Climate and Disaster Risk Screening Report for Edo Bus Terminal Project in nigeria

Table 1: Project Information

Project Title:	Edo Bus Terminal Project
Project Number:	002
Assessment completed by:	Ngozi
Estimated timeline for PCN Year:	2023
Estimated timeline for PCN Quarter:	Q4
Screening Tool Used:	In-Depth Screening Assessment

The Climate and Disaster Risk Screening Tool provides high-level screening to help consider short- and long-term climate and disaster risks at an early stage of project design. The tool applies an Exposure–Impact–Adaptive capacity framework to characterize risks (Annex 1). Potential risks are identified by connecting information on climate and geophysical hazards with users' subject matter expertise of project components (both physical and non-physical) and understanding of the broader sector and development context.

The tool does not provide a detailed risk analysis. Rather, it is intended to help inform the need for further consultations, dialogue with local and other experts and analytical work at the project location to strengthen resilience measures in the course of project design.

[1] This is the output report from applying the World Bank Group's Climate and Disaster Risk Screening Project Level Tool (Global website:climatescreeningtools.worldbank.org; World Bank users: wbclimatescreeningtools.worldbank.org). The findings, interpretations, and conclusions expressed from applying this tool are those of the individual that applied the tool and should be in no way attributed to the World Bank, to its affiliated institutions, to the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the information included in the screening and this associated output report and accepts no liability for any consequence of its use.

Summary Climate and Disaster Risk Screening Report

1. Exposure of the project location : This step assesses the current and future exposure of the project location to relevant climate and geophysical hazards.

Exposure ratings for climate and geophysical hazards that are likely to be relevant to the project location both in the present and in the future:

	Climate Change Hazards					Geophysical Hazards
	Extreme Temperature	Extreme Precipitation and Flooding	Sea Level Rise	Storm Surge	Strong Winds	Wildfires
Historical/Observed Trends						
Projected Climate						

2. Impacts on the project's physical components: This step assesses the current and future impacts of identified climate and geophysical hazards on the project's physical components as currently designed under relevant subsectors.

	Multi-modal and Transit Systems	Roads
Historical/Observed Trends		
Projected Climate		

3. Adaptive Capacity: modulating effect of the project's non-physical components and development context : This step assesses how the project's non-physical components, together with its broader development context, modulates potential impacts from climate and geophysical hazards. This step also considers particularly vulnerable groups, namely women, migrants and displaced populations.

Modulation of impacts by the project's soft components Reduce Risk	**Modulation of impacts by the project's Transportation sector context** Increase Risk **Modulation of impacts by the project's social, economic and political factors** Reduce Risk	**Women identified as particularly vulnerable to impacts from climate and geophysical hazards** Yes **Components designed to help alleviate the risks to women from climate and geophysical hazards** Yes

4. Risk to the outcome/service delivery of the project : This step assesses the level of risk to the outcome/service delivery that the project is aiming to provide based on previous ratings.

	Multi-modal and Transit Systems	Roads
Historical/Observed Trends		
Projected Climate		

Key for risk ratings:

Insufficient Understanding	No Exposure No Potential Impact No Risk	Low Exposure Low Potential Impact Low Risk	Moderate Exposure Moderate Potential Impact Moderate Risk	High Exposure High Potential Impact High Risk

Guidance on Managing Climate Risks through Enhanced Project Design

By understanding which of your project components are most at risk from climate change and other natural hazards through initial screening, you can begin to take measures to avoid impacts by:

- Enhancing the consideration of climate and disaster risks early in project design.
- Using your risk screening analysis to inform follow-up feasibility studies and technical assessments.
- Encouraging local stakeholder consultations and dialogue to enhance resilience measures and overall success of the project.

Table 1 provides some general guidance based on the risk ratings for Outcome/Service Delivery, and Table 2 lists some climate risk management measures for your consideration. Visit the "Screening Resources" page of the tool for additional guidance and a list of useful resources.

Note: Please recall that that this is a high-level screening tool, and that the characterization of risks should be complemented with more detailed work.

Table 1: General Guidance Based on Risk Ratings for Outcome/Service Delivery

Insufficient Understanding	Gather more information to improve your understanding of climate and geophysical hazards and their relationship to your project.
No/Low Risk	If you are confident that climate and geophysical hazards pose no or low risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented.
Moderate Risk	For areas of Moderate Risk, you are encouraged to build on this screening through additional studies, consultation, and dialogue. This initial screening may be supplemented with a more detailed risk assessment to better understand the nature of the risk to the project.
High Risk	For areas of High Risk, you are strongly encouraged to conduct a more detailed risk assessment and to explore measures to manage or reduce those risks.

Table 2: Types of Climate Risk Management Measures for Typical Transportation Projects

OBJECTIVE	EXAMPLES
Changes in Operations	• Shift construction schedules to cooler parts of the day to address health and safety concerns and avoid vehicle overheating and deterioration • Develop redundant structures or services that can be relied upon if disruptions occur • Shorten maintenance periods to accommodate changes in precipitation and temperature • Increase inspection frequency to ensure structures are enduring climate change pressures • Increase financial and technical resources for more frequent maintenance and repairs • Shortening of season for use of ice roads to reduce removal costs and environmental impacts from salt and chemical use • Increase use of sonars to monitor stream-bed flow and bridge scour • Integrate emergency evacuation procedures into operations • Use bridge openings more frequently for ships in the event of severe storm surges • Increase payload restrictions on aircraft at high-altitude or hot-weather airports • Temporarily close airports and ports when extreme weather events occur

Changes in Infrastructure Design and Materials	• Develop new, heat-resistant paving materials for construction of roadways, runways, and rail tracks • Use improved asphalt/concrete mixtures for roads and runways • Increase use of heat-tolerant street and highway landscaping • Greater use of continuous welded rail lines to avoid rail-track deformities • Use insulation in road prism to reduce thawing of permafrost, which causes subsidence of roads, rail beds, bridge supports (cave-in), and pipelines • Elevate bridge, tunnel, and transit entrances to reduce inundation and severe flooding of low-lying infrastructure • Build and strengthen existing levees, seawalls, and dikes to protect high-value coastal real estate • Upgrade existing infrastructure drainage systems and increase standards for new transportation infrastructure and major rehabilitation projects (e.g., assuming 100-year and 500-year storms) • Increase pumping capacity for tunnels • Increase culvert capacity • Use flexible, expandable materials in railway systems • Protect critical evacuation routes • Protect bridge piers and abutments with riprap • Change bridge design to tie decks more securely to substructure and strengthen foundations • Adopt modular construction techniques where infrastructure is in danger of failure (such as modular traffic features and road sign systems for easier replacement) • Use more dredging of channels • Raise docks, wharf levels, jetties, and seawalls to protect harbors and terminal and warehouse entrances • Extend runway lengths at high-altitude or hot-weather airports
Retreat/Relocate	• Convert coastal land uses to establish natural buffer zones • Relocate roads, railways, and airport runways further inland
Build information collection and management systems	• Strengthen climate information systems, building on existing regional and national networks • Build capacity of national governments to harmonize data across regions • Build relevant national and/or regional research programs on the links between climate and transportation sector • Improve the ability to forecast landfall and trajectory of hurricanes • Track changes in maintenance needs and schedules over time as adaptation actions are implemented • Monitor changing environmental conditions affected by climate (e.g., land erosion patters, frequency and severity of inundation events) to understand evolving adaptation needs

Strengthen policies, planning and systems	• Identify transportation-related development goals important to the country, region , or community • Identify inputs and enabling conditions necessary to achieving transportation-related development goals • Integrate climate information into system planning to assess climate impacts on transportation infrastructure and understanding adaptation needs and economic implications • Design flood risk-management plans with both ecosystem- and construction-based adaptation options • Update design standards to elevate roadways to accommodate future sea level rise and high winds • Consider storm surge in coastal road planning • Improve coordination of policies and programs across government agencies to address the additional pressures imposed by climate change • Improve finance for transportation systems that are more adaptive and better designed for a changing climate, including through private sector investment and incentives; ensure consideration of climate risk in financing approaches • Strengthen disaster planning and response for transportation infrastructure and services

Sources: USAID Climate Risk Screening and Management Tools: Infrastructure, Construction, and Energy; Addressing Climate Change Impacts on Infrastructure; TRS Special Report: Potential Impacts of Climate Change on Transportation

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1. Introduction

Building resilience to climate and geophysical hazards is a vital step in the fight against poverty and for sustainable development. Screening for risks from these hazards improves the likelihood and longevity of a project's success. The project level **Climate and Disaster Risk In-depth Screening** provides early stage screening for climate and disaster risks at the concept stage of project development. The tool uses an **exposure - impact - adaptive capacity** framework to consider and characterize risks from climate and geophysical hazards, based on key components of a project and its broader development context.

This report summarizes the results of the screening process for in , which was applied to the following selected subsectors:

✔ Multi-modal and Transit Systems

✔ Roads

The potential risks flagged in this report were identified by connecting information on climate and geophysical hazards exposure with the user's subject matter expertise and understanding of the project components and sensitivity to rate the impacts. The the in-depth screening assessment does not provide, rather it flags risks to inform consultations, enhance dialogue with local and other experts, and define further analytical work at the project location.

This early stage screening can be used to strengthen the consideration of climate and disaster considerations in key components of the project design, including the physical aspects (e.g., farm irrigation, water storage, etc.) and soft components (e.g., capacity building of farmers, institutional strengthening at community level, early warning systems, etc.). The broader sectoral (e.g., appropriate water policies, emergency protocols are in place that enable the water authority to respond to natural disasters, etc.) and development context conditions (e.g., appropriate policies on crop prices, water tariffs, risk insurance schemes for Transportation production), etc.) could help modulate the risks to the delivery of the outcome/service level. The results of the screening are presented below, with supporting narrative to guide their interpretation.

2. Exposure of the Project Location to Climate and Geophysical Hazards

The table below presents a summary description of exposure to climate and geophysical hazards at the project location for the Current and Future time frames. Exposure to climate hazards is evaluated in two time frames, because past records are not necessarily indicative of future conditions.

The following guiding questions are used to assess exposure.

- What have been the historical trends in temperature, precipitation and drought conditions?
- How are these trends projected to change in the future in terms of intensity, frequency and duration?
- Has the location experienced strong winds, seal level rise, storm surge, and/or geophysical hazards in the past that may occur again in the future?

The descriptions provide a summary of the key characteristics and some indication of the trends in exposure from each hazard, drawing on global, quality controlled data sets from the Climate Change Knowledge Portal (CCKP). It is useful, for example to understand the temperature range and the rate of annual or decadal increase in a region; or precipitation patterns for historical and future time frames and seasonality shifts. Understanding the trends of hazards is important as they act individually and collectively on components/subsectors of the project. Because geophysical hazards (such as earthquakes, tsunamis, landslides, and volcano eruptions) do not have associated future projections, exposure for those hazards is assessed only in the Historical/Current time frame.

Summary of Exposure to Climate and Geophysical Hazards at Project Location

Hazard	Time frame	Description of hazards for the project location
Extreme Temperature	Historical/Observed Trends	According to ThinkHazard!, Edo State, where the project is located, is highly vulnerable to extreme heat. Mean annual temperature has increased by 0.81°C between 1960 and 2021, an average rate of 0.14°C per decade. Average monthly temperatures range from 25.27 ^{0}C in August to 29.33 ^{0}C in March. Prolonged exposure to extreme heat, resulting in heat stress, is expected to occur at least once in the next five years.
	Projected Climate	The starting point for this rating is the Current rating of Highly Exposed. Mean annual temperature in Nigeria is projected to increase by 0.77 (SSP1-2.6) to 1.19°C (SSP5-8.5) by 2050. All projections also indicate substantial increases in the frequency of ‘hot’ days and nights. ‘Hot’ days are projected to increase by 40 days (SSP5-8.5) by 2050 (days with Tmax greater than 35°C). The Future exposure rating is "High". The projections clearly indicate an increase in the frequency and intensity of extreme temperature in future decades.

Extreme Precipitation and Flooding	Historical/Observed Trends	Urban & river flood hazards are classified as "high" for Edo state based on modeled flood information according to ThinkHazard!.This means that potentially damaging and life-threatening urban floods are expected to occur at least once in the next 10 years. Mean annual precipitation has decreased in recent decades. However, The southern regions experience strong rainfall events during the rainy season from March to October with annual rainfall amounts, usually above 2,000 mm, and can reach 4,000 mm and more in the Niger Delta. in 2018, about 42 communities in Edo state, where the project is located was submerged by flood. Over 8,000 houses and thousands of hectares of farmland were affected by the flood and no fewer than 30,000 persons were displaced. Four years later, in 2022, 12 Edo communities were submerged by flood as a result of torrential rain, destroying property, farmlands and displacing people.
	Projected Climate	The proportion of precipitation that falls in heavy events is projected to increase by approximately 20.79% in the coming decades. In the project location, annual maximum monthly rainfall (10-yr return level) is expected to increase by 8.5mm by mid-century, while the rainfall of very wet days is projected to increase by up to 87% within the same time frame (SSP5-8.5). Given the "High" current risk rating and that extreme precipitation and flooding are projected to continue in the future, the future exposure risk rating remains "High."
Sea Level Rise	Historical/Observed Trends	
	Projected Climate	
Storm Surge	Historical/Observed Trends	
	Projected Climate	
Strong Winds	Historical/Observed Trends	
	Projected Climate	
Wildfires	Historical/Observed Trends	

Insufficient Understanding	Not Exposure	Slightly Exposed	Moderately Exposed	Highly Exposed

3. Impacts on the Project's Physical Components Under Relevant Subsectors

This section presents the detailed results of screening for relevant subsectors to the Transportation project, including the project's investments in physical structures. The impact ratings are based on the exposure ratings and the understanding of the project's sensitivity by the user. Understanding the contribution of risks from the subsectors, both individually and collectively can help inform the process of dialogue, consultation, and analysis during project design.

The following guiding questions are used to assess potential impacts:

- Does the project design take into account recent trends and future projected changes in identified climate and geophysical hazards?
- Does the project design consider how the structural integrity, materials, siting, longevity and overall effectiveness of transportation infrastructure, if applicable, may be impacted?
- In particular, does the design "lock in" certain decisions for the future?

Roads

The potential impact of climate and geophysical hazards on the project's roads investments is rated based on exposure ratings for the location, and an understanding of the project's historical and future sensitivity to these risks. Please note that for this step, the tool is helping judge the effect that these impacts may have on the investment, and the ability of the project to sustain and enhance resilience of roads infrastructure and connectivity under a changing climate. Extreme temperatures and heavy precipitation, for example, can impact the performance and durability of the physical components of road infrastructure (e.g., asphalt, pavement, gravel), and take road infrastructure out of service temporarily or permanently. Sea level rise and storm surges also pose risks to tunnels and drainage systems and can overwhelm roads with water and storm debris. It is important that when planning and constructing road infrastructure, climate and disaster risks are integrated into decision making processes to enhance resilience in such contexts.

The ratings are based on expert judgment and an understanding of the local development context.

	Potential Impact	
	Historical/Observed Trends	**Projected Climate**
Roads		
Description of impacts		

Insufficient Understanding	No Potential Impact	Low Potential Impact	Moderate Potential Impact	High Potential Impact

Multi-Modal and Transit Systems

The potential impact of climate and geophysical hazards on the project's multi-modal and transit systems investments is rated based on exposure ratings for the location, and an understanding of the project's historical and future sensitivity to these risks. Please note that for this step, the tool is helping judge the effect these impacts may have on the investment, and the ability of the project to sustain and enhance multi-modal and transit systems under a changing climate. Many multi-modal and transit systems will face multiple threats from increased flooding, storm surge, and heat waves. For example, extreme precipitation or storm surge can cause flooding of tracks, bus ways, tunnels, lots, electrical equipment, or other facilities or assets. Any one of these factors (or the factors in combination), should be planned for in project design to facilitate more resilient infrastructure development, as well as implementing the necessary preparedness and contingency planning measures to mitigate the risks.

The ratings are based on expert judgment and an understanding of the local development context.

	Potential Impact	
	Historical/Observed Trends	**Projected Climate**
Multi-Modal and Transit Systems		
Description of impacts	Extreme precipitation or flash flood can cause tempory inundation of bus ways, terminals or other project facilities or assets. These could also also rapidly degrade unsealed, pavements, thereby raising rehabilitation and maintenance costs. Extreme heat poses another threat. High temperatures cause petroleum-based bitumen pavement to melt, increase lifecycle maintenance costs, and reduce the useful life of transportation assets. extreme weather such as heavy and intense rainfall and heat can negatively impact the mode shifting behavior of commuters who may chose the comfort and safety of their private cars and cab hailing services, as alternatives to public transport mode to cope with the challenges of adverse weather conditions.	Extreme precipitation and temperatures are expected to increase in the project area due to climate change, with implications for the project's investments.

Insufficient Understanding	No Potential Impact	Low Potential Impact	Moderate Potential Impact	High Potential Impact

4. Adaptive Capacity: modulating effect of the project’s soft components and development context

The potential impact on key components/subsectors due to exposure from hazards is modulated by the project's soft components (enabling and capacity building activities). The right kind of capacity building measures could increase preparedness and longer-term resilience and reduced the risks. An understanding of larger sector and development context with respect to key modulating factors helps to assess the climate risks in terms of adaptive capacity. For example, in the Transportation sector, policies and programs that facilitate diversified transportaion production systems may help reduce risks; while lack of appropriate Transportation sector policies such as pricing and subsidy policies may aggravate the risks.

In addition, vulnerable groups, namely women, migrants and displaced populations may be particularly affected by climate and disaster risks. Soft components can be designed to help alleviate the risks to women from climate and geophysical hazards.

The table below presents a summary description of the modulating effect the project’s soft components and broader development context, which includes the Transportation sector context and other social, economic and political factors.

Summary of Adaptive Capacity: modulating effect of the project’s soft components and development context

<table>
<tr><th colspan="3">Adaptive Capacity</th></tr>
<tr><td rowspan="2">Modulation of impacts by the project's soft components
Reduce Risk</td><td>Modulation of impacts by the project's Transportation sector context
Increase Risk</td><td>Women identified as particularly vulnerable to impacts from climate and geophysical hazards
Yes</td></tr>
<tr><td>Modulation of impacts by the project's social, economic and political factors
Reduce Risk</td><td>Components designed to help alleviate the risks to women from climate and geophysical hazards
Yes</td></tr>
</table>

Description of modulating effects of non-physical components:

Description of modulating effects of the Transportation sector context:

Description of modulating effects of social, economic and political factors in the project country:

5. Risk to the Outcome/Service Delivery of the Project

This section provides information on the level of risk to the outcome/service delivery that the project is aiming to provide based on previous ratings.

The actual ratings themselves, while instructive, should inform further consultations, dialogue, and future planning processes. Keep in mind that the greatest value of the tool is that it provides a structured and systematic process for understanding climate and disaster risks.

5.1 Level of Risk by Subsector

Table a. below highlights the impact ratings on the project's components/subsectors, and the overall risk to the outcome/service level for both Current and Future time frames.

The ratings are derived on the basis of the hazard information, subject matter expertise, contextual understanding of the project, and modulated on the basis of adaptive capacity and the large development context of the Transportation sector and country. The results indicate what components are most at risk. The results indicate where risks may exist within one or multiple components and where further work may be required to reduce or manage these risks. An ongoing process of monitoring risks, refining climate and other information, and regular impact assessment may also be appropriate.

Table a. Summary of Risk to Outcome/Service Delivery by Subsector

Sub-sector	Potential Impact		Non-Physical Components		Devlopment Context				Outcome/Service Delivery			
					Transportation-sector		Broader Context					
Time Frame	Historical/Observed Trends	Projected Climate	Historical/Observed Trends	Projected Climate	Historical/Observed Trends	Projected Climate	Historical/Observed Trends	Projected Climate	Historical/Observed Trends	Projected Climate		
Roads												
Multi-modal			Reduce Risk		Increase Risk		Reduce Risk		Reduce Risk		Increase Risk	Reduce Risk

Insufficient Understanding	No Risk	Low Risk	Moderate Risk	High Risk

5.2 Level of Risk by Time Frame

Table b. below draws attention to how climate impacts and risks shift from the Current to the Future time frame. Potential impacts to subsectors are evaluated separately for the Current and Future time frames to capture changes in the exposure from climate hazards over time. For example, projections might indicate that extreme temperature conditions and flood risk are likely to increase significantly. Both of these changes would affect transportation infrastructure.

For investments with long operational lifetimes, such as physical infrastructure, considering future climate variability and change is critical to avoid “locking in” designs and features that are only suited to the current climate. For example, roads can be inundated from sea level rise and storm surge or experience damage from earthquakes, while sustained temperatures above 42°C may affect pavement integrity. Furthermore, increases in very hots days can result in rail track deformations. Tunnels and drainage systems capacity can be overwhelmed by excessive precipitation and flooding. These impacts may influence the resilience of transportation investments.

Table b. Summary of Risk to Outcome/Service Delivery by Time Frame

	Historical/Observed Trends	Projected Climate

Sub-sector	Potential Impact	Non-Physical Components	Devlopment Context		Outcome/ Service Delivery	Potential Impact	Non-Physical Components	Devlopment Context		Outcome/ Service Delivery
			Transportation-sector	Broader Context				Transportation-sector	Broader Context	
Roads										
Multi-modal										

Insufficient Understanding	No Risk	Low Risk	Moderate Risk	High Risk

5.3 Key Drivers of Risk

Table c. below highlights the key drivers of risk for each project subsector ratings, in terms of hazards that are likely to pose the greatest challenge.

The ratings for the potential impact to each subsector reflect the aggregate rating across multiple hazards, drawing on all of the exposure information and expert judgment. For example, extreme temperatures can affect infrastructure and service delivery of multi-modal and transit systems, while sea level rise combined with storm surge can cause damage to port infrastructure.

Table C. Key Drivers of Risk

	Historical/Current Drivers	Future Drivers
Hazards & Location	Extreme Temperature Extreme Precipitation and Flooding	Extreme Temperature Extreme Precipitation and Flooding
Physical Components	Multi-modal and Transit Systems	Multi-modal and Transit Systems
Outcome/Servicedelivery	Multi-modal and Transit Systems	Multi-modal and Transit Systems

Key High Risk Moderate Risk

* If a cell is blank it implies there is 'No high or moderate risks 'identified for this aspects of the project.

Specific consideration should be given to those hazards which have high ratings, or are moving from moderate to high ratings over time. For example, sea-level rise may not be a key risk driver in the Historical/Current time frame; but may emerge as a key driver across multiple sectors in the future time frame. Understanding which hazards are key drivers may help flag follow-on work to manage climate risks within the design and delivery of the project.