Climate and Disaster Risk Screening - Sector Screening Guidance Note
Transportation Sector

This Sector Screening Guidance Note provides an end-to-end roadmap of the climate and disaster risk screening process.

Climate and disaster risk screening applies to:

- All IDA operations
- All IBRD operations starting July 1, 2017

Why screen for climate and disaster risk?

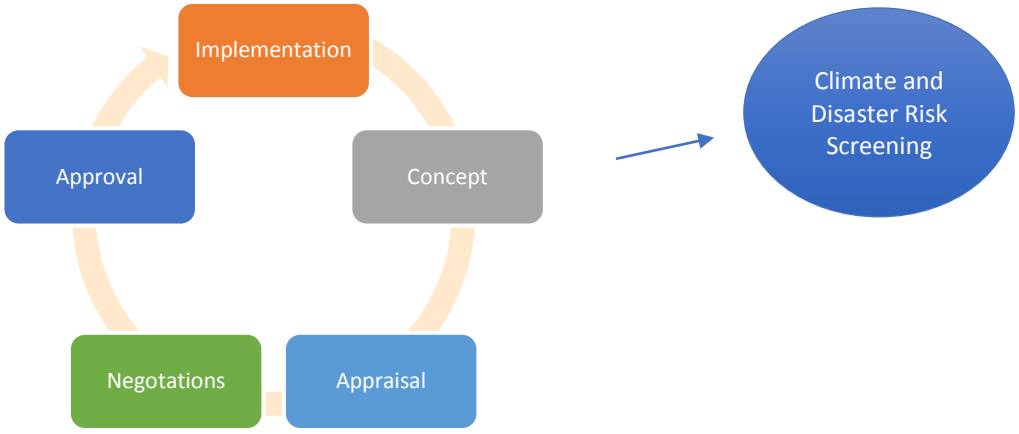
- Meeting the corporate climate commitment (WBG Climate Change Action Plan (CCAP) commits to increasing the climate related share of the portfolio to 28% by 2020)
- Complying with the screening requirement (IDA-17 policy commitment to screen operations since July 1, 2014; commitment will continue under IDA-18; screening requirement extended to IBRD operations starting July 1,2017 as per CCAP commitment)

What is climate and disaster risk screening?

- A **proactive approach to managing short- and long-term climate and disaster risks** with the final aim of integrating appropriate resilience measures in development policies, programs and projects

When to screen operations?

- Climate and disaster screening is carried out at an **early concept stage** of the project cycle



What information is required for screening?

- An initial understanding of project components and location
- Some knowledge of the project's country context including the water sector context and the political, social and economic context
- No specialized knowledge of climate change and disasters is required

Where to get screening support?

- Visit the Country Adaptation Profiles and Climate Change Knowledge Portal (CCKP) for information on climate and disaster risks
- Watch the training videos for screening and the CCKP
- Follow an e-learning course

- Join a face to face training session
- Contact the Climate Help Desk at climatescreeninghelpdesk@worldbankgroup.org

What screening tools are available?

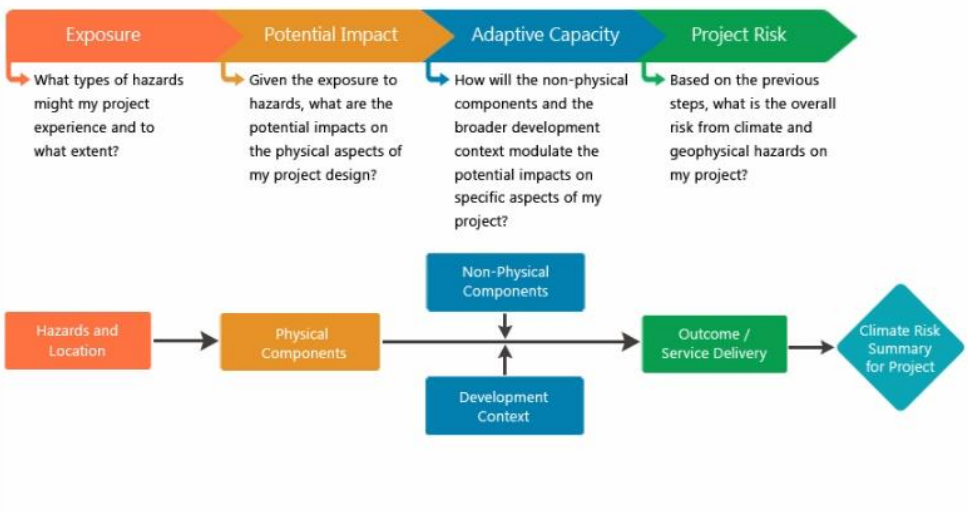
- Two screening tools are available: one **Rapid Screening Assessment** and one **In-Depth Screening Assessment**
- The tools can be used for all WBG lending and financing instruments
- **Note**: These tools provide high-level screening at an early stage of project and/or program development. They **do not** provide a detailed risk analysis, nor do they suggest specific options for increasing the project's resilience. They are intended to help determine the need for further studies, consultation and/or dialogue in the course of project and/or program design.

Tool	Description	Completion Time	Outputs
Rapid Screening Assessment	• Provides a lightweight, rapid assessment of current and future climate and disaster risks. • A good option for users who already have knowledge on the climate and disaster risks that may impact their project/program.	Around 30 minutes	Downloadable summary report of selected risk ratings to be included in project and/or program documents
In-Depth Screening Assessment	• Provides a more in-depth assessment of current and future climate and disaster risks. • A good option for users who may need additional guidance on the climate and disaster risks that may impact their project/program.	Around 2 hours	Downloadable detailed project risk report to be included in project and/or program documents

What are the key steps to screen for climate and disaster risks using the WBG screening tools?

The screening tools follow four main steps:

1. Exposure
2. Potential Impact
3. Adaptive Capacity
4. Risks to the Project Outcome/Service Delivery



STEP 1: EXPOSURE OF PROJECT LOCATION TO CLIMATE AND GEOPHYSICAL HAZARDS

- This step assesses the current and future exposure of the project location to relevant climate and geophysical hazards.
- This is based on climate information drawing on global, quality controlled data sets from the Climate Change Knowledge Portal (CCKP)
- Understanding the climate trends is important as they act individually and collectively on project components
- Certain climate indicators are specifically relevant for transportation projects

Climate and geophysical hazards	Guiding questions for transportation projects
Extreme temperature	• Is annual and monthly temperature (i.e. seasonality) projected to change? • Is the frequency, intensity and duration of extreme temperatures projected to change?
Extreme precipitation and flooding	• Are annual and monthly (i.e. seasonality) precipitation patterns projected to change? • Is the frequency, intensity and duration of extreme precipitation projected to change?
Droughts	• Is the frequency, intensity and duration of droughts projected to change?
Strong Winds	• Is the project location exposed to winds from tropical cyclones, such as hurricanes or typhoons?
Sea level rise	• Is local sea level projected to change by the end of the project lifetime?
Storm surge	• Does the project location include areas that have experienced storm surge in the past?
Geophysical hazards (earthquakes, volcanic eruptions, landslides, etc.)	• Have there been historical earthquakes? • Is the project located below a dam or levee that could be damaged by flood? • Is the project located in a tsunami zone area? • Is the project located near an active volcano? • Has the location of the project ever experienced landslides or wildfires in the past?

STEP 2: IMPACT ON THE PROJECT'S PHYSICAL INFRASTRUCTURE AND ASSETS

- This step assesses the current and future impacts of identified climate and geophysical hazards on the project's physical infrastructure and assets as currently designed under relevant subsectors
- Understanding where risks may exist within one or multiple components and identifying where further work may be required to reduce or manage these risks can help inform the process of dialogue, consultation and analysis during project design

Transportation subsectors	Potential impacts from climate and geophysical hazards
Roads	• Extreme precipitation and flooding can prevent access to roads by motorists or maintenance crews. It also poses risks to tunnels and drainage systems by overwhelming them with water and storm debris • Some types of asphalt binder have exhibited sensitivity beginning at 42°C, particularly if combined with truck traffic • There is an employee health & safety risk possible above 30°C and a high risk above 40°C • There is a potential for significantly reduced operational capacity above 46°C due to impacts on both the road surface and vehicle operation • Thresholds for damage to roads and drainage systems are often observed at the 50 to 100-year flood level • Bridges, which are often designed with higher thresholds in mind, may be susceptible to 100-500 year floods • Strong winds have been observed to impact usability of roads above 62 km/hr and pose a significant hazard above 119 km/hr • Winds over 150 km/hr may cause damage to permanent road signage • Winds over 225 km/hr may cause stress to bridges
Multi-modal and transit systems	• Extreme precipitation or storm surge can cause flooding of tracks, bus ways, tunnels, lots, electrical equipment, or other facilities or assets • Extreme temperatures can cause track or road buckling • High winds and debris can cause damage to transit structures • Heavy precipitation can reduce visibility of signals and impede traffic due to ponding on roads • Transit systems that rely on catenary lines may require speed restrictions when high temperatures cause sagging of lines, or may experience disruption of services when strong winds cause trees to fall on the lines • Extreme weather conditions can also impact the health and safety of multi-modal and transit workers and passengers
Rail	• Storm surge and flooding can cause track washout and bridge scour • Extreme temperatures can cause track buckling • Continuous welded rail is more susceptible to buckling from heat than joint rail • Rock ballast is more susceptible to buckling than concrete slab, since concrete slab provides stronger support • Wood ties are more sensitive to inundation than concrete ties, since immersion in water softens or expands the wood, weakening its ability to support tracks • Rail systems that rely on catenary lines may require speed restrictions when high temperatures cause sagging of lines, or may experience disruption of services when strong winds cause trees to fall on the lines • Extreme weather conditions can also impact the health and safety of rail workers and passengers
Aviation	• Extreme temperatures can cause buckling of airport runways, pavements, and access roads • Flooding can inundate and damage runways and parked aircraft

	• Storm surge and sea level rise can inundate assets and equipment at low-lying, coastal airports • Exposure to salt water can cause short-circuiting and accelerated corrosion of electrical equipment • Extreme temperatures can reduce aircraft lift and require longer take off runs • Extreme weather conditions can impact the health and safety of aviation workers and passengers
Marine transportation	• Storm surge and flooding can damage marine port buildings and equipment, including damage to structures from increased wave and water loads and increased corrosion due to exposure to salt water • Sea level rise can lower the clearance under waterway bridges • Extreme precipitation can increase erosion and sedimentation around harbors and access channels • Extreme temperatures can cause buckling of the port's paved surfaces and access roads • Changes in extreme precipitation can result in need for additional dredging • Extreme weather conditions can also impact the health and safety of marine transport workers and passengers
River transportation	• Extreme temperatures can cause buckling of paved surfaces • Flooding can damage port buildings and equipment in buildings • Drought can cause low water levels that decrease cargo limits, restrict ship navigability and berthing, and potentially require additional dredging • Sea level rise can cause water to back up and increase upstream flooding in nearby rivers, which can damage port infrastructure and alter navigation channels • Drought can cause water levels to periodically decrease and limit inland shipping • Heavy precipitation can increase sedimentation and reduce accessibility of channels • Changes in extreme precipitation can result in need for additional dredging • Extreme weather conditions can also impact the health and safety of river transport workers and passengers

STEP 3: MODULATING EFFECT OF THE PROJECT'S ADAPTIVE CAPACITY

- This step assesses how potential impacts on key components/subsectors due to exposure to hazards is modulated by the project's soft components and broader development context.
- The right kind of soft components can increase preparedness and long-term resilience and reduce risk.

	Modulating effect of adaptive capacity
Soft components: Policy development, Long-term strategic planning, Capacity building, Training and Outreach, Emergency Planning, Data gathering, monitoring and	• Establishing information systems that can collect and monitor information on future climate and disaster risks • Emergency protocols to respond to natural disasters, such as tropical cyclones

Information Management System, Maintenance and Operations	• Capacity building and training to help prepare for and cope with hazards or build longer-term resilience • Budgeting processes that account for additional maintenance costs to address increasing damages from hazards, and • Flexibility in the project's management protocols that allow them to be adapted to changing hazards
Sector context: Transportation	• Having alternative means of transportation (such as secondary roads or other modes of transport) can reduce risk by providing critical supplies and services if your project is disrupted by climate or geophysical hazards • Having the capacity and systems in place to identify and respond to disruptions from climate and geophysical hazards can lessen their duration and severity • Alternative routes are readily available, and they are resilient to the impacts of climate and geophysical hazards • The roads authority is actively monitoring climate change impacts and taking steps to combat them • Emergency protocols are in place that enables the roads authority to quickly and effectively respond to natural disasters.
Social, economic and political factors: Access to technology, Prices (food and energy), Financial resources, Conflict, Political instability, Legal enforcement, Population growth, Urbanization, Land ownership issues, Land and soil quality, Nutrition, Education, Gender	• The impact of a service disruption can be significantly greater if the affected infrastructure provides access to publicly critical facilities or areas such as hospitals and schools • Access to technology can reduce impacts by improving communications before, during, and after extreme weather events

- This step is also a place to think about particularly vulnerable groups including **women, migrants and displaced populations**.

Women, migrants and displaced populations	**Adaptive capacity elements that help alleviate risks**
Soft components	• Capacity building that enables women to serve as decision makers and effective agents for community preparedness for flooding and other extreme events. This can improve their standing in the public sphere as leaders and reduce disproportionately high mortality rates among women in such disasters • Transport infrastructure improvement project can include a component focusing on building flash-flood refuges for women and children in economic centers to address their needs during heavy rainfall seasons

	• Incorporating changing climate and migration patterns in population projections when estimating the population to be served by a transportation system
Development context	• Equal access to information and communication technologies (ICT) including radio, TV, and mobile devices to easily access weather forecasts can reduce the impacts of extreme events on women.

STEP 4: RISK TO PROJECT OUTCOME/SERVICE DELIVERY

- This step assesses the level of risk to the outcome/service delivery that the project is aiming to provide
- The screening tools will provide guidance on next steps to take and on how to use your risk assessment based on the level of risk identified for your project
- The table below provides some general guidance based on risk ratings for project outcome/service delivery:

HIGH RISK	• You are strongly encouraged to conduct a more detailed risk assessment and to explore measures to manage or reduce those risks.
MODERATE RISK	• For areas that your screening has identified as at *Moderate Risk*, you are encouraged to build on the 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
LOW/NO 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.
INSUFFICIENT UNDERSTANDING	• Gather more information to improve your understanding of climate and geophysical hazards and their relationship to your project

Please see below for some climate risk management measures for typical transportation projects for your consideration.

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 • 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 • Increase ice-free shipping season and increase ice-free ports and resources in remote areas • Prolong season for barge transport • 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

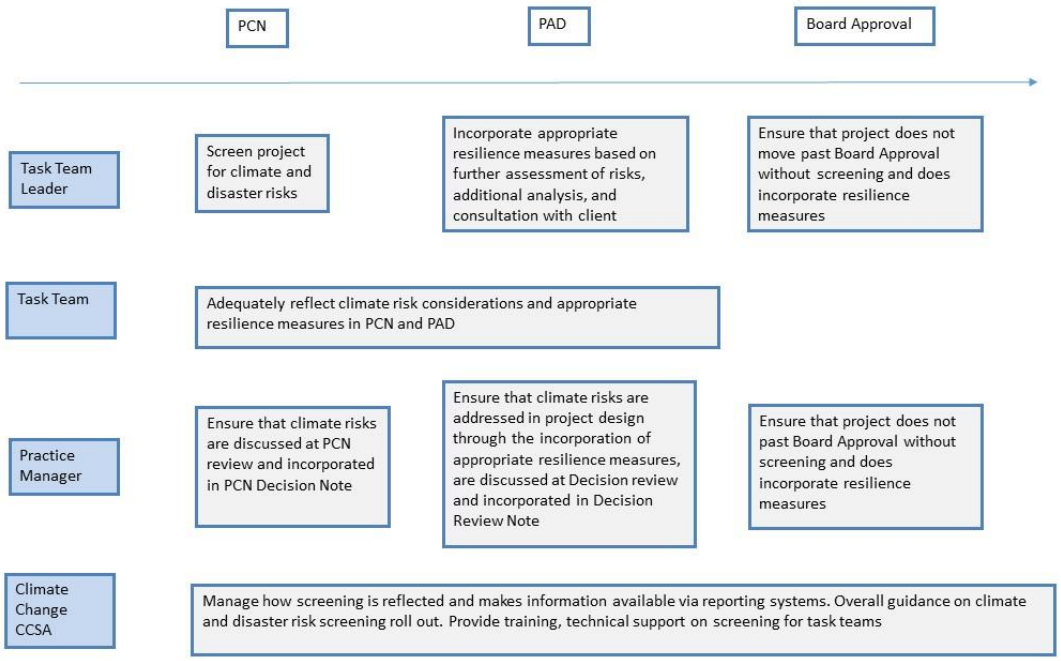
Changes in Infrastructure Design and Materials	• Develop new, heat-resistant paving materials for construction of roadways, runways, and rail tracks • Increase use of heat-tolerant street and highway landscaping • Greater use of continuous welded rail lines to avoid rail-track deformities • Use insulation 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 • Restrict further development in high density coastal areas and floodplains by increasing flood insurance rates • Upgrade existing infrastructure drainage systems and increase standards for new transportation infrastructure and major rehabilitation projects (e.g., assuming 100-year and 500-year storm) • Increase pumping capacity for tunnels • Increase culvert capacity • 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
Accommodate/ Manage	• 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 • Plan for extreme event evacuation • Design flood risk-management plans with both ecosystem- and construction-based adaptation options • Increase financial and technical resources for more frequent maintenance and repairs • Temporarily close airports and ports when extreme weather events occur
Protect/ Harden	• Update design standards to elevate roadways to accommodate future sea level rise and high winds • Consider storm surge in coastal road planning • Use flexible, expandable materials in railway systems • Use improved asphalt/concrete mixtures for roads and runways • Protect critical evacuation routes • Protect bridge piers and abutments with riprap
Retreat/	• Plan for community relocation in coastal areas

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, community, or sector • 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 • 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

WHO DOES WHAT AND WHEN?

- The figure below depicts clear roles and responsibilities for the TTL, task team, relevant Manager, and Climate Change CCSA at key points in the project cycle, as related to screening.



- Task teams should be able to do the following at project concept and appraisal stage:

Project concept stage	Project appraisal stage
• Identify the climate change and disaster risks that could potentially impact project outcomes • Determine, based on available knowledge, the level of risk to project outcomes • Discuss screening results at the project concept note review meeting and record decision on potential level of risk to project outcomes in the review minutes	• Demonstrate how the project components can be better designed. As appropriate, understand how to integrate resilience measures into project design • Discuss key climate and disaster risks and resilience considerations at the PAD review meeting and record decisions in the decision meeting minutes

HOW TO REFLECT SCREENING IN PROJECT DOCUMENTS?

- Summarize potential climate and disaster risks in the 'Introduction and Context" and the "Overall Risk and Explanation" sections of the PCN document.
- Where risks exist, identify potential resilience-enhancing measures in appropriate sections.
- If risks and resilience-enhancing measures have not been identified at PCN stage, these must be considered by appraisal stage and reflected in the appropriate sections of the PAD.

Additional Resources

For information on climate data:

- The World Bank's Climate Change Knowledge Portal (CCKP) provides historical and future climate and climate-related datasets.
- The CCKP's Country Adaptation and Risk Profiles synthesize and distill datasets for the purposes of the screening tool.
- The Intergovernmental Panel on Climate Change (IPCC) Working Group I's contribution to the IPCC's Fifth Assessment Report presents the latest (as of summer 2014) in observed climate changes and future climate projections.

For more information on climate change impacts on transportation systems:

- Turn Down the Heat: Why a 4°C Warmer World Must be Avoided is a World Bank report focused on the impacts of climate change on developing countries.
- Turn Down the Heat: Climate Extremes, Regional Impacts and the Case for Resilience builds on the previous report and focuses on impacts in Sub-Saharan Africa, South East Asia and South Asia.
- Turn Down the Heat : Confronting the New Climate Normal is a World Bank Report that builds on previous reports and focuses on impacts to development in Latin America and the Caribbean, the Middle East and North Africa, and parts of Europe and Central Asia.
- Potential Impacts of Climate Change on U.S. Transportation by the U.S. Transportation Research Board, identifies climate vulnerabilities to the transportation system.
- "Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I". This study explores how climate will affect transportation, and Table 1.1 identifies a comprehensive list of climate impacts on transportation identified through a literature review.
- "Addressing Climate Change Impacts on Infrastructure: Transportation" is a factsheet released by USAID that summarizes climate stressors on transportation systems.
- The National Research Council's Special Report on "Potential Impacts of Climate Change on U.S. Transportation" provides an overview of the scientific consensus on current and future climate changes to the transportation sectors and identify adaptation options to such changes.

For more information on case studies that identify climate change impacts and vulnerabilities to a country's transportation system:

- The World Bank series *Making Transport Climate Resilient*, includes three case studies-- Country Report: Ghana, Country Report: Ethiopia, and Country Report: Mozambique that identify country-specific climate impacts on roads, identify adaptation measures, conduct economic assessments, and develop short- and long-term strategies.
- Asian Development Bank's Climate Proofing: A Risk-based Approach to Adaptation features a case study, "Climate Proofing a Road-building Infrastructure Project in Kosrae, Federated State of Micronesia." The analysis develops a climate-proofed design adjusted for rainfall projections and estimates the design's marginal cost and net benefit.

- The UK Highways Agency Climate Change Risk Assessment identifies climate risk by scoring and ranking the vulnerability of the agency's assets.
- Design Standards for U.S. Transportation Infrastructure: The Implications of Climate Change examines how climate can impact transportation design and identifies strategies to reduce risk through means other than altering design standards.
- The World Bank Resilience M&E (ReM&E): good practice case studies aim to develop and increase the application of systematic, robust, and useful approaches to monitoring and evaluation (M&E) for resilience-building projects and programs.

For more information on evaluating climate change vulnerability to transportation systems:

- The U.S. Federal Highway Administration's (FHWA) Climate Change & Extreme Weather Vulnerability Assessment Framework is a guide for conducting vulnerability assessments of transportation assets and systems. It uses in-practice examples to demonstrate a variety of ways to gather and process information.
- The Use of Climate Information in Vulnerability Assessments by the U.S. FHWA provides recommendations on how transportation planners can use historical and projected climate information as they consider climate-related risks.
- Assessing Criticality in Transportation Adaptation Planning, by the U.S. FHWA, identifies a conceptual framework for narrowing the universe of transportation assets to study in a climate-change vulnerability and risk assessment.
- Assessing the Sensitivity of Transportation Assets to Climate Change in Mobile, Alabama introduces the Sensitivity Screen, for planners to identify assets that are sensitive to a particular climate impact, and the Sensitivity Matrix, which enables planners to identify a deeper level of detail, including information on the threshold at which assets become sensitive and features of the asset which may be associated with increased sensitivity.
- The World Bank's Highway Development and Management Model (HDM-4) Dissemination Tools can help to predict road network performance as a function of climate, among other input factors.
- Evaluation of resilience-building operations: operations guidance paper for project task teams was developed by the World Bank to help team task leaders know what to do differently when managing an evaluation of climate and disaster resilience building projects and programs.
- Operational guidance for monitoring and evaluation in climate and disaster resilience-building operations offers more detailed and practical guidance for monitoring and evaluation (M&E) of World Bank operations that aim to increase resilience to climate-related natural disasters and long-term climatic changes (resilience M&E), through activities that include climate change adaptation and disaster risk management (resilience-building) components.

For additional tools that are relevant to transportation:

- *Think Hazard!*, is a web-based tool enabling non-specialists to consider the impacts of disasters on new development projects. Users can quickly and robustly assess the level of river flood, earthquake, drought, cyclone, coastal flood, tsunami, volcano, and landslide hazard within their project area to assist with project planning and design.

- *USAID Climate Risk and Management Tools* including an *Infrastructure, Construction, and Energy Annex*. These tools are meant to support climate risk screening and management in strategy, project and activity design. Excel templates enable the user to record results.

Climate change and migration:

- *Environmental Change and Human Mobility: Reducing Vulnerability & Increasing Resilience* is a policy brief by the KNOWMAD Thematic Working Group on Environmental Change and Migration summarizes major findings and policy implications of papers commissioned to examine vulnerability and resilience, with particular focus on developing countries.
- The *IDMC's Global Internal Displacement Database* is an interactive platform designed for policy makers, NGOs, researchers, journalists and the general public for data and analysis on internal displacement.
- IOM's *Environmental Migration Portal / Country Profiles*