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Report No: PAD5450

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT
ON A
PROPOSED LOAN

IN THE AMOUNT OF US$150 MILLION

TO THE

REPUBLIC OF ECUADOR

FOR

ECUADOR: EMERGENCY RESILIENT RECONSTRUCTION PROJECT

May 26, 2023

Transport Global Practice
Latin America And Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective {Apr 03, 2023})

Currency Unit =
US$

FISCAL YEAR
January 1 - December 31

Regional Vice President:	Carlos Felipe Jaramillo
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ABBREVIATIONS AND ACRONYMS

AADT	Annual Average Daily Traffic
AM	Accountability Mechanism
AF	Additional Financing
ANT	National Transit Agency
BCE	Central Bank of Ecuador
CAF	Development Bank of Latin America and the Caribbean
CBA	Cost-Benefit Analysis
CGAF	General Administrative and Financial Coordination
CGE	*Contraloría General del Estado* (General Controller of the State)
COOTAD	*Código Orgánico de Organización Territorial, Autonomía y Descentralización* (Organic Code of Territorial Organization, Autonomy and Decentralization)
COPLAFIP	*Código de Planificación y Finanzas Públicas* (Planning and Public Finance Code)
CPF	Country Partnership Framework
CTE	Ecuadorean Transit Commission
DA	Designated Account
DRM	Disaster Risk Management
e-Sigef	Country Integrated Financial Management Information System
E&S	Environmental and Social
EIRR	Economic Internal Rate of Return
ESFS	Environmental and Social Framework Support
ESIA	Environmental and Social Impact Assessments
ESMF	Environmental and Social Management Framework
ESS	Environmental and Social Standard
FIDIC	International Federation of Consulting Engineers
FM	Financial Management
GCRF	Global Crisis Response Framework
GoE	Government of Ecuador
GRS	Grievance Redress Service
HEIS	Hands-On Expanded Implementation Support
HVTI	Highly Vulnerable Transport Infrastructure
ICR	Implementation Completion Report
IDB	Inter-American Development Bank
IFR	Interim Financial Report
INEC	*Instituto Nacional de Estadística y Censos* (National Institute of Statistics and Censuses)
IPP	Indigenous Peoples Plan
IPPF	Indigenous Peoples Policies Framework
ISR	Implementation Status and Results Report
LMP	Labor Management Procedures

LOIEV	Organic Law to Boost the Purple Economy
LOTTTSV	*Ley Orgánica de Transporte Terrestre, Tránsito y Seguridad Vial* (Organic Law of Land Transportation, Transit and Road Safety)
M&E	Monitoring and Evaluation
MEF	Ministry of Finance
MTOP	Ministry of Transportation and Public Works
NBS	Nature-Based Solutions
NMTS	National Multimodal Transportation System
NPV	Net Present Value
PDO	Project Development Objective
PEM	Strategic Mobility Plan
PIT	Project Implementation Team
PMO	Project Management Office
PMTS	Project Management and Technical Support
POA	Project's Annual Program
POM	Project Operational Manual
PPSD	Project Procurement Strategy for Development
RAI	Rural Accessibility Index
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SEP	Stakeholder Engagement Plan
SNGRE	National Secretariat of Disaster Risk Management
SOE	Statement of Expenditure
SNP	National Planning Secretariat
SPC	Shadow Price of Carbon
STEP	Systematic Tracking of Exchanges in Procurement
ToRs	Terms of Reference
VOC	Vehicle Operating Costs
WBG	World Bank Group
WMO	World Meteorological Organization

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DATASHEET

BASIC INFORMATION

Country(ies)	Project Name
Ecuador	Ecuador: Emergency Resilient Reconstruction Project

Project ID	Financing Instrument	Environmental and Social Risk Classification	Process
P181079	Investment Project Financing	High	Urgent Need or Capacity Constraints (FCC)

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
[ ] Alternate Procurement Arrangements (APA)	[✓] Hands-on Enhanced Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
09-Jun-2023	30-Jun-2028

Bank/IFC Collaboration

No

Proposed Development Objective(s)

The Project Development Objective (PDO) is to restore connectivity and improve infrastructure resilience and road safety in areas affected by Natural Hazards.

Components

Component Name	Cost (US$, millions)
Infrastructure Rehabilitation and Resilience Interventions	135.00
Project Management and Institutional strengthening	15.00

Organizations

Borrower:	Republic of Ecuador
Implementing Agency:	Ministerio de Transporte y Obras Públicas (MTOP)

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	150.00
Total Financing	150.00
of which IBRD/IDA	150.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	150.00

Expected Disbursements (in US$, Millions)

WB Fiscal Year	2023	2024	2025	2026	2027	2028
Annual	0.00	0.00	0.00	0.00	0.00	0.00
Cumulative	0.00	0.00	0.00	0.00	0.00	0.00

INSTITUTIONAL DATA

Practice Area (Lead)

Transport

Contributing Practice Areas

Climate Change and Disaster Screening

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

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

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

COMPLIANCE

Policy

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

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

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

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

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

Legal Covenants

Sections and Description

No later than thirty (30) days after the Effective Date, contract for or appoint a civil servant of the Borrower to each of the following PIT team members: (i) a project coordinator, (ii) two planning specialists, (iii) three civil engineer/transport specialists, (iv) a communications specialist, (v) a financial management specialist, (vi) a financial analyst, (vii) a procurement expert, (viii) an environmental specialist, (ix) a social specialist, (x) an environmental and social coordinator, and (xi) a legal expert. (Section I.A.1(b) of Schedule 2 to the Loan Agreement)

Sections and Description

Project Management and Technical Support Firm; and Environmental and Social Framework Support

The Borrower through MTOP shall, no later than ninety (90) days after the Effective Date (and, in accordance with

Section III.B.1(b) below, as a condition of any withdrawal under Category (a)), hire, and thereafter maintain at all times during the execution of the Project:

(a) a project management and technical support firm to support MTOP in the design and implementation of Project activities, including support with engineering, gender, road safety, resilience, and other technical relevant topics (the "Project Management and Technical Support Firm"); and

(b) an environmental and social framework support consultancy firm to support MTOP in environmental and social risk and impact management, including: (i) elaboration of environmental and social instruments referred to under the ESCP; (ii) capacity building of MTOP in environmental and social risk management matters; (iii) supporting MTOP in carrying out consultations, monitoring, and management of grievances; (iv) coordination with technical teams to address emerging environmental and social implementation issues; and (v) facilitation of other participatory processes beyond environmental and social risks (the "Environmental and Social Framework Support Firm");

in each case with terms of reference and qualifications acceptable to the Bank all as further specified in the Operational Manual. (Section I.A.2 of Schedule 2 to the Loan Agreement)

Sections and Description

The Borrower, through MTOP, shall obtain the Bank's prior written approval of each Eligible Activity that is proposed to be included in the Project. (Section I.A.5 of Schedule 2 to the Loan Agreement)

Sections and Description

The Borrower, through MTOP in collaboration with MEF and NPS, shall ensure that multi-year certification is issued for the cost of each activity to be implemented under the Project (including the cost of all contracts required to implement such activity) and for the respective implementation period. (Section IV.A.2 of Schedule 2 to the Loan Agreement)

Sections and Description

The Borrower shall ensure that no Loan proceeds are used for any expenditures relating to activities carried out by security and military forces or agencies. The Borrower shall also ensure that no activities under the Project are implemented by, or with the involvement of, security forces or agencies, including the military. (Section I.A.4 of Schedule 2 to the Loan Agreement)

Sections and Description

The Borrower, through MTOP in collaboration with MEF and NPS, shall manage the budget's inclusion in the Annual Investment Plan in a timely manner and ensuring timely budget allocation for the project implementation. (Section IV.A.1 of Schedule 2 to the Loan Agreement)

Conditions

Type	Financing source	Description
Effectiveness	IBRD/IDA	(a) The Operational Manual (including but not limited to its financial management chapter) has been prepared and adopted, through a ministerial agreement, by the Borrower through MTOP in form and substance satisfactory to the Bank. (Section 4.01(a) of the Loan Agreement)
Type	Financing source	Description
Effectiveness	IBRD/IDA	(b) the Borrower through MTOP in coordination with MEF and NPS has issued the priority opinion (dictamen de prioridad) for the entire Project. (Section 4.01(b) of the Loan Agreement)
Type	Financing source	Description
Disbursement	IBRD/IDA	Notwithstanding the provisions of Part A above, no withdrawal shall be made: (a) for payments made prior to the Signature Date, except that withdrawals up to an aggregate amount not to exceed sixty million Dollars ($60,000,000) may be made for payments made prior to this date but on or after July 9, 2022, for Eligible Expenditures under Categories (1) and (2), 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)
Type	Financing source	Description
Disbursement	IBRD/IDA	Notwithstanding the provisions of Part A above, no withdrawal shall be made: (b) under Category (1) until: (i) the ESMF, RPF, SEP, LMP, and IPPF have been prepared, consulted, disclosed, and adopted as provided for under the ESCP; and (ii) the Project Management and Technical Support Firm and the Environmental and Social Framework Support firm have been hired, in each case with terms of reference and qualifications acceptable to the Bank all as further specified in the Operational Manual.

		(Section III.B.1(b) of Schedule 2 to Loan Agreement)

I. STRATEGIC CONTEXT

A. Country Context

1. **Ecuador is an oil-exporting upper-middle-income country taking steps to rebalance its economy after imbalances accumulated during the oil price boom from 2008 to 2014.** Ecuador's state-led economic model allowed the economy to grow during the oil boom, also reducing poverty[1]. However, substantial macroeconomic and structural imbalances, including a large fiscal deficit, revenue collection vulnerable to oil price volatility, and high trade barriers, emerged once the oil price boom ended in 2014. With a fully dollarized economy, macroeconomic adjustments, but limited access to international capital markets, the country reduced the fiscal deficit from a peak of 9.7 percent of Gross Domestic Product (GDP) in 2016 to near balance in 2022, by rationalizing expenditures, increasing taxes on higher income firms and households, and taking advantage of recovering oil prices. Ecuador also took steps to foster private investment by reducing trade barriers, advancing trade agreements, easing constraints on the financial sector, and streamlining business regulation. Yet, despite restoring macroeconomic stability and confidence in dollarization, these partial reforms were insufficient to tackle long-lasting development challenges, including a rigid and costly labor market, low access to finance, limited international integration, a challenging business environment, and high and regressive fuel subsidies.

2. **Over the pre-covid period of 2016 to 2018 economic activity dampened, compounded by a challenging external and domestic context, including Natural Hazards**. GDP growth averaged only 0.5 percent between 2015 and 2019. With little scope for fiscal stimulus, the economy contracted by 7.8 percent in 2020 due to the pandemic and grew by 4.2 and 2.8 percent in 2021 and 2022, respectively. The recovery was constrained by the ongoing consolidation process and by tightening international financial conditions and uncertainty generated by Russia's invasion of Ukraine. On the domestic front, it was negatively affected by increasing uncertainty arising from recurrent waves of social unrest and political polarization, and the sporadic disruption in oil production due to damaged pipelines caused by the regressive erosion in the Coca River basin. Furthermore, in early 2023, oil production was affected by new damage to the oil pipelines and protests by indigenous communities, and the coastal Guayas region was hit by a 6.8 earthquake, compounding the adverse effects of a heavy rain season. This challenging context not only prevented the country from resuming the issuance of sovereign bonds after a friendly renegotiation with international bondholders in 2020, but also discouraged local and foreign private investment.

3. **Ecuador still needs significant reforms to achieve sustainable, inclusive, green, and resilient growth**. Despite reaching fiscal balance in 2022, Ecuador still needs to cement a sustainable, inclusive, and resilient fiscal framework to reduce debt and build buffers to face the potential effects of compounded global crises, future natural disasters, and reach its upcoming climate commitments. Despite its low per capita GHG emissions, Ecuador is committed to reaching carbon neutrality by 2050, which will require improving sustainable forest management, reducing gas flaring in the oil fields, and fostering private investment in non-conventional renewable energy generation. The country needs to enhance private investment and productivity to improve competitiveness and generate new growth engines and employment, as a decarbonizing world induces the country to move away from the oil sector.

[1] ECV-INEC. Encuesta de condiciones de vida. 2014.

This will require developing the private sector by addressing high informality and limited diversification, prevalent protectionism, rigidity in labor markets, and distortive market regulation. Coupled with a more efficient public sector, these steps would help improve service provision and support the most vulnerable population. Households have been affected by high levels of food insecurity and low access to education and health services since the onset of the pandemic, foreshadowing long-term impacts on human capital.

4. **Ecuador is among the 10 countries with the highest Natural Hazard risk in the region and among the top 20 in the WorldRiskIndex 2022.**[2] This is due to its exposure to geological and hydrometeorological hazards such as earthquakes, volcanic eruptions, floods, and droughts.[3] Moreover, most of the urban population, 96 percent, resides in coastal and mountainous areas, which further increases the country's vulnerability to phenomena such as El Niño, that can trigger floods and landslides, and La Niña, associated with increased droughts. With frequent climate extremes events adversely affecting both Ecuador's population and economy, and with global climate change projected to intensify such events, Ecuador's vulnerability to Disasters is expected to rise in the future.

5. **Recent disasters have caused loss of life and serious damage to critical public infrastructure and are expected to recurr.** The earthquake on March 18, 2023, combined with heavy winter rains resulted in widespread flooding, erosion, and landslides, and caused loss of life and the destruction and serious damage to critical transport infrastructure. The most recent government estimates indicate that 35 people died (21 from the rains and 14 from the earthquake) and more than 18,000 people were affected (17,491 people from the heavy rains and 1,107 from the earthquake). At least 28 roads (including five bridges) were affected throughout the country, eight of which remain closed. The combination of those events epitomizes a broader vulnerability to natural disasters, first of which floods and heavy rains, that are the most frequent hazards. Over the last 35 years, they have accounted for 44 percent[4] of the hazards. In line with those long-term patterns, according to Ecuador's National Institute of Meteorology and Hydrology (INAMHI), heavy rains have continued in April, with potential compounding effects on the recent events. Recent estimations have raised probability for El Niño phenomenon later this year to 62 percent.

6. **In response to the above events, the Ministry of Transport (MTOP) has declared emergencies in all affected areas but requires support to shift from a reactive to a proactive disaster risk management strategy.** So far, MTOP has declared Emergencies in Pichincha, Esmeraldas, Santo Domingo, and Azuay provinces and is procuring studies under expedite national mechanisms to prepare the response. By using an asset management system, MTOP could minimize asset downtime, reduce maintenance costs, and improve the overall reliability and safety of its transportation systems. The Bank, through the Green, Safe and Efficient transport infrastructure in Ecuador (P179175) activity, is supporting MTOP in its efforts to improve road safety management and increase institutional capacity for different aspects of planning, prioritization, and tools to monitor and visualize risks. It is defining a prioritization methodology, a criticality analysis, and a tool for risk management and early alert. An asset management system for transport infrastructure is critical to ensure that assets are maintained effectively and efficiently, and to help them make informed decisions about their infrastructure investments.

[2] https://weltrisikobericht.de/wp-content/uploads/2022/09/WorldRiskReport-2022_Online.pdf.
[3] Pan American Health Organization. 2021.
[4] Secretaría Nacional de Gestión de Riesgos del Ecuador. 2023.

7. **Ecuador experiences interrelated gender gaps including but not limited to education, employment, and decision-making.** Women, who make up a larger proportion of the vulnerable population and the poor, face challenges in the workforce with limited access to leadership positions, significant gender pay gaps, and barriers to entrepreneurship. In the workforce, including in the construction sector, women tend to be concentrated in low-paying jobs and have limited access to leadership positions where there is a significant gender pay gap, with women earning less than men for doing the same job. Women have additional barriers to their entrepreneurship. For instance, only 58 percent of women have access to a financial account compared to 71 percent of men. Women are 17 percentage points more likely than men to have vulnerable employment, represented by inadequate earnings and difficult conditions of work that undermine workers' rights, further complicating their health and safety.[5] In terms of education, although girls and boys have equal access to education, there is still a gender gap in terms of completion rates, quality, and type of education. Girls tend to drop out of school at higher rates than boys, particularly in rural areas. Additionally, among the people studying Science, Technology, Engineering and Mathematics (STEM) careers, fewer than 1 in 3 graduates in Ecuador are women, perpetuating employment segregation. In politics, women are underrepresented at all levels of government. Although the constitution establishes gender parity in political representation, women hold only a small percentage of political positions, particularly at the national level. Ecuador has taken steps to address these gender gaps, including passing laws to promote gender equality and establishing government institutions to address gender issues. However, there is still much work to be done to ensure that women have equal opportunities and rights in all aspects of life in Ecuador.

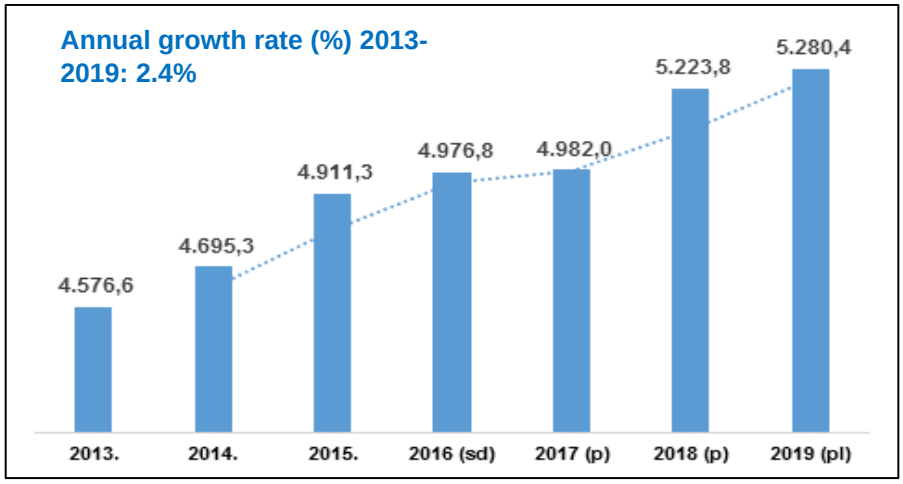
B. Sectoral and Institutional Context

8. **Transport is key for the development of the Ecuadorean economy.** In 2019, the sector contributed US$ 5.3 billion dollars (see Figure 1.1 below) or 7.3 percent of Ecuador's GDP. Construction represents 7 percent of the employment generation in the country, followed by trade and transport. At the basis of most economic and social interactions, transport infrastructure limitations challenge equality and access to opportunities: in Ecuador only 60 percent of the population lives in urban areas, but the Rural Accessibility Index (RAI) shows that only 52 percent of the rural population lives closer than 2 kilometers to a primary or secondary road. Similarly, the economy is impaired by inefficient transport systems.[6] Road safety is another significant challenge, and although crash rates are similar than in other countries in the region, mortality rates are higher in Ecuador.

[5] WB, Ecuador Gender Scorecard. 2023.

[6] Matriz Insumo Producto Industria por Industria (MIP) Available at: https://contenido.bce.fin.ec/documentos/PublicacionesNotas/Catalogo/CuentasNacionales/Anuales/Dolares/MenuMatrizInsumoProducto.htm.

Figure 1.1 GDP Transport 2013 – 2019 (US$, millions)



Source: Diagnostic of the transportation sector in Ecuador. (World Bank., 2020).

9. **Transport is particularly vulnerable to natural and climate-driven disasters.** Losses of connectivity due to Natural Hazards impact both affected users and economic growth. Affected users see their access to social and economic opportunities impacted via increased transportation costs. Out of the total national road network, around 52 percent are in landslide-prone areas, jeopardizing the road network as a whole. Moreover, 66 percent are in areas vulnerable to seismic intensities that endanger the physical integrity of users and the functionality of roads and related infrastructure (bridges and slopes). In addition, the road network is highly vulnerable to hydrometeorological hazards with 46 percent of major roads are in flood-prone areas (450 kilometers in areas at high risk of flooding). The road network also faces risks from the presence of potentially active and erupting volcanoes. The country has 84 volcanic formations, of which nine could pose a volcanic hazard to the state road network. Approximately 476 kilometers (8.5 percent of the total) of main roads are in volcanic hazard zones: an area of 913.57 square kilometers has a high probability of being affected by mud and lahars from an eruption of Cotopaxi (including bridges connecting to Quito). Additionally, around 282 kilometers are exposed to risks from other potential volcanic activity.

10. **MTOP has oversight of the sector**. The MTOP mandate covers the development and management of the national public infrastructure, a significant portion of which is transport infrastructure. It is in charge of the preparation, implementation, monitoring, and evaluation of public policy related to safe transportation services and infrastructure, and sustainable public works. It has a decentralized structure with regional sub secretariats (7) and district directorates (23) who are responsible for implementing the established public policies. In recent years, MTOP has been transitioning from a model of direct administration, where it had a strong capacity to intervene and directly manage infrastructure projects, to a more managerial role where it focuses on planning and oversight. However, this transition poses challenges for MTOP in terms of planning, implementation, and resource allocation. Moreover, low allocation of budget to MTOP in recent years has led to limited capacity to maintain and rebuild the network in case of disasters. MTOP does not have an asset management system. The monitoring of road conditions is rudimentary, and the institution needs support to strengthen its capacity and transition to a proactive asset and risk management system with early alerts. In addition, MTOP is responsible for the routine maintenance of publicly

managed roads, both directly and through community managed microenterprises. Out of 431 units of MTOP´s heavy equipment, only 150 (35 percent) are fully operational. There are 95 units operating with failures, 6 decommissioned, and 180 requiring repairs for operation. In the meantime, MTOP keeps operators for the whole fleet as staff. These operators cannot currently work due to lack of equipment.

11. **MTOP is updating the 2012 Mobility Strategy Plan (PEM in Spanish), which is the main strategy document for the transport sector** to proposes anew transportation system and promotes a change in the productive matrix. The PEM entered into force in 2013 with an intervention planned for 25 years until 2037. The document defines its objectives, priorities, pace of action, and working methods, as well as the capabilities and resources that are necessary to achieve the proposed changes. The PEM relies on open data from the Geoportal, a central repository for geospatial data and information in Ecuador, which enables users to access and download a variety of geospatial data, such as maps, aerial photographs, satellite images, and other geographic information. The platform also provides tools for analyzing and visualizing geospatial data. MTOP requires support to update and improve usability of the portal.

12. **The National Multimodal Transportation System (NMTS) has gradually deteriorated since 2015, a result of poor maintenance and lack of investment in both existing and new roads.** The NMTS includes 10,313 kilometers of roads, 21 operational airports, and four maritime ports, as well as 965.6 kilometers of deteriorating decommissioned rail network. In 2014, 74.2 percent of the road network was in good condition, 21.0 percent in regular condition, and 4.9 percent in bad condition. However, the condition of the national road network has deteriorated alarmingly, with 46.8 percent of the roads falling below the acceptable level of quality in 2023. This deterioration is closely correlated to low levels of investment in the NMTS infrastructure, and the limited budget dedicated to maintenance.

13. **The transport sector in Ecuador is the second biggest global greenhouse gas (GHG) emitting sector in the country, and the only one that is growing.** Despite Ecuador's GHG emissions accounting for only 0.20 percent of global GHG emissions, the country ranks as the 8th-largest emitter in Latin America. Moreover, the country's economic growth and its emissions have shown no signs of decoupling. Transport is, second to land-use change, the largest contributor to GHG emissions in Ecuador, and the only sector with an upward trend. Notably, 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. Transport emissions make up nearly a fifth of Ecuador's total GHG emissions and nearly half of the total final energy consumption.[7] One of the main contributing factors to this rise is the fact that the number of registered vehicles 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.

14. **Ecuador suffers from a high rate of vehicle crashes, and the World Health Organization reports that road crash injuries are one of the leading causes of death.** Factors contributing to road safety issues include poor road infrastructure, inadequate vehicle maintenance, and reckless driving. Furthermore, the terrain in Ecuador is complex

[7] Climate Watch Historical GHG Emissions. 2022. Washington, DC: World Resources Institute. Available online at: https://www.climatewatchdata.org/ghg-emissions. Notes: Totals excluding Bunker Fuels. Energy excludes transportation. For more information about the categories, see the Climate Watch Country Greenhouse Gas Emissions Data Method Note.

due to its diverse geography, which includes coastal plains, Andean mountains, Amazon rainforest, and volcanic islands. About 76 percent of Ecuador's terrain is hilly or mountainous, higher than either of its neighboring countries[8]. 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, accidents are currently rising from previous years. According to the Road Safety Yearbook 2021 (GoE), 85 percent of fatalities are men, compared to 15 percent for women. 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 high productive age group including many heads of households. This translates into a social and economic problem for families and their environment. In August 2020, the United Nations General Assembly approved Resolution A/Res 74/299 establishing a Second Decade of Action for Road Safety with the goal of reducing road traffic deaths and injuries by 50 percent between 2021 and 2030.

15. **There is gender segregation in employment in the infrastructure and transport sectors.** Women's participation in transportation sector jobs is very low. Only seven percent of workers in the transport and storage sectors in Ecuador are women, and only four percent of workers in the construction sector are women.[9] Based on analysis conducted for women working on roads in a similar context in Latin America, Ecuadorian women face barriers that hinder participation with recruitment (for example, lack of gender sensitive engagement and selection processes, job descriptions targeting men, gender stereotypes, lack of skills and access to training for the use of specialized equipment) and retention (for example, lack of flexible work policies, limited access to care options, sexual harassment in the workplace).[10]

16. **The proposed project will support the Government of Ecuador (GoE) in responding to the impacts of the March 2023 earthquake and the heavy rains of the 2022-2023 winter season on the road network, while supporting strategic initiatives to improve resilience.** The project includes interventions both to restore connectivity in areas impacted by Eligible Disasters, as well as to reduce vulnerability in areas subject to imminent risk to people, assets, or the environment. Moreover, the project will improve response capacity in MTOP both by providing financing to restore heavy equipment fleet, and capacity strengthening. Finally, all interventions will include activities to improve road safety and gender performance.

C. Relevance to Higher Level Objectives

17. **The proposed Project is aligned with National priorities, such as the Nationally Determined Contributions (NDC), the *Plan de Creación de Oportunidades* (2021-2025), National Adaptation Plan (NAP), the National Climate Change Strategy (ENCC) of Ecuador**. In 2021, Ecuador set the unconditional goal of reducing its GHG emissions by 9 percent by 2025 and conditioned to international support and cooperation, the commitment goes up to 20.9 percent.

[9] ILOSTAT. 2021. https://www.ilo.org/shinyapps/bulkexplorer28/?lang=en&segment=indicator&id=SDG_0831_SEX_ECO_RT_A.
[10] Casabonne, Ursula, et al. 2015. Roads to Agency: Promoting Women's Participation in Rural Transport Projects, Washington: World Bank: 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.

Regarding the *Plan de Creación de Oportunidades,* it highlights the Country's urgent need to drive equal opportunities, sustainability, and inclusive growth. In the current social and economic context, the development and enforcement of Disaster Risk Management (DRM) and climate change adaptation policies in Ecuador are particularly crucial. Such policies must be implemented to increase resilience and minimize the consequences of Natural Hazards, which have already negatively affected the economy. Specifically, this Project is aligned with: (i) Objective 9: strengthening resilience to the effects of climate change and adverse natural events, and Eligible Disaster risk management; (ii) Objective 12: strengthening climate change mitigation and adaptation actions; and (iii) Objective 14: strengthening the State's institutional capacities and information management for better decision-making to withstand Eligible Disasters. 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 from the sector.

18. **The proposed Project is also aligned with Goal 2 of the National Council for Gender Equality of Ecuador, which pursues the incorporation of the gender perspective in all State plans, programs, and projects.** It is also aligned with the WBG's Gender Strategy (FY16-23), which recognizes gender equality as a key driver of poverty reduction, economic growth, and social inclusion. The project will incorporate gender considerations in project design and implementation, recognizing discrimination as a barrier to development and promoting social inclusion.

19. **The proposed Project is fully aligned with the World Bank Group's (WBG) Country Partnership Framework (CPF)[11] for the Republic of Ecuador (FY19-23). The CPF identifies the country's vulnerability to Natural Hazards as a key constraint to its development.** Results Area 3 of the CPF, "Enhancing Institutional and Environmental Sustainability," includes 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. It further includes the development of disaster risk reduction activities and plans. The Project contributes to the achievement of this objective as it will improve the reliability of key road infrastructure by supporting interventions both to restore connectivity in areas impacted by Eligible Disasters, as well as to reduce vulnerability in areas subject to imminent risk to people, assets, or the environment.

20. **The proposed Project will contribute toward the WBG's Climate Change Action Plan (2021-2025); and is consistent with the Green, Resilient, and Inclusive Development (GRID) Approach; the WBG's Global Crisis Response Framework (GCRF).** The Climate Change Action Plan (2021-2025) pursues poverty eradication and shared prosperity with a sustainability perspective. This includes: (i) post-disaster risk and recovery support so that climate change risk and resilience are integrated into rebuilding efforts; and (ii) resilient infrastructure solutions. The latter comprises investments in physical infrastructure and community-implemented adaptation strategies. Therefore, there is an urgent need to integrate climate and development strategies to deliver green, resilient, and inclusive development. The GRID addresses the risks to people, the planet, and the economy in an integrated manner that is tailored to

[11] Report No. 135374-EC.

country needs and objectives. Specifically, it focuses on: (i) strengthening resilience to climate change and Natural Hazards by integrating climate and disaster risk considerations into development planning, and by enhancing infrastructure; (ii) fostering social inclusion and equity by ensuring that vulnerable groups have access to basic services and economic opportunities; and (iii) promoting good governance and institutional capacity by enhancing institutions' ability to plan, implement, and monitor sustainable development initiatives. The proposed Project is fully consistent with the WBG's GCRF to improve prospects for long-term sustainable development, while developing long-term resilience to help prepare for future shocks. The project is aligned with pillar 3 "Strengthening Resilience," which includes disaster risk management and climate resilience activities, among others, and pillar 4 "Strengthening Policies, Institutions, and Investments for Rebuilding Better," which includes resilient reconstruction and institutional strengthening & capacity-building activities, among others.

II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

21. **The Project Development Objective (PDO)** is to restore connectivity and improve infrastructure resilience and road safety in areas affected by Natural Hazards.

PDO Level Indicators

22. **PDO 1: Restore connectivity in areas affected by Natural Hazards**: (i) Average travel time in areas of intervention; and (ii) People with enhanced access to transportation services.

23. **PDO 2: Improve infrastructure resilience in areas affected by Natual Hazards:** (i) Number of beneficiaries with access to climate-resilient roads in areas of intervention.[12]

24. **PDO 3: Improve road safety in areas affected by Natural Hazards:** (i) Number of road traffic fatalities in areas of intervention.

B. Project Components

Component 1: Infrastructure Recovery and Resilience Interventions (estimated total costs US$135 million)

25. **Framework approach for infrastructure interventions.** The project activities are defined under a framework approach. There is uncertainty about future emergent needs, as well as about existing emergencies that will be supported by the project (the Borrower may resort to national funds to intervene on any of them during preparation). The eligibility of Infrastructure Recovery and Resilience Interventions under the Project activities will be assessed against a positive list of eligibility criteria set out in the Project Operations Manual (POM). The POM will include a process to identify Eligible Activities under Subcomponents 1.1 and 1.2 that comply with requirements regarding their scope, as well as environmental, social, and technical risks. The POM will clarify that any activities that involve the use or potential pollution of international waterways, i.e., river systems and connected aquifers, will not be eligible for Project financing. As a covenant in the Loan Agreement, the Borrower, through the MTOP, will be required to obtain the Bank's prior written approval of each Eligible Activity that is proposed to be included in the Project.

26. **Subcomponent 1.1. Infrastructure Recovery.** This subcomponent includes Eligible Activities related to restoring connectivity lost by damages in transport infrastructure caused by an Eligible Disaster. This may include, among

[12] The number of beneficiaries under the PDO 2 will comprise people with enhanced access to transportation services (PDO 1), plus beneficiaries of stand-alone resilient interventions. All Infrastructure Recovery Interventions will include Infrastructure Resilience Interventions. In case the project includes stand-alone Resilience Interventions, the number of beneficiaries of Resilience Interventions will be higher than the number of beneficiaries of Infrastructure Recovery Interventions.

others, designs, works supervision, audits, project management, general civil works (construction, rehabilitation, or improvement), procurement or leasing of equipment, operators, consultancy services, resettlement-related land compensation payments, and any other investment directly linked to infrastructure recovery. All infrastructure recovery interventions will address climate resilience, including: (i) priorization based on climate and disaster resilience assessment, (ii) use of climate change projections for its engineering designs, and (iii) inclusion of resilience interventions (as defined in the next paragraph). These activities will support both provisional solutions and activities for immediate emergency response, as well as definitive solutions to rebuild better. In the interventions to be financed for both construction and rehabilitation, MTOP will prioritize the implementation of mechanisms to ensure universal access for all beneficiaries, i.e., free access for people of all ages and abilities in different situations and in different circumstances. Through this subcomponent, the project will contribute to closing gender employment gaps in the construction sector by providing training opportunities for women in the operation of specialized equipment (for example, heavy machinery, vehicle drivers, and occupational health and safety) and provision of a certificate prior to the commencement of works. Unlike Component 2, training and community activities under this subcomponent will be specifically related to Eligible Activities implementation.

(a) **An Eligible Disaster** refers to an event—national or localized in scope—that affects transportation infrastructure and has occurred on or after 2022, for which one or more of the following have been issued by a competent authority:

i. Declaration of Emergency (*Declaratoria de Emergencia*)[13]
ii. State of Emergency (*Estado de Excepción*)[14]

27. **Subcomponent 1.2. Resilience Interventions.** This subcomponent will include Eligible Activities related to increasing the resilience of Highly Vulnerable Transport Infrastructure (HVTI) to Natural Hazards. This may include, among other, designs, works supervision, civil works, acquisition of equipment, consultancy services, or resettlement-related land compensation payments. These activities will support interventions such as urgent rehabilitation of poorly maintained HVTI and mitigation of Natural Hazards,[15] with a focus on climate resilience (for example, slope stabilization and revegetation, drainage, or increase in road elevation). In the case of standalone Resilience Interventions (that is, not linked to an Infrastructure Recovery Intervention under Subcomponent 1.1), the Borrower will prepare a technical justification providing evidence of HTVI for the purposes of assesing elegibility. As a covenant in the Loan Agreement, the Borrower, through the MTOP, will be required to obtain the Bank's prior written approval of each Eligible Activity that is proposed to be included in the Project. The POM will define the process for this assessment.

[13] MTOP is responsible for issuing Declaration of Emergency related to the transportation sector.

[14] According to the National Constitution (Article 164), the President of the Republic may decree a state of emergency in all or part of national territory in case of aggression, international, or internal armed conflict, serious internal commotion, public calamity, or natural disaster. Also, Article 166 of the National Constitution mentions that the President shall notify the declaration of the state of emergency to the National Assembly and the Constitution Court within 48 hours of the signing of the corresponding decree.

[15] Interventions will be informed by best practices and international guidelines, such as, "Green Roads For Water," Guidelines for road infrastructure in support of water management and climate resilience. World Bank Group., 2021.

(a) **Natural Hazards** refer to:
   i. Geological hazards: extreme natural events originating in the Earth's crust, such as earthquakes, volcanic eruptions, tsunamis or tidal waves, and landslides (as a secondary event after an earthquake);
   ii. Hydrometeorological hazards[16]: natural events such as heavy rains and flooding caused by rainfall; and
   iii. Intensified El Niño phenomenon causing heavy rains, floods, storm surges, or landslides caused by rainfall.

(b) **HVTI** refers to transport infrastructure that is exposed to Natural Hazards, and that poses, or, upon the occurrence of the Natural Hazard, likely would pose an imminent threat to lives, assets, or the environment.

28. **Subcomponent 1.3. Activities to complement Recovery and Resilience Interventions.** This subcomponent will include main or complementary activities in the areas of intervention to foster community participation, efficiency, resilience, road safety and inclusive participation for projects. To foster community participation, in addition to consultations, this subcomponent may include training for local communities and microenterprises. This may include, among other things, capacity building to participate in the implementation of project activities, community response to emergencies, encouraging the participation of local microenterprises in post-reconstruction maintenance works. To promote efficiency, resilience and road safety, the design (Terms of Reference, or ToRs) of Infrastructure Recovery and Resilience Interventions will consider recycling opportunities, prioritize the use of environmentally friendly materials (for example, asphalt emulsions, warm and cold asphalt mixes, asphalt base stabilization) and construction methods (for example, water reuse, minimization of material transport needs). To promote resilience and road safety, all interventions will include road safety audits and resilience considerations from the pre-design phase and the implementation of the road safety audit recommendations. To help bridge the gender gap, civil works contractors will include in their offers, as per their ToRs, the provision of training for women to obtain certifications to operate heavy machinery prior to the commencement of civil works. Community emergency response training and microenterprise training activities will also promote women's leadership and management.

29. **Subcomponent 1.4. Acquisition of MTOP's equipment for emergency response and preventive maintenance.** This subcomponent can include the acquisition of emergency response and maintenance equipment by MTOP necessary to respond to emergencies in the short term. The acquisition or overhaul of heavy machinery for emergency response[17] may include equipment such as dump trucks, backhoe loaders, loaders, and excavators. The acquisition of temporary equipment for emergency response may include temporary bridges, temporary culverts, generators, lighting, and communications equipment. The acquisition or overhaul of heavy machinery for evaluation, preventive maintenance, and reconstruction may include pavement and vulnerable zone evaluation equipment such as deflectometers, laser profilometers, roughness meters; and construction execution equipment such as motor

[16] As described in Annex 2 section A, climate change is expected to intensify hydrometeorological hazards and El Nino phenomenon; therefore, Project activities that improve resilience to those hazards will support climate change adaptation of Ecuador's transport infrastructure.
[17] UNOPS is supporting MTOP in the needs assessment and may support procurement processes in the future.

graders, finishers, road rollers, asphalt mixers, asphalt distributors, and recycling machines. The contracts will include maintenance.

Component 2: Project Management and Institutional Strengthening for Resilience (US$15 million)

30. **Subcomponent 2.1. Asset management system and planning tools**. This subcomponent includes the purchase and/or design and implementation of a transportation infrastructure asset management system, as well as training of staff in its use, which will improve MTOP capacity for asset and disaster risk management. The system will include climate hazard data, which will be used to prioritize resilient interventions and will support an effective climate adaptation planning of transport assets. It consists of a software-based solution designed to help MTOP manage the lifecycle of its transportation assets, such as roads, bridges, tunnels, railways, airports, seaports, and other related infrastructure. It will include a combination of tools for inventory management, condition assessment, performance monitoring, scheduled maintenance and repair activities, budgeting, forecasting, reporting, and analytics. The Asset Management system will enable the MTOP to prioritize interventions in the medium term and swiftly identify urgent action needs such as preventive maintenance, all while responding to early warnings. This will significantly enhance the resilience of roads to climatic change impacts, including floods and landslides, thereby ensuring their durability and safety. The system will also improve the capacity for operation and maintenance of the heavy machinery for which MTOP is responsible. This subcomponent includes the operationalization of these tools and the improvement of the MTOP geoportal. The subcomponent may include support to improve the geoportal and the development of tools for open data and information sharing. The aim is to increase competitiveness and efficiency. This will in turn enable the development of information sharing platforms based on planned or executing activities. These activities include employment opportunities from private contractors, availability or need of materials for recycling, machinery.

31. **Subcomponent 2.2. Capacity building activities, including training, knowledge exchanges, guidelines, and manuals on relevant topics**. In addition to specific support in capacity building linked to activities included in Component 1, this subcomponent will include capacity building activities for civil servants in relevant agencies,[18] civil society, media, private firms, and other relevant stakeholders. This will include training in relevant topics for those responsible for the planning, implementation and policy related to transport infrastructure management, climate resilience and adaptation, road safety, gender, and other topics relevant to the project. Activities may take the form of training workshops, knowledge exchange visits, drafting of guidelines and manuals. They will target implementation and planning capacity strengthening on topics such as community participation, efficiency, climate resilience and adaptation, circular economy, road safety, gender, and emergency response. This subcomponent may also include technical support for updating relevant technical regulations issued by MTOP. The technical regulation may be updated to better account for climate change projection and prioritization of climate adaptation investment in the transport sector. The subcomponent may also include an analysis of the specific barriers that women in the project areas face in order to work in construction. The analysis will be used to develop an Action Plan for the training and certification of women on specialized equipment, which will be implemented under Component 1.

[18] "Relevant agencies" refers to agencies involved directly or indirectly in the implementation of activities or policies related to the project activities and objectives. For example: MTOP, ANT, and CTE.

32. **Subcomponent 2.3. Project Management Support.** This subcomponent includes activities to support the Borrower in the technical and administrative management of the Project. It includes:

(a) **Support to the Project Implementation Team (PIT)**. This subcomponent may include any expenditure related to the PIT operation, including, among other staff costs, acquisition of equipment, travel related expenses, office supplies, or communications-related expenditures.

(b) **Project Management and Technical Support (PMTS).** In addition to the PIT, this subcomponent will include a Project Management and Technical Support firm. The PMTS firm will provide specialized technical support to the Borrower in the design and implementation of relevant activities during the implementation of the Project. This includes engineering support, as well as support on gender, road safety, resilience, and other technical relevant topics.

(c) **Environmental and Social Framework Support (ESFS).** Like the PMTS, this subcomponent will include an environmental and social (E&S) consultancy firm in charge of supporting MTOP in environmental and social risks and impact management. The firm will elaborate E&S instruments as required for different interventions. It will also ensure MTOP capacity building in E&S risk management matters and support MTOP in carrying out consultations and monitoring and supporting management of grievances. In addition to design, implementation and monitoring activities, the firm will coordinate with the technical teams to address emergent issues with environmental and social implementations, as well as facilitate other participatory processes beyond E&S risks. The ESFS will also provide training to MTOP on E&S risk management and World Bank Standards.

C. Project Beneficiaries

33. **The Project will generate direct benefits to the users of the NMTS affected by Eligible Disasters, and indirect benefits to communities in areas affected by Natural Hazards.** The number of annual users of the NMTS is estimated at 5.3 million (29 percent of the total population). Infrastructure Recovery interventions are estimated to directly benefit at least 70,000 users of intervened infrastructure. Resilience Interventions are estimated to directly benefit at least 70,000 users. Al users benefiting from Infrastructure Recovery Interventions will benefit from Resilience Interventions, as all project activities will include resilience. However, in case the project includes stand-alone Resilience Interventions, the number of beneficiaries of Resilience Interventions will be higher than the number of beneficiaries of Infrastructure Recovery Interventions. Infrastructure Recovery Interventions related benefits include restored travel times and vehicle operating costs. Resilience Interventions related Benefits include reduced risk of future impacts on travel benefits. In Ecuador, the Rural Accessibility Index is 52 percent, which means that the 52 percent of the population living next to a main road may potentially benefit from project activities. The same goes for producers, who are affected by logistics chains disruptions due to disasters.

34. **MTOP, the National Transit Agency (ANT, in Spanish), the Ecuadorian Transit Commission (CTE, in Spanish) and other relevant public agencies will benefit from strengthened planning and implementation capacity, as well as from acquisition of machinery.** In addition, the tools for asset management and prioritization will allow both MTOP and ANT to increase their planning capacity and MTOP ability to respond to disasters.

35. **Finally, community members, microenterprises and local construction firms will also benefit from increased capacity.** Capacity building activities under Component 1 will target communities and microenterprises to increase capacity for emergency responses and improve access to jobs for women both for infrastructure building and maintenance. In addition, requirements in the ToRs for the interventions will push local construction firm to acquire capacity and experience in efficiency, resilience, road safety, gender, circular economy, and eco-friendly construction methods.

D. Results Chain

Activities	Outputs	Outcomes (PDO)	Long-Term Development Impact
Component 1 Infrastructure Recovery and Resilience Interventions	i. New roads constructed ii. Roads rehabilitated iii. Roads with improved resilience (including new and rehabilitated roads, and resilient interventions not including works on the road). iv. Road safety audits implemented in constructed, rehabilitated, and improved roads v. MTOP heavy machinery repaired and in working condition vi. Women trained and certified in specialized skills (including the use of heavy machinery)	**PDO1** Restored connectivity in areas affected by Natural Hazards **PDO2** Improved infrastructure resilience in areas affected by Natural Hazards **PDO3** Improved road safety in areas affected by Natural Hazards	• Improve climate resilience to risks and climate change (CPF FY19-23, Objective 7) • Drive for equal opportunities, sustainability, and inclusive growth (*Plan de Creación de Oportunidades* 2021-2025) • Strengthened institutional capacity to plan, implement and manage a resilient and inclusive transport infrastructure (*Plan de Creación de Oportunidades* 2021-2025, Objective 14) • Drive mitigation and adaptation measures (National Climate Change Strategy, Pillar 1 & 2).
Component 2 Institutional Strengthening for Resilience	i. Road asset management including risk monitoring and early alerts system implemented ii. Planning, project prioritization and risk management tool implemented iii. MTOP officials trained in the management of road assets and prioritization of road projects		

Critical assumptions/challenges:

- Strong political ownership and commitment continue during the project life
- Project Implementation Team (PIT) has adequate capacity for implementing the project
- PMTS will review technical studies and support implementation, filling MTOP and contractor capacity gaps

E. Rationale for Bank Involvement and Role of Partners

36. **The World Bank can deliver financing fast and has accumulated substantial regional and global experience in supporting post-disaster recovery, making it well placed to support this emergency, help build back better and strengthen capacity for implementation and risk management.** Ecuador is vulnerable to extreme climate events, such as heavy rains, flooding, earthquakes, volcano activity, and landslides. The recent emergencies require fast reaction, and the Bank is well equipped to provide financing with expedited processing mechanisms to shorten loan preparation time. The Bank brings additional value to build more resilience in the transport sector. Transport can also mitigate climate change, although the magnitude of the project's contribution may be limited given the vast need for infrastructure recovery and maintenance, which is estimated to total US$1 billion. The World Bank has significant experience in strengthening institutional and regulatory frameworks and facilitating collaboration with relevant stakeholders. The Bank can help improve road infrastructure in Ecuador to achieve more sustainable, resilient, and safe infrastructure. It can provide Ecuador needed and substantial external assistance to close investment gaps and build institutional capacity. Given the country's fiscal constraints and recent external shocks, synergies among intervened areas are critical.

F. Lessons Learned and Reflected in the Project Design

37. **Working with existing agencies with a proven track record is an effective approach for implementing emergency response.** Expedient and effective implementation is inherent in emergency recovery loans. To the extent possible, emergency recovery projects can thus capitalize on the comparative advantage of using counterpart institutions that have proven implementation capacities and a proven ability to collaborate with other institutions. MTOP is the natural implementing agency for transport infrastructure.

38. **The Project draws on early capacity building and long-term planning lessons from the Risk Mitigation and Emergency Recovery Project (P157324) in Ecuador in 2016.** Toward the end of 2015, Ecuador faced two imminent Natural Hazards which could cause major damages and losses, the eruption of the Cotopaxi Volcano and adverse effected from the El Niño phenomenon, leading the Bank to prepare an emergency loan (P157324). This past emergency project emphasized the importance of involving all relevant governmental bodies in project planning and contracting to overcome implementation delays. To address this concern, procurement capacity building and contract management workshops will be conducted during Project preparation to ensure clarity and agreement on implementation procedures. Moreover, analysis shows that expenditures on prevention are generally significantly lower than those for relief and reconstruction. Prevention is rooted in quality infrastructure, but its effectiveness depends on proper maintenance. Maintenance expenditures are often postponed by governments, in turn generating increased risks, especially in tight fiscal situations. Lack of planning and poor asset management have negative fiscal impact by creating bigger needs in the future to bring back infrastructure. In this sense, the Project is designed to support rehabilitation and emergency maintenance works and minimize both the disaster and fiscal risks from unintentionally deferred maintenance in the wake of an emergency.

39. **Emergency operations require maximum flexibility in design, simplicity in the institutional arrangements and activities, and effective governance.** Flexibility is important in the definition of eligibility. Hence, the project is adopting a framework approach to adapt to emergent needs and client priorities. There is also a likelihood of low

implementation capacity for a WB-financed project, coupled with the complexity of emergency operations. To succeed, it is crucial to prioritize flexibility, simplicity, and commitment to the plan. The Jamaica Hurricane Dean Emergency Recovery Loan (P109575) demonstrated the positive aspects of flexible project design on the scope of the works financed, enabling the project to respond fluidly to needs. The Emergency Recovery and Disaster Management Project (P106449) in Bolivia supported the need to simplify implementation arrangements as much as possible, especially regarding the number and responsibilities of executing agencies. Finally, in 2007, Ecuador faced a similar situation, which triggered *Plan Relámpago*, or Plan Flash, an ambitious investment plan to reconstruct and rehabilitate the National Multimodal Transportation System (NMTS). The recovery of the NMTS was quick and efficient thanks to the government´s investment efforts and commitment to the plan. As a result, the Project design incorporates the financing of the PMTS firm that will support the Borrower in the design and implementation of relevant activities during project implementation.

40. **Financing sub-project designs and feasibility studies with Project funds is crucial to guarantee their quality and conformity with the policies and standards of the World Bank.** In the Emergency Recovery Project of 2016, the GoE decided to use Government funds to finance the designs and feasibility studies for most of the sub-projects. Unfortunately, the technical quality of these designs was subpar, as they failed to meet national legislation, international best practices, and World Bank requirements. To rectify this issue, the World Bank and the PIT enlisted the help of two engineers to review the designs. However, since the designs had already been approved by the co-executing agencies that procured them, it proved difficult to implement any changes. To avoid similar issues, it is advisable to finance sub-project designs and feasibility studies with Project funds, particularly in countries with low technical capacity. This will help ensure adherence to quality standards and prevent lengthy delays caused by revision loops.

41. **Emergency recovery operations in disaster-prone countries like Ecuador should aim to incorporate disaster mitigation in a culturally and socially responsible manner.** The Project's primary focus is on rebuilding safer communities by rehabilitating or reconstructing infrastructure. This is achieved through improved construction standards that consider disaster risk mitigation, traditional designs, and social organization. An emergency project provides an opportunity to apply the knowledge gained from promoting disaster resilience, preparedness, and risk mitigation through non-structural measures such as shelter planning and evacuation plans. Additionally, the design of the project should consider the livelihood patterns and the needs of female-headed households in activities such as housing reconstruction, which involve direct labor contribution from beneficiaries.

42. **In emergency operations, Monitoring and Evaluation (M&E) is key to ensure the achievement of goals set in the recovery plan.** The 2016 Emergency Project aimed to ensure a comprehensive and inclusive recovery by introducing socioeconomic variables as key outcome indicators, in addition to the typical focus on reconstruction and rehabilitation indicators used in emergency operations. While this effort presents an opportunity to address development issues, it requires additional resources and effort to ensure related activities are fully evaluated. Moreover, challenges related to monitoring and evaluating social and economic outcomes remain due to the lack of reliable information, proper survey design, and database administration. To address these challenges, M&E guidelines and training will be provided to the implementing agency. M&E should be mainstreamed into day-to-day project administration, particularly for projects that have socioeconomic outcomes as part of their results matrix.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

43. **MTOP will be the Project's implementing agency.** MTOP through the PIT, and with support from the PMTS and the ESFS, will be responsible for the implementation and overall project coordination, planning, monitoring, procurement, financial management, ESF matters, and all other aspects related to Project implementation. The members of the PIT will be dedicated exclusively to project implementation. The PIT will work across MTOP's organic structure and coordinate with relevant departments. It will be the main focal point for the Bank, and in terms of project execution. The PIT 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) institutional arrangements; (ii) operation of the PIT and involved MTOP departments; (iii) Project planning and M&E; (iv) social and environmental management, reporting, communication, and human resources; (v) procurement; (vi) administrative processes and financial management (FM); (vii) grievance procedures and (viii) procedures for amending the POM. In addition, the PMTS, and the ESFS will provide technical support in its respective areas. The Bank will provide Hands-on Expanded Implementation Support (HEIS) on procurement if requested by the Borrower. 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.

44. Annex 1 includes further details in Institutional and Implementation Arrangements.

B. Results Monitoring and Evaluation Arrangements

45. **MTOP, through the PIT, will be responsible for implementing the M&E framework of the Project.** The PIT will be responsible for data collection[19] (both from MTOP 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 Bank and MTOP will conduct a Mid-Term Review with the Borrower between 24- and 36-months following project effectiveness.

C. Sustainability

46. **Borrower's commitment and ownership**. As shown in Section I C. the project design is consistent with the country's needs and priorities. The needs that this project tackles are unanimously recognized and urgent. Close and early engagement with the government will ensure commitment and ownership is maintained in the short term. In the longer term, the provision of tools such as the asset management system, guidelines and strategies will work towards sustainability of the interventions. Regarding fiscal constraints, the project amount is only a percentage of the needs for transport infrastructure (estimated at US$1 billion) and not significant from a macroeconomic point of view.

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

47. **Infrastructure sustainability and institutional capacity.** The project will adopt a “build back better” approach to the design and implementation of programmed infrastructure recovery and resilience interventions. The Borrower will achieve this by incorporating cutting-edge strategies to increase efficiency, resilience, and road safety. These strategies will also help bridge the gender gap from the design phase, during implementation, and through to future maintenance. The emergent nature of the interventions will require rapid but efficient design, implementation, and flexibility. The Borrower has limited experience in using cutting-edge strategies and is not sufficiently familiar with the Bank's ESF and procurement policies, nor with International Federation of Consulting Engineers (FIDIC) contract management. To fill any capacity gaps of the Borrower or any relevant stakeholders, the project design incorporates the financing of a Project Management and Technical Support (PMTS) firm that will support the Borrower in the design and implementation of relevant activities during Project implementation. Similarly, the project includes capacity building and institutional strengthening of public and private entities and stakeholders, and engagement of community members.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis (if applicable)

48. **The project will focus on rebuilding back better, quickly responding to new disasters, and preventing imminent threats under a framework approach.** The Project uses a framework approach enabling the client to intervene in existing and future Eligible Disasters and conduct Resilience Interventions in areas where an imminent threat has been identified. This approach is based on best practice in international recovery and rehabilitation. The Project will support ongoing efforts to plan for, identify, prioritize, and select eligible interventions. The project design will address the main issues the sector is facing. At a sectoral level, the project will include capacity building and provide tools to strengthen planning, implementation, and risk management capacity. At a project level, the innovative methods will be used to increase efficiency, resilience, and road safety, and help bridge the gender gap. The urgent nature of the interventions will require fast design, implementation, and flexibility. The MTOP also requires specific equipment that can strengthen the entity's capabilities and response times where infrastructure recovery and resilience interventions are needed. It is again necessary to note that the Borrower has limited experience with Bank policies regarding ESF and procurement, including International Federation of Consulting Engineers (FIDIC) contract management. The Project Management and Technical Support (PMTS) firm will provide additional implementation support to address these limitations.

49. **The Economic appraisal results show the urgency of the interventions and the economic profitability of the project.** Interventions are expected in the most important national roads, which have high traffic demand. This is consistent with the extremely high Economic Internal Rate of Return (EIRR) resulting from the analysis (171 percent).

50. **The Economic appraisal includes a standard incremental cost-benefit analysis (CBA) methodology in compliance with World Bank Operational Policy 10.04.** The appraisal focuses on Infrastructure Recovery and Resilient Interventions. To that end, it analyzed a sample of five representative interventions with estimated US$67 million financing needs. The analysis compares a situation with and without project (with disrupted connection or worsened

speeds due to an Eligible Disaster). 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) Restored connectivity in areas affected by Eligible Disasters: This benefit includes reduced travel times, reduced Vehicle Operating Cots (VOC) and reduced CO_2 emissions after the intervention.
(b) Improved resilience: This benefit measures the reduced cost of vulnerability. The cost of vulnerability is estimated multiplying the probability of occurrence of a Natural Hazard by the associated cost of the impact of the Natural Hazard. This impact includes the cost of reconstruction and the cost of worsened or lost connectivity.
(c) Improved safety: This benefit measures the reduced fatalities economic benefits by assigning and economic value to lives saved. This is conservative, as it does not consider the personal and economic costs of injuries, disabilities and property damage stemming from traffic crashes.

51. **See Annexes 2 and 3 for additional details.**

B. Fiduciary

(i) Financial Management

52. **A simplified Financial Management Assessment (FMA)[20] was conducted to evaluate the adequacy of the proposed FM arrangements in the Ministry of Transport and Public Works (MTOP) for the implementation of the Project.** The objective of the assessment was to determine whether the proposed financial management and disbursement arrangements are acceptable and in place to adequately control, manage, account for and report on the use of project funds. Due to the nature of the proposed emergency response operation, this assessment was prepared considering an overarching objective of maximizing the flexibility in the FM and disbursement arrangements. The project would benefit and build on any existing capacity within MTOP and use of the country's FM systems. A summary of these arrangements is presented below.

53. **Based on the assessment performed, the FM risk is rated Substantial.** The potential risks regarding FM include: (a) the country's fiscal constraints and lengthy timelines for the approval of budget funds for project implementation[21]; (b) high staff turnover at PITs due to salary scales[22]; (c) MTOP's limited experience implementing WB-financed projects and related FM knowledge gaps, despite its robust experience implementing projects of the Development

[20] In accordance with the condensed procedures provided for under: (i) Bank Policy for IPF, paragraph 12. Projects in Situations of Urgent Need of Assistance or Capacity Constraints; (ii) pursuant paragraph 57 of Bank Directive for IPF, Exceptional Arrangements in Situations of Urgent Need of Assistance or Capacity Constraints; (iii) Bank Guidance Projects in Situations of Urgent Need of Assistance or Capacity Constraints; and (iv) in accordance with Financial Management Practice Manual Sector Board on March 1, 2010.

[21] The most recent Public Financial Management assessments of Ecuador (most notably the PEFA report, 2019) pointed out various deficiencies including inter alia the need to strengthen transparency of public finances; the budget preparation, management, and control framework; and improving internal control and external oversight of the public sector. Such deficiencies may impact this project (as it is the case for other Ecuador projects) and be reflected in delays in getting the budget approved in time.

[22] Established by MEF Oficio Nro. MEF-VGF-2020-0281-O.

Bank of Latin America and the Caribbean (CAF) [23]; (d) lack of familiarity with eligibility requirements for retroactive financing, which will likely be needed due to the emergency nature of interventions (expenditures eligible for retroactive financing must be fully compliant with World Bank E&S and procurement policies and approved by the World Bank); and (e) the need to supplement project flow of funds oversight and recording processes to ensure timely control of execution and project financial reporting.

54. **To mitigate the identified risks, the following measures are recommended:** (a) MTOP will carry out continuous monitoring, flagging to the corresponding authorities any potential budget delays affecting the project. (b) MEF issued new increased salary scales on March 30, 2023, which is expected to help reduce staff rotation, but close follow-up during implementation is still needed. (c) The General Administrative and Financial Coordination (CGAF) through the Finance Directorate comprise qualified professionals who will be responsible for overall project financial management arrangements. This team will be supported by experienced FM professionals fully dedicated to the project and training will be provided. (d) Retroactive financing requirements are being discussed with MTOP in terms of financial reporting, and disbursement arrangements and documentation required to support these payments. (e) MTOP has adequate capacity to implement the project and will rely on country systems such as the Single Treasury Account and the country Information Financial Management System (e-Sigef) which have proved to operate well for other projects. Project budgeting, accounting and disbursements will be fully centralized. These arrangements will be supplemented by specific procedures agreed upon for the project, including specific roles and responsibilities of the CGAF and FM Project Implementation Team; customized financial reporting; and the assurance of adequate supporting documentation for ex-post reviews. The POM will reflect detailed procedures for the financial management arrangements agreed upon with MTOP.

55. **To accommodate the project in the existing FM system and ensure readiness, the following measures should be taken as *Effectiveness Conditions and Covenants*.**

(a) Effectiveness condition:
   i. the Borrower, through MTOP in coordination with Ministry of Finance (MEF) and National Planning Secretariat (SNP), has issued the priority opinion (*dictamen de prioridad*) for the entire Project.
   ii. the POM (including but not limited to its financial management chapter) has been prepared and adopted, through a ministerial agreement, by the Borrower through MTOP in form and substance satisfactory to the Bank.

(b) Covenants:
   i. no later than thirty (30) days after the Effective Date, a civil servant of the Borrower must be contracted for or appointed to each of the PIT team members. The PIT will include, among other key positions, an FM Specialist and an FM Analyst.
   ii. The Borrower, through MTOP in collaboration with MEF and SNP, shall manage the budget's inclusion in the Annual Investment Plan in a timely manner and ensuring timely budget allocation for the project implementation.

[23] Risk Mitigation and Emergency Recovery Project (IBRD 8591, P157324).

iii. The Borrower, through MTOP in collaboration with MEF and SNP, shall ensure that multi-year certification is issued for the cost of each activity to be implemented under the Project (including the cost of all contracts required to implement such activity) and for the respective implementation period.

56. **Staffing and organization structure:** MTOP will be the project implementing agency. MTOP's CGAF and Finance Directorate (comprising qualified professionals responsible for budgeting, accounting, and treasury) will be responsible for overall project financial management arrangements. However, due to limited experience implementing projects financed by multilaterals, MTOP will establish a PIT comprising, among others, an FM Specialist and an FM Analyst. The FM Specialist will monitor project budget, funds flow, validate eligibility of expenditures, prepare disbursements requests, financial reporting, and auditing aspects. The FM Analyst will conduct ex-ante control of supporting documentation of project expenditures before they are recorded in the e-Sigef and processed for payment. Both FM professionals will be hired under ToRs acceptable to the Bank, following WB procurement requirements and financed with loan proceeds. The POM will reflect detailed roles and responsibilities.

57. **Budgeting.** The Project budget allocation will be subject to approval by the SNP and the MEF. Preparation of the Project's Annual Program (POA) and budget will follow local regulations including the *Código de Planificación y Finanzas Públ*icas (COPLAFIP). The POA will be subject to the Bank's review and approval before the beginning of each year. Timely recording of the approved project budget, commitments, and accruals will be conducted through the e-Sigef. However, to avoid delays in timely project budget approvals and a negative impact on Project implementation of certain weaknesses in Ecuador's budget management and control framework (as noted in the most recent PFM assessments for Ecuador[24]), continuous monitoring by the Bank and MTOP will be needed, with early flagging of and action on any potential budget delays to the relevant authorities and the Bank.

58. **Accounting and financial reporting.** MTOP must comply with the Governmental Accounting Standards and chart of accounts established by MEF. MTOP will maintain project accounting records and transactions in the e-Sigef using the accrual basis. The CGAF in coordination with the FM Specialist will prepare Interim Financial Reports (IFRs) based on the e-Sigef information and complementary Excel spread sheets to record/obtain detailed information of the project by components/categories. MTOP will submit semiannual IFRs to the Bank no later than 45 (forty-five) days after the end of each semester. The content and format of the first IFR will be subject to review by the WB through a financial reporting pro-forma during implementation and before the due date of the first report to ensure they include relevant information. The POM will include the project IFR forms.

59. **Internal Controls.** MTOP has experience implementing infrastructure contracts and will follow the COPLAFIP and local regulations to ensure the funds are adequately executed, managed, controlled, and incorporated under its institutional accounting and budgeting systems and follow internal control regulations,[25] which set up segregation of duties in terms of roles and responsibilities for approval and authorization of payments, ex-ante controls of expenditures, and safeguarding of project assets. For project purposes, some processes and procedures will be

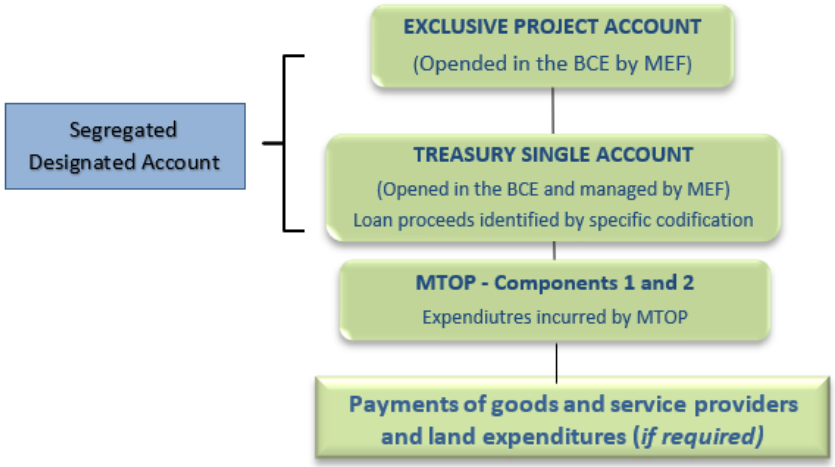
[24] PEFA report. 2019.

[25] Internal Control Regulations issued by the *Contraloría General del Estado*.

supplemented. For instance, all project expenditures will be subject to ex-ante controls conducted by FM Analyst and based on a checklist that lays out key supporting documentation required. The PIT will review and ensure that any prepaid eligible expenditures that are proposed to be financed (retroactively or otherwise) with Loan proceeds via the reimbursement method comply with the World Bank's procurement regulations and E&S requirements, and are properly documented, before requesting Bank's reimbursement. A POM will describe detailed internal control mechanisms to properly manage, control, and oversight the FM arrangements of the project.

60. **Flow of funds and Disbursement arrangements.** Flow of Funds and disbursement arrangements proposed for the project are streamlined considering that all payments will be managed by MTOP's central office and processed using country systems. Under the advanced method, a segregated Designated Account (DA) in US Dollars will be opened and maintained by MEF in the Central Bank of Ecuador (BCE). Advances will be first deposited in the External Credit Account[26] and immediately transferred to the project sub-account within the Single Treasury Account (STA), where loan proceeds are virtually identified by financier and loan.[27] All payments under the Project will be requested by MTOP to MEF and processed through the Interbank Payment System (SPI) to withdraw from the project DA. (See Figure 4.1 diagram below with flow of funds.)

Figure 4.1 Flow of Funds



Source: World Bank.

61. **The Bank will disburse loan proceeds using the disbursements methods of advances to the DA, reimbursement, and direct payment.** The DA will have a variable ceiling, this means MTOP through MEF will submit a request of funds based on six-month forecast of cash flow and subject to Bank's approval and according to POA. For reimbursements purposes, the Project will require to open a different account from the DA to receive reimbursements. Expenditures financed by the Loan will be documented using Statements of Expenditure (SOEs). The Project will have one disbursement categories. This first Category is composed of US$125 million to finance goods, consulting and non-consulting services, and financed 100 percent by loan proceeds following good practices

[26] *Cuenta de Crédito Externo* - CX, by its name in Spanish.
[27] *Código de Organismo y Correlativo*, by its name in Spanish.

in rapid response projects and covering Component 1 activities. A second Category is composed of US$15 million to finance goods, consulting and non-consulting services, training, operating costs, and Project external audits under for Component 2. The project will have a third disbursement Category of US$10 million to cover resettlement-related land compensation payments[28]. The project does not foresee local counterpart financing. Although financing of taxes (IVA[29]) is not required at this time, the Bank will leave the option to cover taxes according to country financing parameters. The Government is still identifying retroactive expenditures. The retroactive financing would be available up to 40 percent of the total loan. In the event that MTOP requests retroactive payments to be made, MTOP 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. The ToRs for this environmental and social assessment shall be part of the ESMF. Submitting the E&S assessment report in terms acceptable to the Bank, shall be a condition of disbursement to access retroactive financing.

62. **External Audit.** The Project will be subject to an external audit of the financial statements of the Project. The audit will be conducted by an external independent auditor acceptable to the Bank and hired under ToRs subject to Bank's no objection. MTOP will be responsible for appointing auditors. Audit costs will be financed out of the Loan proceeds. The auditor will also review retroactive expenditures and confirm they comply with Bank's minimum requirements. The audited financial statements will be submitted to the Bank's review, no later than six (6) months after the end of each year or any other period agreed with the Bank. MTOP will ensure project audited financial statements are posted in its website following the Bank Access to Information policy. In addition to the external audit, the public sector in Ecuador is subject to the oversight of the General Controller of the State (CGE—*Contraloría General del Estado*), who has the legal authority to conduct audits as it sees fit. Then funds executed under this Project may be also subject to the audit of the CGE.

63. **FM supervision and implementation support.** The FM supervision program will include at least two FM reviews per year, either as standalone reviews or as part of the overall project supervision. Offsite FM implementation support will also be conducted through the review of the Interim Financial Reports (IFRs) and audit report reviews, and continuously monitor the Designated Account activity and timely documentation of advances in Client Connection.

(ii) Procurement

64. **The Procurement for the Project will be carried out in accordance with the World Bank's Procurement Regulations for IPF Borrowers for Goods, Works, Non-Consulting and Consulting Services**, dated July 1, 2016 (revised in November 2017, August 2018, and November 2020). The Project will be subject to the World Bank's Anticorruption Guidelines, dated October 15, 2006, revised in January 2011, and as of July 1, 2016. The Project will

[28] "Land Compensation Payments" will be defined in the Loan Agreement as "means expenditures incurred in financing the cost of providing cash compensation and/or cash assistance resulting from land acquisition under the Project in accordance with the RPF and any RAP required thereunder".
[29] Value Added Tax.

use the Systematic Tracking of Exchanges in Procurement (STEP) to plan, record, and track procurement transactions.

65. **The major planned procurement packages are the following**: (a) rehabilitation of public infrastructures (roads, bridges, among other public infrastructure) and related engineering and project management services; (b) consultant services to improve or prepare designs, preventative maintenance programs, design, implementation, and staff training of a transportation infrastructure asset management system, among others; (c) purchase or repair of equipment for road rehabilitation or maintenance, among other goods/services. The finalization of the streamlined Project Procurement Strategy for Development (PPSD) and procurement plan have been deferred to implementation.

66. **The proposed procurement approach prioritizes fast-track emergency procurement for the emergency works, goods and services needed**. Key measures to fast-track procurement include: (a) use of simple and fast procurement and selection methods fit for an emergency situation, as appropriate; (b) streamlined competitive procedures with shorter bidding time; (c) procurement from UN Agencies enabled and expedited by Bank procedures and templates; (d) considering the use of leasing or the procurement of second-hand goods; and (e) no prior review for emergency procurement unless approved otherwise in the procurement plan. If requested by the Borrower, the Bank may provide procurement HEIS to help expedite all stages of procurement (if applicable).

67. **Procurement will be carried out by MTOP as the implementing agency.** Additionally, MTOP may enter into an agreement with one or more UN Agencies to provide TA and/or purchase goods for which they have a comparative advantage (if deemed appropriate).

68. **Advance Procurement and Retroactive Financing**: The Borrower may advance with the procurement under the above procurement arrangements and may seek the Bank's approval of advance contracting and the recognition of retroactive financing within the parameters set forth in the Loan Agreement.

69. **Procurement risk rating is assessed as Substantial.** The potential risks identified regarding procurement include: (a) lack of availability of capacity to provide certain goods, services or works due to increased local and international demand that may expose weaknesses in the supply chain and/or significant price increases; (b) ensuring that the staff comprising the PIT is hired quickly and possesses the capacity and experience to perform its duties appropriately; (c) governance-related issues common in emergency situations; and (d) conflict of interest with purchases or contracts with local vendors.

70. **To mitigate the identified risks, the following measures are recommended**: (a) performing market research and analysis to identify potential works contracts and classify these according to their capacity, experience, and type of works executed; (b) the Project, through the PIT will access local and international markets to reserve and ensure that goods, services and works may be delivered in a short timeframe; (c) strengthening the PIT with the hiring of experienced procurement and technical staff to perform the actions needed; (d) if applicable, procuring via UN agencies (UNOPS, UNDP or others) of technical assistance or goods where they have a comparative advantage; (e) performing a respective due diligence to ensure that no conflict of interest exists and that mitigation measures are

in place; and (f) ensure that the POM clearly defines roles and responsibilities that allow the PIT to operate in a fast manner within MTOP. Moreover, HEIS will be provided if requested by the Borrower.

C. Legal Operational Policies

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

D. Environmental and Social

71. **The overall environmental and social risk rating is considered High at this stage under the ESF.** Typically, the activities expected to be carried out under this scope would be given a Substantial level of risk; however, given the urgent and pressing need of the subprojects that will be financed, it is possible that some subprojects (specifically those involving repairs or maintenance) are located within environmentally, socially, or patrimonial protected and sensitive areas. This includes potential impacts to Indigenous Peoples and Nationalities, Afro-Ecuadorians, and Montubians. Specific interventions to be financed and their related technical details including the location, type, and activities involved will be defined and detailed during Project implementation, with the government presenting the possible eligible emergencies as required. On the other hand, some social benefits are expected, through resilient rehabilitation and reconstruction of public infrastructure such as roads and bridges to reestablish connectivity vial and strengthening of the project implementing agencies' technical and institutional capacity to respond to the emergency.

72. **MTOP staff has limited experience working with the Bank.** Although MTOP has experience with projects financed by international institutions such as CAF, BID, and the World Bank (in 2016), the MTOP specialists are new to managing World Bank projects under the ESF. The Bank considers it necessary to strengthen the team's capacity as soon as possible to develop E&S instruments that comply with the project's requirements under the ESF. Additionally, MTOP will require capacity building to manage E&S risks during project preparation and implementation, including monitoring E&S risks and impacts, as well as reporting activities.

73. **As the interventions to be carried out under Component 1 are not currently specified, an E&S framework approach will be adopted**. The core project instruments to assess and manage E&S risks and impacts will consist of: (i) an Environmental and Social Management Framework (ESMF), with general guidelines for E&S management; (ii) a Stakeholder Engagement Plan (SEP); (iii) Labor Management Procedures (LMP); (iv) a Resettlement Policy Framework (RPF); and (v) an Indigenous Peoples Policies Framework (IPPF). Additionally, the ESMF will include an E&S methodology for risk classification of site-specific project activities, which will set forth the requirements for site-specific Environmental and Social Impact Assessments (ESIAs) and Environmental and Social Management Plans (ESMPs)—instruments that shall be prepared in a manner acceptable to the Bank and be in effect prior to the commencement of field activities.

74. **The following is a timeline of ESF-related activities during preparation.** Activity specific instruments such as Resettlement Action Plans (RAPs) or Indigenous Peoples Plans (IPPs) will be prepared during implementation as part of the activity's preparation:

ESF Activity	Timeframe	Responsible Entity
Bank-delivered capacity building for MTOP E&S team in charge of Project preparation	During Project preparation	WB - MTOP
Hiring the E&S consulting firm	No later than 90 days after the Effective Date	MTOP
Hiring the E&S staff for the PIT	No later than 30 days after the Effective Date	MTOP
MTOP-developed capacity building plan to ensure adequate capacity of the PIT and E&S consulting firm in the preparation and implementation of the Project.	As early as feasible during Project preparation and during the first 60 days after the ESFS firm	MTOP
Development and implementation of an E&S training plan to ensure the required capacity for environmental and social implementation of the Project. Training sessions shall be provided during Project implementation by the PIT and/or their supervision consultants or other consultants retained for Project support, in accordance with an agreed timeline as per the plan.	No later than 60 days after hiring the E&S consulting firm	MTOP - E&S consulting firm
Preparation, consulting on, disclosure, and adoption of the E&S instruments (ESMF, LMP, RPF, SEP, IPPF)	No later than 60 days after hiring the E&S consulting firm	MTOP
Preparation, consulting on, disclosure, and adoption of the site-specific E&S instruments (ESIAs, ESMPS, IPPs, RAPs)	Prior to the commencement of the respective Project activity	MTOP

V. GRIEVANCE REDRESS SERVICES

75. **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 to the Bank's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project-affected communities and individuals may submit their complaint to the Bank's independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result 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), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the Bank's Accountability Mechanism, please visit https://accountability.worldbank.org.

VI. KEY RISKS

76. **The overall risk of the project is rated Substantial.** The main risks and mitigation measures are described below.

77. **Political and Governance risk is Substantial.**

Inherent Risk	- **Political**: Significant tensions have arisen between the country's Executive and Legislative branches. As a result of political volatility, the risk of senior management changes within the Ministry of Transport has increased. Materialization of this risk could lead to delays in project preparation and implementation.
Mitigation Approach	- **Consensus about the need to support reconstruction and recovery:** In spite of the political polarization, there is broad understanding across political authorities of the urgency and importance of supporting reconstruction and recovery efforts. The GoE has demonstrated a strong interest in the project, particularly in the context of the emergencies that many parts of the country are facing. - **Collaboration between the Government and social movements**: Close work with communities to ensure substantive participation and ownership during project implementation including strong consultations and training to allow direct participation in activities, future maintenance, and emergency response will make the project more resilient to protests and social unrest.

78. **Technical Design risk is Substantial.**

Inherent Risk	- **Operationalization**: The necessary flexibility to deal with current and potential Eligible Disasters requires a framework approach where the activities to be financed by the Loan are not defined. This could lead to risks in achieving the PDO. - **Technical complexity**: The need for urgent action can lead to rushing the design or construction process, resulting in less robust designs that may not adequately address the underlying issues or withstand future events. This can affect the implementation of the project, leading to delays and cost overruns. Additionally, technical complexity can also result in delays during the implementation process.

Mitigation Approach	- **Lessons learned**: The World Bank has extensive experience in preparing and implementing both emergency projects and road projects. Moreover, the interventions planned for the project are relatively simple and do not carry significant innovation risks. The Bank will facilitate the GoE to adopt more effective policies for the construction and maintenance of road infrastructure, thereby improving quality and resilient standards. - **Technical capacity:** The existence of national implementation capacity helps minimize the impact on the PDO. - **Quality and appropriateness measures:** Support activities (Component 2) will include planning and disaster risk management tools, as well as a Project Management Office, which, along with the PMTS and ESFS, will account for technical support. Additionally, the use of International Federation of Consulting Engineers (FIDIC) contracts is expected. - **Supporting implementation readiness during preparation.** The Borrower is coordinating early with the Bank to get support in identifying and preparing activities for early implementation. - **PMTS.** The PMTS will support bridging Borrower capacity gaps on the technical side.

79. **Institutional Capacity for Implementation and Sustainability risk is Substantial.**

Inherent Risk	- **Limited Institutional Capacity**: MTOP lacks previous experience in implementing projects financed by WB and has limited capacity in designing and executing resilience and road safety projects, and in understanding the World Bank's procurement policies and ESF principles. It may take time for MTOP to establish the PIT and to find qualified experts who have experience in working on internationally financed projects. The numerous Deconcentrated Units (District Transport and Public Works Direction of each Province and the seven Transport and Public Work Subsecretaries that group them) that play a key role in the administration of civil works contracts financed by the project lack experience in working on internationally financed projects. - **Recruitment and Retention**: the limited availability of competent staff is further exacerbated by salary-setting constraints that make it difficult to attract and maintain qualified personnel.
Mitigation Approach	- **PIT.** MTOP will hire a PIT that will be exclusively dedicated to project implementation. The PIT composition will be agreed upon in the POM. The coordination arrangements and accountabilities will also be agreed upon in the POM, which will be a loan effectiveness condition. - **PMTS:** The project will finance a PMTS firm that will provide specialized technical support to the PIT/MTOP in the design and implementation of relevant

	activities during the implementation of the Project ranging from engineering support to road safety, environmental and social matters, ESF, resilience, and gender. The hiring of the PMTS will be a condition of Effectiveness. - **Technical Advisory**: HEIS will support procurement and safeguard procedures if requested by the Borrower. The World Bank will also provide intensified implementation support to the GoE, including capacity-building workshops and training.

80. **Fiduciary risk is Substantial.**

Inherent Risk	- **Fiduciary risk** is deemed Substantial due to (i) the emergency nature of the operation, (ii) the country's fiscal constraints and lengthy process of getting timely approval of budget funds for implementing projects, (iii) MTOP's limited experience in implementing projects according to World Bank Procedures (including the World Bank Procurement Regulations), (iv) high government staff turnover, (v) the constraints in hiring experienced staff to undertake the financial management (FM) and procurement functions due to the complexity and size of the project, and (vi) the fiduciary arrangements that are necessary to provide a robust fiduciary environment for implementation.
Mitigation Approach	- **Project design** includes several mitigation (and oversight) measures to reduce these risks, as detailed in paragraphs 52–63 (for FM) and 64–70 (for procurement) under the Fiduciary section.

81. **Environment and Social risk is High.**

Inherent Risk	- Typically, the E&S risk of expected project activities would warrant a Substantial risk classification. However, as project locations are not yet known and may include environmentally, socially, or patrimonial protected and sensitive areas, the risk classification is High. This rating will be reviewed regularly during the course of project implementation. - **Social impact**: (i) Land acquisition and resettlement: This project (road construction) may require the acquisition of land, which can result in the displacement of local communities; (ii) Health and safety risks: This project may create safety hazards for workers and local communities, including the risk of accidents, and injuries; and (iii) Impacts on access to services: This project may impact access to services, including healthcare, education, and transportation, particularly if local roads or infrastructure are disrupted during the construction process.

	- **Environmental impact**: (i) Land use and biodiversity impacts: This project may result in the loss of natural habitats and ecosystems, including disruption of wildlife habitats; and (ii) Air and water pollution: through dust, emissions from construction machinery and vehicles, and the disposal of construction waste.
Mitigation Approach	- **Preparation of relevant instruments**: During the project implementation Environmental and Social Management Framework will be prepared, consulted, and disclosed to manage construction impacts based on good international practice and WBG General Environmental Health and Safety (EHS) Guidelines. Mitigation measures for the aforementioned risks are detailed. - **Social risk mitigation approach**: (i) Land acquisition and resettlement: Develop a comprehensive RAP, provide compensation and support for affected households and communities, ensure voluntary resettlement, and establish a grievance mechanism; (ii) Health and safety risks: Develop and implement a comprehensive health and safety plan, provide safety equipment and training, implement appropriate traffic management measures, and manage hazardous waste and materials; and (iii) Impacts on access to services: Develop a traffic management plan, engage with local communities to identify their needs, provide temporary transport or mobile services, and develop a communication plan. - **Environmental risk mitigation approach**: (i) Land use and biodiversity impacts: Undertake an environmental impact assessment, develop an environmental management plan, implement measures to protect and restore natural habitats, and ensure project activities minimize disturbance to wildlife habitats; and (ii) Air and water pollution: Develop and implement a pollution control plan, use low-emission machinery and vehicles, implement appropriate measures for disposal of construction waste, and monitor air and water quality during construction.

VII. RESULTS FRAMEWORK AND MONITORING

Results Framework
COUNTRY: Ecuador
Ecuador: Emergency Resilient Reconstruction Project

Project Development Objectives(s)

The Project Development Objective (PDO) is to restore connectivity and improve infrastructure resilience and road safety in areas affected by Natural Hazards.

Project Development Objective Indicators

Indicator Name	PBC	Baseline	End Target
Restored connectivity in areas affected by Natural Hazards			
Average travel time in intervened areas (Minutes)		130.00	75.00
People with enhanced access to transportation services (CRI, Number)		0.00	70,000.00
Improved infrastructure resilience in areas affected by Natural Hazards			
Number of beneficiaries with access to climate resilient roads in intervened areas (Number)		0.00	70,000.00
Improved road safety in areas affected by Natural Hazards			
Number of road traffic fatalities in intervened areas (Number)		49.00	22.00

Intermediate Results Indicators by Components

Indicator Name	PBC	Baseline	End Target
Infrastructure Recovery and Resilience Interventions			
Roads constructed (CRI, Kilometers)		0.00	37.00
Roads rehablitated (CRI, Kilometers)		0.00	281.00
Roads with improved climate resilience (Kilometers)		0.00	318.00
Percentage of road safety audits implemented in constructed, rehabilitated, and improved roads (Percentage)		0.00	100.00
Percentage of MTOP heavy machinery in working condition (Percentage)		34.00	100.00
Number of women certified for operating heavy machinery (Number)		0.00	80.00
Percentage of civil works contractors with training on GBV/SH (Percentage)		0.00	100.00
Percentage of complaints responded to and/or resolved within the stipulated standard for response times (Percentage)		0.00	100.00
Institutional Strengthening for Resilience			
Road asset management, including risk monitoring and early alerts system implemented (Yes/No)		No	Yes
Planning, project prioritization and risk management tool implemented (Yes/No)		No	Yes
Number of MTOP officials trained in the management of road assets and prioritization of road projects (Number)		0.00	15.00
Number of public servants and community members trained (Number)		0.00	100.00

Monitoring & Evaluation Plan: PDO Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
Average travel time in intervened areas	Weighted average (by transport demand) of travel time after restoring lost connectivity by Infrastructure Recovery Interventions.	Every 6 months	MTOP from transport model and latest traffic data	This indicator will gradually include sub-indicators corresponding to Intervened Areas. The sub-indicators will report estimated change in travel time before (baseline) and after the intervention to recover lost connectivity (end target). The estimation will consider the level of service on the roads given traffic levels, which will result in an estimated speed. They will also consider the change in travel length. The final indicator will correspond to the average of travel time change in all interventions. The current target	MTOP

				corresponds to an estimation of potential time travel changes once connectivity is recovered in five representative interventions identified and potentially eligible. The target may be revised during implementation of the project.	
People with enhanced access to transportation services	The indicator measures the number of direct beneficiaries that experience improved access to transport infrastructure and services that have been built or rehabilitated through a WBG-financed project (including highways, rural roads, urban and interurban roads, mass transit systems, ports/waterways, railways, and airports). Beneficiaries typically experience reductions in cost and time to travel and/or improvements in safety, as well as increased access to	Every 6 months	MTOP and ANT	The estimation is based on traffic demand modelling using the latest traffic counts and occupation factors. The target is estimated using traffic demand on five representative and potentially eligible infrastructure recovery interventions.	MTOP

	markets, job opportunities, and health and education services. In urban areas, beneficiaries include the increase in the number of users of improved services. In rural areas, beneficiaries include the increase in the number of people who live in proximity to improved services.				
Number of beneficiaries with access to climate resilient roads in intervened areas	The indicator measures the number of direct beneficiaries that experience improved access to transport infrastructure and services that have been made more resilient to future Natural Hazards through a WBG-financed project.	Every 6 months	MTOP and ANT	This indicator is closely linked to the previous indicator “People with enhanced access to transportation services” after connectivity restoration. Considering all interventions to restore connectivity will ensure the infrastructure is climate resilient, we can estimate that 70,000 people will benefit from improved climate resilient transport infrastructure. The estimation is based on traffic demand modelling using the	MTOP

				latest traffic counts and occupation factors. The target is estimated using traffic demand on five representative and potentially eligible recovery interventions.	
Number of road traffic fatalities in intervened areas	Number of annual traffic fatalities in Intervened Areas.	Every 6 months after intervention is implemented	ANT traffic crash data	This indicator will gradually include sub-indicators corresponding to intervened areas. This indicator will use ANT traffic crash data. If the intervention is not completed, the indicator will correspond to a rolling annual average of traffic fatalities of the last five years in the intervened area. If connectivity was disrupted due to an Eligible Disaster, the data will take into account fatalities in alternative routes for the period the interruption lasted. Once the intervention	MTOP

				is completed, the indicator will report actual fatalities after the intervention is over. And the yearly average after the second year of implementation. The baseline corresponds to the application of this methodology to five interventions identified as potentially eligible. The end target is esmitated using RSSAT, as in the economic analysis, to estimate reasonable fatality reduction. This indicator may need to be fine-tuned.	

Monitoring & Evaluation Plan: Intermediate Results Indicators					
Indicator Name	**Definition/Description**	**Frequency**	**Datasource**	**Methodology for Data Collection**	**Responsibility for Data Collection**
Roads constructed		Every 6 months	MTOP and Project Progress Reports	Out of the US$135 million of Component 1, where US$30 million will be dedicated for	MTOP

				equipment, we are assuming that for the remaining US$105 million, around 31 percent of all infrastructure recovery will be dedicated to construction, 54 percent for rehabilitation and reconstruction, and 15 percent for improving resilience. Those assumptions come from the share of costs in five representative and potentially eligible interventions identified . Taking US$105 million (the amount Infrastructure Recovery Interventions) and multiplying by 31 percent, we can calculate the amount of investment expected in road construction. Dividing expected investment in construction by an	

				estimated average cost per km (US$0.892 million per km, also from the data on representative interventions) we are able to estimate the target of how many km will be constructed. The current values are a conservative estimation as construction costs may vary, but it is a good indicator to visualize how many km can be constructed with the given budget. The actual values will be reported by MTOP during the implementation of the projects.	
Roads rehablitated		Every 6 months	MTOP and Project Progress Reports	Out of the US$135 million of Component 1, where US$30 million will be dedicated for equipment, we are assuming that for the remaining US$105 million, around 31 percent of all	MTOP

				infrastructure recovery will be dedicated to construction, 54 percent for rehabilitation and reconstruction, and 15 percent for improving resilience. Those assumptions come from the share of costs in five representative and potentially eligible interventions identified. Taking US$105 million (the amount Infrastructure Recovery Interventions) and multiplying by 54 percent, we can calculate the amount of investment expected in road construction. Dividing expected investment in rehabilitation by an estimated average cost per km (US$0.2 million per km, also from the data on representative	

				interventions) we are able to estimate the target of how many km will be rehabilitated. The current values are a conservative estimation as rehabilitation costs may vary, but it is a good indicator to visualize how many km can be rehabilitated with the given budget. The actual values will be reported by MTOP during the implementation of the projects.	
Roads with improved climate resilience	Length of roads with climate resilient features.	Every 6 months	MTOP and Project Progress Reports	This indicator is closely linked to the previous indicators “Roads constructed” and “Roads rehabilitated”. Considering all interventions will ensure the infrastructure is climate resilient we can already say that at least 318 km will improve their climate resilience (37	MTOP

				construction + 281 rehabilitation).	
Percentage of road safety audits implemented in constructed, rehabilitated, and improved roads	Road Safety Audits or Road Safety Inspections are a requirement to comply with the law at the local level (as stated in the Transport, Traffic and Road Safety Law of Ecuador) and to comply with the Bank's safeguards.	Every year	Supervision reports	Reports	MTOP
Percentage of MTOP heavy machinery in working condition	This indicator measures the percentage of machinery owned by MTOP that is currently operational and in good working condition.	Every year	MTOP	Data will be provided by MTOP on the condition of their machinery.	MTOP
Number of women certified for operating heavy machinery	Number of local women trained by the contractor on the use of various kinds of heavy equipment, such as vehicle operating, and in skills needed to perform occupational activities or other skilled identified positions on road works that are certified in Ecuador.	Every year	Supervising consultants progress reporting	A headcount of the women trained and certified in medium skills related to road works in the interventions will be conducted. The required number of heavy machinery operators and assistants in the identified and potentially eligible interventions has been estimated (approximately	MTOP

				673). Considering the gender gap in the construction sector, a reasonable estimate has been calculated, to ensure at least 80 women obtain certification to participate in activities that require higher skills. This will allow more women to become suitable for employment in the sector and contribute to reducing the gender gap.	
Percentage of civil works contractors with training on GBV/SH	The indicator measures the proportion of civil works contractors who have received training on gender-based violence (GBV) and sexual harassment (SH) prevention and response measures.	Every 6 months	Supervision reports	Divide the number of civil works contractors who have received training on GBV and SH by the total number of civil works contractors.	MTOP
Percentage of complaints responded to and/or resolved within the stipulated standard for response times	This indicator aims to ensure that any grievances raised by the beneficiaries are addressed promptly and withing the stipulated timeframe of the Grievance	Every 6 months	The data collection process should be standardized and	The methodology is not restricted to complaints received by email, but rather includes all available channels, such as contractor	MTOP

	Redress Mechanism (GRM).		consistent. MTOP can use a database or spreadsheet to track complaints received, response times, and resolution times.	mailboxes, in-person complaints, complaints received through other channels, and complaints derived by the World Bank that have been received through the Bank's Grievance Redress System (GRS). A complaint will be considered 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.	
Road asset management, including risk monitoring and early alerts system implemented	The indicator will measure whether the Asset Management System is made functional or not.	Every year	Project Progress Reports	Asset Management System implemented yes/no.	MTOP
Planning, project prioritization and risk management tool implemented	The toll will helps teams make informed decisions by providing a systematic approach to identify and mitigate potential risks, prioritize tasks, and allocate	Every year	Project Progress Reports	The framework for the planning, project prioritization and risk management tool will be developed with support from the Bank.	MTOP

	resources effectively.			The indicator will be achieved once the tool is established within MTOP.	
Number of MTOP officials trained in the management of road assets and prioritization of road projects	This indicator is used to track the capacity-building efforts of the Ministry and the extent to which officials are equipped with the knowledge and skills required to manage road assets and prioritize projects effectively	Every year	Project Progress Reports	A training plan will be developed that will include the objectives, content, and delivery method of the training program. The plan should also specify the number of officials to be trained, the timeline for training, and the evaluation method to assess the effectiveness of the training. There will be a report on the number of officials who have received training, the effectiveness of the training program, and any lessons learned. The data will be used to inform future training programs and capacity-building efforts.	MTOP
Number of public servants and community members trained	The outcome of this indicator can be multifaceted. The training	Every 6 months	Supervision reports	Headcount the number of public servants and community members	MTOP

	programs can have various objectives, such as building capacity, improving skills, increasing awareness, and changing behavior.			participating in different training activities.	

ANNEX 1: Implementation Arrangements and Support Plan

A. Project Institutional and Implementation Arrangements

1. **The Ministry of Transportation and Public Works (MTOP) will be the Project's implementing agency because of it being head of the sector and having the capacity and responsibility to implement the activities of the nature of the Project's.** MTOP is the governing body of the National Multimodal Transportation System, executing and managing state infrastructure; it implements, controls, and evaluates public policy, strengthening services and infrastructure for safe transportation and sustainable public works.

2. **MTOP will hire a Project Implementation Team (PIT) exclusively dedicated to project implementation, working across the institution's organic structure, and coordinating with relevant departments.** For the purposes of project implementation, MTOP will use loan resources to finance a team with exclusive dedication. MTOP can also designate members of the civil service who will be exclusively dedicated to the project to fulfill roles in the PIT. In these cases, salaries, or any other salary supplements for members of the civil service are ineligible expenditures to be financed by the Loan. The PIT will be the main focal point for the purposes of coordinating with the Bank team. MTOP has agreed with the following minimum key team members, which will be reflected in the Project Operational Manual (POM) and updated as necessary during project implementation:

    a. Project coordinator (x1): The project Coordinator will be a professional with extensive experience in project management and relevant technical skills. He or she will be the main focal point for the purposes of coordination with the Bank and coordinate the PIT. He or she will respond directly to the Minister´s Office or the General Administrative and Financial Coordination Department.

    b. Planning Specialist (x2): Planning Specialists will play a key role in easing internal planning processes, including working with the National Secretary for Planning and Development (SENPLADES in Spanish) as needed. They will be seasoned professionals with adequate technical skills and proven experience in project management and public planning processes in Ecuador. They will work in the General Planning and Strategic Management Unit.

    c. Civil Engineer / Transport Specialist (x3): These experts will bring a mix of technical skills required for project implementation including risk management, civil engineering, structural engineering, geological and hydrogeological engineering, and transport planning. They will work in the Vice Minister of Transport Infrastructure and Civil Works´ office.

    d. Communications Specialist (x1): The Communications Specialist will be responsible for organizing and supervising the project and PIT communications efforts, as well as supporting participatory processes. He or she would work under the Direction of Social Communications, dependent on the Minister´s Office.

    e. Financial Management Expert (x1) and Financial Analyst (x1): Both, the FM expert and Financial Analyst will be responsible for ensuring timely implementation and compliance with the financial management

arrangements of the Project. The FM Expert will work in the Direction of Credits and International Cooperation, dependent on the General Administrative and Financial Coordination Department, and will monitor audits and general project FM. The Financial Analyst will support the Financial Director on processing payments to contractors.

f. Procurement Expert (x1): The Procurement Expert will be responsible for designing and ensuring timely implementation and compliance with the procurement arrangements of the Project. He or she will work in the Direction of Pre-contractual Processes Management, dependent on the General Administrative and Financial Coordination Department. This Direction will centralize all procurement processes management.

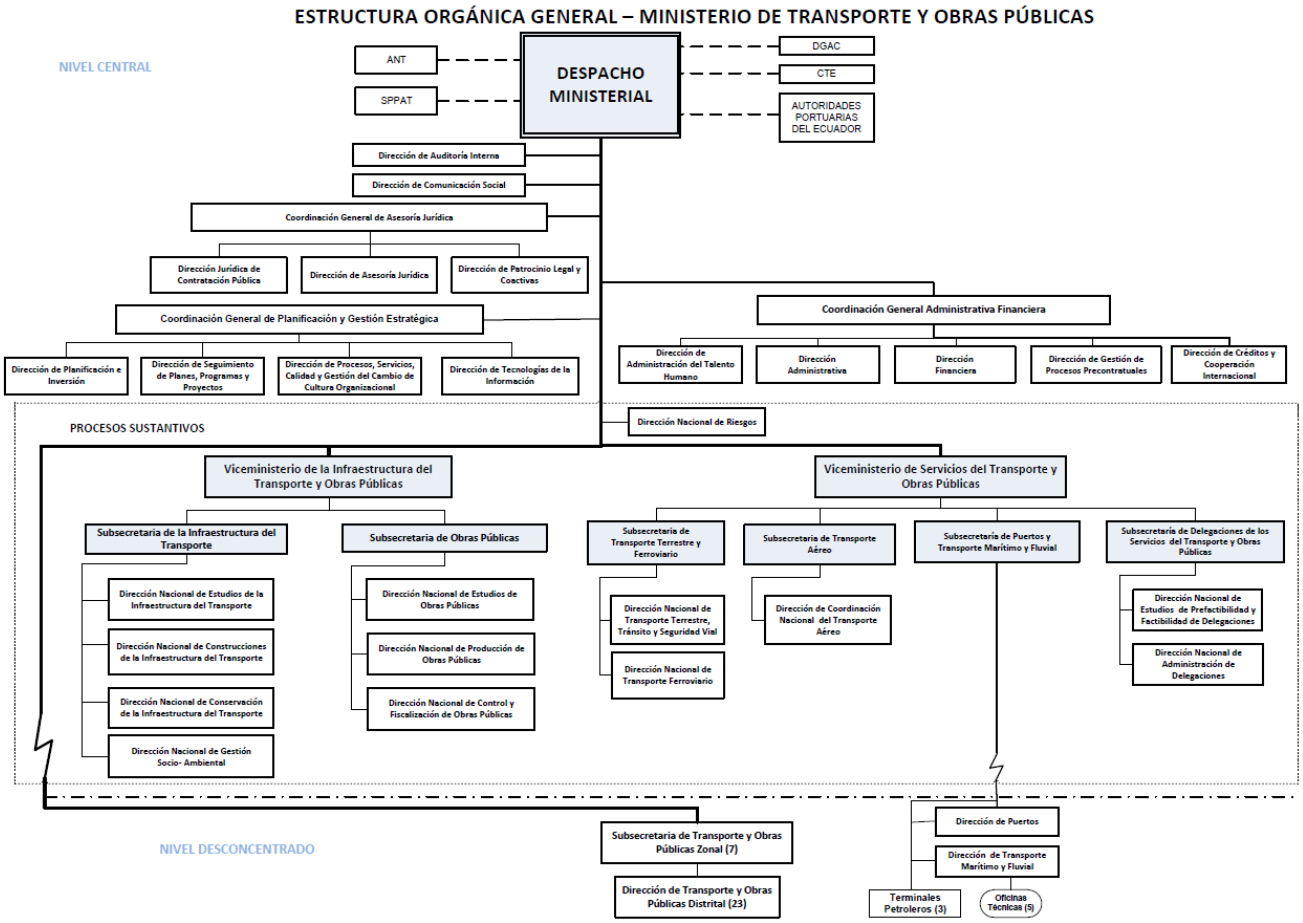
g. Environmental Specialist (x1), Social Specialist (x1) and E&S coordinator (x1): The Environmental Specialist and Social Specialist will be responsible for ensuring the design and implementation of arrangements and instruments required to comply with the Banks´ E&S Framework´s standards as applicable to the project. An E&S Coordinator will also be recruited within the PIT to ensure better coordination between the technical work of the E&S specialists and the Bank's requirements. The E&S Coordinator would be the focal point for technical communications between the PIT and the Bank. The E&S specialists and the E&S Coordinator will work in the National Direction of Social and Environmental Management, dependent on the Subsecretary of Transport Infrastructure in the Vice Ministry of Transport Infrastructure and Civil Works.

h. Legal Expert (x1): The Legal Expert will provide guidance on required regulation to the PIT. He or she will also advise the PIT on contractual requirements under the Bank Loan agreement and related documentation. He or she will work in the General Coordination of Legal Advisory.

3. **In addition, the Decentralized Units will play a key role in the administration of civil works contracts included in the project.** The Decentralized Units refer to the District Transport and Public Works Direction of each Province and the seven Transport and Public Work Subsecretaries that group them. They will get support from the PIT in the implementation of the project activities and Bank policies and fiduciary requirements applicable to the operation. These Units will provide the General Administrative and Financial Coordination Department and the PIT copies of all relevant fiduciary (financial management and procurement) documentation generated during the implementation of project activities. These units are part of MTOP. In terms of funds, these units will not manage loan proceeds, but depend on MTOP central departments to request payment related to activities under their administrative and technical coordination.

4. The Figure 1A.1 diagram below corresponds to the current organic structure of MTOP.

Figure 1A.1 Current MTOP Organic Structure



Source: World Bank.

5. **Project Management and Technical Support (PMTS) firm.** In addition to the PIT, the project will include a PMTS firm to assist implementation during the life of the Project. The project design involves the application of innovative methods to increase efficiency, resilience, road safety and help bridge the gender gap. Moreover, the emergent nature of the interventions will require fast design, implementation, and flexibility. Finally, the Borrower has limited experience in the use of Bank policies and procurement, including the International Federation of Consulting Engineers (FIDIC) contract management. This component will include a Project Management and Technical Support firm that will support the Borrower in the design and implementation of relevant activities during the implementation of the Project.

6. **Environmental and Social Framework Support (ESFS).** Like the PMTS, this component will include an environmental and social consultancy firm in charge of supporting MTOP in Environmental and Social risks and impact management. The firm will elaborate E&S instruments as required for different interventions. It will also ensure MTOP capacity building in E&S risk management matters and support MTOP in carrying out consultations and monitoring and supporting management of grievances. In addition to design, implementation and monitoring activities, the firm will coordinate with the technical teams to address emergent issues with environmental and social implementations, as well as facilitate other participatory processes beyond Environmental and Social risks. Finally, the firm will provide training to MTOP on Environmental and Social risk management and World Bank policy.

7. **Hands-On Expanded Implementation Support (HEIS).** Given MTOP's lack of experience in working with the Bank, and the urgency of the project activities, the Bank will support MTOP with HEIS to ease the management of procurement matters if requested by the Borrower.

8. **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 PIT and involved MTOP departments; (iii) roles, responsibilities, and Terms of Reference (ToRs) of key PIT staff members, the Project Management and Technical Support Firm, and the ESFS firm; (iv) eligibility requirements for Eligible Activities; (v) Project planning and monitoring and evaluation; (vi) social and environmental management, reporting, communication, and human resources; (vii) procurement; (viii) administrative processes and financial management; (ix) grievance procedures; and (x) procedures for amending the POM.

9. **Results Monitoring and Evaluation.** The PIT will be responsible for the overall Project Monitoring and Evaluation (M&E) and reporting. To that end, the PIT will (i) collect, consolidate, analyze, and report on Project performance data, as well as (ii) provide periodic information on Project results and progress. In accordance with WB policy, the Bank will complete: (a) periodic Implementation Status and Results Reports (ISRs), (b) a mid-term review of implementation to revise the objectives and targets, (c) an Implementation Completion Report (ICR) within six months following the Closing Date. 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) M&E results.

ANNEX 2: Sector Analysis and Technical Appraisal

A. **Ecuador: A country highly exposed to Climate Change and Natural Hazards**
B. **The National Multimodal Transportation System (NMTS): Critical for the economy and highly vulnerable to Natural Hazards**
C. **Climate Change Mitigation within the Transport sector: a large GHG emissions source, and the only sector where emissions are growing**
D. **Road Safety in Ecuador: A growing concern and an institutional challenge**
E. **Bridging the gender gap in the transportation sector**
F. **Benchmark projects description and potential implementation timeline**

A. Ecuador: A country highly exposed to Climate Change and Natural Hazards

1. **Ecuador's economy and population are highly exposed to the impact of climate-related disasters, earthquakes, and volcanic risks.**[30] Ecuador is among the top 10 countries in the region for Eligible Disaster risk, and among the top 20 in the WorldRiskIndex 2022.[31] This is due to its exposure to geological and hydrometeorological hazards such as earthquakes, volcanic eruptions, floods, and droughts.[32] The country is located in one of the most complex tectonic zones in the world where the Nazca and South American plates meet, and it has the most active volcanoes, which are part of the zone called the "Pacific Ring of Fire." Also, Ecuador is in the intertropical convergence zone, where a low-pressure belt surrounds the globe and produces hydrometeorological hazards such as floods, droughts, frosts, and the effects of El Niño Southern Oscillation (ENSO). These geological and hydrometeorological effects make Ecuador susceptible to several types of natural and geological occurrences including earthquakes, volcanic eruptions, tropical storms, floods, and landslides.

2. **National Emergency Declarations in Ecuador.** The country legislation provides various mechanisms to determine the imminence of various adverse hazards or emergency events, and to classify their effects. These are: (i) Declaration of an Alert (*Declaratoría de Alerta*); (ii) Declaration of an Emergency Situation (*Situación de Emergencia*); and (iii) State of Emergency (*Estado de Emergencia*). The Declaration of an Alert has three established states of alert, and its upgrading or downgrading corresponds to the evolution of an identified threat. Scientific and technical agencies who report to the Secretariat of Risk Management oversee the monitoring following the protocol corresponding to the alert. Each alert categorization has an associated set of actions and protocols to safeguard human life and goods and ensure continuity of services. However, it is not always possible to gradually elevate the alert level according to the hazard situation. In some cases, elevations from Yellow to Red can occur in an instant.[33] Also, the Declaration of an Emergency Situation has at least two immediate effects: (i) it activates humanitarian assistance processes; and (ii) it allows for the contracting of goods, works and services to address the emergency through special procurement procedures within the national legal framework. By law, Emergency situations are defined as those generated from serious events such as earthquakes, floods, droughts, imminent external aggression, and Eligible Disasters at the national, sectorial, or institutional level.[34]

Table 2A.1. Significance of the Alert of National Emergency Declarations

Alert	Significance of the Alert
Yellow	Advisory of a significant activation of the threat
Orange	Advisory that occurrence of threat is imminent
Red	Notice that emergency or disaster is occurring

Source: World Bank. 2016. "Risk Mitigation and Emergency Recovery Project Appraisal Document" (P157324).

[30] Thinkhazard.: https://thinkhazard.org/en/report/73-ecuador. Date: 04/02/2023.
[31] World Risk Report (Bündnis Entwicklung Hilft et al., 2022). https://weltrisikobericht.de/wp-content/uploads/2022/09/WorldRiskReport-2022_Online.pdf.
[32] Pan American Health Organization. 2021.
[33] World Bank. 2021. *Ecuador: Estrategia de gestión financiera ante el riesgo de desastres*.
[34] World Bank. 2016. "Risk Mitigation and Emergency Recovery Project Appraisal Document" (P157345).

3. **Climatic Natural Hazards have increased in magnitude and occurrence, and Climate Change will make it worse.** Climate change is expected to increase the intensity and incidence of extreme weather events, raising vulnerability in the country. This includes, for instance, the relationship between increased ocean temperatures and global warming triggers such as the El Niño phenomenon, followed by floods and mass displacements. On the other hand, the La Niña phenomenon, associated with the cooling of ocean temperatures, could increase droughts and, potentially, forest fires. In the last decades, the magnitude and occurrence of Eligible Disasters in Ecuador have been increasing in the number and severity of their impact. Of the 29 largescale Eligible Disasters that have affected the country in the last 30 years, 59 percent had a climatic origin. Moreover, there has been a significant increase in the number of victims, where the most affected population is poor people living in rural areas, since they are located on the banks of rivers or on the slopes of volcanoes. In Ecuador, 36.3 percent of the population is below the poverty line, and this percentage rises to 61.5 percent in rural areas. Also, the severity of socioeconomic losses has grown, where earthquakes have generated the largest number of historical losses in the last 50 years for a total of US$8,467 million, followed by the climatic effects generated by the El Niño—La Niña phenomenon with losses of US$4,373 million.[35] Also, the incidence of these disasters evidences the lack of planning, including protection and conservation and resettlement projects in vulnerable areas aimed at risk reduction. The expansion of human settlements in unstable areas has increased the impact of Eligible Disasters, especially in developing countries.

4. **Floods and heavy rains are the most frequent hazards, and the ones with the highest incidence in the national territory in the last 35 years at 44 percent.[36]** The increase in rainfall, temperature, and air humidity as a result of global warming had a greater impact on the incidence of flooding, exacerbated by human activity (deforestation, induced erosion,).The areas under the influence of floods have increased, as has the vulnerability of the infrastructure works linked to river channels—piers, bridges, roads and so on—where the lack of early warning mechanisms and poor management of dams and dikes are considered factors that have increased the magnitude of the disaster. The worst floods in the country in the last decade occurred in early January 2008, affecting the entire coastal region of Ecuador (the provinces of Guayas, Santa Elena, El Oro, Manabí, Los Ríos, and Esmeraldas). According to the Ministry of Internal and External Security, approximately three and a half million people, 20 percent of Ecuador's total population, were affected by this Eligible Disaster, including 57 deaths, 90,297 affected families, and an estimated value in losses and damages of around US$ 1,000,000.[37]

5. **Ecuador expects a severe new El Niño episode in the coming months, which would have a significant impact.** According to the World Meteorological Organization (WMO), long-term forecasts for the months of June through August of this year indicate a 55% probability of an El Niño event.[38] During this episode, the coast experiences hot and humid air from the northeast, which accentuates precipitation levels. The normal process of cloud displacement to the mountainous area of the Andes is more pronounced, producing unusual heavy rains along the coast would affect most of the country, in particular the littoral zone, causing flooding and landslides. Ecuador was severely hit in 1982 and 1997 by this phenomenon, which claimed dozens of lives and destroyed a large part of the crops, as well as the road infrastructure, with economic losses in the millions—ranking among the 5 most severe Eligible Disasters

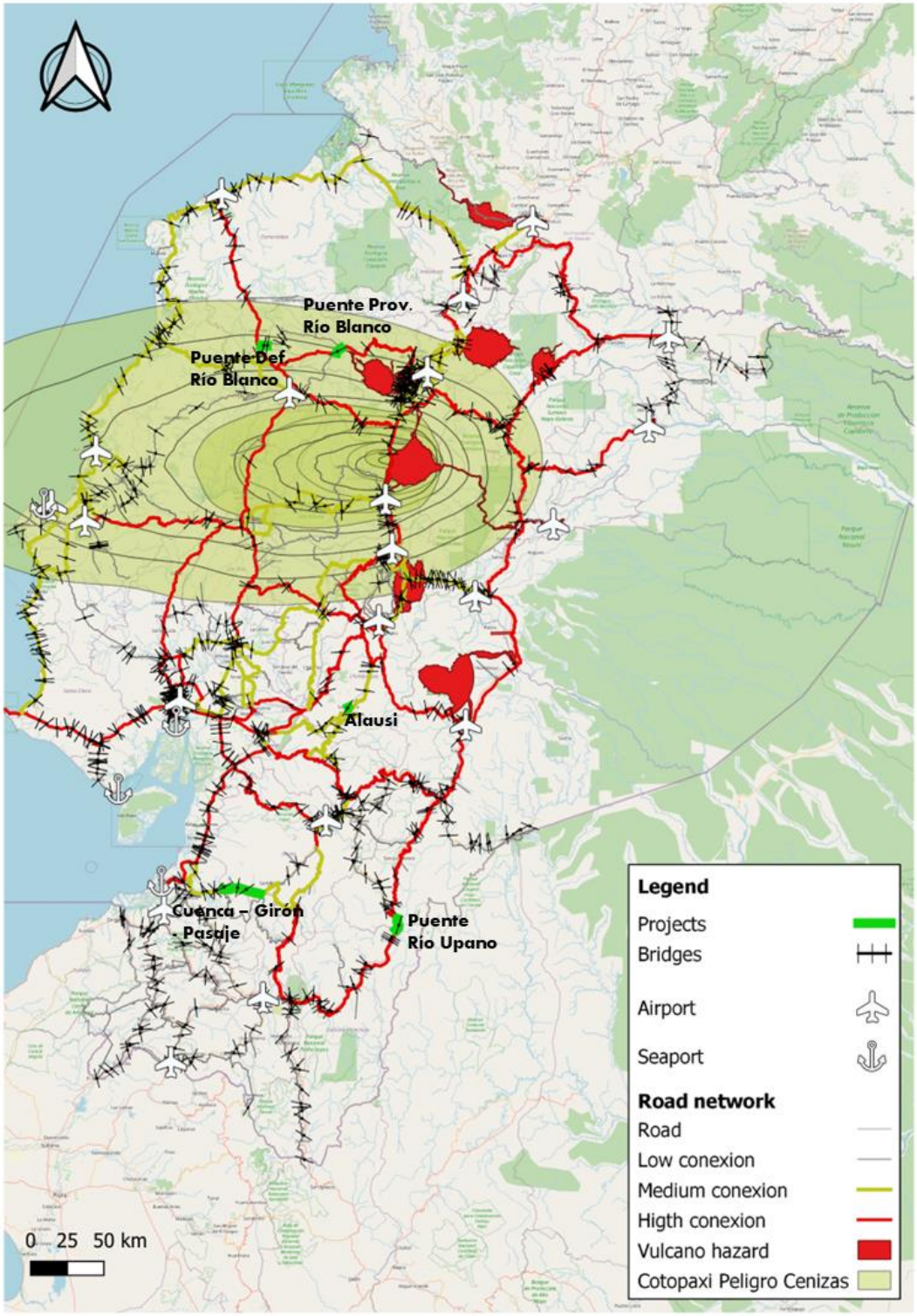
[35] World Bank. 2021. *Ecuador: Estrategia de gestión financiera ante el riesgo de desastres*
[36] *Secretaría Nacional de Gestión de Riesgos Ecuador* (SNGRE, 2020).
[37] Pacheco, T. et al., 2020.*Valoración económica del impacto de la inundación de febrero 2019 en la Unión, Santa Ana, Manabí, Ecuador*.
[38] WMO. 2023.

in the country in the last 30 years.[39] The 1982–83 El Niño episode saw 700,000 people affected, 307 deaths, and estimated economic losses at US$1.43 billion (2015 US$). During the 1997–98 El Niño episode, increase in sea level reached up to 42 centimeters in some areas, causing significant coastal flooding as well as pluvial flooding, and subsequent drainage challenges: discharges in most coastal rivers were recorded to reach return periods of 100 years. The Government of Ecuador (GoE) recorded 13,374 families affected, 293 deaths, 30,000 subsequent homeless people.[40]

6. **Ecuador is in a region with active volcanoes and is therefore at high risk for eruptions, with three volcanoes in yellow alert for increased activity, including Cotopaxi,[41] and Reventador in orange alert.[42]** The country has one of the most dangerous volcanoes in the world, Cotopaxi volcano, due to the frequency of its eruptions, eruptive style, glacial cover, and the number of populations exposed to its threats. Since the Spanish conquest, Cotopaxi has presented five major eruptive periods (1532–1534, 1742–1744, 1766–1768, 1853–1854 and 1877–1880)[43], where the last four periods resulted in very significant socioeconomic losses. Moreover, the danger of Cotopaxi lies in the fact that its eruptions can lead to the formation of huge lahars (mud and debris flows from melted glacier) that would rapidly transit to densely populated areas such as the Inter-Andean Valley between Mulaló and Latacunga, and part of the Chillos Valley, and put surrounding densely populated areas at risk (for example, Quito southern neighborhoods). In addition, ash fall produced during an eruption could affect a significant part of the highlands and the coast of Ecuador that have a direct impact on the agriculture sector and health of the population. Currently, the National Secretariat of Disaster Risk Management (SNGRE) (Resolution No. SNGRE–311–2022 issued on October 22, 2022), declared a state of yellow alert for the Cotopaxi volcano, meaning that the volcano shows signs of elevated agitation above the known background level and is at risk of erupting in a matter of weeks or months. According to SNGRE, an estimated 400,000 people (including at least 145,000 in the high-risk areas) and some key infrastructure (including 7 health centers, 133 schools, 41 kilometers of roads, 39.5 kilometers of electrical infrastructure) would be affected if an eruption triggers explosions, volcanic gases, mudslides, lava flows, lahar, and debris avalanches, with potential damages and losses estimated at US$1.37 billion. In addition to Cotopaxi, Sangay, Sierra Negra, and Chiles Cerro Negro are under yellow alert.

[39] GEOECUADOR2008 (United Nations Environment Program, 2008).
[40] World Bank. 2016. “Risk Mitigation and Emergency Recovery Project Appraisal Document” (P157345).
[41] SNGRE. 2022. Resolución Nro. SNGRE-311-2022.
[42] SNGRE. 2023. Alert levels elaborated by the National Situation Room under the Adverse Event Monitoring Directorate.
[43] Cotopaxi Volcano (Instituto Geofísico – Escuela Politécnica Nacional, 2022).

Figure 2A.1: Volcanic Activity hazard map



Source: Authors´ elaboration.

7. **Ecuador has declared red alert for the regressive erosion of the Coca River.**[44] It is important to note that this is a unique phenomenon in the world, which has been recorded since February 2020, following the collapse of the San Rafael waterfall (150 meters), located on the provincial boundary of Napo and Sucumbíos. During this time, the phenomenon has advanced about 13 kilometers and has destroyed road, oil, electrical and private infrastructure that crosses its path. According to the monitoring of the *Corporación Eléctrica del Ecuador* in the riverbed, the regressive erosion is located approximately 7.9 kilometers from the water catchment works of the Coca Codo Sinclair hydroelectric plant, located in the San Luis sector, and in February, when winter had just begun in the area, it caused the collapse of two bridges. Moreover, the high erosion exposure zone comprises the region between the old San Rafael waterfall and the convergence of the Malo River with the Coca River, with an approximate length of 8.62 kilometers and an area of 20.03 square kilometers. The area is predominantly made up of volcanoclastic fills of the Reventador volcano, fine granular clayey-sandy matrix, and rocky blocks, with generally loose to firm compactness, easily crumbled by the erosive action of the Coca River. Also, the constant instability of the slopes on the left bank of the Coca River, especially those located between the east and northeast sector of the town of San Luis and the Nueva Piedra Fina River, resulted in the loss of the roadway for the E45 Pan American Highway at kilometer 108 from Lago Agrio, and part of the bypass road located a few meters away, on May 16, 2021.[45]

B. The National Multimodal Transportation System (NMTS): Critical for the economy and highly vulnerable to Natural Hazards

8. **Transportation is crucial to support economic growth in the country, as it enables the movement of goods, creates jobs, and connects people to essential services such as education and health care**. Due to the diverse geography, transportation plays a critical role in connecting the different regions of the country; especially because Ecuador's economy relies heavily on export commodities such as oil, bananas, shrimp, and flowers. The NMTS provides essential links to export these goods to markets in North America, Europe, and Asia. The efficiency of the transportation system affects time and cost-effective delivery of these goods to international markets. In addition, transportation infrastructure provides essential support for other industries such as manufacturing, agriculture, and tourism. Developing countries have the double challenge in the transport sector, which is to ensure that everyone has access to an efficient, safe, and affordable service, and to achieve this goal with a much smaller climate footprint. In 2019, the transport sector generated 7.3 percent of GDP (equivalent to US$5.3 billion) and was responsible for 6.9 percent of employment generation at the national level in 2018, translating to around 524,000 jobs.[46]

9. **The NMTS is critical to achieve national economic and climate goals.** In Ecuador, transport is an essential service to ensure the achievement of national objectives such as productivity, equal access to economic and social opportunities, and education and health services. In the country, transportation is the main source of greenhouse gases because one-fifth of CO_2 emissions are caused by the burning of gasoline and diesel, producing impacts on the health of their inhabitants due to pollution from the gases. This problem has been exacerbated due to the increase

[44] SNGRE. 2021. Resolución Nro. SNGRE-058-2021

[45] SNGRE. 2023. *Proceso de Erosión Hídrica Regresiva de la Microcuenca del Río Coca.* Available at: https://www.arcgis.com/apps/dashboards/9e9ef254289a4a47942a8b5156fb3874.

[46] World Bank. 2020.

in the number of vehicles with less productivity and more pollution.[47]

10. **Heavy rains during this season, combined with an earthquake on March 18, 2023, have had a significant impact on the vulnerable NMTS, which would be further affected as the country expects additional climatic events.** Heavy rains in the first quarter of the year and an earthquake measuring 6.5 on the Richter scale on March 18, 2023, led to accelerated flooding, river erosion, and widespread landslides, resulting in collapse, destruction, and severe damage to transportation infrastructure with loss of life. The most recent government estimates indicate that more than 18,000 people were affected in the country (17,491 people from the heavy rains and 1,107 from the earthquake), resulting in 35 deaths (21 from the rains and 14 from the earthquake). In addition, at least 28 roads (including five bridges) are affected throughout the country, of which eight remain closed. In addition, due to the heavy rains and earthquake, on March 26, a landslide of 2 million cubic meters occurred in the sector of Alausí, affecting more than 500 people (23 deaths) and destroying part the Pan American Highway (E35), which is an arterial corridor crossing the country from north to south.[48]

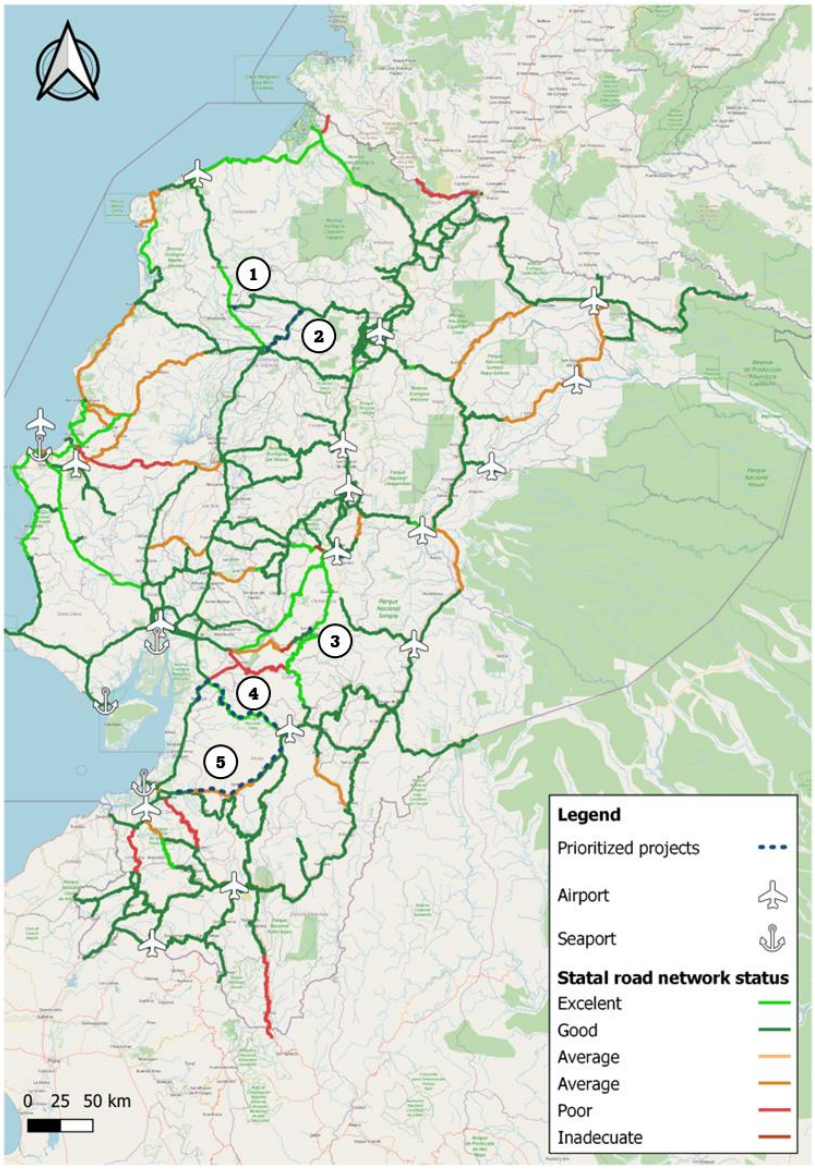
11. **The NMTS includes 10,313 km of roads, 21 operational airports, and 4 maritime ports, as well as 965.6 km of deteriorating rail network.** Over the last 15 years, the length of the network increased by 19 percent, from 8,654 km in 2007 to 10,313 km in 2023; in contrast, to virtually no increase in length between 2001 and 2007.[49] According to the evaluation conducted by MTOP, there were substantial improvements in the quality of the road network between 2007 and 2014 where roads in good condition increased from 4,359 km to 7,198 km, while roads in fair condition decreased from 3,946 km to 2,035 km, and roads in poor condition increased marginally from 348 km to 473 km. Currently, the state of the road network is visibly deteriorating, with roads in good condition reduced to 5,482 km, an increase to 3,103 km of roads in regular condition, and a substantial increase of 1,727 km of roads in poor condition. There is also a railroad infrastructure of 965.6 km, of which nearly 90% is out of service due to abandonment, theft, and lack of maintenance.

12. **The NMTS is heavily exposed to Natural Hazards**. Out of the 10,300 total km of national road network, about 52 percent are located in landslide-prone areas. Around 52 percent of the state road network is in landslide-prone areas, jeopardizing the road network connection. Moreover, 66 percent are in areas vulnerable to seismic intensities that endanger the physical integrity of users and the functionality of the roads and related infrastructure (bridges and slopes). Also, road network is highly vulnerable to hydrometeorological hazards considering that 46 percent of major roads are in flood-prone areas (450 km in areas at high risk of flooding). The road network also faces risks from the presence of potentially active and erupting volcanoes. The country has 84 volcanic formations, nine of which have some volcanic hazard feature on the NMTS. Approximately 476 km (8.5 percent of the total) of main roads are in volcanic hazard zones: an area of 913.57 km^2 has a high probability of being affected by mud and lahars from an eruption of Cotopaxi (including bridges connecting to Quito). Additionally, around 282 km are exposed to risks from potential volcanic activity.

[47] Policy Note World Bank Group's Global Transport Practice for Latin America and the Caribbean. 2021. Ecuador Transport Note State, "Challenges and Opportunities."
[48] SNGRE. 2023.
[49] MTOP. 2023.

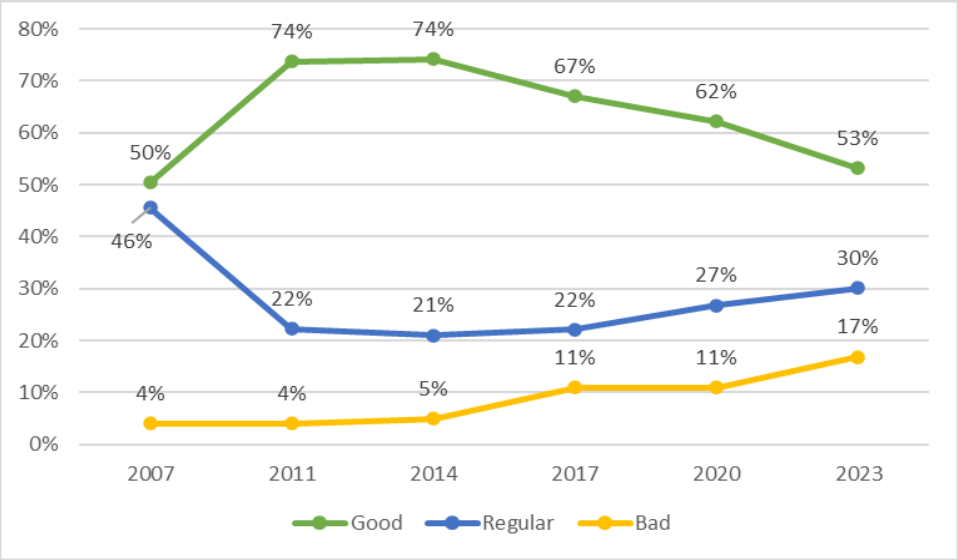
13. **The NMTS has gradually deteriorated since 2014 due to poor maintenance and lack of investments.** In 2014, 74.2 percent of the road network was in good condition, 21.0 percent in regular condition and 4.9 percent in bad condition. Currently, 46.8 percent of the national road network is below good condition. This deterioration is closely correlated to low levels of investment in the NMTS infrastructure, and the limited budget dedicated to maintenance.

Figure 2A.2. Map of state of Ecuador road network



Source: Authors´ elaboration.

Figure 2A.3. Road network state trends in Ecuador since 2007



Source: MTOP, 2023.

14. **The country faced a similar situation in 2007, which triggered *Plan Relámpago* (Plan Flash), an ambitious investment plan.** The road development has been closely linked to the country's economic cycle. In Ecuador, this is influenced by the evolution of the international price of oil, which is the main export product in the country and an important source of resources for the public sector. Before 2007, the condition of the national road network was seriously deteriorated, mainly due to several Eligible Disasters (for example, the El Niño phenomenon in 1997–1998) and the lack of an adequate investment in maintenance works. The precarious state of the road infrastructure constituted a major barrier to the country's economic, productive, and social development. Due to the state of total abandonment of roads infrastructure, on February 21, 2007, the authorities, and representatives of the province of Loja proposed to the National Congress the declaration of an emergency. The government accepted the proposal and expanded the entire road network, recognizing the critical state that affected the national production, access to health and education, and the provision of products and services. This was the beginning of *Plan Relámpago*.

15. ***Plan Relámpago* (Plan Flash) brought a period of infrastructure recovery.** This consisted of 87 projects for the construction, reconstruction, rehabilitation, and maintenance of road projects for a total of 4,708 kilometers intervened. Between 2007 and 2016, *Plan Relámpago* had a total investment in road infrastructure estimated at around US$8.825 billion, which represented an average of 1.3 to 2 percent of Gross Domestic Product (GDP) during that period, coinciding with the super-cycle of high oil prices.[50] The contracts included the development of the main rehabilitation works and, in many cases, routine maintenance during the four years following the works. Due to this large public investment, between 2008 and 2017, Ecuador moved from 100th to 29th place out of 138 countries in the road quality indicator published in the Global Competitiveness Report (ICG). This implies that infrastructure in good condition increased from 51 percent to 71 percent, while those in fair condition went from 29 percent to 23

[50] Díaz-Cassou et al. 2018. *Reformas y desarrollo en el Ecuador contemporáneo.*

percent, and those in poor condition dropped from 20 percent to only 5 percent. However, several events took place since 2014 that affected the continuity of this plan, such as the collapse in oil prices, which deteriorated the country's economy; Eligible Disasters affecting the country (El Niño, phenomenon, which absorbed about US$116 million of work); and the 2016 earthquake that severely affected the provinces of Manabí and Esmeraldas. The recovery in investments for the maintenance and improvement of the NMTS has not yet occurred, considering factors that aggravate the country's economic recovery such as the aftermath of the impacts of COVID-19, and low oil prices.

16. **The recovery of the National Multimodal Transportation System (NMTS) in an unusually short period set an example; however, it also generated some lessons learned**. The progress achieved was possible due to the government´s investment efforts and commitment to the Plan. Nevertheless, lessons learned can be drawn from this experience. These include the improvement in planning processes and level of detail of studies to avoid cost overruns, address problems of malpractice in construction and quality control, and deal better with difficulties in jurisdictional definitions. An important consideration for the future of the NMTS is to give continuity to the development of the system with a solid basis, improving road management in MTOP, and strengthening the road infrastructure sector.

17. **In addition to institutional challenges, the tough Ecuadorean terrain is an additional hurdle.** The terrain in Ecuador can be considered complex due to its diverse geography, which includes coastal plains, Andean mountains, Amazon rainforest, and volcanic islands. About 76 percent of Ecuador's terrain is hilly or mountainous, higher than either of its neighboring countries, according to a study by Briceño-Garmendia et al.[51] This study divided road segments into seven terrain types based on horizontal and vertical curvature and found that 55 percent of the road network in Ecuador consists of bending and undulating roads. The complexity of the terrain provides unique challenges for transportation For example, the mountainous terrain of the Andes can make road construction and maintenance difficult. Meanwhile, the Amazon rainforest presents challenges for accessing and navigating through dense jungle. Therefore, the terrain likely increases costs of transport infrastructure, since large volumes of earthworks and slope stabilization works accompany road development, whether for trunk or feeder roads. These increased costs would not only affect rural Andean areas, but also Quito and other cities in the mountain region.

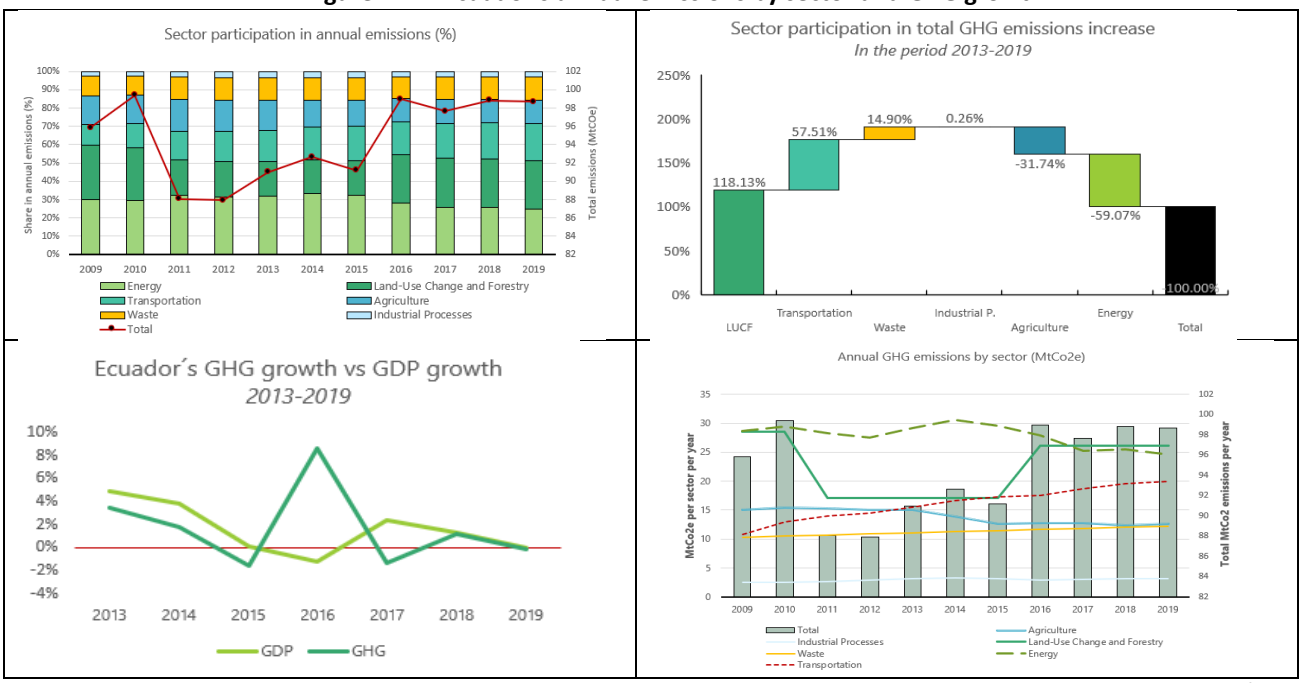
18. **The need to mitigate environmental impacts of road construction is also affected by terrain composition.** Deforestation is of concern along the coastal plain and in the highlands. However, the most impacted region is the Amazonian rainforest in the east of the country due to the construction techniques used to build the road, and the impact of activities induced by increased accessibility created by the road itself. Moreover, the need for slope stabilization around road infrastructure is critical to protect not only life and livelihood, but also the road infrastructure, as landslides and mudslides resulting from unstable soil can destroy roadways. Also, slope stabilization methods used in Ecuador usually are not consistent with sustainable practices. A commonly used method involves covering the slope with asphalt-based surfaces to prevent soil movement that creates impermeable surfaces, thus inhibiting filtration of rainwater and increasing the albedo of the surface. In addition, it destroys fauna habitats, and inhibits their movement. Therefore, ecological slope stabilization techniques, well known and understood in the road construction industry globally, must need to be considered to create eco-friendly road recovery solutions.

[51] Briceño-Garmendia et al. 2015.

C. Climate Change Mitigation within the Transport sector: a large GHG emissions source, and the only sector where emissions are growing.

19. **In terms of mitigation, transportation is the main emitting sector within energy emissions and the only one that is expected to grow.** According to Climate Watch (CAIT)[52] in 2019, Transport accounted for 44.8 percent of Energy emissions. When excluding Transport from Energy emissions (as done in the previous paragraph), Fugitive Emissions[53] account for 34.7 percent, Electricity and Heating 26.4 percent, Building[54] 15.8 percent, Manufacturing/Construction 8.5 percent, and Other Fuel Combustion 14.5 percent. The decreasing trend in Energy emissions (excluding transport) in the period 2013–2019 was driven mainly by a 35 percent decrease in Electricity and Heating and supported by a 40 percent decrease in Manufacturing and Construction. Compared to 2009, all categories showed a reduction by 2019, except for Building and Transport. The percentage of electricity generated from renewable sources has been increasing, according to the National Electricity Operator. In 2019, 90 percent of the net electricity produced in Ecuador was from renewable sources (88 percent from hydroelectric plants and just 2 percent from non–conventional like wind and solar), while in 2009, these accounted for 71 percent.[55] The non–renewable thermoelectric sources in 2019 included 4.5 percent from fuel oil, 2.9 percent from diesel, and 1.8 percent from waste. Electricity imports from Peru and Colombia accounted for only 0.02 percent.

Figure 2A.4. Ecuador's annual emissions by sector and GHG growth



Source: https://www.climatewatchdata.org/ghg-emission Historical GHG Emissions. World Resources Institute. 2022.[56]

[52] Climate Watch (CAIT).

[53] Contains fugitive CO_2 and CH_4 emissions from Flaring, Coal mining, Natural gas and oil systems, and other energy sources.

[54] Contains $C0_2$, CH_4 and N_20 emissions from Residential and Commercial and public services. Note that only onsite fuel combustion is covered here, and emissions associated with the use of electricity are included in electricity/heat.

[55] CENACE. 2020. *Informe Anual 2019.*

[56] Totals exclude bunker fuels; energy excludes transportation.

20. **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.** The number of registered vehicles almost tripled in a decade, from 918,908 in 2008 to 2,403,651 in 2018, and CO_2 emissions from the transport sector doubled for the same period.[57] Moreover, these 2.4 million vehicles have an average age of 16 years, making it an old, polluting, and unsafe fleet.[58] In Ecuador, the legislation of the transport sector known as the Organic Law of Land Transport, Traffic and Road Safety (LOTTTSV) was only focused on traffic control and speed limits. To combat this increase in emissions, and after years of effort to improve this approach, a new LOTTTSV was issued in August 2021, which introduces for the first-time new concepts on sustainable mobility, road safety and promotion of zero-emission vehicles. In addition, the lack of adequate road infrastructure impacts accessibility and efficient driving, and it increases congestion and travel times, causing higher fuel consumption and GHG emissions.

D. Road Safety in Ecuador: A growing concern and an institutional challenge

21. **The country has a high rate of road crashes, and the World Health Organization reports that road traffic injuries are one of the leading causes of death in Ecuador.** The main probable causes of crashes are inattentive driving conditions (distractions), disregarding traffic signals, and driving over speed limits.[59] Road safety in Ecuador can be a concern, especially in rural areas and during the rainy season. Additional factors contributing to road safety issues include poor road infrastructure, inadequate vehicle maintenance, and reckless driving. Some of the specific challenges include poorly marked roads, inadequate lighting, and insufficient road safety measures, such as guardrails and speed limits. 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.

22. **Ecuador has a regulatory and legal framework that has evolved over the last decade; however, there are several issues related to the strengthening of road safety.** One of the main problems now regarding the framework's application, monitoring and promotion is the lack of definition at national level as to which government agency is in charge of road safety. Therefore, it is necessary to designate a specific unit responsible for the definition of public policies, and execution of processes based on current regulations. These regulations include the guidelines issued by the United Nations in relation to Road Safety Management 2022–2030. Additionally, several technical tools are necessary to strengthen the technical capacities of the different road safety stakeholders.[60] Since the launch of the United Nations' Road Safety Management 2022–2030, Ecuador has created its own National Road Safety Strategy 2022–2030, outlining a series of activities that contribute to fulfilling objectives related to the reduction of traffic crashes and their consequences in the coming years. To fulfill the objectives, it is necessary to strengthen the capacity to manage, monitor and evaluate road safety data as a fundamental tool. It is expected that this work will result in better coordination, implementation, and evaluation of road safety interventions in Ecuador, which will result in improved levels of road safety in the country.

[57] Private vehicles are the types of transport that emit the highest CO_2 emissions per traveler and per kilometer, with emissions up to 6 times higher than that of a bus (European Parliament. 2019. *Emisiones de CO_2: hechos y cifras*.)

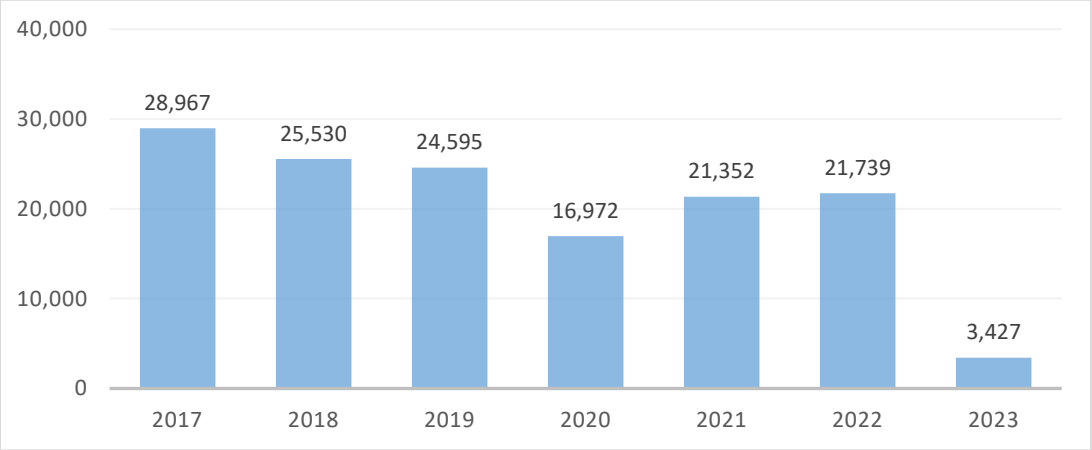
[58] National Institute of Statistics and Censuses Ecuador. 2019.

[59] Government of Ecuador. 2021. Road Safety Yearbook 2021.

[60] Ferrer et al. 2023. *Análisis de la capacidad institucional para la gestión de la Seguridad Vial*.

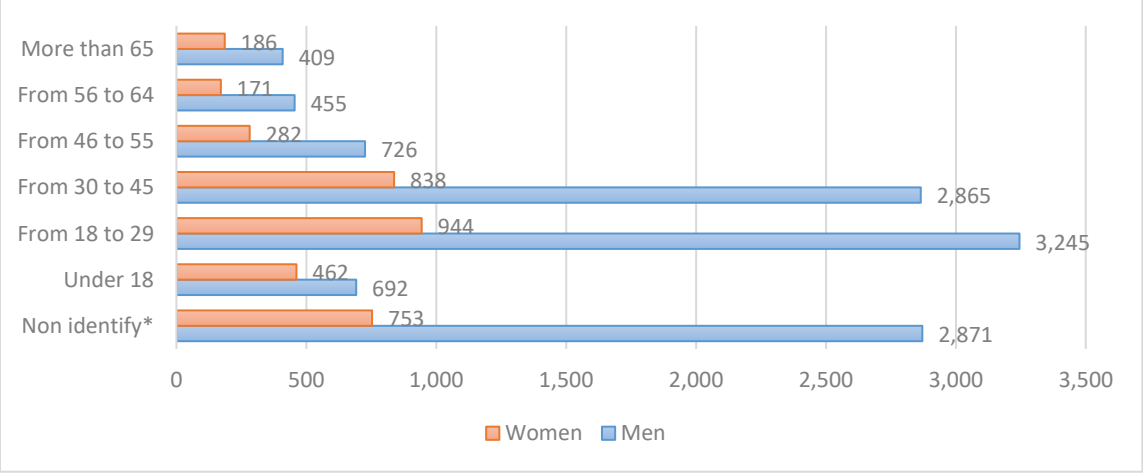
23. **Due to various efforts by government agencies, driver awareness and the pandemic, the number of road accidents decreased from 2017 to 2020; however, accidents are currently on the rise from previous years (Figure 2A.5)**. According to the Road Safety Yearbook 2021,[61] 85 percent of fatalities occur in men, compared to 15 percent in women (Figure 2A.6). Of the total number of deaths, it is important to understand the most affected group was those between 20 and 29 years of age, which is considered a high productive age where many are heads of households. This translates into a social and economic problem for their families and environments (Figure 2A.7).

Figure 2A.5. Historical accident information



Source: National Agency of Traffic, 2023.

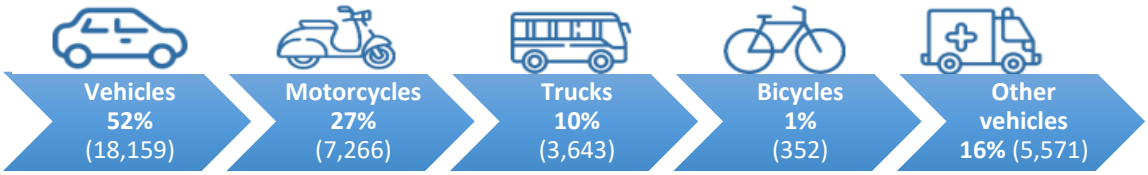
Figure 2A.6. Accidents by age group and gender in 2021



Source: National Agency of Traffic 2020–2021.

[61] Government of Ecuador. 2021. Road Safety Yearbook 2021.

Figure 2A.7. Accidents by transport mode in 2021



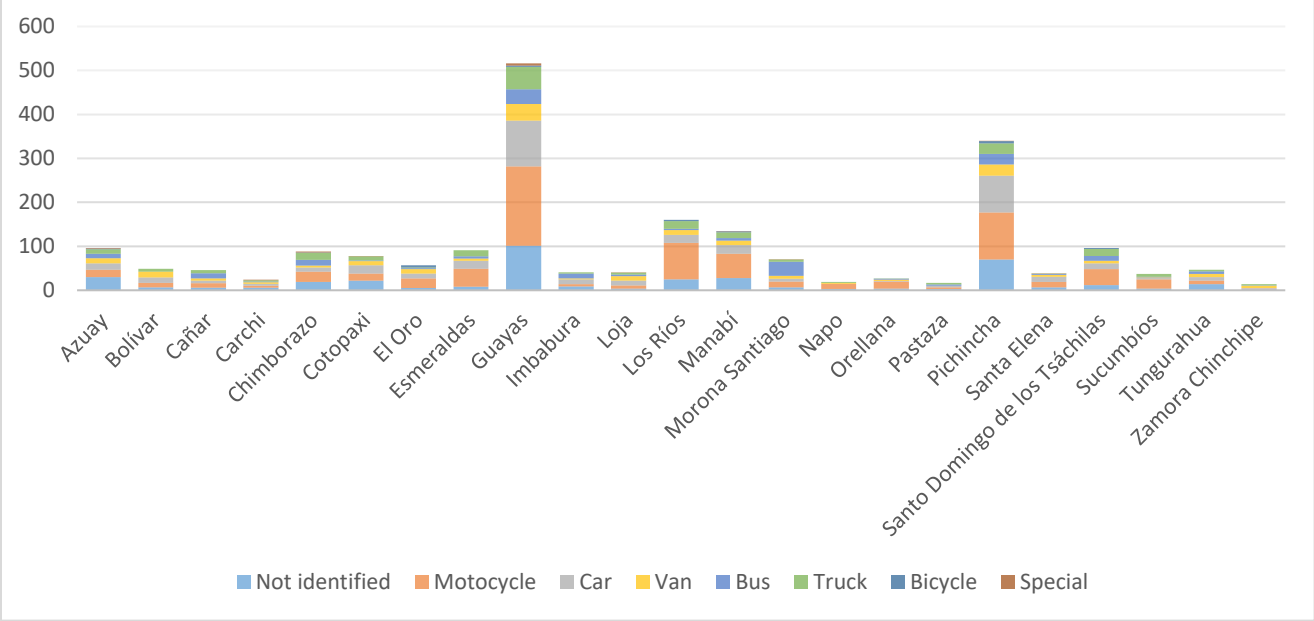
Source: National Agency of Traffic 2020–2021.

Table 2A.2. Accidents by province in 2021

Number	Provinces	2020	2021	Variation
1	Guayas	6,377	7,765	22%
2	Pichincha	3,266	3,808	17%
3	Manabí	1,107	1,957	77%
4	Los Ríos	800	1,137	41%
5	Sto. Domingo de los Tsáchilas	995	1,082	9%
6	Tungurahua	755	1,076	43%
7	Azuay	788	836	6%
8	El Oro	559	783	40%
9	Chimborazo	369	622	69%
10	Santa Elena	377	517	37%
14	Rest of provinces	1,579	1,769	12%
24	**Total**	**16,972**	**21,352**	**26%**

Source: National Agency of Traffic 2020–2021.

Figure 2A.8. Fatalities by modal transport in the provinces in 2021



Source: Road Safety Yearbook 2021.

24. **Despite a lower crash rate than neighboring countries, the mortality rate is higher in Ecuador.** When analyzing injuries per 100,000 inhabitants, Ecuador occupies the second-lowest value in this rate. In 2010, Ecuador had a rate of 134.4 with a maximum peak in 2014 and then a period of decreases until 2019 with a value of 115.8. Colombia has the lowest rate in the region, and Peru maintains the highest value with an increasing trend to 2019. However, in 2010, Ecuador had the highest rate of deaths per 100,000 inhabitants with a value of 15.4, reaching a rate of 12.6 in 2019, which was the second worst in the region after Colombia. The main cause of road fatalities is excessive speed, which is aggravated by the fact that in the last few decades several major highways have increased lanes, causing drivers to have a false perception of safety.[62]

25. **Actions and indicators.** One solution to improve road safety in the program's intervention zones is Road Safety Audits. These audits will involve data collection, storage, and analysis of annual crash fatality data (segregated by four road user types: vehicle occupants, motorcyclists, pedestrians, and bicyclists). It will also include Road infrastructure safety assessment, Safe Speed analysis, and consideration of road safety regulations in road design. In addition, training will be provided to communities and schools in road safety awareness programs and capacity building to civil works of MTOP to apply the road safety regulations together with analysis of road accident hotspots.

E. Bridging the gender gap in the transportation sector

26. **Ecuador experiences a gender gap in various aspects of life, including but not limited to education, employment, and politics.** In terms of education, although girls and boys have equal access to education, there is still a gender gap in terms of completion rates and quality of education. Girls tend to drop out of school at higher rates than boys, particularly in rural areas. Additionally, there is a lack of emphasis on gender issues and women's studies in the educational system where less than 1 in 3 Science, Technology, Engineering and Mathematics (STEM) graduates in Ecuador is a woman. In the workforce, women tend to be concentrated in low-paying jobs and have limited access to leadership positions where there is a significant gender pay gap, with women earning less than men for doing the same job, and only 58 percent of women have access to a financial account compared to 71 percent of men. Also, women are 17 percentage points more likely than men to have vulnerable jobs, further complicating their health and safety.[63] In politics, women are underrepresented at all levels of government.

27. **Labor market and gender equality.** The Constitution guarantees gender parity in political representation, but women hold only a small percentage of political positions, particularly at the national level. Ecuador has taken steps in Supporting Fundamentals for Inclusive Growth, Boosting Human Capital, and Protecting the Vulnerable.64 One of the main challenges for the country is to improve the quality of labor supply among the poorest quintiles (B40) which has worsened due to the COVID-19 pandemic and disproportionally affected specific groups like women and young people.

[62] Analysis of Road Safety Management Capacity in Ecuador 2023. In press. SGCAN data.
[63] World Bank. 2023. Ecuador Gender Scorecard.
[64] Results Areas I and II, respectively, of the Country Partnership Framework for Ecuador for the period FY19–FY23.

28. **Women are disadvantaged compared with men in the transport sector.** Limited access to and safety of transportation is estimated to be the greatest obstacle to women's participation in the labor market in developing countries. Women experience high rates of sexual harassment on or near transport facilities in the country, which is a barrier for women's participation in the economy. Moreover, women are often underrepresented in transportation-related jobs and face various barriers to entering and advancing in these fields. According to the ILOSTAT database, only 11 percent of workers in the transport sector in Ecuador are women. One of the main reasons for this gap is the perception that transportation is a male-dominated field, leading to cultural and societal biases against women entering the industry. Additionally, women often face challenges related to workplace culture, including harassment and discrimination, as well as difficulty balancing work and family responsibilities.

29. **Harassment of women in road construction projects can take many forms, including unwanted sexual advances, comments, or gestures, and other forms of inappropriate behavior or language**. Women working in road construction projects and living in the communities where work is developed may face gender-based discrimination, harassment, and other forms of gender-based violence. Such behavior can create a hostile and intimidating environment for women, making it difficult for them to perform their jobs and jeopardizing the integrity of young girls. To prevent gender harassment in transportation infrastructure projects, it is important to establish clear policies and procedures for reporting and addressing instances of harassment including training for employees and contractors on how to prevent and respond to gender harassment, as well as establishing a system for reporting and investigating incidents.

30. **Actions and indicators.** The interventions in the program will consider activities that contribute to closing the gap and promoting gender diversity and inclusion in the transportation sector in Ecuador and beyond. These efforts include women's participation in transportation-related fields, providing training opportunities in the operation of heavy equipment used in road construction. Also, programs will be carried out for community response emergency. Women will participate as leaders in their communities when facing Eligible Disaster emergencies, and female involvement will create community ownership to determine the best pathways for the roads, drawing on field knowledge, contributing to employment and decision making in resilient communities. In addition, it will promote the contracting of women-led microenterprises for routine road maintenance programs. It will communicate success stories in the country, such as microenterprises that work with the Pichincha Provincial council to maintain the road between Río Blanco and Calacalí, and also supports the General Rumiñahui Highway. Furthermore, to address gender biases in teaching and to build a 'science identity' for women, training will be encouraged, exposing young girls to female mentors and role models in STEM to promote and retain women in these careers.

F. Benchmark project description and potential implementation timeline

31. **The Borrower has identified five interventions that could potentially be subject to Loan Financing.** The Bank is currently supporting the preparation of these activities. However, given the emergent nature of the interventions, the financing of these activities will be confirmed after loan approval. The identified interventions are described below:

(a) Río Blanco Bridge. The Río Blanco rose due to intense rains in the early morning of March 18, 2023, and it destroyed the bridge (120 meters) located at kilometer 166 of the Calacalí—La Independencia road. Through MTOP, the government proceeded with the emergency declaration and initiated the transportation and logistics procedures. It began assembly of a provisional bridge, and in parallel it will begin executing studies on a definitive bridge. This intervention will provide a climate resilience alternative route for the communities disrupted by the flooding. The definitive construction of the bridge is projected to begin in June 2023 with an estimated execution time of 18 months and a budget of around US$19 million.

(b) Girón Pasaje Basin. On March 18, 2023, an earthquake of magnitude 6.8 on the Richter scale occurred, with an epicenter in Balao. As a result of this natural phenomenon, several faults were activated on the road, interrupting traffic circulation. As part of the emergency declaration on this road, an investment of US$28.2 million (148 kilometers) that includes slope stabilization of critical points and rehabilitation of several bridges, all of which will account for the projected impact of climate change (see section A paragraphs 1 to 7). Repair activities are scheduled to begin in April 2023 and to last approximately 8 months.

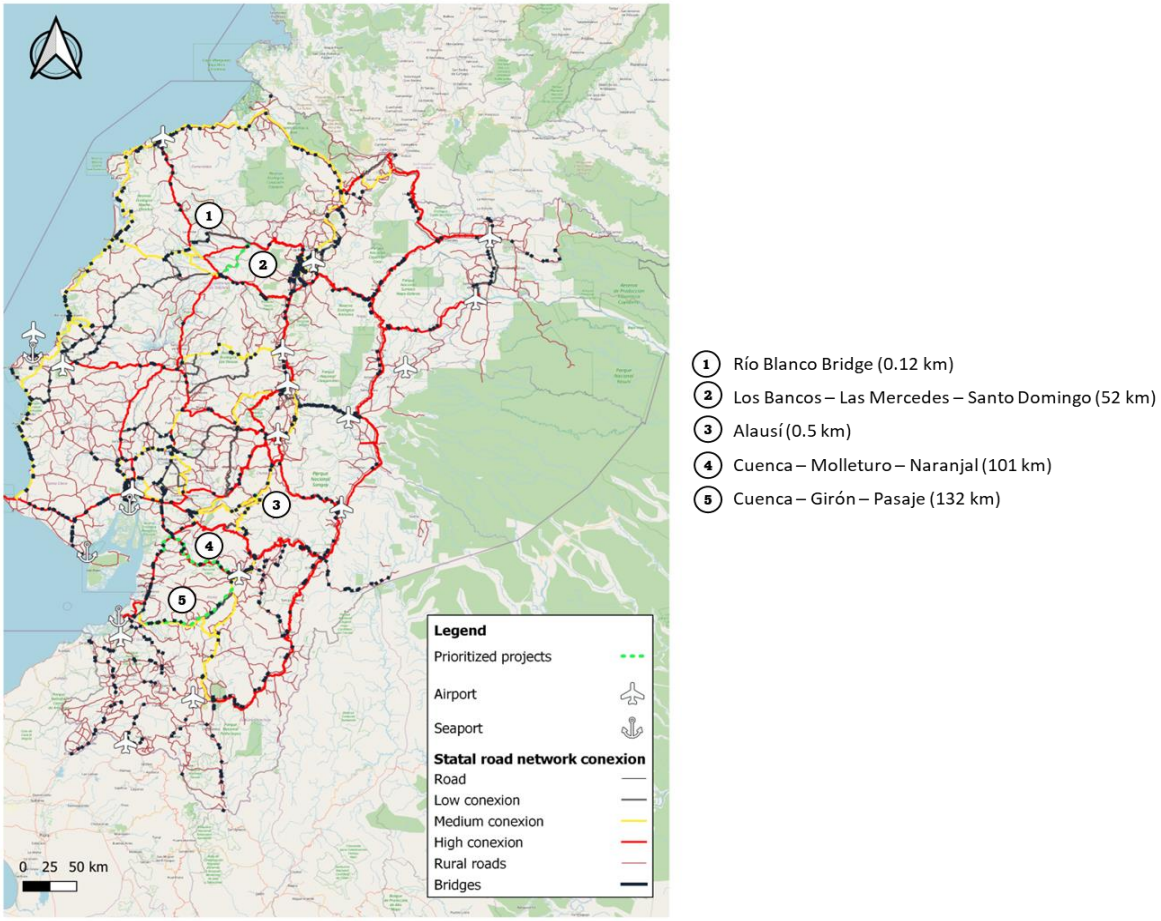
(c) Cuenca Molleturo—Naranjal Road. This corridor is the main connection between Cuenca and Guayaquil. Due to its geomorphological characteristics, it has presented several critical zones (the main concern being at kilometer 49), where MTOP has invested US$7.9 million to enable a provisional bypass in 2022. As a result of the earthquake on March 18, 2023, several additional unstable points were activated, which limited mobility. Due to these alerts, MTOP foresees the declaration of emergency on this road, with an additional investment of US$31.3 million (194 kilometers). This intervention will include landslide stabilization that will bring climate resilience by reducing the risk of climate-triggered slope failure. Activities are scheduled to begin in April 2023 and expected to last approximately 8 months (December 2023).

(d) Los Banco—Las Mercedes Road. As part of the intense rains in recent months and aggravated by the earthquake of March 18, 2023, the connections between the provinces of Pichincha and Santo Domingo de los Tsáchilas were affected at several critical points, which forced MTOP to declare an emergency on this road corridor, which will also serve as a connection between the highlands and the coast while the definitive bridge over the Río Blanco is being built. An investment of US$12.5 million (67.3 kilometers) is foreseen for the immediate attention of this road. This intervention will bring redundancy and a climate-resilient alternative route to a road that is currently disrupted by climate impacts. Works are expected to begin in April 2023 and to be completed in December 2023.

(e) Alausí – Tixán. A deadly landslide occurred on the night of March 26, 2023 in the city of Alausí, in the Province of Chimborazo. It caused the death of 7 people, and more than a hundred people went missing. Many homes were destroyed, and the E35 road, at kilometer 535, experienced sinking, according to the Secretariat of Risk Management. The road damage is estimated at 65 percent. Since December 2022, this section of the road has experienced landslides, cracking and sinking of

pavement. According to MTOP, this has worsened in recent months due to the saturation of water on the slopes caused by heavy rains and irregular discharge of sewage by the area's inhabitants. An investment of US$14 million (10 kilometers) is foreseen for the construction of a new road to reconnect the E35 highway. This intervention will include an alternative route to the road that has been disrupted by climate impacts. It will bring climate resilience by reducing the risk of climate-triggered slope failure.

Figure 2A.9. Location of the preliminarily identified projects proposed in emergency loan



Source: Authors´ elaboration.

32. **These projects are considered representative of interventions that could be financed by the Loan.** They are being used to estimate costs (see Table 2A.3 below). These costs, together with estimated potential benefits, have been used for the purpose of the economic feasibility assessment (see Annex 3). Based on these costs, it is estimated that with the US$105 million available for Infrastructure Recovery and Resilience interventions, a combination of up to 59 kilometers in construction and 225 kilometers in rehabilitation could be intervened. In addition, the assessment considers external sources for cost references. The cost estimates for the interventions for major structures (such

as bridges, tunnels, drainages) were calculated under the reference of the Resilience Study for the State Road Network of Ecuador,[65] obtaining the costs in Table 2A.4 below. Landslides are associated with slope instability aggravated by the pressure exerted by human activities. To address this problem, works must be done to prevent this phenomenon by focusing on the conservation and quality of slopes that have been created by deforestation. For this intervention, a reference value of US$15.8 million is taken to reforest 110,500 hectares according to the AECOM and IDB study mentioned in this paragraph.

Table 2A.3. Costs of Infrastructure Recovery and Resilience Interventions

Budget total	**100%**	**$105,000,000.00**
Infrastructure Recovery costs (roads)	**85%**	**$89,250,000.00**
Construction cost (w/o resilience)/km	$892,500.00	
Rehabilitation cost (w/o resilience)/km	$200,097.86	
% Construction	37%	
% Rehabilitation	63%	
Km constructed	37	$33,022,500.00
Km rehabilitated	281	$56,227,500.00
Resilience Interventions costs (roads)	**15%**	**$15,750,000.00**
Resilient cost construction/km	$67,534.00	
Resilient cost rehabilitation/km	$31,801.78	
Resilient cost for new infrastructure/km	$31,801.78	
Resilience Intervention linked to construction	20%	$3,150,000.00
Resilience Intervention linked to rehabilitation	80%	$12,600,000.00

Source: MTOP, 2023.

[65] AECOM and Inter-American Development Bank-IDB. 2019.

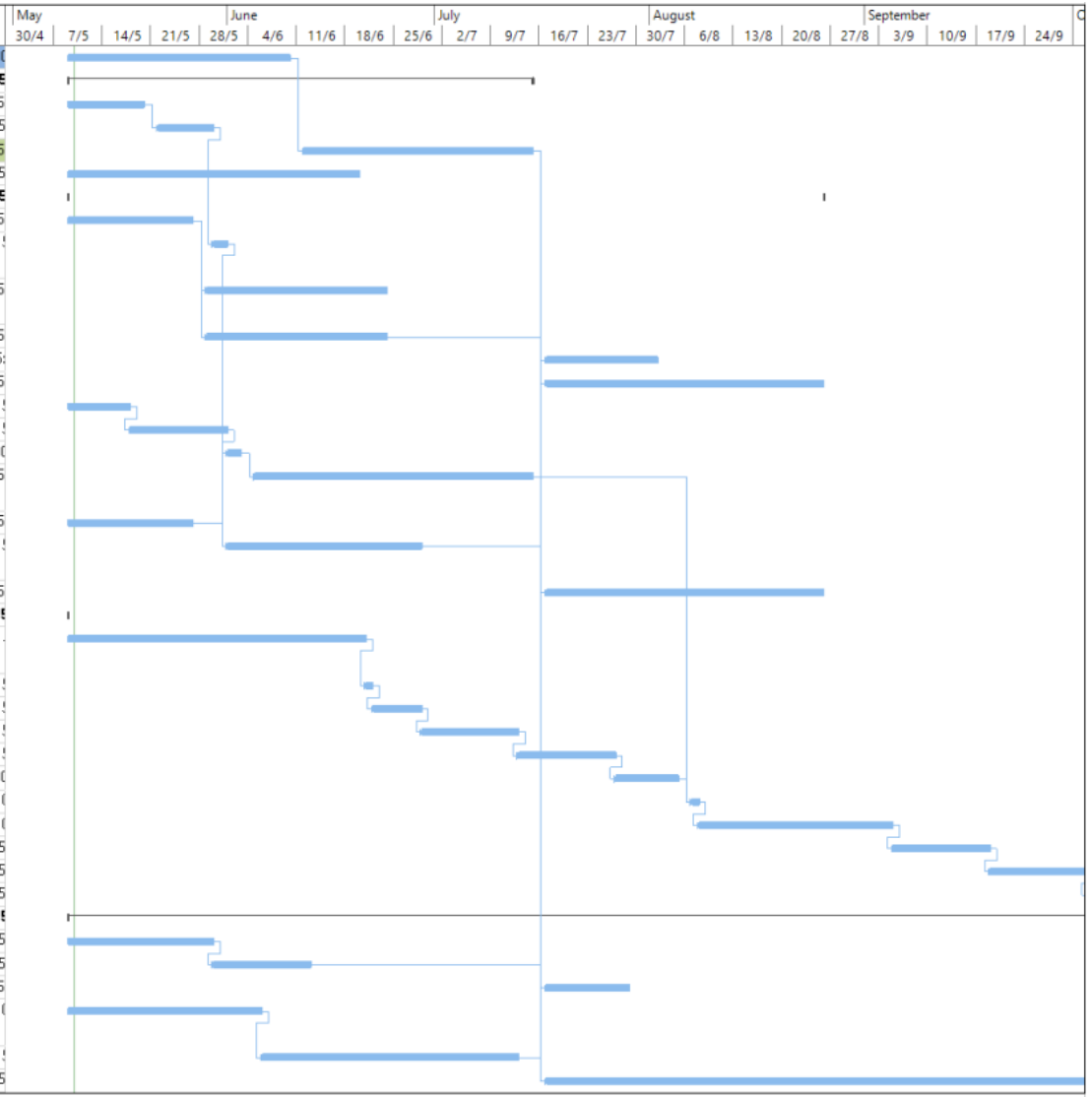
Table 2A.4. Estimated costs for major structures

	Cost US$
Evaluation per unit (tunnel)	20,000
Routine maintenance per unit (bridge or tunnel)	50,000
Corrective maintenance per unit (bridge or tunnel)	250,000
Drainage replacement per unit	4,300

Source: MTOP, 2023 and Resilience Study for the State Road Network of Ecuador (AECOM and IDB, 2019.)

Table 2A.5. Key milestones for potential activities preidentified for loan financing.

	Task Name	Dura	Start	Finish
1	Board Approval	24 d	mar. 9/5/23 8:	vie. 9/6/23 5:(
2	**LOAN**	**49 d**	**mar. 9/5/23 8**	**vie. 14/7/23 5**
3	PLANIFICA Priority Opinion	9 da	mar. 9/5/23 8:	vie. 19/5/23 5
4	PAI Inclusion Opinion	6 da	lun. 22/5/23 8	lun. 29/5/23 5
5	Signing of the Loan	25 d	lun. 12/6/23 8	vie. 14/7/23 5
6	Approved Operations Manual	30 d	mar. 9/5/23 8:	lun. 19/6/23 5
7	**CONTRACTING FIRMS PIT, PMTS, E&S**	**79 d**	**mar. 9/5/23 8**	**vie. 25/8/23 5**
8	TOR of PIT and PMTS	14 d	mar. 9/5/23 8:	vie. 26/5/23 5
9	Budget certification for PIT, PMTS, ESFS contracting (annual and pluriannual)	2 da	mar. 30/5/23	mié. 31/5/23 5
10	Pre-contractual process for the PIT (ternary, direct, etc.)	20 d	lun. 29/5/23 8	vie. 23/6/23 5
11	Pre-contractual process for the PMTS	20 d	lun. 29/5/23 8	vie. 23/6/23 5
12	PIT Contracting	12 d	lun. 17/7/23 8	mar. 1/8/23 5:
13	PMTS Contracting	30 d	lun. 17/7/23 8	vie. 25/8/23 5
14	TOR Environmental Framework	7 da	mar. 9/5/23 8:	mié. 17/5/23 5
15	Process Launch	10 d	jue. 18/5/23 8	mié. 31/5/23 5
16	Environmental Framework Contracting	2 da	jue. 1/6/23 8:(	vie. 2/6/23 5:(
17	Elaboration of Framework Instruments (ESCP)	30 d	lun. 5/6/23 8:(	vie. 14/7/23 5
18	TOR ESFS	14 d	mar. 9/5/23 8:	vie. 26/5/23 5
19	Pre-contractual process for ESFS (request for EoI and short list)	20 d	jue. 1/6/23 8:(	mié. 28/6/23 5
20	ESFS Contracting	30 d	lun. 17/7/23 8	vie. 25/8/23 5
21	**CONTRACTING WORKS**	**110**	**mar. 9/5/23 8**	**lun. 9/10/23 5**
22	ToR elaboration (design and construction)	31 d	mar. 9/5/23 8:	mar. 20/6/23
23	Send to the WB	1 da	mié. 21/6/23	mié. 21/6/23 5
24	OK of the WB	5 da	jue. 22/6/23 8	mié. 28/6/23 5
25	EoI order for design and construction	10 d	jue. 29/6/23 8	mié. 12/7/23 5
26	Expression of interest by firms	10 d	jue. 13/7/23 8	mié. 26/7/23 5
27	Conformación de lista corta	7 da	jue. 27/7/23 8	vie. 4/8/23 5:(
28	Formation of short list	1 da	lun. 7/8/23 8:(	lun. 7/8/23 5:(
29	Preparation of proposals by firms	20 d	mar. 8/8/23 8:	lun. 4/9/23 5:(
30	Proposal evaluation	10 d	mar. 5/9/23 8:	lun. 18/9/23 5
31	Award and suspension period	10 d	mar. 19/9/23	lun. 2/10/23 5
32	No Objection and signature	5 da	mar. 3/10/23	lun. 9/10/23 5
33	**ACQUISITIONS**	**110**	**mar. 9/5/23 8**	**lun. 9/10/23 5**
34	ToR Equipment	15 d	mar. 9/5/23 8:	lun. 29/5/23 5
35	Pre-contractual process for equipment	10 d	mar. 30/5/23	lun. 12/6/23 5
36	Contractual process for equipment	10 d	lun. 17/7/23 8	vie. 28/7/23 5
37	ToR Asset Management Implementation System	20 d	mar. 9/5/23 8:	lun. 5/6/23 5:(
38	Pre-contractual process for the sistem	27 d	mar. 6/6/23 8:	mié. 12/7/23 5
39	Contractual process for the sistem	61 d	lun. 17/7/23 8	lun. 9/10/23 5



*Note: The financing of these activities with loan proceeds will be confirmed after approval.

ANNEX 3: Economic Analysis

A. Introduction

1. **The Economic analysis shows that the Emergency Resilient Reconstruction Project (P181079) is economically profitable**. **The high cost of the lost connectivity further justifies the urgency of the interventions.** The Project Development Objective (PDO) is to restore and ensure connectivity in areas affected by Eligible Disaster or Highly Vulnerable Transport Infrastructure (HVTI) while improving resilience and safety. The incremental cost-benefit analysis (CBA) used to reach these conclusions is based on time savings and reductions in vehicle operating costs (VOC) as well as CO_2 emissions reductions and other measurable and immeasurable benefits. These include improvement of accessibility and connectivity to the National Multimodal Transportation System (NMTS), and lives saved by reduction in deaths in road crashes. The project's economic internal rate of return (EIRR) is 171 percent, with a net present value (NPV) of US$2.559 billion. These figures are for a 31-year evaluation period. The results show that the NPV for the Project remains positive at a 4.8 percent discount rate. Given the high demand of the projects per kilometer and the great impact of the loss in connectivity (although it is relatively cheap to recover this connectivity) the benefits are enormous, further justifying the urgency of the intervention. In analyzed projects, the average cost of lost connectivity in only one year surpasses the average cost of the interventions with an average increase in kilometers travelled of 28.8 percent on routes with high traffic.

2. **Public sector financing is justified because the private sector does not have the incentives, nor the capacity to bear Natural Hazard-related risks, and because the NMTS is a public good.** The Ministry of Transportation and Public Works (MTOP) and the entities in charge of the administration, maintenance and improvement of roads need to be trained to apply the resilience approach in the infrastructure for the consolidation of the NMTS. Investments in infrastructure and prioritization in the execution of projects should consider addressing the sectors of the NMTS that have the greatest impact on accessibility and connectivity for the movement of people and goods.

3. **The use of World Bank resources is justified because of the institution's experience, processes, and the alignment of the operation with World Bank objectives.** First, the World Bank has accumulated substantial regional and global experience in supporting post-disaster recovery, making it well placed to support this emergency, help build back better and strengthen capacity for implementation and risk management**.** Second, the recent emergencies require fast reaction, and the World Bank is well equipped to provide financing with expedited processing mechanisms to shorten loan preparation time. Finally, the improvement of transport and mobility infrastructure allows connectivity and accessibility of people and goods, which has positive repercussions on economic growth, impact that is in line with the objectives of the World Bank to end extreme poverty and promote shared prosperity in a sustainable way.

B. Cost-Benefit Analysis Methodology and Assumptions

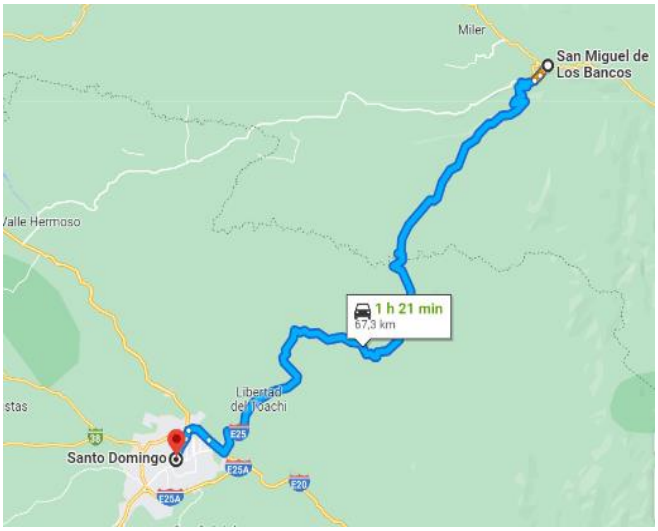
4. **The analysis follows a standard incremental CBA methodology in compliance with World Bank Operational Policy 10.04.** For each benefit, the analysis compares likely outcomes with and without the Project. It then calculates the social NPV of estimated net costs and benefits and the ERR. This is defined as the rate at which the discounted costs and benefits over the life of the Project are equal. Shadow prices are used to calculate the economic value of costs and benefits. To do so, the analysis adjusts market prices and eliminates taxes, subsidies, and any other factors that

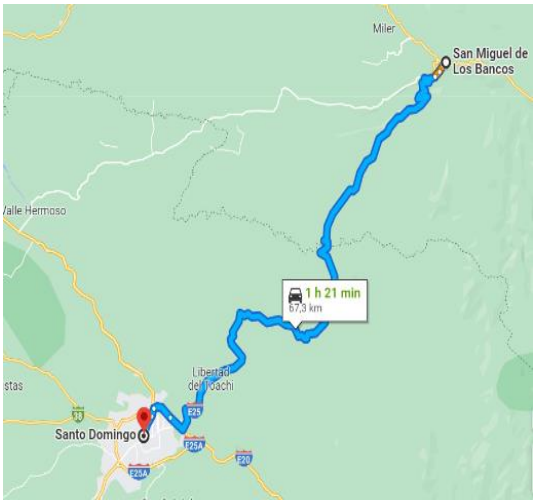
distort the actual economic value for society. Data limitations made it necessary to apply several conservative adjustments that may underestimate the Project's potential benefits while keeping the results within a credible range of expected benefits. In this analysis, the shadow price used is 0.815, the same as considered in other transport projects in Ecuador.[66] It is the same value used by MTOP for its own analysis.

5. **Scope of the evaluation.** This analysis focuses on Infrastructure Recovery and Resilient Interventions, as defined in Component 1. To provide an analysis of the Loan's potential impact, five projects have been identified as potentially eligible and are considered as a representative sample of the interventions that the Loan will finance. The projects have been characterized based on their expected costs, length, speed of operation, and fatalities in road crashes. Two scenarios have been proposed for each project: (i) the baseline scenario, a situation with a disaster, that results in reduced speeds due to the partial or total closure of the road or to a very bad condition of the pavement for an average of one year, requiring drivers to travel more kilometers through alternative roads; and (ii) the project scenario, implementation of recovery interventions such as construction and rehabilitation, as well as resilience works to prevent future disasters, enabling continued passage and constant speed.

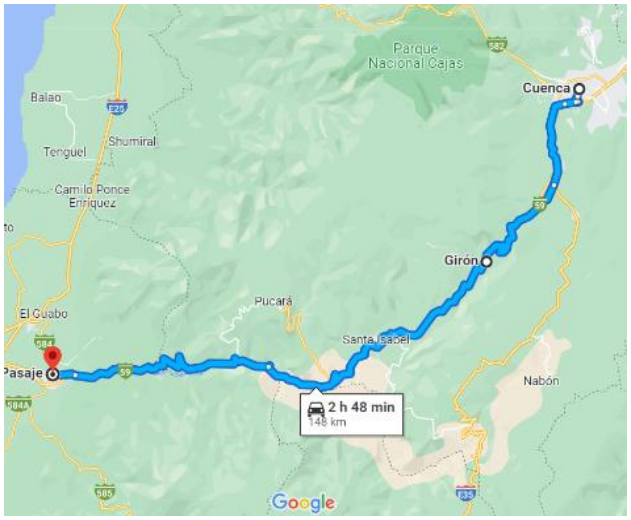
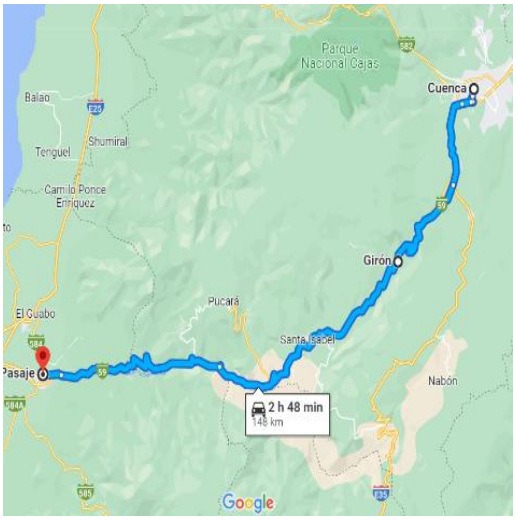
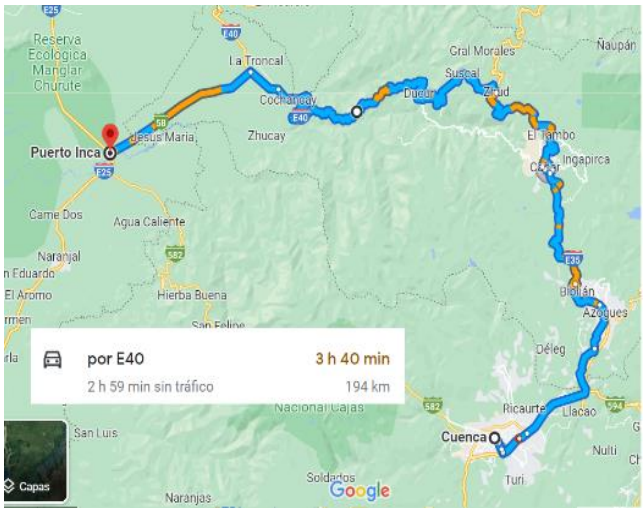
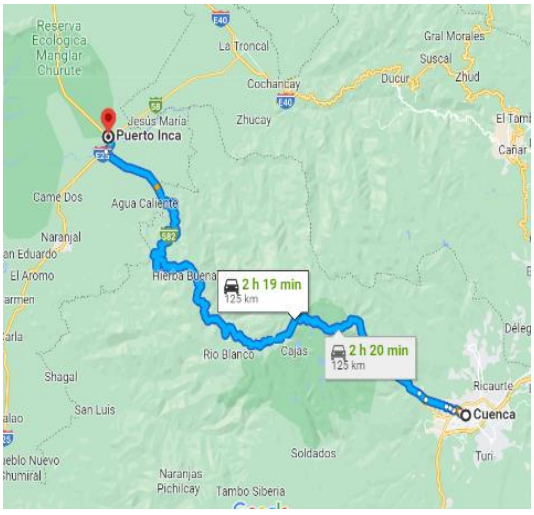
Table 3A.1 Representative projects

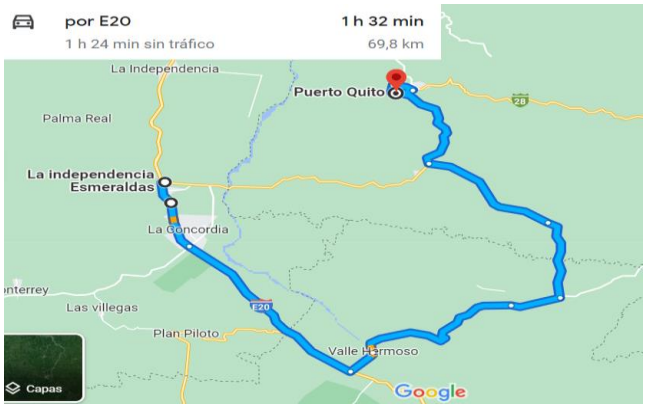
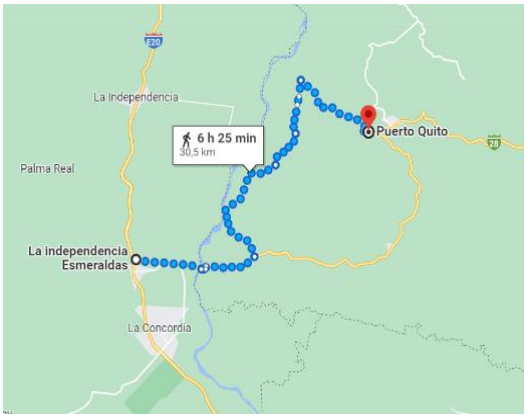
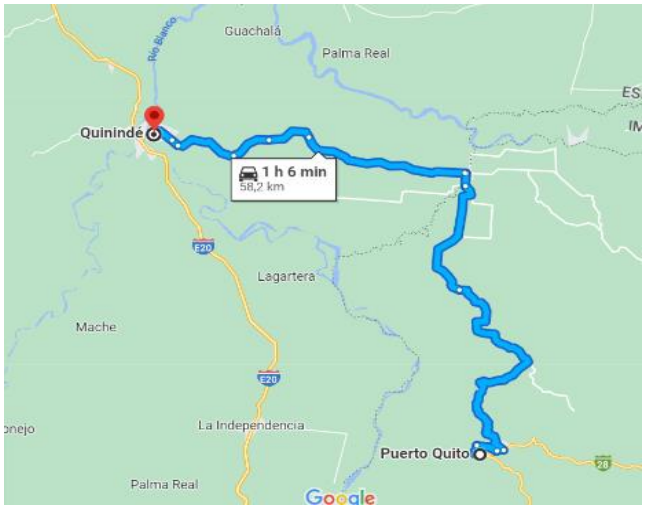
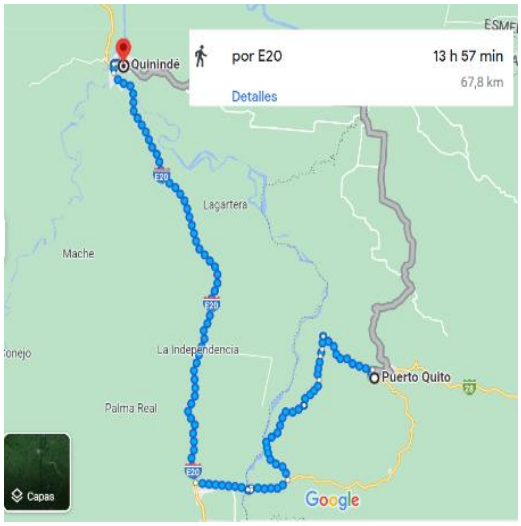
Project	km without project	km with project	km intervened (US$, millions)	Speed without project (kph)	Speed with project (kph)
San Miguel De Los Bancos – Las Mercedes	67.3 km	67.3 km	62.4 km (US$12.5)	50 kph	60 kph



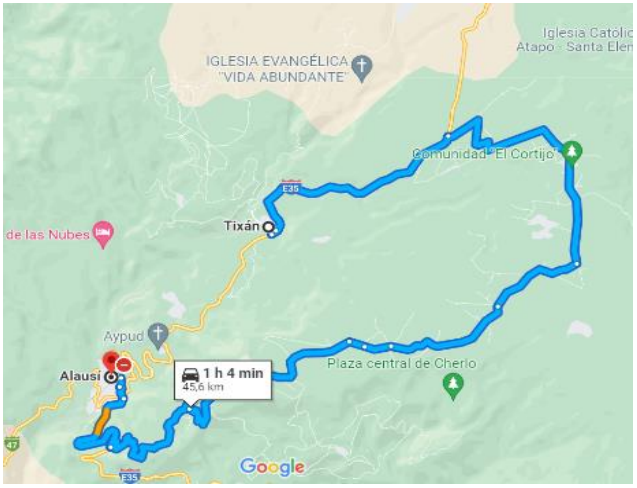
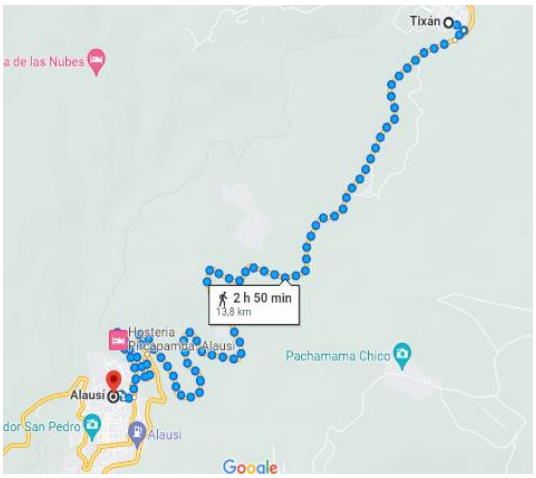


[66] World Bank. 2022. Ecuador: Improving Mobility in Ibarra, Ecuador (Additional Financing) (P180667); and GADI (2015). *Informe de Factibilidad: Tramo Norte*.

Project	km without project	km with project	km intervened (US$, millions)	Speed without project (kph)	Speed with project (kph)
Cuenca – Giron – Pasaje	148 km	148 km	136 km (US$28.2)	40 kph	60 kph
					
Cuenca – Molleturo – Naranjal (Puerto Inca)	194 km	125 km	119 km (US31.3)	60 kph	60 kph
					

Project	km without project	km with project	km intervened (US$, millions)	Speed without project (kph)	Speed with project (kph)
Puente Río Blanco (Puerto Quito – Valle Hermoso – La Independencia)[67]	69.8 km	30.5 km	0.12 km[68] (US$12)	30 kph	60 kph
					
Puente Río Blanco (Puerto Quito – Valle Hermoso – La Independencia)[69]	58.2 km	67.8 km	0.12 km[70] (US$12)	30 kph	60 kph
					

[67] In the case of the Puente Río Blanco, the assigned flow was divided into two, 30 percent recognizing local trips that are made by an alternate route and 70 percent long-distance trips that will use the other alternate route.
[68] This intervention consists of a bridge over the Río Blanco.
[69] In the case of the Puente Río Blanco, the assigned flow was divided into two: 30 percent recognizing local trips that are made by an alternate route and 70 percent long-distance trips that will use the other alternate route.
[70] This intervention consists of a bridge over the Río Blanco.

Project	km without project	km with project	km intervened (US$, millions)	Speed without project (kph)	Speed with project (kph)
Alausí – Tixan	45.6 km	13.8 km	10 km (US$14)	60 kph	60 kph
					

6. The analysis has used the following inputs:

(a) **Representative sample projects data.** The analysis has used data on interventions and estimated costs of the representative sample projects provided by MTOP. The analysis considers the current state of the national road network (pavement condition, width, and the number of lanes) provided by MTOP and the operating speeds registered by the Waze database (2022). Data on speeds have been calibrated given road capacity and pavement condition, and Google travel time estimates.

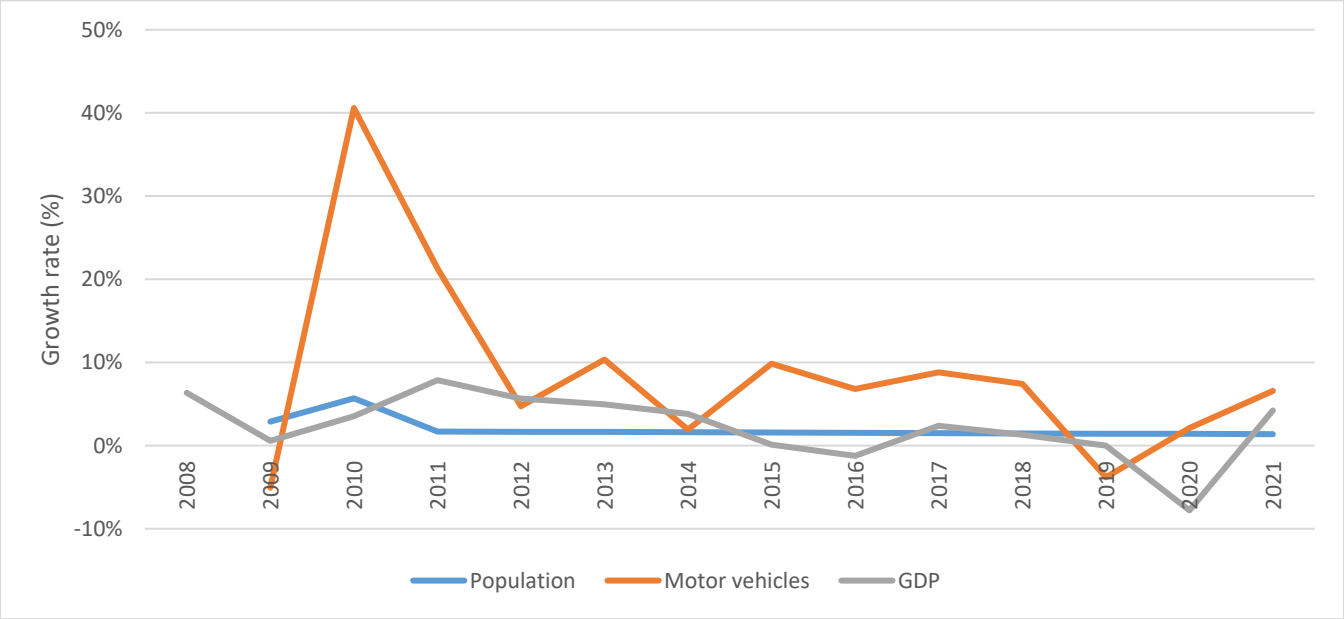
(b) **Update of flows assigned in the Strategic Mobility Plan (PEM in Spanish) model 2012-2022.** The PEM model 2012 is an MTOP tool for representing the assigned vehicular flows of different types (cars, single-axle trucks, and trucks with two or more axles) distributed in the national road network for a typical day. The methodology developed by the National Transit Agency (ANT) in 2016, which took 2012 flows as a reference, was replicated to estimate vehicle flows in 2022 using as the limits for the growth rate of traffic in the period 2012–2021, the average growth rate of the population (1.5 percent) and the average growth rate of GDP (1.3 percent). The growth rate fluctuated between these values for the total network considering that not all road network sections grow or decrease homogeneously, since there are areas of greater or lesser development in the period 2012–2021.

(c) **The PEM 2012 transport model is a reliable source of information about Annual Average Daily Traffic (AADT) and kilometers traveled on the state road network**. To estimate the kilometers traveled in 2022, the team multiplied the assignment of vehicle flows on the network by the length of the sections. The AADT was estimated to be 6,659, which is the average data per kilometer over the total network. To calculate this, the team divided the total kilometers traveled in a day (52,023,912 kilometers) by the total length of the road network (7,813 kilometers), considering the length represented in the 2012 model.

However, since this model is the most recent transportation model that Ecuador has, and the network has increased by more than 3,000 kilometers since then, reaching approximately 10,000 kilometers, the team did not consider the influence of these new kilometers on the network to avoid affecting the estimated average with traffic data projected to 2022.

(d) **To increase the number of beneficiaries for the traffic projection from 2022 to 2053, the team considered the population growth rate (1.5 percent) as an explanatory variable associated with future traffic projections**. The team evaluated the impact of proposed interventions on traffic growth with population, GDP, and registered fleet vehicles as variables for years 2012–2021 (refer to Figure 3A.1). For the traffic projection from 2022 to 2052, population growth rate was used, ensuring conservative results.

Figure 3A.1. Different factors affecting traffic growth rate



Source: Own elaboration from INEC population, World Bank GDP base date and ANT vehicle registration.

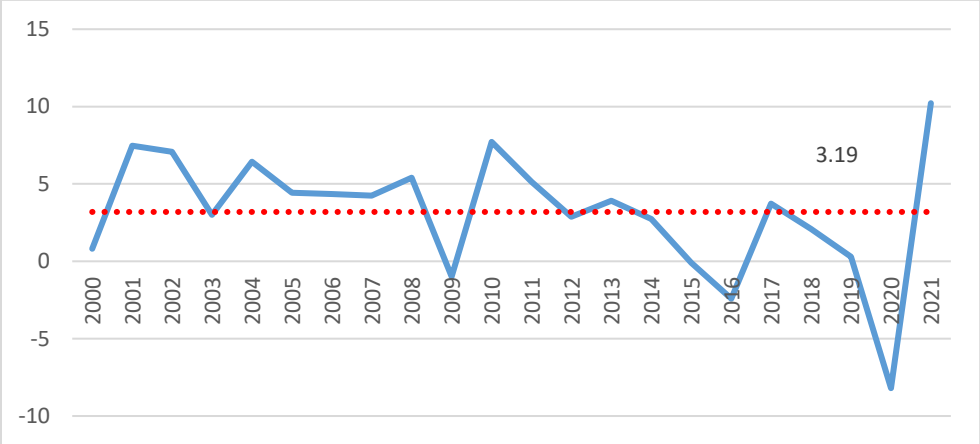
7. **Following the Bank's latest guidance on the social discount rate,[71] the analysis uses a social discount rate of 4.8 percent.** The calculation is based on one of three elements: (i) estimated economic growth (g); (ii) elasticity of marginal utility (θ); and (iii) rate of time preference (ρ). The three elements correspond to the components of the Ramsey equation.[72] In terms of estimated economic growth, we have estimated 3.2 percent corresponds to the average household's final expenditure growth in the last 20 years, which equals 3.19 percent (see Figure 3A.2). The elasticity of marginal utility (θ) represents how much the marginal utility decreases as beneficiaries become richer: usually considered between 1 and 2. Due to the lack of a better estimate, we are using 1.5. The last element, intertemporal preference, is usually defined between 0 and 0.2. For the purpose of calculating the discount rate of the analysis, we have selected 0, which reflects equal preference for current and future benefits.

[71] World Bank. March 2016. "Discounting Costs and Benefits in Economic Analysis of World Bank Projects."
[72] Frank Ramsey. 1928. "A Mathematical Theory of Saving."

Table 3A.2. Ramsey equation[73]

EIRR = ρ + θ g = 0 + 1.5 x 0.032 = 0.048
ρ: Intertemporal preference = 0
θ: Elasticity of marginal utility = 1.5
g: Growth rate = 0.032

Figure 3A.2. Ecuador household final expenditure growth



Source: Own elaboration from Ecuador Central Bank data.

8. **The analysis incorporates an improved estimation of the Value of Time (VOT) for beneficiaries.** The team has considered the estimated VOT in Improving Mobility in Ibarra Project for Ecuador (AF, P180667) for cars and trucks given that it is also a highway project, which is conservatively estimated at US$2.51 per hour according to the Bank's recommendation.[74, 75]

9. **Vehicle Operating Costs – VOC reduction as a consequence of the reduction of kilometers traveled.** To estimate the VOC reduction based on the reduction in kilometers traveled, the following reference values were used: US$0.2/km for cars, US$1/km for two-axle trucks, and US$1.5/km for trucks with more than two axles. This VOC value includes fuel and maintenance costs.

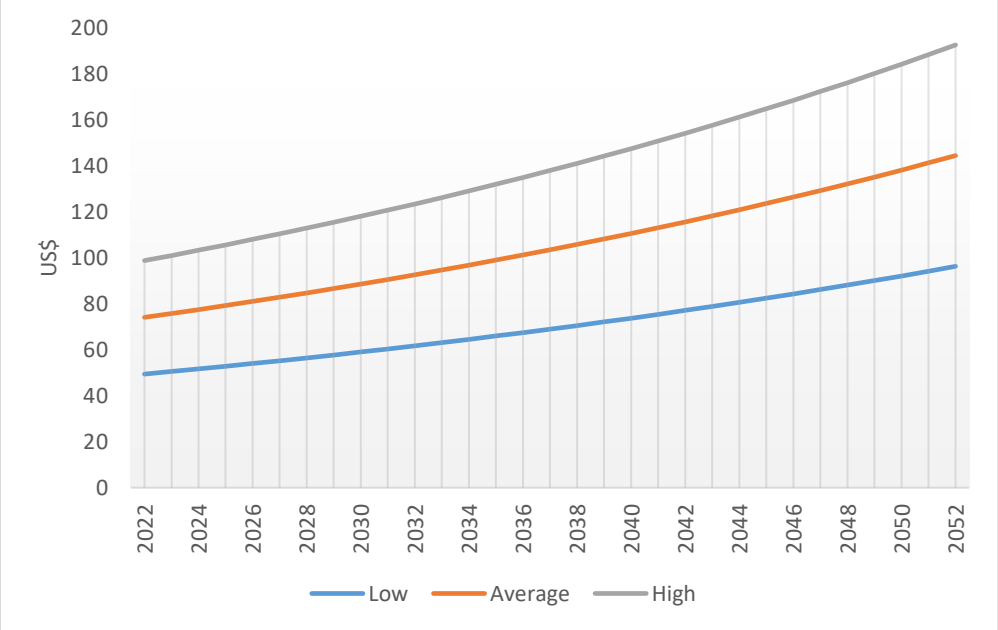
10. **The analysis estimates CO_2 reduction based on emission factors determined by the type of vehicle and distance traveled annually**. The team utilized emission factors for Ecuador estimated by the Army Polytechnic School between 2004-2009 and updated by the Ministry of Energy and Non-Renewable Natural Resources. These factors

[73] Frank Ramsey. 1928. "A Mathematical Theory of Saving."
[74] World Bank. 2005. "Transport Note No. TN-15, Notes on the Economic Evaluation of Transport Project."
[75] 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 (The weighted average value of time is US$2.51).

accounted for an average of 2.35 kg of CO_2 emitted per liter of fuel,[76] and specific values of 0.22 kg of CO_2/km for cars, 0.25 kg of CO_2/km per year for trucks with 2 axles, and 0.30 CO_2/km per year for trucks with more than 2 axles. The team calculated the average distance traveled annually by each vehicle type (with the baseline scenario accounting for longer trips due to road disruptions), based on the transport model of the national road network of the PEM, and multiplied it by the corresponding emission factor. This enabled the team to determine the emissions emitted with and without the project (intervention on 300 kilometers of road), as well as the emission savings expressed in tons of CO_2 saved per year. It is important to note that the analysis, at present, does not account for the reduction in emissions due to speed variation, driver behavior or induced traffic as the project aims to restore previous conditions to the disaster. The team is currently conducting an analysis of the Ecuadorian network to obtain this data.

11. To consider the costs associated with the emission of CO_2, the team has followed the recommendations of the World Bank guide[77] about the shadow price of carbon (Figure 3A.3).

Figure 3A.3. Recommended shadow price of carbon in US$ per 1 metric ton of CO_2 equivalent (constant prices)



Source: World Bank. 2017. "Shadow price of carbon in economic analysis."

12. For the purposes of analyzing Infrastructure Recovery Interventions' economic feasibility, the analysis has considered two scenarios. First, the team provided the results of analyzing Infrastructure Recovery interventions preliminarily identified as eligible. Second, the team analyzed the average Economic Internal Rate of Return (EIRR) in the national road network and estimated total benefits from the implementation of the resilient roads with the limit of Component 1 resources.

[76] 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.

[77] World Bank. 2017. "Shadow price of carbon in economic analysis."

13. **For the purposes of analyzing Resilience Interventions' economic feasibility, the analysis estimates an average 10 percent likelihood reduction of the cost of transport infrastructure vulnerability at a network level, as result of resilience benefits for non-loss of assets.** The analysis estimates the probability of earthquakes, floodings, landslides, and volcanic activities by network sections and their potential impact in terms of the cost of infrastructure recovery and loss of connectivity. Then, given the average cost of necessary interventions to reduce vulnerability and increase resilience, the team estimated the reduction of the risk cost (combined reduced probability of occurrence and/or reduced impact). This resulted in a global analysis of the benefits of addressing all vulnerabilities of transportation infrastructure. Finally, for conservative purposes of the analysis, instead of prioritizing the most economically profitable infrastructure, the team has simulated the use of Component 1 resources for intervention, averaging the benefits of the whole network.

C. Summary of Cost-Benefit Analysis Results

14. **Benefits from Infrastructure Recovery Interventions.** Visualizing the national network as a resilient NMTS is key to reducing emergency response times and preventing or mitigating the intensity of damage to infrastructure—this is summarized in the benefits of the project. Ecuador's geographic location, combined with threats to which the territory is exposed, along with the existing road network and climate change-associated droughts and long periods of rain, mean that various emergencies are common. The result is the paralysis of a large part of the movement of people and goods throughout the year. The benefits associated with investing in a resilient NMTS are the following:

    (a) **Reduced travel distances—time, vehicle operating costs (VOC), and emissions.** The improvement of the state of the road network will allow higher and constant operating speeds that will result in the reduction of travel times and VOC (in the form of vehicle wear and fuel consumption). This has great impacts on passenger transport, contributing to the quality of life, and in the case of cargo movement, it allows an improvement in the logistics performance of the country, improving supply times and being attractive for investment. Optimizing the road network and increasing its resilience to the different threats that occur in Ecuadorian territory reduces kilometers traveled, with a consequent reduction in CO_2 emissions, travel time and VOC. Currently, road closures and the non-operation of vehicular bridges generate 28.8 percent increase in travel distances that remain between 2 months and 2 years. Therefore, an average closing year was taken.

    (b) **The analyzed representative interventions will reduce a total of 1,896,538 tCO_2 emissions**. The total emissions in the baseline scenario are 9,496,031 tCO_2. In the Project scenario, total emissions are 7,599,493 tCO_2. This represents a resulting emission decrease of 1,896,538 tCO_2, or 20 percent, as compared with the baseline scenario. To estimate the economic impact of CO_2 emissions reduction, the updated WB guidance note recommends that projects' economic analysis use a low and high estimate of the carbon price starting at US$47 and US$95 per ton, respectively, in 2020 and increasing by 2.25 percent per year. According to these notes, the shadow price of carbon can be derived from three different measures: (i) social cost of carbon; (ii) marginal abatement costs; and (iii) carbon market prices. In this sense, the WB guidance note recommends that projects with carbon reduction externalities should undertake the economic analysis with and without the carbon benefit. The team

has considered the average cost to estimate the economic impact of CO_2 emissions reduction. A sensitivity of this price was also considered, taking a high and low referential cost (See Figure 3A.3).

(c) **Reduced fatalities.** For the evaluation of future crashes, the Road Safety Screening and Appraisal Tool developed by World Bank was used, taking as baseline input the 49 crashes with fatalities reported in the National Transit Agency (ANT) database 2022 for the five representative projects and the Statistical Value of Life for Ecuador. The Statistical Value of Life for Ecuador was taken from a thesis carried out by students at the Central University of Ecuador, in which they estimate the Statistical Value of Life for Ecuador in the year 2019 as US$384,938.64.

15. **Costs of Infrastructure Recovery Interventions.** The NPV of the CAPEX linked to Infrastructure Recovery Interventions totals US$117 million after applying a shadow price factor of 0.815 to the estimated financial costs of the five representative projects analyzed. The NPV of the economic costs associated with maintenance of these assets for 31 years total US$12.5 million.

16. **Benefits from Resilience Interventions: The cost of transport infrastructure vulnerability.** The benefits stemming from Resilience Interventions are estimated due to the non-loss of assets resulting from the sum of infrastructure recovery costs and investments in resilience interventions multiplied by the probability of disaster occurrence, which decreases to an estimated 10 percent. To this are added the savings in time and operational costs, by keeping the road enabled all year without any type of partial or permanent closure.

17. **Costs of Resilience Interventions.** For the purposes of the analysis, Resilience Interventions correspond to those linked to the construction or rehabilitation of transport infrastructure as part of Infrastructure Recovery Interventions. However, the project may include standalone Resilience Interventions in HVTI. An updated analysis at mid-term review or at the Implementation Completion Report (ICR) should consider these interventions separately. Although for the purposes of evaluation, specific benefits, and costs linked to these interventions (reduced vulnerability) are higher when there is a new construction, and lower (or equal) for both Resilience Interventions linked to rehabilitation of existing transport infrastructure, or those not associated with any intervention on the transport infrastructure. Table 2A.3 reflects these costs.

18. **CBA results summary.** The relationship between the quantification of the costs and the expected benefits is presented below for a 31-year evaluation period (including two years of construction and 29 years of operation). Table 3A.4 provides a summary of the Project's economic costs and benefits. For investments in infrastructure recovery, investments in Resilience Interventions, and a weighted average for whole results, in all three cases, favorable indicators for the project are presented, given the high demand of the projects per kilometer and the great impact of the loss in connectivity (although it is relatively cheap to recover this connectivity), the benefits are enormous. This further justifies the urgency of the intervention.

Table 3A.4. CBA summary with updated costs and 4.8% discount rate

Economic benefits		
Benefit	**%**	**NPV (US$, millions)**
TOTAL BENEFITS	**100%**	**$2,697**
Restored connectivity in areas affected by Eligible Disasters	84%	$2,266
Time savings	22%	$596
VOC reduction	58%	$1,573
CO_2 emissions savings	4%	$98
Improved resilience (reduced cost of vulnerability)	9%	$250
Improved safety (reduced fatalities)	7%	$181
Economic costs		
Cost	**%**	**NPV (US$ millions)**
TOTAL COSTS	**100%**	**$138**
Infrastructure Recovery (construction and rehabilitation)	77%	$107
Resilience Interventions	14%	$19
Maintenance	9%	$13
INCREMENTAL BENEFITS - COST		**$2,559**
EIRR		**171%**

D. Sensitivity Analysis

19. **The sensitivity analysis shows that the results are robust.** The investment would still be profitable with an additional increase of 20 times the investment costs. On the other hand, the project would still be viable if there was a decrease in the demand up to 97 percent. A combined reduction of demand of 70 percent (to 30 percent), and cost increase of 7.5 times would make the project not feasible. Those scenarios are highly improbable.

Table 3A.5. Sensitivity Analysis

IRR	Demand (decrease)				
Costs (increase)	**100%**	**70%**	**50%**	**30%**	**15%**
100%	170.72%	113.95%	78.37%	45.21%	22.14%
250%	57.21%	38.67%	27.03%	15.82%	6.87%
500%	26.22%	18.01%	12.51%	6.52%	0.64%
750%	16.91%	11.42%	7.47%	2.79%	-2.34%
1000%	12.28%	7.93%	4.64%	0.51%	-4.37%
1200%	9.88%	6.05%	3.05%	-0.83%	-5.67%

20. **The reduction of 1.897 million tons of CO_2 emissions resulting in a net economic benefit of US$97.6 million using the WBG standard shadow price of carbon (SPC) rate.** This guidance note recommends that projects' economic analysis use a low and high estimate of the carbon price starting at US$47 and US$95 per ton, respectively, in 2022 and increasing by 2.25 percent per year, presenting a net economic benefit associated to emission reduction of US$65.1 million in the low-cost estimate and a net economic benefit of US$130.1 million in the high-cost estimate.

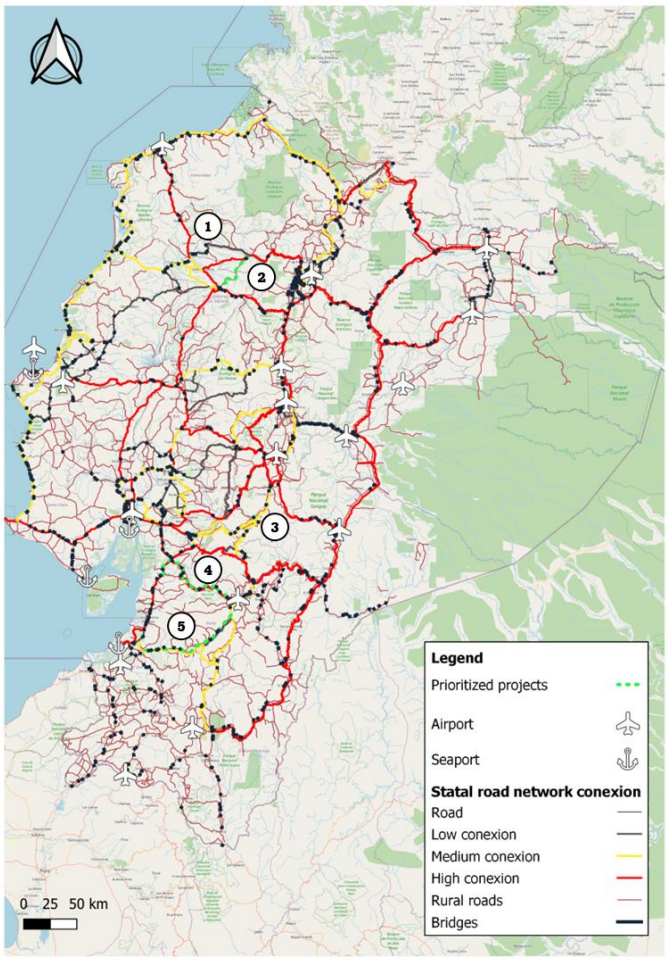
21. **The Project's updated NPV, including CO_2 emissions reduction benefits, is US$ 2,559 million, with an EIRR of 171 percent.** Excluding CO_2 emissions reduction benefits the Project's updated NPV, including CO_2 emissions reduction benefits, is US$ 2,461 million, with an EIRR of 165 percent.

E. Conclusion

22. **In conclusion, the CBA and sensitivity analysis for the Project show that the Project is economically viable at a 4.8 percent discount rate, as its benefits are larger than its costs**. The NPV is positive. Should the Bank agree to process this Investment Project Financing (IPF), the updated CBA shows the decision is justified on economic grounds.

ANNEX 4: Maps

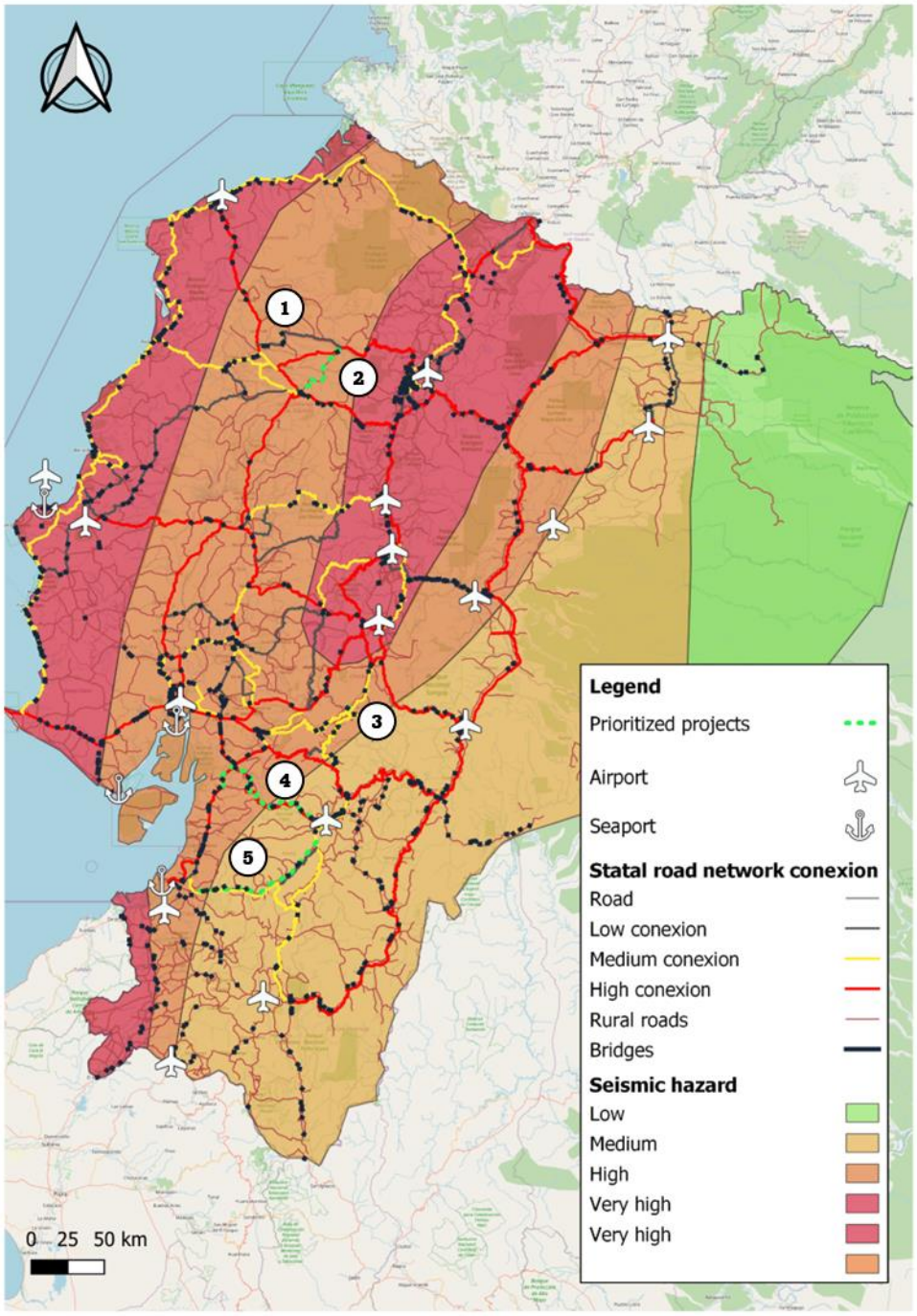
Figure 4A.1. Location of projects proposed in emergency loan



1. Río Blanco Bridge (0.12 km)
2. Los Bancos – Las Mercedes – Santo Domingo (52 km)
3. Alausí (0.5 km)
4. Cuenca – Molleturo – Naranjal (101 km)
5. Cuenca – Girón – Pasaje (132 km)

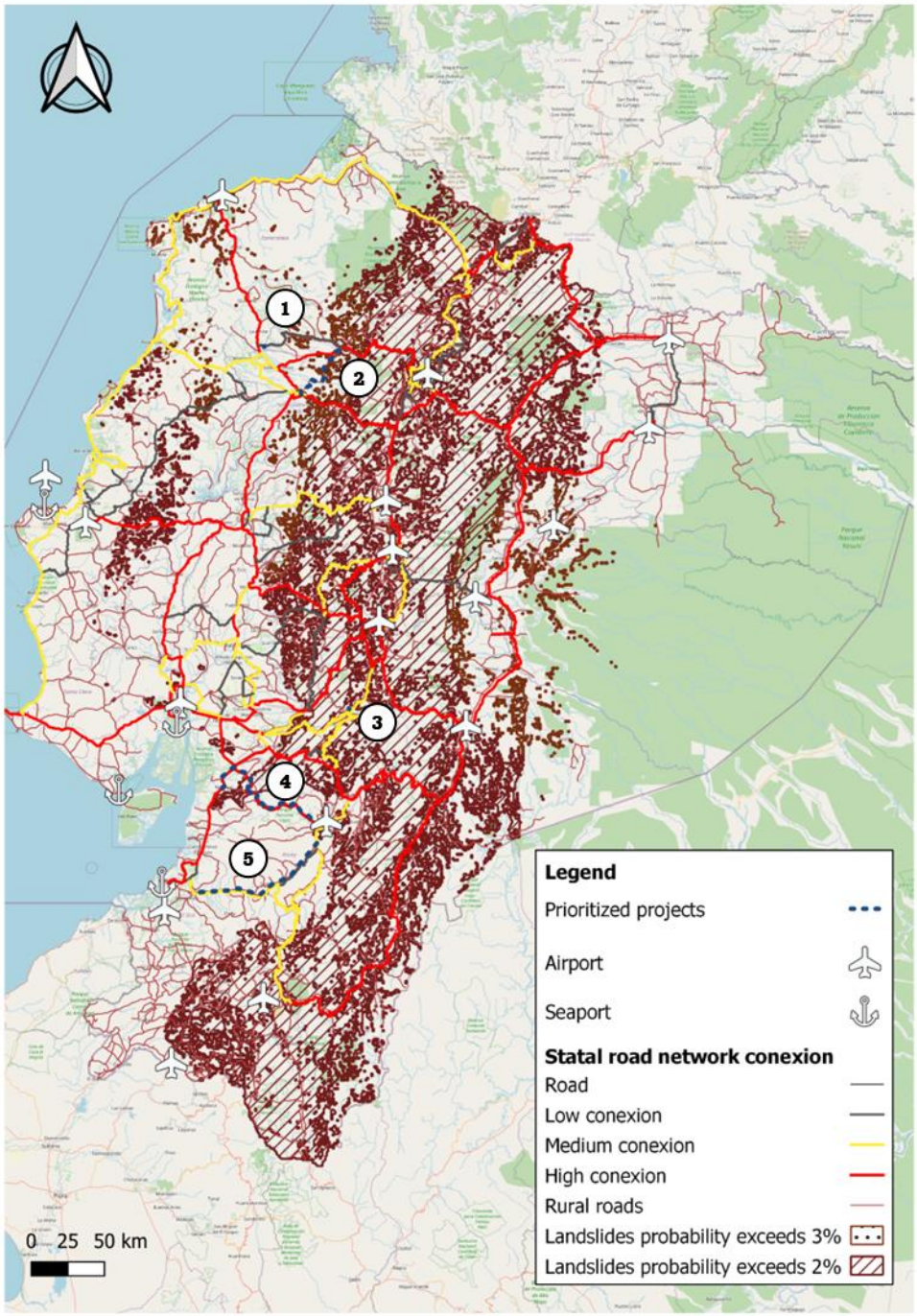
Source: Own elaboration.

Figure 4A.2. Seismic hazard map



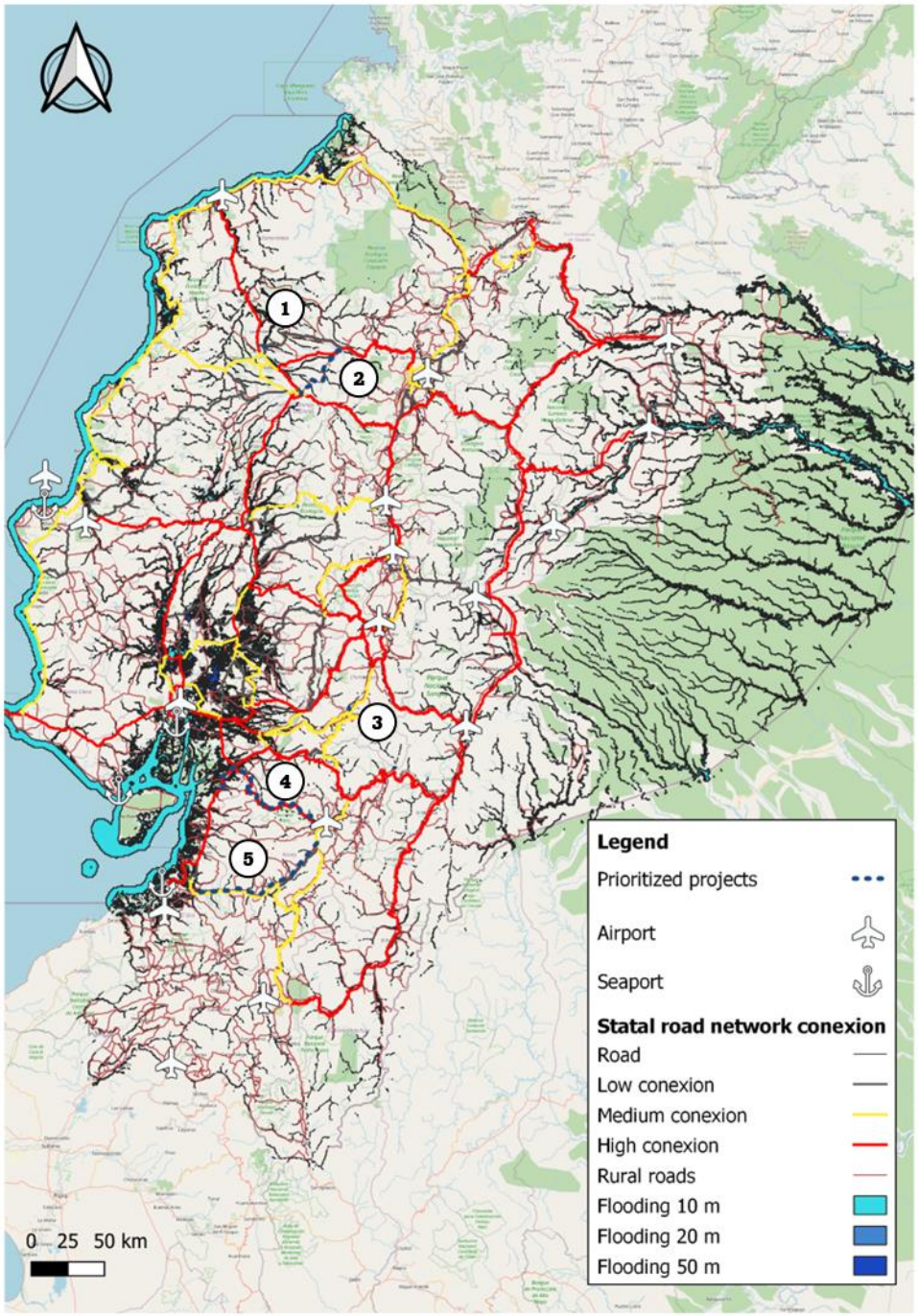
Source: Own elaboration BID information about Ecuador hazards, 2022.

Figure 4A.3. Landslides hazard map



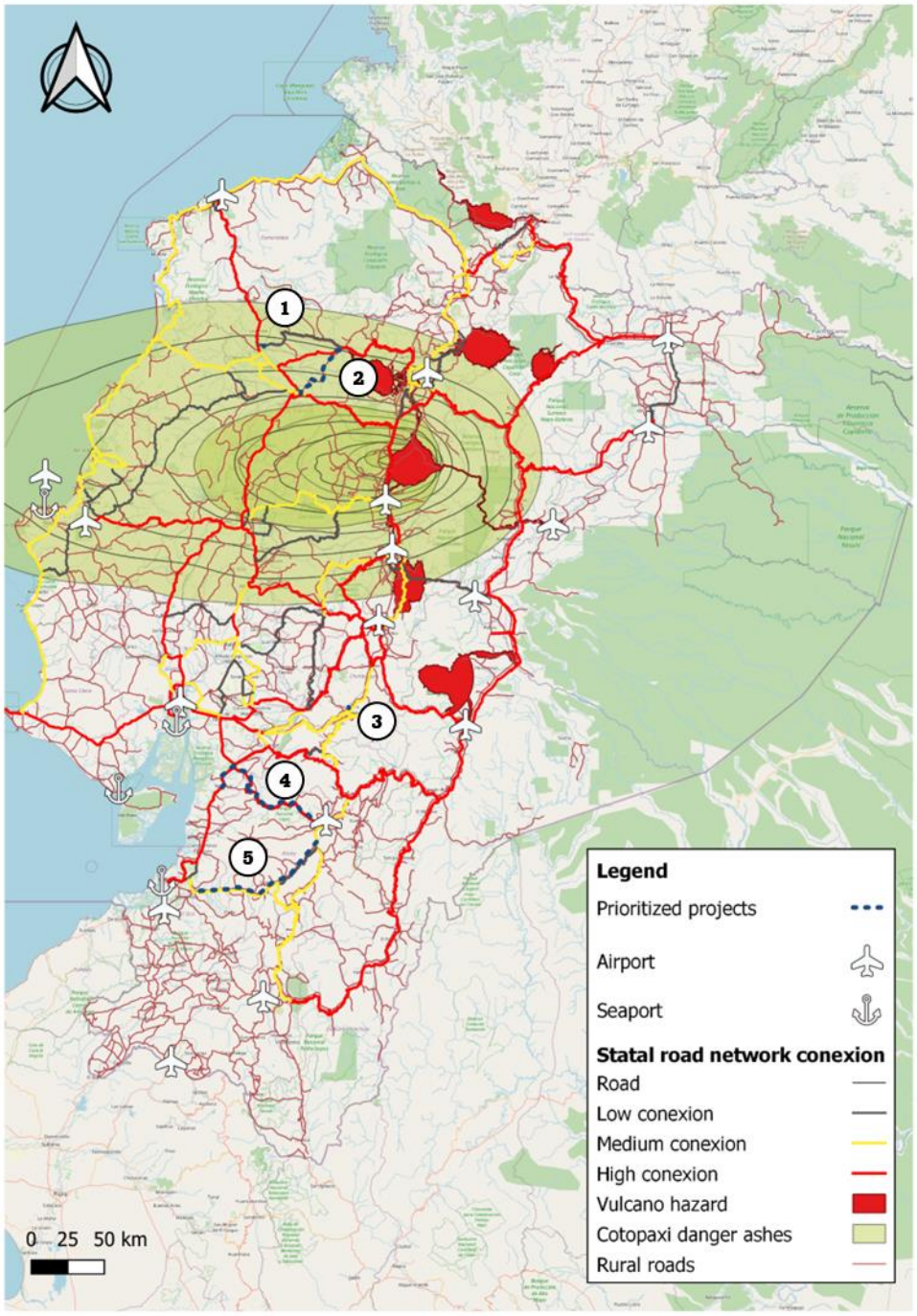
Source: Own elaboration.

Figure 4A.4. Flood hazard map



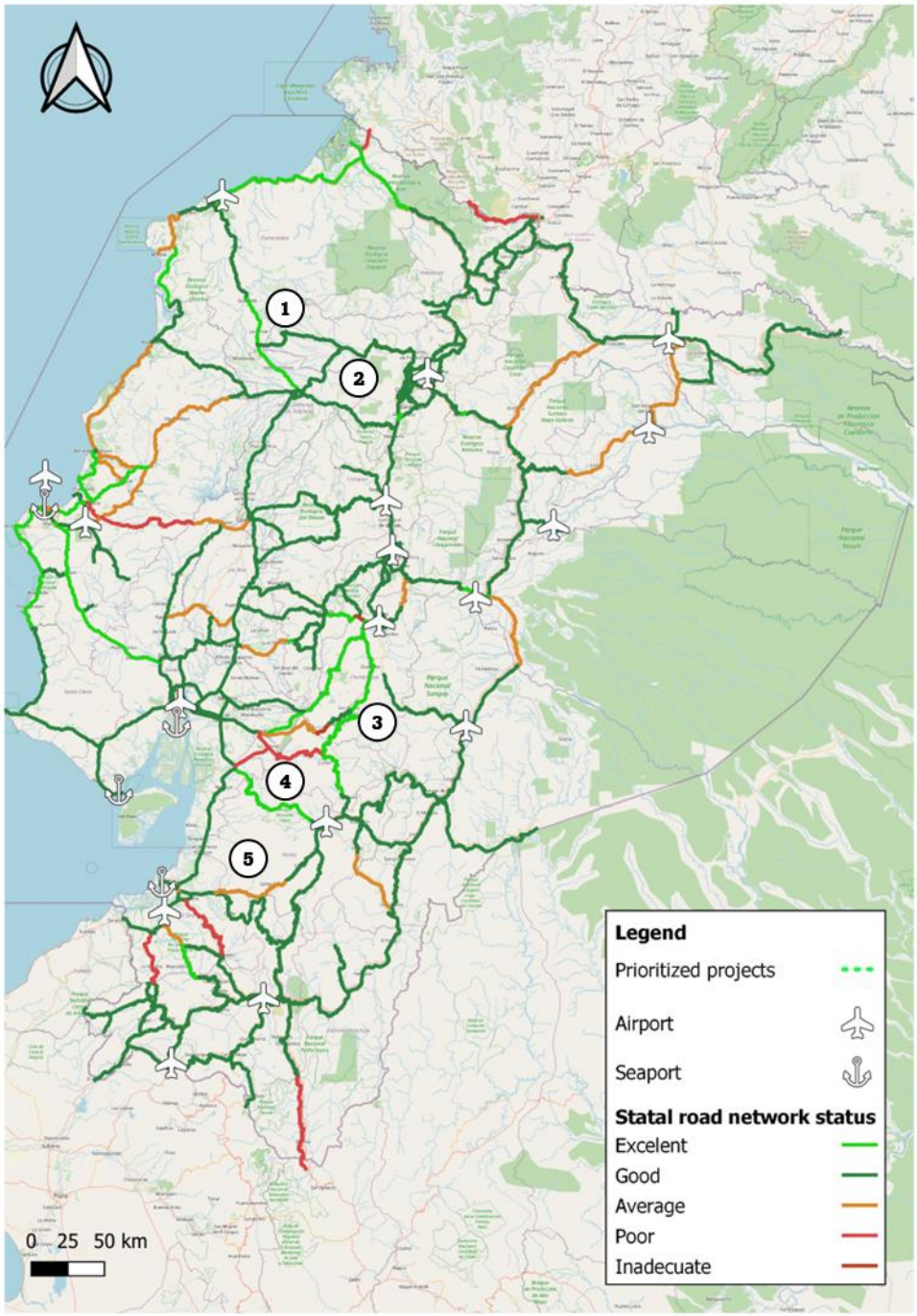
Source: Own elaboration from raster information.

Figure 4A.5. Volcanic Activity hazard map



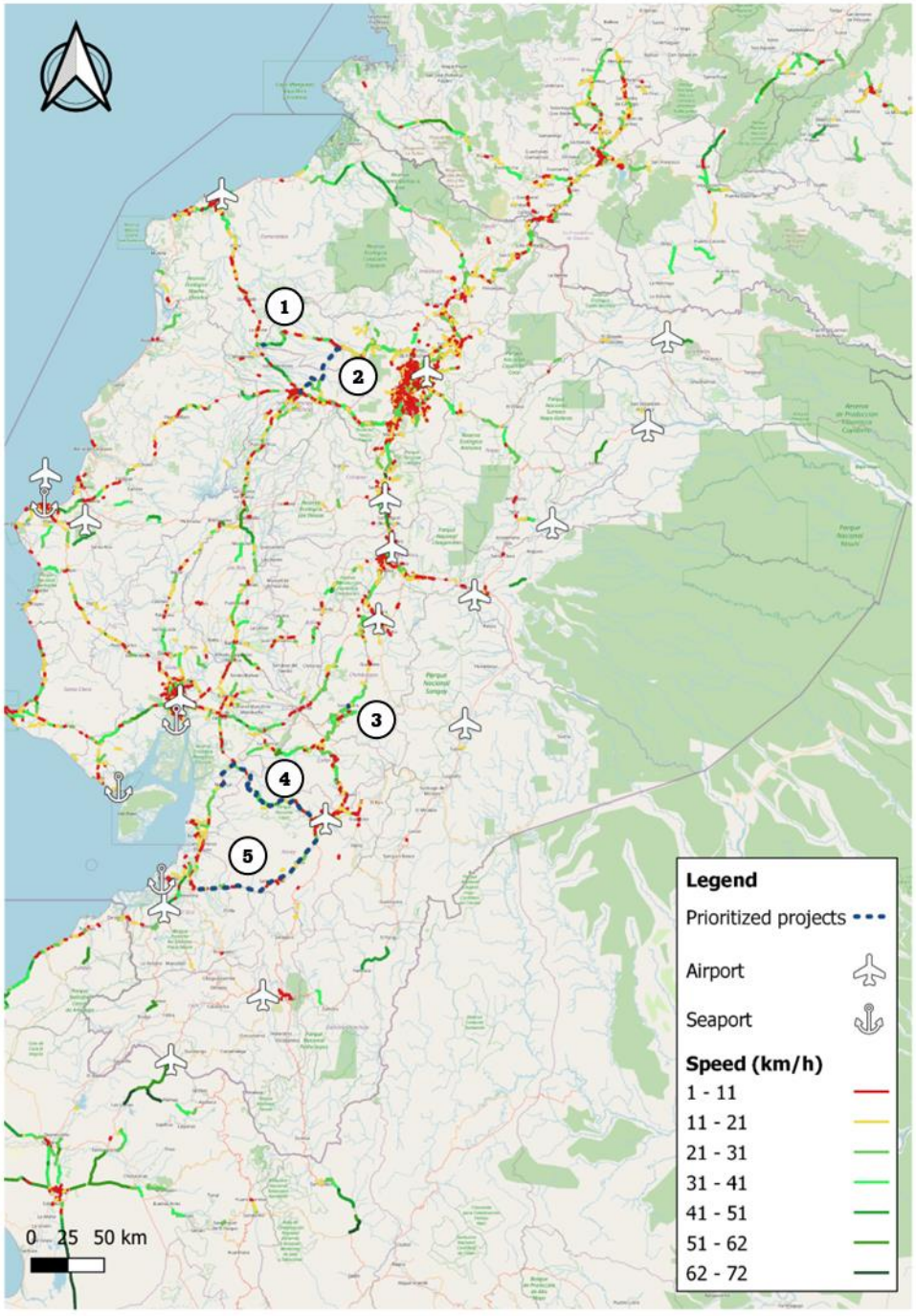
Source: Own elaboration from raster information.

Figure 4A.6. State map of the national road network



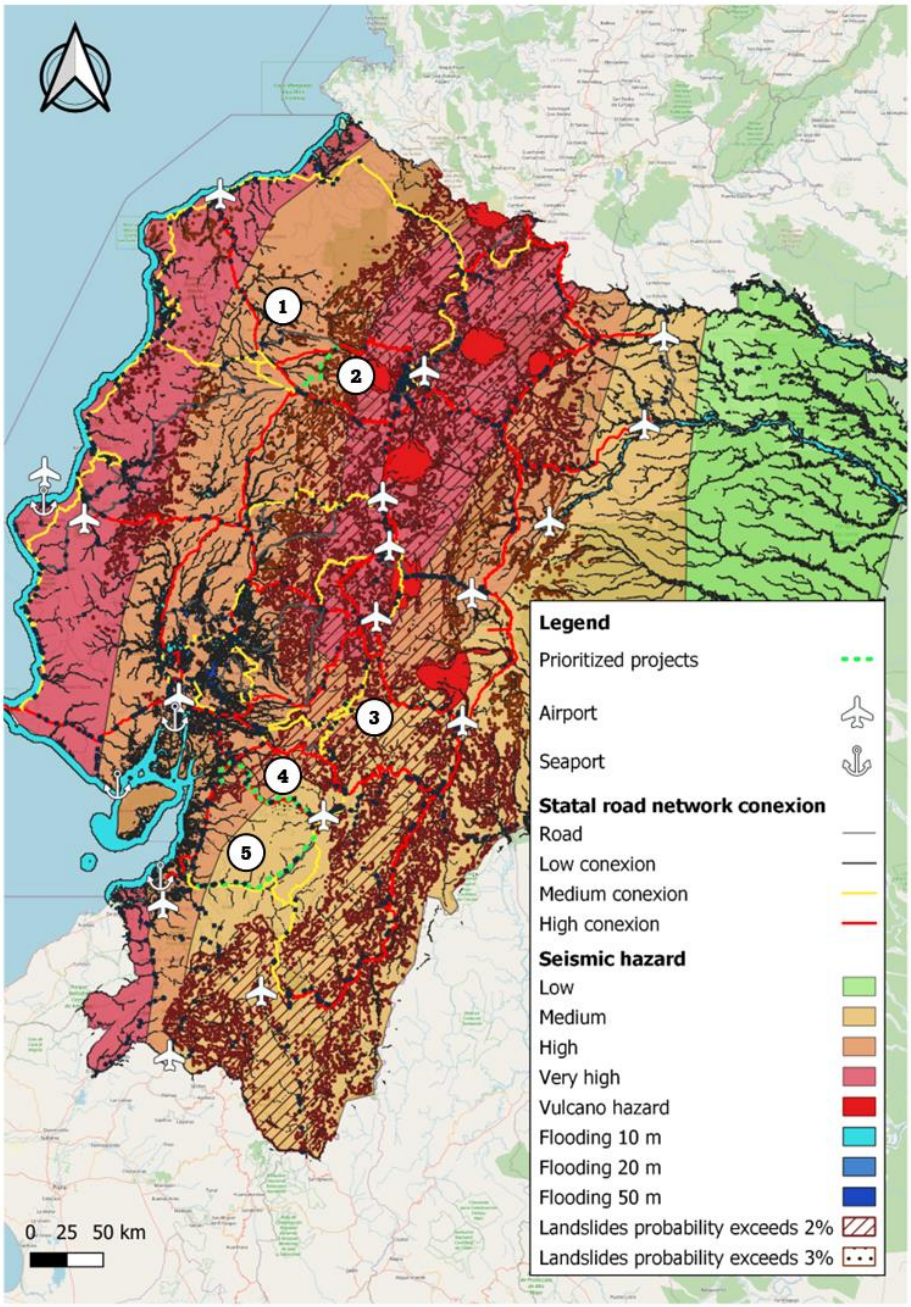
Source: Own elaboration from transport model PEM 2012.

Figure 4A.7. Speed map on the national road network



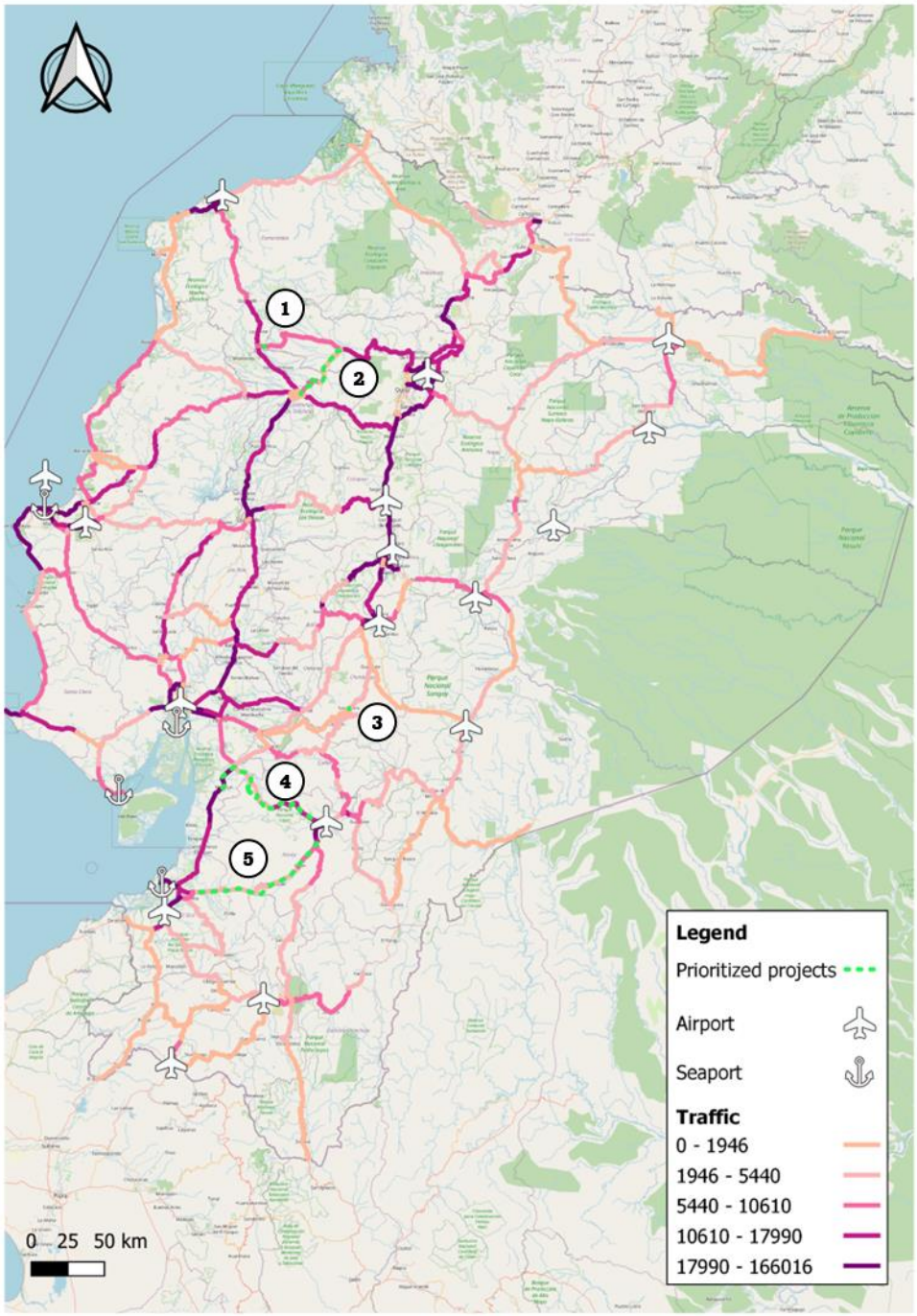
Source: Own elaboration from Waze information 2022.

Figure 4A.8. Consolidated map of all Natural Hazard + NMTS + location of interventions



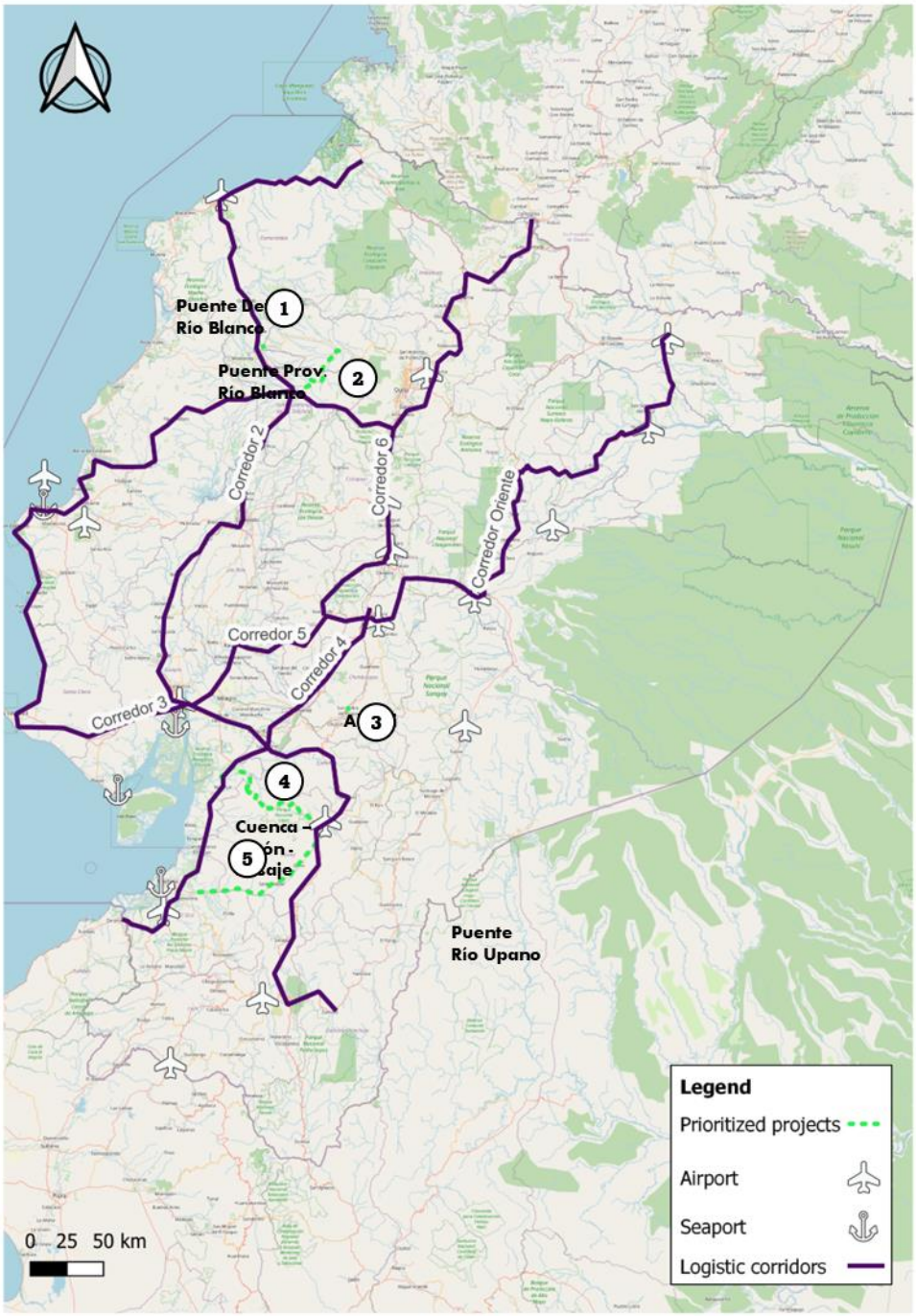
Source: Own elaboration from raster information.

Figure 4A.9. Annual Average Daily Traffic (AADT) national network map 2022



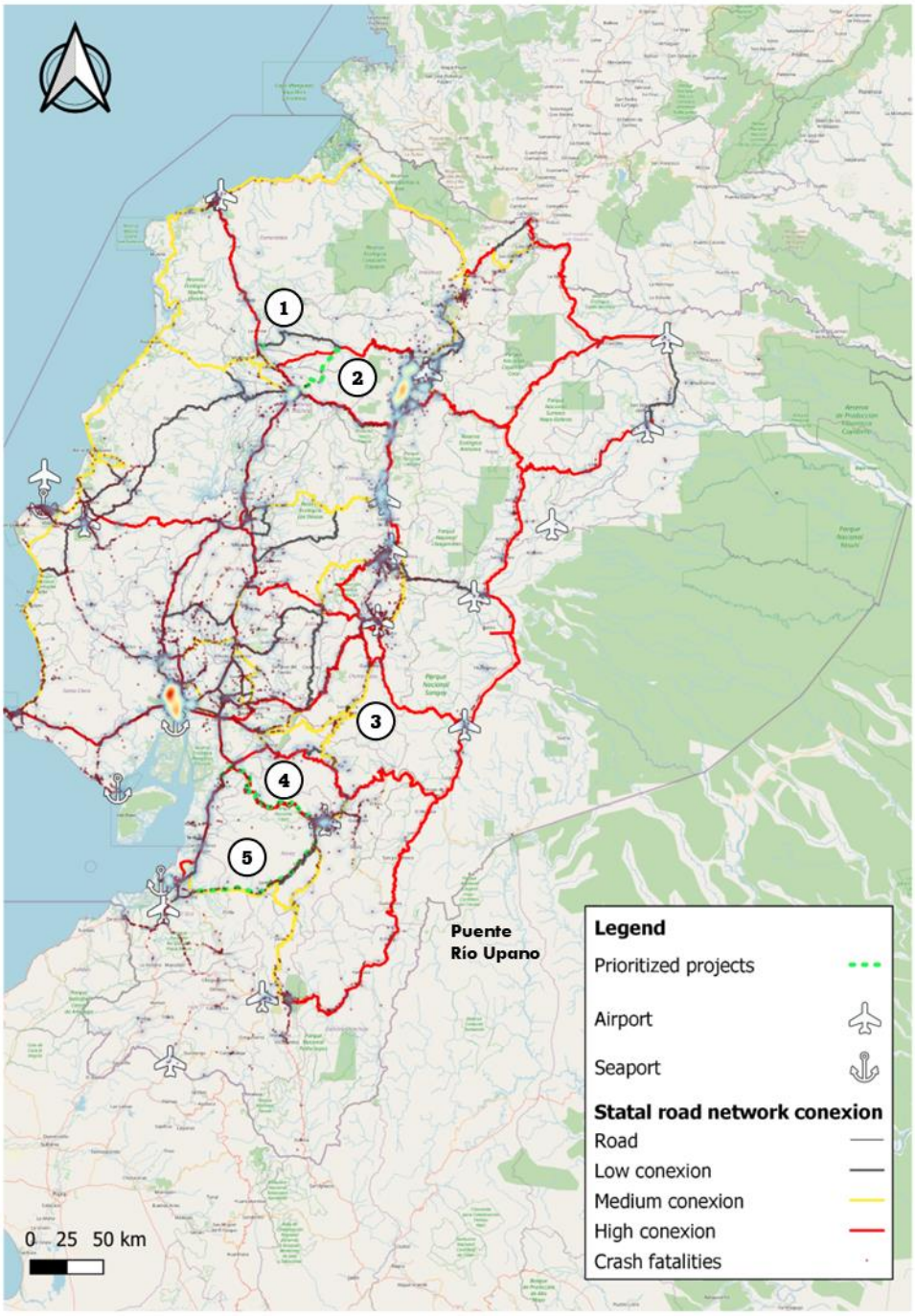
Source: Own elaboration from transport model PEM 2012.

Figure 4A.10. Logistics corridors and preidentified activities map



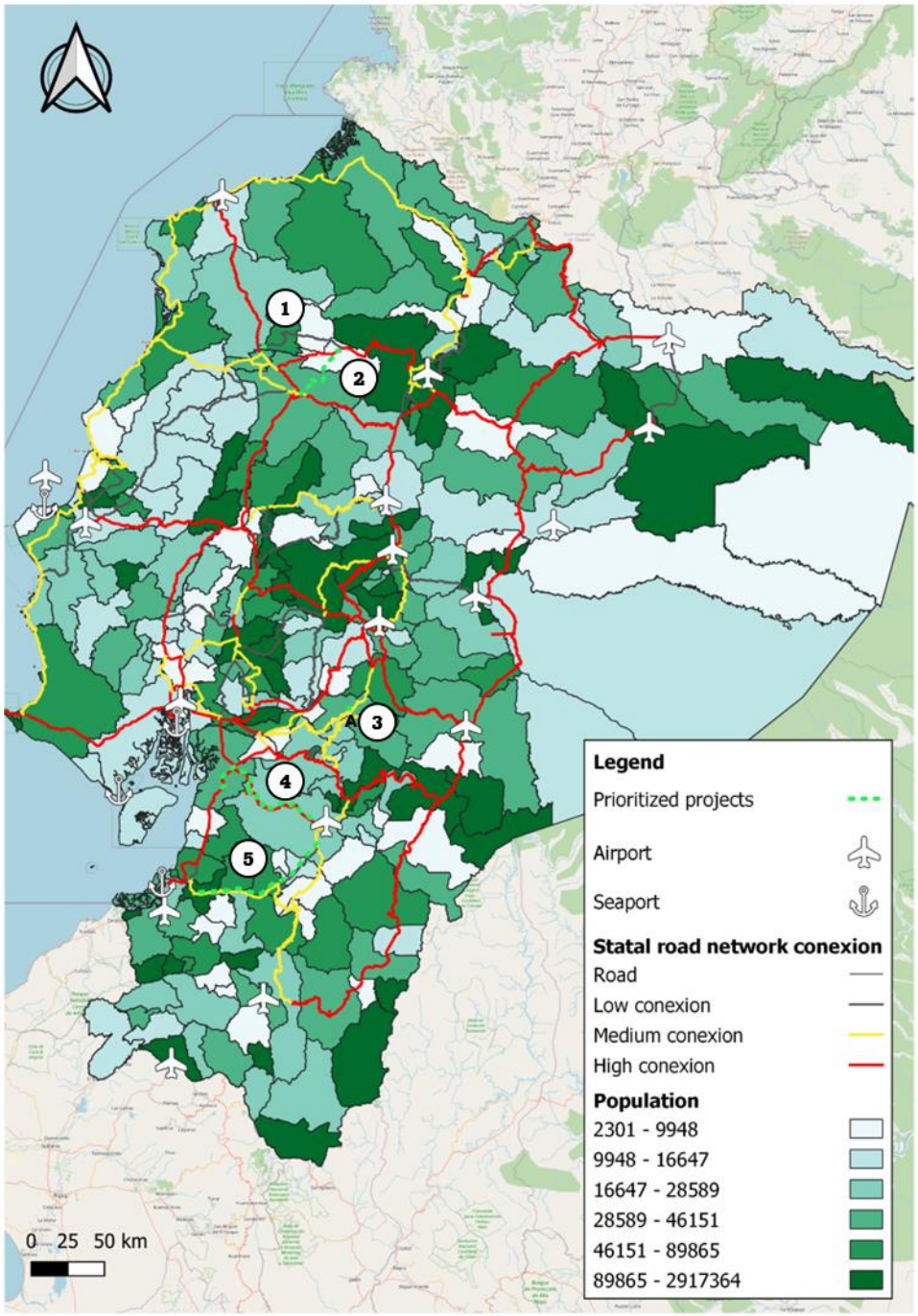
Source: Own elaboration from MTOP geographical information.

Figure 4A.11. Fatal crash map



Source: Own elaboration from base data 2022, ANT crash viewer.

Figure 4A.12. Distribution of the population by canton



Source: Own elaboration from Instituto Nacional de Estadística y Censos *(INEC), 2023.*