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Report No: PADHI00560

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT
ON A
PROPOSED LOAN

IN THE AMOUNT OF US$100 MILLION

TO THE

PROVINCIAL DECENTRALIZED AUTONOMOUS GOVERNMENT OF GUAYAS

FOR THE

ECUADOR GUAYAS: RESILIENT RURAL ROADS PROJECT

August 21, 2024

Transport Global Practice
Latin America And Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective {Aug 06, 2024})

Currency Unit = US DOLLAR

FISCAL YEAR
January 1 - December 31

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ABBREVIATIONS AND ACRONYMS

AADT	Annual Average Daily Traffic
AFS	Annual Financial Statements
CERC	Contingency Emergency Response Component
CGO	Comptroller General's Office
CPF	Country Partnership Framework
CREMA	*Contrato de Rehabilitación y Mantenimiento* (Rehabilitation and Maintenance Contracts)
EIRR	Economic Internal Rate of Return
ENCC	*Estrategia Nacional de Cambio Climático* (National Climate Change Strategy)
ESF	Environmental and Social Framework
ESMP	Environmental and Social Management Plan
FM	Financial Management
GADPG	Provincial Decentralized Autonomous Government of Guayas
GBV	Gender-based violence
GDP	Gross Domestic Product
GHG	Green House Gases
GRS	Grievance Redress Service
GRSF	Global Road Safety Facility
HIV/AIDS	Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome
IDB	Inter-American Development Bank
INEC	*Instituto Nacional de Estadística y Censos* (Ecuadorian Institute of Statistics and Census)
IPF	Investment Project Financing
M&E	Monitoring and Evaluation
MAATE	*Ministerio del Ambiente, Agua y Transición Ecologica* (Ministry of Environment, Water, and Ecological Transition)
MEF	*Ministerio de Economia y Finanzas (*Ministry of Economy and Finance)
MFD-EP	Maximizing Finance for Development – Enabling Project
MTOP	*Ministerio de Transporte y Obras Públicas* (Ministry of Transportation and Public Works)
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions
NMT	Non-Motorized Transport
PAD	Project Appraisal Document
PDO	Project Development Objectives
PEU	Project Execution Unit
PoG	Provincial Decentralized Autonomous Government of Guayas
POM	Project Operational Manual
PPSD	Project Procurement Strategy for Development
RAMS	Road Asset Management System
RAP	Resettlement Action Plan
RSSAT	Road Safety Screening and Appraisal Tool
SEAH	Sexual Exploitation, Abuse, and Sexual Harassment
SEP	Stakeholder Engagement Plan
SGP	S*istema de Gestión Pública* (Accounting and Budgeting System)

SIGEF	*Sistema Integrado de Gestión Financiera* (Integrated Financial Management System)
STEM	Science, Technology, Engineering, and Mathematics
VOC	Vehicle Operating Costs
UA	Universally Aligned
WB	World Bank
WHO	World Health Organization
WRI	World Resources Institute

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DATASHEET

BASIC INFORMATION

Project Beneficiary(ies)	Operation Name		
Ecuador	Ecuador Guayas: Resilient Rural Roads		
Operation ID	Financing Instrument	Environmental and Social Risk Classification	
P504400	Investment Project Financing (IPF)	Substantial	

Financing & Implementation Modalities

[ ] Multiphase Programmatic Approach (MPA)	[✓] Contingent Emergency Response Component (CERC)
[ ] Series of Projects (SOP)	[ ] Fragile State(s)
[ ] Performance-Based Conditions (PBCs)	[ ] Small State(s)
[ ] Financial Intermediaries (FI)	[ ] Fragile within a non-fragile Country
[ ] Project-Based Guarantee	[ ] Conflict
[ ] Deferred Drawdown	[ ] Responding to Natural or Man-made Disaster
[ ] Alternative Procurement Arrangements (APA)	[ ] Hands-on Expanded Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
13-Sept-2024	31-Dec-2029
Bank/IFC Collaboration	
No	

Proposed Development Objective(s)

The Project Development Objectives (PDO) are to improve resilient, sustainable, and safe road connectivity in rural areas of the Province of Guayas and, in case of an Eligible Crisis or Emergency, respond promptly and effectively to it.

Components

Component Name	Cost (US$)
Rural Road Construction and Rehabilitation	93,500,000.00

Project Management and Capacity Building	6,500,000.00
Contingency Emergency Response Component (CERC)	0.00

Organizations

Borrower:	Provincial Decentralized Autonomous Government of Guayas
Implementing Agency:	Provincial Decentralized Autonomous Government of Guayas

PROJECT FINANCING DATA (US$, Millions)

Maximizing Finance for Development

Is this an MFD-Enabling Project (MFD-EP)? Yes

Is this project Private Capital Enabling (PCE)? No

SUMMARY

Total Operation Cost	**100.25**
Total Financing	**100.25**
of which IBRD/IDA	**100.00**
Financing Gap	**0.00**

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	100.00

Non-World Bank Group Financing

Counterpart Funding	0.25
Borrower/Recipient	0.25

Expected Disbursements (US$, Millions)

WB Fiscal Year	2025	2026	2027	2028	2029	2030

Annual	5.00	20.00	22.00	25.00	25.00	3.00
Cumulative	5.00	25.00	47.00	72.00	97.00	100.00

PRACTICE AREA(S)

Practice Area (Lead)

Transport

Contributing Practice Areas

CLIMATE

Climate Change and Disaster Screening

Yes, it has been screened and the results are discussed in the Operation Document

SYSTEMATIC OPERATIONS RISK- RATING TOOL (SORT)

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

POLICY COMPLIANCE

Policy

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

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

ENVIRONMENTAL AND SOCIAL

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

E & S Standards	Relevance
ESS 1: Assessment and Management of Environmental and Social Risks and Impacts	Relevant
ESS 10: Stakeholder Engagement and Information Disclosure	Relevant
ESS 2: Labor and Working Conditions	Relevant
ESS 3: Resource Efficiency and Pollution Prevention and Management	Relevant
ESS 4: Community Health and Safety	Relevant
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant
ESS 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
ESS 8: Cultural Heritage	Relevant
ESS 9: Financial Intermediaries	Not Currently Relevant

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

LEGAL

Legal Covenants

Sections and Description
The Borrower shall: (a) maintain at all times during implementation of the Project, a project execution unit with functions, responsibilities and resources, and staffed with personnel exclusively dedicated to the Project in number and with qualifications, experience and functions acceptable to the Bank, including, inter alia, (i) a project coordinator, (ii) three civil engineers, (iii) a social specialist, (iv) an environmental specialist, (v) a procurement specialist, (vi) a financial management specialist, (vii) a monitoring and evaluation specialist, (viii) a legal expert, and (ix) a road safety expert, all in number and with terms of reference and qualifications acceptable to the Bank all as further specified in the Operational Manual; and (b) without limiting the generality of paragraph (a) above, no later than forty-five (45) days

after the Effective Date, contract for or appoint the financial management specialist, the procurement specialist, the social specialist, and the environmental specialist. (Section I.A.1 of Schedule 2 to the Loan Agreement)

Conditions

Type	Citation	Description	Financing Source
Effectiveness	Section 4.01 of the Loan Agreement	The Operational Manual has been prepared and adopted by the Borrower in form and substance satisfactory to the Bank. (Section 4.01 of the Loan Agreement)	IBRD/IDA
Disbursement	Section III.B.1(a) of Schedule 2 to Loan Agreement	For payments made prior to the Signature Date; except that withdrawals up to an aggregate amount not to exceed $20,000,000 may be made for payments made prior to this date but on or after March 23, 2024, for Eligible Expenditures under Category (1), provided that an environmental and social compliance assessment has been carried out with respect to such Eligible Expenditures in accordance with the ESCP and in form and substance satisfactory to the Bank. (Section III.B.1(a) of Schedule 2 to Loan Agreement)	IBRD/IDA
Disbursement	Section III.B.1(b) of Schedule 2 to Loan Agreement	For Emergency Expenditures under Category (3), unless and until all of the following conditions have been met in respect of said expenditures: (i) (A) the Borrower has determined that an Eligible Crisis or Emergency has occurred,	IBRD/IDA

		and has furnished to the Bank a request to withdraw Loan amounts under Category (3); and (B) the Bank has agreed with such determination, accepted said request and notified the Borrower thereof; and (ii) the Borrower has adopted the CERC Manual and Emergency Action Plan, in form and substance acceptable to the Bank. (Section III.B.1(b) of Schedule 2 to Loan Agreement)	

I. STRATEGIC CONTEXT

A. Country Context

1. **Ecuador's government is grappling with a trilemma number of challenges: an unprecedented security crisis, fragile public finances, and sluggish economic growth.** In 2023, Ecuador's homicide rate more than doubled, becoming one of the highest in the region, which led to the declaration of a state of internal armed conflict in January 2024. Climate events and historically low investment in the electricity sector caused widespread electricity rationing in the last quarter of 2023. Amid these challenges, snap elections resulted in a fragmented National Assembly and an interim government with an 18-month mandate. When this government assumed office in November 2023, it faced a challenging fiscal situation caused by budget rigidities, spending pressures due to the El Niño weather phenomenon and the security crisis, declining oil prices and production, legislative demands in a political unstable environment, and a slowing economy. Economic growth has been tepid at 2 percent over the last decade, which compounds the difficulty of addressing a sustained structural central government's fiscal deficit amid unmet social demands. Adding to the fiscal and growth challenges, a referendum in August 2023 mandated the cessation of oil extraction in the Yasuní National Park by the end of August 2024, affecting one-tenth of the national oil production, a key source of fiscal revenues and foreign reserves. President Noboa acted decisively following a series of violent, highly visible gang-related attacks, which bolstered his popular support and enabled him to push for stringent anticrime measures through a referendum. However, voters rejected other reforms that could have spurred growth, such as the legalization of hourly contracts and the international arbitration of commercial disputes.

2. **Ecuador ranks among the top 10 countries facing the highest Natural Hazard risk in the region and is listed among the top 20 in the WorldRiskIndex 2022.** This vulnerability stems from its exposure to a range of geological and hydrometeorological threats, including earthquakes, volcanic eruptions, floods, and droughts. The recurrent occurrence of climate extremes not only poses a direct threat to the well-being of Ecuador's population but also exerts pressure on the country's economy. One of the most affected sectors is transport, where the repercussions of connectivity loss due to these natural events extend beyond individual users to impact overall economic growth. Approximately 52 percent of the national road network lies in areas prone to landslides, posing a significant threat to the integrity of the road network. Hydrometeorological hazards compound these risks, with 46 percent of major roads situated in flood-prone areas, covering 450 kilometers in regions at substantial risk of flooding. Considering projections indicating an intensification of such events due to global climate change, Ecuador's vulnerability to disasters is expected to escalate in the coming years.

3. **Latin America and the Caribbean stand out as the most urbanized developing region globally, yet in Ecuador, a notable 37 percent of the population resides in rural areas, for which subnational governments are responsible.** The National Institute of Statistics and Census (INEC) underscores a concerning trend, revealing that the poverty rate in these rural zones in the country has risen to 46 percent, compared to the country average of 27 percent.[1] Agricultural, livestock and fishing activities accounted for 69.8 percent of rural jobs; however, figures from the INEC show that 71.3 percent of rural employment is inadequate (without social security and adequate conditions), and 20 percent of rural work is unpaid.[2] This is due to the production scheme of family agriculture. A primary

[1] INEC, 2023.
[2] *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), Anual 2022 (INEC, 2023).

obstacle hindering rural communities' access to essential services and impeding economic development is the lack of road infrastructure and its insufficient maintenance. For farmers, low accessibility constrains the ability to get the best prices for their produce, increases the cost of transport of inputs e.g., seeds, fertilizers, farm implements, and leads to unnecessary loss and waste of produce when it cannot be picked up or delivered on time.

4. **Guayas, one of the 24 provinces of Ecuador, stands out as a vital economic, agricultural, and industrial center, the largest contributor to Ecuador's economy, accounting for 30 percent of the country's GDP[3].** Recognized for its important agricultural activities, such as the cultivation of bananas, cocoa and other products, Guayas contributes significantly to the country's economic landscape. Its capital, Guayaquil, is Ecuador's most populous city and a crucial economic and commercial center. With one of the most important ports in Latin America, the seaport of Guayaquil, the province plays a fundamental role in facilitating international trade and connecting Ecuador to the global market. In addition, Guayas is one of the main sources of rice and corn production, from where these products are transported to other coastal and highland areas for consumption and distribution.

B. Sectoral and Institutional Context

5. **Transportation plays a pivotal role in the development of the Ecuadorian economy, and addressing sector challenges is key for promoting equality, improving access to markets and social opportunities, ensuring road safety, and enhancing the overall well-being and health of the Ecuadorian population, especially in rural areas.** Transport corresponds to US$5.3 billion or 7.3 percent of the country's GDP in 2019 and employment generation; however, it is one of the sectors most affected by natural disasters impacting overall economic growth. The sector is a linchpin for employment generation, with construction accounting for 7 percent of job creation, closely followed by trade and transport. Serving as the foundation for numerous economic and social interactions, the limitations in transport infrastructure pose a substantial challenge to equality and hinder access to opportunities. Despite 63 percent of the population residing in urban areas, the Rural Accessibility Index (RAI) reveals a stark reality — only 52 percent of the rural population lives within a proximity of two kilometers to a primary or secondary road. This stark contrast underscores the pressing need for improved accessibility in rural regions to ensure that economic and social opportunities are not geographically constrained. The economic repercussions of inefficient transport systems further exacerbate these challenges. Moreover, the impact of transport and mobility on advancing human capital agendas in education and health cannot be overstated. In health, limited accessibility directly contributes to higher mortality rates due to difficulties in securing health care on time. In education, compromised accessibility hampers the regular presence of both students and teachers in schools, fostering conditions that lead to school dropouts. Additionally, food security is significantly impacted by the inadequate rural road infrastructure and connectivity.

6. **In Ecuador, the provinces are responsible for the provincial road system.[4]** Provinces, adhering to national regulations, possess the mandate to plan, construct, and administer the provincial road network while the Ministry of Transport and Public Works (MTOP) holds oversight over the national transportation sector. The Provincial Decentralized Autonomous Government of Guayas (PoG) has championed the Guayas Road Plan (2017). The primary objectives of the Road Plan are to elevate the quality of service within the provincial road system; ensuring its optimal functionality; enhance provincial competitiveness by curbing transportation costs and

[3] *Cuentas Nacionales Anuales. Banco Central del Ecuador*, 2022.

[4] Resolution CNC - 009 – 2014. Other laws and codes that complement this resolution are as follows: Organic Code of Territorial Organization, Autonomy and Decentralization (COOTAD) of 2010, and Law of the National System of Road Infrastructure for Terrestrial Transportation of 2017.

reducing travel times; facilitate greater accessibility and internal cohesion, thus promoting social inclusion; mitigate the environmental impact of the provincial road system; and elevate safety standards across the province.

7. **Guayas' road network spans 7,302.06 km and features 249 bridges; however, they are deteriorating due to limited investments, lack of an adequate road asset management, and increasing vulnerability to natural disasters.** At the core of this transportation network is the E25 Coastal Highway, a vital artery that traverses the province from north to south, complemented by connecting branches linking Guayas to Azuay, Los Rios, Manabí, and Santa Elena provinces. The state road network has a length of 882.49 km, and the provincial network is 6,419.57 km, which are essential for transporting local, regional, and national production to markets, as well as for facilitating the movement of people engaged in various activities. Within the province, economic-productive activities are intricately woven into the road network, with 83.15 percent dedicated to agricultural sectors, 13.65 percent to livestock sectors, 2.46 percent to the tourism sector, 0.68 percent to the fishing sector, and 0.06 percent to shrimp farming. The condition of the roads in the provincial network is classified as follows: 22 percent in good condition (1,410.95 km), 66 percent of the roads are in fair condition (4,24633 km), and 12 percent are in poor condition (762.30 km). The type of material used in the roads is gravel with 79.37 percent; flexible asphalt with 11.32 percent; earth with 9.29 percent, and rigid asphalt with 0.02 percent.[5] The condition of the province's road network has raised concerns due to its deterioration, which has been aggravated by heavy rains during the 2022-2023 winter season. This deterioration is closely correlated with inadequate investment and maintenance of transportation infrastructure, and the lack of a road asset management system within the PoG. Out of the entire 15,900 km2 area within the province, 58.8 percent is susceptible to 10-inch floods, while a staggering 93.5 percent is characterized by a high seismic hazard (see Annex 4). These floods have a significant impact on the population, causing temporary displacement, damage to infrastructure, economic losses, and risks to public health. In the winter season of 2024, 7,000 people have been affected and 2,047 homes have been damaged due to the rains so far.

8. **Transport is, second to land-use change, the largest contributor to GHG emissions in Ecuador, and the only sector with an upward trend.** The transport sector has experienced a significant increase in its share of national emissions in the last decade, rising from 11.12 percent in 2009 to a share of 20.9 percent of all emissions in 2019. This increase alone has accounted for 57 percentage points of the total increase in GHG emissions in the country from 2013 to 2019.[6] This sector in the country produced 25,850,111 tons of CO2 in 2022, of which 21 percent of the emissions were produced in the territory of Guayas. One of the main contributing factors to this rise is the fact that the number of registered vehicles in the country more than doubled in a decade, from 918,908 in 2008 to 2,403,651 in 2018. Moreover, these 2.4 million vehicles have an average age of 16 years, making it an old, polluting, and unsafe fleet sector.

9. **The road infrastructure in the PoG is highly susceptible to the adverse effects of climate change, particularly flooding, which poses significant challenges to the province.** A substantial 93.5 percent of the province's territory is in a high seismic hazard zone, while 58.5 percent is prone to floods of up to 10 inches. These factors, combined with rising sea levels, make it one of the provinces with the highest incidence of natural disasters and historically one of the most affected by the El Niño-Southern Oscillation (ENSO). Floods significantly impact the population, causing temporary displacement, damage to infrastructure, economic losses, and public health risks. During the

[5] Rigid pavement refers to a concrete overlay surface treatment; flexible pavement involves a flexible asphalt overlay; earth faced is associated with a compacted gravel overlay; and soil does not have a constructed treatment.

[6] Climate Watch Historical GHG Emissions. World Resources Institute (WRI), 2022.

2024 winter season, 7,000 people have been affected so far, and 2,047 homes have been damaged by rain. Moreover, rural areas are particularly vulnerable to climate-induced risks such as heavier rains and flooding due to the low resilience of the rural road network, which was not designed to cope with such climatic stresses. Climate events are the main driver of road deterioration in these areas. According to the 2024 Country Climate and Development Report for Ecuador, climate change is expected to exacerbate these vulnerabilities, which require proper maintenance and resilient investments to mitigate the impacts.

10. **Of the total number of deaths caused by road crashes in the country, Guayas reports around 25 percent of deaths, with 556 deaths in 2022.** The World Health Organization (WHO) information for 2021[7] showed high numbers of fatalities as well as rates of deaths for the country comparable with neighbors. Moreover, the death rate of 23 per 100,000 population,[8] which positions Ecuador as the third highest road mortality rate country in the region, after Haiti and Dominican Republic, and 10 times higher than Europe best performing countries. Also, the Global Road Safety Facility's (GRSF) Country Profiles report identified that the cost to society of serious road injury in Ecuador was equivalent to 7 percent of GDP (US$7 billion per year), which directly affects the country's budget. Factors contributing to road safety issues include poor road infrastructure, inadequate vehicle maintenance, speeding, driving under the influence of alcohol or narcotic substances, cell phone use, and reckless driving.[9] In addition, driving conditions can be particularly challenging during the rainy season, when landslides and flooding can lead to road closures, delays, and hazards due to hydroplaning effects. Various efforts by government agencies combined with increased driver awareness and traffic reduction related to the COVID-19 pandemic contributed to a decrease in the number of road crashes from 2017 to 2020. However, crashes are currently rising from previous years. According to the INEC, 2022 was the year of most mortality due to road crashes. Of the total number of deaths (around 2,000 deaths per year), the most affected group were between 20 and 29 years of age, a highly productive age group including many heads of households. The modes of transportation where most crashes occur in the Guayas are by motorcycle (28 percent) and car (27 percent).

11. **There are gender gaps in the infrastructure and transport sectors, where women's participation remains notably low**. Only 9 percent of workers in Ecuador's transport and storage sectors, including construction, are women.[10] As in other countries in Latin America[11], Ecuadorian women encounter barriers that impede their participation both in recruitment and retention. In recruitment, the challenges include the absence of gender-sensitive engagement and selection processes, established gender stereotypes, insufficient skills, and limited access to training for specialized equipment. These barriers collectively contribute to the underrepresentation of women at the initial stages of employment in the transport and infrastructure sectors. In terms of education, among the people studying Science, Technology, Engineering, and Mathematics (STEM) careers, fewer than 1 in 3 graduates in Ecuador are women. Along with barriers for women to access specialized training for required skills in the market[12] in jobs associated to men, for instance, usage of heavy machinery, employment segregation and gaps in

7 Global Status Report (WHO, 2023).

8 WHO estimated double of the number of road fatalities than those officially reported (~4,000 road deaths a year), which reflects a high degree of under reporting.

9 Analysis of the institutional capacity for road safety management Ecuador (World Bank, 2023).

10 National Employment, Unemployment and Underemployment Survey (ENEMDU), 2023.

11 World Bank. (2015). Roads to agency: effects of enhancing women's participation in rural roads projects on women's agency - a comparative assessment of rural transport projects in Argentina, Nicaragua, and Peru: *https://documents.worldbank.org/en/publication/documents-reports/documentdetail/666721468185041902/roads-to-agency-effects-of-enhancing-women-s-participation-in-rural-roads-projects-on-women-s-agency-a-comparative-assessment-of-rural-transport-projects-in-argentina-nicaragua-and-peru*

12 Young women are 17 percentage points more likely than young men to be out of employment, not in education, or in specialized training. See World Bank. (2023). Ecuador Gender Scorecard:

wages are perpetuated. Guayas is one of the most affected by gender violence (32.9 percent of women have been victims in the province),[13] which can be a driver in the decision for women to work in male dominated sectors. These factors not only dissuade women from entering the sector, but also contribute to high attrition rates among those who do manage to secure employment.[14] There is an opportunity to create space for women trained in the operation of heavy machinery as, with the rapid expansion of the infrastructure sector in Latin America, there is demand for skilled labor.[15]

12. **Limited resources, changing government priorities and the lack of an adequate road maintenance plan have a directly impacted the condition of PoG roads, which can be improved with the implementation of Rehabilitation and Maintenance Contracts (CREMAs).** Currently, road maintenance is reactive, initiated by user requests. Upon receiving a request, the GOP's technical team conducts on-site inspections, records findings, and prioritizes actions based on available resources. This maintenance system is dependent on the information received by the users, so it is not possible to determine long-term resource planning to serve the province equitably. CREMAs contracts are a useful mechanism to guarantee an adequate level of maintenance at a more efficient cost.[16]

13. **The Project, requested by the PoG, will contribute to promote and sustain inclusive economic growth in the context of increasing exposure to climate change and natural disasters.** The Project aims to enhance resilient and safe transport connectivity between population centers in selected priority rural areas to foster their economic and social development. The Project will respond to the need to better withstand climate challenges, in an inclusive and collaborative manner with local communities. Moreover, it will enhance the capacity of PoG to address future climate challenges in the transport sector and promote a cultural shift towards improving preparedness to respond to them.

C. Relevance to Higher Level Objectives

14. **The Project is fully aligned with the World Bank Group's (WBG) Country Partnership Framework (CPF)[17] for the Republic of Ecuador (FY19-23).**[18] The proposed project contributes to CPF Results Area, "Enhancing Institutional and Environmental Sustainability", Objective 7 "Improve resilience to disaster risks and climate change." Specifically, it includes the rehabilitation and improvement of existing assets to "build back better" standards to restore productive activities and strengthen long-term resilience. This improves value for money and ensures the sustainability of the investments. Moreover, it contributes to CPF Focus Area 2: "Boost Human Capital and Social Inclusion."

15. **The Project is consistent with Ecuador's commitments on climate change, such as the Nationally Determined Contributions (NDC), National Adaptation Plan (NAP), and the National Climate Change Strategy (ENCC)**. In 2021, Ecuador set the unconditional goal of reducing its GHG emissions by 9 percent by 2025, and conditional on international support and cooperation, the commitment goes up to 20.9 percent. The NDC submitted in 2019[19]

*https://documents1.worldbank.org/curated/en/099613203062310049/pdf/IDU0775459cc0f4d704f610a8a40b4fd1088627c.pdf?_gl=1*1kd3imk*_gcl_au*MTcyMzY0MzQwMC4xNzIxOTM4ODI5*

13 Family Relationships and Gender Violence against Women (INEC, 2019).

14 Casabonne, Ursula, et al. 2015. Roads to Agency: Promoting Women's Participation in Rural Transport Projects, Washington.

15 6Wresearch. (2022). Latin America Construction Equipment Market (2020-2026) | Industry, Size, Share, Growth, Revenue, Outlook & COVID-19 IMPACT: *https://www.6wresearch.com/industry-report/latin-america-construction-equipment-market-2020-2026*

16 Performance-based Road Rehabilitation and Maintenance Contracts (CREMA) in Argentina. A Review of Fifteen Years of Experience (1996-2010) (Silva M., Liautaud G., World Bank Group, 2011).

17 Report No. 135374-EC.

18 The CPF was extended until 2025.

19 NDC Ecuador, 2019.

included adaptation actions related to transport, referring to the NAP and ENCC. One of the main objectives of the NAP is to reduce the vulnerability of Ecuador's transport infrastructure to the impacts of climate change by increasing its adaptive capacity and building resilience, which will comply with sectoral policies and integrated guidance for the Public Investment Plan. Similarly, the main objective of the ENCC is to reduce the negative impacts of climate change on Ecuador's economy, society, and environment, while also promoting sustainable development. The ENCC aims to improve the resilience of transport infrastructure by strengthening its design, operation, and maintenance, considering the projected impacts of climate change, and implementing measures to reduce emissions.

16. **The Project is aligned with the *Plan de Desarrollo para el Nuevo Ecuador* (2024-2025) of Ecuador.** The main objective of the Plan is to establish a comprehensive roadmap that fosters inclusive economic growth, strengthens national infrastructure, improves the quality of life of citizens and promotes environmental sustainability. The project is aligned with the infrastructure, energy, and environment axis, aimed at improving road, port and energy infrastructure, ensuring the proper and responsible use of natural resources. This will facilitate the planning, implementation, and management of a resilient and inclusive transportation infrastructure.

17. **This Project is considered a Maximizing Finance for Development – Enabling Project (MFD-EP).** The Project is considered MFD-EP as it aims to pilot CREMA contracts for road rehabilitation, building essential experience within the PoG to scale up these contracts and attract more private participation in future projects. The primary constraint preventing the PoG from attracting private participation is its lack of experience with such contracts. Both the PoG and the Bank agree that gaining this experience is the pathway toward greater private sector involvement. This Project directly addresses this binding constraint and aligns with the CPF, which identifies this as a key bottleneck. The positive impacts of the pilot are expected to be realized within three years of project completion, resulting in significant improvements to the maintenance of the Guayas Roads, and promoting performance-based contracts.

II. PROJECT DESCRIPTION

A. Project Development Objective

18. **PDO Statement**

19. **The Project Development Objectives (PDO)** are to improve resilient, sustainable,[20] and safe road connectivity in rural areas of the Province of Guayas and, in case of an Eligible Crisis or Emergency, respond promptly and effectively to it.

20. **PDO Level Indicators**

a) Resilience: Number of people benefiting from climate resilient infrastructure.[21]
b) Sustainability: Direct users that benefit from improved access to sustainable transport infrastructure and services.
c) Safety: Road traffic fatalities in the areas of intervention.
d) Connectivity: Average travel time in areas of intervention in rural areas.

[20] Sustainable roads refer that will be built taking into account the reduction of the environmental impact of its construction.

[21] The methodology of the Scorecard Indicators has not been published yet. The team will access the relevance for measuring PDO once it is available.

B. Project Components

21. The Project comprises three components that, as applicable, will be implemented with exploration of community inclusive gender-balanced approaches and careful attention to resilience to climate change and natural disasters.

22. **Component 1: Rural Road Construction and Rehabilitation (US$93.5 million).** This component comprises two mutually reinforcing sub-components aimed at enhancing resilient connectivity in selected lagging rural areas of the PoG vulnerable to climate change effects. Due to the increasing intensity of flooding caused by climate change, both roads and bridges are impassable for several months each year.[22] All interventions have available detailed designs for construction. Additionally, the contract for building the roads and bridges will include the supervision of the works. The bridges envisaged in Subcomponent 1b are situated in disparate locations compared to the roads in Subcomponent 1a. Also, this component will include the development of pilot(s) for the application of CREMA contracts[23] within the interventions, and Land Compensation Payments. A diagram of the network level approach and a map with the Project area can be found in Annex 2. The PoG has prioritized road and bridges interventions based on the following criteria: (i) works to ensure connectivity between population centers, such as districts and parishes, prioritizing the areas most affected by flooding due to the effects of climate change; (ii) works with a large number of direct and indirect beneficiaries, especially those that promote the socioeconomic productive and tourist sectors of the communities to be benefited; (iii) works located on provincial boundaries that have not received attention to their needs on the last decade.

23. *Subcomponent 1a. Rehabilitation of Rural Roads* (US$87.61 million). At present, the PoG's roads are in poor condition and vulnerable to climate change, with about four months a year without passage, a figure that is expected to increase due to climate change projections. Rehabilitation of these roads is essential, as without this restoration they are at extreme risk of becoming impassable during the next rainy season for longer periods, further isolating the population. This subcomponent will support works, supervision, and maintenance of seven rural roads, including rehabilitation of road structures, replacement of drainage structures, geometric rectifications, signage, carriageway or pedestrian bridges (see Annex 2). The works will reduce physical climate risk and build adaptive capacity in the PoG through dedicated measures to ensure road resilience to expected climate change impacts, including: (i) use of asphalt on roads to improve intense water runoff, thus preventing surface and platform erosion for flood events; (ii) use of warm weather resistant materials for pavement construction to withstand high temperatures and minimize degradation; (iii) protection of slopes from landslides and embankment erosion caused by heavy rainfall using bioengineering techniques, such as nature-based solutions; (iv) raising embankments above water level to protect road structures from erosion and ensure year-round trafficability during rainy seasons; and (v) constructing culverts designed to withstand future climatic events, such as increased rainfall and flooding. It is estimated that about 90 km could be accommodated. The works will have an execution time of 6 to 15 months and have environmental permits.

24. *Subcomponent 1b. Reconstruction and construction of bridges in rural areas* (US$5.89 million). This sub-component will support works, supervision, and maintenance of eight bridges in rural areas. The bridges are in poor condition, with many reaching the end of their useful life, exacerbated by increasing flooding events. The

22 Flood projections, which take climate change into account, indicate that both the duration and extent of flooding will increase. This will prolong road and bridge closures and exacerbate infrastructure and social damages.

23 Experiences in Argentina and Brazil with CREMA have shown that the appropriation of this type of contracts by the private sector has been successful in having a high level of competition at the bidding stage, and better overall road conditions obtained at lower costs compared to traditional contracts (average 15 percent more cost-effective than traditional contracts). Experience (Lancelot E., World Bank Group, 2010).

rainy seasons, intensified by the effects of climate change, often lead to bridge collapses that isolate communities. Upgrading these bridges to be more resilient is essential to ensure year-round connectivity. The works will consider the expected intensification of weather events, with higher volumes of water in a short period of time. The climate-resilient measures include: (i) constructing bridges or culverts adapted to future climate events; and (ii) waterway crossings will be sized to handle expected water flow, and all bridges will have hydraulic capacity for 100-year rainfall return events. The bridges will be 15 to 75 meters long, will take 4 to 12 months to complete, and have current national environmental permits. The description is presented in Annex 2.

25. **Component 2: Project Management and Capacity Building (US$6.5 million).** The component will primarily focus on supporting PoG with managing the operation and increasing capacity for sustainable management of the transportation infrastructure. Also, it includes a cross-cutting subcomponents that will maximize the impacts of the Component 1 by reviewing designs, proactively defining activities for engaging communities and implementing approaches that will ensure social inclusion and protection while increasing woman's participation and decision making, especially for women.

26. *Subcomponent 2a. Project management (US$2.9 million).* This component supports the Project administration and management, including Execution Unit (PEU) in the PoG, that is established as a competent implementation team, which is composed of specialists detailed in Annex 1, as well as monitoring and evaluation, Project external audits and related expenses.

27. *Subcomponent 2b. Technical support (US$2.95 million).* This subcomponent will support technical support that includes the development and implementation of an organization and business plan for planning, and maintenance of the PoG's rural road network. It includes: (i) reviews of the design for the selected roads and bridges and, as necessary, recommendations or modifying the designs to incorporate aspects of climate resilience[24], road safety audits, and gender; (ii) implementation of a Road Asset Management System (RAMS) for maintenance and prioritization of investments which includes the collection of information, manual for operation, and the implementation of the system, with resilience and road safety considerations; (iii) development of technical manuals and guidelines for updating provincial road planning, considering selection of the pavement type[25], and resilience and climate change analysis; and (iv) capacity building, Training (including CREMA content and climate change risks considerations), and outreach activities.

28. *Subcomponent 2c. Community Engagement, Protection, Gender, and Inclusion. (US$0.65 million).* This subcomponent seeks to consult communities in the design, implementation, and supervision for rural road sector projects. Activities will include: (i) gender assessment of women participation in the rural roads sector; (ii) development of a Gender Action Plan and carrying out Training to support contractors in the operationalization of clauses for training and employment of women; (iii) activities to address sensitive community and gender issues arising from Project activities, such as sexual exploitation and abuse and sexual harassment (SEA/SH) and HIV/AIDS, including the design and monitoring the implementation of prevention and mitigation measures for potential victims, incorporating SEA/SH-related provisions in contract documents (such as codes of conduct); (iv) Training on gender and gender-based violence (GBV) risk prevention and mitigation; (v) community awareness on SEA/SH and GBV; and (vi) public consultations through meetings with the community. More detailed definition of these activities will occur during implementation, once the results of an ongoing Bank implemented study on gender gaps is available.

[24] The reviews of the design will consider the expected intensification of the weather events, with higher volumes of water in short period of time, among others.

[25] Including as part of the evaluation concepts from the document "To pave or not to pave: A systematic framework for decision making in the choice of rural road paving technologies (WBG, 2021)".

29. **Component 3: Contingency Emergency Response (CERC) (US$ 0 million).** This Contingent Emergency Response Component (CERC) is included under the Project in accordance with OP/BP 10.00, paragraphs 12 and 13, for situations of urgent need of assistance, as a Project specific CERC. Rural transport infrastructure is particularly vulnerable to climate disasters, including the CERC under the project will allow for rapid reallocation of Project funds in the event of a natural disaster/crisis during the Project's lifespan. Eligible emergency needs and the conditions to trigger this component will be specified in the CERC operations manual. This component will have no funding allocation initially and will draw resources from the unallocated expenditure category in the case of activation.

C. Project Beneficiaries

30. **The Project primarily aims to benefit the rural inhabitants of the PoG, where the highest concentration of vulnerable and low-income populations is located**. The PoG has estimated a total number of daily beneficiaries of 24,208 people by 2029, with 47.3 percent of these being women. These benefits will be represented through enhanced connectivity and travel time savings between population centers, as well as interprovincial travel. Furthermore, users are expected to benefit from improved access to sustainable transport infrastructure and services, resulting in greater resilience to climate-related risks. Moreover, local women will also benefit from training programs aimed at empowering them to participate in road maintenance microenterprises and works of rehabilitation. Finally, community members and local construction companies will experience increased capacity-building opportunities because of the Project.

D. Results Chain

31. **Problem Statement:** In the rural regions of the PoG, the challenges of restricted connectivity, compromised road safety, and inadequate resilience hinder economic and social progress. The limited institutional capacity for road asset management increases these problems, amplifying the cost of transporting agricultural goods while heightening the vulnerability to road crashes and the prevalence of floodings.

	Activities	Outputs	Outcomes (PDO)	Long-Term Outcomes
COMPONENT 1	Constructing and rehabilitating rural roads and bridges	a. Roads constructed or rehabilitated with climate and road safety considerations. b. Bridges constructed or rehabilitated with climate and road safety considerations.	PDO is to improve resilient, sustainable, and safe road connectivity in rural areas of PoG and, in case of an Eligible Crisis or Emergency, respond promptly and effectively to it.	Improve resilience to disaster risks and climate change. Drive for equal opportunities, sustainability, and inclusive growth. Strengthened institutional capacity to plan, implement, and manage a resilient and inclusive transport infrastructure. Drive mitigation and adaptation measures.
COMPONENT 2	Building capacity and technical support (PoG, communities, women)	1. Designs with resilience considerations for the selected roads and bridges. 2. Road asset management system with resilience and road safety considerations designed and operational. 3. Road Safety Audits recommendations on the selected roads and bridges. 4. Construction workers trained in GBV risk prevention and mitigation. 5. Women Certified in Heavy Machinery Operation. 6. Women Trained in Road Maintenance.		
COMPONENT 3	Providing Contingency Emergency Response	7. Contingent activities to respond to emergencies.		

Critical assumptions/external factors:

- Strong political ownership and commitment continue during the Project life.
- The Borrower has adequate capacity for implementing the Project.

E. Rationale for Bank Involvement and Role of Partners

32. **The WB has relevant regional experience in supporting the development of rural roads.** Transport infrastructure is a key aspect in helping countries improve their competitiveness and supports regional trade. The WB has supported rural roads projects globally. Noteworthy regional experiences include support in Guatemala, El Salvador, Honduras, Nicaragua, and Peru. Lessons learned are reflected in the Project design.

33. **Drawing upon its international experience and proficiency in climate resilience, disaster risk management, road safety, and gender-focused initiatives, the WB is well positioned to support addressing those challenges.** Specifically, in bolstering climate resilience within infrastructure, the WB offers a wealth of knowledge encompassing the development of analytical tools for assessing climate vulnerability within national and provincial road networks, methodologies for prioritizing investments that consider vulnerabilities and enhance network redundancy, and the integration of technical specifications into road designs tailored to countries susceptible to natural disasters. Moreover, in the realm of road safety, project interventions will benefit from the support of the WB's esteemed GRSF. This entity has played a pivotal role in financing the design and implementation of impactful road safety reforms within the transportation sectors of various countries, including

Argentina, Brazil, and Ecuador. Furthermore, the WB has played a prominent role in narrowing the gender gap within the transport and road sector, particularly in countries like Peru, Haiti, Nicaragua, and other regions worldwide. Leveraging this experience, the Bank is well-positioned to mainstream effective practices already successfully implemented in other projects, thereby contributing to gender equality initiatives in the PoG.

F. Lessons Learned and Reflected in the Project Design

34. **The commitment of state governments to adequately fund and undertake rural road maintenance is essential for sustainability.** Securing long-term funding and commitment from the PoG is necessary to guarantee the maintenance and sustainability of rural roads, a strategy that has demonstrated effectiveness worldwide.[26] This lesson learned has been acknowledged into the Project's design, ensuring the support to the province in the development of a long-term maintenance plan. This plan will be designed considering climate change events, road safety and sustainable financing mechanisms for rural roads.

35. **Improving infrastructure through strategic road selection and sustained planning support is crucial for resource efficiency and fostering a robust planning.** A comprehensive road selection methodology, incorporating technical, economic, and social factors, ensures sustainability and cultivates a culture of thoughtful development. Moreover, effective planning, guided by RAMS, optimizes maintenance funding allocation for enduring outcomes. By integrating principles, processes, tools, data, policies, and economic insights, RAMS facilitates a structured and adaptable framework for informed maintenance decisions.[27]

36. **Climate-resilient infrastructure ensures that roads endure the duration for which they were constructed, even when faced with challenging climate conditions, making them accessible in all weather conditions.**[28] This Project has prioritized climate resilience, acknowledging the importance of implementing resilient road design and construction practices not only on a global scale but specifically in South America. The road and bridge designs will adhere to climate-resilient standards, particularly due to their placement in regions prone to high flooding risks and characterized by geomorphic terrain susceptible to seismic activity. Moreover, the Project will promote the use of recycled materials in construction to further enhance sustainability. Additionally, the Project will allocate funds for tools aimed at integrating climate resilience into the road planning and management systems of PoG.

37. **Capacity building support for construction supervision plays a key role in ensuring the success of the Project.** Effective supervision of road design and construction quality is essential for achieving the anticipated durability and delivering long-term benefits to road users.[29] To integrate this lesson into the Project, there will be a focus on training and establishing a competent implementation team dedicated to detailed project management. This underscores the significance of investing in the expertise and knowledge of personnel involved in project management, thus ensuring the seamless execution of the Project objectives. Moreover, promoting the support and engagement of the community is essential for their active participation. It helps in identifying opportunities or issues within the area, fosters local job creation, and minimizes problems through effective dialogue, reducing construction delays. Within the Project, community consultations will be actively promoted in the design, implementation, and supervision of rural road sector projects.

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26 India - Rural Roads Project (WB, 2014); Rural roads in sub-Saharan Africa: lessons from WB experience (2002).

27 Compendium of Best Practices in Road Asset Management (Asian Development Bank, 2018).

28 Fourth Roads Rehabilitation and Maintenance Project and Rural Roads Infrastructure Improvement Project – Nicaragua, Report No. 151099 (WB, 2020).

29 Program to Support GADs in Provincial Roads – PROVIAL EC-L1125 (Inter-American Development Bank IDB, 2022).

38. **Incorporating training and employment for women in the Project's construction activities is expected to narrow the gender gap in the sector.** The Project's activities include a training plan to boost job opportunities for women in road maintenance. Experiences in the region indicate that trained women can effectively work in road construction roles and can secure employment post-project with proper certification. This approach enhances community involvement, aiding in identifying needs, adapting designs to local conditions, and increasing community participation in construction and maintenance. Activities will also mitigate the risk of sexual violence in project implementation.

39. **Integrating risk-sharing models between the private and public sectors during the development and maintenance of road infrastructure significantly accelerates a country's infrastructure goals.** The Project will develop a pilot using CREMA contracts that are results or performance-based contracts. This strategy has been successfully adopted by other countries in the region, such as Argentina and Brazil, where federal and local levels have implemented these contracts since the 1990s, leading to improved management of their road networks.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

40. **The PoG will be responsible for Project Implementation.** The PoG functions as a decentralized autonomous entity overseeing provincial affairs. Among the responsibilities of the PoG are the planning and execution of provincial development projects, the management of infrastructure and public services at the local level, the promotion of tourism and culture, as well as the promotion of policies to improve the quality of life of the inhabitants of the province. The Project will be implemented by the PoG through the PEU, operating under the General Coordination of Infrastructure within the PoG. The PEU will be formed as a competent implementation team dedicated to detailed project management and shall be maintained during the implementation, with qualified personnel and resources to support the fiduciary management and its environmental and social risks and impacts, including financial management, procurement, environmental, and social specialists with qualifications and experience acceptable to the WB. The PEU members will be dedicated exclusively to project implementation and serve as the primary liaison for the Bank throughout the Project lifecycle. Depending on project requirements during preparation and monitoring, additional staff may be recruited for the PEU. Key positions within the PEU include the project coordinator, three civil engineers, a social specialist, an environmental specialist, a procurement specialist, a financial manager specialist, a monitoring and evaluation specialist, a legal expert, a road safety expert, and a climate resilience expert. The PEU is responsible for overall Project monitoring and evaluation (M&E) and reporting. The Project Operational Manual (POM) will include all procedures, rules, and standards for the implementation of all components and aspects of the Project including, but not limited to: (i) roles, responsibilities, and Terms of Reference (ToRs) of key PEU staff members; (ii) institutional arrangements; (iii) operation of the PEU and involved PoG departments; (iv) Project planning and M&E; (v) social and environmental management, reporting, communication, and human resources; (vi) procurement; (vii) administrative processes and financial management (FM); (viii) grievance procedures; and (ix) procedures for amending the POM. Annex 1 includes further details in institutional and implementation arrangements. The Borrower may also make use of Loan proceeds for retroactive financing for eligible expenditures that fully comply with the applicable provisions of the Loan Agreement.

B. Results Monitoring and Evaluation Arrangements

41. **PoG, through the PEU, will be responsible for implementing the Monitoring and Evaluation (M&E) framework of the Project.** The PEU will be responsible for data collection[30] (both from PoG and other agencies), analysis and preparation of required periodic reports. M&E relies on already available data sources to avoid creating obstacles to implementation. The reports will be prepared semiannually, no later than 30 days after the six-month reporting period. They will cover six months and will be presented to the WB for review. In addition to reporting on the outcome indicators and intermediate outcome indicators of the Project, the reports will include information on actual and estimated value of contract commitments, disbursements, financial management, procurement, and social and environmental policies and guidelines, as well as an updated annual plan of works and activities. In addition, the Bank and PoG will conduct a Mid-Term Review with the Borrower between 24- and 36-months following project effectiveness. Also, PoG will be responsible for preparing and submitting to the WB its own implementation completion report (no later than six months after the closing date) and assisting with the preparation of the WB's implementation and completion results report at completion. The PEU will be responsible for preparing these reports and will have a specialized and capable technical and planning team to conduct this M&E periodically. Moreover, periodic Bank supervision and monitoring will include field visits, activities, and process reviews, reporting of outputs and the maintenance of updated records. The thematic areas that will be supervised and monitored include: (i) social and environmental monitoring; (ii) regular quality supervision and certification; (iii) periodic physical progress monitoring; and (iv) the result framework.

C. Sustainability

42. **Borrower's Commitment and Ownership.** As delineated in Section I.C "Relevance to Higher Level Objectives," the project design aligns closely with the country's pressing needs and priorities. Through initiative-taking and early engagement with the PoG, sustained commitment and ownership will be fostered in the short term. Over the longer term, equipping stakeholders with essential tools such as the asset management system, guidelines, and strategies will further bolster the sustainability of the interventions.

43. **Infrastructure Sustainability and Institutional Capacity.** Embracing a "build back better" ethos, the Project will infuse innovative strategies into the design and execution of programmed infrastructure resilience initiatives. The Borrower will achieve this by revising designs to ensure high standards of resilience, road safety and efficiency. These strategies will also narrow the gender gap from inception through implementation and into future maintenance phases. While acknowledging the Borrower's limited experience with advanced strategies and familiarity with the Bank's Environmental and Social Framework (ESF) and procurement policies, the Project prioritizes capacity building and institutional strengthening of both public and private entities, along with stakeholder engagement.

44. **The Project will increase capacity in asset management to help ensure sustainability in the longer term.** The Project will include capacity building and implementation on RAMS. This will help the PoG to foster accountability, transparency, and continuous improvement in the road maintenance, reducing downtime and improving overall performance. The Project will also work to build institutional capacity regarding CREMA projects for future operations to further strengthen asset management efficacy and efficiency.

45. **The Project design prioritizes the cultivation of local community interaction.** In addition to road improvements and interventions, complementary works will be undertaken to enhance mobility conditions within the area.

[30] If data involves personal data, it should comply with Bank policies.

These efforts will address technical aspects related to road safety and the specific mobility requirements of women and individuals with disabilities, where applicable, by implementing the recommendations of the road safety audit. By strengthening residents' sense of ownership through consultation, these initiatives will foster greater community involvement in preserving and maintaining the enhancements. Moreover, the training initiatives outlined in Component 2, aimed at empowering women and promoting their participation in road maintenance microenterprises, are anticipated to be implemented by the PoG to sustain the constructed and rehabilitated interventions effectively.

IV. PROJECT APPRAISAL SUMMARY

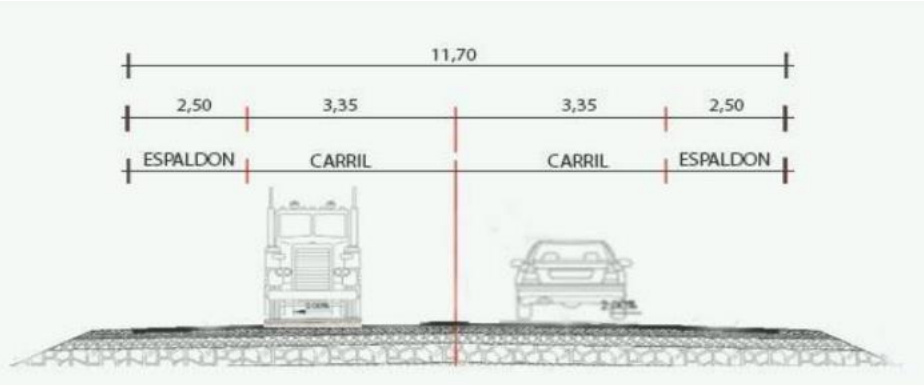
A. Technical, Economic and Financial Analysis

Technical Analysis

46. **The Project proposes an integrated approach to the connectivity of PoG.** Focused on supporting the province in constructing and rehabilitating roads and bridges, the Project prioritizes resilience and road safety considerations, thereby fortifying rural connectivity and enhancing climate resilience.

47. **The Project includes the rehabilitation of seven roads** (see Annex 2). The roads are in poor condition, which hinders the passage of vehicles, increasing travel times, fuel consumption, and vehicle maintenance costs. According to the traffic behavior analysis derived from the design studies, the roads are classified as Class III roads with an Annual Average Daily Traffic (AADT) between 160 and 1.115 vehicles/day. The roads are between 5 km and 30 km long. Roadway designs have considered the use of flexible asphalt (with recycle materials if possible) to increase durability and reduce the need for frequent maintenance, and for considerations of climatic variations where there is a high presence of flooding. According to the road design, the typical pavement structure to be used for the roads will be: 5-7.5 cm asphalt binder, 10 cm base, 15 cm sub-base, and 0.70 m improvement material. The road sections are planned to have two lanes of 3.00-4.00 meters and shoulders of 1.40-2.50 meters. Figure 1 shows an example of a typical section.

Figure 1. Typical road section - Example T de Baba Road.



Source: T de Baba geometric design study. PoG, 2022.

48. **The Project includes the rehabilitation and construction of eight bridges** (see Annex 2). The bridges range in length from 15 to 75 meters long and are approximately 6 to 9 meters wide. Most of the areas where the bridges are located are susceptible to flooding during the rainy season. The typical structure of the vehicular bridges

consists of six pre-tensioned longitudinal girders supported by a reinforced concrete slab with vehicular protection.

49. **The Project will address the two areas where gender gaps materialize: low participation of women in the transport sector workforce, and potential barriers of women as users.** The Project includes specific measures to foster participation of women in civil works, such as capacity building in operation of heavy machinery delivered by contractors, or technical assistance to support women led microenterprises for routine maintenance. Project design also includes technical assistance to foster women leadership in community response mechanisms to emergencies and to better understand potential barriers of women as users in rural areas.

50. **The Project includes a CERC component to provide flexibility in case of an emergency.** PoG is vulnerable to natural hazards, specially floodings (up to 50 inches) and earthquakes (see Annex 4). The CERC component will provide the ability to swiftly use loan resources to provide a response if an emergency materializes.

Economic Analysis

51. **The road investments under the Project were assessed using an economic (cost-benefit) analysis in compliance with World Bank Policy: Investment Project Financing.** The package of road investments is found to have an Economic Internal Rate of Return (EIRR) of 8.9 - 9.2 percent.[31] With the social discount rate of 4.8 percent used in Ecuador for evaluating transport projects, the roads yield a net present value of 2024 US$34.7 - US$37.1 million. The Project remains economically viable even with increases in capital cost or reductions of demand. Annex 3 shows the detailed economic analysis and its assumptions. Financial costs are converted to shadow economic prices by removing taxes and subsidies and including opportunity costs. In terms of benefits, the analysis has estimated incremental benefits stemming from:

a. Improved connectivity: This benefit includes reduced travel times and reduced Vehicle Operating Costs (VOC) resulting from improved road conditions after the intervention.
b. Improved resilience: This benefit measures the improved resilience of connectivity to flooding events. It quantifies the travel time and vehicle operating costs saved by not having to detour around flooded routes.

Road Safety

52. The Project interventions were screened using the Bank's Road Safety Screening and Appraisal Tool (RSSAT). This screening informs the minimum design standard for the interventions to ensure no increase in risk of death or serious injury from road traffic crashes. The Project will include road safety audits, which will identify additional improvements to road safety beyond the minimum standard screened. See External Document 1 for details.

Assessment of Alignment with the Paris Agreement

53. **Paris Alignment**. The operation is aligned with the goals of the Paris Agreement on both mitigation and adaptation[32].

[31] The range spans from low to high social price of carbon following World Bank guidance (2024).

[32] This is assessed using the three-step World Bank IPF Investment Method for Assessing Paris Alignment. Step 1, which assesses the Project's consistency with the country's climate strategies, is discussed in the Higher-level Objectives section.

a. ***Assessment and reduction of mitigation risks:*** The operation supports activities that are neutral and/or encourage sustained country progress towards low-carbon development. The integral rehabilitation of rural roads—including upgrading, rehabilitation, reconstruction, and maintenance with minor capacity enhancements—focuses on climate resilience, road safety, and universal accessibility. These interventions promote public and Non-Motorized Transport (NMT) without significantly increasing traffic capacity (Component 1.a). Additionally, the project management and capacity-building activities, which address all functional areas such as planning, design, construction, maintenance, and social and environmental management of the rural road network, aim to improve climate resilience (Component 2.a). Both components are considered Universally Aligned (UA) and do not pose any inherent risks. Furthermore, the selected rural roads and bridges are intended primarily for the transport of agricultural produce and small manufactured goods and are not expected to transport coal products. The construction of new bridges or the reconstruction of existing ones in rural areas (Component 1.b), although not UA due to capacity expansion, is designed to increase the climate resilience of bridges that are frequently rendered unusable by flooding during rainy seasons. This component is considered low-risk, given the significant access and connectivity deficits in the rural area of Guayas. The minimal traffic flow and modest scale of the bridges further mitigate potential carbon lock-in risks. The project does not pose a risk of contributing to deforestation or supporting fossil fuel-based transportation. Instead, it aligns with national climate change strategies, ensuring that the selected roads and bridges primarily serve the transport of agricultural produce and small manufactured goods, consistent with national climate change objectives.

54. **Assessment and Reduction of Adaptation Risks:** The main climate and disaster risks likely to affect the project include sea-level rise, floods, and landslides in targeted areas with high and moderate exposure. The project incorporates adaptation measures to reduce risks from natural hazards, combining structural, nature-based, and soft adaptation solutions, including: (i) implementing designs that prioritize resilience to climate change impacts like sea-level rise and floods, and promoting the use of nature-based solutions and heat-resistant materials in road construction (Component 1); (ii) improving roads to ensure year-round access in areas currently impassable during rainy periods (Component 2); and (iii) enhancing network resilience and preparedness through comprehensive maintenance plans that specifically address climate-related risks (Component 3). These measures are detailed in Annex 4, Table A4.1. As a result, the project is assessed to have an acceptable level of residual risk concerning climate hazards, and its adaptation design considerations adequately reduce the physical climate risks to the project outcomes, making the project aligned on adaptation.

(i) Fiduciary

55. **Financial Management (FM).** A comprehensive FM Assessment was conducted to evaluate the adequacy of the FM arrangements for the Project. This assessment reviewed the FM proposals put forth by the PEU that will be created within the PoG. Overall, the FM arrangements within the PoG were deemed acceptable to the Bank and encompass FM staffing, budgeting, and planning, internal controls, fund flow mechanisms, accounting procedures, financial reporting, and external audit processes. These responsibilities will fall under the FM specialist with the support of the Administration Unit ("*Dirección Provincial Financiera*"). The PoG possesses accounting systems endorsed by the Bank, facilitating the registration of accounting records, oversight of technical and fiduciary activities, and experience in managing resources from multilateral international organizations such as the IDB through the Development Bank of Ecuador. The new PEU will be assembled using these same systems and will be supported by the FM staff within the PoG. While a few shortcomings were identified, an action plan has been devised, outlining the necessary activities to establish FM arrangements that align with the World Bank's minimum fiduciary requirements. For detailed insights, please refer to Annex 1 – Financial Management.

(ii) Procurement

56. **Procurement procedures.** Procurement will be conducted following the WB's Procurement Regulations for IPF Borrowers, dated September 2023 (5th Edition), and will be subject to the WB's Anticorruption Guidelines, dated October 15, 2006, revised in January 2011, and as of July 1, 2016. For procurement involving National Open Competitive Procurement, the Borrower may use documents agreed with the WB. For each contract to be financed by the Loan, the different procurement methods or consultant selection methods, the estimated costs, prior review requirements, and time frame will be agreed between the Borrower and the Bank in the Procurement Plan, which will be registered in the corresponding System (STEP – Systematic Tracking of Exchanges in Procurement). The Procurement Plan will be updated at least annually or as required to reflect the actual Project implementation needs.

57. **Procurement implementation arrangements.** Procurement activities under the Project will be implemented by Project Executing Unit of Guayas. A virtual procurement capacity assessment of Provincial Directorate of Public Works of Guayas was conducted on January 2024. The PEU has limited exposure to Bank's procurement framework as this will be the first operation to be implemented.

58. **CERC Component.** The CERC will include a specific section detailing the procurement arrangements for the component, including simplified procurement procedures. The CERC manual will include a specific section detailing the procurement arrangements for the Component, including roles and responsibilities of PEU and other institutions involved procurement staff.

59. **Procurement risk is Moderate.** To ensure that the procurement functions are carried out satisfactorily some mitigation measures have been identified: (i) hiring qualified procurement consultant with experience in WB's procurement regulations; (ii) inclusion of a procurement section in the POM, detailing roles, responsibilities, and timeframes for executing procurement functions; (iii) inclusion of non-Bank standard procurement documents in the POM, including Bank's standard fraud and anti-corruption clauses; (iv) annex to POM a CERC Manual including simplified procurement procedures; and (v) an specific procurement training to PEU's Staff will be conducted by the Bank, when the Procurement staff will be hired.

60. **A simplified Project Procurement Strategy for Development (PPSD)**. Provincial Directorate of Public Works of Guayas is working on the preparation of a PPSD, which will identify the most suitable procurement arrangements that will support the management of processes while efficiently achieving the PDOs. Procurement activities foreseen at this stage include civil works for secondary roads, technical works supervision, and consultant services to implement the PEU Staff.

61. **Procurement Plan.** The PEU will also reflect the activities derived from the PPSD in a Procurement Plan for the processes expected to be conducted during the first 18 months of the Project. Both the Procurement Strategy and the Procurement Plan for the Project will be updated on a regular basis during Project implementation, in accordance with the needs identified.

C. Legal Operational Policies

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Area OP 7.60	No

D. Environmental and Social

62. **The overall Environmental and Social (E&S) Risk Rating is rated Substantial.** As the Project involves mostly the rehabilitation and reconstruction of existing roads and bridges rather than the construction of new infrastructure, significant E&S risks are not anticipated.

63. **Implementation experience and the PEU mitigate the lack of previous experience managing E&S requirements from multilateral entities.** The PoG lacks previous experience in executing and implementing projects under the E&S requirements of multilateral entities in this domain. Nonetheless, they have extensive experience in implementing infrastructure road projects following national regulations, which the Bank considers essential for implementing the Project. Furthermore, the E&S team appointed by the PoG for the Project preparation demonstrated fully involvement. For Project implementation, a full-time environmental specialist and full-time social specialist shall be hired as part of the PEU. Moreover, through the capacity-building components, the PoG is expected to enhance their ability to manage E&S provisions required by the relevant Environmental and Social Standards (ESS) during project implementation.

64. **During Project preparation, the Bank provided direct support to the E&S team appointed by the PoG**. They conducted an initial analysis of E&S risks and impacts by developing an E&S Risk and Impact Matrix specific to each intervention. This tool verifies whether E&S risks, impacts, and mitigation measures as per required within the ESS align with the Environmental Management Plan included as part of the permit issued by the Ministry of Environment, Water, and Ecological Transition (MAATE, according to its name in Spanish). Any identified gaps or additional considerations shall be addressed through the development and implementation of specific Complementary Environmental and Social Management Plans (Complementary-ESMPs) for each intervention which will be used along the bidding processes and further Contractor's ESMP (C-ESMP) shall be developed by the selected contractors. These matrices serve as a reference to ensure ESMPs alignment with relevant ESSs, guiding its effective development and implementation.

65. **From an environmental perspective, the Project involves a range of relevant activities, including earth movement, work near water bodies, drainage systems, pavement construction, ancillary facilities, and road safety measures**. These activities pose various anticipated environmental risks, including nuisances from noise, vibration, dust, traffic disturbances, waste management issues, potential water contamination, inadequate environmental liability management, and occupational health hazards for workers. Additionally, road improvement activities under Component 1 may extend beyond established Rights of Way, potentially altering irrigation and drainage systems and directly impacting crop productivity and the livelihoods of local farmers. An adequate management of said risks and impacts can be addressed with mitigation measures to be developed as part of the Complementary ESMPs for each intervention, which will be implemented by the contractors through the C-ESMPs and supervised according to the POM.

66. **From the social perspective, the risk is primarily due to concerns surrounding resettlement and land acquisition, despite the Project's overall manageable execution.** While rehabilitation efforts focus on existing roads, potential land acquisitions along road sides or bridge areas require attention. The client has identified affected properties, yet comprehensive data on affected populations and socioeconomic impacts are needed. Risks related to construction activities, including labor hiring and safety concerns, have been noted by the Bank team. Additionally, health and safety risks to the community, such as noise and traffic disruptions, require mitigation measures, including addressing gender-based violence concerns and potential problems. The PoG team has assessed potential impacts on vulnerable populations, emphasizing the importance of addressing variants and security risks during project execution. For the management of these impacts and control the respective risks, Resettlement Action Plans (RAP) must be proposed for each intervention where needed, along with Labor Management Procedures (LMP), and Stakeholder Engagement Plans (SEP), which will be part of the Complementary ESMPs, and may be executed with the support of the contractors with the C-ESMP, for which this responsibility must be ensured in the terms of their contracting.

67. All the identified E&S risks, along with adverse impacts on health and the environment, are expected to be predictable, temporary, and site-specific, for which known and reliable mitigation measures exist and shall be part of the ESMPs.

68. In case the Component 3 is activated, the Borrower will develop and adopt CERC E&S instruments, according to the Bank's CERC Guidance Note (Oct. 2017). This document will incorporate at least: (i) a positive list of activities that will be financed by this component; (ii) analysis of potential E&S risks and impacts; and (iii) processes for completing, submitting to the WB for approval, and disclosing any necessary E&S instruments as required under the ESF prior to initiation of corresponding activities.

69. The retroactive financing would be available up to 20 percent of the total loan. In the event that Borrower requests retroactive financing, PoG shall carry out an E&S assessment to confirm that activities subject to retroactive financing have been implemented in accordance with the relevant Environmental and Social Standards (ESSs), in accordance with ToRs acceptable to the Bank. The results of the assessment shall be used to inform the preparation of a corrective action plan, if necessary. Submitting the E&S assessment report in terms acceptable to the Bank, shall be a condition of disbursement to access retroactive financing, whereby the assessment will be conducted on a one-time basis for all activities to be retroactively financed.

Citizen Engagement

70. **The proposed Project's strategy is centered on active citizen engagement in different activities during Project preparation and implementation.** The complementary interventions under Component 1 will be selected based on consultations with the population. Also, the road infrastructure projects whose designs will be prepared under Component 2 will also be selected based on consultation with the population to include gender and vulnerability considerations in the processes for the preparation of design studies and other Technical Assistance (TA) activities, for this, there will be communication and meetings with community. Public consultations will also be conducted for other aspects of the Project affecting local communities, including representatives of People with Disabilities and universal access aspects of technical design. These consultations will occur after the public announcement of the interventions and before the start of civil works. The PoG will detail the scope of designs and other construction aspects for the defined interventions and will document community proposals or suggestions in meeting minutes. The PoG will respond and share them with the community. The citizen engagement process will ensure equal access for women and other disadvantaged groups and their equal participation in the Project.

Gender

71. **The Project will address the identified gender disparities and limitations faced by women in the transport sector (see paragraph 11) by implementing the activities under Subcomponent 2c**. The activities will continue good practices and experiences in technical training and women's inclusion in the workforce. Key initiatives include conducting a gender assessment of women's involvement in rural roads, implementing training programs for women in heavy machinery operation and road maintenance with certifications. Certifications will be facilitated through the Ecuadorian Federation of Truck Equipment Operators and Mechanics (FEDESOMEC) or another entity formally enable to award such certifications.[33] The contractors involved in the interventions will cover the costs of FEDESOMEC's training and certification. The gender assessment will inform community awareness before and after the implementation to contribute to addressing the social constraints that might impede women from participation. Women who are recruited will be mapped through the assessment in coordination with women groups and civil society organizations on the ground. The project will assess opportunities through procurement to promote training and employment opportunities for women. Informed by the assessment, it will develop any Gender Action Plan with clear responsibilities, including for supporting the contractor in the operationalization of the clauses by enabling a safe and healthy workspace for women.

V. GRIEVANCE REDRESS SERVICES

72. ***Grievance Redress.*** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed to address project-related concerns. Project affected communities and individuals may submit their complaint to the Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, because of Bank non-compliance with its policies and procedures, and the Dispute Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the Bank's Grievance Redress Service (GRS), visit http://www.worldbank.org/GRS. For information on how to submit complaints to the Bank's Accountability Mechanism, visit https://accountability.worldbank.org.

VI. KEY RISKS

73. **The overall risk** to the achievement of the PDO has been assessed as **Moderate**.

74. **Environment and Social risk is Substantial.**

Inherent Risk	**Social Risk:** (i) Land management and resettlement; interventions are expected to require land acquisition to ensure the technical conditions of roads and bridges, which may involve acquiring portions of land alongside the routes or in areas adjacent to bridge installation sites. Temporary land use for contractor camps, machinery parking areas, material storage, etc., is also foreseen. (ii) Worker's health and safety: it is considered relevant to have standardized measures to manage the diverse types of labor expected: direct workers, contractor workers, and workers from primary

33 The Ecuadorian Federation of Truck Equipment Operators and Mechanics (FEDESOMEC) is responsible for providing training and certification for the operation of heavy equipment in Ecuador.

	suppliers. (iii) Community health and safety; transmission of communicable and non-communicable diseases, traffic safety during construction, potential occurrences of events related to exploitation and sexual and/or harassment, and the use of private security for custody of machinery, camps, and work fronts. (iv) Stakeholder engagement: Stakeholder positive and negative expectation management and stakeholder engagement are related to the interactions that will occur with communities, neighbors, vulnerable populations, people affected by resettlement, local authorities, institutions, among others. All of these social risks and impacts will be addressed in the specific management plans, such as the Complementary ESMPs, C-ESMPs, Labor Management Procedures (LMP), Stakeholder Engagement Plans (SEP) and Resettlement Action Plans (RAPs), as required for each intervention. **Environmental Risk:** (i) the Project interventions already have environmental permits in accordance with national legislation, although gaps with the ESS requirements were duly identified in the E&S risk and impact matrices developed by the PoG during Project preparation; (ii) all the activities will be developed within existing footprints and mostly in degraded areas; however, some civil works may potentially interfere with native vegetation or areas of importance for biodiversity; and (iii) Project activities will generate typical risks and impacts related to road and bridges construction works, such as: soil degradation due to adaptation of areas for ancillary activities; air degradation due to noise emissions, and particulate matter; water pollution due to effluent generation; and environmental risks and impacts related to transportation and use of hazardous materials, hazardous waste, transportation and storage of construction materials, temporary disposal of debris, among others. The environmental risks and impacts identified during Project preparation can be managed by the PoG according to proposed mitigation measures to be provided as part of Complementary ESMP for each intervention, and further observed in the C-ESMPs. The implementation of the mitigation measures set forth in each C-ESMP will be under the responsibility of the contractor, and duly supervised in accordance with the provisions of the POM and the ESCP.
Mitigation Approach	**Project design:** This operation defines specific interventions for its execution. In general, these are road rehabilitation and bridge construction work with E&S risks that could be considered mitigated with the appropriate application of specific instruments. **Social risk mitigation approach:** To manage these risks, an E&S risk and mitigation Matrix was developed for each intervention. These matrices will serve as a reference point to ensure alignment of the Complementary ESMP and C-ESMP with relevant ESF standards, guiding its effective development. Moreover, the respective RAP must be proposed for each intervention where needed, LMP, and SEP, which will complement the C-ESMP and the complementary ESMP and may be executed with the support of the contractors, for which this responsibility must be ensured in the terms of their contracting. **Environmental risk mitigation approach:** The E&S risk and impact matrix mentioned above was also developed to cover mitigation measures associated to the identified environmental risks and impacts. Furthermore, all the impacts can be managed with specific Complementary ESMP and C-ESMP for each intervention, executed by contractors and supervised by the project executor. Moreover, road safety considerations will be considered during construction of the interventions.

VII. RESULTS FRAMEWORK AND MONITORING

PDO Indicators by PDO Outcomes

Baseline	Closing Period
Improved connectivity	
Average travel time in areas of intervention (Minutes)	
Sept/2024	Dec/2029
187	82.20
Direct users that benefit from improved access to sustainable transport infrastructure and services (Number of people) CRI	
Sept/2024	Dec/2029
0	8,835,943
➢Direct users that benefit from improved access to sustainable transport infrastructure and services - Female (Number of people) CRI	
Sept/2024	Dec/2029
0	4,181,077
➢Direct users that benefit from improved access to sustainable transport infrastructure and services - Youth (Number of people) CRI	
Sept/2024	Dec/2029
0	836,024
Improved resilience	
People benefiting from climate resilient infrastructure (Number of people) CRI	
Sept/2024	Dec/2029
0	66,023
➢People benefiting from climate resilient infrastructure - Female (Number of people) CRI	
Sept/2024	Dec/2029
0	33,180
➢People benefiting from climate resilient infrastructure - Youth (Number of people) CRI	
Sept/2024	Dec/2029
0	6,858
Improved road safety	
Road traffic fatalities in areas of intervention (Number)	
Sept/2024	Dec/2029
5	1

Intermediate Indicators by Components

Baseline	Closing Period
Rural Road Construction and Rehabilitation	
Roads constructed or rehabilitated (Kilometers)	
Sept/2024	Dec/2029
0	89.75
Bridges constructed or rehabilitated (Number)	
Sept/2024	Dec/2029
0	8
Project Management and Capacity Building	
Recommended resilience measures included in the designs for the selected roads and bridges (Percentage)	
Sept/2024	Dec/2029
0%	100%
Road asset management system designed and operational with resilience and road safety considerations (Yes/No)	
Jun/2024	Dec/2029
No	Yes
Share of roads and bridges rehabilitated where road safety audit recommendations have been implemented (Percentage)	
Sept/2024	Dec/2029
0%	100%
Civil works contractors trained in GBV risk prevention and mitigation (Percentage)	
Sept/2024	Dec/2029
0%	100%
Complaints responded to and/or resolved within the stipulated standard for response times (Percentage)	
Sept/2024	Dec/2029
0%	100%
Women Certified in Heavy Machinery Operation (Number)	
Sept/2024	Dec/2029
0	33
Women Trained in Road Maintenance (Number)	
Sept/2024	Dec/2029
0	55
Contingency Emergency Response Component (CERC)	

Monitoring & Evaluation Plan: PDO Indicators by PDO Outcomes

Improved connectivity	
Average travel time in areas of intervention (Minutes)	
Description	This indicator measures the total average travel time on the seven roads before and after the Project, reflecting the savings in travel time resulting from the Project's interventions.
Frequency	Every 6 months.
Data source	The PoG will measure the changes in real speeds and the new traffic composition when the civil works have been completed and opened to traffic.
Methodology for Data Collection	The calculations are based on the following assumptions: (1) Traffic composition: 80% cars and 20% buses and trucks in both scenarios; (2) Speeds without the Project: 30 km/h for cars and 25 km/h for buses and trucks; and (3) Speeds with the Project: 70 km/h for cars and 50 km/h for buses and trucks. To calculate the average travel times, the length of each road is divided by the average speed of each mode of transport, weighted by the traffic composition. The total travel time for the seven roads is then summed for both the without Project and with Project scenarios. Results: (1) Total average travel time without the Project: 187 minutes; (2) Total average travel time with the Project: 82.2 minutes; and (3) This results in travel time savings of 104.8 minutes.
Responsibility for Data Collection	PoG.
Description	Direct users measure the number of people directly benefiting from improved transport services and infrastructure. More specifically: Includes current and new users of the road section who will benefit from reductions in costs and time to travel, and/or improvements in safety, quality, and comfort. This is estimated using annual average daily traffic (AADT), multiplied by an appropriate contextual occupancy factor per vehicle type.
Frequency	Every 6 months.
Data source	The PoG will measure the new AADT and will consider the actual occupancy rates when the civil works have been completed and opened to traffic. The input data for this indicator are reported by clients and are either estimated (for expected results) or collected (for achieved results). Data on "women" and "youth-women" will be estimated from the 2022 census.
Methodology for Data Collection	The following assumptions were used to estimate the AADT: 1. Type of Vehicle: The PoG estimated the traffic for 2022, considering four types of vehicles: cars, buses, medium trucks, and large trucks. 2. Occupancy Rate: The following occupancy factors were considered: (a) Cars: 2 persons; (b) Buses: 20 persons; (c) Medium trucks: 1 person; and (d) Large trucks: 1 person. 3. Annual Growth Rate for Roads: • Cars: 4.6% (2023), 4.6% (2024), 4.4% (2025), 4.21% (2026), 4.04% (2027), 3.89% (2028), 3.74% (2029) • Buses: 1.92% (2023-2025), 1.77% (2026-2029) • Medium and large trucks: 1.19% (2023-2025), 1.16% (2026), 1.15% (2027), 1.13% (2028), 1.12% (2029) 4. Annual Growth Rate for Bridges (excluding buses): • Cars: 4.33% (2023), 4.15% (2024), 3.99% (2025), 3.84% (2026), 3.69% (2027), 3.56% (2028), 3.44% (2029) • Trucks: 3.59% (2023), 3.47% (2024), 3.35% (2025), 3.24% (2026), 3.14% (2027), 2.04% (2028), 2.95% (2029) • Does not include the "Puente Cone" and "La Dolorosa" bridges, as they are pedestrian bridges. 5. Induced Traffic "with Project scenario": a 25 percent growth in induced traffic on all roads and bridges is considered for 2026, when the civil works are expected to be completed. This reflects the additional traffic generated due to improved infrastructure.
Responsibility for Data Collection	PoG.
Improved resilience	
Description	This indicator measures the number of people benefiting from climate risk-resilient infrastructure.
Frequency	Every 6 months.
Data source	The WBG geospatial tool provides information on inferred beneficiaries along the transport infrastructure zone within a 2 km radius using WorldPop data. Data on "female" and "youth-female" will be estimated from the 2022 census.

Methodology for Data Collection	The Geospatial tool has provided data on the population within a 2 km radius of each intervention site. This data, from 2020, has been adjusted using an annual population growth rate of 1.5% to estimate the baseline population (2024) and the end target population (2029). The proportions of the "female" and "youth-female" populations have been derived from the 2022 census and have been kept constant throughout the projections.
Responsibility for Data Collection	PoG.
Improved road safety	
Road traffic fatalities in areas of intervention (Number)	
Description	This indicator measures the number of fatalities on the seven roads intervened by the Project.
Frequency	Every 6 months.
Data source	The PoG will measure traffic fatalities on the seven roads to be intervened by the Project once the civil works have been completed and opened to traffic. The PoG will coordinate with the corresponding emergency institutions to collect this information.
Methodology for Data Collection	Over the past four years, there have been 5 fatalities on these roads. Although the planned interventions will increase driving speeds, the Project includes road safety audits (Component 2) and the implementation of road safety measures (Component 1) to improve overall road safety and reduce fatalities and serious injuries. The Project aims to reduce fatalities by 80 percent, targeting just one fatality during the period 2026-2029.
Responsibility for Data Collection	PoG.

Monitoring & Evaluation Plan: Intermediate Results Indicators by Components

Rural Road Development and Maintenance	
Roads constructed or rehabilitated (km)	
Description	This indicator measures the total number of kilometers of rural roads constructed or rehabilitated by the Project. It will track the progress of completed kilometers based on the physical progress reported by the Project's audit.
Frequency	Every 6 months.
Data source	The Project Supervision firm will report on the physical progress achieved.
Methodology for Data Collection	The Project encompasses the construction and/or rehabilitation of the following seven roads: (i) T de Baba: 11.40 km; (ii) Cruce Bueno: 5.05 km; (iii) Pedro Velez: 16.70 km; (iv) San Antonio: 7.50 km; (v) Colimes-Olmedo: 30.00 km; (vi) 7 Cascadas - Pauji: 6.30 km; and (vii) Valle de la Virgen: 12.80 km.
Responsibility for Data Collection	PoG.
Bridges constructed or rehabilitated (unit)	
Description	This indicator measures the total number of bridges constructed or rehabilitated by the Project. A bridge will be considered completed when the project's auditors report 100 percent physical progress.
Frequency	Every 6 months.
Data source	The Project Supervision firm will report on the physical progress achieved.
Methodology for Data Collection	The Project includes the construction and/or rehabilitation of the following eight bridges: (i) Evia Bridge; (ii) Las Flores Bridge; (iii) El Hediondo Bridge; (iv) Milagro Bridge; (v) Limon Bridge; (vi) El Toro Bridge; (vii) Cone Bridge; and (viii) La Dolorosa Bridge.
Responsibility for Data Collection	PoG.
Project Management and Capacity Building	
Recommended resilience measures included in the designs for the selected roads and bridges (Percentage)	
Description	This indicator measures the percentage of resilient and sustainable infrastructure considerations implemented by the Project.
Frequency	Every 6 months.
Data source	The PoG will report the number of resilience and sustainability considerations included in each design. Project Supervision firm will report the number of resilience and sustainability considerations implemented.
Methodology for Data Collection	All road and bridge designs under the Project will incorporate resilience and sustainability features. Component 2 of the Project provides funding for these studies where necessary. This indicator will report the percentage of these considerations that have been fully implemented, based on the total number of resilience and sustainability measures included in the designs. This indicator will be assessed based on each road segment (7 units) and each bridge (8 units). Achieving 100 percent will indicate full compliance with the recommended interventions across all 15 interventions. However, if a bridge design neglects the recommended resilience measures, the indicator value decreases accordingly.
Responsibility for Data Collection	PoG.
Road asset management system designed and operational with resilience and road safety considerations (Yes/No)	
Description	This indicator measures the implementation of the road asset management system.
Frequency	Every 6 months.
Data source	The PoG will report once the road asset management system is integrated into the province's systems and is operational.
Methodology for Data Collection	Subcomponent 2.b of the Project funds the development and implementation of this system, which includes resilience and road safety considerations. The system will prioritize road maintenance investments systematically using software that collects data on road conditions and identifies periodic and routine maintenance needs. Additionally, the Project will provide an operation manual for the asset management system.
Responsibility for Data Collection	PoG.
Share of roads and bridges rehabilitated where road safety audit recommendations have been implemented (Percentage)	

Description	This indicator measures the percentage of road safety recommendations implemented, based on the total number of recommendations made by the Project following road safety audits.
Frequency	Every 6 months.
Data source	The road safety specialist will conduct road safety audits for the roads and bridges to be intervened by the Project and will make any recommendations it deems necessary. The PoG will report all recommendations received. In addition, the PoG will report which recommendations are accepted and which are not, including their justification. The Project Supervision firm will report on the recommendations implemented.
Methodology for Data Collection	Road Safety Audits are legally required in Ecuador under the Transportation, Transit, and Road Safety Law, and are also mandated by the World Bank's Environmental and Social Framework. Subcomponent 2a of the Project funds a road safety specialist who will conduct safety audits for all roads and bridges constructed or rehabilitated.
Responsibility for Data Collection	PoG.
Civil works contractors trained in GBV risk prevention and mitigation (Percentage)	
Description	This indicator measures the percentage of civil works contractors trained in Gender-Based Violence (GBV) risk prevention and mitigation, relative to the total number of contractors involved in the construction and rehabilitation of roads and bridges financed by the Project.
Frequency	Every 6 months.
Data source	The PoG will hire a consulting firm for the training described above. The consulting firm will report once the training has been completed, including the number of people trained.
Methodology for Data Collection	The training will cover community and gender-sensitive issues related to project activities, such as the vulnerability of women and girls due to the influx of non-local labor at construction sites. Topics will include Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH), and HIV/AIDS awareness and prevention. After the training, participants will take a test to assess their knowledge and understanding of GBV risk prevention and mitigation.
Responsibility for Data Collection	PoG.
Complaints responded to and/or resolved within the stipulated standard for response times (Percentage)	
Description	This indicator measures the percentage of grievances responded to and/or resolved in accordance with World Bank standards. The purpose of this indicator is to ensure that grievances raised by beneficiaries and stakeholders are addressed promptly and within the timeframes stipulated by the Grievance Redress Mechanism (GRM).
Frequency	Every 6 months.
Data source	The data collection process should be standardized and consistent. PEU can use a database or spreadsheet to track complaints received, response times, and resolution times.
Methodology for Data Collection	The methodology is not restricted to complaints received by email, but rather includes all available channels, such as contractor mailboxes, in-person complaints, complaints received through other channels, and complaints derived by the WB that have been received through the Bank's GRS. A complaint will be addressed when it has been received (by any means), a response has been provided to the complainant, and the complaint is either resolved or in the process of being resolved.
Responsibility for Data Collection	PoG.
Women Certified in Heavy Machinery Operation (Number)	
Description	This indicator measures the number of women trained and certified by the contractor in the operation of various types of heavy equipment and other skills necessary for occupational activities or skilled positions in road construction in Guayas.
Frequency	Every 6 months
Data source	The PoG will report on the number of women registered for training and certification, those who have completed the training and obtained certification, and ultimately, the number of women hired for employment.
Methodology for Data Collection	The estimated need for heavy machinery operators and helpers for the identified interventions is approximately 300. Currently, only 9 percent of women in Ecuador are engaged in transportation-related construction jobs, equating to about 27 women operating heavy machinery or similar equipment. The project aims to train 60 women in heavy machinery operation (20 percent of the total personnel required) and expects at least 33 women to achieve certification. This initiative will increase the eligibility of women for employment in the sector and help reduce the

	gender gap in the construction industry.
Responsibility for Data Collection	PoG.
Women Trained in Road Maintenance (Number)	
Description	This indicator measures the number of women trained in maintenance and other essential skills for road maintenance in Guayas.
Frequency	Every 6 months
Data source	The PoG will report on the number of women enrolled in maintenance training, those who have successfully completed the training, and ultimately, the number of women employed by the Project. The Borrower will also measure the number of micro-enterprises established by these women.
Methodology for Data Collection	The estimated annual need for maintenance personnel and assistants for the identified interventions is approximately 500 people. Currently, only 9 percent of women in Ecuador are involved in transportation maintenance work, equating to about 45 women. The project aims to train 100 women in maintenance-related jobs (20 percent of the total personnel required) and expects at least 55 to complete the training, thereby increasing their employability in the sector and contributing to reducing the gender gap in transport maintenance.
Responsibility for Data Collection	PoG.
Contingency Emergency Response Component (CERC)	

ANNEX 1: Implementation Arrangements and Support Plan

A. Financial management

1. **A Financial Management (FM) Assessment was performed** in accordance with the World Bank Policy: Investment Project Financing issued on September 7, 2021, to evaluate the adequacy of the FM arrangements for the implementation of the project.

2. **FM risk and mitigation measures.** The residual FM risk (after mitigation measures) is rated **as Moderate** considering the following FM risks and mitigation measures:
   a. Delays in budget allocation and low budgetary execution. It is common at the beginning of projects implementation, to have delays in budget execution and low levels of project execution. To mitigate this risk, the PEU PoG will allocate the institutional budget for external resources once the loan is signed and with the approval of the Provincial Council. All the budget procedures will be included in the POM.
   b. Potential for inaccuracies in the accounting figures that could lead to incorrect financial statements. A mitigation measure to tackle this risk is the use of the accounting and budgeting system Sistema de Gestión Pública - SGP from the PEU that will support the timely process of all the transactions. In addition, the project will have annual financial audits performed by independent auditors acceptable to the Bank.
   c. Unclear definition of the roles, responsibilities, and coordination procedures within the PEU. To manage this risk, the PEU PoG shall ensure that the FM specialist is hired to work full time, under terms of reference acceptable to the Bank not later than forty-five days (45) after the Effective Date. Moreover, terms of reference for the other FM positions indicated in the Project Operational Manual (POM) will be prepared in a timely manner, and all the remaining FM staff within the current organizational structure of the PoG will be supporting the project. In addition, the POM will include the definition of clear roles and responsibilities within the PEU, including: (i) the minimum financial management procedures according to WB requirements, (ii) the identification of key controls, (iii) and accounting and reporting systems that will support project activities.
   d. Lack of familiarity with eligibility requirements for retroactive financing: Expenditures eligible for retroactive financing must be fully compliant with World Bank FM, E&S, and procurement policies and approved by the World Bank. The PEU will review and ensure that any retroactive financing proposed, and if it is used, must comply with the World Bank's procurement regulations and E&S requirements, and are properly documented, before requesting Bank's reimbursement.

Table 1A.1. FM Action Plan

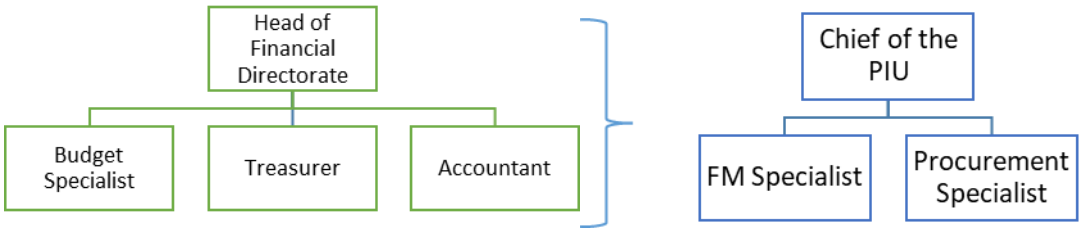
Action to be completed	Responsible	Target Date
Budget allocation to the project for period 2024	PoG	Upon Loan Agreement signature
Obtaining No Objection from the WB on the POM (including the FM section)	PoG	As a condition of effectiveness in the Loan Agreement
Recruitment of the key staff (FM specialist and Procurement specialist)	PoG	Forty-five days after the declaration of effectiveness
Obtaining No Objection from the WB on the audit terms of reference (ToR)	PoG	2 months after the declaration of effectiveness.

B. Strategy and approach for implementation support

3. Based on the assessment performed, the following proposed FM arrangements are considered acceptable subject to the successful implementation of agreed mitigating measures.

4. **Organization and Staffing**. The new PEU created within the PoG will undertake overall responsibility for the project's FM tasks with sufficient and experienced staff. Therefore, the PEU will hire the FM Specialist, and the Procurement Specialist as key staff up to forty-five (45) days after the declaration of the loan effectiveness. The key staff will be financed out of the loan resources and will be dedicated in an exclusive manner to the project. Moreover, depending on the workload during implementation the PEU will consider hiring a FM and a Procurement assistant as additional support to the FM activities. The FM Specialist will count with the support of the Administration Unit (*"Dirección Provincial Financiera"*) in PoG. This unit will support the FM activities with the following positions: Head of the Financial Directorate, Budget specialist, Treasurer, and Accountant.

Figure 1A.1: FM organizational structure



5. The FM staff, with required qualifications and experience, will be key to ensuring adequate FM arrangements throughout the life of the Project, and all the specific and required positions will be described in the POM under terms of reference acceptable to the WB.

6. **Planning and Budgeting**. The preparation of the annual budget follows procedures regulated by the PEU PoG. The Province Council oversees approving the annual budget. The budget is monitored through the Sistema de Gestión Pública (SGP), which was designed by the IT Department. It is used to record budgeting, accounting, and payment transactions. PoG through the Budget Sub directorate have the responsibility to formulate the budget and the preparation of an annual operating plan, including IBRD funds. Those general procedures will be complemented by specific procedures described in the POM. PoG, through the Financial Directorate, will be responsible for: (1) budget formulation and timely request of resources for each year as established in the work plan and budget; (2) proper recording of the approved budget in the respective information systems following classification by project component/sub-component/category; and (3) timely recording of commitments, accruals, and payments, to allow an adequate budget monitoring and provide accurate information on project commitments for programming purposes. Once the financing is approved by the World Bank and the approval of the Provincial Council is obtained, the resources from the financing will be integrated into the entity's budget.

7. **Accounting – Information Systems.** The PEU PoG will record all accounting transactions in the Sistema de Gestión Pública - SGP (a tailor-made system developed within the Province of Guayas) and the Sistema Integrado de Gestión Financiera - SIGEF to comply with the Regulations of the National Public Finance System by the Ministry

of Economy and Finance (MEF) as well as the article No 157 of the General Regulations of the Organic Code of Planning and Public Finances. The PEU will use information extracted from SGP and exported to Excel spreadsheets to issue the following reports: Statement of Sources and Uses of Funds, Statement of Cumulative Investments, and Statement of Expenditures. The chart of accounts that will be used by the project will be consistent with eligible expenditures classified by project component and subcomponent which will be financed out of the proceeds of the Loan as established in the Legal Agreement and the Project Appraisal Document (PAD).

8. **Internal Controls.** Under current Ecuadorian legal regulations, control examinations are carried out by the internal and external audit units of the State Comptroller General's Office (CGO). Moreover, the PEU PoG has the Coordination of Control Agencies, a unit in charge of carrying out internal monitoring of compliance with the recommendations resulting from the examinations carried out by the State CGO. The PEU has processes, procedures, and internal control mechanisms. The POM will reflect processes, procedures, and internal control mechanisms for the new project, chart of accounts according to the functional classification of the project, preparation of the Interim Financial Reports (IFRs), terms of reference of the FM staff, the flow charts that describe the procedures, roles and responsibilities, and specific internal controls to be followed for the implementation of the project. Therefore, this chapter, as with the entire POM, must be satisfactory to the Bank as an effectiveness condition.

9. **Internal Audit.** PoG organizational structure includes an Internal Audit Unit dependent on the State CGO which will play a role in ex-post internal control on project transactions.

10. **Financial reporting.** Interim Financial Reports (IFRs) will be issued from Excel spreadsheets on a cash accounting basis and should specify sources and uses of funds with expenditures classified by category and component. The IFR arrangements are the following:

PoG will be responsible for preparing and presenting project IFRs, including:

a. Semiannual IFRs such as:
   - **Statement of Sources and Uses of funds**, including reconciling items, bank reconciliations, cash balances, bank statements and reports.
   - **Statement of Uses of funds** reporting the current semester and the accumulated operations against ongoing plans with footnotes explaining the important variances.
   - Notes to the Financial Statements.

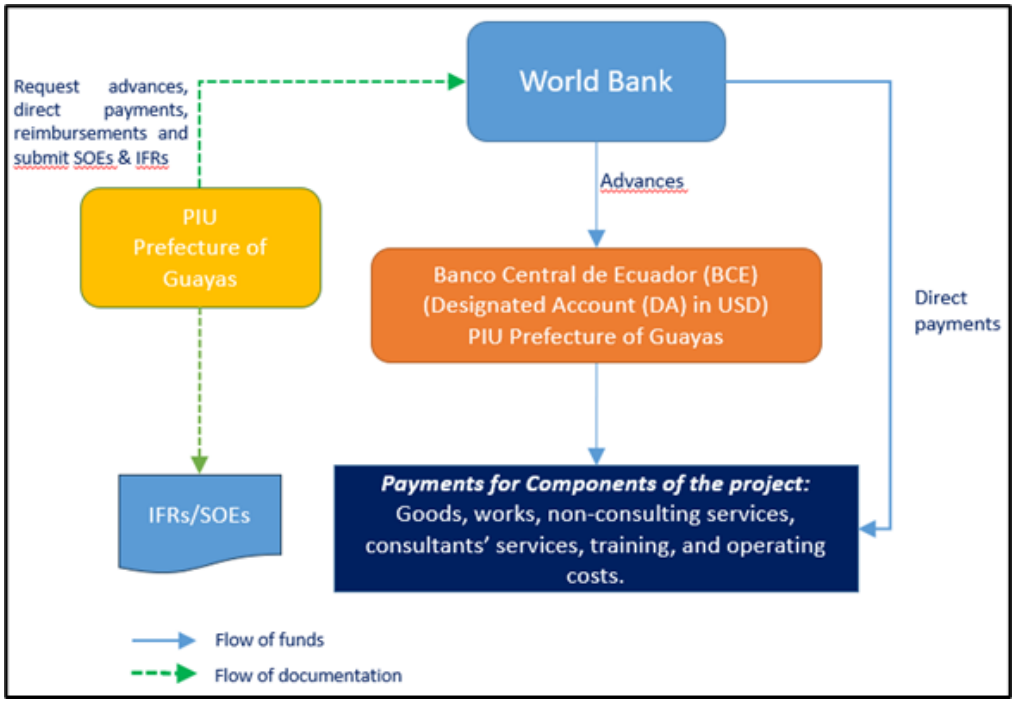
b. Annual financial statements (AFS) for project implementation subject to external audits.

The IFRs will include updated information on the use of loan. The IFRs will be prepared in US Dollars and will be submitted to the WB on a semester basis no later than 45 days after the end of each period. In addition, the PEU will prepare Annual Financial Statements (AFS) no later than 60 days after the end of the fiscal year. These AFS will be submitted to the auditors on time to meet the audit report deadline (see External Audit).

11. **External audit.** Project financial statements will be audited following International Standards on Auditing (ISA), by an independent firm and in accordance with terms of reference, both acceptable to the Bank. An audit firm will be hired by the PEU which will perform the audit of the project and provide the audit report to the PEU. The PEU will submit the audit report to the WB no later than 6 months after the end of each fiscal year or any other period agreed with the WB. Audit cost would be financed out of the loan resources. The scope of the audit will be defined by the PoG and the WB, based on project specific requirements and responding, as appropriate to identified risks.

12. **Flow of funds and disbursement arrangements.** Bank loan proceeds will follow the Bank's disbursement policies and procedures as described in the Disbursement and Financial Information Letter (DFIL). The Bank will disburse loan proceeds using one of following three methods: (i) advance method with a variable ceiling; (ii) direct payment; and (iii) reimbursement. The project's flow of funds is presented in the following chart:

Chart A1.2: Flow of funds and documentation



- *Advance method:* The PEU plans to open a designated bank account (DA) in U.S. dollars at Banco Central de Ecuador (BCE) that will be segregated, meaning the funds disbursed into the DA cannot be commingled with other funds. The DA ceiling, which establishes the maximum amount that can be disbursed into the account, will be based on a three-month forecast. The PEU PoG will have responsibility over the funds deposited in the DA and for the proper use of these funds for the purposes of the Project. However, the use of a DA for advances is currently suspended for new projects in the Ecuador Portfolio due to the PEU of MINEDUC (P152096) not returning to the Bank US$6.33 million of unspent funds since June 30, 2023. The Country Operations Officer is overseeing the situation. The project cannot use the advance disbursement method until the PEU reimburses the funds. Once the Bank receives the overdue amount, the Disbursement Team will revise the DFIL to permit DA usage again.
- *Direct payment and reimbursement methods:* The PEU will also use direct payment and reimbursement method following Bank procedures as established in the DFIL.
- *Retroactive expenditures:* Eligible payments must meet the following conditions:
  - Payments made on or after the date specified in the Financing Agreement (prior to the signing of the Financing Agreement).
  - That does not exceed 20 percent of the loan amount.
  - Retroactive expenses must comply with the Bank's regulations (financial management, procurement regulations and even safeguards depending on the expense).

- The retroactive expenditures would be subject to the same systems, controls and eligibility filters described above. Those expenditures would also be subject to the regular Project external audit.
- If retroactive financing is used, it is required to have a detailed list of expenses and what components/subcomponents and/or categories of the loan they would be related to.

13. The PEU will use the Statement of Expenditures (SOEs) to report eligible expenditures of the project following details established in the DFIL. All consolidated SOEs documentation will be maintained for post-review and audit purposes for up to one year after the final withdrawal from the loan account.

Category	Amount of the Loan Allocated (Expressed in USD)	Percentage of Expenditures to be financed. (Inclusive of Taxes)
(1) Goods, works, consultants' services and non-consulting services, Operating Costs, Training under parts 1 and 2 of the project (other than Land Compensation Payments)	**97,250,000**	100%
(2) Land Compensation Payments under part 1 of the project	**2,750,000**	100%
(3) Emergency Expenditures	**0**	
TOTAL AMOUNT	**100,000,000**	

(*) Although financing of taxes (IVA) is not required now, the Bank will leave the option to cover taxes according to country financing parameters.

14. **Supervision Strategy.** The Bank will conduct at least two FM supervisions per year and provide FM implementation support throughout the life of the project. Close FM supervision will be conducted based on the FM risk assessed, which will be continuously revised throughout project implementation and updated as risk assessment conditions might change.

Implementation support plan and resource requirements

15. **Supervision Strategy.** The Bank will conduct at least two FM supervisions per year and provide FM implementation support throughout the life of the project. Close FM supervision will be conducted based on the FM risk assessed, which will be continuously revised throughout project implementation and updated as risk assessment conditions might change.

16. **PEU.** Depending on the needs identified during the preparation and monitoring phase, additional staff may be recruited for the PEU based on operational needs. The selection of the positions listed below will require the approval of the Bank and may be filled by external consultants or PoG staff.

a. Project Coordinator: He/she will have experience in project management and relevant technical skills. He/she will be the main focal point for the purposes of articulation with the Bank and coordinate the PEU.
b. Civil Engineer (x3): The experts will technical skills required for project implementation including civil, structural, road, geotechnic, geological, and hydrogeological engineering, and transport planning.
c. Social Specialist: Senior professional with experience in road projects with Bank's E&S Standards.
d. Environmental Specialist: professional with experience in road projects with Bank's E&S Standards.

e. Procurement Specialist: Senior professional with experience in road projects, who ensures compliance with the national and international legal framework for state procurement and contracting, and with the WB Procurement Regulations.

f. Financial Management Specialist: Senior professional with experience in the implementation of externally financed public investment programs and projects. He/she will ensure timely implementation and compliance with the financial management arrangements. He/she will be supported by a Financial Assistant.

g. M&E Specialist: The Specialist will oversee the implementation of the monitoring system and will provide technical support to the Project Coordination and the PEU in the follow-up of the project activities to visualize the progress and/or difficulties for the fulfillment of the project development objective and results set.

h. Legal Expert: The Legal Expert will provide guidance on required regulation to the PEU. He or she will also advise the PEU on contractual requirements under the Bank Loan agreement and related documentation.

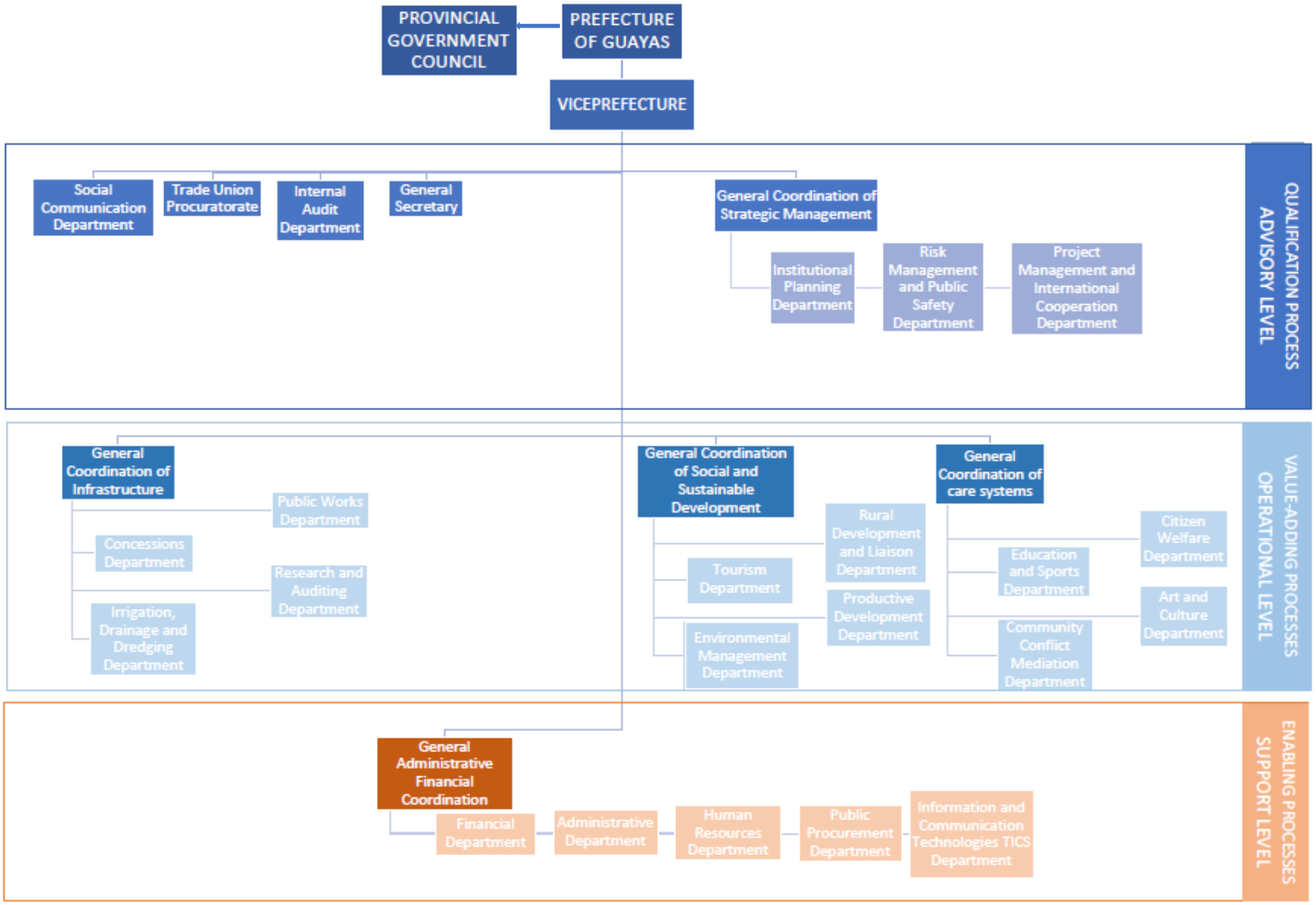
i. Road Safety Expert: The Expert will provide guidance on the road safety aspects of the interventions.

j. Climate Resilience Expert: The Expert will provide guidance in disaster risk reduction, climate-related hazards, and resilience planning due to climate change in the transport sector for rural roads and bridges.

The Figure 1A.3 diagram below corresponds to the current organic structure PoG.

17. **Project Operational Manual (POM).** The POM will include all procedures, rules, and standards for the implementation of all components and aspects of the Project including, but not limited to: (i) Institutional arrangements; (ii) operation of the PEU and involved PoG departments; (iii) roles, responsibilities, and Terms of Reference (ToRs) of key PEU staff members; (iv) Project planning and monitoring and evaluation; (v) social and environmental management, reporting, communication, and human resources; (vi) procurement; (vii) administrative processes and financial management; (viii) grievance procedures; and (ix) procedures for amending the POM.

Figure 1A.3 Current PoG Organic Structure



Source: PoG, 2024.

ANNEX 2: Sector Analysis and Technical Appraisal

A. Benchmark projects description

Table 2A.1. List of the Rehabilitation of Rural Roads of the Project

CODE	NAME	ABBREVIATION	BUDGET ($US)	LENGHT (KM)	AADT 2022 (VEH/DAY)	GEOGRAPHICAL COORDINATES			
						START		END	
						Latitude	Longitude	Latitude	Longitude
SUBCOMPONENT 1.A. Road Construction and Rehabilitation			**87,613,000**	**89.75**	**4,796**				
1.1	Rehabilitation of the road km 3.3 Salitre-Vernaza-Bodeguita-T de Baba-provincial boundary, located in the Salitre canton.	T DE BABA	5,910,000	11.40	811	1°50'52.45"S	79°43'48.48"O	1°48'1.16"S	79°47'24.35"O
1.2	Rehabilitation of El Deseo - La Inmaculada - Cruce Bueno Road, located in the canton of Yaguachi.	CRUCE BUENO	2,823,000	5.05	487	2°12'50.64"S	79°35'41.63"O	2°12'6.55"S	79°37'38.62"O
1.3	Rehabilitation of the road connection E30 - Pedro Vélez - Carlos Julio Arosemena, located in the canton of El Empalme.	PEDRO VELEZ	18,281,000	16.70	981	0°55'52.47"S	79°43'32.04"O	1° 2'43.48"S	79°45'16.23"O
1.4	Rehabilitation of the road San Antonio - San Miguel, in the Guayaquil and Playas cantons.	SAN ANTONIO	8,432,000	7.50	534	2°33'0.43"S	80°19'38.77"O	2°32'0.15"S	80°23'17.46"O
1.5	Rehabilitation and asphalting of the Colimes - Olmedo provincial limit road in the Colimes canton.	COLIMES OLMEDO	31,212,000	30	*1,115	1°32'21.24"S	80° 1'27.35"O	1°24'40.00"S	80° 9'53.25"O
1.6	Rehabilitation of the access roads to the tourist centers 7 Cascadas and Pauji, in Naranjal canton.	7 CASCADAS	5,088,000	6.30	*160 and 426	2°43'3.66"S	79°38'8.60"O	2°42'30.39"S	79°39'27.87"O
		PAUJI				2°40'58.25"S	79°34'44.88"O	2°40'32.63"S	79°36'16.41"O
1.7	Rehabilitation of the road the Valle de la Virgen - provincial boundary and provincial boundary - Las Muras - provincial boundary roads, located in the Pedro Carbo and Colimes cantons.	VALLE DE LA VIRGEN I	15,867,000	12.80	*282	1°34'27.62"S	80°13'59.53"O	1°36'58.28"S	80°14'11.87"O
		VALLE DE LA VIRGEN II				1°40'42.40"S	80°12'30.87"O	1°43'58.67"S	80°11'54.25"O

*2023

1. **Rehabilitation of the T de Baba Road.** The rehabilitation of the road Bodeguita – T de Baba – Provincial Boundary provides a road with adequate characteristics to connect the populations neighboring the road with the rest of the country's road network. Currently, the road is at gravel level; however, at the beginning of 2024, it was reshaped with a double irrigation system at a width of seven meters. According to the analysis of the behavior of the traffic that circulates in the road, this project has been catalogued as a Class II Road with an Annual Average Daily Traffic (AADT) of 811 veh/day in 2022. The road is 11.40 kilometers long and is designed to have an asphalt pavement. Two road sections are contemplated: in the resettlement area next to the highway with two lanes of 3.50 meters each, and a rural section with two lanes of 3.50 meters and shoulders of 2.50 meters. It is planned to raise the road surface by 32 cm in anticipation of the increased intensity of flooding due to climate change. The current road users are two and three wheeled motorized traffic, buses, and vehicles, and in urban areas pedestrians, and bicycles. There is a school within the urban area of the road.

2. **Rehabilitation of the Cruce Bueno Road.** The road El Deseo – La Inmaculada – Cruce Bueno, located in the Yaguachi canton of the Province of Guayas, is currently in poor condition, consisting of a double irrigation pavement of an average width of 6 meters along the road. There are numerous potholes and sinkholes, due to lack of maintenance and structural support in its pavement, making it difficult for vehicles to pass, increasing transportation times and vehicle maintenance costs. According to the analysis of the behavior of the traffic that circulates on the road, and considering the amount of population that is settled on the sides of the road, it is classified as a Class III Road with an AADT of 487 veh/day in 2022. The road has a length of five km and is designed to have an asphalt pavement. Two road sections are contemplated: in the resettlement area next to the highway with two lanes of 3.35 meters, curbs, and sidewalks of 1.40 meters, and a rural section with two lanes of 3.35 meters and shoulders of 1.50 meters. It is planned to raise the road surface by 40 cm in anticipation of the increased intensity of flooding due to climate change. The current road users are two and three wheeled motorized traffic, public transportation, and private vehicles, and in the resettlement area next to the highway pedestrians, and bicycles.

3. **Rehabilitation of the Pedro Velez Road.** The E30 – Pedro Velez – Carlos Julio Arosemena road is in the Empalme canton of the Province of Guayas. Currently, the road presents an asphalt layer in poor conditions. According to the analysis of traffic behavior on the road, it is classified as a Class II Road with an AADT of 981 veh/day in 2022 The road is 16.79 km long and is designed to have an asphalt pavement. Two road sections are contemplated: a rural section with two lanes of 3.50 meters and shoulders of 1.5 meters, in the resettlement area next to the highway with two lanes of 3.10 to 4.00 meters, curbs and sidewalks of 1.5 to 2.00 meters. It is planned to raise the road surface by 82.5 cm and a new bridge in anticipation of the increased intensity of flooding due to climate change. The construction of two new bridges is also planned: Jermud Bridge (45 meters) and Pedro Velez Bridge (20 meters). The current road users are two and three wheeled motorized traffic, public transportation, private vehicles, pedestrians, and bicycles.

4. **Rehabilitation of the San Antonio Road.** The project is in the Cantons of Guayaquil and Playas, it starts in the San Antonio Commune, advancing along the road until it reaches the sector known as San Miguel along an existing road of regular conditions. According to the analysis of the behavior of the traffic that circulates on the road, it is classified as a Class III Road with an AADT of 534 veh/day in 2022. The road has a length of 7.5 km and is designed to have asphalt pavement. The project envisions two road sections. One section in the resettlement area next to the highway with two lanes of 3.35 meters, curbs, and existing sidewalks. A second rural section with two lanes

of 3.35 meters and shoulders of 2.00 meters. The activity also includes the construction of a new bridge over the El Morro estuary (50 meters). The current bridge is in poor condition, especially the deck, which is seriously deteriorated and could collapse completely especially due to the risk of flooding impacted by climate change. It is planned to raise the road surface by 89 cm in anticipation of the increased intensity of flooding due to climate change. The current road users are two and three wheeled motorized traffic, public transportation, private vehicles, pedestrians, and bicycles.

5. **Rehabilitation of the Colimes Road.** The Colimes – Provincial boundary road is in the Colimes Canton, in the Province of Guayas. It starts on the outskirts of the Cantonal head of Colimes, running along the road with a length of 29.16 km. Currently, the road presents an asphalt layer in poor vehicular conditions. According to the analysis of the behavior of the traffic circulating on the road, it is classified as a Class II Road with an AADT of 1,115 veh/day in 2023. The road has a length of 30 km and is designed to have an asphalt pavement. The road section is contemplated as two lanes of 3.50 meters and shoulders of 2.00 meters. The longitudinal profile of the existing road was redesigned based on the flooding levels due to climate change impact. It is planned to raise the road surface by 87.5 cm in anticipation of the increased intensity of flooding due to climate change. Also, it was determined that the existing bridges are in good condition, so only their maintenance is contemplated, in addition to the installation of a superlight culvert. The current road users are two and three wheeled motorized traffic, public transportation, private vehicles, pedestrians, and bicycles.

6. **Rehabilitation of the Siete Cascadas and Paují Roads.** This project contemplates the rehabilitation of the access road to the Siete Cascadas tourist center and the Naranjal-Paují roads, both located in the Naranjal canton of the Province of Guayas. The access road to the Siete Cascadas tourist center is currently in poor condition, making it difficult for vehicles to pass, increasing transportation times and vehicle maintenance costs. According to the analysis of traffic behavior on the road, it is classified as a Class III Road with an AADT of 160 veh/day in 2023. The road has a length of 2.8 km and is designed to have an asphalt pavement. The road section is contemplated as two lanes of 3.00 meters and shoulders of 1.50 meters. It is also planned the placement of a superlight culvert. The Naranjal – Paují road is currently in poor condition, making it difficult for vehicles to pass, increasing transportation times and vehicle maintenance costs. According to the analysis of traffic behavior on the road, it is classified as a Class III Road with an AADT of 426 veh/day in 2023. The road is 3.5 km long and is designed to have asphalt pavement. The road section is contemplated as two lanes of 3.00 meters and shoulders of 1.50 meters. It is planned to raise the roads surface by 895 cm in anticipation of the increased intensity of flooding due to climate change.

7. **Rehabilitation of the Valle de la Virgen Road.** The project is in the Province of Guayas, with a total length of approximately 12.88 km. It is divided into Section 1: Valle De La Virgen - Provincial Boundary and Section 2: Provincial Boundary Road - Las Muras - Provincial Boundary, which are in the Pedro Carbo and Colimes cantons, respectively. Sections 1 and 2 are classified as Class III Road, with a traffic of 282 veh/day in 2023. Section I has a length of 7.64 km. The design includes the construction of the Las Naranjas bridge (20 meters). Section 2 has a length of 5.24 km and includes the Dos Bandas Sector bridge (35 meters) and the London Sector bridge (11.65 m), which will be rebuilt. Both sections have a gravel-type roadway and are currently in poor condition. It is planned to raise both roads surface by 72.5 cm in anticipation of the increased intensity of flooding due to climate change.

8. The Borrower has identified a list of the Rehabilitation of Bridges that will be subject to Financing, described below:

Table 2A.2. List of the Rehabilitation of Bridges of the Project

CODE	NAME	ABBREVIATION	BUDGET ($US)	LENGHT (m)	AADT 2022 (VEH/DAY)	GEOGRAPHICAL COORDINATES			
						START		END	
						Latitude	Longitude	Latitude	Longitude
SUBCOMPONENT 1.B. Construction and Rehabilitation of Bridges in rural areas			5,887,000	265	1,348				
2.1	Construction of the bridge over the Evia River, in the canton of El Triunfo.	PUENTE EVIA	663,000	25	176	2°14'26.02"S	79°10'55.46"O	2°14'8.16"S	79°10'56.89"O
2.2	Construction of the bridge over the river Las Flores in the canton of El Triunfo in the province of Guayas.	PUENTE LAS FLORES	639,000	25	177	2°14'39.85"S	79°10'53.49"O	2°14'26.02"S	79°10'55.46"O
2.3	Construction of the bridge over the Estero El Hediondo in the Naranjito canton.	PUENTE EL HEDIONDO	563,000	20	255	2° 9'1.32"S	79°21'24.80"O	2° 9'20.95"S	79°21'26.64"O
2.4	Construction of the bridge over the Milagro stream, in Naranjito canton.	PUENTE MILAGRO	565,000	20	296	2° 8'34.12"S	79°18'48.36"O	2° 8'51.21"S	79°18'58.44"O
2.5	Construction of the El Limón bridge, in Naranjito canton.	PUENTE LIMÓN	663,000	30	242	2° 9'19.08"S	79°22'10.32"O	2° 9'37.65"S	79°22'18.10"O
2.6	Construction of the bridge over the Toro stream, in the Naranjito canton.	PUENTE EL TORO	553,000	15	202	2° 7'45.60"S	79°21'17.43"O	2° 8'6.11"S	79°21'19.54"O
2.7	Construction of a pedestrian bridge over the Chimbo River, in the cone - Chobo sectors, in the cantons of Yaguachi, Milagro.	PUENTE CONE	942,000	55	not applicable	2°10'1.39"S	79°38'49.02"O	2° 9'59.96"S	79°38'47.42"O
2.8	Construction of a pedestrian bridge in La Dolorosa 2, Lorenzo de Garaicoa canton, Simón Bolivar cantón.	PUENTE LA DOLOROSA	1,299,000	75	not applicable	2° 5'22.53"S	79°24'18.01"O	2° 5'23.84"S	79°24'20.13"O

9. **Evia and Las Flores Bridges.** The bridges are in the Province of Guayas, in the canton of El Triunfo. They will connect the San Luis and San Joaquín precincts. Currently, there are no bridge infrastructure, which means that in the event of flooding, the road becomes inaccessible, leaving no alternative routes for transporting agricultural products or moving people. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months of the year. Bridge over the Evia River. It is 25 meters long and nine meters wide bridge and is located inside a secondary road that emerges in the San Francisco sector from the main collector road that joins the towns of Bucay and Naranjito, in an area that is susceptible to flooding during the rainy season. The bridge consists of six pre-tensioned longitudinal beams supported by a reinforced concrete slab with vehicular protection. Bridge over Estero Las Flores. It is 25 meters long and nine meters wide and is located inside a secondary road that emerges in the San Francisco sector from the main collector road that joins the towns of Bucay and Naranjito, in an area that is susceptible to flooding during the rainy season. The bridge consists of six pre-tensioned longitudinal beams supported by a reinforced concrete slab with vehicular protection.

10. **El Hediondo Bridge.** The bridge will link the San Francisco and La Primavera areas, the construction of the bridge will help to efficiently move products that are produced in the area such as cocoa, sugar cane, bananas, among others, in addition to encouraging tourism in the sector, there are several sites such as La Playita del Bosque that has been operating for several years. The bridge is 20 meters long and 9 meters wide, it is located inside a secondary road that emerges from the main collector road that connects the towns of Bucay and Naranjito. It is an area that is susceptible to flooding during the rainy season. The bridge consists of six pre-tensioned longitudinal beams on which rests a reinforced concrete slab that has vehicular protection. Currently, the bridge is in poor condition and frequently affected by flooding, making the road inaccessible. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months each year.

11. **Milagro Bridge.** The bridge is 20 meters long and nine meters wide and is located inside a secondary road that emerges in the San Francisco sector from the main collector road that connects the towns of Bucay and Naranjito, in an area that is susceptible to flooding during the rainy season. The bridge consists of six pre-tensioned longitudinal beams supported by a reinforced concrete slab with vehicular protection. Currently, the bridge is in poor condition and frequently affected by flooding, making the road inaccessible. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months each year.

12. **Limón bridge.** The Limón bridge will join the San Enrique and San Antonio precincts. It is 30 meters long and nine meters wide and is located inside a secondary road that emerges in the San Francisco sector from the main collector road that joins the towns of Bucay and Naranjito, in an area that is susceptible to flooding during the rainy season. The bridge consists of six pre-tensioned longitudinal beams supported by a reinforced concrete slab with vehicular protection. Currently, the bridge is in poor condition and frequently affected by flooding, making the road inaccessible. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months each year.

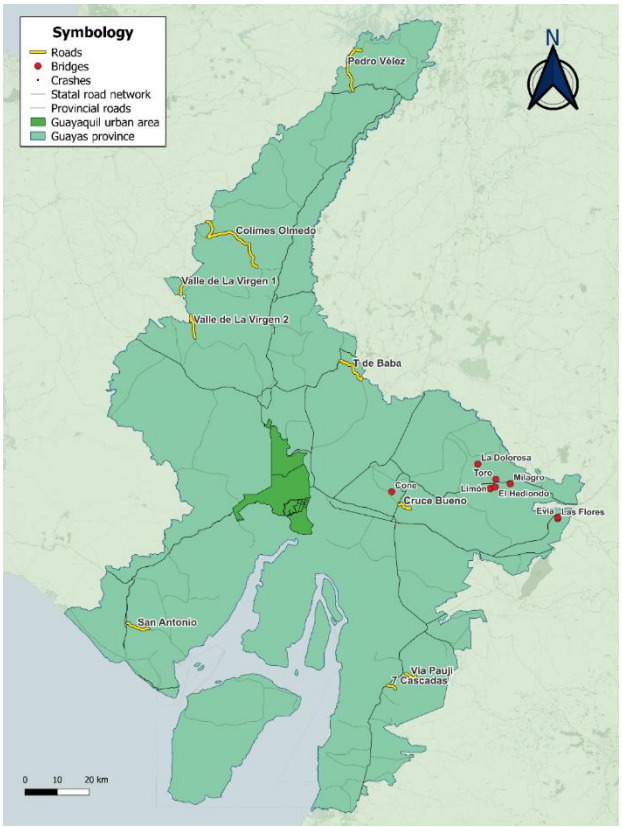
13. **El Toro Bridge.** The bridge will link the Amarrillo and San Francisco precincts. It is 15 meters long and nine meters wide and is located inside a secondary road that emerges in the San Francisco sector from the main collector road that joins the towns of Bucay and Naranjito, in an area that is susceptible to flooding during the rainy season. The bridge consists of six pre-tensioned longitudinal beams supported by a reinforced concrete slab with vehicular protection. Currently, the bridge is in poor condition and frequently affected by flooding, making the road inaccessible. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months each year.

14. **Cone Bridge.** The pedestrian bridge, which connects the parishes of Cone (Yaguachi Viejo) in the San Jacinto de Yaguachi canton with Chobo in the San Francisco de Milagro canton, is structural design as a pedestrian bridge structure over the Chimbo River with 55.60 meters long, with a height at the free edge or gauge of two meters.

The superstructure of the bridge is made up of modified Warren type trusses, with an underpass, supported on reinforced concrete heads, with direct surface foundations, following the recommendations of the geotechnical study and in accordance with the resistant characteristics of the terrain. This bridge will be revised since it is also used for motorcycles. Currently, the bridge is in poor condition and frequently affected by flooding, making the road inaccessible. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months each year.

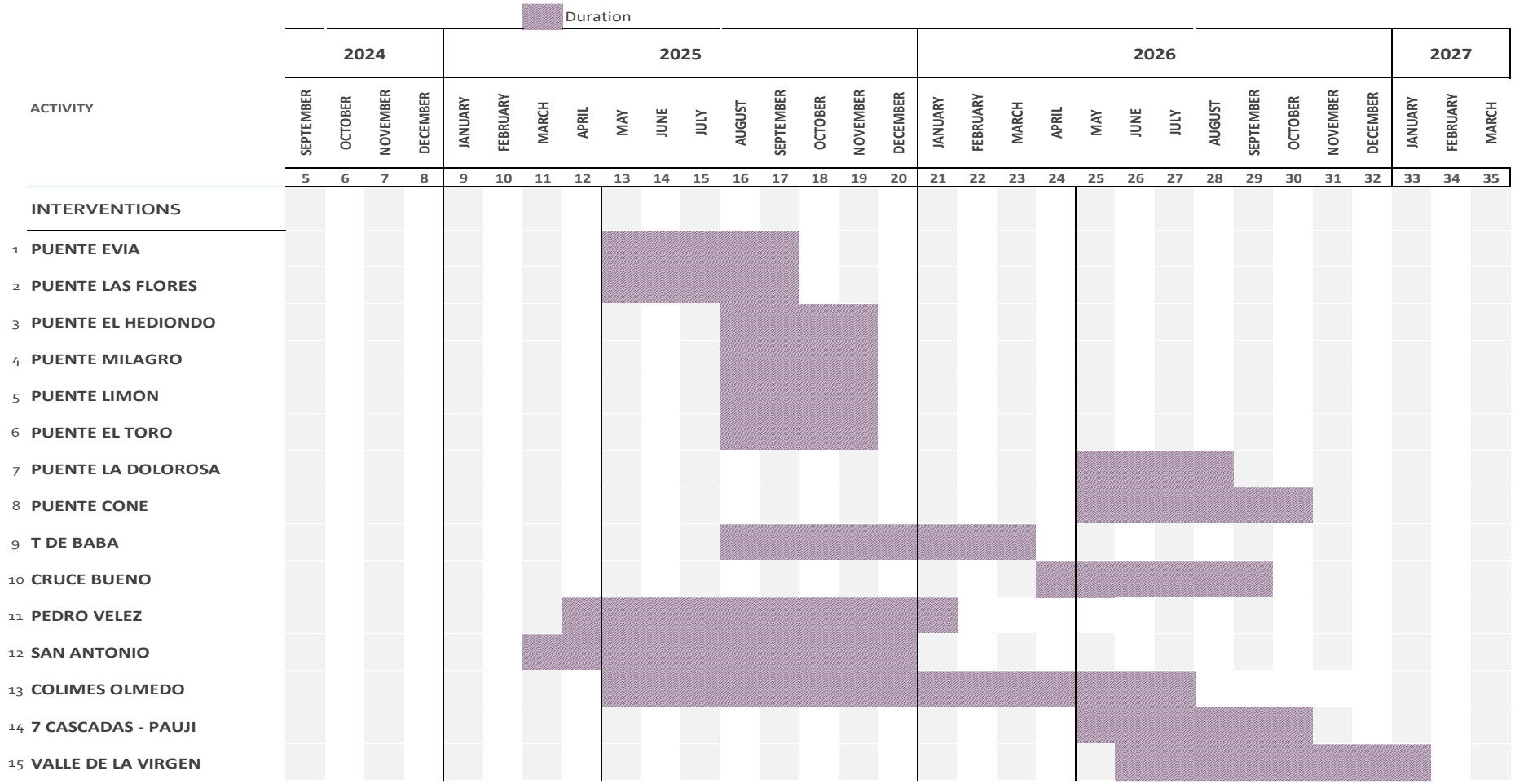
15. **La Dolorosa Bridge.** La Dolorosa bridge is located in the Simón Bolívar Canton, Lorenzo de Garaycoa Parish, La Dolorosa 2 Recinct. The bridge will have a length of 75 meters, considering the recommendations of the hydrological-hydraulic report and the conditions of the project, with a height to the free edge or gauge of two meters. The bridge superstructure consists of modified Warren type trusses, with underpass, supported on reinforced concrete piers, with deep foundations by means of bored piles built on site, following the recommendations of the geotechnical study and according to the resistant characteristics of the soil. The footbridge deck will be made up of a combination of corrugated galvalume or steel deck and cast concrete. Currently, the bridge is in poor condition and frequently affected by flooding, making the road inaccessible. The duration of these isolations is increasing because of climate change, rendering the road impassable for at least four months each year.

Figure 2A.1. Map of Roads and Bridges



Source: Province of Guayas, 2024.

C. Estimated implementation timeline for Component 1 Rural Road and Bridges Construction and Rehabilitation.



ANNEX 3: Economic Analysis

Methodology and Assumptions

1. The Project's economic analysis focuses on Component 1, evaluating the Cost-Benefit Analysis (CBA) of rehabilitation of rural roads. The analysis follows a standard incremental CBA methodology in compliance with World Bank Policy: Investment Project Financing with a one-year construction period (2025) and a 29-year operations period (2026-2055). The analysis calculates the social present value of each cost and benefit and then summarizes the Economic Internal Rate of Return (EIRR)[34] and Net Present Value (NPV) of discounted benefit - discounted costs (in 2024 US$).

2. For Project costs, the analysis considers only the capital expenditure needed for road rehabilitation as estimated by individual works studies. Periodic maintenance expenditures will also be necessary to keep assets in good condition and deliver Project benefits throughout the asset's lifetime. However, without reliable information on the estimated maintenance costs of the roads with and without the Project, these costs are not considered. This is a conservative approach for the CBA as it is likely that maintenance needs will be higher in the *without project* scenario compared to the *with project/rehabilitation* scenario as assets become more expensive to maintain as they age and deteriorate.

3. For benefits, the analysis considers passenger travel time savings, vehicle operating cost savings, resilience benefits, and consumer surplus from greater mobility (derived from demand generated from improvement of the road). The generated demand also leads to externalities such as increases in Greenhouse Gas (GHG) emissions. GHG emissions are priced in the analysis.

4. With increased traffic and higher operating speeds, rehabilitated roads can increase traffic crashes and associated fatalities and injuries. To mitigate road safety risk, the design of all roads will include road safety improvements. External Document for Road Safety includes further details on the road safety screening, which was used to determine the minimum acceptable design to mitigate road safety risk from rehabilitation works (i.e., to avoid an increase in probability of traffic fatalities and serious injuries). For the CBA, it was assumed that the minimum acceptable road safety improvements would be incorporated into project design resulting in no (dis)benefit from road safety. This is a conservative estimate because, should road safety design elements beyond the minimum be adopted, the benefit-cost ratio of the projects would only improve.

5. For costs, shadow prices are used to calculate the economic value of estimated financial costs. The analysis adjusts market prices and eliminates taxes, subsidies, and any other factors that distort the actual economic costs. In this analysis, the shadow price used is 0.815, the same as considered in other transport projects in Ecuador. It is also the value used by the Ecuador Ministry of Transport and Public Works (MTOP) for its own analysis.

6. Following World Bank guidance[35], the analysis uses a social discount rate of 4.8 percent. The calculation is based on the three elements of the Ramsey equation: $EIRR = \rho + \theta g$, where g indicates estimated economic growth rate; θ is elasticity of marginal utility which typically takes a value between 1 and 2; and ρ is the rate of time preference which typically takes a value between 0 and 0.2.[36] For Ecuador, g = 0.032 (or 3.2 percent) corresponding to the average household's final expenditure growth in the last 20 years; θ = 1.5 representing the midpoint elasticity value defining how much the marginal utility decreases as beneficiaries become richer; and ρ = 0 indicating equal preference for current and future benefits.

[34] This is defined as the discount rate at which the discounted costs equal the discounted benefits over the life of the Project.
[35] World Bank. March 2016. "Discounting Costs and Benefits in Economic Analysis of World Bank Projects."
[36] Frank Ramsey. 1928. "A Mathematical Theory of Saving."

7. **Average daily traffic** on all roads was estimated from manual or automatic traffic counts conducted during preliminary project design. Counts were completed at 2-4 stations along each road for seven consecutive days in 2022 or 2023. Annual average daily traffic (AADT) is estimated by vehicle type—cars, buses, medium-sized trucks (two axles), and large trucks (more than two axles)—from the traffic counts averaged across stations using the Geometric Design Norms of the MTOP (2003) and Cal and Reyes Spindola (1994).[37]

8. For the *without project* scenario, the AADT is projected forward using growth rates by vehicle type estimated from historic traffic growth for the province of Guayas[38] adjusted by local population growth. The median growth rate by vehicle type across each of the road traffic studies was used.

9. For the *with project* scenario, the analysis further considers the traffic generated by the rehabilitation of the road. Generated traffic accounts for the traffic that may reroute to the newly rehabilitated road, trips made by the current population that were not possible before the project, and additional trips that may arise from development adjacent to the new road in the future. In the absence of a detailed demand model, generated traffic is assumed to be an additional 30 percent of the AADT in the base year. This follows the Geometric Design Norms of the MTOP (2003) which suggest 20 percent generated traffic plus an additional 5 percent of development-induced traffic. The adjusted AADT is then projected forward using the same growth rates by vehicle type as applied in the without project scenario (based on historic data).

10. Projections of AADT for the *with* and *without project* scenarios are then multiplied by an annualization factor of 365 days per year to get annual vehicle flows for each road, which can be multiplied by the length of the segment to get vehicle-km.

11. **Resilience benefit.** For the *without Project* scenario, additional vehicle-km are added to the projection of AADT for roads that experience annual flooding. The daily traffic is multiplied by the number of days in a year in which the road is typically impassable and then further multiplied by the length of the additional km of detour needed to take the alternative route. For the *with Project* scenario, no detour vehicle-km are included since the project designs will incorporate adequate resilience measures to avoid such flooding events.

12. **Travel time savings** derive from the improvement in vehicle free-flow speed on the roads after their rehabilitation (with no change in travel distance). With improvement to the road pavement it is assumed that cars are able to increase speeds from 30 km/hr *without project* to 70 km/hr *with project* while buses and trucks are able to increase speeds from 25 km/hr to 50 km/hr. Travel time savings accrue to passengers (or goods) in the vehicles rather than the vehicles themselves, so vehicle times are multiplied by assumed occupancy rates by vehicle type of 2 for cars, 20 for buses, and 1 for both medium and large trucks. Travel times are converted into monetary values using a Value of Time (VOT) for beneficiaries. The VOT is conservatively estimated at US$2.51 following World Bank guidance.[39] This VOT is consistent with that used in other recent roads projects in Ecuador, including the Ecuador Emergency Resilient Reconstruction Project (P181079) and Improving Mobility in Ibarra Project for Ecuador (AF, P180667).

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37 Cal, Rafael, and Mayor Reyes Spindola (1994). *Ingeniería de Transito Fundamentos y Aplicaciones.*

38 National Institute of Statistics and Census (*Instituto Nacional de Estadística y Censos*, INEC). Estadísticas de Transporte 2003-2015.

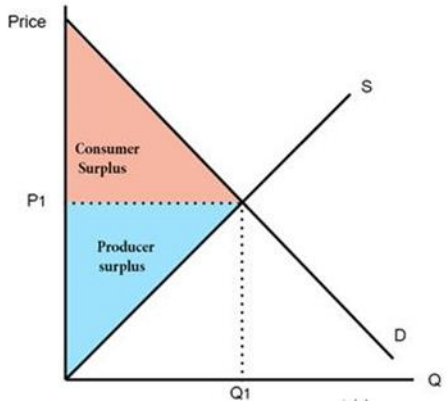
39 World Bank. 2005. "Transport Note No. TN-15, Notes on the Economic Evaluation of Transport Project. "The value of time due to work was estimated as follows: 1.33 x wage rate. Using US$ 435.19 as average monthly income, and 198 hours worked per month (US$ 3.06 per hour for work-related travel). The value of leisure time was estimated as follows: 0.3 x household income, using US$ 793.33 as the average monthly income of a household (2022); 3.9 people the average size of the household in Ecuador; and 198 hours worked per month (US$ 0.31 per hour for leisure travel). The team assumed that 80 percent of travel is for work and 20 percent of travel is for leisure. Thus, the weighted average value of time is US$ 2.51 per hour.

13. **Savings in vehicle operating costs (VOCs)** derive from improvements to the quality of the road pavement surface after rehabilitation. To estimate the VOC reduction based on the reduction in kilometers traveled, the reference values in Table 3A.1 were used. This VOC value includes cost of depreciation, maintenance, tires, and fuel estimated from HDM4 calibrated to the Ecuador context.

Table 3A.1. Vehicle Operating Cost Assumptions used in the Economic Analysis (US$/veh-km)[40]

Type of Vehicle	*without project*	*with project*
Car	0.2136	0.1473
Bus	0.1797	0.1372
Truck, medium	0.3160	0.1549
Truck, large	0.3160	0.1549

14. **Consumer surplus.** Since the analysis considers the negative externalities associated with induced demand, it also accounts for the benefits of additional travel in the *with project* scenario. To quantify the benefit, we assume an elasticity of 1 and calculate the consumer surplus (CS) triangle area as induced demand (D) times travel time (T) times value of time (VOT), divided by 2 such that: CS = (½)[Q*P], where Q = D*T and P = VOT.



15. **GHG emissions.** The analysis estimates GHG emissions from vehicles on the roads and bridges based on emission factors determined by the type of vehicle and distance traveled annually. First distance traveled by vehicle type is converted to fuel consumption based on estimates of fuel economy by vehicle type in Ecuador: 10.6 km/L for cars, 9.2 km/L for medium (two-axle) trucks, and 7.9 km/L for large trucks of more than two axles.[41] Buses were assumed to have the same fuel economy as large trucks. Then fuel consumption is converted to GHG emissions using an average of 2.35 kg CO_2 emitted per liter of fuel[42] and then scaled by a factor of 1.11 to account for the approximately 10 percent of vehicle GHG emissions that come from gases other than CO_2, such as CH4 and NO2. The analysis conservatively assumes no improvement in vehicle fuel efficiency in both the with and without project scenarios. To consider the costs associated with the emission of GHGs, the team has followed World Bank guidance on the shadow price of carbon, using a low-value scenario (that starts at a price of US$45/t$CO_2$e in 2025

40 Average across HDM4 estimates in feasibility studies implemented by the PoG.

41 Emission factors for Ecuador estimated by the Army Polytechnic School between 2004-2009 and updated by the Ministry of Energy and Non-Renewable Natural Resources. These are the same emission factors used in preparation of the Ecuador Emergency Resilient Reconstruction Project (P181079).

42 This is in line with the "Default CO_2 emission factors for common Transportation Fuels" mentioned in the Bank's guide "Greenhouse Gas Accounting and Shadow Price of carbon for Transport Investment Operations" (p. 22) which indicates a value of 2.3 kg CO_2/liter for when local values are not available.

and grows to US$80/tCO$_2$e by 2050) and a high value scenario (that starts at a price of US$89/tCO$_2$e in 2025 and grows to US$156/tCO$_2$e).

Summary of Cost-Benefit Analysis Results

16. Under base case assumptions, the package of road investments under the project achieves an EIRR of 8.9 - 9.2 percent, depending on the shadow price of carbon. Using the social discount rate of 4.8 percent, the investments achieve a NPV of 2024 US$ 34.7 - US$ 37.1 million.

17. The largest benefits from the project come from travel time savings (present value of 2024 US$ 67.3 million) as rehabilitated and more resilient roads allow for higher speeds of travel and avoid potential detours due to flooding. The second largest benefit comes from vehicle operating cost savings (present value of 2024 US$ 26.5 million). Consumer surplus from increased mobility provides a present value of nearly 2024 US$ 8.2 million, while generated traffic also comes at a cost of 2024 US$ 2.4 - 4.7 million in GHG emissions, depending on the shadow price of carbon used.

18. Under base case assumptions, the roads interventions are estimated to increase greenhouse gas emissions by a cumulative 83,197 tCO$_2$e over the full evaluation period of 2025-2055.

Sensitivity Analysis

19. A sensitivity analysis demonstrates that the results of the economic analysis are robust to changes to investment costs and generated traffic (demand) (see Table 3A.2.). The road investments would still be economically viable if capital costs were to increase by 50 percent with base case assumption of generated demand. If investments were to generate significantly more demand than was originally estimated by inducing greater travel, the EIRR of the project decreases because the travel time and VOC savings of existing traffic is offset by increased costs from new traffic (accompanied by an increase in greenhouse gas emissions and other externalities). Only in the unlikely case where costs are 30-50 percent higher than originally estimated and generated demand is 30-40 percent does the project become economically unviable compared against the social discount rate of 4.8 percent.

Table 3A.2. Summary of EIRR (%) with Sensitivity Analyses, high shadow price of carbon

EIRR	Generated demand				
Capital costs	+10%	+20%	+25% (base case)	+30%	+40%
+0% (base case)	11.1	9.7	8.9	8.2	6.5
+10%	10.0	8.7	7.9	7.2	5.6
+20%	9.1	7.8	7.1	6.4	4.8
+30%	8.2	7.0	6.3	5.7	4.2
+40%	7.5	6.3	5.7	5.0	3.6
+50%	6.8	5.7	5.1	4.5	3.1
+60%	6.3	5.2	4.6	4.0	2.6

ANNEX 4: Climate Co-Benefits

1. **The Project is consistent with Ecuador's National priorities, such as the Nationally Determined Contributions (NDC), National Adaptation Plan (NAP), and the National Climate Change Strategy (ENCC) of Ecuador**. In 2021, Ecuador set the unconditional goal of reducing its Greenhouse Gases (GHG) emissions by nine percent by 2025 and conditional on international support and cooperation, the commitment goes up to 20.9 percent. The NDC submitted in 2019[43] included adaptation actions related to transport, referring to the NAP and ENCC. One of the main objectives of the NAP is to reduce the vulnerability of Ecuador's transport infrastructure to the impacts of climate change by increasing its adaptive capacity and building resilience, which will comply with sectoral policies and integrated guidance for the Public Investment Plan. Similarly, the main objective of the ENCC is to reduce the negative impacts of climate change on Ecuador's economy, society, and environment, while also promoting sustainable development. The ENCC aims to improve the resilience of transport infrastructure by strengthening its design, operation, and maintenance, considering the projected impacts of climate change, and implementing measures to reduce emissions.

2. **The primary natural hazards that significantly affect the population of the Guayas are flooding and high-intensity earthquakes.** 93.5 percent of the province's territory is in a high seismic hazard zone, while 58.5 percent is prone to floods of up to 10 inches. These factors, combined with rising sea levels, make it one of the provinces with the highest incidence of natural disasters, and it is historically one of the most affected by the ENSO. The floods have a significant impact on the population, causing temporary displacement, damage to infrastructure, economic losses, and public health risks. In the 2024 winter season, 7,000 people have been affected and 2,047 homes have been damaged by the rains so far.

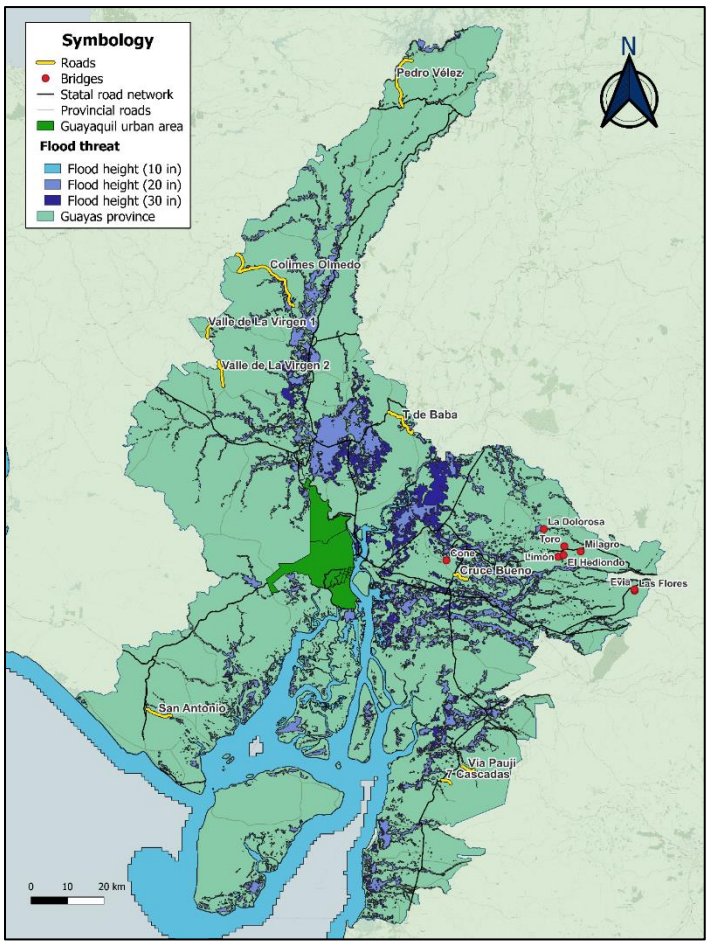
3. **The road infrastructure in the PoG is highly susceptible to the adverse effects of climate change, particularly to flooding which poses significant challenges to the region**. Employing a criticality analysis model using Geographic Information System (GIS) tools, it was conducted a comprehensive simulation to measure the impact of climate change on Guayas' provincial road network. The findings underscore the urgent need to assess the magnitude of extreme weather events and their repercussions on local mobility and economic activities. This vulnerability underscores the critical importance of bolstering the resilience of these roads against such environmental threats. Moreover, the lack of alternative routes exacerbates the situation, underscoring the necessity for investments in road rehabilitation and risk mitigation measures. These interventions are not merely infrastructural upgrades but pivotal steps towards fostering resilient development in rural communities mitigating the impact of climate change. Furthermore, they are essential for safeguarding human lives during evacuation scenarios. The Figure 4A.1 shows that the roads and bridges of the project are prone to flooding, which will be aggravated by the effects of climate change.

4. **Developing a greener, safer, and more efficient infrastructure will help reduce emissions from the transport sector, target fuel subsidies, and promote infrastructure that is more resilient to natural hazards.** Due to the government's lack of updated guidelines for designing and constructing road infrastructure, coupled with inadequate long-term maintenance planning and frequent natural disasters, rural roads pose a significant risk of failing to provide adequate service to communities, especially during the rainy season. The most notable climate risks for the proposed Project are flooding throughout the province that affects the drainage capacity of the roads, the high exposure to earthquakes in the country and the rise in sea level in the projects in the coastal zone. Therefore, the Project aims to enhance connectivity by promoting sustainable, safe, and resilient road transport in the PoG. This includes implementing mitigation and adaptation measures for climate change effects, such as:

[43] NDC Ecuador, 2019.

(i) integrating climate change considerations into road and bridge designs within the province; (ii) providing training to the PoG technicians on incorporating climate change parameters into project works to foster resilience; and (iii) promoting the recycling of materials where feasible.

Figure 4A.1. PoG road network exposed to flooding of more than 50in.



Source: WB, 2024.

5. **The Project is centered on enhancing the resilience of road infrastructure, and drainage systems, especially those susceptible to climate-related events**. The roads and bridges of the project will be designed with standards that prioritize resilience to climate change, mitigating and adapting to the potential impacts of sea-level rise and enhancing the designs to withstand a 100-year return period for floods. Moreover, the design incorporates features to enhance road safety and promote non-motorized transport (NMT), including the development of trails, bicycle lanes, and new bus stops tailored to the specific needs of the area.

6. **Several measures will be integrated in the Project design to address its vulnerability to climate change.** These include the following:

   a. **Resilience through protective works on culverts and bridges:** In all interventions planned by the Project, the design will focus on implementing adequate cross drains, culverts, and bridges to improve resilience to known risks and potential hazards. For example, waterway crossings will be sized to handle expected water flow, and all bridges will have hydraulic capacity for 100-year rainfall return events. These new designs will be governed

by technical standards based on international best practices, such as wider bridge spans and culvert openings designed to accommodate heavier precipitation flows.

b. **Resilience through Maintenance:** Improving maintenance plans is crucial for ensuring the resilience of road infrastructure. Regular maintenance of sewers, longitudinal and transversal drainage systems, and other critical components is essential to prevent roads from being adversely affected during extreme weather events. Studies have shown that adequate maintenance significantly reduces the frequency and severity of disruptions in the rural road network, leading to reduced response times and costs associated with road disconnections. Therefore, developing comprehensive maintenance plans that specifically target risks associated with extreme weather events is imperative for enhancing the sustainability of investments in road infrastructure.

c. **Resilience through Nature-Based Solutions:** Protecting newly constructed or rehabilitated water crossing structures against erosion and stabilizing slopes and cuts against landslides and erosion are critical aspects of resilience. Various measures will be implemented to safeguard these structures and their surroundings during extreme precipitation events, including: (i) incorporating vegetation for slope stabilization, which has been proven to reduce erosion rates by up to 90 percent in some cases; (ii) installing retaining walls, breakwaters, and gabions to prevent erosion and protect infrastructure near water bodies; (iii) implementing debris flow prevention and mitigation measures, such as catchment systems and barriers, to reduce the impact of sediment transport during heavy rainfall; and (iv) utilizing shotcrete for slope stabilization. These nature-based solutions not only enhance the resilience of infrastructure but also contribute to environmental sustainability and biodiversity conservation.

d. **Resilience to flooding and sea level rise:** Given that flooding is the most significant risk for the project, the design will incorporate measures to identify local flood zones and areas susceptible to flash floods and sea-level rise. This includes conducting detailed studies to assess current and future river crossings and improve local drainage capacity as needed to enhance flood resilience. Additional data and measures considered include: (i) utilizing advanced hydrological modeling techniques to accurately map flood-prone areas and identify vulnerable zones; (ii) incorporating climate-resilient materials and construction techniques for infrastructure located in high-risk flood zones. These comprehensive resilience strategies aim to safeguard the infrastructure against the increasing challenges posed by flooding and sea-level rise, ensuring long-term functionality and sustainability.

e. **Resilience to extreme high temperatures:** During high summer periods, it is expected to increase the temperature due to climate change. Therefore, the project will utilize materials specifically designed to withstand extreme heat in bituminous pavement layers. These materials are crucial for resisting deformation and rutting, which are common issues associated with high temperatures that lead to premature deterioration of bituminous courses. Some of the strategies are: (i) incorporating polymer-modified bitumen for surface seals, which significantly enhances the resilience of pavements to thermal stress and prolongs their service life; (ii) developing maintenance plans focused on proactive measures to address temperature-induced distress, such as crack sealing and joint maintenance, to prevent accelerated deterioration; amount others.

f. **Resilience through climate resiliency studies**: To ensure the robustness of rural roads and bridges funded under the Project, comprehensive climate resilience studies will be undertaken. These studies will be conducted by independent consulting firms with expertise in climate adaptation and infrastructure resilience. The resulting recommendations and designs will adhere to climate-resilient standards, which may exceed the existing national design standards to account for future climate change impacts. These studies will include: (i) conducting vulnerability assessments to identify climate-related risks and vulnerabilities specific to each

intervention; (ii) incorporating innovative design solutions, such as drainage systems capable of handling extreme weather events, into the road infrastructure; (iii) implementing green infrastructure practices to reduce flood risks; and (iv) integrating climate-resilient materials, such as recycled and locally sourced materials, to enhance durability and reduce environmental impact.

7. **Most of the road and bridge rehabilitation will be to improving the resilience of transport connectivity and climate adaptation.** The climate change affects almost all elements of construction, due to increased size, strength, and functionality. The cost of climate adaptation varies from a small additional amount (green solutions for slope stabilization) to a large share of the investment cost (adequate hydraulic capacity and drainage), according to road and bridge class and capacity. Table A4.1 offers an estimation of the budget share of each activity specifically invested in climate adaptation and mitigation.

Table 4A.1.Estimated Climate Benefits of Project Activities with IBRD Financing

Description	Cost (US$)	Contribution to Climate Adaptation	Contribution to Climate Mitigation
Component 1: Rural Road Construction and Rehabilitation	**93,500,000**		
Subcomponent 1.a: Rehabilitation of rural roads ***(Improve the resilience of rural roads under high climate vulnerability risk)***	87,613,000	**Improving the resilience of rural roads in PoG to climate change is a core objective of the rehabilitation project**. PoG is highly exposed to climate vulnerabilities, with extreme weather events like heavy rainfall often rendering roads impassable. This isolation disrupts the transportation of goods, particularly agricultural products, and affects rural populations. The selected roads require significant improvements, including culvert construction and upgrades to longitudinal and horizontal drainage systems, to minimize climate vulnerabilities. For this subcomponent, climate adaptation features focus on rehabilitating roads at extreme risk of becoming non-passable during the next rainy season due to their poor condition. The design of these rehabilitated sections will account for the forecasted intensification of weather events, expecting higher water volumes over shorter periods. Effective drainage will be ensured by designing the system's capacity using IDF (Intensity-Duration-Frequency) curves updated to reflect projected rainfall characteristics in future climate scenarios. Key measures include: • *Drainage System Enhancement*: Designing drainage structures to handle 100-year return rainfall events, requiring longer structures and larger openings to enhance hydraulic capacity. • *Erosion Protection*: Implementing measures around water outlets and fast-flow drainage channels, such as return walls and slope stabilization using riprap, to prevent deterioration during heavy rainfalls. Current inadequate drainage systems often lead to water retention, causing erosion and road damage. • *Slope Protection*: Utilizing bioengineering and civil works, such as gabions, retaining walls, and riprap, to reduce the risk of landslides and embankment erosion. Planting vegetation like vetiver for slope stabilization provides low-emission construction solutions. • *Surface and Platform Protection*: Sealing roads with asphalt to improve resistance to intense water runoff, preventing surface and platform erosion. Raising embankments above high-water levels will protect road structures from erosion, ensuring year-round passability during rainy seasons. • *Recycling and Sustainable Practices*: Encouraging the recycling of pavement and using mixtures prepared at low temperatures. These measures will reduce physical climate risks and build adaptive capacity in PoG, ensuring the resilience of roads to expected climate change impacts. By integrating bioengineering solutions	The interventions will prioritize road safety measures, including the construction of sidewalks and physical barriers along rural roads that pass-through towns. These designs will integrate protective measures into the road alignment, enhancing safety for pedestrians and cyclists. By improving safety infrastructure, such as designated pedestrian pathways and barriers, the project aims to promote the use of sustainable transportation options and contribute to reducing GHG emissions. It is estimated that 5 percent of the total cost will contribute to climate mitigation by the implementation of NMT interventions in the roads.

		and environmental protection measures along the roads, the project aims to further mitigate the risk of landslides and embankment erosion due to heavy rainfall.	
Subcomponent 1.b: Reconstruction and construction of bridges in rural areas ***(Improve the resilience of the bridges in rural areas under high climate vulnerability risk)***	5,887,000	**Improving the resilience of bridges in PoG's rural areas to climate change is a core objective of the rehabilitation project**. In PoG, which is highly exposed to climate vulnerabilities, extreme weather events like heavy rainfall often render bridges impassable, isolating rural populations and disrupting the transportation of goods, particularly agricultural products. The selected bridges currently require reconstruction or construction to minimize climate vulnerabilities and upgrade longitudinal and horizontal drainage systems. For this subcomponent, the focus on climate adaptation includes the urgent need to construct or reconstruct bridges that are at extreme risk of becoming non-passable during the next rainy season due to predicted increases in flooding from climate change. The design of new bridges will take into account the forecasted intensification of weather events, expecting higher water volumes within shorter periods. The climate-resilient measures include: (i) constructing bridges or culverts adapted to future climate events; (ii) sizing waterway crossings to handle expected water flows, ensuring all bridges have the hydraulic capacity for 100-year rainfall return events; and (iii) developing studies and designs with technical standards based on international best practices, such as wider bridge spans and culvert openings designed to accommodate heavier precipitation flows. These works will reduce physical climate risk and build adaptive capacity in PoG through dedicated measures to ensure the resilience of bridges to expected climate change impacts.	The interventions will prioritize road safety measures, including the construction of sidewalks and physical barriers along rural roads that pass-through towns. These designs will integrate protective measures into the road alignment, enhancing safety for pedestrians and cyclists. By improving safety infrastructure, such as designated pedestrian pathways and barriers, the project aims to promote the use of sustainable transportation options and contribute to reducing. It is estimated that 5 percent of the total cost will contribute to climate mitigation by the implementation of NMT interventions in the roads.
Component 2: Project Management and Capacity Building	**6,500,000**		
Subcomponent 2a. Project Management	2,900,000		
Subcomponent 2b. Technical support	2,950,000	**Review of the design of selected roads and bridges with a focus on resilience**. A specialized firm will be hired to review existing designs to incorporate climate considerations into road and bridge designs. This review is fundamental to ensure the resilience of the infrastructure, adapting it to the effects of climate change, mainly due to rainfall, tidal behavior, and sea level rise. Enhancing the resilience of these critical structures will ensure the infrastructure can withstand future climate-related challenges.	
		Implementation of a Road Asset Management System (RAMS). This RAMS will provide comprehensive data on the condition and performance of roads in Guayas, enabling informed decision-making. This is crucial for identifying vulnerabilities and prioritizing interventions to address climate change impacts.	

		It will also allow planners to incorporate climate projections, such as rainfall or sea level rise, into infrastructure development and maintenance plans. This facilitates the implementation of adaptation measures, such as raising roadways, improving drainage systems, and using climate-resilient materials, which are essential interventions to mitigate the adverse effects of climate change on road infrastructure.	
		Development of guidelines for provincial road planning. This activity includes the development of technical manuals and guidelines essential for updating provincial road planning and maintenance. The guidelines will include considerations for the implementation of road safety audits. All technical manuals and guidelines developed will consider the vulnerability of the province of Guayas to climate change. Emphasis will be placed on vulnerability analysis to inform and prioritize resilient road planning for climate change phenomena, focusing on rainfall flooding, tidal behavior, and sea level rise. Additionally, these guidelines will support the implementation of an asset management system focused on climate change adaptation and resilience considerations. This comprehensive approach will ensure that road infrastructure in Guayas is planned, designed, and maintained with a robust understanding of climate risks, thereby enhancing the province's capacity to withstand and adapt to future climate-related challenges.	The activity will develop technical manuals and essential guidelines for updating provincial road planning, maintenance, resilience and climate change analysis, road safety audits and implementation of an asset management system.
		Capacity building and training. The PoG will receive comprehensive training on climate change adaptation, enabling them to replicate the methodologies applied in this project across other infrastructure works in the province financed with their own resources. This training will encompass best practices in resilience planning, climate impact assessment, and the integration of adaptive measures into infrastructure development and maintenance. By building local expertise, the province will be better equipped to independently manage and mitigate the effects of climate change, ensuring sustainable and resilient infrastructure for the future.	
Subcomponent 2c. Community Engagement, Protection, Gender, and Inclusion.	650,000	**This sub-component aims to develop and implement proactive policies to engage communities in project design and monitoring**. It specifically targets women and other vulnerable groups, who can be employed by microenterprise organizations for road maintenance. Engaging these groups in maintenance activities will enhance adaptation and resilience measures, ensuring that local knowledge and needs are incorporated into sustainable infrastructure practices.	
Component 3: Contingency Emergency Response (US$0,000,000)			
Total project: 100,000,000			