 average extra jobs per zone for zones within 1 kilometer of project stations).

Table A4-2: Percentage of AMBA Jobs Accessible within 90 minutes

Affected area around stations	Population-weighted average			Poverty-weighted average		
	Baseline	With project	Change	Baseline	With project	Change
1 km	48.20%	52.18%	3.98 pp	45.61%	49.29%	3.68 pp
1.5–3.5 km	41.25%	43.90%	2.64 pp	38.16%	40.55%	2.40 pp

Source: World Bank calculations. Note: pp = percentage points.

Table A4-3: Number of AMBA Jobs Accessible within 90 minutes

Affected area around stations	Population-weighted average			Poverty-weighted average		
	Baseline	With project	Change	Baseline	With Project	Change
1km	2,814,026	3,046,139	8.25%	2,662,302	2,877,296	8.08%
1.5–3.5 km	2,408,303	2,562,543	6.40%	2,227,622	2,367,470	6.28%

Source: World Bank calculations.

10. **Limitations of accessibility analysis.** First, job and population values per zone were assumed to remain constant throughout the analysis period. Accessibility improvements from this or other transit projects combined with expected population and job growth in the region will generate differences over time in the total number of agents and their spatial distribution within the region, although this is not something that the project could claim as part of its benefits. These differences will affect the magnitude and spatial distribution of access to jobs. One possibility to overcome this limitation is to develop a land use model capable of estimating spatial patterns of growth of population and jobs. In the absence of such a model, the accessibility increases estimated here can be considered as a rough minimum or conservative estimate, which could be larger if more jobs were added to the region, population growth occurred following current densification trends away from downtown. Second, raw data on population and jobs came aggregated to the census tract level, and a uniform distribution of agent was assumed when converting from tracts to equally-sized hexagons. For large census tracts there could be large variations in the distribution of agents within the tract, and these variations could result in small differences in accessibility results. Third, not all transit services provide the same capacity. Bus routes connecting the same origin-destination pairs as rail services might sometimes produce a route with very similar or lower total time, but those routes will reach full capacity quicker and then stop effectively offering that alternative to reach jobs. Since the results presented here do not account for capacity, the accessibility increases estimated here can be considered as a lower estimate than one accounting for capacity, which increases in the situation without project. Fourth, when adding a time penalty of headway divided by two to represent wait times, the calculation does not account that for very large headways travelers are likely to plan ahead and not arrive randomly. In this case, they are likely to wait a lower amount of time than what was considered to calculate the accessibility improvements presented, although this situation is equally considered in the situation of with- and without-project.



ANNEX 5: Fiduciary Assessment Summary

FM Assessment

1. **Introduction.** A FM Assessment was carried out to assess the adequacy of FM arrangements⁸⁴ in place at the DGPPSE within the MTR and ADIF to support project implementation. It was determined that the FM arrangements in place at the DGPPSE and ADIF are acceptable to the World Bank because they (i) are capable of correctly and completely recording project transactions, (ii) facilitate production of the requisite financial reporting on timely manner, (iii) safeguard the project's assets, and (iv) are subject to auditing arrangements acceptable to the World Bank.
2. **Organization and Staffing.** The DGPPSE line departments have qualified FM staff who can undertake the project's FM function. These FM professionals have relevant experience in World Bank-financed project implementation.⁸⁵ Staff mapped to the DGPPSE (some to be funded from the MTR local budget, that is, local counterpart funds, and some to be supplemented by consultants, where required) will always need to include an overall FM coordinator responsible for ensuring that the project's fiduciary obligations are met and its transactions are valid, accurate, and completely captured. This coordinator will act as the main counterpart to the World Bank regarding FM and disbursement issues. The DGPPSE is expected to be the same team as for the project Mitre Passenger Railway Line Modernization Project (P175138) plus additional staff members hired by 2022. In summary, the DGPPSE has a suitable organizational structure to ensure competent and responsible project management.
3. **Budgeting.** National budget formulation and implementation are guided by rules established by the National Constitution and the Financial Administration Law. The preparation of the annual budget, which integrates current and capital expenditures, is coordinated by the Ministry of Economy and follows a clearly defined calendar that is generally adhered to. The federal government's integrated budget and accounting system (e-SIDIF) will be used for fulfilling the project's budgeting and accounting needs. The project will execute the budget allocation from the MTR's general budget. The DGPPSE will rely on ADIF disbursement projections and inputs to prepare the budget requests encompassing this project. The project will rely on the Argentinian procedures for budget formulation and execution.
4. **Accounting.** The accounting module of the external financing executing units (*Unidades Ejecutoras de Proyectos con Financiamiento Externo*, UEPEX) system will be used for recording the project's transactions. Furthermore, the e-SIDIF accounting module will be used to record project transactions. UEPEX⁸⁶ is the federal government's IT module for accounting and financial reporting of donor-financed operations. The UEPEX system allows the MTR to record project transactions in US dollars and local currency. The UEPEX system provides a good ex ante internal control framework, and it is considered adequate for accounting purposes.
5. **Internal Control and Internal Auditing.** The internal control environment to be used for the project is anchored in Argentina's legal and institutional framework and the MTR internal approval processes and systems, which provide for reasonable segregation of duties, supervision, quality control reviews, and reconciliation. The

⁸⁴ The financial management assessment is conducted in accordance with FM directives and in line with specific the World Bank's *Guidelines Manual for World Bank-Financed Investment Operations*.

⁸⁵ Urban Transport in Metropolitan Areas Project (P095485) financed through Loan 7794 AR for US\$150 million (closed on December 31, 2017) and Loan 8700 AR for US\$45 million (closed on December 31, 2019).

⁸⁶ UEPEX: Argentina budget execution and recording software for multilateral financed operations.



internal controls relevant to the project include arrangements to provide assurance that (i) operations are conducted effectively, efficiently, and in accordance with relevant financing agreements; (ii) financial and operational reporting is reliable; (iii) applicable laws and regulations are complied with; and (iv) assets and records are safeguarded. The use of the national e-SIDIF and the UEPEX systems, with inbuilt controls that ensure proper authorization of transactions, contribute to the observance of these controls.

6. The DGPPSE and ADIF are subject to internal audit by the General Syndicate of the Nation (SIGEN), which is the federal government's internal audit agency, under the jurisdiction of the executive branch. SIGEN is an integral part of the federal government's internal control system providing the following core services: (i) assessing the adequacy and effectiveness of the internal control system (internal audit of the executive branch); (ii) supervising and coordinating the actions of the various ministries/agencies' internal audit units and approving their audit plans; and (iii) compliance auditing of procurement processes and contracts. The unit carries out the internal audits per request by SIGEN. The audits are scheduled by specific civil work and not by projects nor by calendar years. The last audit carried out by the internal audit unit within the DGPPSE took place between August and December 2020 and the report was submitted to the DGPPSE. It was a performance audit of Sáenz station and the audit reviewed civil work certifications (payments). As per the discussions with the DGPPSE no major internal control weaknesses were identified in the report. The World Bank asked if the audit report could be shared with the World Bank and this assessment will be updated once the report is received and reviewed.

7. ADIF transaction processing will use DGPPSE requirements established in the OM that provide for reasonable segregation of duties, supervision, quality control reviews and reconciliation. The process flows appear to be well understood by ADIF personnel. Bank reconciliations are performed regularly and there is adequate segregation of duties/functions. The ADIF bank account reconciliation will be prepared by someone from ADIF who does not process or approve payments, and all unusual items on the bank reconciliation will be reviewed and approved by the FM coordinator.

8. ADIF maintains detailed fixed asset registers, and there is a specific unit/department responsible for asset monitoring. Goods are assigned unique identifier codes, to facilitate identification and tracking, with counts taking place at least once a year (as part of the preparation of ADIF annual financial statements) and reconciliation with the accounting records. The sale or disposal of fixed assets is done throughout the year, following established norms and procedures. There are also detailed depreciation schedules utilized to reflect a truer and fairer picture of the value of these assets and prepare ADIF to be ready to purchase new assets once an asset is worn out.

9. **Flow of funds and disbursement arrangements.** The primary disbursement method will be advances to a designated account. There are no lapsed loans. The DGPPSE will be also able to process reimbursements and direct payments, if required.

10. Figure A5-1 indicates the flow of funds for the project:

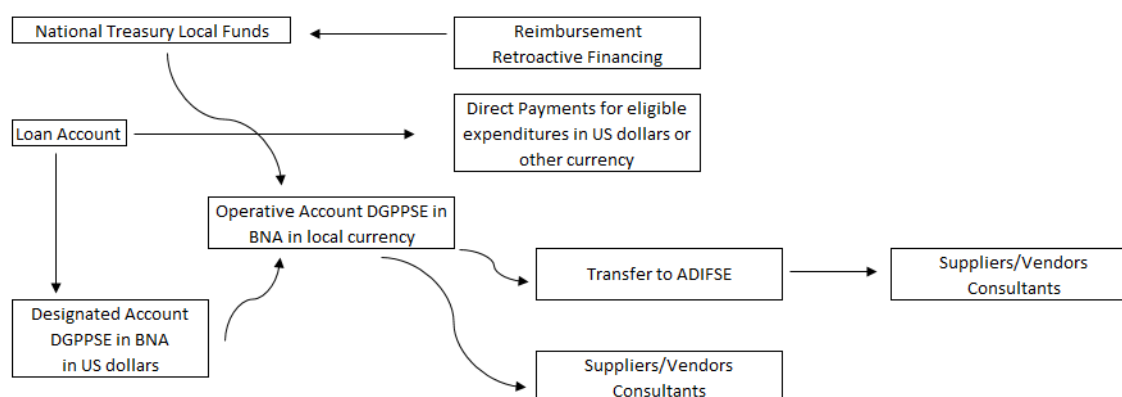
- a. Bank funds will be transferred to specific, segregated account, to be opened specifically for the project, designated account in US dollars at the Banco de la Nación Argentina (BNA) under control of the DGPPSE.
- b. Another segregated bank account will be opened (DGPPSE local currency operating account) in the BNA, in local currency, for the purpose of: (i) receiving funds from the designated account to pay for eligible expenditures to be paid to suppliers/vendors by the DGPPSE, (ii) receiving local funds from the national budget and (iii) transferring funds to the ADIF bank account.
- c. ADIF will open a segregated bank account (called ADIF bank account) in local currency in the BNA to



receive funds from the DGPPSE local currency operating account to pay for project transactions to be executed by ADIF. When ADIF needs to pay for eligible expenditures, the obligation is registered in the UEPEX system, with all the supporting documentation attached and sent to the DGPPSE for review, indicating the amount requested. The DGPPSE reviews all the documentation and, if it is correct, transfers the funds (in local currency) for the specific payments from the DGPPSE local currency operating account to the ADIF bank account. ADIF will process the payments to the suppliers/vendors and send through the UEPEX system all the supporting documentation to the DGPPSE. With all the documentation completed, the eligible expenditure is ready to be documented for the World Bank by the DGPPSE. Prior to the first disbursement to ADIF, the UEPEX system should be in place, and the ADIF bank account in the BNA should be opened.

- d. Payment processes will be registered by the DGPPSE and ADIF in the UEPEX systems, accordingly.
- e. The IFRs (for financial reporting purposes and not disbursement purposes) and state-owned enterprises will be prepared by the DGPPSE, with information available in UEPEX.⁸⁷
- f. DGPPSE staff would request access to the World Bank’s Client Connection webpage to perform the periodic reconciliation between its own registries and the World Bank’s disbursement records.

Figure A5-1: Flow of Funds



Source: World Bank. Note: ADIFSE = Administración de Infraestructuras Ferroviarias S.E.; BNA = Bank of the Argentine Nation; DGPPSE = General Directorate for Sectoral and Special Programs and Projects.

11. The disbursement of project funds to the DGPPSE will be processed in accordance with World Bank procedures as stipulated in the loan agreement and in the disbursement and financial information letter. Funds will be disbursed with respect to eligible expenditures incurred or to be incurred under the project and will be disbursed in accordance with agreed financing percentages.

12. **Retroactive Financing.** Payments made prior to the loan agreement signing date but on or after January 1, 2022 (but in no case more than one year prior to the signature date) are included as retroactive financing. If

⁸⁷ The General Conditions require the borrower to retain all records (contracts, orders, invoices, bills, receipts, and other documents) evidencing eligible expenditures and to enable the World Bank’s representatives to examine such records. They also require the records to be retained for at least one year following receipt by the World Bank of the final audited financial statements required in accordance with the loan agreement or two years after the closing date, whichever is later. Borrowers are responsible for ensuring that document retention beyond the period required by the loan agreement complies with their government’s regulations.



any retroactive expenditures are claimed to the World Bank, a transaction review⁸⁸ will be carried out of these payments to confirm that the expenditures to be claimed as retroactive are acceptable. Furthermore, the external auditors will be requested to specifically review the expenditures paid retroactively (if any), including the counterpart funding. This will be included in the auditor's terms of reference. The retroactive financing cannot exceed the amount of US\$120 million or equivalent (at estimated a 20 percent approximately of the signed loan amount).

13. Loan proceeds would be disbursed against the eligible expenditures in table A5-1.

Table A5-1: Loan Categories

Investment category	Total amount of the loan allocated (in US dollars)	Percentage of expenditures to be financed (%) (inclusive of taxes)
1. Category 1: Civil works, goods, consulting services, non-consulting services under Component 1	580,000,000	88.55
2. Category 2: Goods, consulting services, non-consulting services, training, and operational costs under Component 2	18,500,000	100
3. Emergency expenditures under Component 3 of the project.	0	100
4. Front-end fee	1,500,000	100
Total Amount	600,000,000	-

Source: MTR and ADIF.

14. **Financial Reporting.** The DGPPSE will prepare and submit to the World Bank semesterly IFRs, no later than 45 days after the end of each reporting period. These IFRs will be produced automatically from the UEPEX system, including the information registered in that system by ADIF, accordingly, using the cash basis. At the end of each fiscal year, the DGPPSE will prepare audited annual financial statements for the project. The second semester IFRs with accompanying notes will serve as the projects' annual financial statements. The following semester's IFRs (to be prepared in US dollars and local currency), will be prepared for project monitoring and management purposes and will be submitted to the World Bank:

- a. IFR 1 –Sources and Uses of Funds by Disbursement Category (period to date, year-to-date, project-to-date) showing budgeted amounts versus actual expenditures, (that is, documented expenditures), including a variance analysis

⁸⁸ The criteria for determining the eligibility of contracts for retroactive financing includes the following: (a) Are the expenditures eligible? That is, are they related to the project development objectives and/or consistent with the project description? This is determined by the task team leader taking into consideration the requirements of the loan agreement. (b) Are the procedures "consistent with" the Regulations? This means are the procurement procedures that were followed in carrying out the procurement "consistent with" sections i, ii and iii of the procurement regulations? (c) Have anti-corruption and sanctions requirements been incorporated? Did the contract specify the application of the World Bank's Anti-Corruption Guidelines and Sanctions Framework? If not, has the supplier/consultants/contractor signed the letter of acceptance of the World Bank's anti-corruption guidelines and sanctions framework (contractors, suppliers or consultants)? (d) Did payments conform to the contract with the supplier? Were the payments made according to the conditions of contract with the supplier? (e) Were payments made within the time frame? Were the payments made by the borrower before the signing of the loan agreement but on, or after, the date specified in the loan agreement? It is important to highlight that in the chain of steps to verify the eligibility of contracts for retroactive financing the FM specialist has a key role in steps 4 and 5, relating to confirming that the payments conform to the contract stipulations and were made within the required time frame. Steps 1, 2 and 3 are the primary responsibility of the task team leader and procurement specialist, to determine that the expenditures are eligible and that the appropriate procurement procedures were followed.



- b. IFR 2 –Uses of Funds by project Component (period to date, year-to-date, project-to-date) showing budgeted amounts versus actual expenditures, (that is, documented expenditures), including a variance analysis
- c. IFR 3 –Statement of Bank Disbursements
- d. IFR 4 – Designated account bank reconciliation and accompanying bank statements

15. **External Auditing.** There are no overdue audit reports and/or outstanding FM or audit issues affecting the MTR at this moment. For project purposes, the external financial statement audit of the project will be performed by an independent auditor and terms of reference both acceptable to the World Bank, and in accordance with International Organization of Supreme Audit Institutions (INTOSAI) rules and procedures. As mentioned before, the ToRs will include a condition that the external auditors should include in the sample the expenses financed retroactively. It is likely that Argentina's Supreme Audit Institution General Audit Office (Auditoria General de la Nacion) will carry out the project's audit.

16. Audited financial statements will be furnished to the World Bank no later than six months after the end of each fiscal year—or another period agreed upon with the World Bank (not exceeding 18 months)—when, due to project circumstances, it is more cost effective to join periods to be audited. Auditors should submit (i) opinions on the project's financial statements, the state-owned enterprise statement and the designated Account statement, and (ii) a management letter. Audit terms of reference will be included in the OM. In accordance with the World Bank's access to information policy, upon receipt of the annual audited financial statements of the project, they will be made available to the public by the World Bank. The borrower agrees to disclose the audited financial statements to the public.

17. **Coordination between the DGPPSE and ADIF.** The DGPPSE will be responsible for presenting the IFRs and audit reports to the World Bank, according to the due dates. It will also be responsible for the overall FM arrangements of the project and ADIF oversight. The DGPPSE will be the main World Bank's counterpart regarding FM in missions and in every World Bank request. ADIF will support the DGPPSE in providing input for the preparation of IFRs and the audit report, providing documentation to the World Bank, when required, addressing requests for the external auditors, reconciling monthly their account, and so on.

18. **Borrower actions to prevent and combat fraud and corruption** in connection with the use of loan proceeds. In furtherance of the above-stated purpose, the borrower will do the following:

- a. Take all appropriate measures to prevent fraud and corruption in connection with the use of loan proceeds, including (but not limited to) (a) adopting appropriate fiduciary and administrative practices and institutional arrangements to ensure that the proceeds of the loan are used only for the purposes for which the loan was granted, and (b) ensuring that all of its representatives involved with the project, and all recipients of loan proceeds with which it enters into an agreement related to the project, receive a copy of the World Bank's IPF Anti-Corruption Guidelines and are made aware of its contents.
- b. Immediately report to the World Bank any allegations of fraud and corruption in connection with the use of Loan proceeds that come to its attention.
- c. In the event that the World Bank determines that any person or entity referred to in (a) above has engaged in fraud and corruption in connection with the use of loan proceeds, take timely and appropriate action, satisfactory to the World Bank, to address such practices when they occur.
- d. Include such provisions in its agreements with each recipient of loan proceeds as the World Bank may require giving full effect to the World Bank's IPF Anti-Corruption Guidelines.



- e. Cooperate fully with representatives of the World Bank in any investigation into allegations of fraud and corruption in connection with the use of loan proceeds.
- f. If the World Bank declares any recipient of loan proceeds ineligible, take all necessary and appropriate action to give full effect to such declaration.

FM Implementation Support Plan

19. The World Bank will undertake formal, informal, and ad hoc supervision of the project based on its risk profile. Formal supervision missions will involve among other steps: (i) the review of the IFRs; (ii) a review of the auditors' reports and follow-up on issues raised by auditors, as appropriate; (iii) the follow-up on any financial reporting and disbursement issues; (iv) a discussion of FM issues with the project team; and (v) an update of the FM risk and performance rating in the implementation status and results report (ISR). Staff weeks estimated for this project are three/year.

Procurement Assessment

20. **Overall project coordination and management will be the responsibility of the MTR through the DGPPSE**, who will be responsible for the direct execution of parts of Component 2 (joint execution with ADIF of subcomponents 2.1, 2.2, 2.3 and 2.4). There will also be a sub-implementing entity in terms of infrastructure construction and operation, the depending public entity ADIF, who will be responsible for the implementation of Component 1 and the partial implementation of Component 2, both under the oversight and supervision of MTR.

21. **A procurement capacity assessment of the MTR and ADIF was updated by the World Bank's procurement team during February 2022.** The assessment reviewed mainly the organizational structure for implementing the project and the experience of the existing procurement staff.

22. **The MTR has extensive experience in implementing World Bank-funded projects with previous urban transport operations in the region.** It has highly experienced procurement staff with knowledge of World Bank procedures that have performed the function for other World Bank-funded projects with satisfactory performance. However, the staff has limited experience in executing FIDIC contracts.

23. **On the other hand, ADIF is in charge of the administration of railway infrastructure and the approval, construction, rehabilitation and maintenance of railway projects.** The Supply and Logistics Management unit within ADIF responsible for carrying out all the contracting processes and procurement functions is made up of 20 professionals with satisfactory experience in the execution of projects financed by multilateral development banks' loans such as CAF and the Financial Development Fund for the La Plata Basin (FONPLATA), as well as in the execution of works financed with ADIF's own resources. However, ADIF's experience with World Bank's procurement procedures is just underway (within the Mitre Line project) and ADIF has no experience with FIDIC contracts.

24. **The borrower through the project implementation has prepared a long form PPSD**, due to the scope, the high cost and risk of the procurement activities, and the fact that the project includes contracts which exceed the value the value thresholds to use a short form PPSD. Activities envisaged during project implementation include procurement of works, goods, and consulting services.

25. **The PPSD defined the most convenient alternatives for procurement activities to support the development objectives of the project, deliver the best value for money and provide adequate justification for the selection methods to be used.**



- a) Works: the project will finance track and infrastructure renovation, signaling and telecommunications and the electrification of the Belgrano Sur Line. These large works will be procured through an initial selection with an open international approach followed by a streamlined request for proposal (single stage). FIDIC's *Plant and Design-Build Contract 2nd Ed (2017 Yellow Book)* will be used. In addition, the railyard workshop and operational building construction will be procured through a request for bidding without pre-qualification with an open international approach, and FIDIC's *Construction Contract 2nd Ed (2017 Red Book)* will be used.
- b) Goods: the project will finance the procurement of concrete mono-block sleepers, fasteners and rails. The national market is developed and has enough suppliers for local manufacturing for the supply of concrete mono-block sleepers. Thus, they will be procured through request for bidding with an open national approach. However, rails and fasteners will be procured through request for bidding with an open international approach because it is expected the participation of international companies with technical and commercial representation in Argentina.
- c) Consulting services: the project will finance consulting services for the supervision of works identified in (a) through open international approach, request for proposals and quality and cost-based selection method, and for the supervision of the procurement of concrete mono-block sleepers, through open national approach, request for proposals and consultant's qualifications based selection.

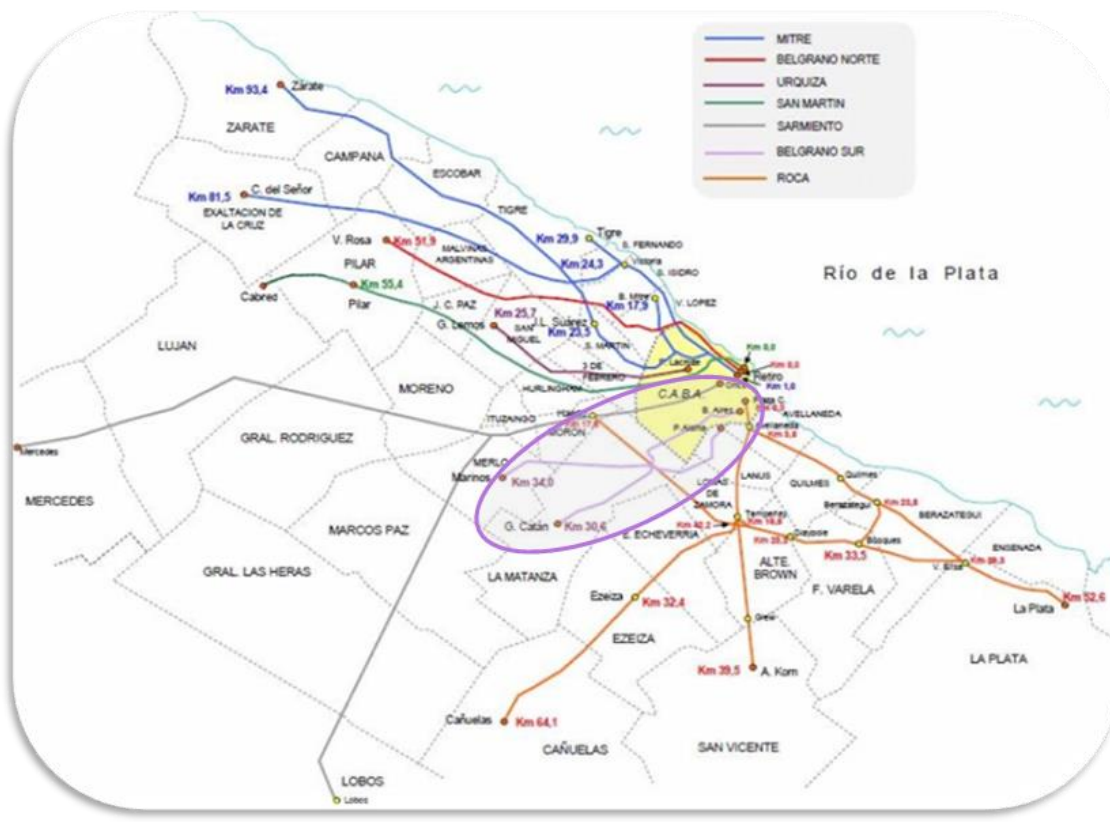
26. **The borrower has developed a procurement plan for the first 18 months with the activities that are already defined.** The rest of the activities will be added once they are defined by the technical areas.

ANNEX 6: Maps

Figure A6-1: AMBA Simplified Railway Network

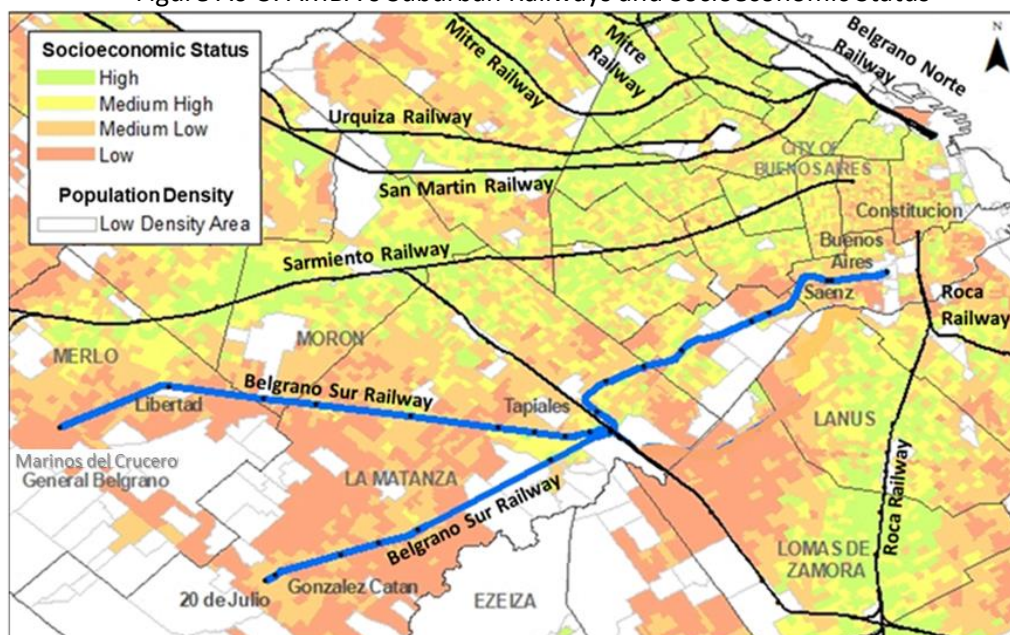


Figure A6-2: AMBA Railway Network, Geographic Representation (2019)



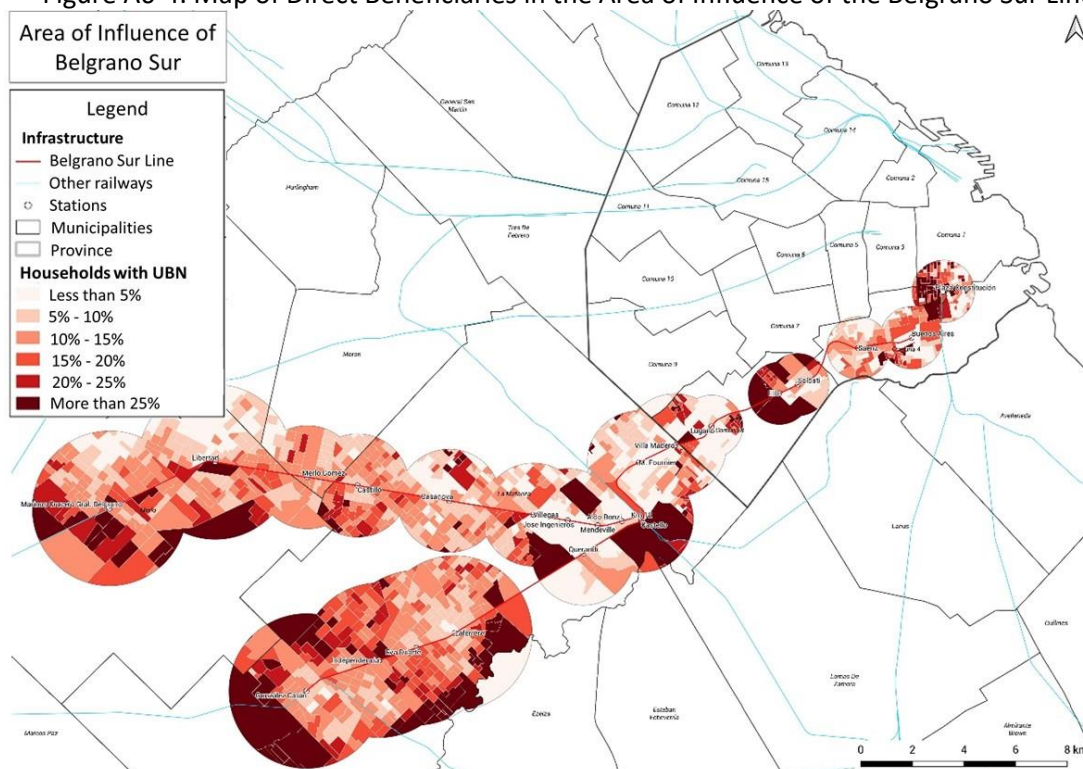
Source: Adapted from Buenos Aires Ciudad.

Figure A6-3: AMBA's Suburban Railways and Socioeconomic Status



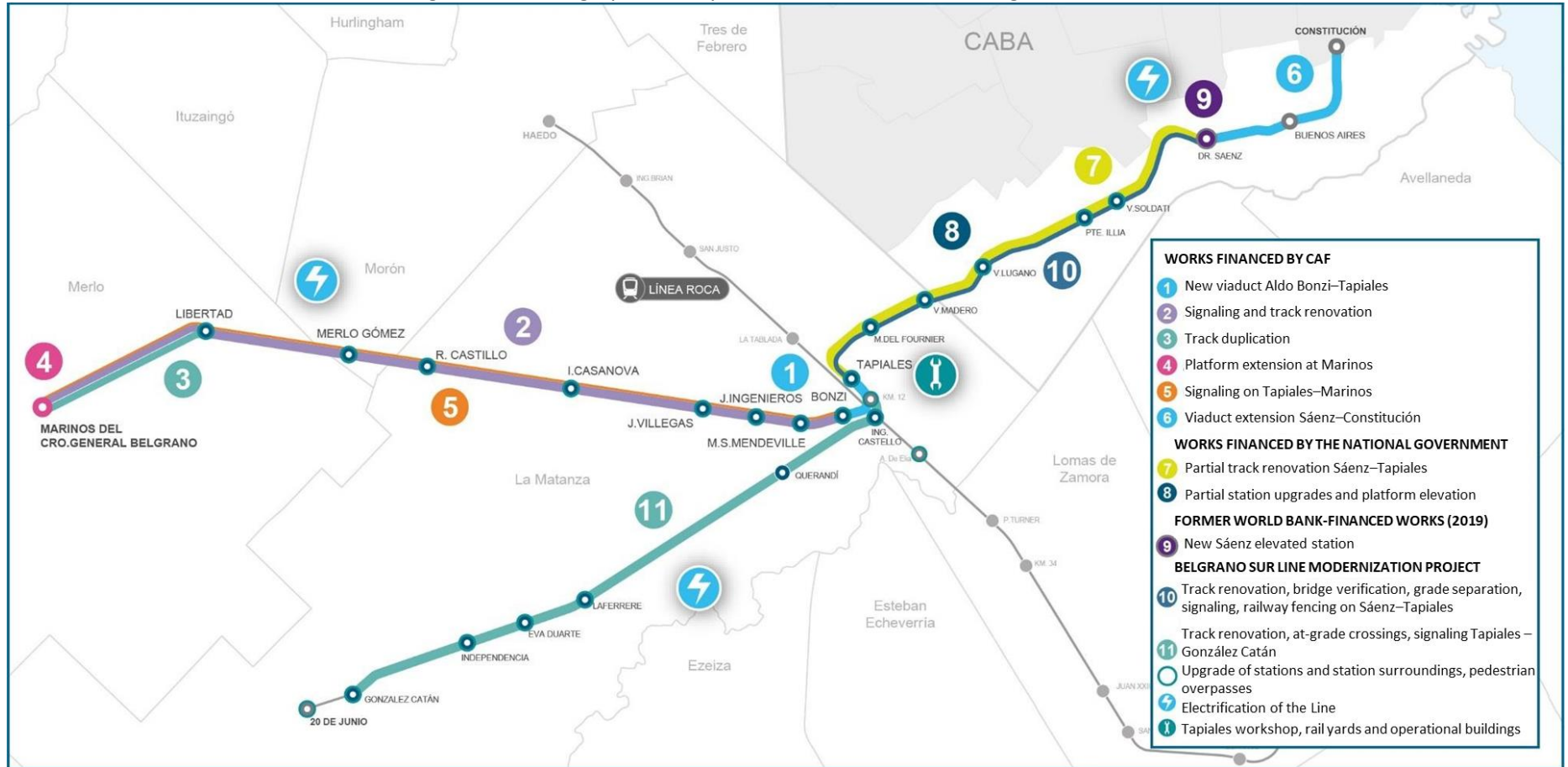
Source: World Bank with data from the 2010 Argentina Census. Note: Socioeconomic status refers to the percentage of households in each census tract with at least one unmet basic need in the 2010 Argentina Census. Thresholds from low to high were selected based on the distribution of the percentage of unmet basic needs within the plotted area.

Figure A6-4: Map of Direct Beneficiaries in the Area of Influence of the Belgrano Sur Line



Source: ADIF with data from the 2010 Argentina Census. Note: Household with at least one unmet basic need calculated based on the most recent census in Argentina (in 2010).

Figure A6-5: Geographical Scope of Interventions on the Belgrano Sur Line



Source: ADIF.

Note: Interventions on the Belgrano Sur Line: (1)–(6) are works financed by CAF, (7)–(8) are works financed by the Government, (9) are works completed as part of the World Bank-financed Urban Transport in Metropolitan Area project and completed in 2019, and (10)–(11) are works that are part of the Belgrano Sur Line Modernization project, in addition to railway track fencing.