

The World Bank Group

**Incorporating Climate Adaptation  
Risks to Performance Based  
Contracting**

**Task 1- Inception Report**

| December 16, 2016

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number TBD

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**ARUP**

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## Executive Summary

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The purpose of the Inception Report is to establish a shared understanding of project strategy, key milestones, and overall expectations for the assignment.

Throughout this report, Arup:

- introduces the project management team and the communications protocol;
- discusses the research methodology, approach, and sources of information;
- clarifies any program, scope, and methodological matters; and
- presents key milestones, tentative dates for workshops, and frequency of regular progress updates.

This report updates the Technical Proposal based on the feedback received from the World Bank's project team on pre-kick-off conference calls and the kick-off meeting.

## 1 Project team organization

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The project team is arranged into four main disciplinary and workstream groups:

- Management and leadership
- Climate hazards and risk modelling
- Infrastructure design and management
- Contracts and financing

The **management and leadership team** will be in direct contact with the WB and will be available for attending conference calls, in-person meetings, presentations, and workshops in Washington DC and Manila.

- Lisa Dickson, out of the Arup Boston office, will have overall responsibility for the assignment and will be the lead contact with the World Bank client team. Lisa will ensure the availability of staff resources to complete the assignment in accordance with the work plan and will have ultimate responsibility for the quality of all deliverables.
- Roberto Sierra, out of the Arup San Francisco office, will serve as the project manager, will be the day to day contact with the World Bank client team and will manage the individual workstreams. Roberto will provide regular updates on progress and oversee project administration matters.

The management and leadership team will be supported by Jo da Silva and Ignacio Barandiaran, which will act as peer reviewers. Jo will provide her extensive experience working with development agencies and providing strategic advice and expertise in post-disaster contexts and Ignacio will leverage his knowledge of the PPP/DBFOM project finance market, working with public sponsors, equity providers, concession companies, contractors, rating agencies, and lenders.

For the duration of the assignment the management and leadership team will provide project status updates to the WB project team every other week via email or conference call. This team will conduct weekly internal conference calls to coordinate resources and check status against the work plan.

As part of the internal Quality Management System, Arup will establish a project data center for team access to project information. In this way, the project team will be working from a consistent set of regularly backed-up information and data files.

The **climate hazards and risk modelling team** is formed by scientists and will provide technical input on the main hazard classes which will be affected by climate change and which present a risk to road and other infrastructure systems. They will lead the workstreams on climate change projections and downscaling, hazard identification, and risk modelling.

The **infrastructure design and management team** is formed by engineers and will bring their experience of road and other infrastructure design and management to identify how climate-related risks are considered and managed or mitigated at design, construction and operations stages. They will provide practical insights from their own project experience and lead engagement with client and contractor stakeholders.

The **contracts and financing team** will focus on how climate change and weather risks are embedded in different forms of infrastructure delivery and maintenance contracts, and how risk allocations can affect the cost and availability of financing and insurance to the different counterparties. The team includes Arup transaction advisors and procurement specialists and Willis Towers Watson risk and insurance specialists

Figure 1 shows the proposed team and workstream organization for the assignment.

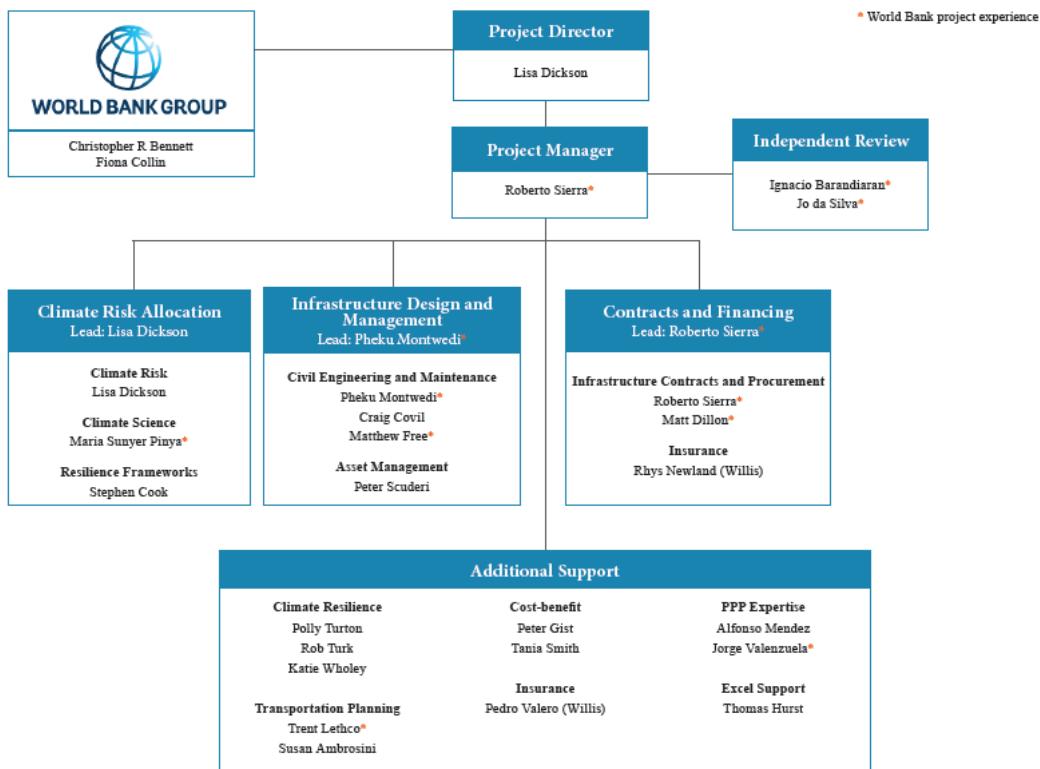


Figure 1. Team Org Chart

## 2 Approach and methodology

### Task 2- Review of existing approaches

The purpose of Task 2 is to establish a baseline of current knowledge on how climate change is addressed in transport projects. It is understood that this review will yield limited information.

Arup will carry out a *literature review* and will *interview select entities* to complement the literature review with a focus on “mature” countries.

The *literature review* will consider the following sources of information:

- Core documentation around climate change risks in the context of infrastructure, disaster risk reduction guidelines and frameworks, PBCs, etc.
- Project case studies to reflect practical experience for up to five projects. The project case studies will address the key issues of the study (incorporating climate risk in procurements and contracts, documenting how contractors have dealt with shock events and stresses to their infrastructure, documenting insurance industry responses to changing climate risks).
- Design standards across the different sectors, which will be reviewed assessing how they address climate change risks.

Appendix A summarizes the key items that the Arup team will review in Task 2.

Arup will conduct up to ten interviews with select entities to obtain insights on key issues facing clients, contractors, financiers, and other key stakeholders. The discussions will be organized around a brief questionnaire to stimulate feedback on specified topics.

Arup will prepare detailed notes from the discussion and incorporate the key themes and findings from the discussions in the Task 2 report. The detailed notes will form a technical appendix.

Appendix B compiles the list of suggested entities to be interviewed. Arup will appreciate the WB project team’s feedback/input to finalize the list and reach out to those parties.

### Timeline and deliverables

Task 2 will be performed over an eight week period. Arup will develop a concise report (with the goal of being less than 20 pages) summarizing the key findings from this effort, with supporting technical annexes, as needed.

The draft report will be submitted in the week of 02/13. After the two-week review and comment period, Arup will submit the final report for Task 2 addressing the WB's comments in the week of 03/06.

Figure 2 shows the detailed schedule for Task 2 and its activities.

Nº	Activity <sup>1</sup>	Dec-16				Jan-17				Feb-17				Mar-17						
		Week beginning		12/5	12/12	12/19	12/26	1/2	1/9	1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/13	3/20	3/27
		Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	<b>Task 2- Review of Existing Approaches</b>	>>>	>>>		>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>	>>>		
	Desktop review of literature																			
	Project case studies																			
	Review of design standards																			
	Meetings with/ Questionnaires to Stakeholders/Market Participants																			
	Development of "Review of Existing Approaches" report																			
	Submittal of Task 2 draft report																			
	WB review & comment period																			
	Submittal of Task 2 final report																			

[ ]

Figure 2. Task 2 Schedule

## Task 3- Methodology for incorporating climate change to PBCs

The purpose of Task 3 is to develop a framework to better incorporate climate change risks into PBCs and to reduce the uncertainty from climate change events when planning, designing, pricing or investing in road infrastructure.

Arup will define a **risk allocation matrix**, will propose a **framework for assessing climate change risk**, and will develop the appropriate **Excel-based tool** to apply the framework on specific projects.

The **risk allocation matrix** will identify key climate change threats, leading climate change vulnerabilities for roadway infrastructure, its physical and operational consequences, and which entity, either the owner or the contractor/developer, will bear each risk.

Arup will propose a **methodology/framework for assessing climate change risks** across a range of existing data and model. Within the framework development, Arup will discuss how to address uncertainty as a function of risk – particularly with respect to consequence and overall risk tolerance of the assets.

Arup will calibrate the framework such that proposed risk allocation considers which entity, either the owner or the contractor/developer, is better positioned to efficiently manage each risk/event.

Arup will consider a number of criteria when developing and calibrating the framework, such as:

- climate vulnerability of the asset/system, defined by ICLEI and others as the product of exposure probability, sensitivity and adaptive capacity;
- risk as a product of vulnerability and consequence of the impact, creating a prioritization based on likelihood of that impact occurring both in the near and distant futures;
- opportunity to develop design criteria for improved resilience, which requires projecting possible futures for which there is little or no data;
- ability to reduce the uncertainty of climate change through the use of technology or data analysis where possible;
- ability to reduce infrastructure vulnerability to climate change through investment in mitigations measures;
- value for money assessment including cost effectiveness of implementing strategies to mitigate the consequences of risks/events;
- successful resilience financing mechanism potential externalities in the society from the occurrence of climate change risks/events;

- availability of third parties (e.g., insurers, investors or sub-contractors) to transfer the risk to; etc.

The framework will be supported by an ***Excel-based tool*** that can be used for specific projects and can be adjusted to different levels of data. It will include flexibility to allow for the use of project level or detailed program-level (IQL-2 data) as well as less detailed data, ranging from detailed planning level to planning and performance evaluation levels (IQL-4/3).

### ***Timeline and deliverables***

Task 3 will be performed over an eight week period. Arup will develop a framework for PBC, which will include a risk allocation matrix and the appropriate Excel-based tool to apply the framework on specific projects.

The draft version of the framework will be submitted in the week of 05/01. After a six-week review and comment period, Arup will submit the final framework for Task 3 addressing the WB's comments in the week of 06/26.

Figure 3 shows the detailed schedule for Task 3 and its activities.

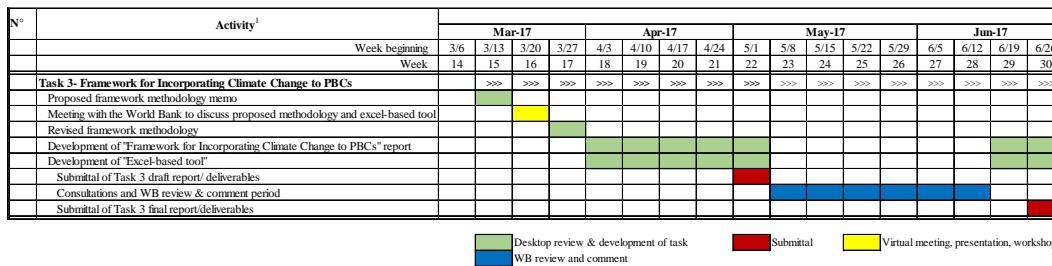


Figure 3. Task 3 Schedule

## Task 4- Performance standards for climate change in PBCs

The purpose of Task 4 is to identify performance standards to be included in Output and Performance-based Road Contracts (OPRC) contracting approaches in order to ensure that O&M procedures are adapted to climate change.

Arup will *review technical requirements* in highway maintenance contracts, will *recommend key performance indicators* to be included as technical requirements/performance standards, and will *identify technologies* to facilitate adopting performance standards to PBCs.

The *review of technical requirements* will focus on current OPRC documentation. The WB will provide [up to three OPRC contracts] from existing projects for Arup's review.

After the review of OPRC documents, Arup will identify additional performance standards that may be relevant from a climate-risk adaptation standpoint for both the construction and the operation and maintenance of road transportation infrastructure.

Arup will summarize the findings of the review and the additional performance standards in a brief memo for discussion with the WB team.

The *recommendation of key performance indicators* will build off the performance standards discussion with the WB team.

Considering the Federal Highway Administration (FHWA) guidance cited in the TOR, Arup will use the following criteria to validate new performance standards:

- Availability of a test for the variable.
- Feasibility of applying the performance standard within the context of infrastructure projects.
- Specificity of the standard to the desired outcome (e.g., improved safety, reduced congestion or improved quality).

Arup will use an asset management approach to propose, vet, catalogue and measure these criteria. An asset management approach considers the “whole” lifecycle of the asset and would help ensure that improvements to operating and maintenance procedures related to climate change are captured and considered in the overall assessment.

Once performance standards have been identified, Arup will pinpoint key performance indicators (KPIs) and response times for applying them. When suggesting KPIs, we will build on the team's experience advising in private-public-partnerships (PPPs). PPPs are long-term contracts, generally over 20 years that usually implement performance-based compensation schemes, including

provisions that link the payment received by the concessionaire to operating and maintenance targets.

Key elements that will be considered for developing KPIs for climate change related events may be:

- For each performance standard, one or more KPIs should be identified and a frequency for measurement should be set.
- Each KPI should have a baseline value or a baseline range based on the level of performance expected when a climate change event occurs.
- Response times for the contractor/concessionaire to cure or mitigate the impact of a climate change event may be provided considering either a qualitative approach (e.g., high priority, mid priority, etc.) or a quantitative approach, when possible.

Finally, the *identification of technologies* will address constraints for the implementation of performance standards considering capacity requirements to the government and the contractor, such as coordination mechanism, human resource, equipment etc. so as to ensure that they are viable and appropriate.

Arup will look at a number of alternatives to implement the recommended performance standards, for instance:

- Use of weather databases to better forecast climate-related hazard events.
- Integrate weather forecasting tools in the design of road infrastructure.
- Integrate weather data collection and road infrastructure asset condition data collection technologies to improve the monitoring of KPIs.
- Implement contractual provisions that align long-term maintenance interests for owner and contractors/concessionaires.
- Develop new insurance coverage products to cover physical damage from climate change related events.

### ***Timeline and deliverables***

Task 4 will be performed over an eight week period and will run in parallel with Task 3. Arup will identify and recommend performance standards to be included in PBC/OPRC contracts so O&M procedures are adapted to climate change.

Arup will develop a concise report (less than 20 pages) summarizing the recommendations from this effort, with supporting technical annexes, as needed. The draft report will be submitted in the week of 05/01. After a six-week review and comment period, Arup will submit the final report for Task 4 addressing the WB's comments in the week of 06/26.

Figure 4 shows the detailed schedule for Task 4 and its activities.

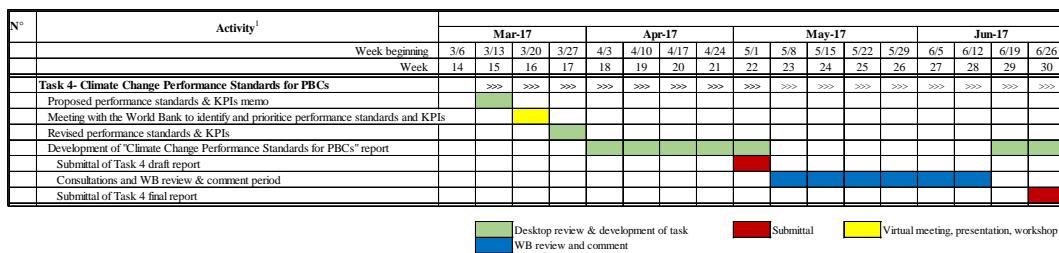


Figure 4. Task 4 Schedule

## Task 5- Recommendations for PBC contracts

The purpose of Task 5 is to develop specific recommendations on how performance standards should be included in PBC contracts for road infrastructure and across other sectors, if possible.

Arup will ***recommend changes to the WB's standard PBRC bidding and contract documents*** for road projects. Arup's input will focus on performance specifications and KPIs addressing climate change and identified in Task 4.

Arup will create a four-page Transport Note suitable for publishing by the World Bank summarizing the project's findings.

### Timeframe and deliverables

Task 5 will be performed over a four week period. Arup will add performance specifications and KPIs addressing climate change to the WB's standard PBRC bidding and contract documents. The draft set of performance specifications will be submitted in the week of 07/24. After a four-week review and comment period, Arup will submit the final set of specifications addressing the WB's comments in the week of 08/28.

Additionally, Arup will submit the draft Transport Note in the week of 09/11. After a one-week review and comment period, Arup will submit the final version of the Transport Note addressing the WB's comments in the week of 09/25.

Figure 5 shows the detailed schedule for Task 5 and its activities.

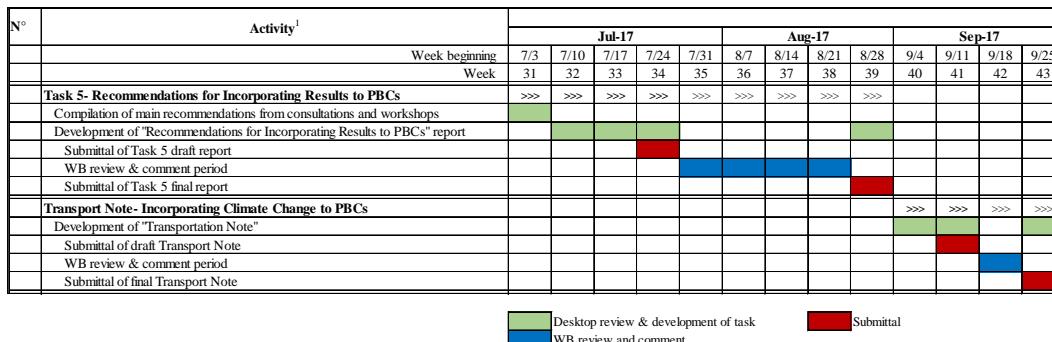


Figure 5. Task 5 Schedule

## Workshops

Arup will participate in three workshops throughout this assignment. The focus of the workshops will be two-fold: to provide an overview of work-to-date (for Task 3 and Task 4) as well as gather input from key stakeholders as to how those results should inform the final recommendations and deliverables.

- Workshop #1. Presentation of draft findings from Tasks 3 and 4 in Washington D.C., hosted by the World Bank
- Workshop #2. Presentation of draft findings from Tasks 3 and 4 in Manila, hosted by the ADB
- Workshop #3. Presentation of final results in Washington D.C., hosted by the World Bank

Workshops #1 and #2 are tentatively scheduled in mid-May, after the submittal of the draft version of the deliverables for Task 3 and Task 4. Workshop #3 is tentatively scheduled in early October, when all the final deliverables have been issued.

Additional workshops, as jointly determined by the World Bank and Arup, may be arranged.

### **3 Detailed Work Plan & Project Schedule**

Desktop review & development of task

Submittal

 Virtual meeting, presentation, workshop

\* Face-to-face meeting, presentation, workshop

WB review and comment



## Appendix A– Literature for Task 2

### Core documentation

Design Guidelines for Climate Resilience – NYNJ Port Authority <a href="https://www.panynj.gov/business-opportunities/pdf/discipline-guidelines/climate-resilience.pdf">https://www.panynj.gov/business-opportunities/pdf/discipline-guidelines/climate-resilience.pdf</a>
US Climate Resilience Toolkit – NOAA <a href="https://toolkit.climate.gov/">https://toolkit.climate.gov/</a>
Climate Resilient Infrastructure – United Nations Development Program <a href="http://www.uncclearn.org/sites/default/files/inventory/undp_paving_the_way.pdf">http://www.uncclearn.org/sites/default/files/inventory/undp_paving_the_way.pdf</a>
Sendai Framework for Disaster Risk Reduction 2015 – 2030 <a href="http://www.unisdr.org/we/coordinate/sendai-framework">http://www.unisdr.org/we/coordinate/sendai-framework</a>
Climate Change Knowledge Portal – The World Bank Group <a href="http://sdwebx.worldbank.org/climateportal/index.cfm">http://sdwebx.worldbank.org/climateportal/index.cfm</a>
PPIAF, March 2016. Climate Risks and Resilience in Infrastructure PPPs
Network Outcome Contracts – NZ Transport Agency <a href="http://www.oag.govt.nz/2014/nzta/part4.htm">http://www.oag.govt.nz/2014/nzta/part4.htm</a> <a href="http://rcaforum.org.nz/sites/public_files/documents/Network%20Outcomes%20Contracts%20Niclas%20Johansson%20NZTA_0.pdf">http://rcaforum.org.nz/sites/public_files/documents/Network%20Outcomes%20Contracts%20Niclas%20Johansson%20NZTA_0.pdf</a>
Climate Change Adaptation Guide for Transportation Systems Management, Operations, and Maintenance – FHWA <a href="http://www.ops.fhwa.dot.gov/publications/fhwahop15026/index.htm">http://www.ops.fhwa.dot.gov/publications/fhwahop15026/index.htm</a>
Climate Adaptation Framework and Indicator Evaluation – USDN <a href="http://usdn.org/public/page/24/Metrics">http://usdn.org/public/page/24/Metrics</a>
Smart Growth Strategies for Disaster Resilience and Recovery – US Environmental Protection Agency <a href="https://www.epa.gov/smartgrowth/smart-growth-strategies-disaster-resilience-and-recovery">https://www.epa.gov/smartgrowth/smart-growth-strategies-disaster-resilience-and-recovery</a>
Recommendations of the Task Force on Climate-related Financial Disclosures <a href="https://www.fsb-tcfd.org/publications/recommendations-report/">https://www.fsb-tcfd.org/publications/recommendations-report/</a>
The Cost of Inaction: Recognizing the values at risk from climate change – The Economist Intelligence Unit <a href="https://www.eiuperspectives.economist.com/sites/default/files/The%20cost%20of%20inaction_0.pdf">https://www.eiuperspectives.economist.com/sites/default/files/The%20cost%20of%20inaction_0.pdf</a>
Economics of Adaptation – Intergovernmental Panel on Climate Change (IPCC) <a href="http://ipcc-wg2.gov/AR5/images/uploads/WGIAR5-Chap17_FINAL.pdf">http://ipcc-wg2.gov/AR5/images/uploads/WGIAR5-Chap17_FINAL.pdf</a>
Wetlands Conservation and Management: a New Model for Urban Resilience in Colombo – The World Bank
Toward Climate-Resilient Hydropower in South Asia – Live Wire series (16/60) – The World Bank

Name of Project	Client	Location
Climate Change Adaptation Plan for the District of Columbia	Washington DC Department of Energy and Environment	Washington DC, USA
Disaster and Infrastructure Resiliency Project	Massachusetts Port Authority (Massport)	Boston, MA, USA
City of Cambridge Climate Change Vulnerability Assessment	City of Cambridge	Cambridge, MA, USA
Post-Sandy Resilient Design	Metropolitan Transit Authority	New York, USA
New York Rising – post-Sandy resilient design and transport planning for various communities	New York Housing Trust	New York, USA
Sandy Resiliency and Renewal Program	New York City Housing Authority	New York, USA
NYS 2100	Rockefeller Foundation	New York, USA
Climate Adaptation Study	Bay Area Transit Authority	San Francisco, CA, USA
Climate Change Vulnerability Assessment	City of Somerville	Somerville, MA, USA
Climate Adaptation Plan	Town of Stonington	Stonington, CT, USA
South Shore Communities Sea Level Rise Vulnerability and Adaptation Plan	Town of Marshfield, Duxbury, and Scituate	Marshfield, Duxbury, and Scituate, MA, USA
New Jersey American Water Climate Risk and Adaptation	Monmouth County	Monmouth County, NJ, USA
Facility Resiliency and Operational Impact Study	Partners Healthcare	MA, USA
T1009 tomorrow's Railway and Climate Change Adaptation	Railway Safety and Standards Board	London, UK
City Resilience Index	The Rockefeller Foundation	USA, Chile, Colombia, South Africa, India, and Indonesia
Cities Resilience Framework Tool	100 Resilient Cities	Global
Asian Cities Climate Change Resilience Network (ACCCRN)	The Rockefeller Foundation	South Asia (Indonesia, Thailand, Vietnam, India)
HS2 Climate Change Impact and Resilience Assessment	High Speed 2 Ltd	UK
C40 Climate Action in Megacities	C40	Global
C40 CRAFT	C40	Global
Long-term Adaptation to Climate Change	Institute of Mechanical Engineers	UK
M&S Climate Change Risk and Adaptation	M&S	UK
Reducing Urban Heat Risk	Arup Internal	Global
Seasonal Health and Climate Change Resilience for Ageing Populations	Arup Global Research Challenge	Global
Integrating Climate Risk and Adaptation	East Gippsland Shire Council	Australia
Climate Change Impacts on Population Health and Vulnerability	Victorian Department of Health	Australia

Name of Project	Client	Location
Climate change vulnerability assessments of selected council buildings	City of Whitehorse	Australia
50 Year Infrastructure Strategy for Melbourne's North	Eight Metropolitan Planning Councils	Australia
Urban Climate Change Resilience	Asian Development Bank	Philippines
Climate Resilient Ningbo	The World Bank Group	China

**Design standards**

AASHTO

<http://www.transportation.org/>

Austroads Guides

<http://www.austroads.com.au/about-austroads/austroads-guides>

Standards for Highways in the UK

<http://www.standardsforhighways.co.uk/ha/standards/index.htm>

FHWA Design Standards

<http://www.fhwa.dot.gov/programadmin/standards.cfm>

FHWA Performance-Based Practical Design

<http://www.fhwa.dot.gov/design/pbpd/>