Position Paper on Flooding and Flood Mitigation

Introduction

Floods in Australia are a natural and frequently occurring event, often affecting thousands of people. While floods confer many benefits to the environment, many Australians are also at risk from flooding in their homes, at work, or while travelling. Floods can cause widespread disruption to commercial and agricultural activities and property damage resulting in millions of dollars of economic loss.

While it is impossible to eliminate floods, the Institution of Engineers, Australia believes that the economic and social impact of floods can be mitigated by a combination of structural and non-structural measures. These include land-use regulation, public education, implementation of flood warning systems as well as the construction of flood mitigation structures.

The Flood Problem

Floods can be caused by:

- Runoff which exceeds the capacity of the drainage channels - rivers and creeks in the rural environment, and stormwater channels in the urban environment;
- Sea level rises due to storm surges and tsunamis; and
- Failure of water supply and sanitary sewer systems.

This position paper is primarily concerned with flooding arising from rainfall. Australia has a more variable climate than many other continents and as a result river flows are more variable. Even though there may be many years between flood events, the risk of flooding is potentially very high. This feature of the Australian environment was not appreciated by many of the early European settlers who, for communication and transportation reasons, tended to settle along the flood plains of the rivers. Many of our current day flood problems have arisen from this initial lack of knowledge about the Australian environment.

No part of Australia near a river or other channel can be said to be flood free. Flooding is a problem in both rural and urban areas.

Some significant characteristics of flooding are:

- Depth of water which affects damage costs;
- Flood duration affects damage costs and may cause social inconvenience;
- Flow velocity which affects the risk to life, damage costs, and erosion and deposition of sediment in the rivers, creeks and floodplains;
- Rate of rise which affects warning and evacuation times;
- Frequency indicates how often floods of a given size are expected to occur;

- Silt and debris can block waterways and cause higher flood levels, affect recovery costs and may result in degradation of channels and structures;
- Wave action can be especially important in inland flooding where very large areas can be inundated by flood waters; and
- Time of year when flooding occurs can affect the flood damage costs, particularly in agricultural areas

Risk of Flooding

The risk of flooding is measured by the probability with which a given flood height (or river flow) will be exceeded in any year. This is usually expressed as an Average Recurrence Interval (ARI) or an Annual Exceedance Probability (AEP).

A flood event criterion commonly used in flood risk assessments is the 100 year ARI or the 1% AEP, This criterion is based upon the acceptance of a 1% chance of that event being exceeded within any one year. Statistics can be used to estimate the risk associated with occurrence of floods within the design life of a structure. For example, it can be shown that there is a 63% chance of having at least one occurrence of a 100 year ARI flood in a period of 100 years.

Implicit in most analyses of flood risk is the assumption that the general climatic conditions do not vary and that evidence of the past is a reliable indicator of potential future conditions and flood events. The recent publicity regarding the influence of the Greenhouse Effect indicates that this assumption may not be valid and potential climatic changes may need to be incorporated into future flood risk assessment. However, at present it is not possible to quantify the magnitude of potential climatic and streamflow changes nor is there strong evidence to justify the inclusion of potential changes in assessments of flood risk. However, this situation may change in the future.

The risk of flooding may also change over time due to changing development conditions within the catchment. Of potential changes to a catchment, one of the most dramatic is urbanisation of part, or all, of a catchment. Urbanisation generally increases the volume of runoff, flood peaks and flow velocities while decreasing the delay between the storm event and the flood. On the other hand, measures such as farm dam construction and soil conservation measures may reduce the flood risk by reducing the flood flows.

The flood risk at a location is, therefore, not a constant risk but rather a risk which will change with time as development within a catchment changes.

The basis of all flood risk assessment is data, either streamflow data collected primarily by Statutory Authorities or meteorological data collected by the Bureau of Meteorology. These data benefit many parts of society and, in the area of flood risk assessment, they are essential for the determination of the flood risk. However, lately there has been a reduction in data collection programs thereby reducing the quantity of data available for assessment of flood risk. To assist the assessment of flood risk, data collection should be increased not decreased.

What Can Be Done ?

Engineers play a key role in the development of appropriate flood awareness in the public and in the mitigation of flood impact upon communities. This is achieved through a number of approaches.

The primary approach is the use of nonstructural measures which involve careful planning of development in potentially flood prone areas. This should be supported by appropriate legislation, public information and education programmes (to ensure that residents understand the flood risk), flood insurance, and flood warning systems (to reduce the impact of floods).

The most important nonstructural measure is appropriate planning and land zoning legislation which places appropriate controls upon development within floodplains. These controls should be based upon assessment of the flood risk determined through a thorough hydrological and hydraulic analysis of flooding in the catchment. The responsibility for implementation of these controls currently rests with State and Local Government Authorities, However, there are large differences in standards applied in different regions of Australia and even in different regions of the same state.

Another nonstructural measure commonly employed is flood forecasting and flood warning services. These are provided primarily by the Bureau of Meteorology with some local authority involvement. This is an important service as the magnitude of economic and social losses associated with a flood event can be significantly reduced with warning. Flood forecasting and warning systems depend on the forecast lead time, the accuracy of the forecasts and community awareness. Long lead times where people have confidence in the forecasts will provide greater benefits.

The perception by the local community of the flood risk is also important with those communities in districts where flood events have not occurred in recent times generally having a low perception of their risk. Public information and education programmes are essential to ensure that local communities are aware of their flood risk.

The most visible approach for flood mitigation involves structural measures which include flood mitigation dams, retarding basins, channel levees, and channel improvements. Structural measures are expensive, highly visible and may initially appear to be the best solution, especially when the political impact is considered. However, they can only benefit specific existing developed areas (they are not appropriate in many areas) and after construction, there may be pressure for further development in the perceived flood free area which may ultimately negate the benefits obtained from construction of the measure. Furthermore, they can generate the perception that the area is flood free when in fact a flood greater than that designed for will occur at some future time; a flood the community in the protected area may not be prepared for.

Conclusions

Engineers play an important role in assessing the risk of communities to flood events and the development and implementation of appropriate mitigation measures to reduce the severity and frequency of flooding. To assist engineers in these tasks The Institution of Engineers:

- Publishes and supports use of Australian Rainfall and Runoff - A Guide to Flood Estimation;
- Supports appropriate legislation for floodplain zoning and implementation or planning measures;
- Supports floodplain planning and its implementation;
- Supports the collection of data essential for the assessment of the community's flood risk and urges the appropriate Statutory Authorities to ensure that data collection programmes are not reduced but rather are increased in scope;
- Will present logical and objective technical information on flooding issues, especially when politically expedient solutions arc proposed as the total answer to a flood problem;
- Will assist in the implementation of public education programmes to inform the community of the potential danger arising from their flood risk and means by which this danger can be mitigated
- Supports the extension of flood forecasting and flood warning systems;
- Supports the evaluation of flood insurance, for residential properties as well as commercial and industrial properties, as a means of discouraging inappropriate use of flood prone land; and
- Supports and disseminates discussion on floods.

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