INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$70 MILLION

TO THE

BOGOTA METRO COMPANY

WITH THE GUARANTEE OF THE REPUBLIC OF COLOMBIA

FOR THE

SUPPORT TO THE BOGOTA METRO LINE 1 SECTION 1 PROJECT – (SERIES 1)

July 12, 2018

Transport & Digital Development Global Practice
Latin America and the Caribbean Region

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CURRENCY EQUIVALENTS

(Exchange Rate Effective June 29, 2018)

Currency Unit = COP

COP 2,931 = US$1

US$1.41 = SDR 1

GOVERNMENT FISCAL YEAR
January 1 - December 31

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Country Director: Ulrich Zachau
Senior Global Practice Director: Jose Luis Irigoyen
Practice Manager: Shomik Raj Mehndiratta
Task Team Leader(s): Camila Rodriguez Hernandez, Mauricio Cuellar
### ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G</td>
<td>Fourth Generation Roads Concession</td>
</tr>
<tr>
<td>APA</td>
<td>Alternative Procurement Arrangements</td>
</tr>
<tr>
<td>BRT</td>
<td>Bus Rapid Transit</td>
</tr>
<tr>
<td>CAPEX</td>
<td>Capital Expenditures</td>
</tr>
<tr>
<td>CONPES</td>
<td>National Council for Economic and Social Policy (Consejo Nacional de Política Económica y Social)</td>
</tr>
<tr>
<td>COP</td>
<td>Colombian Pesos</td>
</tr>
<tr>
<td>CPF</td>
<td>Country Partnership Framework</td>
</tr>
<tr>
<td>DANE</td>
<td>National Statistics Department (Departamento Administrativo Nacional de Estadística)</td>
</tr>
<tr>
<td>DFBOMT</td>
<td>Design-Finance-Build-Operate-Maintain-Transfer</td>
</tr>
<tr>
<td>DNP</td>
<td>National Planning Department (Departamento Nacional de Planeación)</td>
</tr>
<tr>
<td>EA</td>
<td>Economic Analysis</td>
</tr>
<tr>
<td>EHS</td>
<td>Environmental, Health and Safety</td>
</tr>
<tr>
<td>EIB</td>
<td>European Investment Bank</td>
</tr>
<tr>
<td>EIRR</td>
<td>Economic Internal Rate of Return</td>
</tr>
<tr>
<td>EMB</td>
<td>Bogota Metro Company (Empresa Metro de Bogota)</td>
</tr>
<tr>
<td>EMPs</td>
<td>Environmental Management Plans</td>
</tr>
<tr>
<td>ESMP</td>
<td>Environmental and Social Management Plan</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
</tr>
<tr>
<td>FDN</td>
<td>National Development Financier (Financiera de Desarrollo Nacional)</td>
</tr>
<tr>
<td>FMA</td>
<td>Financial Management Assessment</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse Gases</td>
</tr>
<tr>
<td>GoC</td>
<td>Government of Colombia</td>
</tr>
<tr>
<td>GRM</td>
<td>Grievance Redress Mechanisms</td>
</tr>
<tr>
<td>IADB</td>
<td>Inter-American Development Bank</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>ICANH</td>
<td>Colombia Institute for Anthropology and History (Instituto Colombiano de Antropología e Historia)</td>
</tr>
<tr>
<td>IDU</td>
<td>Urban Development Institute (Instituto de Desarrollo Urbano)</td>
</tr>
<tr>
<td>IFC</td>
<td>International Finance Corporation</td>
</tr>
<tr>
<td>IFRS</td>
<td>International Financial Reporting Standards</td>
</tr>
<tr>
<td>IPF</td>
<td>Investment Project Financing</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>MDB</td>
<td>Multilateral Development Bank</td>
</tr>
<tr>
<td>MFD</td>
<td>Maximizing Finance for Development</td>
</tr>
<tr>
<td>MHCP</td>
<td>Ministry of Finance and Public Credit (Ministerio de Hacienda y Crédito Público)</td>
</tr>
<tr>
<td>MoT</td>
<td>Ministry of Transport (Ministerio de Transporte)</td>
</tr>
<tr>
<td>NGOs</td>
<td>Nongovernmental Organizations</td>
</tr>
<tr>
<td>OM</td>
<td>Operational Manual</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operation and Maintenance costs</td>
</tr>
<tr>
<td><strong>OP/BP</strong></td>
<td><strong>Policy/OP, Directive/BP</strong></td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>PDO</td>
<td>Project Development Objective</td>
</tr>
<tr>
<td>PLMB</td>
<td>Bogota Metro Line 1 Section 1 (<em>Primera Línea del Metro de Bogota, Tramo 1</em>)</td>
</tr>
<tr>
<td>PMO</td>
<td>Project Management Office</td>
</tr>
<tr>
<td>PPP</td>
<td>Public-Private Partnership</td>
</tr>
<tr>
<td>PPSD</td>
<td>Project Procurement Strategy for Development</td>
</tr>
<tr>
<td>RAP</td>
<td>Resettlement Action Plans</td>
</tr>
<tr>
<td>RPF</td>
<td>Resettlement Policy Framework</td>
</tr>
<tr>
<td>SCD</td>
<td>Systematic Country Diagnostic</td>
</tr>
<tr>
<td>SDM</td>
<td>Mobility Secretariat (<em>Secretaria Distrital de Movilidad</em>)</td>
</tr>
<tr>
<td>SITP</td>
<td>Integrated Public Transit System (<em>Sistema Integrado de Transporte Publico</em>)</td>
</tr>
<tr>
<td>SOE</td>
<td>State Owned Enterprise</td>
</tr>
<tr>
<td>SOP</td>
<td>Series of Projects</td>
</tr>
<tr>
<td>S-PDO</td>
<td>Series Project Development Objective</td>
</tr>
<tr>
<td>S&amp;P</td>
<td>Standard &amp; Poor</td>
</tr>
<tr>
<td>TOD</td>
<td>Transit-oriented Development</td>
</tr>
<tr>
<td>TRR</td>
<td>Transportation Research Record</td>
</tr>
<tr>
<td>UMUS</td>
<td>Unit for Sustainable Urban Mobility (<em>Unidad de Movilidad Urbana Sostenible</em>)</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
<tr>
<td>WDI</td>
<td>World Development Indicators</td>
</tr>
</tbody>
</table>
BASIC INFORMATION

<table>
<thead>
<tr>
<th>Country(ies)</th>
<th>Project Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>Support to the Bogota Metro Line 1 Section 1 Project - (Series 1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Financing Instrument</th>
<th>Environmental Assessment Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>P165300</td>
<td>Investment Project Financing</td>
<td>A-Full Assessment</td>
</tr>
</tbody>
</table>

Financing & Implementation Modalities

- [ ] Multiphase Programmatic Approach (MPA)
- [✓] Series of Projects (SOP)
- [ ] Disbursement-linked Indicators (DLIs)
- [ ] Financial Intermediaries (FI)
- [ ] Project-Based Guarantee
- [ ] Deferred Drawdown
- [✓] Alternate Procurement Arrangements (APA)

<table>
<thead>
<tr>
<th>Expected Approval Date</th>
<th>Expected Closing Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-Aug-2018</td>
<td>31-Dec-2023</td>
</tr>
</tbody>
</table>

Bank/IFC Collaboration

No

Proposed Development Objective(s)

The Series Project Development Objective (S-PDO) is to improve access to jobs and quality transit for public transport users in the area of influence of the Bogota Metro Line 1, Section 1 (PLMB).

The PDO (PDO-1) of the proposed first Project under the series is to improve readiness and start the implementation of the Bogota Metro Line 1, Section 1 (PLMB).
## Components

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Cost (US$, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component 1: Detailed Designs, Initial Construction, and Work Supervision Contract</td>
<td>67.00</td>
</tr>
<tr>
<td>Component 2: Institutional &amp; Policy Strengthening</td>
<td>3.00</td>
</tr>
</tbody>
</table>

## Organizations

- **Borrower:** Bogota Metro Company
- **Implementing Agency:** Bogota Metro Company

## PROJECT FINANCING DATA (US$, Millions)

### SUMMARY

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (US$, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Project Cost</td>
<td>4,400.00</td>
</tr>
<tr>
<td>Total Financing</td>
<td>3,870.00</td>
</tr>
<tr>
<td>of which IBRD/IDA</td>
<td>70.00</td>
</tr>
<tr>
<td>Financing Gap</td>
<td>530.00</td>
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</tbody>
</table>

### DETAILS

#### World Bank Group Financing

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (US$, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Bank for Reconstruction and Development (IBRD)</td>
<td>70.00</td>
</tr>
</tbody>
</table>

#### Non-World Bank Group Financing

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost (US$, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counterpart Funding</td>
<td>700.00</td>
</tr>
<tr>
<td>Borrower</td>
<td>700.00</td>
</tr>
<tr>
<td>Commercial Financing</td>
<td>2,000.00</td>
</tr>
<tr>
<td>Commercial Financing Guaranteed</td>
<td>2,000.00</td>
</tr>
<tr>
<td>Other Sources</td>
<td>1,100.00</td>
</tr>
<tr>
<td>EC: European Investment Bank</td>
<td>500.00</td>
</tr>
<tr>
<td>Inter-American Development Bank</td>
<td>600.00</td>
</tr>
</tbody>
</table>
The World Bank
Support to the Bogota Metro Line 1 Section 1 Project – Series 1 (P165300)

Expected Disbursements (in US$, Millions)

<table>
<thead>
<tr>
<th>WB Fiscal Year</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>1.00</td>
<td>1.00</td>
<td>33.00</td>
<td>34.00</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cumulative</td>
<td>1.00</td>
<td>2.00</td>
<td>35.00</td>
<td>69.00</td>
<td>70.00</td>
<td>70.00</td>
</tr>
</tbody>
</table>

INSTITUTIONAL DATA

Practice Area (Lead)  Contributing Practice Areas
Transport & Digital Development  Social, Urban, Rural and Resilience Global Practice

Climate Change and Disaster Screening
This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

|   | Does the project plan to undertake any of the following?
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF  Yes</td>
</tr>
<tr>
<td>b.</td>
<td>Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment  Yes</td>
</tr>
<tr>
<td>c.</td>
<td>Include Indicators in results framework to monitor outcomes from actions identified in (b)  Yes</td>
</tr>
</tbody>
</table>

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Political and Governance</td>
<td>High</td>
</tr>
<tr>
<td>2. Macroeconomic</td>
<td>Moderate</td>
</tr>
<tr>
<td>3. Sector Strategies and Policies</td>
<td>Moderate</td>
</tr>
<tr>
<td>4. Technical Design of Project or Program</td>
<td>Substantial</td>
</tr>
<tr>
<td>5. Institutional Capacity for Implementation and Sustainability</td>
<td>High</td>
</tr>
</tbody>
</table>
### 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

#### Safeguard Policies Triggered by the Project

<table>
<thead>
<tr>
<th>Policy</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment OP/BP 4.01</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Performance Standards for Private Sector Activities OP/BP 4.03</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Natural Habitats OP/BP 4.04</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Forests OP/BP 4.36</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Pest Management OP 4.09</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Physical Cultural Resources OP/BP 4.11</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Indigenous Peoples OP/BP 4.10</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Involuntary Resettlement OP/BP 4.12</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Safety of Dams OP/BP 4.37</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Projects on International Waterways OP/BP 7.50</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Projects in Disputed Areas OP/BP 7.60</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

#### Legal Covenants

**Sections and Description**

 Loan Agreement: Institutional Arrangements (Schedule 2, Section I.A.1.). The Borrower shall maintain, for purpose
of the implementation, monitoring and supervision of the Project, a structure, functions and responsibilities, and staffing including fiduciary, technical, social and environmental specialists, all with qualifications, experience acceptable to the Bank, as set forth in the Operational Manual.

Sections and Description
Loan Agreement: Institutional Arrangements (Schedule 2, Section I.A.2). The Borrower shall, not later than one month after the Effective Date, employ a consultant with qualifications and experience acceptable to the Bank to provide advisory services to the Borrower in technical, strategic and management aspects of the Metro Line 1 Section 1.

Sections and Description
Loan Agreement: Institutional Arrangements (Schedule 2, Section I.A.3): The Borrower shall, not later than December 31, 2019 select the Concessionaire and thereafter enter into a contract with the Concessionaire under terms and conditions satisfactory to the Bank which shall include inter alia the Concessionaire’s obligation to comply with the Safeguard Instruments and grievance redress mechanisms referenced therein.

Sections and Description
Loan Agreement: Institutional Arrangements (Schedule 2, Section I.A.4): The Borrower shall exercise its rights under the Concessionaire Contract in such manner as to protect the interests of the Borrower and the Bank and to accomplish the purposes of the Loan. Except as the Bank shall otherwise agree, the Borrower shall not assign, amend, abrogate, terminate, waive or fail to enforce the Concessionaire Contract or any of its provisions.

Sections and Description
Loan Agreement: Operational Manual (Schedule 2, Section I.B.1). The Borrower shall carry out the Project in accordance with a manual (the Operational Manual), acceptable to the Bank, which shall include, inter alia: (a) the budgeting, accounting, auditing, reporting, financial, procurement and disbursement procedures of the Project; (b) the organizational structure for implementation of the Project; (c) the Project indicators for the monitoring and evaluation of the Project; (d) the Safeguards Instruments, including the grievance redress mechanism referenced therein; and (e) the Annual Disbursement Ratios.

Sections and Description
Loan Agreement: IDU Agreement (Schedule 2, Section I.C.1). The Borrower shall, not later than one month after the Effective Date, and in any event prior to the initiation of any works for which land acquisition is required under the Project, whichever is earlier, amend the IDU Agreement under terms and conditions acceptable to the Bank, including inter alia, IDU’s obligation to carry out land acquisition activities in accordance with the provisions of the Initial RAP, the RPF and any applicable RAPs.

Sections and Description
Loan Agreement: IDU Agreement (Schedule 2, Section I.C.2). The Borrower shall exercise its rights and carry out its
obligations under the IDU Agreement and the IDU Amendment in such manner as to protect the interests of the Borrower and the Bank and to accomplish the purposes of enabling the Borrower to comply with its obligations under Section I.D of this Schedule. Except as the Bank shall otherwise agree, the Borrower shall not assign, amend, abrogate, terminate, waive or fail to enforce the IDU Agreement or the IDU Amendment or any of their provisions.

Sections and Description
Loan Agreement: Safeguards: (Schedule 2, Section I.D.5). Except as the Bank shall otherwise agree, the Borrower shall ensure that none of the provisions of the Safeguards Instruments is abrogated, amended, repealed, suspended or waived. In case of any inconsistencies between the provisions of any of the Safeguards Instruments and the provisions of this Agreement, the provisions of this Agreement shall prevail.

Sections and Description
Loan Agreement: Safeguards: (Schedule 2, Section I.D.4). The Borrower shall maintain and publicize the availability of a grievance redress mechanism, in a form and substance satisfactory to the Bank, to hear and determine fairly and in good faith all complaints raised in relation to the Project, including any Bogota Metro Line 1 Section 1 activities, and take all measures necessary to implement the determinations made by such mechanism in a manner satisfactory to the Bank.

Sections and Description
Loan Agreement: Safeguards: (Schedule 2, Section I.D.1). The Borrower shall ensure that: (a) the Project and the construction of the remainder of Bogota Metro Line 1 Section 1 are carried out with due regard to appropriate health, safety, social and environmental standards and practices, and in accordance with the ESIA, ESMP, RPF, the Initial RAP and the RAPs; (b) for each activity for which the RPF provides for the preparation of a RAP, such RAP is prepared and disclosed in accordance with the RPF, adequately consulted with Affected Persons as per the RPF, and furnished to the Bank for review and approval; and (c) all measures are taken to implement the Initial RAP and the RAPs in accordance with their terms and in a manner acceptable to the Bank. To this end, the Borrower shall ensure, without limitation, that: (i) funds are available to cover all the costs of implementing the Initial RAP and the RAPs; (ii) Affected Persons shall be compensated at replacement cost, in accordance with the Initial RAP and the RAPs, as applicable; and (iii) the implementation, monitoring and evaluation of the Initial RAP and the RAPs is completed and reported in a manner satisfactory to the Bank.

Sections and Description
Loan Agreement: Safeguards: (Schedule 2, Section I.D.2). The Borrower shall ensure that the obligation to comply with the relevant Safeguard Instruments is incorporated in the bidding documents and contracts between the Borrower and the Concessionaire, other contractors or subcontractors and any entity undertaking works supervision as needed to enable the Borrower to comply with its safeguard obligations.

Sections and Description
Loan Agreement: Safeguards: (Schedule 2, Section I.D.3). The Borrower shall require the Concessionaire that the obligation to comply with the Safeguard Instruments is incorporated in the bidding documents and contracts between the Concessionaire and other contractors and subcontractors as needed to enable the Borrower to comply with its safeguard obligations.

Loan Agreement: Disbursements/Other Undertakings (Schedule 2, Section IV.1). The Borrower shall, throughout Project implementation, comply with the Annual Disbursement Ratios.

Loan Agreement: Disbursements/Other Undertakings (Schedule 2, Section IV.2). For purposes of ensuring compliance with the Annual Disbursement Ratios, the Borrower shall not later than forty-five days after the end of each calendar year furnish to the Bank, a consolidated interim financial report, acceptable to the Bank, which shall identify the Eligible Expenditures financed under the Loan and the Project expenditures financed under each Co-financier Loan.

Loan Agreement: Procurement (Schedule 2, Section V.2). All goods, works, non-consulting services and consulting services required for the Project and to be financed out of the proceeds of the Loan shall be procured by the Borrower in accordance with: (a) the provisions set forth in: (i) the Policies for Procurement of Goods and Works financed by the Inter-American Development Bank (GN 2349-9) of March 2011 with respect to goods, works and non-consulting services; and (ii) the Policies for the Selection and Contracting of Consultants Financed by the Inter-American Development Bank” (GN-2350-9) of March 2011 with respect to consulting services; (b) the provisions of Paragraphs 3.21, 3.23 (e) and 3.32 of the IBRD Procurement Regulations; and (c) the Procurement Plan.

Loan Agreement: Disbursements/Other Undertakings (Schedule 2, Section IV.3). Without limitation to the provisions of paragraphs 1 and 2 above, and Section 2.08 of the General Conditions, and in order to comply with the Annual Disbursement Ratios, the Borrower may request the Bank to finance a lower percentage of expenditures under the Loan.

Loan Agreement: Procurement (Schedule 2, Section V.1). At the request of the Borrower, the Bank has agreed that the procurement of all goods, works, non-consulting services and consulting services required for the Project and to be financed out of the proceeds of the Loan and the Co-financiers Loans, be made under the alternative procurement arrangements referred to in Paragraph 2.4 (a) of the IBRD Procurement Regulations.
Loan Agreement: Procurement (Schedule 2, Section V.3). In the event that the alternative procurement arrangements referred in paragraph 1 above are terminated at the request of the Borrower, IADB or the Bank, goods, works, non-consulting services and consulting services required for the Project and to be financed out of the proceeds of the Loan shall be procured in accordance with the IBRD Procurement Regulations. In such case, the term Procurement Plan shall be the Borrower’s procurement plan for the Project provided for under Section IV of the IBRD Procurement Regulations, as such plan may be updated from time to time with the Bank’s approval.

Sections and Description
Loan Agreement: Modifications to the General Conditions (Appendix, Section II). Section 5.13 (Procurement) is deleted in its entirety and the remaining section in Article V is renumbered accordingly. Paragraphs 84 (Procurement) and 85 (Procurement Regulations) in the Appendix are deleted in their entirety and the subsequent paragraphs are renumbered accordingly.

Conditions

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>The IADB Co-financing Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of the Borrower to make withdrawals under it (other than the effectiveness of this Agreement) have been fulfilled.</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>The Operational Manual has been adopted by the Borrower in form and substance satisfactory to the Bank.</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>The Trust Account has been established in form and substance satisfactory to the Bank.</td>
</tr>
</tbody>
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I. STRATEGIC CONTEXT

A. Country Context
1. Since the early 2000s, Colombia experienced a decade of strong economic growth, accompanied by significant gains in terms of poverty reduction. Between 2004 and 2014, the country’s economy grew on average by 4.8 percent per year, making it one of the strongest performers in Latin America (Figure 1). This expansion was supported by high commodity prices and important macroeconomic and structural reforms. Growth was accompanied by a fall in unemployment, which dipped below 9 percent in 2015 before increasing marginally in 2017. Job creation was the main driver behind the gains in shared prosperity, with the income of the bottom 40 percent growing by 4.4 percent between 2002 and 2015, well above the 3.1 percent increase in average income per capita. The period also saw an impressive reduction in poverty rates, which declined from close to 50 percent in 2002 to 28 percent in 2016 (National Poverty Line). Income inequalities as measured by the Gini coefficient however remained high and behind other countries in the region, marginally declining from 0.567 in 2008 to 0.517 in 2016.

2. In recent years, despite adverse external shocks, Colombia’s economy has shown resilience supported by a robust macroeconomic policy framework. Since 2014 the country experienced a significant terms of trade shock, estimated at nearly 4 percent of GDP, one of the largest in the region and its largest from a historical perspective. Yet the economy showed resilience underpinned by far-reaching macroeconomic and structural reforms undertaken over the last decade. The robust macroeconomic framework, anchored by an inflation targeting regime, floating exchange rate and the fiscal rule, ensured orderly fiscal and external adjustments. Colombia’s economy decelerated gradually to 1.8 percent by 2017. The historical peace agreement with the FARC, which has a strong focus on rural and institutional development in conflict-affected areas, as well as the structural tax reform, higher oil prices, stronger private sector demand and an expected pick-up in investments in the Fourth Generation Roads Concession (4G) Program set the stage for relatively favorable outlook with growth accelerating to 2.7 percent in 2018, and further to 3.6 percent by 2020.

3. Colombian cities have been an engine of economic growth, playing a key role in continued poverty reduction and shared prosperity until 2014; still urban poverty has increased in the past two years. Colombia is a highly-urbanized country with 77 percent of its population living in cities (2017). The cities of Bogota, Cali, Medellin and Barranquilla account for more than 30 percent of the population. In 2016, Bogota represented more than a quarter of the country’s GDP. Economic growth in urban areas has been pivotal for Colombia’s advances in poverty reduction and shared prosperity during the last decade. However, recent declines in rural poverty have been offset by a relative deterioration of the well-being of urban households, with close to a one percentage point increase in the urban poverty rate between 2015 and 2016, to 24.9 percent. Further, while poverty rates are still higher in rural areas (38.6 percent in 2016), the size of the urban population implies that cities house more people living in moderate and extreme poverty, and are also characterized by higher inequality. Policies that allow for more equitable access to economic and social opportunities for urban citizens will be essential for overall reduction in poverty levels and inequality.

B. Sectoral and Institutional Context
4. Bogota, Colombia’s economic and political capital, has historically been at the forefront of urban mobility reforms but important challenges remain to address congestion costs that constrain agglomeration economies. With a population of more than 8 million people (2017), the Capital District of Bogota (“the District”)

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1 In 2016, Gini coefficients showed more pronounced inequality in main cities (0.495) than in rural areas (0.458) (DANE 2016).
is Colombia’s largest city. During the past two decades, important reforms have promoted urban mobility and social inclusion. In the early 2000s, the District introduced one of the most efficient mass transit solutions in the world, the TransMilenio Bus Rapid Transit (BRT) system, developed one of the largest bicycle networks in Latin America, and reclaimed public space. Despite these achievements, important challenges remain. For instance, between 2011-2015 motorized transport significantly increased; out of 1.2 million daily new trips, the main modal change corresponded to an increase in the use of private vehicles by 22 percent, largely driven by the drastic increase in the number of motorbike trips (104 percent since 2011, while private cars only marginally increased). 2 Severe congestion taxes public transit users, particularly those using the District’s zonal buses. In 2015, the commercial speed of the almost 5 million daily trips made in buses running in mixed traffic was only 13km/hr. 3 Congestion costs in Bogota are mounting, and are estimated to be close to 0.5 percent of the city’s annual GDP. All cities are subject to the opposing forces of agglomeration and congestion, and their net outcomes determine their productivity. 4 When cities fail to curb the congestion costs created by high density, they are constraining the size of the agglomeration economies that would allow for better knowledge sharing, innovation and job matches. On the positive side, congestion can be limited by policy choices and infrastructure investments, as the ones supported by the metro line.

5. The Primera Linea de Metro de Bogota, Tramo 1 (PLMB) 5 will directly contribute to advance Bogota’s agenda for fully harnessing the benefits of agglomeration economies and tackle large income inequalities. Addressing the negative externalities of rapid motorization such as congestion, road safety and pollution is critical to promote shared prosperity in urban areas as these externalities are regressive: they disproportionately affect the poor. For instance, in 2014, households in the poorest areas of the District spent up to 6 times more of their monthly income on transport than those in richer areas, and their employment accessibility worsened. 6 These challenges are all the more pressing as the city’s poverty rate has steadily increased during the last five years (11.6 percent in 2016), making Bogota the most unequal of Colombia’s large cities 7 with a Gini coefficient of 0.499 in 2016, above Medellin and Cali’s (0.478 and 0.476, respectively). Cities are sources of agglomeration economies to the extent that they allow labor market interactions, linkages between intermediate and final goods (input sharing) and knowledge spillovers. 8 More efficient public transportation is vital for people to access employment, education and health opportunities, and for Bogota to be a more productive and equitable city. 9 This operation supports the District into becoming more equitable, greener and accessible to fully tap into its agglomeration economies.

6. Bogota has become an international reference for innovative and sustainable mobility; the Bank has supported Bogota’s mobility agenda with lending and analytical work. By the end of the 1990s, Bogota reformed its public transport system with the advent of the TransMilenio — a BRT system that used exclusive bus ways, high-capacity buses, a centralized fare collection and fleet control system, and concession or franchise

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2 Encuesta de Movilidad, Secretaría Distrital de Movilidad, 2015
3 Rodríguez et al. 2015, TRR Paper 16-4349.
4 Raising the bar for Productive Cities in Latin America and the Caribbean (World Bank, 2018).
5 PLMB always refers to PLMB Section 1 (Tramo 1).
6 The poorest households spend close to a quarter of their monthly income on transport and the employment accessibility of some of Bogota’s poorest areas, particularly the southern periphery (the locality of Usme and parts of Ciudad Bolívar) has declined (decrease in the number of employment opportunities that can be reached within 60 minutes) due to increased congestion and the reforms introduced by the SITP; Rodríguez et al. 2015, TRR Paper number 16-4349.
7 Nationally, it is the 3rd most unequal city as measured by the Gini coefficient, behind Quidbo and Riohacha (DANE 2016).
agreements with bus operators who had to establish formal companies. Currently, the system operates 6 BRT lines with a total length of 113km, carries 36 percent of the District’s public transport trips, and has successfully cut as much as one third of the commuting time of many of Bogota’s citizens. In late 2010, Bogota also formalized the remaining traditional buses and integrated them with the TransMilenio system under a unified operation, tariff structure and infrastructure. This new system, termed the Integrated Public Transport System (Sistema Integrado de Transporte Publico or SITP) calls for the future integration of other transit modes, including the metro. Bogota has also implemented one of the largest bicycle networks in the developing world and has redefined and reclaimed public space for its citizens. The result is that as much as 70 percent of its trips are in public transit, walking and cycling.

7. Despite these achievements, increasing travel demand, lagging mass transit infrastructure and increased congestion have led to a public transport system that is saturated and a deteriorated level of service. Compared to 2008, the average speed of public transport in mixed traffic lanes decreased from 23km/h to 15.6km/h, which resulted in almost a 30 percent increase in the average travel time. In the TransMilenio system, although average commercial speeds are around 26km/hr, overcrowding remains a critical concern and is ranked as the number one complaint from users. In the Avenue Caracas corridor alone, the number of passengers has reached 56,000 p/h/d (passenger per hour per direction; 2016), which has already exceeded the capacity of 45,000 p/h/d. Partly, this reflects the fact that only 30 percent of the mass transport infrastructure that should have been built when the system entered into operation is available to date. Passenger satisfaction surveys have shown that crowded stations, service interruptions and increased waiting times due to longer boarding and alighting, as well as security and safety concerns for women and vulnerable groups are the main challenges today. At the same time, the implementation of the SITP, particularly the abrupt formalization of the traditional buses, has resulted in a suit of implementation challenges and discomfort by users: less frequencies, more cumbersome recharge and payment with the smartcard as opposed to readily available cash, confusing routes, long wait times and lines in bus stops, to name a few. Trips by private travel modes increased 18 percent from 2011 to 2015, with motorcycle trips almost doubling due to their flexibility and affordability.

8. The PLMB builds on a vast body of work and reflects the vision for a cost-effective rail system to compliment the existent TransMilenio BRT network as part of an integrated system (SITP). Several attempts were made to address the District’s mobility problems through a rail/metro solution in the past. The Bank has been involved with these efforts since 2008, supporting conceptual and detailed engineering designs. The  

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10 The Bogota Urban Services Project (IBRD IPF; P074726) financed Ave. Caracas; the Integrated Mass Transit System Project (P082466) financed the NQS.
11 Encuesta de Movilidad, Secretaria Distrital de Movilidad, 2015.
12 The SITP required incumbent bus owners to form companies, scrap old units, renew their fleet, and operate services under scrutiny from the transport authority. As a result, the city’s nearly 700 bus routes and more than 16,000 traditional urban buses were transformed into 450 routes, a fleet of almost 10,000 buses, 6,700 bus stops, and 4,600 smartcard recharge points. The Bank has supported analytical work to prop up the operational and financial sustainability of the system.
13 Decree No. 309 dated July 2009 lays out the conditions under which a future metro system should be integrated under the SITP.
14 Encuesta de Movilidad, Secretaría Distrital de Movilidad, 2015
16 The TransMilenio system was originally planned back in the late 1990s, to have a network of BRT corridors of almost 400km, to be developed in phases. To date, the system has 1.14km of trunk corridors.
17 Refer to Rodriguez et al. 2015, TRR Paper number 16-4349 for a full discussion of the impact of this reform.
18 The first metro line was conceived in 1942 but several proposals failed to materialize throughout the 20th century due to lack of political alignment between the GoC and the city, and financial constraints (Refer to Annex 6).
conceptual design evaluated alternatives for an urban rail network, given the existent TransMilenio BRT network, and prioritized the alignment. In 2012 the Bank co-financed the basic detailed engineering design of this first metro line, which originally foresaw 27km of a subway line. Given the subjacent geological risks with Bogota’s soil, which could potentially lead to cost overruns, and the stark devaluation of the peso in 2013, in 2014 the Bank provided technical advice to the District on a value engineering exercise to assess alternatives to generate project efficiencies. The scope of the metro line was reassessed and instead an elevated metro with similar alignment from previous plans was proposed to minimize costs (Refer to Annex 6). Colombia’s Mass Transit Law (Law 310 dated 1996) provides for the joint financing of mass transit systems between the GoC (up to 70 percent of the total financing of capex and financial costs) and cities. On November 9, 2017, the Government of Colombia (GoC) and the District signed the Co-Financing Agreement for the PLMB with a total cost of COP22.33 trillion (US$7.4 billion equivalent). This Co-Financing Agreement defines the annual contributions of the National and local government and the eligible expenses to be financed (Refer to Annex 1).

C. Higher Level Objectives to which the Project Contributes

9. The PLMB is closely aligned with the 2016-2021 World Bank Group Country Partnership Framework (CPF) for Colombia. The PLMB directly supports the objectives set under its third pillar promoting competitive cities by improving infrastructure and urban integration. The PLMB improves access to opportunities for the population along the influenced segments especially for low-income groups, and it further addresses the question of universal accessibility in public transport, a key transversal theme of the World Bank’s engagement with Colombia. Also, by directly addressing the issue of traffic congestion, one of the main barriers for urban agglomeration economies, the PLMB has the potential of boosting the District and country’s productivity. Further, the PLMB supports the integrated public transport system of Bogota which is essential for improving the District’s competitiveness.

10. The PLMB supports the World Bank’s twin goals. The construction of the PLMB, and its integration with the District’s public transit system (other BRT lines, zonal and feeder buses, a first cable line, and a network of non-motorized transit), will directly benefit low-income households by increasing their affordable access to socioeconomic opportunities via reduced travel times, and an integrated single fare system. The PLMB also aligns with the Bank’s agenda of fostering green growth as it is expected to reduce GHG emissions and local pollutants.

11. The PLMB will directly address climate change. The PLMB will lead to net GHG emissions reductions due to modal shift to a cleaner mass transit mode from the more polluting buses and cars/motorcycles. The PLMB will be powered by electricity, and given that Colombia has a clean energy grid (64 percent of total energy is from renewables), the metro favors a change towards the use of cleaner energy in the transport sector. Also,

19 The Bank’s Bogota Urban Services Project supported financing of the metro’s conceptual design study; an Additional Financing supported the metro’s detailed engineering design; several technical assistances embedded in Productive and Sustainable Cities Programmatic Knowledge Services have supported Bogota’s SITP.
20 Colombia’s Mass Transit Law refers to Law No.86 dated December 29, 1989 as amended by Law No.310 dated August 6,1996, and approves Co-Financing arrangement between the GoC and cities to build infrastructure for mass transit systems. The financial contributions of the GoC and cities are allocated through a flow of earmarked yearly fiscal transfers ("vigencias futuras"). The GoC and cities signed Subsidiary Agreements (Convenios de Cofinanciación) laying out the financial and technical commitments to carry out the projects.
21 The construction of the first metro line is divide in 3 phases or sections. The Co-Financing agreement covers Section 1 of the PLMB; subsequent sections to extend the line will be planned and their financing thought out in the future (Refer to Annex 1).
22 Discussed by the World Bank’s Executive Directors on April 7, 2016.
the PLMB includes the development of bike lanes and the pedestrian access along stations. Overall, the PLMB is part of a general strategy by District authorities to curb car use and promote sustainable mobility in the city, aligned with the World Bank Green Growth agenda. The PLMB is also aligned with the Green Growth Strategy established by the National Development Plan (6 article, Law 1752/2005) and the National Climate Change Policy, being a low-carbon project that promotes a sustainable urban transport in the country. This Project will also contribute to the mitigation goal proposed in Colombia’s Nationally Determined Contribution (NDC).

12. **The PLMB also reflects the Maximizing Finance for Development (MFD) approach of the World Bank.** The PLMB will be implemented under a single concession arrangement, corresponding to the Design-Finance-Build-Operate-Maintain (DFBOMT) model. The financing approach is considering a blended and sequenced financing, including Multilateral Development Banks (MDB) financing, and financial markets funding. Initial financing will come from Bogota’s own resources (US$700 million) and MDB (US$1.7 billion from the World Bank, IADB, and EIB) which will finance initial costs, before the possible deployment of financial markets financing. By leveraging limited MDB and public resources, the Government aims to crowd-in private finance. The World Bank Group’s support is critical to provide confidence to investors in the sector, as a limited amount of IBRD lending could enable about US$2 billion of other sources of financing to be deployed for the PLMB.

II. **PROJECT DEVELOPMENT OBJECTIVES**

A. **A Series of Projects for the PLMB**

13. **The Borrower has requested an estimated IBRD lending envelope of US$600 million to support the PLMB in two phases, which would facilitate the mobilization of private financing by signaling the Bank’s long-term commitment.** A phased approach would also be more conducive to the PLMB disbursement needs. The Bogota Metro Company or Empresa Metro de Bogotá (EMB), the Borrower and implementing entity, is requesting an estimated IBRD lending envelope of US$600 million to be disbursed over the 2021 to 2025 period, which coincides with the PLMB construction period. However, EMB currently needs to secure a considerable amount of this financing (primarily MDBs loans) to launch the bidding process of the DFBOMT contract (August 2018). To this aim the World Bank is using a Series of Projects approach (SOP), with two Investment Project Financings (IPFs) in the series that align with the metro’s actual disbursement needs. As the PLMB disbursement needs during the initial period (2018-2021) will be relatively small, the first Project (the “Project”) of the series would finance US$70 million over a five-year period and would cover initial civil works related to the railyard, viaduct, the work supervision contract, and preparatory consultancies and studies (see SOP #1 in Table 1 below). The second Project (SOP #2) would finance an estimated US$530 million over the 2022-2025 period, supporting the main construction phase. Notwithstanding, since the intention is to finance a stand-alone metro investment, the appraisal presented for the proposed SOP #1 covers the PLMB (including SOP #2). The innovative use of the SOP instrument for a stand-alone investment, incorporates flexibility to allow for the effective use of IBRD resources and an agile preparation of subsequent phases, while signaling the Bank’s long-term commitment, which should potentially facilitate private capital mobilization.

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23 The GoC commits to reduce its greenhouse gas emissions by 20 percent with respect to the projected Business-as-Usual Scenario (BAU) by 2030.
Table 1: The Project Framework based on the SOP Approach

<table>
<thead>
<tr>
<th>SoP #</th>
<th>Sequence</th>
<th>Proposed DOs</th>
<th>Instrument</th>
<th>Est. amount (US$ million)</th>
<th>Est. approval date</th>
<th>Overall risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Simultaneous</td>
<td>Improve readiness and start the implementation of the PLMB.</td>
<td>IPF (5 years)</td>
<td>70</td>
<td>August 2, 2018</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Simultaneous (Preparation starts year 2 of the SOP#1)</td>
<td>Improve access to jobs and quality transit for public transport users in the area of influence of the PLMB.</td>
<td>IPF (5 years)</td>
<td>530</td>
<td>2021</td>
<td>High</td>
</tr>
</tbody>
</table>

14. The key elements in Theory of Change to the achievement of the SeriesPDO (S-PDO) are: (i) bidding and contract award of the DFBOMT single contract (output to be achieved during SOP #1); (ii) infrastructure and systems investments for the realization of the PLMB (mostly during SOP#2); and (iii) institutional strengthening of the different urban mobility actors in the District of Bogota (SOP#1 & #2), particularly the Bogota Metro Company (EMB), to allow the completion of works, proper management of the single contract and launch of operations of the PLMB, and its successful integration as part of Bogota’s SITP. Achievements in the three areas should result in improved public transport quality, and consequently access to jobs for public transport users in the area of influence of PLMB, as shown in Figure 1 below.

B. PDO

15. The Series Project Development Objective (S-PDO) is to improve access to jobs and quality transit for public transport users in the area of influence of the Bogota Metro Line 1 Section 1 (PLMB).

16. The PDO (PDO-1) of the proposed first Project under the series (SOP #1) is to improve readiness and start the implementation of the Bogota Metro Line 1 Section 1 (PLMB).
C. Project Beneficiaries

17. The PLMB expected area of influence includes a population of over 2.9 million. According to the preliminary economic analysis, the PLMB will benefit 2.92 million inhabitants in its area of influence in terms of their ability to use a more efficient and safer public transport system. The 24km alignment will run from the district of Bosa and until the NQS corridor, which covers some of the poorest districts in Bogota with households from the lowest socioeconomic strata.24 The PLMB will then turn into the Caracas Corridor which currently has the highest demand of public transport (53,000 passenger p/h/d). The Caracas Corridor also goes through the central business districts (CBD) where a significant number of jobs, services and amenities are located. When in operation, the metro ridership is estimated at around 26,500 p/h/d during the first year of operation, increasing to 32,900 p/h/d by 2030 and 53,000 p/h/d by 2050. In addition, the PLMB is estimated to increase accessibility to an additional estimated 28,000 jobs within 60min by transit system throughout the District. Furthermore, there will also be 180,700 pedestrians and bicycles that will benefit from the dedicated bicycle lanes and public space upgrading that are integrated with the metro station. 25 As the majority of users of public transport and non-motorized modes tend to be lower income, the PLMB is expected to clearly benefit the bottom 40 percent. Lastly, the PLMB is also expected to significantly enhance women’s mobility, by given them access to a faster mode, that is more safe and secure.

D. PDO-Level Results Indicators

18. The achievement of the PDO for the Series of Projects (S-PDO) will be measured by the result

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24 DANE classifies districts in Bogota according to 6 socioeconomic strata of resident households. The area from Bosa to NQS cover areas with households of strata 1 to 3. These levels are considered low-income and low middle-income households that are eligible for Government subsidies.

25 CONPES 3900.
indicators:

- **Ridership:**
  - Passengers traveling at peak hour in the operational segment of the PLMB, differentiated by gender; and
  - Passengers traveling at peak hour in *TransMilenio* in the segment of the Caracas Avenue, differentiated by gender.

- **Employment Accessibility:** Percentage of jobs that can be reached by public transport within a 60-min one-way commute in the PLMB area of influence, differentiated by income;

- **Citizen engagement:** User satisfaction (Percentage of users satisfied with overall metro service, its security and comfort, differentiated by gender and income).

19. The achievement of the PDO for the first Project (PDO-1) will be measured by the following result indicators:

   - Cumulative percentage of physical works:
     - Cumulative percentage of physical works for rail yard (patio)
   - DFBOMT Contract awarded (Y/N)

20. **Intermediate indicators to be measured by the first Project include:**

    - Project Management Office hired (Y/N)
    - DFBOMT contract includes target of women employed in the operation & maintenance phase (Y/N)
    - Cumulative percentage of transfer of utility networks
    - Traffic management plan during construction approved by Secretariat of Mobility (Y/N)
    - Grievances responded and/or resolved within the stipulated service standards for response times

21. **In addition, intermediate indicators that could be measured by the second Project include the following:**

    - Cumulative percentage of physical works:
      - Cumulative percentage of physical works in civil works other than stations
      - Cumulative percentage of physical works for stations
    - Cumulative percentage of systems installed (power supply, auxiliary, signaling and telecom)
    - Cumulative percentage of rolling stock manufactured
    - Cumulative percentage of fare collection system installed that is interoperable with SITP
    - Accessibility for disabilities: percentage of stations that have facilities for people with disabilities for seamless travel
    - GHG emissions: estimated net GHG emissions reduction from transport.
    - **MFD:** “MDB finance” multiplier defined as percentage of financial markets funds facilitated by MDB financing.
    - Road Safety Indicator: A road safety assessment of the accesses to all stations (Y/N)
    - Gender: Percentage of women that perceive the metro service to be safe for their daily commute.

22. All corporate indicators have been calculated for the PLMB, and will be measured at the end of the second Project in the SOP.
III. PROJECT DESCRIPTION

A. Project Components

23. The PLMB consists of 24km of new urban rail infrastructure. Works to be carried out as part of the whole PLMB investment include preliminary works by EMB with counterpart funding: transfer of utility networks along the alignment and land acquisition. All other PLMB activities are to be carried out by the single DFBOMT Concessionaire: (i) the construction of 24km (including the rail yard connection line and end of line rail turnouts) of a 100 percent elevated rail viaduct starting from the metro railyard (in the southwest of the District, locality of Bosa) to Calle 78 with Avenida Caracas in the central business district (see alignment below); (ii) the construction of 16 stations, 10 of which will be integrated with the TransMilenio system, and one rail yard; (iii) the construction of 22km of bicycle lanes, intervention of targeted sections and stations of TransMilenio along the Caracas Ave. (until Calle 78) and adjacent roads along the alignment, and public space upgrading on 600,000 sq. meters of public space; and (iv) the provision and installation of the necessary rails, rolling stock, electrical, control, telecommunications and fare collection system for the operation of the metro. The PLMB will pay attention to enhance security and safety for women, by designing gender-informed infrastructure and operation.

24. The World Bank will finance as part of this Project the following components:

25. Component 1: Detailed Designs, Initial Construction, and Work Supervision Contract (approx. total cost US$190 million, of which World Bank financing is US$67 million): Detailed Designs, initial construction works, including inter alia, civil works related to ground improvement and compacting for the railyard, and initial pilling installation for the viaduct, and the works supervision contract for the DFBOMT contract.

26. Component 1 will be co-financed with the IADB and EIB. The World Bank, IADB and EIB’s total financing under Component 1 will amount to US$190 million.

27. Component 2: Institutional & Policy Strengthening. (Total cost US$6 million, of which World Bank financing is US$3 million). This includes strengthening the Borrower’s capacity through inter alia, carrying out of technical studies as needed for the implementation of the PLMB, including studies for the integration of the PLMB with the SITP (operational design, subsidy requirements, fare collection, among others), transit oriented development and land value capture instruments, detailed assessments of GHG emissions, local pollutants, noise and vibrations, and institutional strengthening of the EMB and Bogota’s Mobility sector, concerns for the security and safety of women in public transport, hiring of technical consultants and other consultants to support safeguard and fiduciary matters, and training.

28. Component 2 will be co-financed by the World Bank and IADB.

29. Currently the EMB through Colombia’s Financiera de Desarrollo Nacional (FDN,) are carrying out the technical, financial and legal structuring of the PLMB. This process will yield a basic advanced detailed engineering design for the technical specifications of the bidding documents. The financial and legal structuring will yield the sources, terms and instruments of the financial closure of the PLMB, and the bidding documents. Metro of Santiago de Chile advised EMB during this structuring phase, and EMB will hire a Project Management Office (PMO) to strengthen its internal capacities to manage the PLMB in subsequent phases (the PMO should be working by January 2019). The bidding process for the DFBOMT concessionaire is foreseen to take place over 2018-2019, with contract award towards mid 2019 (a dated covenant includes December 2019 as a deadline), with early interventions and preliminary works by EMB to transfer utility networks and advance land acquisition
and resettlement needs over 2018-2019; over the 2019 period, the selected concessionaire is also expected to carry out the final detailed designs. Construction is foreseen to start in 2020 and last until 2025 (Refer to Annex 1 for a Detailed Project Description).

30. **The PLMB will be implemented under a single concession arrangement, corresponding to the DFBOMT model.** The District carried out an alternatives analysis and benchmarking of international experiences to decide on the best transaction model for the PLMB. After considering possible downside risks, such as potentially higher cost and risk of lower number of qualified bidders, this contracting model was selected given that EMB placed particularly high stakes on the need to mitigate the interface risk associated with several contractors being awarded the various parts of the contract such as civil works, equipment supply, operation and maintenance, in a project of this magnitude. EMB will conduct a competitive bidding process to select a consortium that will be awarded the concession to implement the PLMB under a DFBOMT modality, over a period of 30 years, including 5 years of construction. EMB will execute preliminary works associated with transfer of utility networks and land acquisition; the concessionaire will be responsible for the implementation of the whole PLMB under one contract.

### B. Project Cost and Financing

<table>
<thead>
<tr>
<th>Sources</th>
<th>US$ bn (eq)</th>
<th>Uses (CAPEX)</th>
<th>US$ bn (eq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bogota District (Cash)</td>
<td>0.7</td>
<td>Direct Investments by EMB***</td>
<td>0.7</td>
</tr>
<tr>
<td>Multilateral Loans (Co-Financing) *</td>
<td></td>
<td>Investments by Concessionaire</td>
<td></td>
</tr>
<tr>
<td>IBRD**</td>
<td>0.6</td>
<td>Civil Works</td>
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<td>IADB</td>
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<td></td>
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<tr>
<td>EIB</td>
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<td>Rolling Stock and Systems</td>
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<td>Other Financing:</td>
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<td></td>
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<tr>
<td>MDBs, Bilateral and/or Financial Markets</td>
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<tr>
<td>Concessionaire Equity / Debt</td>
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<td></td>
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<tr>
<td><strong>TOTAL^</strong></td>
<td><strong>4.4</strong></td>
<td><strong>TOTAL^</strong></td>
<td><strong>4.4</strong></td>
</tr>
</tbody>
</table>

* Reflects total envelope requested by EMB to MDBs. EIB and IADB are expected approve their first tranches in July 2018.

** Total requested IBRD financing for the entire SOP, these are split in SOP#1 (US$ 70 million) and SOP#2 (US$530 million).

***Includes transfer of utility networks (US$0.10 bn), land acquisition (US$0.40 bn).

^ Does not include O&M of US$1.2 billion; sources will be user tariffs and District fiscal transfers.

31. **The capital cost estimated of the PLMB is US$4.4 billion; operation and maintenance costs are estimated at US$1.2 billion over the life of the concession.** The estimated total capital costs of the PLMB amounts to US$4.4 billion, which includes transfer of utility networks, land acquisition, civil works, rail systems, rolling stock, public space upgrading for pedestrian use around the alignment, construction of 22km of bicycle lanes, intervention of targeted sections of TransMilenio, construction of new BRT stations and demolition of a road structure and some BRT stations, set up of PMO and civil work supervision. The total costs are allocated as follows: Land acquisition and utility network transfers amount to 16.25 percent of the total cost; civil works, viaduct foundation, piles and decks amount to 35 percent of the total costs; stations to 11 percent of the total costs. Due to Bogotá’s geotechnical conditions, the average foundation will be 65m deep whereas other projects could typically have 25m foundations. The viaduct will be built with a height of 13.5m (between 3.5m higher than average) and since Bogotá is set in a high seismic area, the structural design takes into account these considerations. Furthermore,

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26 Total capex cost includes AIU (administración, imprevistos e utilidades) and value added taxes.
almost 10 percent of these costs (civil works and stations) account for costs related to road interventions, TransMilenio stations, urban space upgrading and bicycle lanes. Other major costs include rolling stock and rail track systems—electrification, signaling, rail, and PMO and supervision (Refer to Annex 1 for detailed description of costs and design).

32. The source of funding for the PLMB capital expenditure (CAPEX) will be vigencias futuras (yearly earmarked budgetary transfers) from the GoC and the District as laid out in the Co-Financing Agreement; the operational expenditures (OPEX) will be financed by user tariffs and fiscal contributions from the District. The source of funding for the financing of PLMB, including capital repayment and financing costs, will be vigencias futuras from the GoC and the District governments, through their respective future commitments as laid out in a Co-Financing Agreement signed by the District and the Nation on November 9, 2017. The GoC will contribute COP15.1 trillion\(^2\) (around US$5 billion) equivalent to around 68 percent of the project's estimated debt service over a period of 30 years and the District will contribute COP7.19 trillion (US$2.4 billion) over a period of 25 years. (Refer to Annex 1 for further details.) The District would be responsible for any other project cost, including any cost overruns or delays.

![Figure 2. Project Phases & Financing](image)

33. A sequenced and blended financing package has been designed as the most appropriate approach to finance the PLMB given the scale of the financing (US$4.4 billion) needed and the long construction period; this approach meets the MFD principles (Figure 5). Backstopped by the vigencias futuras, the financing will include: loans from MDBs, Bilaterals and financing from financial markets. In a first phase, funding will come from Bogota municipality’s own resources (US$700 million) followed by loans from MDBs (US$1.7 billion) which will finance initial costs, before the possible deployment of commercial capital. MDB financing will come from IBRD, IADB and EIB.\(^2\) Once the construction has initiated and further financing requirements are verified, the PLMB

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27 Constant pesos as of December 31, 2017
28 Preliminary requests for financing from tier 1 MDBs amount to US$600 million from World Bank, US$600 million from IADB, and approximately US$500 million from the EIB. These three MDBs have aligned their Board Approval for early August 2018. Financing from
will tap into additional sources of financing, which might include tier-2 development banks and other financial markets to raise approximately US$0.9 billion. Commercial funding by the private concessionaire will be about US$1.1 billion through a combination of equity and debt.

C. Lessons Learned and Reflected in the Project Design

34. The metro design has sought to apply the lessons learned from other elevated systems seeking to generate the highest efficiencies and the lowest impacts. The PLMB was designed following three key criteria: (i) urban planning considerations; (ii) operational savings; and (iii) environmental sustainability. Among others, it will include a communications-based train control (CBTC) railway signaling system to accommodate the very high ridership expected in the future of up to 50,000 person per hour per direction, and considers the following design aspects and structures to generate the least urban impacts: an elevated viaduct with a height of 13.5m at rail level, to minimize the generation of shade in the surrounding buildings and limit impact on the urban fabric, designs of beams in the viaduct that minimize noise and vibrations (seismic resistant elements); designs of large stations with sufficient access to avoid congestion and facilitate evacuation in the case of emergencies.

35. The PLMB adopts lessons learnt from similar transactions and financing models of mega infrastructure projects. The metro leverages funds from MDB to finance initial costs to open the opportunity to crowd-in commercial capital and private finance. The PLMB will be implemented under a single concession DFBOMT model. Attention has also been paid to strengthen EMB as the conceding entity, and to hire a PMO to support the bidding process and project implementation.

36. It also recognizes the importance of a comprehensive effort to maximize the benefit from the metro to the citizens. Integration of various transport modes with the PLMB under the SITP is essential to maximize the benefit to the travelers. Several feeder bus lines as well as BRT lines are planned together with the Metro to have a network-level impact on increasing accessibility by public transport. The integration will not only be at the infrastructure level, but also in terms of operation, payment medium and fares, as stipulated in the SITP. In addition, the design of the stations considers land use planning around the station to promote Transit Oriented Development (TOD) and seamless transfer from other travel modes to the metro.

37. The Project also draws from experience gathered from several World Bank financed urban transport Projects; specifically, from the Lima Metro Line 2 project (R2015-0168), São Paulo Metro Line 4 project (R2001-0214), Quito Metro Line 1 (R2013-0133), Nanchang Urban Rail (R2013-0102) and urban transport operations in Colombia such as Support to National Urban Transport (R2011-0164) and Integrated Mass Transit Systems (R2004-0093). The main lessons learned include:

38. The importance of an integrated public transit network. The PLMB will be part of an already integrated public transit system with an operational, fare and infrastructure integration between TransMilenio and the zonal buses. As such, the metro will be part of a hierarchically integrated network, that includes BRT and zonal buses, which supports its sustainability. The Bank has supported this through analytical work (Refer to Annex 6).

39. The importance of coordination between various government agencies and among financiers. Coordination has been actively carried out by MDBs and government agencies to ensure that the planning, budgeting and future construction phases are aligned and well-sequenced. To ensure the sustainability of this approach, particularly in procurement matters, the Project will adopt an Alternative Procurement

other MDBs (tier 2) is being assessed for a later stage by the GoC and EMB, including, Development Bank of Latin America – CAF, French Development Agency—AFC, and the German Development Bank—KfW.
Arrangement (APA), whereby the IADB’s procurement guidelines will be followed (see Section VI. D). The Project will also adopt an Operational Manual, developed jointly with other MDBs.

(iii) The need for phased financing. The phased financing approach requested by EMB and adopted by MDBs (World Bank under the SOP instrument) ensures that financing is more attuned with the real disbursement needs of the project. MDB commitments to broad envelopes allows EMB to access financial markets through the leveraging of MDBs resources.

(iv) The importance of strong institutional and technical arrangements during implementation. EMB is being advised by the Metro de Santiago de Chile during the technical, financing and legal structuring of the Project. Further, a PMO will advise on Project implementation.

(v) Good construction management and timing. Minimizing disruptions to District residents has been one of the guiding principles behind the design of the Project, including developing the project in phases and placing a lot of emphasis on monitoring traffic management responsibilities of the Concessionaire during construction. Relatedly, land acquisition and transfer of utility networks has been scheduled to start 2 years earlier than the beginning of civils works to avoid costly delays.

(vi) Adopt good practices in construction safety. Substantial attention needs to be paid to safety and the ESMP for the Project contains detailed procedures for industrial safety and occupational health, emergencies and contingency responses.

(vii) Women safety concerns. Based on international and national best practices, the PLMB will incorporate a reporting mechanism for cases of violence against women and girls in public transport. An action protocol for metro staff members to intervene in cases of sexual harassment and security issues will be developed accompanied by training to metro police and staff, as done in Mexico City. Further, the design of the stations has been done following gender-informed stations and supporting the development of action protocol for metro staff members to intervene in cases of sexual harassment. Upgrades in sidewalks and walking infrastructure, paired with well-lit and camera-surveilled stations, will provide for safer access to and from public transport for women.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

38. A Co-Financing Agreement between the GoC, the District of Bogota, and the EMB defines the financial contributions and obligations of the respective parties, the eligible expenses, and their fiduciary and oversight roles. The Co-Financing Agreement30 signed on November 9, 2017, defines the commitments, terms and conditions under which the National and local government agree to cofinance the PLMB, including the annual contributions of each party, their responsibilities, the eligible expenses that can be financed by these proceeds.

39. The EMB, a state-owned enterprise, will be the Borrower and Implementing Entity for the Project. It is also the concession’s awarding authority, and it will be in charge of the overall oversight of the PLMB. EMB is carrying out the technical, financial and legal structuring of PLMB. This process already resulted in the definition of the DFBOMT model as well as the definition of the sources, terms and instruments for the financial closure of the PLMB, and the bidding process and bidding documents. Given the transaction model chosen, the Concessionaire will be the primary entity responsible to implement the engineering design, construction, operations and maintenance, while the EMB is responsible for the supervision of the concession contract. Its

duties include: (i) preparing the bidding documents and selecting the concessionaire; (ii) reviewing the concessionaire’s designs and execution plans (including any changes the concessionaire may propose and its impact on budget, schedule, quality); (iii) monitoring the execution of the works (including social, environmental, health and safety); (iv) monitoring the testing and commissioning phase for infrastructure, systems and rolling stock; and (v) monitoring the beginning of the service operations. Furthermore, EMB will be supported by a civil work supervision contractor that will monitor compliance of the Concessionaire with the DFBOMT contract. A PMO will help strengthen EMB’s internal capacity to effectively monitor the Concessionaire. Finally, EMB is also responsible for the planning and management of related urban developments and real estate projects.

40. Since EMB is a new institution, to strengthen its role, it will be supported by relevant agencies and several strategies have been put in place to ensure its sustainability. EMB was established in November 2016 with administrative, financial and budgetary autonomy, and linked to Bogota’s Secretariat of Mobility (SDM). Given the choice of a DFBOMT contract, the organizational structure of EMB has been designed to ensure a high level of specialization while reducing its size to focus on contract management, oversight and supervision roles. While EMB is a relatively young entity with no previous experience, several measures have been put in place to allow the proper implementation of PLMB. First, an institutional strengthening plan has been developed with the support of Deloitte (financed by the IADB) that will address resource gaps, ensure qualified technical teams, and clarify mandates between the EMB, the PMO, the Concessionaire and national and local agencies involved in planning, implementing or supervising the future PLMB. Second, Financiera de Desarrollo Nacional (FDN), Colombia’s leading infrastructure financing entity, has been accompanying EMB in the financial, legal and technical structuring of the PLMB. This close support will continue until the award of the single contract, and could be extended over the life of the construction cycle. Third, EMB has received close support and technical assistance from the Metro of Santiago de Chile. This partnership is expected to continue to support the bidding process. Fourth, a PMO is being hired (January 2019) to support EMB until the second year of operations of the PLMB. The PMO will oversee the technical and strategic aspects of the PLMB implementation, while EMB carries out the general supervision. Additionally, the construction of civil works will be supervised by a firm with experience in metro projects. Finally, given the experience and capacity of IDU in matters related to land acquisition and resettlement, EMB subscribed an agreement (Convenio Interadministrativo No. 1021 2017) according to which IDU is carrying out the land acquisition and resettlement process for the initial properties to be acquired for the metro alignment; this agreement will be amended no later than one month after the Project’s effectiveness to reflect that IDU will carry out all land acquisition activities in accordance with the provisions of the Project’s social safeguard instruments (Refer to section VI D). Technical assistance expected to be carried out under Component 2 of the Project, will further support EMB throughout the PLMB project cycle. (Refer to Annex 2 for more details on the implementation arrangements.)

41. An Alternative Procurement Arrangement (APA) with the IADB will be signed so all activities in the Project will follow the IADB’s procurement guidelines. 31 As previously mentioned total financing envelopes from the World Bank, IADB and EIB will amount to US$1.7 billion, with initial lending commitments from each at US$70 million, US$70 million and US$56 million, respectively. The Bank’s Loan includes a cross effectiveness condition with the IADB’s Loan--the Bank will only declare its Loan effective if the IADB Loan is ready to disburse. Regarding the EIB, the deadline for the effectiveness of the EIB Co-Financing Agreement (October 31, 2019 or a later date as the Bank may agree) is a Bank remedy; however, the suspension of the loan will only be effective if no other source of financing is secured to replace EIB. The choice of an APA is motivated by the request from the Borrower, in the interest of having a coordinated and unified approach to procurement that would reduce

31 The intention is that the WB and the IADB sign the APA agreement ahead of the loan signatures with the Borrower.
transaction costs. Under the APA, the IADB will take the lead in providing Project implementation support and monitoring with respect to the procurement of activities financed; however, the World Bank will provide input and have its due diligence reflected on technical and safeguard matters, before a No Objection by the IADB is considered. In addition, the IADB has agreed to consult and inform the Bank in a timely manner of any complex or delicate procurement issues that may impact on the cooperation between the IADB and the World Bank under this arrangement, and provide the Bank with periodic reports on the status of Project procurement implementation. The Bank, without interpreting IADB procurement policies, will provide throughout the Project cycle capacity building contributions and exchange of international best-practices in the interest of the PLMB investment. The APA will be signed between the Bank and IADB before loan signature and after respective Board approvals. EIB will also follow the IADB’s procurement guidelines. Regarding environmental and social safeguards, each financier will follow their own policies and regulations; all safeguard instruments (Environmental and Social Impact Assessment—ESIA, Environmental and Social Management Plan—ESMP, Resettlement Policy Framework—RPF, and initial Resettlement Action Plan—RAP and initial RAP) were prepared to meet both World Bank, IADB and EIB requirements.

B. Results Monitoring and Evaluation

42. A detailed Results Framework (RF) for the first Project is provided in Section VII. Progress on results and implementation will be monitored throughout the life of the series. Data on the progress towards achieving the PDO-1 and intermediate indicators will be collected through the existing information systems. EMB will be responsible for most data collection and reporting in a coordinated fashion with all MDBs. Deployment of an Impact Evaluation of the Project is currently being assessed jointly with the IADB.

C. Sustainability

43. The PLMB will be financially sustainable given the high demand and the integration with the public transport network. The currently saturated demand along the metro corridor provides a promising ridership to the Metro when in full operation. In addition, integration with SITP will enhance the network-level impact of travel time reduction to generate demand of public transport. As noted, Bogota’s current SITP calls not only for the physical integration, but also for the operational and fare integration between all modes of transport. At least 10 multimodal stations will be integrating TransMilenio with the Metro. This will ultimately make public transit more convenient for users, and may dissuade car owners from using this mode as they will see another viable alternative. The PLMB feasibility study suggests that the cost for operation and maintenance will be largely covered by fares collected from users (Detailed fiscal analysis can be found in Annex 4).

44. The PLMB also promotes the sustainability of the District by reducing congestion, GHG emissions and local pollutants, and increasing productivity. With the promotion of the public transport system by building a Metro integrated with SITP, the PLMB will reduce the congestion. Thus, the whole transport system in the District will have lower total operational costs than without the Metro and the SITP. The carbon footprint of Bogota’s transport system will also be lower than that of the current system. Bogota will be a more competitive city because the Metro and the SITP will increase the accessibility to opportunities by improving public transport services.

45. Active contract management is needed to ensure the successful construction, operation and maintenance of the PLMB. Building on lessons learned from similar contractual models in World Bank financed metro lines such as Lima Line 2, capacity building within the EMB will be key to ensure sustainability of the PLMB. Institutional strengthening has been discussed extensively with the counterpart, and is an integral part of the
World Bank and IADB’s Technical Assistance components of the Project. The financial commitment of the National and District governments to finance the CAPEX through earmarked transfers (vigencias futuras) committed until 2048 are reflected in the CONPES document 3900 (and predecessors) and the subsequent Co-Financing Agreement. These agreements are legally binding in Colombian Law. The GoC is committed to provide its sovereign guarantee to the loans incurred by the EMB with all MDBs (CONPES document 3923). Annex 4 includes a financial and fiscal analysis of the PLMB.

D. Role of Partners
46. The WB, the IADB, and the EIB are fully aligned to provide MDB-financing to the PLMB, and avoid duplicating procedures. The preparation stage was done jointly with technical teams of all banks to ensure proper coordination. Joint coordination protocols, to be reflected in an Operations Manual, will be developed to avoid duplicating procedures; the IADB’s procurement guidelines will be used to streamline procedures and provide clarity to the bidding process. Some of these arrangements have emulated practices adopted in Quito and Lima Metros. Furthermore, the APA will establish the protocols for the World Bank to provide its due diligence on technical and safeguards matters before the IADB’s No Objection. Environmental and social teams have worked closely together during preparation to ensure compliance with the social and environmental safeguards of the IBRD and IADB.

V. KEY RISKS
A. Overall Risk Rating and Explanation of Key Risks
47. The overall risk rating is high considering the scale and nature of this complex Project. Several risks are deemed substantial or high, including:

(i) Political and Governance risks are high. While there is strong alignment and support for the current design of the PLMB between the GoC and the District, political risk stem from the upcoming mayoral elections for Bogota in 2019, and more generally, from the continued, long-term political support needed to implement the PLMB. This is mitigated by the fact that the GoC and District governments have signed the Co-Financing Agreement, which contemplates compliance with requirements and prior approvals in terms of technical, fiscal, fiduciary and development matters related to the PLMB. Also, the budgetary commitments in the Co-Financing Agreement are inflexible and with strict compliance in the Budget Law, which leads to low risk of non-compliance of financing by one of the parties. Governance and transparency risks also stem from the possibility of politicizing EMB - an SOE - and from its vulnerability to corruption. Mitigating factors include the following: first, the corporate governance of EMB has been designed to be insulated from political cycles (Refer to Annex 2); second, the IADB’s procurement framework will be used, and MDBs will closely monitor the procurement process, to add transparency and shield the process. Also, the World Bank’s Anticorruption Guidelines will be fully applicable, as well as its complaint management review process.

(ii) Institutional Capacity risks are high. EMB was recently created and has no experience in the implementation of mega-projects. The project is mitigating these risks by: First, making sure EMB is being staffed with experienced professionals in the development of urban mobility projects in all management units (technical, legal, administrative, financial and environmental and social areas). Second, by providing support to the EMB from the Metro of Santiago de Chile during the technical, financing and legal structuring of the PLMB. Third, a PMO will be hired to support EMB in subsequent phases, and the construction of civil works will be supervised by a firm with experience in metro projects. Lastly, the institutional strengthening component of this Project, also includes the possibility of hiring firms and/or
professionals in different areas when required.

(iii) **Stakeholder risks are substantial.** During construction, there will be the need to supervise a high number of simultaneous construction sites. The project will mitigate this risk by making sure EMB and the concessionaire have a very good stakeholder engagement strategy and grievance and redress mechanism in place building on the experience of the *TransMilenio* as well as other Bank projects.

(iv) **Technical Design risks are substantial.** The international experience with large projects suggests that significant costs increases, scope changes, and/or schedule delays are likely between preliminary design and final construction. To mitigate these risks, the project will hire the PMO to strengthen the monitoring of the PLMB. Also, the Co-Financing agreement between the GoC and the District establishes that overrun costs will be borne by the District. This is an incentive for the District administration to generate monitoring and control mechanisms to mitigate against this risk.

(v) **Fiduciary risks are high.** This is due to: the complexity of the PLMB and its procurement process; the fact that the EMB is a new entity; and the existence of several sources of financing and their different fiduciary requirements. Proposed mitigation includes, first, the support by the PMO with prior experience in highly complex contracts and contract management, coupled by additional staff at EMB, and the support of all MDBs through the supervision and the technical assistance component, which will help prop up EMB’s ability to procure and manage the contract. Second, the Bank, IADB, and EIB have agreed to harmonize fiduciary requirements to not increase the transaction cost for the EMB from the multiplicity of sources of financing.

(vi) **Environmental and Social risks are high.** Due to the magnitude of the proposed works in an urban environment, there are potential high environmental and social risks. The Project’s safeguard instruments (ESIA, ESMP, RPF and several RAP) will help mitigate against these risks. Various specific environmental, social, and health and safety requirements will be established in the Concession Agreement. The APA will also lay out that the World Bank will provide input on the draft Concession Agreement. The Project Operation Manual will establish environmental and social management actions for ESMPs. A qualified social and environmental team is being consolidated within EMB to manage the impacts, risks and handle complaints and claims. A grievance address mechanism will be established.

(vii) **Other—Financial and credit risks are moderate.** In December 2017 Standard and Poor revised Colombia’s sovereign credit rating from BBB to BBB- which may impact the terms for raising large amounts of private funds for the PLMB. However, Colombia’s robust macroeconomic and fiscal framework, coupled by the relatively favorable growth outlook for the next couple of years, and the fact that *vigencias futuras* have proven to be very reliable and bankable structures for financing infrastructure in Colombia, help mitigate these risks.

VI. **APPRaisal SUMMARY**

A. **Economic and Financial Analysis**

48. The World Bank economic analysis of the PLMB, (Annex 4, part I) estimating its quantifiable benefits and costs yielded an economic internal rate of return (EIRR) of 7.82 percent and a NPV of US$547 million with a discount rate of 6 percent. This base case assumed a 30-year horizon using a conservative demand

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32 This analysis has been executed on the same transport model and avoided costs methodology used when the project was prioritized by the GoC and the District (CONPES 3900 de 2017). The assumptions and analyzed scenarios of the present economic analysis are different from the former analysis and therefore the results are not comparable.

33 In the past, WB infrastructure projects often assumed a 12 percent discount rate, but a much lower rate between 4 and 8 percent has been observed recently for large public transportation projects with long-lived benefits. WB Guidelines now suggest an appropriate rate of return in a country such as Colombia should be close to 6 percent because social benefits materialize over the long-run (Discounting
assumption of 40,891 passengers at peak hour in the first year of full operation and a 0.10 percent ridership average annual rate of growth. The annual growth rate for the ridership of the Metro is estimated at 0.1 percent. The mode share varies marginally at around levels of 45 percent for public transport and 20 percent for private modes among all the trips. This is a highly conservative estimation to avoid the overestimation of transfer from private modes to public transport. Also, the demand model considered high growth rates of automobile and motorcycle which has been a rising concern in Bogota. However, even within this conservative estimation, the PLMB is still economically viable according to the analysis results. The quantifiable benefit from the PLMB include travel time savings, private vehicle and bus operation cost savings, on-road traffic accidents reduction and emissions reduction. The results indicate that the benefits of the PLMB mainly come from travel time savings which account for 65.31 percent of the total benefits, with bus operation costs savings second, accounting for 23.96 percent of total benefits. Sensitivity analyses detailed in Annex 4 confirm that the EIRR is more sensitive to decreases in benefit than increases in costs. The EIRR remains above 5.94 percent in all sensitivity tests carried out. A further sensitivity analysis was performed with a combination of decreased benefits and costs, with the lowest EIRR of 4.66 percent. Simulations with other discount rates and switch value tests are presented in Annex 4. The PLMB is also expected to yield non-quantifiable benefits such as livability and public trust improvement, employment generation, satisfaction with public transport services, increased accessibility and sustainable urban development.

49. The PLMB is expected to save 0.938 million tons of Green House Gas (GHG) for the year 2025-2049. The PLMB impact was defined as the difference in emissions between a reference scenario ‘without-Project’ and the ‘with-Project’ scenario. The PLMB will reduce air pollution and GHG emissions due to optimization of the current public transport network and reduced congestion. The assessment estimated the GHG emission is expected to be reduced by 0.94 million tons with the PLMB. The annual net reduction of GHG emissions is estimated at about 37,554 tons (estimated 58 percent from buses; 42 percent cars/motorcycles).

50. A preliminary financial analysis estimated that the net PLMB cash flows for the concession period (2019-2049) would yield a negative financial IRR (FIRR). The FIRR in the base case is estimated to be -5.4 percent over the evaluation period of 2019-2049 and assuming a base fare of approximately US$0.70 equivalent (COP 2000), a base demand of 40,891 by 2022 and a tariff income growth of 4 percent until 2030 and 3 percent thereafter. This negative return is typical of mass transport projects such as this metro line. It is consequence of the very high initial investment required over a 5-year construction period. EMB plans to obtain additional revenues from land value capture taking advantage of Real Estate development around the metro stations that are expected to increase in price once the metro starts operations. EMB will have a unit dedicated to this activity, but is currently not factoring in any expected revenues given its uncertainty.

51. Despite the high up-front investment needed, the proposed financing structure would not have a significant impact on the fiscal position of Bogota. A fiscal assessment of the PLMB was carried out to see if the District could afford the financing structured proposed. The analysis concludes that Bogota can afford the metro line given its projected revenues and obligations, particularly given the long maturities over which the vigencias

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Costs and Benefits in Economic Analysis of World Bank Projects, 2016). Moreover, it is not possible to quantify all positive externalities from this Project, particularly as it is the initial section of a larger transport network with long-term benefits and possible spillover effects. The same discount rate was used for Lima Line 2 (P145610).

34 These include a cost overrun of CAPEX and OPEX by 20 percent; a decrease in all benefits by 20 percent; a lower-than-forecasted demand by 20 percent.

35 It is expected that the PLMB fare will be exactly the same as the one for TransMilenio trunk lines.
futuras are paid. The outstanding debt\textsuperscript{36} of the District at the end of 2017 yielded a total debt/tax base ratio of only 14 percent. The District Council of Economic and Fiscal Policy of Bogota requested approval (Acta 14 de 2017) to commit vigencias futuras below the authorized ceiling. Bogota ranks at the highest level of creditworthiness amongst Colombian municipalities. The strong economy of Bogota and the confidence in its ambitious investment program is reflected in the credit ratings at same level as the sovereign.

B. Technical

52. Recently completed elevated metro projects showed significant variance in unit cost in developing countries. The World Bank’s analysis of the PLMB capital and operating costs based on the available preliminary designs suggests that the costs of the PLMB are in the upper bound of these benchmarks; Bogota’s geological and seismic conditions, the chosen construction methodology, and related interventions in road network, TransMilenio stations, and upgrading of public space, explain this. As noted, numerous reasons explain why the cost estimate is at the higher end. First, as much as 10 percent of civil works and stations costs account for road interventions, TransMilenio stations and interventions in trunk lines, urban space upgrading and 22km of bicycle lanes. Second, the stations are designed in a decentralized manner such that they are parallel buildings and access are adjacent to the elevated structure with 10 new stations that will be integrated with BRT ones. Third, the construction methodology of using concrete segment is around 5 percent more expensive than the more traditional one. Fourth, the height of the elevated structure between 3.5m higher than average, also adds to the costs. Fifth, costs are higher due to geotechnical conditions. For instance, the depth of the foundations is considerably higher than for an elevated structure in average geotechnical conditions. The average of the foundation will be 65m whereas other projects could have 25m foundation. Finally, the rail yard has specific geotechnical conditions that increases its costs by 1.8 percentage points; it will also need to be covered entirely (Refer to Annex 1).

C. Financial Management

53. During Project preparation, IADB and World Bank have agreed to harmonize and put in place common acceptable minimum requirements, mitigate identified risk and ensure adequate implementation capacity regarding Financial Management aspects. A Financial Management Assessment (FMA) has been carried out during the preparation phase of the Project to evaluate the adequacy of financial management arrangements for the implementation of the PLMB. The reviewed arrangements are based on the fact that there are a number of co-financiers to the Project (IADB, EIB) that have agreed to harmonize fiduciary requirements to not increase the transaction cost for the Borrower from the multiplicity of sources of financing.

54. The EMB will be responsible of Project implementation. A PMO will provide project management support throughout implementation and a Fiduciary Trust Fund (Encargo Fiduciario), a Project designated account, will be set up to hold Project related funds and make suppliers payments. The setup of this Fiduciary Trust Fund will be a condition of effectiveness; effectiveness deadline was set at 180 days, in light of the estimated time required to have the Trust Account competitively tendered and established.

D. Procurement

55. Procurement activities for the supply of goods, works, non-consulting and consulting services under the Project, financed totally or partially with World Bank proceeds, will have to comply with the Inter-American Development Bank’s (IADB’s) Procurement Policy – GN-2349-9 dated March 2011. Since the Project will be co-

\textsuperscript{36} Note that the vigencias futuras are not accounted as debt, but as contingent obligations.
financed by the IADB and the EIB, and the Borrower, after careful analysis of the differences between the IADB’s and WB’s procurement policies and procedures, has defined the use of the IADB’s procurement policies. The World Bank is able to move forward with these policies as an APA. Such policies are the result of the harmonization process carried out by the MDBs in 2005, and are basically identical to the former WB’s Procurement Guidelines applied until July 1st, 2016. The IADB has committed to implement their policies with the only exception of the eligibility provisions (i.e., IADB will waive their restriction on eligibility limited to contractors from its member countries, allowing global participation with no restrictions). World Bank’s Anticorruption Guidelines will be fully applicable including the World Bank’s right to audit related documents and apply its sanction regime, as well as the World Bank’s Sanctions List. In addition, the complaint management review process will remain applicable and the IADB will promptly inform the World Bank of any complaint received. Finally, the loan agreement contains a default provision for the event that the APA agreement is terminated; in such case the Bank procurement rules would apply.

56. **IADB will take the leading role in providing implementation support and monitoring procurement activities.** Nevertheless, the World Bank has carried out a procurement capacity assessment of the implementing agency to review the organizational structure for project implementation, staffing and procurement systems that are in place, to determine the risk and mitigation measures. The assessment concluded that, even though the EMB has qualified staff, they have not implemented similar projects or monitored the execution of highly complex contracts. An action plan that includes adding professional staff in procurement of high complex contracts and contract management, developing a detailed contract management plan, and proper IT tools to support contract management, and hiring of PMO are suggested. Furthermore, the World Bank under the APA and without interpreting IADB procurement policies, will provide throughout the Project cycle capacity building contributions and exchange of international best-practices in the interest of the PLMB.

57. **The Borrower has worked on a full version of the Project Procurement Strategy for Development (PPSD), and concluded that the best option is to pursue a DFBOMT contract.** The Borrower has also worked on a Procurement Plan, dated June 6, 2018 that was agreed by all three co-financiers. Given that the activities under Component 2 have not been decided yet, the Strategy is focused on the DFBOMT contract for the PLMB. Such a high-risk, high-value contract will demand a very complex procurement process that will basically consist of a prequalification process followed by a bidding process. A summary of such analysis can be found in Annex 2. Based on the complexity of the procurement process and the results of the capacity assessment, it was determined that the procurement risk is High.

**E. Social (including Safeguards)**

58. **The PLMB is expected to generate important long-term social benefits.** The PLMB, as part of a larger integrated public transport system, will improve mobility options in Bogota, particularly for the lower income segments of the population that rely more heavily on public transport. The metro will improve their access to services, markets and economic opportunities by generating travel time and travel cost savings, improved safety and reduced emissions of local pollutants and greenhouse gases, better managed public spaces and increase the overall user satisfaction with public transit, among others.

59. **The PLMB implementation is expected to transform the way in which citizens relate to the District administration, and how they participate in its planning.** The EMB has been developing periodic workshops and seminars in order to inform about the PLMB and the preparation of the ESIA. The EMB has identified project stakeholders, social leaders and community and civil society organizations since its concept stage and during the
preparation of the ESIA. These spaces have made it possible to identify relevant actors, leaders and influential social organizations. Citizens who serve as Veedurías Ciudadanas, a social control mechanism to monitor the public management, specifically in the advancement of the PLMB. It is expected that this communication scheme will continue during implementation, and that these social actors strengthen their organizations to execute a responsible control of the commitments and obligations of the PLMB. Communication and coordination with stakeholders will continue during the project lifecycle, both by EMB and the Concessionaire.

60. **Women and men in Bogota have different mobility patterns; the PLMB is expected to significantly enhance women’s mobility.** Generally, women face more mobility constraints than men due to their caregiver roles\(^\text{37}\), lower affordability and security concerns. In Bogota women’s overall travel times are higher than men, and they also spend a larger share of their income on travel.\(^\text{38}\) Women also walk more than men (51 percent vs. 39 percent, respectively), which limits the scope of their effective labor market. The difference is less pronounced for higher income groups, suggesting poor women are even more penalized. Relatedly, the ILO estimates that women are overrepresented in the informal sector with 2/3 of women working informally in Colombia in 2016; this implies low quality jobs, temporary contracts with no social security affiliation, low pay and low levels of productivity.\(^\text{39}\) Security is also cited as one of the main concerns against the use of public transport by women in Bogota. Studies show that men prefer TransMilenio, the fastest but crowded mode; while women prefer slower, but less crowded options as the zonal buses. Analysis also show that, whenever possible, women prefer private vehicles such as taxis, showcasing that women’s accessibility to employment opportunities is not only affected by time and budget factors but their modal choice is also based on security and comfort.\(^\text{40}\) Around 64 percent of women have faced a form of sexual harassment in public transportation in Bogota; more men than women use public transport, 53 percent and 47 percent respectively. The PLMB will design metro stations from a gender-based violence prevention environmental design by incorporating parameters such as – lighting, openness, visibility, crowd, security, and perception of safety. In addition, as an urban transport project, the labor during the PLMB construction phase will be drawn mostly from the 8 million citizens living in Bogota. Thus, the risk of gender-based violence associated with the labor influx is low.\(^\text{41}\)

61. **The PLMB will also contribute to close the gender gap of women employed in the transport sector.** According to the CEPAL Observatory for Gender Equality, 32 percent of women work in non-remunerated jobs compared to 9 percent of men. According to the National Administrative Department of Statistics of Colombia (data from last trimester December 2017-February 2018), male unemployment rate is 8 percent, compared to 13.6 percent for women. The employment participation rate for men is of 74.5 percent while it is only 53.1 percent for women. According to data from the ILO, jobs in Colombia are still segregated; only 14.5 percent of the population employed in transport and communication was female. To address this, the PLMB will make sure that at least 20 percent of women will be employed in the metro operations by incorporating this requirement

\(^{37}\) Studies show that women travel shorter distances since they do several stops for household errands, travel with children and carry more packages, which also impacts their speed. This also impacts their options in terms of employment. [http://blogs.worldbank.org/transport/are-women-forced-work-closer-home-due-other-responsibilities-does-contribute-gender-wage](http://blogs.worldbank.org/transport/are-women-forced-work-closer-home-due-other-responsibilities-does-contribute-gender-wage)


\(^{39}\) J. Bocarejo and M. Lecompte. (2016).

\(^{40}\) Bocarejo. (Op. cit.), p. 4256

\(^{41}\) To note, indicators to monitor the increase of women’s mobility and on personal security are mentioned in this project document. They are not included in the results framework because of the two-phase approach of the project. The first phase will only finance preliminary activities, and will not include any indicator on ridership or user satisfaction, as this will be measured after the closing of the Series of Projects, and included in the Phase 2 project document.
in the bidding documents of the Concessionaire. This is an ambitious target given that the operation will be concessioned.

62. **Women were specifically consulted during the process of socialization of the ESIA to integrate their concerns into the metro designs and public spaces.** A relatively high participation of women was achieved during the participatory process for the socialization of the ESIA, with an average between 30 to 50 percent of participants being women. Their interventions allowed to identify concerns and suggestions on environmental issues (waste management and forest exploitation), design of public spaces and security concerns. Women also highlighted the importance of implementing traffic management measures during the construction phase to guarantee access to transport and jobs. These were taken into consideration in current plans.

63. **While land acquisition and construction works for the PLMB will cause economic and physical displacement, appropriate measures have been put in place.** The PLMB is also expected to generate temporary or permanent adverse social impacts mainly associated with the necessary acquiring of land for civil works construction. It is estimated that approximately 1500 properties will be affected for the constructions of the PLMB. The PLMB will provide sufficient compensation and support so that the social unit is appropriately compensated. Affected street vendors will also be provided with support programs such as capacity building, credit opportunities and other economic conversion programs. Likewise, efforts will be made to provide additional support to businesses and other commercial activities because of temporary impacts during the construction phase. These programs have been included in the ESIA and their implementation will be mandatory for the Concessionaire. The grievance redress mechanisms during Metro construction are the responsibility of Concessionaire with support and oversight by EMB and other project-related agencies. The EMB is responsible for the Project’s social management and compliance with World Bank safeguard policies.

64. **Safeguard OP 4.12 is triggered, requiring a Resettlement Policy Framework (RPF) and several Resettlement Action Plans (RAP).** These instruments were prepared to meet both World Bank and other MDBs requirements. The ESIA identifies multiple impacts on properties required to: (i) improve the curves along the metro alignment, (ii) increase and improve public space along the alignment, (iii) build a railyard, and (iv) build the metro stations. Therefore, the Involuntary Resettlement Safeguard OP 4.12 is triggered, requiring a RPF and several RAPs. Since at the time of preparation only the properties required for the metro alignment and curves were completely identified, but those needed for the stations (which are the largest group) are still being assessed, the Project has an RPF. The RPF determines what is necessary for the preparation of subsequent RAPs that can only be designed after appraisal. The Ministry of Transport’s RPF has been used as reference in the preparation of the RPF for the PLMB and includes specific particularities of the District’s regulations. The RPF and the initial RAP were disclosed on July 5, 2018.

65. **EMB has signed an agreement with the Instituto de Desarrollo Urbano (IDU) to carry out the property acquisition and resettlement of the first set of priority properties along the metro alignment.** IDU, one of the entities in Colombia with the most experience in resettlement, will carry out the first RAP, corresponding to a total of 129 properties. This agreement will be amended by one month after effectiveness to make the World Bank safeguard requirements applicable. Simultaneously, EMB has hired a basic team (5 social professionals) responsible for monitoring this implementation. EMB will carry out the property acquisition and resettlements of

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42 The Ministry of Transport has an RPF that has been used for Colombia’s National Urban Transport Program, which has been supported by four World Bank loans since 2003 to implement mass transport systems, including the latest Support National Urban Transit Program Project (P117947).
the remaining (1,345) properties with a team of approximately 60 professionals (social, legal and technical) organized in 10 teams in the field and office. EMB has advanced in the ToRs for hiring these teams: the first two teams will be hired by August 2018 and the entire team will be completed before 2019. The RAPs are estimated to be implemented 24 months after the Project’s approval.

**F. Environment (including Safeguards)**

66. **The Project is classified as Environmental Category A.** This is due to the risks related to the construction of a metro line of significant magnitude, crossing the District of Bogota from south to north, and from east to west. The PLMB is implemented in urban areas, which have already significantly altered the natural environment, mainly along the existing roads that are currently being used in the transit of the city (Av Villavicencio, Av 1 de Mayo and Av Caracas).

67. **An Environmental and Social Impact Assessment (ESIA), including an Environmental and Social Management Plan (ESMP), was prepared by EMB to meet both World Bank and other MDBs requirements. It was consulted and disclosed on June 18, 2018.** The ESIA includes consideration of alternatives, assessment of potential impacts and risks, and measures to prevent, control, mitigate and monitor related environmental and social impacts and risks. The ESIA was developed by EMB based upon both existing feasibility studies and recently developed the PLMB specific basic engineering studies (e.g., design, alternative analysis, geotechnical investigation, traffic study, etc.) and environmental assessment study that were developed by an international consortium contracted by FDN. FDN also contracted a third-party international consortium to provide quality control during the development of these studies. The PLMB ESIA includes an ESMP, which contains numerous management programs for the prevention, mitigation, correction or compensation of environmental and social impacts. These will be mandatory for the Concessionaire. The ESMP also includes a Monitoring and Supervision Plan, composed of various programs including air quality, water quality, noise, vegetation, solid waste and construction and demolition debris management, information and participation of interest groups, information and attention for mobility, worker safety, and contingency and emergency plans (Refer to Annex 3 for details).

68. **The PLMB has various positive benefits, and the key project-specific environmental impacts and risks have been identified; measures have been properly identified for mitigation.** These benefits include improved transportation, reduced traffic and reduced air emissions due to vehicles, reduced travel time, improved access to employment, improvement in the quality of life, promotion of sustainable urban integration and land development, job creation, and increased commercial and economic activity. The PLMB design includes various aspects to help minimize potential impacts, such as rail and viaduct design to minimize noise and vibrations, and stations with bioclimatic architecture to reduce energy consumption. The design also incorporates some aspects to help provide positive benefits, such as bicycle paths, pedestrian space and green spaces. In terms of potential negative environmental, health and safety impacts and risks, in addition to typical infrastructure construction impacts which are localized and of short duration, some key specific impacts and risks include: dust and noise around station construction, traffic congestion, transport and disposal of construction materials and of soil/excavated material and construction debris, relocation of the Monument Heroes, impact on urban trees, potential presence of contaminated ground water or soils, worker and community health and safety risks, visual impacts of elevated metro, noise and vibrations during operations, waste management of metro rail car maintenance facilities, and risk of emergency events.

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43 The first version was disclosed on March 9th, 2018.
63. **Bank OP/BP 4.04 on Natural Habitats, OP/OP/BP 4.09 on Pest Management and OP/BP4.11 on Physical Cultural Resources are triggered.** Bank OP/BP 4.04 is triggered since the railyard (including train maintenance facilities) will be constructed in an open space in an area presently designated as an environmental protection zone for the Rio Bogota called Environmental Management and Preservation Zone (ZMPA). OP/BP 4.09 is triggered since the PLMB operation will require the use of regularly available pesticides for pest control (e.g. rodents, etc.) at stations and metro cars. OP/BP 4.11 is triggered since the PLMB will have a direct impact on the Heroes Monument (Refer to Annex 3 for details).

69. **The ESIA development involved two rounds of consultation consistent with Bank OP/BP 4.01.** The first consultation was focused on the ESIA Terms of Reference and included an outreach program to communities along the metro route with twelve meetings of around 2,800 participants. For the process of the ESIA consultations, EMB developed a strategy for draft ESIA disclosure and consultation with different actors at the district level, local governments, the academy, organizations or NGOs, and local social organizations, and general public. In April 2018, the EMB initiated the program of consultation of the draft ESIA. Representative comments from these consultations include: concern about the damage to properties during construction and operation; uncertainty regarding the properties that will be the subject of a property acquisition process for the construction of the viaduct and the stations; concerns regarding the noise levels during operations; concerns about the work fronts that will be implemented, as to whether they will be done in sections and simultaneously; impact and treatment of cultural interest assets; request when formulating the traffic management plans to not divert routes through neighboring neighborhoods; and some members expressed concerns about the proposed changes to traffic and pruning and transfer of trees located along Caracas Avenue. The ESIA includes programs to provide ongoing information disclosure during project construction and operation, including a grievance redress mechanism.

70. **EMB is responsible for environmental, social and health management and compliance with World Bank safeguard requirements.** EMB has two units in charge of environmental and social management. The Environmental, Health and Safety Management Unit is part of the Technical Department and is in charge of leading, planning, coordinating and following up the guidelines to the environmental, occupation health and safety for the construction and operation of the PLMB. On the other hand, the Social Management Unit is part of the Communications Community Department and is in charge of leading, managing, developing, and following up on the social programs developed in the ESIA. The Concessionaire will be responsible to include inter alia the safeguard requirements and grievance redress mechanisms of the Project, and ensure its compliance by sub-contractors (Refer to Annex 3).

**G. World Bank Grievance Redress**

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 WB’s Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB’s independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance 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 Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank’s corporate Grievance Redress Service (GRS), please visit [http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service](http://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](http://www.inspectionpanel.org).
## VII. RESULTS FRAMEWORK AND MONITORING

### Results Framework

**Project Development Objective(s)**

The Series Project Development Objective (S-PDO) is to improve access to jobs and quality transit for public transport users in the area of influence of the Bogota Metro Line 1, Section 1 (PLMB).

The PDO (PDO-1) of the proposed first Project under the series is to improve readiness and start the implementation of the Bogota Metro Line 1, Section 1 (PLMB).

<table>
<thead>
<tr>
<th>PDO Indicators by Objectives / Outcomes</th>
<th>DLI</th>
<th>CRI</th>
<th>Unit of Measure</th>
<th>Baseline</th>
<th>End Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>To improve readiness and start the implementation of the Bogota Metro Line 1, Section 1 (PLMB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DFBOMT Contract awarded</td>
<td></td>
<td>Yes/No</td>
<td>N</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Cumulative percentage of physical works for rail yard.</td>
<td></td>
<td>Percentage 0.00</td>
<td></td>
<td></td>
<td>30.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate Results Indicators by Components</th>
<th>DLI</th>
<th>CRI</th>
<th>Unit of Measure</th>
<th>Baseline</th>
<th>End Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component 1: Detailed Designs, Initial Construction and Work Supervision Contract</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative percentage of transfer of utility networks completed.</td>
<td></td>
<td>Percentage 0.00</td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
</tbody>
</table>
### Grievances responded and/or resolved within the stipulated service standards for response times (%)

| Percentage | 0.00 | 80.00 |

### Traffic management plan during construction approved by the Secretariat of Mobility

| Yes/No | N | Y |

### Component 2: Institutional & Policy Strengthening

| Project Management Office hired | Yes/No | N | Y |
| DFBOMT contract includes target of women employed in O&M phase of the PLMB | Yes/No | N | Y |
### Monitoring & Evaluation Plan: PDO Indicators

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Definition/Description</th>
<th>Frequency</th>
<th>Data Source</th>
<th>Methodology for Data Collection</th>
<th>Responsibility for Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFBOMT Contract awarded</td>
<td>The PLMB will be implemented under a single concession arrangement, corresponding to the Design-Finance-Build-Operate-Maintain-Transfer (DFBOMT) model. The bidding process for the DFBOMT concessionaire is foreseen to take place over 2018-2019 (starting in August 2018 and with contract award second quarter 2019), over the 2019 period, the selected concessionaire is also expected to carry out the final detailed designs. The award of the contract is one of the most important milestones of the first project in the series. It will be measured as the legal signature of the award.</td>
<td>Once, in December 2019 when it will have either been awarded or not.</td>
<td>Baseline or without Project: No, since no award has been signed as of date. With Project Target: Yes. It will be measured by the existence of a legal document between the EMB and the concessionaire, i.e. the winner of the bidding process for the DFBOMT contract.</td>
<td>Legal document provided by EMB.</td>
<td>EMB</td>
</tr>
</tbody>
</table>
## Definition/Description

This indicator measures the cumulative percentage of physical works achieved for the construction of the rail yard. It will be measured by the S curve of planned physical works, that is the costs incurred to date against planned costs to date for the construction of the rail yard. The components that will be measured by the S curve will include: lots, design, excavations, refills, levelling, foundations works, equipment of buildings, ventilation-related works, transport of equipment and logistics, installation of equipment, trials, training and spare parts.

## Frequency

Every 3 months

## Data Source

Baseline or without project: zero as no work has been started.
Target with project: The target represents the expected total cumulative physical works that have been estimated to be completed by end of the first Project in the SOP by the EMB (S-curve estimations).
Project management progress reports. This indicator will be measured from progress reports produced by the contractor and verified by the supervisor and EMB.

## Methodology for Data Collection

It will be measured by the S curve of planned physical works, that is the costs incurred to date against planned costs to date for the construction of the rail yard. The components that will be measured by the S curve will include: lots, design, excavations, refills, levelling, foundations works, equipment of buildings, ventilation-related works, transport of equipment and logistics, installation of equipment, trials, training and spare parts.

## Responsibility for Data Collection

EMB
### Monitoring & Evaluation Plan: Intermediate Results Indicators

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Cumulative percentage of transfer of utility networks completed.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition/Description</strong></td>
<td>This indicator refers to the cumulative percentage of completed utility network transfers necessary to start construction of the PLMB, along the alignment. This activity falls in the preliminary works activities category carried out ahead of the construction phase by EMB. The needed transfer of utilities include: IT and telecommunications, electricity, and gas networks, as well as the sewerages. It has been estimated that 270 interferences will need to be transferred, for a total of 99 km of networks.</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Every three months until completion.</td>
</tr>
<tr>
<td><strong>Data Source</strong></td>
<td>Project Management Reports. The indicator will be measured from progress reports produced by EMB.</td>
</tr>
<tr>
<td><strong>Methodology for Data Collection</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Responsibility for Data Collection</strong></td>
<td>EMB</td>
</tr>
<tr>
<td>Indicator Name</td>
<td>Grievances responded and/or resolved within the stipulated service standards for response times (%)</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Definition/Description</strong></td>
<td>Each section of the work will include in the Concessionaire TORs, the obligation to have a specific GRM for the direct and indirect intervention area, which will report to the EMB periodically. The first RAP will follow IDU's GRM. During implementation, Centers for Public Attention are probably the most critical mechanism and point of contact with the community for receiving questions, claims and complaints. The Centers for Public Attention are to be set up under the guidelines established in the Project’s Environmental and Social Management Framework. These grievance mechanisms will be established for each section of the works including the direct and indirect intervention areas and are a one-stop-shop located for citizen attention and problem resolution. Claims can also be posted on the website of the EMB or received directly in their office. Every step of this process will be well documented and the information digitized by the contractor and sent periodically to the EMB for supervision. Lastly, citizens can also place specific complaints regarding fraudulent or corrupt practices by calling the Government’s corruption hotline (Línea Transparente).</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Every 6 months, until Project completion.</td>
</tr>
<tr>
<td><strong>Data Source</strong></td>
<td>Project Supervision Reports.</td>
</tr>
<tr>
<td><strong>Methodology for Data Collection</strong></td>
<td>Every step of this process will be well documented and the information digitized by the contractor and sent periodically to the EMB for supervision. EMB will provide a summary of all Grievances received and time of response.</td>
</tr>
<tr>
<td><strong>Responsibility for Data Collection</strong></td>
<td>EMB</td>
</tr>
<tr>
<td>Indicator Name</td>
<td>Traffic management plan during construction approved by the Secretariat of Mobility</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Definition/Description</strong></td>
<td>The PLMB ESIA includes an Environmental and Social Management Plan (ESMP), which contains 38 management programs for the prevention, mitigation, correction or compensation of environmental and social impacts, generated by the pre-construction, construction and operation of the Project. The ESMP includes a Monitoring and Supervision Plan including traffic management plans. The ESMP will be updated by the Concessionaire to reflect final project design details. The construction contractor will need to develop specific Traffic Management Plans (that needs to be developed with input from relevant governmental authorities) which should include measures to minimize the impact of traffic. These plans need to be approved by the Secretariat of Mobility, which is the local road safety author in charge of final approval of the Traffic Management Plan proposed by the Concessionaire. This indicator aims at measuring the existence of these approved Traffic Management plans during construction phases for works conducted under SOP#1 (rail yard and initial phases of viaduct).</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Before the start of works in rail yard, and initial phases of viaduct (expected by 2020).</td>
</tr>
<tr>
<td><strong>Data Source</strong></td>
<td>Baseline or without project: zero as no work has been started. Target with project: The target represents the existence (Y) of traffic management plans approved by the Secretariat of Mobility during or before the start of construction. Project management progress reports. This indicator will be measured from progress reports produced by EMB.</td>
</tr>
<tr>
<td><strong>Methodology for Data Collection</strong></td>
<td>Existence of Approved Traffic Management Plans,</td>
</tr>
<tr>
<td><strong>Responsibility for Data Collection</strong></td>
<td>EMB</td>
</tr>
<tr>
<td>Indicator Name</td>
<td>Project Management Office hired</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Definition/Description</strong></td>
<td>EMB is hiring a Project Management Office to strengthen its internal capacities to manage the project in subsequent phases. The PMO will overlook the technical and strategic aspects of Project implementation. This indicator will measure whether the PMO has been hired (through legal agreements).</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Once, after expected date of signing defined at baseline.</td>
</tr>
<tr>
<td><strong>Data Source</strong></td>
<td>Baseline or without Project: No PMO hired as of date. With Project target: PMO hired, as per the existence of a legal agreement between EMB and PMO.</td>
</tr>
<tr>
<td><strong>Methodology for Data Collection</strong></td>
<td>Legal document exists regarding hiring of PMO.</td>
</tr>
<tr>
<td><strong>Responsibility for Data Collection</strong></td>
<td>EMB</td>
</tr>
<tr>
<td><strong>Indicator Name</strong></td>
<td>DFBOMT contract includes target of women employed in O&amp;M phase of the PLMB</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Definition/Description</strong></td>
<td>This indicator aims at measuring women's inclusion in the transport sector labor force, as per best practices in the Quito Metro Line One project. The indicator will be measured by the inclusion (Y/N) of a clause in the bidding documents stipulating the minimum percentage of women hired during the Operations &amp; Maintenance (O&amp;M) phase; this minimum is set at 20%.</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>Once, after signing of bidding documents.</td>
</tr>
<tr>
<td><strong>Data Source</strong></td>
<td>Baseline or without Project: No, as no bidding document exist as of date. With Project Target: Yes, to be measured by the inclusion of a legally binding clause in the bidding document. The target is set to 20%, which is ambitious given that the operation will be concessioned to a firm different to the implementation agency. Currently, the ILO, estimates that only 14.5% of the population employed in transport and communication is female.</td>
</tr>
<tr>
<td><strong>Methodology for Data Collection</strong></td>
<td>Existence of clause in bidding contract.</td>
</tr>
<tr>
<td><strong>Responsibility for Data Collection</strong></td>
<td>EMB</td>
</tr>
</tbody>
</table>
ANNEX 1: DETAILED PROJECT DESCRIPTION

1. The PLMB will be implemented under a single Concession Agreement corresponding to the Design-Finance-Build-Operate-Maintain-Transfer (DFBOMT) modality. The concession encompasses the design, financing, construction of civil works, provision of rolling stock, and operation and maintenance of the new infrastructure over a period of 30 years. This is known as a fully-bundled vertically integrated Public-Private Partnership (PPP). With an estimated capital cost of US$4.4 billion and operation and maintenance estimated at US$1.2 billion during the lifetime of the concession, the PLMB is one of the single largest infrastructure contract to ever be awarded in Colombia.

A. The DFBOMT Transaction

Contractual Arrangements and Key Stakeholders

2. EMB is the Borrower and the Implementing Agency for the PLMB. Established in December 2016, EMB is a company majority owned by the District of Bogota\(^4\), with administrative, financial and budgetary autonomy, linked to Bogota’s Secretariat of Mobility. EMB was created with the purpose of planning and structuring the construction, operation and maintenance of the PLMB (Refer to Annex 2). EMB will implement preliminary works and the hiring of a PMO in preparation for the implementation by the Concessionaire. EMB can also execute urban projects, especially urban renewal and real estate development in the areas of influence of the metro, to raise alternative sources of financing for the metro’s long-term sustainability.

3. The GoC and the District of Bogota entered into a Co-Financing Agreement for the financing of the PLMB through future budget allocations (vigencias futuras) for a total of COP 22.33 billion (around US$ 7.88 billion) intended to support the capital expenditures and associated financing costs. These vigencias futuras are in constant 2017 Colombian pesos (adjusted based on inflation). The vigencias futuras contributed by the GoC amount to COP 15,143,344 million from 2019 until 2049; the District’s contributions amount to COP 7,187,644 m (of which COP 1,100,000 million were allocated in 2017 and already transferred to EMB, while the balance will be allocated from 2018 to 2041) and will be responsible for any cost overruns. Part of the vigencias futuras will be used to pay cash to the concessionaire during construction. Finally, the repayment of the multilateral loans (including IBRD) will be funded by vigencias futuras from the GoC to EMB and backed by a sovereign guarantee.

4. The structuring of the financing from multilaterals (IBRD, IADB and EIB) is designed to mitigate some inherent risks of the transaction. Given that the funding of MDBs is in hard currency (US$ or Euros) and the repayment from the vigencias futuras is in local currency, MDBs will need to provide hedging mechanisms to prevent the EMB from taking the risk of Colombian peso devaluation. The limited capacity of the swap markets for the long tenors required will dictate the maximum amount of MDB borrowing that the EMB would be able to take. The total amount of borrowing from multilaterals under the current structure is expected to be around USD1.7 billion, which is within this limit. Funding from MDBs will require most disbursements to occur during the period 2020-2025 and may be converted into COP as the loans disburse. The GoC has requested the World Bank, the EIB and IADB’s Treasury support managing

\(^4\) Other shareholders with a 2 percent shareholding each are: Urban Development Institute (IDU), TRANSMILENIO S.A., Tourism District Institute, and Urban Renewal and Development Company.
this cross-currency swap market, as there is a need to convert close to US$300 million per annum in
disbursements to COP.

**Government Payments to Concessionaire**

5. The proposed concession structure contemplates three cash flows from the Government to the
Concessionaire to be channeled through EMB: (a) Cash payments during construction; (b) equal
annuities during operations; and (c) performance-based payments during operation:

a. **Cash Payments During Construction:** EMB will raise debt financing from Multilaterals,
Bilaterals and financial markets, and will use the proceeds to make cash payments to the
concessionaire to cover part of the capital expenditures (approximately 70 percent). Payments
will be made to reimburse for expenditures incurred. The repayment of both the multilateral debt
and other sources of financing will be backed by a portion of the *vigencias futuras* committed by
the Nation.

b. **Titles During Operations:** The Concessionaire will also receive payments over the life of
the concession to compensate for the capital expenditures funded by the Concessionaire
(approximately 30 percent). These annuities will be backed by the remaining allocation of the
*vigencias futuras* committed in the form of payment certificates that the concessionaire will
receive at the time of construction based on construction milestones, but that only become
effective over time. The payment certificates might be traded in the market by the concessionaire
or used as collateral to raise debt.

c. **Performance-Based Payments During Operations:** Payments to cover operating and
maintenance costs will be performance-based. O&M costs incurred by the Concessionaire
during the life of the concession plus a reasonable margin will be paid by EMB following pre-agreed
performance criteria (KPIs) and funded from tariff collection and the District’s own resources, as
needed. These performance-based payments are expected to help align the long-term interests
of the Concessionaire with those of EMB. EMB is evaluating whether allocating some very limited
demand risk to the concessionaire during the operating phase to better align interests.

**Financing Arrangements for the DFBOMT Contract**

6. The Concessionaire will need to fund around US$1.2 billion equivalent or about 27 percent out
of the US$4.4 billion equivalent of total capital expenditures. The winning bidder is likely to be a Special
Purpose Vehicle (SPV) owned by relevant stakeholders. These investors will seek to raise debt to leverage
their equity contributions and improve their return.

7. In line with other transactions of this type, the debt raised by the Concessionaire will not have
recourse (or only limited recourse during construction) to the sponsors. This “project finance” structure
requires that certain risks are mitigated for lenders to be able to provide the financing, particularly given
the long maturity needed for this debt (in the order of 15 years). Lenders will look, for instance, at risks of
cost overruns or delays during construction, the certainty that payments will be made in full and on time,
potential impact of currency fluctuations on the repayments, provisions given an early termination of the
concession, political risk, etc.

8. The repayment profile to the equity investors would be back-ended with only small dividend
distributions in the early years (except potentially a partial cash-out at the time of refinancing), which
would allow sufficient cash flows from the EMB annuities to be used to service the debt with a comfortable
coverage ratio. This return profile provides an incentive to the Concessionaire to retain the concession until the end of its life to maximize the return, therefore being more aligned with EMB.

9. **Protection mechanisms. The proposed financing structure has several components that aim to mitigate the risk to the Concessionaire and lenders, and contribute to make the PLMB more “bankable” for private sector participation:**
   
a. **Vigencias Futuras:** A stable stream of cash flows that is not dependent on traffic demand is likely to be well received by lenders to the PLMB. The yearly earmarked budgetary transfers proposed for PLMB, including the Project, have a track record of being successfully used in Colombia. Although the vigencias futuras from the District of Bogota are not as strong as the ones from the Nation, the impact on the District’s fiscal standing should be negligible given that the total amount of vigencias futuras that the District can commit for a given year are capped 0.4 percent of the District’s annual budget.

b. **Cash Contributions:** EMB will fund a significant portion of the PLMB cost with cash payments during the construction period. This reduces the need of financing from the Concessionaire and allows for a reasonable debt-to-equity ratio. Furthermore, EMB intends to make payments denominated in other currencies for the portion of the project cost that is related to rolling stock and imported equipment to mitigate the currency risk to the Concessionaire.

c. **Conservative Assumptions:** The financial projections for the base case considers conservative assumptions, for instance, regarding the total PLMB cost (i.e. Value Added Tax for imported rolling stock and equipment may not apply; contingencies are assumed at the higher end of the range; etc.) To the extent that the cost is lower than originally estimated, the need for commercial financing will be less, improving the debt service capacity of the project.

**Additional Sources of Financing**

10. **A Transit Oriented Development (TOD) approach in surrounding areas of the PLMB stations, could mobilize additional private sector funding for transport and urban infrastructure through the implementation of land value capture (LVC) mechanisms.** LVC mechanisms, such as public-private transactions for the additional air development rights in surrounding metro station areas, under existing legal and regulatory frameworks, are being explored to generate additional future non-tariff revenues for the system. Potential uses for these revenues include operational and maintenance costs of the public transit system and EMB. The World Bank is supporting these TOD approaches in other cities in South America through the metro projects of Quito, Lima, Fortaleza, and Buenos Aires. A TOD approach for the PLMB would be taking into account the strong urban and transport legal framework for TOD implementation already in place, the accessibility conditions around stations, and the mandate of the EMB to manage related urban developments and real estate projects around metro stations.

**B. Detailed Description of PLMB**

**Construction**

11. **PLMB is planned in 3 phases or sections to be completed by 2050. The Series of Projects finance the first section, which is the only one in the Co-Financing Agreement and which is expected to be operational by end 2025, with civil works completed by 2025** (Figure A1.2). PLMB includes the segments from Carrera 96 station to Calle 72 station along with Avenida Caracas, for a total length of 24 km (including the railyard connection line and end of line rail turnouts) and 16 stations (10 with planned connection with TransMilenio, 9 fully integrated). Sections 2 and 3 are planned as future extension but no financing has been earmarked yet. Section 2 from North of Calle 78 to Calle 127 station (5.2 km and 4
stations) to be completed by 2030; and Section 3 from North of Calle 127 station to Calle 170 station and a potential extension towards Mosquera in the West (approx. 7.4 km; 7 stations). The PLMB will be 100 percent elevated. EMB has been developing PLMB since 2016, although discussions have been ongoing for a longer period, with alternatives analysis and detailed engineering designs co-financed by the Bank as early as in 2012 (Refer to Annex 6). PLMB (Section 1) has conducted, among other things, technical feasibility and demand studies, basic designs and technical specifications of civil works and rolling stock, environmental and social assessments, economic and financial feasibility studies, and a financial structuring of the metro. Detailed studies included demand modeling, transport planning, alternatives analysis, route design, geotechnical and geological surveying and sociological studies.

Figure A1.2 (a) Planned construction Sections of PLMB
Figure A1.2 (b) Alignment of PLMB Section 1

12. **Ongoing detailed design for the PLMB proposes the following characteristics for civil works of the elevated deck and stations.** The PLMB is conceived to be built as an elevated structure (rail level 13.5 m from surface) through concrete piles. Each segment has been designed according to the following characteristics to blend with the urban environment and reduce visual and noise pollution:

1) **Overpass:** The elevated deck will be built using concrete segments by push. Civil works are expected to be completed in 3 Phases: First, the foundation of the piles for the elevated structure; second, the construction of piles and capitol, works on push launching and partial road reconstitution; and third, reconstruction of the complementary public space. Overall there will be 587 standard piles, 51 gantries and 121 stations and special piles. The average depth of the foundations is 64.8 m for the elevated structure and 67 m for the stations. Piles are expected to reach a diameter of up to 2.0 m and a length between 32.5 m and 73 m. The gantries will be built in areas where required. The deck will be built with concrete segments. It will have a “U” shape to minimize noise leak. The deck will be at least 10 m farther from the nearest building and a height of 13.5 m (at rail level), to reduce impacts. Noise waves will be absorbed through the installation of absorbent elements and/or by treating the internal side of the deck with porous concrete. The construction methodology will be done according to concrete segments instead of beams, which is safer, easier to transport, and does not require the interruption of traffic during the works.

2) **Stations:** The metro stations are designed as decentralized parallel buildings and access is adjacent to the elevated structure. All stations will have one escalator (up) and elevators as well
as universal accessibility parameters. There are different 3 types of stations: 6 simple stations (Carrera 96, Carrera 80, Carrera 42 sur, Kennedy, Nariño, Calle 26); 4 special stations (Portal Las Americas, Av. Boyacá, Av. 68, Carrera 50); and 6 interconnection stations (N.Q.S, Calle 1ª, Calle 10ª, Calle 45, Calle 63, Calle 72). Given that currently, BRT stations in Avenida Caracas will be below the elevated deck, 2 stations are expected to close, and all others require to be widened to cope with the new layout.

3) **Rail yard:** The yard is located in the locality of Bosa (Corzo area) in the South West of Bogota, with approx. 32 hectares. It is designed to park and maintain the fleet for 2050, and to keep the 2030 trains. The area will require ground improvement. The railyard is one of the critical paths of the PLMB timelines. These works are partially covered by the Project.

**Program of works**

13. **The PLMB has been planned to be built using 6 concrete push launching systems.** The production rate considered seems to be sensible and it is synchronized with the overall planning. The Concessionaire may come up with a different number of push launching systems as far as the overall programme is not compromised. The critical path of the planning as contained in the preliminary design, is linked to the testing of the trains. This is linked to the design, procurement and delivery of the rolling stock and its systems, and in parallel, to the construction of the rail yard and the infrastructure facilities to do the SIL 4 system test. It is convenient to look carefully to the first section (out of 6), which is closer to the rail yard, and guarantee that it is finished on time, as that area is part of the length required for the initial system test. Similarly, in order to have the rail yard ready at the end of year 5 for all the tests, it is required to plan the ground improvement that the rail yard will require during year 1.

14. **Increasing the number of push launching systems keeping the production rate, would speed the construction of the elevated structure, which is always good to have more clearance in the PLMB.** This needs to be considered holistically, as there are some tradeoffs in having more push launching systems. This would imply additional traffic management. Although there may be savings in the overall program, this may increase the costs.

**Rolling Stock, Signaling and Systems**

15. **The PLMB also includes provision of the rolling stock, systems and other equipment needed to operate the 24km alignment.** The Concession contract will specify the rolling stock, currently expected to involve the provision of 23 trains sets with 6-7 coaches each, with a maximum capacity per train of 1,800 passengers. The total length of train sets is set to 140 m; with a maximum design speed of 90 km/h. The coach width is expected to be 2.90 m.

16. **Concerning Systems and signaling, the Concessionaire will be responsible for the design and operation of the PLMB power systems.** Electric power produced in substations (750 V CC) will be transferred to the trains through third rail. The Concessionaire will also be responsible for managing CBTC. System functions will be completely automated through a CBTC that will ensure driverless operation.

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45 Given the limited availability and high cost of land in Bogota, it has been decided by the EMB that the railyard should be large enough to serve the entire fleet until 2050, that is, including the fleet for expansion phases 2 and 3—estimated at 64. The size of the yard will depend primarily to the length of the train, and the land needed for the Control center and maintenance facilities. In this case the trains will be quite long (140 m), and they will have a big turning radius.
(GoA4 automation) with commercial speed not inferior to 43 km/h and intervals of 180 seconds at peak hour.

**Demand, Costs & Supervision**

17. **Ridership is estimated at around 26,500 p/h/d during the first year of operation, increasing to 32,900 p/h/d by 2030, and 53,000 p/h/d by 2050.** Demand for 2016 at Av. Caracas (section Av. Jimenez-CI 19 S-N) has been estimated to be 51,000 p/h/d and at NQS (CI 26 S-N) 45,000 p/h/d. The metro alignment runs along the Avenida Caracas along the BRT. The PLMB in this section will be like an express line as it will be faster than the BRT and the distance between the stations will be longer. The rest of the alignment outside Avenida Caracas will intersect with other BRT lines.

18. **The Bank’s analysis of CAPEX and OPEX based on the available preliminary designs suggests that these costs are slightly higher than the international experience for similar projects.** The estimated total capital/infrastructure costs of the line amounts to US$4.4 billion. The total cost is allocated as follows: 10 percent of civil works, 18 percent for the viaduct foundations, 7 percent for the viaduct piles and deck, 11 percent for the stations, 4 percent for the rail yard, 16 percent for rail systems, 12 percent for rolling stock, 2.25 percent for utilities diversion, 14 percent for land acquisition, 1 percent for PMO, 2 percent for site supervision. When costs not directly linked to an elevated metro line construction are excluded, as land acquisition, public utilities diversions, roads intervention, pavement of adjacent roads, urban space upgrading, PMO and works supervision are deducted, the total cost of the project amounts to approximately US$2.5-3.0 billion, which yields a unit cost of the project of US$100-125 million per km. Recently completed elevated metro projects showed significant variance in unit cost in developing countries such as Sao Paulo Line 5 (US$157 million per km), Bangkok BTS (US$ 236 million per km), Kuala Lumpur LRT Extension (US$104 million per km), Mumbai Line 1 (US$77 million per km). Thus, the estimated unit cost of the PLMB is within this variation with a reasonable unit cost for an elevated metro line within the upper bound.

19. **There are some specific cost drivers that support the slightly higher cost:**

   - Due to the geotechnical conditions in Bogota, the depth of the required foundations is considerably higher than for an elevated structure in average geotechnical conditions. The average of the foundation will be 65 m whereas other projects have 25 m foundation. The deeper the piles are, the more risk associated to it: difficulty, time and cost increase more than proportionally.
   - The construction methodology of using concrete segment by push launching is around 5 percent more expensive than the more traditional one with concrete beams.
   - The viaduct will be built with a height of 13.5m (between 3.5m higher than average) and the deck in U shape to reduce the impact to the urban fabric.
   - Bogota is set in a high seismic area, so the structural design takes this into consideration.
   - The stations are designed as parallel buildings and access is adjacent to the elevated structure with 10 new stations that will be integrated with TransMilenio BRT ones (the civil work done at the BRT stations is 2.1 percent of the total budget).
   - Almost 10 percent of these civil works account for costs related to road interventions, TransMilenio stations, urban space upgrading (close to 600,000 mts²) and 22km of bicycle lanes.

   46 Dario Hidalgo, Dominic Pasquale Patella, Leonardo Cañón and Juan Miguel Velásquez, How much does a metro cost? a continuing saga, insights from recently completed projects, World Congress on Transport Research Conference, Shanghai, 2016.
The World Bank
Support to the Bogota Metro Line 1 Section 1 Project – Series 1 (P165300)

- The cost of the railyard includes also a soil improvement treatment and filling which will increase costs.
- VAT tax of 19 percent is applied to rolling stock and other imported rail systems, when it is believed they these items could be exempted.
- There are other taxes and guarantees applied that seems to be higher than other similar projects.

20. **Work supervision and project management, are essential to ensure that design standards and specifications are met and that construction happens within budget and on schedule.** PLMB management through a PMO is also needed to follow international best practices with subway construction, with a knowledgeable set of experts, to help resolve technical controversies and keep the PLMB construction on track and within budget.
ANNEX 2: IMPLEMENTATION ARRANGEMENTS

Project Institutional and Implementation Arrangements

1. **Four National Economic and Social Policy Council documents (CONPES)** approved in 2017 and 2018, have established the strategic importance and the GoC’s support to the first phase of the **PLMB**. These policy documents: (i) declare the GoC’s support to a set of mobility projects for the Bogota-Cundinamarca region; (ii) establish the first line of the Bogota Metro of national strategic importance; (iii) request the National and local government to enter into a Co-Financing Agreement for the project; and (iv) provide a sovereign guarantee to EMB to attain local or international public credit transactions for financing the PLMB.

2. **The Co-Financing Agreement between the GoC, the District of Bogota, and the EMB defines the fiduciary and oversight roles.** On November 9, 2017, the GoC and the District signed the Co-Financing Agreement. This Co-Financing Agreement defines the commitments, terms and conditions under which the National and local government agree to co-finance the project. In particular, the agreement: (i) assigns overall responsibility for undertaking and financing any potential cost overrun and/or operational deficit of the public transport operation to Bogota; (ii) defines the schedule of GoC financial commitments by year, previously approved by the **Consejo Superior de Política Fiscal (CONFIS)** and recorded as future budgetary commitments (vigencias futuras) for proper fiscal accounting; (iii) instructs the District to budget the funds to cover any cost overrun once they are identified; (iv) establishes a trust fund to managed both the GoC and the District of Bogota financial contributions for the project; and (v) makes mandatory the use of fiduciary and safeguards procedures (financial management, disbursement and procurement) of the World Bank, EIB and IADB financing the PLMB.

3. **Specific fiduciary and monitoring arrangements under the Co-Financing Agreement include the creation of a Fiduciary Trust Fund and the definition of oversight roles with participating agencies.** As the recipient of the funds under the Co-Financing Agreement EMB will be responsible for their administration through the establishment of a dedicated Fiduciary Trust. Until the latter is created, the funds are being managed by the District Treasury (DDT) since the first transfer in December 2017. For the overall monitoring, administration and oversight of the transfers of vigencias futuras the Fiduciary Trust Fund in place, is composed of members from the MoT, the Ministry of Finance, Bogota’s Secretariat of Mobility (SDM), Bogota’s Secretary of Finance and the Manager of EMB, or their representative. The

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47 These are CONPES No. 3882 “Apoyo del gobierno Nacional a la política de movilidad de la región capital Bogota-Cundinamarca y declaratoria de importancia estratégica del proyecto sistema integrado de transporte masivo – Soacha fases II y III” from January 10th 2017; CONPES No. 3899 “Actualización de CONPES 3882 - Apoyo del gobierno Nacional a la política de movilidad de la región capital Bogota-Cundinamarca y declaratoria de importancia estratégica del proyecto sistema integrado de transporte masivo – Soacha fases II y III” from September 14th 2017; CONPES No. 3900 “Apoyo del gobierno nacional al sistema de transporte público de Bogota y declaratoria de importancia estratégica del proyecto primera línea de metro-tramo 1” from September 25th 2017, and CONPES No. 3923 “Concepto favorable a la Nación para otorgar garantía a la Empresa Metro de Bogotá (EMB) para contratar operaciones de crédito público interno o externo hasta por la suma de 7,8 billones de pesos constantes de Diciembre de 2017, o su equivalente en otras monedas, destinados a financiar el Proyecto Primera Línea de Metro de Bogotá Tramo 1” from May 8th, 2018.

48 Refer to [http://metrodebogota.gov.co/sites/default/files/Convenio%20de%20Cofinanciaci%C3%B3n.pdf](http://metrodebogota.gov.co/sites/default/files/Convenio%20de%20Cofinanciaci%C3%B3n.pdf) [Last visited 3.3.2018]

49 Council on Fiscal Policy.

50 DDT can act as the delegated administrator of EMB funds according to Art. 18 of the Distrital Decree 216 of 2017.
Fiduciary Trust Fund will be responsible for providing trimestral reports about the execution of funds under the Co-Financing Agreement to the Boards of EMB, the District and the UMUS (Unidad de Movilidad Urbana Sostenible) from the Ministry of Transport (MoT). UMUS, which has a long-standing experience in urban infrastructure projects in Colombia, will carry out oversight of the commitments acquired by each party in the Co-Financing agreement.

4. **EMB is responsible for the overall implementation of the PLMB and the Project.** The company was established in December 201651 with administrative, financial and budgetary autonomy, linked to Bogota’s Secretariat of Mobility. Its legal regime is that of industrial and commercial state enterprise. The company is majority owned by the District of Bogota (92 percent); other shareholders with a 2 percent shareholding each are: Urban Development Institute (IDU), TransMilenio S.A., the Tourism District Institute, and the Urban Renewal and Development Company (ERU). The Board of EMB comprises an equal number of members from the GoC and the District (three members each), as well as three independent members, each for 5-year terms to generate relative independence from political cycles. The three members from the National Government will come from DNP, the Ministry of Finance and the Ministry of Transport (MoT)52, and as requested by the Co-Financing Agreement, they will remain in the Board up until one year following the end of construction.

5. **EMB will carry out the planning, structuring, bidding process, and oversight of the DBFOMT contract of the PLMB.** EMB through Colombia’s Financiera de Desarrollo Nacional (FDN) are carrying out the technical, financial and legal structuring of the PLMB. The technical structuring was awarded to an engineering consortium comprised of SYSTRA-INGETEC in January 2017, who is carrying out the basic detailed engineering design of the metro and the technical specifications for the bidding documents. The financial and legal structuring was awarded in May 2017 to a consortium comprised by Structure, a local investment bank, and KPMG, and the legal firms Garrigues and Duran & Osorio. This process resulted in the definition of the transaction model—a single DFBOMT contract; the financial and legal structuring team is working on the PLMB financial closure (sources, terms and instruments). The technical, financial and legal teams will design the bidding process and bidding documents, and will accompany EMB until the contract award (no later than December 2019). Furthermore, throughout the metro structuring phase, EMB has been supported by Metro of Santiago de Chile53, and will launch in the second quarter of this year a process to hire a PMO and a works supervising agency to support its internal capabilities to manage the project. The PMO will overlook the technical and strategic aspects of Project implementation, while EMB carries out the general supervision. EMB is also responsible for the land acquisition (Refer to Annex 3), and management of related urban developments and real estate projects to be promoted in the metro stations.

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51 According to the Distrital Agreement No. 642 signed on May 12, 2016.
52 DNP, MHCP and MoT are also instructed to monitor the Project from the structuring to its operation, through their participation in the Board, fiduciary committees, and the committees overseeing the financing agreements (Convenio de Cofinanciacion).
53 Metro de Santiago de Chile was hired by the Ministry of Transport, through the Bank’s Support for the National Urban Transport Program project (P117947).
6. **The organizational structure of EMB has been defined according to international best practices.** The company will be organized in 7 units, of which 5 already exist (see Figure A2.1). These units will each be responsible for the management and oversight of key areas: (1) Technical areas including all areas pertaining to construction and operations; (2) Financial structuring and management; (3) Real estate development including land-value capture; (4) Contract management; (5) Administrative and financial areas of EMB; (6) Communications and citizen engagement; and (7) Risks and safety. Given the choice of a DFBOMT contract, the organizational structure of EMB has been designed to ensure a high level of specialization while reducing its size, and focus on its contract management, oversight and supervision roles. The governance model is based on international best practices to ensure transparency and anti-corruption mechanisms that aim at insulating its Board from political cycles and includes the adoption of a transparency policy with active citizen engagement mechanisms. While EMB is a relatively young entity with no previous experience, it has been staffed with experienced personnel in all its main units. Further, an institutional strengthening plan has been developed with the support of Deloitte (financed by the IADB). This plan addresses resource gaps, ensure qualified technical teams, and clarify mandates between the EMB, the PMO, the Concessionaire and national and local agencies involved in planning, implementing or supervising the PLMB construction.

7. **The EMB is linked to the Secretaria Distrital de Movilidad (SDM), Bogota’s Transport Authority in charge of planning, regulating and overseeing public transport policies and long-term mobility plans in Bogota.** The relationship between EMB, SDM and other transport bodies/modes such as TransMilenio S.A. is being carefully analyzed to ensure the sustainability of Bogota’s SITP, and to confer SDM with the appropriate tools to carry out the integrated planning of the SITP, and the coordination between modes.
The objective is that SDM will achieve this coordination through the SDM, which will act as the planning, regulatory and coordinating agency for public transport in Bogota. An important aspect, will be how operating subsidies will accrue and be allocated to the metro under the already established SITP Tariff Stabilization Fund. This aspect is currently being assessed by the Deloitte instructional strengthening component, and Project technical assistance funds will likely finance further studies related to the operational and financial implications of the metro’s integration with the SITP. Likewise, the further strengthening of SDM as a Bogota’s Transport Authority and its coordination with EMB and TransMilenio will be part of the institutional strengthening component of this Project.

8. **Given the choice of a DFBOMT contract, it is important to outline the future institutional arrangements with the Concessionaire.** Preliminarily, the Concessionaire will be responsible for the detailed engineering designs both for civil works and rolling stock. As such, it shall prepare the Project’s Definitive Engineering Studies (EDIs). Once prepared, the EDIs should be delivered to the EMB and the PMO for their respective revision. EMB will make payments against progress in the delivery of construction works (including related systems) and purchase of rolling stock in accordance with the schedule that will be established with the Concessionaire. Works and rolling stock will be delivered in milestones *(hitos de obra)*. The completion and certification of these milestones gives rise to a payment obligation on the part of EMB. These payment obligations will be made either in certificates or direct payments/cash. The works supervision will be responsible for contract supervision and therefore the validation of the milestones for purposes of payments to be made to the Concessionaire. The EMB will be responsible for issuing the payment process once the milestones are validated.

9. **There are two main coordination mechanisms for implementation support between MDBs involved in the Project: an APA agreement for the use of the IADB’s procurement guidelines; and a single Operational Manual (OM), developed jointly by all MDBs and the EMB.** The OM will describe supervision and reporting requirements that will be common for all MDBs with EMB.

**Financial Management & Disbursement**

**Summary of financial management arrangements**

10. **The overall the PLMB design is straightforward with only one DFBOMT contract for the Bogota metro, and related technical assistance expenditures; nonetheless, the financial management aspects are complicated by the lack of experience of the borrower and the existence of several sources of financing and their different fiduciary requirements.** Proposed mitigation measures aim to address identified risks. The existence of different sources of financing and the proposed co-financing of every single payment demand a strong and sophisticated budgeting, accounting and flow of funds arrangements, including internal controls. The proposed arrangements are considered adequate taking in consideration the identified mitigation measures and the disbursement conditions in place. The risk assigned for Financial Management arrangements is Substantial. The Integrated Fiduciary Risk as determined by the integration of the FM and Procurement risk is considered High.

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54 The *Fondo de Estabilizacion Tarifaria* (FET) was created as a result of the implementation of Bogota’s SITP and the need to subsidize system transfers and provide further operational subsidies, particularly for the new zonal bus system. It is funded from Bogota’s general fiscal transfers.
11. **Proposed FM and disbursement would be reflected in a single Operational Manual that will be finalized and approved as an effectiveness condition.** The financial management requirements would be harmonized among the financing institutions, IADB, EIB and WB and between the IADB and WB there is an agreement to join efforts during the preparation phase to not duplicated assessment processes and have only one requirement for budgeting, accounting, flow of funds, internal controls and audit for the Project. There are other local instances that also require financial information to be reported from EMB about the project that would add to the complexity of the financial management aspects of the Project.

12. **EMB will be responsible for the financial management of the Project.** EMB was created in 2016 and is adjusting its structure to the project phases. As previously mentioned, it is receiving technical assistance financed by the IADB and carried out by the firm Deloitte for the definition of the organizational structure and risk identification and management including corruption risk. The Project includes technical assistance related to fiduciary aspects regarding corporate governance, anti-corruption, internal control, budget execution and other aspects related to financial management responsibilities under the EMB. This support would be coordinated with other MDBs to not duplicate efforts and provide the support needed to have adequate implementation capacity.

13. **Organization and Staffing.** The initial structure has been modified to adapt to the different Project stages and the most recent one has been approved in October 2017 but has not been fully completed. The adequacy of the structure, staff capacity and the evaluation of the internal process have been completed during the FMA. EMB has been receiving technical assistance during the preparation process and the Project would also include technical assistance activities related to implementation capacity, internal control and anti-corruption mechanisms. EMB would hire staff for key roles related to MDB financing in EMB’s FM area with experience in multilateral financing and additionally there will be training to be provided to the FM staff at EMB jointly with IADB disbursements.

14. **EMB should maintain during Project implementation an organizational structure and staffing adequate for implementation and acceptable to the Bank.** EMB should attend any request regarding FM arrangements that the Bank in coordination with other MDBs may reasonably request as should be included in the OM.

15. **Budget execution.** Project planning is aligned with the *Plan Distrital de Desarrollo 2016-2020, Bogota Mejor para Todos* and Bogota’s municipal budgetary regulation for commercial and industrial SOE would be applied. Investment execution will be monitored by SEGPLAN, a planning information system from Bogota’s city planning system, that is currently being upgraded to be accessible by the public to follow up on Bogota’s projects and programs (www.bogota.gov.co/tag/segplan).

16. **Accounting and information system.** EMB legal regime is that of a State-Owned Enterprise of the Accountant General Office, which requires the use of a modified International Financial Reporting Standards (IFRS) for institutional accounting. EMB has a system in place (ZBOX), but plans to evaluate the procurement of an accounting and financial reporting system (including modules for budget, procurement, treasury, accounting and financial reporting, monitoring among others). The requirements are that any system used by EMB should be able to keep the accounts by source of financing, issue the consolidated financial statements in Colombian pesos and other currencies as required under the accrual
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method of accounting. The Project financial statements are agreed to be prepared on a cash basis of accounting.

17. **Flow of funds.** EMB will manage Project funds through a fiduciary arrangement (encargo fiduciario) that has not yet been selected to manage all sources of financing. EMB is in the process of preparing the Terms of Reference for the fiduciary arrangement. Project funds would be disbursed to a designated account in dollars and converted in local currency to be deposited in the fiduciary arrangement. EMB would prepared justification of expenditures that would be distributed proportionally to the financiers (World Bank, IADB, EIB) in the percentage established for the recognition of the expenditures as established in the Operational Manual.

18. **Disbursement of Loan proceeds from IBRD.** The agreed ceiling amount for the segregated account is variable and would be established based on the Bank’s approval of cash forecast needed for a given period considering any unused balance. The Disbursement and Financial Information Letter (DFIL) reflects the detailed requirements for requesting withdrawals from the Loan account, and how to submit justification of expenses. The Statement of Expenditure (SOE), will be used for expenditure justification purposes; the FM team will evaluate the use of Interim Financial Reports (IFRs), when the harmonization of financial reporting procedures with the project Co-financers and the borrower be finalized. The frequency of reporting expenses will be semiannual at a minimum, taking into consideration that main contract payments are forecasted to take place on quarterly basis; detailed procedures will be included in the financial management section of the project operational manual.

19. **The eligible expenditures to be financed and not completed at this stage and could comprise works and technical assistance among others.** Loan proceeds would be disbursed against the following expenditures categories (table A2.1). On an annual basis, EMB will comply with aggregate loan amounts or annual disbursement ratios from each co-financer (World Bank, IADB, EIB); these annual disbursement ratios have been estimated at 36 percent, 36 percent and 28 percent for the World Bank, IADB, EIB, respectively and will be set forth in the Operations Manual.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount of the Loan Allocated (expressed in USD)</th>
<th>Percentage of Expenditures to be financed (inclusive of Taxes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Goods, works, non-consulting services, and consulting services for Part A of the Project</td>
<td>67,000,000</td>
<td>100 percent as set forth in the Operational Manual</td>
</tr>
<tr>
<td>(2) Consulting services and Training for Part B of the Project</td>
<td>3,000,000</td>
<td>100 percent as set forth in the Operational Manual</td>
</tr>
<tr>
<td>TOTAL AMOUNT</td>
<td>70,000,000</td>
<td></td>
</tr>
</tbody>
</table>

*As defined in the Loan agreement to include, consultant and non-consultant services, travel and per diem.
20. **Financial Reporting.** In support of harmonized requirements, all financing institutions will look to harmonize information requirements to have only one set of financial reports that would be used by all financing institutions. The financial reports would be system generated in Colombian pesos and US dollars.

21. **Project-interim financial reports (IFRs).** For reporting purposes, IFRs would be harmonized as well and would include: i) brief background of project status at the end of each period; ii) a statement of sources and uses of funds and cash balances by source of financing; iii) statement of cumulative investments with cash forecast for the next period; and iv) a disbursement statement for each co-financier. These reports would be submitted semiannually, no later than 45 days after the end of each reporting period. For purposes of ensuring compliance with the Annual Disbursement Ratios, the Borrower shall not later than forty-five days after the end of each calendar year furnish to the Bank, a consolidated interim financial report, acceptable to the Bank, which shall identify the Eligible Expenditures financed under the Loan and the Project expenditures financed under each Co-financier Loan.

22. **Internal Control.** EMB has designed and put in place internal control mechanisms for institutional processes and include as part of the assurance the functioning of an internal audit to assess and report the system status of compliance and risk management. The internal audit will assess and report on EMB compliance on internal control mechanism and its reports would be part of the documentation available for project supervision and would allow to assess the effectiveness of the institutional technical assistance.

23. **Auditing.** For this Project, specific harmonized external auditing arrangements would be agreed, including agreement on a single set of terms of reference. Audit ToRs are being harmonized and would be included in the Project operational manual. The main opinion of audit reports of the project would be public and published in EMB website. In accordance with the World Bank’s Access to Information Policy,
the annual audited financial statements of the Project will be publicly available by the Bank upon receipt, review and approval.

24. **Audit of annual financial statements of the Project** will be conducted by in accordance of International Standards on Auditing (ISAs) issued by the International Federation of Accountants (IFAC). Audited financial statements will have to be furnished to the Bank no later than six months after the end of the auditing period, the end of each year or other period agreed with all co-financiers. Auditors should submit: i) an opinion on the Project financial statements; and ii) a management letter.

25. **Anti-corruption.** In response to the corruption risk the EMB is implementing a high-level reporting and denounce mechanism with the assistance of OECD that comprise an internal denounce mechanism and an external one. EMB has requested the Bank for technical assistance on this regard. Functioning of the denounce mechanisms would be monitored during project supervision.

26. **Bank Supervision.** Financial Management supervision would include on-site and off-site supervisions. On-site supervisions will be carried out at least three or four times the first year and later calibrated to twice a year. Off-site supervisions will comprise desk reviews of interim financial reports and audited financial statement.

### Project Action Plan

<table>
<thead>
<tr>
<th>Action</th>
<th>Responsible</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denounce mechanism as part of the Anti-Corruption arrangements</td>
<td>EMB</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Alternative Procurement Arrangement approved</td>
<td>World Bank, IADB</td>
<td>After IADB Board approval,</td>
</tr>
<tr>
<td>IADB Co-Financing Agreement is approved and ready to disburse</td>
<td>EMB, IADB</td>
<td>Effectiveness Condition</td>
</tr>
<tr>
<td>Operational Manual finalized and approved</td>
<td>EMB</td>
<td>Effectiveness Condition</td>
</tr>
<tr>
<td>Fiduciary Trust Fund (Encargo Fiduciario)</td>
<td>EMB</td>
<td>Effectiveness Condition</td>
</tr>
<tr>
<td>Adequate implementation fiduciary structure and staffing</td>
<td>EMB</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Incorporation of Staff with Multilateral financing experience</td>
<td>EMB</td>
<td>As needed for disbursements</td>
</tr>
<tr>
<td>Joint Fiduciary training to EMB staff</td>
<td>World Bank, IADB, EIB</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

### Procurement

27. **Procurement activities for the supply of goods, works, non-consulting and consulting services under the Project, financed totally or partially with WB proceeds, will have to comply with the Inter-American Development Bank’s (IADB’s) Procurement Policy – GN-2349-9 dated March 2011.** The Project will be co-financed by the IADB and the EIB; the World Bank will implement the IADB’s procurement policies as an APA. The IADB has committed to implement them with the only exception of the eligibility provisions (i.e., IADB will waive the restriction on eligibility limited to contractors from its member countries, allowing the participation with no restrictions). World Bank’s Anticorruption Guidelines will be fully applicable including the World Bank’s right to audit related documents and apply its sanction regime. On top of this, the complaint management review process will remain applicable and the IADB will inform promptly to the World Bank regarding any complaint received under the procurement processes financed totally or partially by this project.
28. **EMB will be responsible for the procurement of all the activities financed under the Project and IADB will take the leading role in providing implementation support and monitoring procurement activities.** An action plan is proposed to strengthen the capacity of EMB and ensure a proper contract management: (i) adding professional staff to the EMB with experience in procurement of high complex contracts and contract management execution, (ii) developing a detailed contract management plan, (iii) implementing a proper IT tool to support contract management, (iv) hiring a PMO that will support contract management. Using this analysis as a basis, it was determined that the procurement risk is rated as high.

29. **A full version of the Project Procurement Strategy for Development (PPSD) has been developed by the Borrower, establishing the best procurement arrangements that will ensure the delivery of value for money while efficiently achieving the agreed PDOs.** The PPSD is focused in the high value and risk contract under this project for the EMB and summarizes the operational environment in which the project is being implemented, the market analysis, the risks asessment and different alternatives to carry out the procurement for this activity. As a result of such assessment, it was concluded that the most suitable option is to implement a DFBOMT contract through a single bidding process with international approach. Considering the complexity of the contract, the procurement process will include a first phase of request for expressions of interest to gather detailed information about the market and interested firms willing to submit a bid (started in March 2018). The inputs that will arise from such process will allow the definition of proper prequalification criteria suitable for the market conditions. Following this stage, there will be a prequalification process and a consultation stage with the prequalified firms. This might include the request of additional studies to the firms and will allow to adjust and update the technical specifications and terms of the contract, based on additional or alternative approaches provided by the prequalified firms. Finally, a bidding process will be carried out to award the contract (estimated for April 2019). The technical component of the project is planned to include PMO and supervision services to support the implementation of the main contract under the PLMB. However, given that the EMB has not yet made a definition about these contracts, these activities were not addressed in detail in the PPSD. The document will be updated once these services are defined to identify a suitable procurement approach to select the firms to carry out this function.
ANNEX 3: Environmental & Social

A. Environmental

1. The PLMB alternatives were assessed in the ESIA and also in previous studies. These compared the possible alternatives according to the technology, design and operation of the proposed Metro Line, and includes alternatives to mitigate environmental and social impacts. The type of metro for the District has been a subject of discussion for many years in Bogota, leading to the realization of several studies. Prior to the aforementioned alternatives study, the Advanced Basic Engineering study for the Bogota metro was developed, which ended in August 2015, leading to the design of the PLMB in Bogota with completely underground infrastructure. This alternative was later revised due to its high costs associated with the devaluation of the local currency, observing the need to improve the benefits for mass transportation and integration with other means of transport.

2. The ESIA contains a summary of the previous studies on alternative analysis and relates to both technology (e.g., above versus below ground) and location (route). All alternatives analyzed had a layout quite similar to the original layout with the exception of specific local variants. The differences of the alternatives are based above all on the constructive process chosen and, on the sections, identified for each type of construction process. All the alternatives that were compared are located between the Portal Americas station and the Calle 127 station. Seven possible alternatives were evaluated. The evaluation of the alternatives included criteria such as the environmental impact, the construction process, the urban-landscape component, user experience, social benefits, financial aspects and risks. Within the environmental impact component, water sources, soil, landscaping, noise and vibrations were taken into account. The evaluation of alternatives concludes that the alternative of viaduct is the most appropriate since it allows to cover a greater demand of passengers, it presents a greater facility to be integrated to the rest of the mass transport system and ease of expansion, greater performance in the construction, with lower construction risks compared to the underground infrastructure. Regarding environmental impacts, the selected alternative does not present the best impacts, but these can be controlled, mitigated, or compensated; and large-scale or significant impacts are not found. The impacts identified in the selected alternative can be controlled, by means of management measures, which have been considered within the project ESIA/ESMP.

3. Some of the PLMB impact assessments and associated management plans will be updated or developed by the Concessionaire based upon the final design details. These shall be prescribed as part of the Concession Contract, and should also apply to sub-contractors. A ESMP will be needed for the maintenance facility construction. A site will be required for the pre-fabrication of the metro line concrete support structures, and is estimated to require approximately 15 hectares. The EMB has currently identified several potential properties within the District, however no final decision/selection has been made and will be part of the Concessionaire responsibility. The PLMB will require small temporary work construction areas near the stations and electric substations. The exact configuration of these will be defined as part of the final designs developed under the Concession Contract. PLMB will also require an area(s) for the disposal of extracted soil materials (e.g. from stations and support structure foundations). The estimated volume of materials is approximately 3.9 million m3. It will also require the development of a traffic management plan for the truck transport of materials and construction debris. The total duration of PLMB detailed engineering and construction is estimated to be 5 years.
4. **Bank OP/BP 4.04 is triggered.** The railyard will be located next to the Corzo site in the South West area of Bogota, between the Bogota River and the Cundinamarca Channel. The area is approximately 32 hectares, where its existing habitat consisting of basically grasses (low lying vegetation), 58 trees, and there are no wetlands; the area is located in an Environmental Management and Preservation Zone (ZMPA). According to the Land Use Master Plan (POT), the ZMPA can be modified since the CAR has executed mitigation works in order to reduce the flooding risk of the Bogota River. Therefore, a permit must be issued by the CAR which is the environmental authority for the Bogota River to delimit the ZMPA, thus allowing the construction of the railway depot. Therefore, a permit must be issued by the CAR which is the environmental authority for the Bogota River to delimit the ZMPA, thus allowing the construction of the railyard. This modification will not cause any significant conversion or degradation of natural habitat and any significant cumulative impacts or flooding of the Bogota River. The construction is estimated to affect approximately 1,373 trees; roughly 1,548 trees are being preserved and around 366 trees will require relocation or replanting in other areas of the District. The landscape design also proposes to plant 2,920 new trees along the PLMB alignment. The PLMB design includes the final closure of work areas and the implementation of green areas (e.g., underneath the metro support structure) that allow green enrichment and the improvement of the landscape. The management of these impacts will be done within the ESIA/ESMPs developed under OP/BP 4.01. The ESMP of the ESIA includes measures for forest intervention and compensation; the SDA and CAR will establish the number of tree species of compensation and the planting site. The plant species to be planted will be selected in coordination with the Botanical Garden of Bogota.

5. **The PLMB operation will require the use of regularly available pesticides for pest control (e.g. rodents, etc.) at stations and metro cars, and thus Bank OP/BP 4.09 is triggered; likewise, Bank OP/BP 4.11 is triggered since the PLMB will have a direct impact on the Heroes Monument.** The PLMB ESIA includes pesticide management aspects. A pest management procedure will be required as part the Project Operational Phase Environmental Health and Safety Management Plan which will be developed under OP/BP 4.01. The monument is located past the last station where there will be rails to allow trains to reverse (Avenida Caracas past station at Calle 76). The construction will require this monument to be relocated. The proposed plan to relocate the monument, has been developed based upon consultations and recommendations of relevant authorities. A specific plan for this relocation will be developed. The proposed plan to relocate the monument, is being developed based upon consultations and input from relevant governmental authorities Instituto Colombiano de Antropología e Historia (ICANH), Instituto Distrito de Patrimonio. The ESIA does not suggest any other significant impacts on physical cultural resources in the direct area of the PLMB and the Project influence. The ESMP in the ESIA (see OP/BP 4.01) includes a chance finds procedures.

6. **The PLMB ESIA includes an ESMP, which contains 38 management programs for the prevention, control, mitigation, correction or compensation of environmental and social impacts, generated by its pre-construction, construction and operation of the.** The ESMP includes a Monitoring and Supervision Plan, composed of 20 programs aimed at evaluating the effectiveness of the management measures provided for the physical, biotic and social impacts of the project and having the basic tools to determine in a timely manner the adjustments in management, consistent with the results obtained. The monitoring programs include air quality, water quality, vegetation, noise and vibrations, solid waste and debris management, information and participation of interest groups, traffic management, worker health and safety, and contingency and emergency plans. As mentioned above, the ESMP will be updated by the
Concessionaire to reflect final project design details.

7. **The ESMP in the ESIA also includes programs on the socioeconomic environment are aimed at restoring the social, economic, human and cultural conditions of the area of influence, as well as the to link local authorities, institutions, social organizations, citizens and other entities that will be impacted by the PLMB.** The management measures focus on the prevention, mitigation, compensation and correction of socio-economic impacts identified in the study. Among the programs, includes: Program of information and participation to the groups of interest; Information and assistance program for pedestrian and vehicular mobility; Traffic management plan; Social work inclusion program; Cultural Heritage Management Program; and Resettlement program.

8. **The Project Operation Manual will establish environmental and social management actions for EMB.** These will include: EHS management for interference works, coordination with other applicable governmental agencies, (e.g., for traffic management, relocation of physical culture resources), ESHS supervision and reporting and notification to MDBs, and ESHS institutional strengthening.

9. **An extensive amount of EHS management aspects will be managed directly by the Concessionaire for the construction, operation and maintenance.** The Concessionaire will need to update, or develop new, environmental and social assessments and environmental and social management plan(s) on their final detailed design and specific locations station infrastructure (e.g., work areas). In addition, the Concessionaire will need to develop specific management plans for the PLMB. These include: (i) Traffic Management Plan (that needs to be developed with input from relevant governmental authorities) which should include measures to minimize the impact of traffic works on the circulation of public transport (including the TransMilenio system), private and pedestrian; the interaction with other projects to be executed at the time will also be taken into account, such as the TransMilenio system along Avenida Carrera 7 from 32nd Street to 76th Street; (ii) Extracted Materials Management Plan will be developed once the exact site(s) for disposal or re-use of extracted materials is defined by the Concessionaire. It intent to use existing authorized sites, which will include supervision and monitoring and truck traffic management; (iii) An Extracted Materials Management Plan will be developed once the exact site(s) for disposal or re-use of extracted materials is defined by the Concessionaire. These disposal sites must be authorized by environmental authorities; the Plan will include supervision and monitoring; and (iv) Health and Safety Management System aimed at preventing and controlling occupational risks and accidents, as well as protecting the health of workers. The Concessionaire will also carry out the management to obtain the environmental authorizations required by the PLMB and the project. These above mentioned requirements are defined partially in the ESIA and will be included in the construction contract. Specific environmental, health and safety terms and conditions will be developed and included in the relevant bid and contract, including updating of environmental and social impact assessment and management plans based upon final design details, and in the independent work supervision contract, and PMO contract. EMB is establishing agreements with the relevant governmental or private companies for the relocation of utilities in areas of project construction, including telephone, water supply and waste water, electricity. The agreements will address EHS management of such works required. The Bank is providing suggestions related to environmental and social sustainable design, construction and operation/maintenance and management of environmental financial risks.

10. **Environmental supervision/performance monitoring will be performed by different entities.**
Environmental supervision/performance monitoring and supervision includes: (i) environmental, health and safety monitoring and reporting by Concessionaire, who by contract must have designated environmental and health safety managers; (ii) environmental, health and safety supervision of construction works by an independent consultant firm reporting to EMB; (iii) supervision by EMB; (iv) supervision by District Secretary of the Environment regarding compliance with local environmental regulatory requirements. EMB will also hire an independent work supervision company, and also a PMO consultant company.

11. **In terms of environmental permits, these are the responsibility of the EMB and/or the concessionaire and are issued by the Secretaria Distrital de Ambiente and Corporacion Autonoma Regional de Cundinamarca.** Regarding Archeological Management Plan will be approved by Instituto Colombiano de Antropología e Historia (ICANH) and the Instituto Distrito de Patrimonio. In addition, the plan to relocate the Heroes Monument requires to be approved by Secretary of Culture, Recreation and Sport (Directorate of Heritage); District Institute of Cultural Heritage; District Planning Secretary and those of the national order as Ministry of Culture.

### B. Social

12. **The PLMB will generate long-term benefits by improving public transit in Bogota.** However, it is also expected to generate temporary or permanent adverse social impacts mainly associated with the acquiring of land for civil works construction which will be mitigated. Some works may cause limitation in the access to residential housing and businesses, as well as the acquisition of properties. The occupants of these properties will need to be either economically or physically resettled, or both. When an affected social unit needs new housing, the Project will provide sufficient compensation and support so that the social unit can acquire a new or used house. Affected street vendors will also be provided participation in support programs such as capacity building, credit opportunities and other economic conversion programs. Likewise, efforts will be made to provide additional support to businesses and other commercial activities because of temporary impacts during the construction phase. These temporary impacts can reduce the vehicular or pedestrian access to the properties, as well as propose schedules for the loading and unloading to the different businesses. To mitigate the adverse effects, a specific program has been included in the ESIA and its implementation will be mandatory for the Concessionaire. Such activities include: (i) capacity building and training for businesses in topics such as accounting, organization, marketing; (ii) strategies to guarantee the flow of customers during the construction phase; (iii) assess the possibility of providing local or national tax exceptions to affected businesses; (iv) design and implement advertising campaigns during the construction period; and (v) strategies for loading and unloading of goods. Additional adverse impacts, most often temporary during the construction phase, involve interference on urban service infrastructure (pavement, phone lines, electricity wiring, water pipes and sewage mains, etc.) as well as potential temporary nuisance during construction (noise, dust, waste, and traffic congestion).

13. **From a social perspective, there are six (6) areas of influence that will be affected once The PLMB is under construction (Table A3.1 and Figure A3.1).** The areas identified will encompass 9 of the 20 districts in which the District is divided. In the following table, a characterization and map of each of the affected areas is presented below.
Table A3.1 Description of Areas by the construction of the PLMB

<table>
<thead>
<tr>
<th>AREA</th>
<th>DISTRICT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Metro Yard</td>
<td>Located in the urban border. High residential growth with presence of small businesses.</td>
</tr>
<tr>
<td>1</td>
<td>Railyard to Portal Americas. From Rio Bogota to Carrera 79.</td>
<td>Kennedy: 20 neighborhoods with different land uses: mainly commercial, medical and recreational.</td>
</tr>
<tr>
<td>2</td>
<td>Kennedy. From Carrera 79 to Carrera 69 B</td>
<td>Kennedy</td>
</tr>
<tr>
<td>3</td>
<td>Puente Aranda. From Carrera 69 B to NQS Avenue with St. 8 South</td>
<td>Puente Aranda: 9 neighborhoods with high residential growth and presence of social institutions. Márteres: 8 neighborhoods which have experienced an important religious, educational and high-impact commercial growth.</td>
</tr>
<tr>
<td>4</td>
<td>Antonio Nariño. From NQS Avenue with Street 8 South to Caracas Avenue with Street 2</td>
<td>Antonio Nariño: 5 educational, medical, and recreational neighborhoods. Santa Fe: Encompasses 7 neighborhoods with a strong business growth. Area of high commercial development, mostly on public spaces. In Street 13 is located the recognized sector of San Victorino with problems associated with insecurity and informality.</td>
</tr>
<tr>
<td>5</td>
<td>Historic Center. From Caracas Ave. with St. 2 to St. 28</td>
<td>Márteres</td>
</tr>
<tr>
<td>6</td>
<td>Caracas Avenue. From Caracas Ave. with St. 28 to St. 72.</td>
<td>Teusaquillo: 7 neighborhoods with commercial, residential and educational growth. Chapinero: includes 7 neighborhoods with large areas for commercial and educational uses. Also has the presence of commercial activities in public space (small squares). Barrios Unidos: 6 neighborhoods where residential, commercial and educational growth prevail.</td>
</tr>
</tbody>
</table>

Note: Area 1 and 2: Where most of the population is located, mainly due to the existence of residential complexes and single-family homes. Area 6: Where least of the population is located. This area corresponds to commercial and services uses along the Caracas Corridor.

Figure A3.1 Location of Areas by the construction of the PLMB

14. Social Safeguards instruments. The RPF that will apply to the PLMB investment has been approved by the Bank and disclosed on July 5, 2018. Based on the different impacts and needs, the Bank has identified that the following RAPs will need to be prepared based on the existing RPF: RAP to acquire 129 critical properties needed for the alignment; this RAP has been approved by the Bank and disclosed on July 5, 2018. Another RAP will be prepared during implementation and will include the remaining properties for the metro stations, the rail yard, and the relocation of street vendors.

15. Complaint and grievance mechanisms. The EMB will implement different GRM mechanisms
during the lifetime of the PLMB. Directly, the EMB has a mechanism to respond to concerns about the PLMB in general. Additionally, each section of the work will include in the Concessionaire contract, the obligation to have a specific GRM for the direct and indirect intervention area, which will report to the EMB periodically. The first RAP has IDU’s GRM mechanism. During implementation, Centers for Public Attention will probably be the most critical mechanism and point of contact with the community for receiving questions, claims and complaints. The Centers for Public Attention are to be set up under the guidelines established in the project’s Environmental and Social Management Plans. These grievance mechanisms will be established for each section of the works including the direct and indirect intervention areas and are a one-stop-shop located for citizen attention and problem resolution. The Centers are used to publicize works plans, work progress and traffic measures and to receive complaints and grievances of all types. Such a tool allows for contractors and community members to report possible issues related to the contract awards and contract implementations. Claims can also be posted on the website of the EMB or received directly in their office. Every step of this process will be well documented and the information digitized by the Concessionaire and sent periodically to the EMB for supervision. Lastly, citizens can also place specific complaints regarding fraudulent or corrupt practices by calling the Government’s corruption hotline (Línea Transparente).

16. **Citizen Engagement.** From the concept stage and during the preparation of the EIAS, the EMB has identified the project stakeholders, social leaders and community and civil society organizations. The identification of the different stakeholders was based on information from the different entities of the District, and compiled according to the social realities of each of the 6 areas under study. The EMB has carried out periodical workshops and seminars with open participation to inform about the project, this communication scheme will continue during implementation. In general, the most significant and repeated topics related to the ESIA are summarized as follows: (i) Tree falling and relocation; (ii) Noise, shadows and vibrations once the Metro Project starts operation; (iii) Uncertainty regarding the property acquisition process and the properties needed for the project implementation; (iv) Detours during the works; (v) Effects to assets of cultural interest; (vi) Effects to economic activities; (vii) Suggestions such as: the installation of public bathrooms in the stations, accessibility for people with reduced mobility and inter-institutional coordination to address problems identified along the corridor. These topics were included in the study and will be developed in the implementation.

17. **Women were specifically consulted during the process of socialization of the ESIA to integrate their concerns into the metro designs and public spaces.** A relatively high participation of women was achieved during the ESIA consultation. Their main concerns are related to: (i) Tree use, management of solid waste, presence of noise and pollution derived from the works; (ii) Opportunities to include as part of the urban renewal further improvements, such as vertical gardens, open spaces; (iii) Insecurity was mentioned as an impact to be mitigated through greater police presence, the generation of safe trails, the installation of more surveillance cameras, lighting at the stations and multimodal connections of the system; as well as the interinstitutional management for the opportune handling of street dwellers; (iv) Women expressed concern about potential vehicular congestion, due to simultaneous projects being undertaken (i.e. Ave Caracas); and (v) participation and consultation during the different stages of the project.

18. **Capacity Building.** The EMB is responsible for the Project’s social management and compliance with Bank safeguard policies. Given that it is a new entity, actions have already been undertaken by EMB
to strengthen and build internal staff capacity to manage the Project in terms of social safeguards. First, three (3) social safeguards workshops were carried out during last year with the participation of IADB and World Bank. The EMB prepared its RPF based on the Ministry of Transport’s Resettlement Policy Framework (RPF), which is currently being applied to all mass transit projects in the country being co-financed by the GoC through Colombia’s National Urban Transport Program and has been used by four World Bank loans since 2003. This RPF lays out the resettlement management approach to be used to prepare the Project’s RAPs. The EMB has signed an agreement with the IDU to carry out the property acquisition and resettlement of the first RAP. This agreement will be amended no later than one month after the Project’s effectiveness to reflect that IDU will carry out all land acquisition activities in accordance with the provisions of the Project’s social safeguard instruments. In addition, the EMB has hired a professional team to advance the census of the rest of the properties which have been identified for acquisition. EMB is also preparing TORs to hire 10 multidisciplinary teams (technical, social and legal) with an estimated total of 60 subcontractors that will advance the formulation and implementation of the Complete Resettlement Action Plan (includes all other 1,031 properties + RAP for Metro railyard + Street Vendor Relocation Plan). The IADB and World Bank will deliver a series of training workshops on social safeguards for the newly hired staff. Regarding the issue of street vendors, the EMB has signed an agreement with the Instituto para la Economía Social (IPES) to carry out the Street Vendors Relocation Plan. The IPES is a District entity specialized in offering alternative income generation for the population of the informal economy that is active in the public space, focusing on training, entrepreneurship, business skills and management of largely informal commercial activities.
ANNEX 4: Economic and Financial Analysis

A. Economic Analysis
1. Economic analysis (EA) results show that the PLMB is economically viable. The Project is going to support the construction of the PLMB; the objective of the Series of Projects being that of improving access to opportunities and quality transit for public transport users in the area of influence of the PLMB. Project costs include total capital costs during the construction phase and operation and maintenance during the operation phase. The quantifiable benefit from the Project include travel time savings, private vehicle and bus operation cost savings, on-road traffic accidents reduction and GHG and pollution reduction. The Project will also yield non-quantifiable benefits such as livability and public trust improvement, employment generation, satisfaction with public transport services, increased accessibility and sustainable urban development. EA results show a Net Present Value (NPV) of US$547 million at a 6 percent discount rate and an Economic Internal Rate of Return (EIRR) of 7.82 percent.

Methodology and Assumptions
2. Demand Forecast Model. The EA was based on the same transport model and benefit methodology used by the District and National authorities when the project was prioritized (CONPES 3900 of 2017). The assumptions for the demand forecast model were highly conservative; i.e. a low annual growth rate of public transport of 0.15 percent and a high growth rate of automobile and motorcycle users. The demand model was created in 2011 using the household travel survey method and has been constantly updated and used in numerous road infrastructure and mass transport analysis and projects. Bogota was divided into 845 Traffic Analysis Zones (TAZ) to define the origin-destination. The demand forecast uses the standard four-step model which was done by Secretaria de Movilidad based on Emme4 Including:
   1) Traffic Attraction and Generation for each typical period of the day during morning peak (6:30 – 7:30am), based on information of population, income level, automobile or motorcycle ownership, family size, land use and education enrollment;
   2) Traffic Distribution through the application of a gravity model estimated according to the distance between zones and a generalized cost;
   3) Mode Choice was calculated through a multi-linear regression model for the possibility of selected travel modes based on socio-economic characteristics as well as the cost and travel time;
   4) Traffic Assignment was calculated based on the current and future transport system supply such as routes, speed and infrastructure construction the possibility of the mode choice.

3. Output of the Demand Forecast Model. The output of the demand forecast model includes the ridership, travel time as well as travel distance for public transport (zonal, TransMilenio and Metro) and private (automobile, taxi, motorcycle, small truck and big truck) travel modes to provide basic input data for the EA.

4. Scenarios for the Demand Forecast Model in this EA. The demand was forecasted for with and

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55 Please note that Project in this annex refers to the PLMB (entire SOP).
56 CONPES 3900 of 2017
**without Project scenario:**

5) **Without Project Demand Forecast:** demand model runs as “business as usual” (BAU) from the year 2016 onwards. The BAU also includes transportation network extensions planned to be built before 2022 which are listed as below:
   - Extension Autonorte corridor (BRT)
   - Extension Calle 80 corridor (BRT)
   - Extension Caracas South Corridor (BR)
   - Soacha Corridor, Phase 2 and 3 (BRT)

6) **With Project Demand Forecast:** demand model runs with assumption that Metro will be in full operation in 2025, and it is the only additional infrastructure improvement on the transport network compared with *Without-Project-Scenario*.

5. **Travel Mode Share.** Within the 4-step model, the mode share only varies marginally within current levels of 45 percent for public transport and 20 percent for private modes among all the trips. The annual growth rate of total demand for public transport is estimated at 0.1 percent for the Base Scenario (bus network in 2022)\(^{57}\), and at 0.15 percent for the Scenario Metro (base scenarios with Metro in operation in 2025). The annual growth rate for the ridership of the Metro is estimated at 0.1 percent. This is a highly conservative estimation to avoid the overestimation of transfer from private modes to public transport. Also, the model considered high growth rate of automobile and motorcycle which has been a rising concern in Bogota. However, even within this conservative estimation, the project is still economically viable according to results below. Under this assumption, the forecasted demand for the PLMB during working day peak hour (6:30am - 7:30am) is 40,891 passengers with the annual growth rate of 0.10 percent.

<table>
<thead>
<tr>
<th>Table A4.1 Demand Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Annual Growth Rate</td>
</tr>
<tr>
<td>Public Transport</td>
</tr>
<tr>
<td>Private Mode</td>
</tr>
</tbody>
</table>

6. **Expected quantifiable benefits**\(^{58}\): The expected or potential quantifiable benefits from the project include:

1) **Travel Time Savings:** Passenger total travel time savings, particularly for public transport users shifting from SITP or *TransMilenio* to Metro, but also from shifting from private modes to a more efficient mass transit mode which will reduce congestion. This impact is measured by estimating travel time differences between with and without the implementation of the Project. The value of time is based on the field survey with the estimation of US$ 2.2 per hour in year 2022 (standard for minimum salary in Bogota), with the annual growth rate of 1 percent.

2) **Traffic Accidents Reduction:** Reduced fatalities and serious injuries due to reduced exposure to non-road traffic by taking a safer transport alternative (public transport) and improvement in land use to provide a safer travel environment to pedestrians and cyclists. External costs for accidents include social spending on medical care, the opportunity cost of society for disabilities or

\(^{57}\) By 2022, the current bus network will be optimized to maximize the whole public transport network’s efficiency adapting the operation of new PLMB in 2025.

\(^{58}\) The EA used the currency of constant Colombian Peso (COP) in 2016 and the exchange rate of 2835

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loss of human lives, and public intervention in accidents. Accident rates and costs are obtained from the Secretaria Distrital de Movilidad (SDM) and a study conducted for Bogota by the Instituto de Seguridad Vial.

3) Emission Reduction: Reduced air (PM2.5, PM10, NOx, CO and SO2) and GHG emissions (CO2) due to optimization of the current public transport network and reduced congestion. The estimation of the emission reduction is based on the kilometers traveled by the different types of vehicles circulating in the District as well as their respective emission factors. The estimation uses the shadow price of carbon (SPC) as specified in 2017 updated WB guidance where annual SPC is provided until 2050. The range of the SPC is between US$ 40 (SPC low) and US$ 80 (SPC high) for the year 2020, with an annual growth rate of 2.25 percent. The results in this section are presented with the assumption of SPC low estimate.

4) Vehicle Operating Cost Reduction: Reduced vehicle operating costs for both SITP buses and private vehicles from reduced congestion. The bus operation costs are estimated based on the distance travelled in the District by public transportation, the unit costs and the composition of the automobile fleet. This information is obtained from studies conducted in Bogota by the IDU, the SDM, as well as by TransMilenio (TM). The private transport operating cost estimate is based on information of distance travelled in the District by each of private transport mode given by the demand model and the unit cost of operation (per km).

7. Expected quantifiable costs: The cost of the Project includes total capital of US$ 4.4 billion. For the EA, costs that are not directly related to the metro project, such as costs related to road interventions, TransMilenio stations, urban space upgrading, PMO, work supervision and 12km of bicycle lanes have been deducted (approx. US$ 3.92 billion when non-metro costs are deducted). The Project cost also includes operational cost, routine and periodic maintenance cost of US$ 1.2 billion for the year 2025 - 2049. The economic costs are calculated based on the shadow prices used in Colombia for the EA.

8. Expected non-quantifiable benefits: In addition to the expected quantifiable benefits, the proposed project will also generate substantial other economic and social positive externalities that are difficult to quantify:

1) Livability and Public Trust Improvement: Livability and public trust in local governments will improve due to the provision of critically needed public transport infrastructure and the improvement of public space around stations. While the benefits from improved public spaces are difficult to monetize and attribute, international best practices show that such enhancements can improve quality of life and social cohesion in the District;

2) Employment Generation: Employment generation during construction phase and during operation due to increased accessibility and economic development along the corridor;

3) Satisfaction with Public Transport Services: Increased passenger’s satisfaction with public transport services due to improved efficiency, reliability (on-time performance), coverage, comfort and accessibility of public transport services;

4) Increased Accessibility: Increased accessibility between residential areas to resources and services, including jobs, schools and hospitals.

59 This approximately equals to 10 percent of the capex costs.

60 https://colaboracion.dnp.gov.co/CDT/Inversiones%20y%20finanzas%20publicas/Estimaci%C3%B3n_de_precios_de_cuenta_para_Colombia.pdf
5) **Sustainable Urban Development**: The District of Bogota would benefit from the upgraded public transport network and land use policies, which may be able to substantially reduce the intensity of energy consumption and greenhouse gas emissions of urban areas as well as allow for better social integration for low-income households.

9. **Discount Rate**. The EA for PLMB uses a discount rate of 6 percent. In the past, WB infrastructure projects often assumed a 12 percent discount rate, but a much lower rate between 4 percent and 8 percent has been observed recently for large public transportation projects with long-lived benefits. A recent World Bank study also suggests lower discount rates for investment projects with similar characteristics in Peru and other countries of the region because social benefits materialize over the long-run. Moreover, it is not possible to quantify all positive externalities from this Project, particularly as it is the Section 1 of PLMB of a larger transport network with long-term benefits and possible spill-over effects. For these reasons, a discount rate of 6 percent was deemed appropriate for the sensitivity analysis.

**Scenarios**

10. **Public Transport Network**. The base scenario (without Project Scenario) includes the public transport network in 2022, which is the year that key investments which are ongoing will be completed. The “with Project” (baseline) is the base scenario with the PLMB added. The results of the EA compare the “with Project” and “without Project” scenarios to estimate the NPV and EIRR.

11. **Sensitivity Analysis**. The result of the EA will be tested under the following sensitivity scenarios:
   1) Cost overrun: CAPEX and OPEX of the Metro increase by 20 percent
   2) Decreased Benefit: All the benefit from the Project decreases by 20 percent
   3) Lower demand: the Metro has 20 percent less demand than forecasted

**Results of the Economic Analysis and Sensitivity Analysis**

12. **Result Summary for Benefits**. The detailed results for the estimated benefits are presented in Table A4.2. The results indicate that the benefits of the Project mainly come from Travel Time Savings which accounts for 65.31 percent of the total benefits, while bus operation costs savings is the second highest contribution that accounts for 23.96 percent.

<table>
<thead>
<tr>
<th>(at discount rate of 6%)</th>
<th>Percentage</th>
<th>Amount (US$ Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time savings</td>
<td>65.31%</td>
<td>1,836</td>
</tr>
<tr>
<td>Private vehicle operation costs savings</td>
<td>5.42%</td>
<td>152</td>
</tr>
<tr>
<td>Accidents reduction</td>
<td>2.76%</td>
<td>78</td>
</tr>
<tr>
<td>GHG and pollution reduction</td>
<td>2.55%</td>
<td>72</td>
</tr>
<tr>
<td>Bus operation costs savings</td>
<td>23.96%</td>
<td>674</td>
</tr>
</tbody>
</table>

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61 A recent review specific to urban rail projects in New York, London and Toronto completed since 2000 revealed that these projects have used rates varying between 2.35 percent and 5 percent. Similarly, results are shown in a study for a set of metro projects in a few OECD countries. Chile is currently using a discount rate of 7 percent for all infrastructure projects.

13. **Results of the NPV and EIRR.** The evaluation horizon for the EA is 30 years (2020-2049), with capital investments and construction during the first 6 years and operations starting in 2025. The results show that at the discount rate of 6 percent, the NPV of Project is estimated at US$ 547 million, with the EIRR at 7.82 percent. The low EIRR and NPV are due to the mega infrastructure capital investment and the conservative public transport demand forecast. The result is with the same level of metro project in Lima (NPV of US$ 459 million at discount rate of 6 percent, and EIRR at 8.9 percent).

14. **Sensitivity Analysis.** The detailed results for the estimated benefits are presented in Table A4.3. The results show that the following observations can be drawn from the sensitivity analysis:

1) The EIRR is more sensitive to decreased benefit than increased cost
2) NPV will become negative when benefit decreased by 20 percent
3) Lower demand by 20 percent has almost the same impact as cost overrun by 20 percent
4) The EIRR will be at 5.94 percent in the more stringent scenario

<table>
<thead>
<tr>
<th>Discount Rate at 6%</th>
<th>NPV (US$ Million)</th>
<th>EIRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change</td>
<td>547</td>
<td>7.82%</td>
</tr>
<tr>
<td>Cost overrun (cost increases by 20%)</td>
<td>126</td>
<td>6.37%</td>
</tr>
<tr>
<td>Decreased Benefit (all benefit decreases by 20%)</td>
<td>-16</td>
<td>5.94%</td>
</tr>
<tr>
<td>Lower demand for Metro (80% as forecasted)</td>
<td>71</td>
<td>6.25%</td>
</tr>
</tbody>
</table>

15. **Switching Values Test.** The Bank also carried out a switching value analysis to assess the sensitivity of the evaluation results to changes in the key variables. Switching values are presented in terms of the percentage change needed in the value of the variable to turn the project’s NPV equal to zero. Table A4.4 presents the results of this analysis at discount rate of 6 percent.

<table>
<thead>
<tr>
<th>Discount rate at 6%</th>
<th>NPV = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Cost</td>
<td>+25.98%</td>
</tr>
<tr>
<td>Project Benefit</td>
<td>-19.44%</td>
</tr>
<tr>
<td>Demand for Metro</td>
<td>-22.97%</td>
</tr>
</tbody>
</table>

16. **Combination of Sensitivity Scenarios.** By combining the sensitivity scenarios (Table A4.5), the results show that the combination of decreased benefit and increased cost will result in an EIRR of 4.66 percent, which is the scenario combination with the lowest EIRR.

<table>
<thead>
<tr>
<th>EIRR</th>
<th>Decreased Benefit (all benefit decreases by 20%)</th>
<th>Lower demand for Metro (80% as forecasted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost overrun (cost increases by 20%)</td>
<td>4.66%</td>
<td>4.89%</td>
</tr>
</tbody>
</table>
17. **Sensitivity Tests with Different Discount Rate.** The test also runs result for NPV with different discount rate (9 percent, 6 percent and 4 percent) for each sensitivity scenarios. The results show that the NPV will become negative for the no change scenario and all the sensitivity scenarios.

<table>
<thead>
<tr>
<th>Decreased Benefit (all benefit decreases by 20%)</th>
<th>4.51%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Table A4.4 NPV under Different Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate</td>
</tr>
<tr>
<td>No change</td>
</tr>
<tr>
<td>Cost overrun (cost increases by 20%)</td>
</tr>
<tr>
<td>Decreased Benefit (all benefit decreases by 20%)</td>
</tr>
<tr>
<td>Lower demand for Metro (80% as forecasted)</td>
</tr>
</tbody>
</table>

18. **The Project is expected to save 0.939 million tons of Green House Gas (GHG) for the year 2025-2049.** The Project’s impact was defined as the difference in emissions between a reference scenario ‘without-Project’ and the ‘with-Project’ scenario. The Project will reduce air pollution and GHG emissions due to optimization of the current public transport network and reduced congestion. The assessment estimated that for a time frame of 25 years (2025-2049), the GHG emissions without the Project are estimated at 99.99 million tons, compared to estimates of 99.05 million tons with the Project. Thus, the GHG emission is expected to be reduced by 0.94 million tons with the Project. The annual net reduction of GHG emissions is estimated at about 37,554 tons. The composition of the total annual net reduction of GHG emissions is as follows: the highest reduction comes from the decline in the km of SITP, followed by automobile and motorcycle.

<table>
<thead>
<tr>
<th>Table A4.5 GHG Emission Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>(million tons)</td>
</tr>
<tr>
<td>Gross GHG Emission</td>
</tr>
<tr>
<td>Net GHG Emission</td>
</tr>
<tr>
<td>Net Annual GHG Emission</td>
</tr>
</tbody>
</table>

**Project Financial Analysis**

19. **The Project is expected to have a negative Financial Internal Rate of Return (FIRR) since revenues generated by the tariff will not be enough to reimburse for the high capital costs incurred.** The FIRR in the base case is estimated to be -5.4 percent over the evaluation period of 2019 - 2049 and assuming a base fare of approximately US$0.70 equivalent (COP 2000)\(^63\), a base demand of 40,891 by 2022 with a demand growth of 4 percent until 2030 and 3 percent thereafter. This negative return is typical of mass transport projects such as this metro line. It is consequence of the very high initial investment required over a 5-year construction period.

**Financial Analysis of the Concession**

20. **The Project will be structured in a way that ensures that it is financially viable to the private concessionaire.** Using vigencias future, a subsidized stream of cashflows that does not depend on demand

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\(^{63}\) It is expected that the PLMB fare will be exactly the same as the one for TransMilenio trunk lines.
for the repayment of the CAPEX makes sense given that this would effectively be paying over time for a service already rendered (construction of the metro line) and that will generate economic benefits to the District. On the other hand, payments to the concessionaire to cover Operation and Maintenance costs, will be subject to performance criteria (Key Performance Indicators, KPIs) and probably some capped level of demand risk to provide an incentive for the operator to provide a quality service. It is expected that the concessionaire will raise long-term debt to leverage its equity return and therefore the equity returns will only materialize towards the end of the concession when the debt has already been repaid. This helps align the interest of the concessionaire with the long-term view of the Government.

Fiscal Sustainability

21. Despite the high up-front investment needed and the need for subsidies for Bogota’s Metro Line 1, the financing structure would not have a significant impact on Colombia’s fiscal position. The fiscal position of Colombia has been deteriorating in recent years with net public debt/GDP increasing to 53 percent and public-sector debt interest payments reaching 2.9 percent of GDP in 2017. Despite the recent credit downgrade by S&P to BBB- and the “negative” outlook by Moody’s, there are expectations that factors like growth, institutions and economic policy will continue to contribute to stability. The largest vigencia futura for the Nation in a single year is US$220m equivalent (in 2028), while the total commitment of vigencias futuras is US$5.3 bn. These amounts are relatively small compared to a GDP in 2017 of US$316bn.

22. The PLMB and the Project are in line with the fiscal responsibility framework for local governments in Colombia and is not expected to jeopardize the credit standing of Bogota. The total amount of vigencias futuras committed by the District is US$2.5 bn equivalent (in constant 2017 pesos). This compares with total revenues of US$5.3 bn equivalent. This additional level of obligations should be manageable given the long maturities over which they are paid. Moreover, the District’s outstanding debt was US$423 m, 2017 which yields a total debt/tax base ratio of only 14 percent. The maximum amount of vigencias futuras the District of Bogota can commit, as required by the Medium Term Fiscal Framework 2017, is (a) between 2017-2027 up to US$458 m per year, and (b) from 2028-2047 up to 0.40 percent of GDP in each year. The largest vigencia futura for the District of Bogota is around US$130m equivalent (in 2024) which still leaves room for additional vigencias futuras to be committed without breaching the statutory limit. Colombia categorizes local governments in three levels depending on their creditworthiness, which also determines to what extent the local government can borrow. Bogota ranks at the highest level. Bogota relies mainly on its own resources (COP 11.5 bn or 80 percent of revenues) with only 20 percent coming from transfers from the central government. The District also has a low level of operating and debt service expenses at COP 1.17 bn (US$413 m or 13 percent) as compared to investments of COP7.90 bn (US$2.8 bn or 87 percent), which provides more flexibility and discretionary resources in the eventuality of liquidity issues. In 2017, debt service/revenues ratio was at a low level of 1.26 percent. Bogota’s strong economy and confidence in its ambitious investment program is reflected in the credit ratings at same level as the sovereign (S&P: BBB- stable affirmed on Dec. 21, 2017; Moody’s: 

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64 A small level of demand risk with some floor and ceiling might be incorporated during the operation to incentive further catering of demand from the private concessionaire.

65 EIU Colombia Country Report Feb 2018

66 Note that the vigencias futuras are not accounted as debt, but as contingent obligations.

67 CONPES 3860 de junio de 2016 “Meta de balance primario y nivel de deuda del sector público no financiero (SPNF) para 2016”
Baa2 stable affirmed on Nov. 16, 2017; and Fitch: BBB stable on Oct. 24, 2017). These investment grade ratings, in turn, allow Bogota to obtain financing at low cost and with long maturities.
ANNEX 5: Resilience to Natural Disasters

Seismic Design

1. **Colombia is a seismically active country.** It has a large seismic risk in many areas of its territory due to its location at the boundaries of the Malpelo, Panama, Caribbean, North Andes (where most earthquakes occurred) and South American Plates along the Pacific Ring of Fire. Bogota is located according to the Colombian seismic design manual within a zone of intermediate seismic hazard; i.e the ‘peak acceleration’ (Aa) and the ‘peak velocity’ are higher than 0.1, but none exceeds 0.2.

2. **Decree 523 of 2010 defines a seismic microzonification for Bogota in relation to the seismic response that contains design spectrum for seismic return period of 31, 225 and 475 years.** Based on this information, The PLMB will be constructed using a design spectrum for a seismic return period of 1000 years.

   ![Figure A5.1: Seismic Map around the alignment of the PLMB](image)

   **Notes:** Source “Estructuración técnica del tramo 1 de la PLMB; ESIA.

3. **The seismic considerations of the design are as follows:** (i) Operational seismic considerations of elevated structures between stations (a likelihood of exceeding in 75 years with a T of 109 years) and elevated structure at stations (a likelihood of exceeding of 80 percent in 50 years and a return period of 32 years); (ii) maximum seism, which has been based on level of service (significant alteration, even disruption for elevated structure between stations), damage (significant but no collapse for elevated structures at station), elevated structure between stations (likelihood of exceed of 7 percent in 75 years and a return period of 1000 years) and elevated structure at station (likelihood of exceed of 10 percent in 50 years and a return period of 475 years); and (iii) horizontal design spectrum, for the elevated structure between stations, a design spectrum exercise has been used for a T 1000 and for the elevated structure at stations, the values form Decree 523 have been considered.

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68 It is considered an essential facility. Essential Facilities” are those of vital roles for the community that shall continue operating during and after a seismic event. For these facilities, the Colombian Norm for buildings (NSR-10) provides an amplification factor which affect the ground motion parameters defined based on a return period of 475 years.
4. The PLMB seismic design uses both Colombian and International Standards applicable to Ecuador. For the design of the elevated structure CCP-2014 and AASHTO 2007 (1000 years) have been used, that is higher than the requirement of the EC8 (475 year). For the stations, it is recommended to do an analysis for return period of 1500 for elevated structure and 2500 for stations.

5. In conclusion, two design events were considered for the PLMB: (i) maximum design event (MDE); and (ii) operating design event (ODE). Therefore, the metro system will be operating during and after the ODE (100 years for the viaduct between stations) and (32 years for viaduct in the station). For the MDE, the structure will not collapse in 1000 years (for the viaduct between stations this return period was considered, and for stations and viaduct at station, as the ground motion parameters were amplified by 1.5, it may satisfy the return period of 1000 years).

6. Finally, it is recommended that EMB install a seismic monitoring system, as this is an important element of seismic hazard reduction. This would constitute an early detection and alarm system for earthquakes that detects P-wave. This monitoring system will need to go hand in hand with a protocol system aligned with the range of the wave detected.

Train Evacuation

7. The current emergency train evacuation system is to be done through lateral doors, along a pedestrian walkway of 1 m within the elevated structure. This has been identified as a potential risk, due to the number of passengers that should be evacuated at peak time (1800 passengers) and the width of the walkway (1 m). As the electrical supply to the train will be done through the third rail, electrocution in case the track level is invaded by passengers during the emergency evacuation needs to be carefully considered. For instance, protection of electrocution of the third rail, modifications to be done to the trains and equipment to have the evacuation at track level, and the platform to be filled and leveled to avoid obstacles that could disrupt the evacuation along the track level, all could be considered.

Rail yard

8. The rail yard has been designed to keep the 2050 fleet and to maintain the 2030 fleet. It has prevision of extension to maintain the flea of 2030. The rail yard has an extension of 32 Ha close to the Bogota River. There is already a protection dike of 4 m height for a return period of 500 years. The rail yard will be filled at a level that it will be protected for an event in a return period of 1000 years.
ANNEX 6: Mobility in Bogota

I. The Challenges of Urban Mobility in a Highly Congested City

1. **Bogota is Colombia’s economic hub but also one of the most unequal cities in the country.** The District of Bogota covers 341 km² of urban land and has more than 8 million residents (2017), making it one of the densest cities in the world. It is Colombia’s economic and political capital as well as its largest city. In 2016, Bogota accounted for more than a quarter of the country’s GDP. Although nation-wide poverty has decreased steadily in the past decade, the city’s poverty rate has increased during the last five years (11.6 percent in 2016). Bogota is also the most unequal of Colombia’s large cities with a Gini coefficient of 0.499 in 2016, well above Medellin and Cali’s (0.478 and 0.476, respectively). Inequalities are reflected in the urban space. Bogota’s population is divided unequally between its 113 urban planning units (*Unidades de Planeamiento Zonal*, UPZ), with density ranging from 56,000 persons/km², usually in lower income areas, to other generally higher-income areas with a density between 6,000-15,000 persons/km². The city tends to have a North-South divide, with higher-income and higher-skill individuals sorting in the Northern parts of the District.

2. **Unplanned city growth, heavy congestion and pollution are among the main challenges concerning mobility in Bogota.** The population distribution has not developed because of careful planning of urban land uses and services, and as a result, the District faces important challenges due to uncoordinated urban expansion and traffic congestion, particularly as the public transport system has not been capable of keeping up with demand. Congestion costs in Bogota are estimated to be close to 0.5 percent of the District’s annual GDP (Bocarejo 2015). Severe congestion taxes public transit users. In 2015, the average trip by *TransMilenio* (TM), the District’s flagship Bus Rapid Transit (BRT) system was close to an hour, particularly hampered are the users of the city’s zonal buses of the Integrated Public Transit System (SITP). In 2015, the commercial speed of the almost 5 million daily trips made in buses running in mixed traffic was only 13km/hr. These negative externalities are regressive as they disproportionately affect the poor who spend more on transport and rely more heavily on public transit. For instance, in 2014, households in the poorest areas of the District spent up to 6 times more of their monthly income on transport than those in richer areas, and their employment accessibility worsened. With an additional 2.5 million people projected in the region over the next four decades, policy makers and planners are increasingly looking at longer-term development and redevelopment of the urban fabric in order to achieve regional sustainability (Suzuki et al. 2013). More efficient public transportation is vital to enhance mobility, access to opportunities, and productivity in Bogota. This operation supports the

69 Nationally, it is the third most unequal city in terms of income as measured by the Gini coefficient, behind Quidbo and Riohacha (DANE 2016).

70 *Interview with Juan Pablo Bocarejo (October 2015), pri.org*

71 In general, the zonal buses of the SITP, which caters to 70 percent or close to 5million of Bogota’s transit trips, has not significantly improved the employment accessibility of users; in some cases, such as in the southern periphery of the city, where many poor people live, accessibility has worsened from pre-SITP reform (before 2011). This is largely due to low commercial speeds due to congestion in mixed traffic, the long routes and low frequencies of the new system, the complexity of the route nomenclature and services offered, the lack of smartcard selling points and recharge network. (Rodriguez et al. 2015, TRR Paper number 16-4349).

72 The poorest households spend close to a quarter of their monthly income on transport and the employment accessibility of some of Bogota’s poorest areas, particularly the southern periphery (the locality of Usme and parts of Ciudad Bolivar) has seen their employment accessibility dented (decrease in the number of employment opportunities that can be reached within 60 minutes) due to increased congestion and the reforms introduced by the SITP; Rodriguez et al. 2015, TRR Paper number 16-4349.
District into becoming more equitable, greener and accessible to fully tap into its agglomeration economies, and provide equal opportunities to all its residents.

II. An Integrated Public Transport System & a Metro for Bogota

3. Until the end of the 1990s, Bogota’s public transportation was characterized by an over-supply of buses that led to high congestion, low vehicular safety and low-quality service. Before the 2000s, all public transportation in Bogota was operated under a scheme under which bus companies owned the routes granted by them to the District, but were not required to own the bus fleet. They instead rented out to private bus owners the right to operate certain routes, leading the latter to compete for increased revenue and higher wages, irrespective of demand patterns. The incorporation of buses beyond those required to serve the market led to excessive competition, locally known as the penny war (guerra del centavo), because drivers literally fought for each prospective passenger (Rodriguez et al. 2017).

4. The TransMilenio was followed by a city-wide reform process started in 2010 to formalize and regulate the remaining bus-based transit services. In late 2010, Bogota embarked on a city-wide reform process aimed at formalizing and regulating the remaining bus-based transit services (70 percent of the city’s public transit trips), under similar competitive concession arrangements for service provision that were implemented under TM. This reform was aimed at implementing a hierarchically integrated public transit system (Sistema Integrado de Transporte Publico or SITP), where the BRT and traditional zonal buses (Transporte Publico Colectivo, TPC) would integrate in terms of operation, infrastructure and fare systems, and in the future with any other mass transit mode to be implemented, such as a metro line. From an operational perspective, the SITP required the reorganization and optimization of the traditional bus systems so that a multimodal integrated system could operate. The new Operational Design entailed a revision of the total number of routes, its timetables, headways and fleet type so that demand could be served in a more efficient manner. As a result, the District’s nearly 700 bus routes and more than 16 thousand traditional urban buses were transformed into 450 routes, a fleet of almost 10 thousand buses, 6,700 stops and 4,600 smartcard recharge points (Rodriguez et al. 2017). Under this scheme, zonal buses are paid on the basis of the number of fleet in operation, cost/km logged and passengers carried, over a 24-year concession period. Bogota opted for a gradual implementation of the SITP, and as of early 2017, 85 percent of the system has been implemented. Currently, the SITP transports 60 percent of the District’s public transport trips.

5. Delays in finalizing the SITP, coupled with increasing travel demand, have led to a saturation of the public transport system of Bogota, with a deterioration in the level of service and an increase in private travel mode. Implementation of the SITP has been slower than planned. While it should have been completed by the end of 2013, only 85 percent of the system has been implemented. As a result, bus operating companies are facing financial constraints that are directly impacting the financial sustainability of the system. This has led to the proliferation of illegal transport, and the quality of the service has been impacted (Rodriguez et al. 2017). The increase in travel demand also pushed for a

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73 The arrangement induced bus owners to compete in the streets against other buses, irrespective of demand patterns, as their revenue and the wage of the bus driver was directly proportional to the number of passengers carried. At the same time, bus companies also have the incentive to lure as many buses as possible to operate their routes.

74 Two operators (Egobus and Coobus) that represented the bulk of incumbent bus owners from the traditional system, and almost 25 percent of the SITP’s demand were facing imminent bankruptcy; the District has decided to proceed with the termination of their contracts (Rodriguez et al. 2017).
deterioration of the overall service of the public transport network. In 2015, 45 percent of the almost 12.5 million daily trips in the District were done using the public transport system. Yet, the latter faces numerous shortcomings. For instance, the number of passengers of TransMilenio’s Avenida Caracas corridor reached 56,000 p/h/d (passenger per hour per direction) in 2016, exceeding its capacity of 45,000 p/h/d. The average speed of zonal buses in mixed traffic lanes decreased from 19.2km/h in 2010 to 18km/h in 2015. Passenger Satisfaction Surveys have shown that crowded stations, service interruptions and increased waiting times due to longer boarding and alighting, as well as security and safety concerns for women and vulnerable groups are the main challenges. At the same time, the trips by private mode increased 18 percent from 2011 to 2015, with motorcycle trips almost doubling due to their flexibility and affordability.

6. **The PLMB will be part of a hierarchically-integrated public transit systems (HITS).** As mentioned, together with the metro the District authorities are also planning to expand its mass transit network with 6 new TransMilenio trunk corridors, finalize the operational redesign of the SITP zonal buses, renew public spaces around metro stations to favor pedestrian, and build 100km of new bicycles lanes, so that all public transit is embedded within a multimodal and hierarchically integrated system. The objective is that by 2050 anyone living in Bogota will be able to find a mass transit corridor within a one-kilometer catchment area. To this aim, integration is being reinforced in several fronts. First, the design of stations includes direct connection to TransMilenio stations (10 out of 16 stations will have a physical integration). Second, the Metro fare is expected to be integrated with the rest of the system, at a fare level equal to that of TransMilenio, with free transfers between zonal, TransMilenio and Metro, and implemented through a smartcard that is interoperable with the current (“Tu Llave”), already working across the entire network.

7. **More than 70 years in the making, the realization of the first metro builds on the long-term engagement of the World Bank in the transport sector in Colombia and Bogota.** The first metro line for Bogota was conceived in 1942 but several proposals failed to materialize throughout the 20th century due to lack of political alignment between the GoC and the District, and financial constraints. The World Bank has been a strategic partner to Colombia’s Public Transport reforms since the mid-1990s, and has been actively involved in urban mobility in Bogota for more than three decades. Support to the sector started under the National Program of Urban Transport (PNTU) which focused on the development of the BRT in Bogota and subsequently, throughout Colombia’s largest cities (Bogota, Barranquilla, Bucaramanga, Cartagena, Medellin y Pereira). Bogota Urban Services Project (BUSP) in 2003, is the first of a series of engagements that accompanied the District in the initial conceptual studies and engineering designs for the PLMB. Under the BUSP, the Bank supported financing of the metro’s conceptual design study; an Additional Financing supported the metro’s detailed engineering design; and several technical assistances embedded in Productive and Sustainable Cities Programmatic Knowledge Services have supported Bogota’s SITP. The engagement has been ongoing under different mayoral administrations, which has positioned the WB as a strategic and long-term partner in the urban transport sector.

8. **The PLMB is embedded within a major overhaul of Bogota’s public transport system.** The administration is also committed to build at least six more TransMilenio BRT corridors to consolidate the District’s mass transit network so that by 2050 anyone living in Bogota will be able to find a mass transit corridor within a one-kilometer catchment area. To further strengthen the SITP, the administration is pursuing initiatives to promote walking and cycling, such as the construction of more than 100km of new bicycle lanes, the upgrading of public space around new mass transit corridors, and strategies to make
walking and cycling safer and more secure. Bogota is also currently building its first cable line system that will improve accessibility of low income areas, and will be fully integrated to the SITP. Currently, the District is carrying out the operational redesign of the SITP zonal buses, to further integrate them with the mass transit system under a more robust trunk feeder network. Lastly, it is considering other initiatives to curb car use, including adding some flexibility to the current license plate restrictions so households are dissuaded to buy a second car, place strict enforcement and fines to street parking, raising parking fees, and taking away car space for further bicycle lanes and public space.

III. Characterizing Mobility in Bogota: Key Issues & Trends

9. This last section provides a detailed characterization of mobility trends in Bogota, and some of the main challenges.75

A. Overall Trends

10. **Motorized transport increased significantly between 2011-2015, but public transport remained the preferred mode for commuting (45 percent of daily trips).** There were close to 12.7 million daily trips in Bogota in 2015. The modal distribution (Figure A6.1) shows a prevalence of public transport which represented 45 percent of total daily trips followed by non-motorized transport and private vehicles. Compared to 2011, there was an increase of almost 1.2 million daily trips, with the main modal changes being an increase in the use of private vehicles by 22 percent and of public transport by 21 percent, as well as a decline in non-motorized transport by 12 percent. The latter was led by a significant reduction in pedestrian trips (18 percent), despite an increase in bicycle usage by 30 percent (4.5 percent of trips overall). Regarding private modes, trips by private cars only marginally increased (1 percent), with the largest increase being in the number of motorbike trips (104 percent since 2011).

11. **Increases in TransMilenio and SITP explained most of the gains in Public Transport; TransMilenio is operating well beyond its capacity.** Within public transport, the main gains were in the SITP, for which the total number of trips with respect to 2011 registered a 129 percent increase; and in TransMilenio, were the number of trips increased by 49 percent – partly generated by the new trunk lines (Calle 26 and Soacha). The total number of trips in TM was 717 million in 2015, an increase of 14 percent

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75 This next section is mostly based on the latest Encuesta de Movilidad (2015) of the Secretaria Distrital de Movilidad (Figures A6.1; A6.2) The report is carried out together with the Chamber of Commerce of Bogota and the University of Los Andes.
year-on-year (y/y). Trips in zonal buses also registered an important increase, by 84 percent (y/y) to 417 million, which corresponds to an accumulated increase of 72 percent since start of operations in 2013. While TM carries 36 percent of all trips in Public Transport, the system is well above its capacity. At peak hour TM mobilized 273,000 passengers, with the Caracas-Autopista segment mobilizing up to 62,000 passengers (p/h/d) at peak hour. This corresponds an overall increase of 17 percent y/y.

12. **Travel times in public transport increased and overall satisfaction declined.** The average speed of public transport decreased significantly since 2011, from 19.2km/h to 16.6km/h in 2015. This is reflected in increasing average travel times. For traditional public transport (TPC)\(^76\), the average travel time was 66 minutes in 2015, while in the SITP the average was close to an hour with that of zonal buses at the upper-tail of the distribution (68 minutes) and increasing almost 10 minutes from 2014 (Figure A6.2). Travel times in TM increased almost as much with average times moving close to one hour and increasing by 13 percent y/y in 2015, due to an increase in ridership and construction works for the remodeling of some stations. Passenger Satisfaction Surveys have reflected the decline in quality with 25 percent of users complaining about the crowding of stations and buses in TM, as well as about a decline in personal safety, specifically that of women. Overall, 25 percent of TM users find the service below average, the number being higher for users of TPC and SITP at 46 and 31 percent, respectively.

B. **Specific Issues**

13. **Road safety.** Road safety has improved in recent years but important challenges remain. Regarding road safety, there were 31,333 road accidents in Bogota in 2015, of which 36 percent included injuries or fatalities. While there was an overall decline of close to 7 percent in the number of accidents with respect to the previous year, 2015 witnessed the largest number of accidents with at least one death since 2009. The vast majority of deaths were pedestrians (48 percent). Overall, the death rate of accidents every 10 thousand inhabitants and every 10 thousand vehicles still declined with respect to 2014 both by less than one percentage point (pp), from 7.92 to 6.99 and from 3.25 to 2.56, respectively. Road safety is a major concern in Bogota. A new public media campaign was launched in October 2017 focusing on reducing speeds, particularly in school zones. The campaign will be coupled with increased enforcement efforts to support behavioral change, and reflects the focus of the District in improving the quality of the urban space.

14. **Pollution.** Despite important efforts to curb pollution, almost half of 2015 registered levels of pollution above the allowed levels.\(^77\) There has been a clear deterioration in the quality of air in Bogota in the past decade due to the significant growth in private vehicle users. Total GHG emissions are

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\(^{76}\) The traditional public transport refers to the remaining bus lines of the Transporte Public Colectivo that have not been formalized yet and integrated within the SITP.

\(^{77}\) Reporte de Movilidad 2015.
estimated to have been close to 12 million tons per year in 2012 (latest data on Co2), of which 38 percent were from transport. The District registered nonetheless a decline in pollution in 2015 when measured by particulate material: the average concentration of particulate material declined by 16 percent y/y. Overall, the levels remain very high with 1/3 of total days in that year exceeding the maximum level allowed of particulate material PM10 and 19 percent of days exceeding the maximum level allowed for Ozone (8h) [ppm], for a total of 176 days in the year with any contaminant above the allowed levels. This deterioration has happened despite the important efforts by the District to curb pollution through investments in public transit and green initiatives. For instance, TransMilenio could generate significant carbon revenue through the sale of both Voluntary Emission Reductions (VERs) in Phase I, and Certified Emission Reductions (CERs) since Phase II. This earned TM the distinction of becoming the world’s first mass transit project registered with the UNFCCC for Cleaned Development Mechanisms credits in 2006. The sale of the CERs was used to provide additional funding for bus purchases; and TM is credited with important declines in pollutants (Turner et al. 2012). These efforts are still ongoing, and include tree planting in stations, concepts that will be integral parts of the PLMB.

15. **Gender.** Security issues create a significant burden on women’s mobility. The lack of personal security, or the inability to use public transport without the fear of being victimized—either while traveling on board a public transport mode, walking to or from the transit facility or stop, or waiting at a bus, transit stop, or station platform— can substantially decrease the attractiveness of public transit (World Bank 2017). According to a recent report by the Thomson Reuters Foundation, 60 percent of women in major Latin American cities report that they have been physically harassed while using transport systems. The issue is particularly important in Colombia, and Bogota specifically. In 2014, Bogota was classified as having the second most dangerous transport system for women in the world (Thomson Reuters Foundation 2014 as reported by IADB 2016). Not only do women face specific barriers in public transport, they accordingly have very different commuting behaviors. For instance, only 1 percent of women used bicycles for commute in Bogota against 5 percent of men; and walked disproportionately more (51 percent vs. 39 percent) (IDB 2016). These constraints are important in that they limit the size of their accessible labor market; low-income women are particularly more vulnerable. The Project will pay particular attention to enhance security for women in the PLMB in as outlined in Annex 3, by designing gender-informed stations and supporting the development of action protocol for metro staff members to intervene in cases of sexual harassment.78

16. **Urban Poor.** The urban poor in Bogota spend 6 times more than affluent households in transport, and their average daily travel times are almost double. The urban poor rely heavily on public transport for commuting. Without fast, secure, and affordable mass transport, the urban poor are typically forced to walk to work, which is time consuming and limits their job search radius. A lack of security in the public transit system may also limit the labor market participation and job search radius, particularly for women (World Bank 2017). According to the last census (2011), 66 percent of households in Bogota belonged to the lowest income ranges. Most of these households lived in the periphery of the city, in the southern and western parts, and spent on average between 20 to 28 percent of their monthly income on transport, well above the international levels of affordability set at 15 percent (Rodriguez et al. 2016). Further, lower-income trip makers spent almost double the travel time than those in the upper-tail of the income distribution: for those in the bottom income quintile travel times were on average 77 minutes vs. 40 minutes for those in the highest (Rodriguez et al. 2016). Increasing accessibility and

affordability of public transport is one of the main objectives of the public transport reforms carried out since TransMilenio and the SITP, as well as with the future construction of the PLMB.

17. The PLMB will make significant improvements in road safety, pollution, female and low-income households' accessibility. These gains are estimated in the cost-benefit analysis in Annex 4, and constitute important advances for improving sustainability and equity concerns in the city.

References

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