SOUTH PACIFIC
ENGINEERS ASSOCIATION

Policy

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Disaster Risk Reduction/ Adaptation to Changing Climate

1. Introduction

The Pacific Islands Forum has recognised the importance of strong approaches to both reducing disaster risk and adapting to changing climate for countries in the region. There is strong evidence that communities will be exposed to increasingly extreme events of one or more of the following:

- Major cyclone
- Flooding from extreme rainfall
- Sea inundation, whether by storm surges, tsunami or as a consequence of sea level rises
- Earthquake
- Volcanic eruption.

Along with the net cost to a country of repair or restitution of damaged assets, the most at-risk communities from an economic and social viewpoint are often located in the highest risk areas for such events. They are least likely to be insured, and thus suffer proportionally the greatest hardship.

As a consequence, most countries in the region have adopted a centralised approach to disaster risk reduction (DRR) and adaptation to changing climate (ACC). Successful approaches recognise and use all the diverse skills in a community, including those of engineers. In this paper, suggestions are made to gain greatest benefit from the local engineering community.

2. Roles of Engineers

Engineers have a primary role to provide and maintain efficient and reliable infrastructure and facilities for their communities. This includes water supply, wastewater treatment, stormwater management, roads, electricity, telecommunications, transport fuel, ports and airports, and buildings and community amenities (such as lighting and sports grounds).

Historically in many nations, the major infrastructural services were provided through State agencies motivated by the public benefit. However, as has happened elsewhere in the world the public infrastructure is now at least part-owned by the private sector, and even for State-owned assets the design and construction supervision has been procured from the private sector. The role of the State in utilising engineers to assist with DRR and ACC has therefore had to change.

These days, the State needs to establish outcomes-based standards and form networks amongst infrastructure owners and critical occupational groups such as engineers to ensure there is adequate preparation for DRR and ACC.

3. Network Approaches to Disaster Risk Reduction

Network approaches to DRR recognise the need for diverse parties to be brought together in a co-ordinated fashion, united by a clear vision and a sense of shared responsibility. Each party can then undertake activities either alone or collaboratively which collectively lead to a more resilient nation. The State has a central co-ordinating role, which is achieved, for instance, through a DRR committee. However, such a committee needs to produce clear statements of the responsibilities and expectation on other parties. A policy decision on the acceptable likelihood of an event exceeding the level of preparedness is a required first step as it sets the level of risk mitigation required from those parties.

The expectations might be formulated as minimum technical standards to be met in construction of artefacts, as service levels for restoration of services (eg. 99 per cent restoration within a certain time period), or as requirements for holding reserve capacity (eg. of food supplies or potable water). There may also be requirements in terms of the capacity of emergency services to be maintained and able to be dispatched (eg. fire services, human rescue, medical services and law and order). Broadly speaking, the required capacity of such services reduces when higher engineering standards to minimise the impact of a natural hazard event are adopted. An important role of a DRR committee is to find the optimum balance.

Having set up the expectations on parties, there then needs to be consistent mechanisms for self-review and reporting back in a manner that assists adherence to the desired level of preparedness and risk reduction.

4. Adaptation to Changing Climate

Changing climate has the effect of making more or less likely natural hazard events over a certain size. If sea level rises, for example, coastal inundation may get higher, the general water table in coastal regions will rise, and so forth. Cyclone events of greater intensity may occur more often.

A first impact is on planning. Suitable uses for at-risk areas of land might have to become more limited. There may be land areas where the approach of isolating a community from a hazard might still be appropriate. In others, however, there may be permitted only uses which can co-exist with the hazard and recover quickly. Uses in other areas might have to be restricted (eg. limited land clearance to avoid creating events such as landslips and erosion).

The development of hazard maps allows the land topography to be understood so that the potential inundation zones arising from either tsunami or storm surges can be identified. Inundation zones from rainfall-induced flooding also need to be considered. Many countries have an urgent need to define at-risk zones through investment in mapping – identifying all areas that are, for example, less than 10 metres above sea level. Treating these as risk areas would be a major advance.

When creating infrastructural assets, an essential approach to address the issue of future change is to set the technical standards of the day against the worst reasonably expected event across an asset's lifetime. If an asset is expected to have a service life of 50 years, it needs to be designed to withstand a design level event in the 50th year every bit as much as the first, even if, for example, the sea level is quite different, or the one-in-five-year cyclone has higher peak wind speeds than in earlier decades.

Both in the planning and technical standards development there are critical roles for engineers. The best policy will consider acceptable levels of risk to human safety, acceptable levels of economic damage, and acceptable levels of damage to the physical environment after considering the cost of creating solutions to make communities and assets more resilient. Engineers are vital contributors to the analysis, communicating the findings to communities and decision makers, and giving effect to the outcomes.

5. Interdependency and Cascade Failure

A critical success factor in both DRR and ACC is to recognise the interdependency of services. Cascade failure occurs when a failure of one service causes failure of another, which in turn might affect a third and so forth. Loss of power might lead to loss of other services like telecommunications or even hospitals; bridges often carry cables and pipes as well as vehicles, and services are often buried close together in the road so if one is damaged there may be effects on others.

Engineers have an important role in identifying interdependency and designing to avoid cascade failure. As an example, critical bridges, road sections and transmission lines should be sited away from at-risk zones. Because bridges often carry other services like water and wastewater pipes, it is particularly critical that special attention is given to their siting. Even if embankments leading to or from a bridge are damaged, the bridge and the services it carries should not be at-risk through inundation. If siting within an inundation zone cannot be avoided, strengthening and protection works need to be considered.

It is particularly important to recognise the critical elements of infrastructure and ensure these have the highest levels of readiness. This includes backup generation plant (eg. for hospitals and to keep airports operational so supplies can arrive).

6. The Critical Role of Engineers

It is vital that governments involve their local engineering community actively in DRR and ACC activities. This can be achieved by working co-operatively with the national professional engineering body.

Government need not be the direct employer of all the engineers involved – the national engineering body can play a major role in facilitating suitable arrangements.

7. Disclaimer

The South Pacific Engineers Association (SPEA) is the non-aligned association of national professional engineering bodies in the South Pacific. It seeks to contribute on matters of national and regional importance. One part of its contribution is to issue position papers, which give a learned view on important issues independently of any commercial interest. Such notes are not consensus papers of the SPEA membership, although they have been widely peer-reviewed amongst the membership. Others are free to quote or use materials from this paper.