सत्यमेव जयते

NATIONAL WORKSHOP

ON

BUILDING COMMUNITY RESILIENCE IN URBAN FLOODING

Organised by

Karnataka State Disaster Management Authority

Bangalore

MARCH 3, 2023

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BUILDING COMMUNITY RESILIENCE IN URBAN FLOODING

Background

Urban floods have become common in many countries, including Europe and America. Few hours of intense rainfall can cause flooding when the existing urban sewage system and draining canals do not have the adequate capacity to drain away the amounts of rain that are falling. Water may even enter the sewage system in one place and then get deposited somewhere else in the city on the streets. Urban floods are a great disturbance of daily life in the city. Roads can be blocked, people can't go to work or to schools. The economic damages are high but the number of casualties is usually very limited, because of the nature of the flood. Community resilience is a key index for describing the response of human habitat systems against hazards, and enhancing community resilience is one measure for mitigating flooding risk. Urban flood also bring huge economic losses to the dense economy in the city, and affect the safety of life of all urban residents.

Keywords: Urban flood, climate change, seepage, sewerage, early warning

Introduction:

Urban flood causes huge property losses in urban areas or urban agglomerations, attracting widespread attention from all of society. In recent decades, climate change is exacerbating meteorological disasters around the world, causing more serious urban flood disaster losses. Many solutions in related research have been proposed to enhance urban adaptation to climate change, including urban flooding simulations, risk reduction and urban flood-resistance capacity. Climate change has been of high interest in urban flood-resilience research. Urban planning and the adaptation of urban systems differ in terms of human involvement and local policies, while more dynamic factors need to be jointly described. Studies about urban flood resilience based on local policies and dynamics within global urban areas combined with fine simulation are needed in the future, improving the concept of resilience as applied to urban flood-risk-management and assessment.

Due to the rapid development and expansion of cities, their highly concentrated population and high intensity of economic activities, the degree of exposure to natural disaster risks is constantly increasing. Now, new composite urban disasters, such as Cyclones/typhoons, urban waterlogging and urban heat islands, have caused the loss of urban meteorological disasters. Among them, urban flooding is one of the meteorological disasters that all regions may encounter, and it is closely and complexly related to climate, urban planning, drainage and human activities.

Urbanization increases runoff two to six times over what would occur on natural terrain. In some of the Indian cities storm water drain system are not adequate through there have been

phenomenal developments in cities like Mumbai, Ahmadabad, Chennai after recent urban flood.

Urban resilience

Urban flood resilience is defined as a city's capacity to maintain future flood risk at tolerable levels by preventing deaths and injuries, minimizing damage and disruption during floods, and recovering quickly afterwards, while ensuring social equity and protecting the city's cultural identity and economic vitality. Urban resilience refers to the adaptive capacity of all urban systems, and urban flood resilience is equivalent to the adaptive capacity to cope with floods caused by climate change in urban resilience research.

In the face of global climate-change challenges, countries need to explore new technologies and methods to make cities more resilient and sustainable in coping with floods. Urban resilience is a comprehensive urban response to various disasters and resilience, and urban flood resilience is a more detailed part of urban flood response; urban resilience and urban flood resilience are largely interactive. The United Nation's International strategy for Disaster Reductions has defined resilience as "the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures."(UN/ISDR 2004).

Main elements of urban system are built environment and population. Physical characteristic of built environment and social characteristic of population have to be examined in order to evaluate resilience. Therefore, presenting methodology for assessing flood resilience in urban areas has to be one of the focal points for the exposed cities. Strategies under flood management planning related to resilience of urban systems are:

- controlling runoff volume,
- increasing capacity of drainage systems,
- spatial planning, building regulations, etc.

Resilience also considers resilience of population to floods and it's measured with time. Assessment of resilience that is focused on population is following bottom-up approach starting from individual and then assessing community level. Building resilience involves also contribution of social networks, increasing response capacity of communities, self-organization, learning and education and cheering adaptation culture. Measures for improving social side of resilience covers: raising public awareness, implementation of flood forecasting and warning, emergency response planning and training, sharing information, education and communication

Flash Flood

Flash floods occur within few hours of a rain event, or after a dam or levee failure, or following a sudden release of water held by an ice or debris jam, and flash floods can catch people unprepared. It does not usually give a warning that these deadly, sudden floods are coming. So in flash floods prone areas, it is to be planned to protect family and property. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Urbanization increases runoff two to six times over what would occur on natural terrain.

Issues of Urban flooding

Urban planning and design are an important basis for studying urban flood resilience. Water management in urban planning in cities is influenced by many social, economic and environmental factors. The size, population and property of cities are also increasing with continuous development. The dense distribution of buildings, population and property in a city also affects the climate of the urban area and the drainage capacity of the city. As for the study of urban flood resilience, the original design and planning of the city is the most basic research framework of the city. The city is accompanied by intensive human activities, which are important influences in the study of urban flood resilience. In addition, the continuous development of urbanization has changed the original hydrological environment, and the pervious area in the city has gradually decreased, while the impervious area has increased, and the urban buildings have also been increasing. It is also very important to discuss urban flood resilience from the perspective of urban planning and design. Through urban planning and urban design, the resilience and the vulnerability of the city can be improved. Proper urban planning can make cities more resilient to floods while achieving sustainable development.

Systematic analysis of the results of urban flood resilience and adaptation to climate change is a hot research area in urban flood resilience. It covers studies related to urban resilience to climate change, which are generally large in scale, and some of them include areas at a Taluka level, while the specialized studies for communities are not comprehensive enough.

The current research on urban flood resilience focuses on the relationship between climate change, urban infrastructure, urban management and environmental vulnerability. However, there are various analytical methods and evaluation indicators available for the analysis of urban flood resilience.

In recent times, urban flooding has increased due to poor and inadequate stormwater drainage facilities prevalent in many Indian cities. Even with an intense rainfall for few hours causes flooding, which is mainly due to drainage congestion aggravated further by improper sloping of drainage channel at the outfalls. During rainstorms and other precipitation events roads, parking lots and footpaths in the cities, along with rooftops, carry polluted stormwater to storm drains. This causes reduced groundwater recharge and flooding when excess water remains stranded on the surface. In cities where

storm water systems discharge stormwater, untreated, to streams, rivers and bays results in health hazards that need serious attention.

Urban flood in Global cities

The differences in urban flooding problems in Asia and in Europe range from levels of economic development, infrastructure age, social systems and decision making processes, to prevailing drainage methods, seasonality of rainfall patterns and climate change trends. Case studies of global cities, e.g. New York City, London, Randstad, Tokyo, Shanghai, and Taipei; will assist cities world-wide to prepare for the future. Results indicate that a hurricane could leave approximately 25% of New York City with severe economic losses by 2050. In London, 15% of the land is located in flood-prone areas. The Thames Barrier began to operate to protect London from flooding in 1982. However, this also encouraged housing development closer to the river, and resulted in higher exposure and vulnerability of flooding. Randstad has approximately 40% of its land areas in flood-prone areas, but Randstad is well prepared for flood risk reduction by land-use and environmental planning. In Tokyo, extensive urbanization suffers from severe damages once flooding occurs. In Shanghai, approximately 50% of its land is in flood-prone areas. Shanghai is the most vulnerable to floods of the coastal cities. Shanghai is still not well prepared in land-use and environment planning for urban flood resilience. In Taipei, flood-prone areas account for approximately 41% of its total land area in an extreme weather scenario. Among these six global cities, Asian cities are to focus more on urban flood resilience since most of flooding hotspots by 2025 will be located in Asian nations (UNISDR 2013).
Asian cities, should promote comprehensive policies of urban flood resilience, focusing on land-use and environmental planning for resilience as well as strengthening their organizations and funding to reduce disaster risk, maintain up-to-date risk and vulnerability assessment. Urban policies should include environmentally responsible development in the face of continued population and economic growth, and being resilient regarding natural disasters

Irrespective of whether urban floods are part of larger riverine floods or result from inadequate drainage capacities, the damage potential of floods in cities is extraordinarily high. Given the high spatial concentration of people and values in cities, even small scale floods may lead to considerable damages. In extreme cases urban floods can result in disasters that set back urban development by years or even decades. Recent statistics clearly indicate that economic damages caused by urban floods are rising. On one hand, the continuing urbanization process in combination with an over-proportional growth of values in cities is responsible for this trend, while on the other hand floods are indeed increasing, both in terms of frequency and magnitude.

Causes

Some of the prime reason for the urban floods are:

- Absence of storm water drains in many localities
- poor maintenance of existing storm water drains leading to their clogging with mud and material
- filling up water bodies and nullahs

- incapacitating drainage through encroachments or poor maintenance
- truncating and concretising open space, depriving them of their permeability
- uncontrolled built and demographic densification beyond the city's infrastructural capacity
- failure to prevent rampant unauthorised construction
- allowing construction in low-lying areas without adequate mitigation measures
- indiscriminate disposal of solid waste
- illegal dumping of construction debris, and
- overlooking the maintenance and upkeep of the city's overall infrastructure that impacts egress of water

Urban Flood Mitigation

One of the best solutions to reduce the chances of flooding is to build away from floodplains and high flood hazard zones. It is a challenging task to identify such zones and water bodies but using geospatial analysis can lend crucial aid in identifying such areas. New construction in flood-prone areas must be strictly monitored and regulated and in areas where constructions had already finished or rather encroached upon. Structural flood control measures, like increasing stormwater drainage capacitors, must be taken into account.

Government initiatives like the Sponge Cities mission and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) can go a long way in helping civic authorities to plan cities keeping flood risks in mind. Further, residential and commercial stakeholders can be further motivated to install green infrastructure options like rain gardens, green roofs, and rainwater harvesting systems.

Some ecosystem-based disaster risk reduction policies in India are: National Mission for Sustainable Habitat, 2007, National Water Mission, 2008 and National Mission for Green India, 2010 under the National Action Plan for Climate Change, 2008.

Fig. 1: Protection of the built up facility by adequate waterproofing of a boundary wall from flood inundation

Fig. 2: Increasing the water flowing capacity of the stream by placing sand filled Geo-bags

Fig. 3: Living with flood by AQUA Dam

Objectives of the one day workshop:

To have stake holders' discussion on the following:

- The preparation of large scale contour maps,
- augmentation of the storm water drainage network, cross-drainage works, and augmentation of pumping capacity
- removal of obstruction to storm water drains
- removal of blockages caused by floating debris,
- restoration of the nalla system that stands constricted due to encroachments
- effective garbage handling,
- desilting, and preservation of holding ponds
- Installation of customized flood barriers in selected pockets to stop inundation
- Regulatory measures include a ban on plastics and prevention of further encroachments

Conclusions

With the consequences of urban flooding, such as loss of the life and property of residents and the disruption of social development, the ability of cities to cope with climate disaster crises needs to be improved. In the context of global climate change, more and more extreme precipitation will occur, and research on the resilience of cities against flood disasters caused by extreme precipitation has thus attracted people's attention in order to cope with the increasing frequency and intensity of urban climate disasters caused by climate change, and to ensure the ability of urban areas to cope with risks.

In order to make urban built-infrastructures disaster resilient it is recommended that:

1. All state governments and all local bodies (urban & rural), development authorities, special and new town development agencies, etc. need to modify, revise, revamp the existing building byelaws; development control rules; planning standards; town planning rules; special regulations for fire, structural, health, construction, electric and

life safety, in line with the NBC 2016 by suitably adopting fully or adapting it with such local variation as may be needed.

2. With a view to give effect to the planning, development and management of the storm water drainage and systems for all cities affected with flooding along with a multi-sectoral, multi-disciplinary and participatory approach as well as integrating quality, quantity and the environmental aspects, the existing institutions at various levels under the urban risk management sector will have to be appropriately reoriented / reorganized and even created, wherever necessary.
3. The strengthening of all building development and regulating agencies with the right level of professional human resources to deal with proactive responses needed with the building professionals and builders. The professional human resource pooling for contiguously situated human settlements and the related regulating agencies should be attempted, considering the socio-economic and budgetary constraints of smaller level local bodies dealing with urban flood regulation work.

Schedule: **"Building Community Resilience in Urban Flooding**", Friday, March 3, 2023

Time	Topic	Speaker	Remarks
10:00 to 10:30	Welcome address About NPDRR-3 pre-events Inaugural address by Chief guest	Prof. Chandan Ghosh, NIDM Prof. Santosh Kumar, NPDRR-3 Secretariat, NIDM Principal Secretary, DM GOK Guest of Honour – Prof.	
10:30 to 11:00	Urban floods – Capacity building & Early warning by State of Karnataka	Dr Manoj Ranjan Commissioner, KSDMA Bangalore	
11:00 to 11:30	Urban Flood Modelling – Current Updates	Prof. P.P. Mujumdar Associate Faculty Dept of Civil Engineering Interdisciplinary Centre for Water Research, IISc - Bangalore	
11:30 to 12:00	Living with urban floods – Aqua dams & Flood barriers systems	Prof. Chandan Ghosh, Head – Resilient Infrastructure Divn., NIDM, Delhi	
12:00 to 12:30	Urban Drainage system – policy vs. implementation issues	Prof. Kapil Gupta Dept of Civil Engineering IIT Bombay	
12:30 to 14:00	PANEL DISCUSSION: Urban Flood		
12:30 to 12:40	Introduction	Prof. A K Gosain Dept. Of Civil Engg. IIT- Delhi	Chairperson
12:40 to 12:50	Challenges and Solutions	Bengaluru City Corporation	TBD
12:50 to 13:00	Challenges and Solutions	Chennai City Corporation	TBD
13:00 to 13:10	Challenges and Solutions	Mumbai City Corporation	TBD
13:10 to 13:20	Challenges and Solutions	Hyderabad City Corporation	TBD
13:20 to 13:45	Summing up	Prof. Chandan Ghosh NIDM	Moderator