TERMS OF REFERENCE
Climate Resilience Diagnosis and Mitigation Plan for Public Infrastructure in The Bahamas

Consultancy for the conceptual frameworks and methodology that will enable the planning and prioritization of intervention

1. Background and Justification:

The IDB is implementing the Technical Cooperation: Climate Resilience Diagnosis and Mitigation Plan for Public Infrastructure in The Bahamas on climate resilience. The Transport Division (INE/TSP) is looking for a firm to support the assessment of climate risks posed by increased variability in climate change related weather patterns and to support the planning and implementation of adaptation measures to improve the resilience of public infrastructure to climate change impacts. Specifically, the aim is to map the degree of severity of climate risks posed to critical transport corridors and associated energy and water supply infrastructure along those corridors, and to create a prioritized set of risk mitigation investments and costs for the Government of The Bahamas.

The Inter-American Development Bank (IDB) is the main source of multilateral financing for economic, social, and institutional development in Latin America and the Caribbean (LAC). Many of these investments may be exposed to observed and anticipated impacts of climate change (CC), which indeed pose a significant threat to sustainable development in the region. These have the potential to significantly cripple climate-sensitive economic sectors and zero out decades of prioritized work on poverty reduction. The expected impacts vary largely among country regions and sectors and include, among others, increasing intensity and frequency of extreme weather events, a rising sea level and long-term changes in water availability. The Caribbean Region is particularly vulnerable to these impacts, especially due to its large coastal population centers and the position of many countries within areas that are subject to recurrent disasters or frequent water scarcity.

The most recent evidence on the effects of climate change reveals that natural disasters crises have significant socioeconomic implications for Small Island Developing States (SIDS). The concentration of population centers and infrastructure along mostly in coastal areas, leads to high risks of exposure to storm surges and flooding. Their reliance on sectors such as tourism renders these countries vulnerable to changes in consumption patterns and commodity prices resulting from macroeconomic disruptions. SIDS are likely to continue suffering significant economic and social impacts from these events given that their exposure is high and their preparedness levels insufficient. According to the International Monetary Fund (IMF), the average annual estimated GDP loss from natural disasters and climate change for small states in Latin America and the Caribbean (LAC), 16%, with 11% of the population affected (versus 2.5% GDP loss and 1% of population affected for larger countries). Latest estimates show that the largest damage in Caribbean islands have been associated with Tropical Cyclones that have resulted in damages of 82% of GDP on average over the period of 1950-2014. Given that most economic activity, including transportation infrastructure and critical power networks, are located on the coastal areas of the islands, they are highly exposed to the impacts of storms and hurricanes and associated storm surge and inundation.

The Transport division (INE/TSP) is looking for a firm with background in environmental engineering, disaster risk management, climate change adaptation, risk modeling, information systems engineering, and differential effects of climate change on infrastructure on vulnerable populations including women, children, the elderly, people with reduced mobility and/or disabilities, to develop a robust conceptual and research framework and design a model for the assessment of the risks posed by climate change to infrastructure and assess the effects of climate hazards such as flooding and storm surges on transport, energy, and water and sanitation infrastructure, examining both slow-onset hazards, such as those likely to occur from increased intensity of rainfall and sea-level rise, and episodic hazards, due to extreme weather events in the island of New Providence in The Bahamas.

2. Challenges

An archipelagic nation made up of 700 low lying islands and cays of which 30 islands are inhabited, is in the Atlantic Ocean and north Caribbean Sea, The Bahamas is one of the most vulnerable countries in the Latin America and Caribbean region to climate hazard events. Small island states are increasingly affected by rising temperatures, which are predicted to continually increase even under the most optimistic scenarios of greenhouse gas reductions. In the Caribbean, additional warming could lead to a drier region (5–15% less rain than present day).

In the past two decades (2000-2020), the country has been hit by 15 major disasters, mainly hurricanes (EM-DAT, 2021). The high winds and flooding from heavy rains and storm surges from these disasters have resulted in over US$6 billion in public infrastructure and housing losses (EMDAT, 2021). Moreover, increases in temperatures and the frequency and duration of heat waves are predicted pose increasing and substantial challenges to transport infrastructure and operations, including to the safety/health of transport road users, public transit passengers, and pedestrians (UNCTAD, 2020).

Infrastructure coverage, capacity, quality, and resilience are essential to enabling access to opportunities and services, reducing poverty and inequality, promoting security, and fostering productivity. However, infrastructure assets in The Bahamas are likely to be increasingly severely affected by increased intensity of climate events and may be unable to accommodate heavy rain and storms. Recently, The Bahamas has experienced unusually heavy short duration rainfalls where almost 12 inches of rain fell in 24 hours causing widespread localized flooding or roads disrupting vehicle movements and causing damage, reducing accessibility to public services, disruption of the provision of public services and reduction in mobility for vulnerable parts of the population that use non-vehicular modes of transportation.

In addition, vulnerable and disadvantaged populations, such as low-income populations, persons with disabilities, children and the elderly are more exposed and vulnerable to impacts of climate change in The Bahamas.

3. Deliverables:

i. Develop a framework and methodology for assessing climate risks for road transport corridors and the planning and prioritization of interventions to strengthen infrastructure climate resilience, the design of methodology, indicators, assessment models, tools, and review of literature to support the framework design.

ii. Collect needed data on precipitation, flooding, wind, capacity of drainage infrastructure and type energy infrastructure in New Providence, The Bahamas.
iii. Hold and lead stakeholder Workshops to gather feedback on method and assessments and plan.
iv. Develop, plan, and carry out a capacity building workshop on road transport resiliency in The Bahamas: present the methodology and explain the step-by-step process to stakeholders.
v. Participate in calls and meetings related to the project.
vi. Prepare and organize workshops related to the project.
vii. Prepare intermediary and final reports.

4. Schedule of Payment

Preliminary Report including deliveries i) for the 25%
First review report including deliveries ii) for the accumulated 50%
Second review report including deliveries iii) and iv) for the accumulated 75%
Final report and deliveries for remaining 25%.

5. Reporting Requirements

Every report must be submitted to the team and the Bank in an electronic file.
The report should include the cover, main document, and all annexes.

6. Acceptance Criteria

The acceptance of each deliverable will be submitted by the team leader via email to the consultant partner.

7. Supervision and Reporting

All activities will be coordinated by the IDB project Team Leader Lynn Scholl, INE/TSP (LSCHOLL@IADB.ORG) in coordination with Christopher Persaud (CHRISP@IADB.ORG) and Seungyeon Kim (SEUNGYEONK@IADB.ORG)

TERMS OF REFERENCE
Climate Resilience Diagnosis and Mitigation Plan for Public Infrastructure in The Bahamas

Assessment of the effects of climate hazards such as flooding and storm surges on transport

1. Background and Justification:

The IDB is implementing the Technical Cooperation: Climate Resilience Diagnosis and Mitigation Plan for Public Infrastructure in The Bahamas on climate resilience. The Transport Division (INE/TSP) is looking for a firm to support the assessment of climate risks posed by increased variability in climate change related weather patterns and to support the planning and implementation of adaptation measures to improve the resilience of public infrastructure to climate change impacts. Specifically, the aim is to map the degree of severity of climate risks posed to critical transport corridors and associated energy and water supply infrastructure along those corridors, and to create a prioritized set of risk mitigation investments and costs for the Government of The Bahamas.

The Inter-American Development Bank (IDB) is the main source of multilateral financing for economic, social, and institutional development in Latin America and the Caribbean (LAC). Many of these investments may be exposed to observed and anticipated impacts of climate change (CC), which indeed pose a significant threat to sustainable development in the region. These have the potential to significantly cripple climate-sensitive economic sectors and zero out decades of prioritized work on poverty reduction. The expected impacts vary largely among country regions and sectors and include, among others, increasing intensity and frequency of extreme weather events, a rising sea level and long-term changes in water availability. The Caribbean Region is particularly vulnerable to these impacts, especially due to its large coastal population centers and the position of many countries within areas that are subject to recurrent disasters or frequent water scarcity.

The most recent evidence on the effects of climate change reveals that natural disasters crises have significant socioeconomic implications for Small Island Developing States (SIDS). The concentration of population centers and infrastructure along mostly in coastal areas, leads to high risks of exposure to storm surges and flooding. Their reliance on sectors such as tourism renders these countries vulnerable to changes in consumption patterns and commodity prices resulting from macroeconomic disruptions. SIDS are likely to continue suffering significant economic and social impacts from these events given that their exposure is high and their preparedness levels insufficient. According to the International Monetary Fund (IMF), the average annual estimated GDP loss from natural disasters and climate change for small states in Latin America and the Caribbean (LAC), 16%, with 11% of the population affected (versus 2.5% GDP loss and 1% of population affected for larger countries). Latest estimates show that the largest damage in Caribbean islands have been associated with Tropical Cyclones that have resulted in damages of 82% of GDP on average over the period of 1950-2014. Given that most economic activity, including transportation infrastructure and critical power networks, are located on the coastal areas of the islands, they are highly exposed to the impacts of storms and hurricanes and associated storm surge and inundation.

The Transport division (INE/TSP) is looking for a firm with background in environmental engineering, disaster risk management, climate change adaptation, risk modeling, information systems engineering, and differential effects of climate change on infrastructure on vulnerable populations including women, children, the elderly, people with reduced mobility and/or disabilities, to develop a robust conceptual and research framework and design a model for the assessment of the risks posed by climate change to infrastructure and assess the effects of climate hazards such as flooding and storm surges on transport, energy, and water and sanitation infrastructure, examining both slow-onset hazards, such as those likely to occur from increased intensity of rainfall and sea-level rise, and episodic hazards, due to extreme weather events in the island of New Providence in The Bahamas.

2. Challenges

An archipelagic nation made up of 700 low lying islands and cays of which 30 islands are inhabited, is in the Atlantic Ocean and north Caribbean Sea, The Bahamas is one of the most vulnerable countries in the Latin America and Caribbean region to climate hazard events. Small island states are increasingly affected by rising temperatures, which are predicted to continually increase even under the most optimistic scenarios of greenhouse gas reductions. In the Caribbean, additional warming could lead to a drier region (5–15% less rain than present day).

In the past two decades (2000-2020), the country has been hit by 15 major disasters, mainly hurricanes (EM-DAT, 2021). The high winds and flooding from heavy rains and storm surges from these disasters have resulted in over US$6 billion in public infrastructure and housing losses (EMDAT, 2021). Moreover, increases in temperatures and the frequency and duration of heat waves are predicted pose increasing and substantial challenges to transport infrastructure and operations, including to the safety/health of transport road users, public transit passengers, and pedestrians (UNCTAD, 2020).

Infrastructure coverage, capacity, quality, and resilience are essential to enabling access to opportunities and services, reducing poverty and inequality, promoting security, and fostering productivity. However, infrastructure assets in The Bahamas are likely to be increasingly severely affected by increased intensity of climate events and may be unable to accommodate heavy rain and storms. Recently, The Bahamas has experienced unusually heavy short duration rainfalls where almost 12 inches of rain fell in 24 hours causing widespread localized flooding or roads disrupting vehicle movements and causing damage, reducing accessibility to public services, disruption of the provision of public services and reduction in mobility for vulnerable parts of the population that use non-vehicular modes of transportation.

In addition, vulnerable and disadvantaged populations, such as low-income populations, persons with disabilities, children and the elderly are more exposed and vulnerable to impacts of climate change in The Bahamas.

3. Deliverables:

i. Assessment of the effects of climate hazards such as flooding and storm surges on transport and energy infrastructure on New Providence Road as well as wind on energy infrastructure.
ii. Analysis of opportunities and prioritization of interventions to improve infrastructure resilience.

iii. Develop a plan for inclusive strategies to mitigate the risks of and respond to flooding and disaster with attention to the needs of poor and low-income populations, persons with disabilities, elderly, women, and children.
iv. The assessment of the differentiated impacts of climate change on women workload: once the firm has identified the infrastructure that might be affected for climate changes disasters, they must analyze which of these is highly used by women and identify the effects of its damage of female population, considering they are the main responsible of caring activities. It should consider the socioeconomic impacts of damage on roads, sidewalks, and limited operation of public transport, to define how these conditions impede their accessibility to the public services they use the most, like education and health. The results of this analysis must be shared with the counterpart team to sensitize about the importance of the gender approach on climate change.
v. Hold and lead stakeholder Workshops to gather feedback on method and assessments and plan.
vi. Develop, plan, and carry out a capacity building workshop on road transport resiliency in The Bahamas: present the methodology and explain the step-by-step process to stakeholders.
vii. Participate in calls and meetings related to the project.
viii. Prepare and organize workshops related to the project.
ix. Prepare intermediary and final reports.

4. Schedule of Payment

Preliminary Report including deliveries i) and ii) for the 25%
First review report including deliveries iii), iv) v) for the accumulated 50%
Second review report including deliveries vi) for the accumulated 75%
Final report and deliveries for remaining 25%.

5. Reporting Requirements

Every report must be submitted to the team and the Bank in an electronic file.
The report should include the cover, main document, and all annexes.

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7. Supervision and Reporting

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TERMS OF REFERENCE
Climate Resilience Diagnosis and Mitigation Plan for Public Infrastructure in The Bahamas

Consultancy for the implementation of the hydrological modeling pilot with drones and organization of a capacity building workshop.

1. Background and Justification

1.1 The most recent evidence on the effects of climate change reveals that natural disasters crises have significant socioeconomic implications for Small Island Developing States (SIDS). The concentration of population centers and infrastructure along mostly in coastal areas, leads to high risks of exposure to storm surge and flooding. Their reliance on sectors such as tourism renders these countries vulnerable to changes in consumption patterns and commodity prices resulting from macroeconomic disruptions. SIDS are likely to continue suffering significant economic and social impacts from these events given that their exposure is high and their preparedness levels insufficient. According to the International Monetary Fund (IMF), the average annual estimated GDP loss from natural disasters and climate change for small states in Latin America and the Caribbean (LAC), 16%, with 11% of the population affected (versus 2.5% GDP loss and 1% of population affected for larger countries). Latest estimates show that the largest damage in Caribbean islands have been associated with Tropical Cyclones that have resulted in damages of 82% of GDP on average over the period of 1950-2014. Given that most economic activity, including transportation infrastructure and critical power networks, are located on the coastal areas of the islands, they are highly exposed to the impacts of storms and hurricanes and associated storm surge and inundation.

1.2 An archipelagic nation made up of 700 low lying islands and cays of which 30 islands are inhabited, is in the Atlantic Ocean and north Caribbean Sea, The Bahamas is one of the most vulnerable countries in the Latin America and Caribbean region to climate hazard events. According to the IPCC (2022), small island states are increasingly affected by rising temperatures, which are predicted to continually increase even under the most optimistic scenarios of greenhouse gas reductions. In the Caribbean, additional warming could lead to a drier region (5–15% less rain than present day. Additionally, over the past 33 years sea level rise has occurred at a rate of about two to four cm per decade, posing risks to the region's freshwater resources and to its largely coastal population dependent on tourism and agriculture (IDB, 2014).

1.3 In the past two decades (2000-2020), the country has been hit by 15 major disasters, mainly hurricanes (EM-DAT, 2021). The high winds and flooding from heavy rains and storm surges from these disasters have resulted in over US$6 billion in public infrastructure and housing losses (EMDAT, 2021). Moreover, The Bahamas is expected to experience rising temperatures and reduced rainfall. Combined with a drier climate, more extreme weather events can place additional stress on infrastructure. Damaged transport assets, as infrastructure structural integrity, operational capacity, from increased variability and extreme weather events, that in turn can lead to reduced mobility and access to key destinations, disrupted power, and lead to loss of life, and can represent a sizable portion of economic losses. Moreover, increases in temperatures and the frequency and duration of heat waves are predicted pose increasing and substantial challenges to transport infrastructure and operations, including to the safety/health of transport road users, public transit passengers, and pedestrians (UNCTAD, 2020).

1.4 This project aims to assess the climate risks posed by increased variability in climate change related weather patterns and to support the planning and implementation of adaptation measures to improve the resilience of public infrastructure to climate change impacts. Specifically, the aim is to map the degree of severity of climate risks posed to critical transport corridors and associated energy and water supply infrastructure along those corridors posed by climate change, and to create a prioritized set of risk mitigation investments and costs for the Government of The Bahamas.

1.5 The analysis will build upon existing models for New Providence to simulate hydrometeorological risks for a range of climate hazards and potential future damages along road corridors and by extension adjacent public infrastructure (i.e., energy, water and sanitation, health, and education infrastructure). Based on the results of the modeling exercises, an investment plan of the interventions and financial needs will be prepared to ensure an adequate climate-resiliency upgrade of current infrastructure stock, including a focus on increasing the stock of sustainable and inclusive infrastructure systems, and requirements to create the enabling policy environment and institutional conditions needed to scale up, sustain, and replicate resilient and environmentally sustainable infrastructure projects in the country.

2. Objectives

2.1 The objective of this consultancy is to introduce technology-based hydrology wind modeling solution in New Providence and disseminate the methodology of the TC through a capacity building workshop. The specific outputs include:

(i) Workplan for pilot project and capacity building workshop
(ii) Implementation of pilot to test technology-based solution for flood modeling
(iii) Organization of workshop in Bahamas to disseminate the results and methodology of the TC, as well as to share South Korea’s experience and knowledge regarding sustainable climate resilient infrastructure.
(iv) Preparation of presentations and reports to share the project results.

3. **Deliverables**

3.1 This Terms of Reference will be used to select and hire a consultant for strengthening the Bahamas Government's capacities on innovative and technology-based solutions for sustainable and climate resilient infrastructure through pilot project and knowledge transfer. The scope of the services includes but is not limited to:

(i) Pilot of technology-based hydrology modeling using drones and AI-technology.

Identify a major section of flood prone area to implement the pilot and complement Component 2 in consultation with the Bahamas government.
Conduct a pilot project of hydrology modeling using Korea's drone and AI-based technology.
Elaborate a report on the results, lessons-learned, and recommendations.

(ii) Capacity building activities for Bahamas government officials

Session for introducing technology and result sharing of the pilot project.
Seminar on Korea's experience in sustainable public infrastructure (Invitation of public/private enterprises of Korea).

4. **Schedule of Payments**

Payment Schedule	
Deliverable	**%**
Product 1	20%
Product 2	40%
Product 3	40%

5. **Reporting Requirements**

5.1 Key project deliverables and milestones must be delivered or executed on the dates proposed by the consultant in the work plan. Any changes to the project schedule must have the express approval of the executing agency, Beneficiary country and the IDB.

5.2 The consultant shall maintain close coordination and communication with the Beneficiary regarding the execution of activities and events for dissemination.

6. **Acceptance Criteria**

The acceptance of each deliverable will be submitted by the team leader via email to the consultant partner.

7. **Supervision and Reporting**

All activities will be coordinated by the IDB project Team Leader Lynn Scholl, INE/TSP (LSCHOLL@IADB.ORG) in coordination with Christopher Persaud (CHRISP@IADB.ORG) and Seungyeon Kim (SEUNGYEONK@IADB.ORG)