case 11

Authors: Doug Mason and
Ben Campbell
Millennium Challenge Corporation

ESIA for infrastructure design in the Philippines

Design of climate resilient roads

Type of impact assessment	Mandatory Environmental and Social Impact Assessment (ESIA)
Type of project/plan	Transportation project (222 km of roads)
Climate change related issues	Storms and typhoons, increased rainfall, sea level rise, floods and landslides, heat waves
Influence of the ESIA	Climate smart choices in engineering design based on general solutions in the ESIA

The ESIA for this project assessed climate change risks over the next 20 years for proposed infrastructure. Measures were identified to adapt to these risks, and were further detailed in engineering design. During typhoon Haiyan, the roads remained largely intact and were crucial in emergency response.

Climate change in the country

The Philippines is one of the most disaster prone countries in the world. It ranks among the five most affected by weather-related events, including storms, floods, and heat waves. This poses challenges, including in infrastructure design.

Assessing climate change risks for the road project

The Millennium Challenge Corporation (MCC) partnered with the Government of the Philippines to build 222 km of roads on Samar Island. The project included rehabilitation of 60 bridges (in total 3 km) and construction of 35 slope protection areas, at a total cost of $228 million.

The ESIA for the project concluded that over the next 20 years, the road would be vulnerable to a higher frequency and intensity of rainfall, as well as sea level rise. It also identified landslide prone areas, which are important given increasing rainfall.

Climate smart adaptation measures in the ESIA

To adapt to the risks associated with climate change, a number of measures was identified, including:

- Raising bridges;
- Upgrading culverts and drainage pipes;
- Widening water channels/canals;
- Improving road embankments;

Objectives	Investments	Costs
Increase hydraulic capacity: • of 60 existing and new bridges • of drainage systems and culverts	Rehabilitate and replace bridges to sustain high storm surges	$2 million
	Upgrade box culverts to handle 1 in 50 year flood (before 1 in 25)	$9 million
Strengthen road embankments, protect road shoulders, shore up slopes to guard against landslides	Construct gabions, sheet piling, articulated concrete, anchors, structural walls, piles, reinforced ground	$10 million
Protect the road from the sea	Build seawalls	$2 million
Total	$23 million (10%)	

Adaptation objectives, investments and costs for Samar Road

- Remediation of slopes/landslides;
- Installing seawalls.

The work initiated under the ESIA was carried forward through engineering design. While the ESIA was useful in identifying problems and general solutions, the solutions were fully fleshed out during engineering design. This included work that flowed from (but was not part of) the ESIA, such as detailed hydrology of studies, the calculation of return periods and increased storm intensity, and the translation of these findings into engineering details (e.g. sizing of bridges and culverts).

In the case of the Samar Road, the total cost of the adaptation measures was approximately 10 percent of project costs (summarised in the table on the previous page).

Conclusion: Climate smart design of road infrastructure

The value of the Samar Road adaption investments became clear in November of 2013. One of the strongest storms ever to make landfall, Typhoon Haiyan had sustained winds of over 190 miles per hour when it struck the Philippines. While the road was directly on the storm's path, it survived largely intact. It provided a crucial artery for the emergency response, subsequent reconstruction, and the ongoing development of Samar Island. The Government of the Philippines is now applying climate smart design standards to other national roads.

Samar Road facilitates emergency response after Typhoon Haiyan

This approach creates value both for project beneficiaries and financiers (i.e. taxpayers). Considering climate risks during project design can lead to "best value" (rather than least cost) designs. These designs increase the likelihood that infrastructure provides benefits over its long useful life, even in the face of a changing climate.

As this case shows, the past may not be an accurate predictor of future risks. Many aspects of infrastructure design respond to past experience such as the frequency of major storm events. But these frequencies are changing. This poses a challenge when designing infrastructure with service lives that span decades. We need complimentary approaches to assess and address risk. Given the uncertainty, it can be useful to implement no (or low) regret approaches that perform well under a range of scenarios.

This case is an example of an ESIA that is influential because general solutions were properly integrated in the design phase. Engineering design includes analytical work that flows from (but may not be a part of) an ESIA. To be effective, environmental assessment and design processes should be integrated, with environment and engineering teams working closely together.

Characteristics of climate smart(er) project:

- Three-step approach applied ✓
- Climate smart(er) project design ✓
- ESIA increased commitment for project ✓

Climate smart(er) because:

- ESIA identified broad solutions which were further detailed in design phases.
- In the face of uncertainty, engineering design was robust to a range of future climate scenarios.
- 'Best value' design benefits users but also financiers.
- Experience with Typhoon Haiyan demonstrated the value of resilient design.