



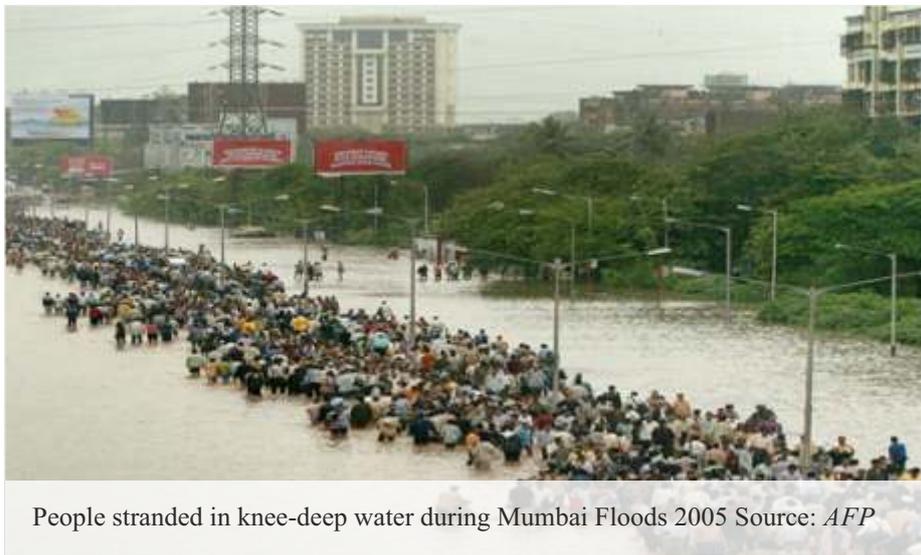
Earth



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URBAN FLOODS IN INDIA: GROWING RISK AND CHALLENGES FOR INSURANCE INDUSTRY

People stranded in knee-deep water during Mumbai Floods 2005 Source: AFP

The Urban Floods, also defined as, Surface Water Flooding occurs when an extremely heavy downpour of rain saturates drainage systems. Due to this, excess water does not find its way to sea or other water bodies and, thus, floods the territories. Poorly designed drainage system clubbed unplanned urban growth contribute to this type of flooding.

In recent years, urban flooding has received considerable attention due its catastrophic impacts in terms of loss of lives, damage to properties and infrastructural facilities.

The urbanization leads to developed catchments and in the event of heavy/ high intensity rainfall there is higher runoff which increases the flood peaks and flood volumes many times. Consequently, flooding occurs very quickly due to smaller lag times, sometimes in a matter of minutes. Urban flooding used to be primary concern for municipal and environmental governance, but now it has attained the status of 'disaster'.

Flood risk in urban areas are attributed to hazards which is further accelerated by growth in terms of population, housing, paved-up areas, waste disposal, vehicles, water use, etc. all contributing urban floods. Haphazard growth of low-income habitations and un-organised trade added to challenge. Spatial dimensions of all these flood factors are often characterized by land use.

Land Use issues like decreased natural areas, loss of water bodies, encroachment of river/streams, and other drainage channels, and uncontrolled multiplication of built-up areas are considered primary reasons for urban floods. The impact of urban flooding is further aggravated due to impact of climate change.

Urban Floods vs Rural Floods

Urban flooding is significantly different from rural flooding as urbanization leads to developed catchments which increases the flood peaks from 1.8 to 8 times and flood volumes by up to 6 times. Consequently, flooding occurs very quickly due to faster flow times, sometimes in a matter of minutes

The hydrology and the hydraulics of urban and rural floods are distinctly different. The three features of the hydrograph of an urban catchment distinguish the rural catchment are:

- Peak run off occurs at a shorter time
- Magnitude of the peak discharge is higher
- Total volume of runoff is larger

The time of concentration in an urban catchment is typically of the order of about an hour, and often much smaller than the sub catchments as against large time of concentration of the order of about 12hours to a few days. The flood damage potential is also high due to population and exposure concentration in relatively small areas such as commercial districts.

Main Reasons of Urban Floods include:

- Heavy Rainfall
- Urbanization
- Shrinking / Encroachment of Water Bodies
- Inadequate Drainage Network

Rainfall

Table below shows average annual rainfall for selected cities in India.

Table 1 Average Annual Rainfall

City	Average Annual Rainfall (mm)	Month with Highest Rainfall
Mumbai	2401.2	July
Trivandrum	1827.7	June
Guwahati	1715.4	August
Kolkata	1614.2	July
Chennai	1266.9	November
Bhopal	1146.7	August
Patna	1130	July
Nagpur	1112.7	July
Bangalore	969.8	September
Hyderabad	804.5	September
Ahmedabad	799.6	July
New Delhi	797.3	August

Source: IMD

Based on available records, areas around Chennai received extremely heavy rainfall with maximum rainfall of 490 mm in Tambaram in 24 hours between Dec 1- 2, 2015. This is more than 35 % of entire season's rainfall. For Mumbai, the worst floods in Mumbai occurred on July 26, 2005 when the city received 944 mm rainfall in 24 hours. This is more than the annual average rainfall of July – 868 mm. Similarly, for Hyderabad the worst floods occurred on Aug 23-24, 2000 when rainfall was around 240 mm- almost a third of entire season's rainfall. For Kolkata, the worst rainfall occurred from Sep 27-29, 1978 – around 45 % of entire season's rainfall.

Urbanization in India

India is a rapidly urbanizing country. With a relatively better life style, career opportunities, better infrastructure, schools, hospitals etc. Indian cities especially the Metro cities are favorite destinations of people living in small towns and villages. Table below shows trend of urbanization in India.

Table 2 Trend of Urbanization in India (Source: Census of India, 2011)

Sl. No.	Details	Year			
		1951	1991	2001	2021 (Est)
1.	No.ofUrbanAgglomerations,Cities &Towns	2765	3768	5161	
2.	UrbanPopulation(inmillion)	62.44	216.61	285.35	433.00
3.	Percentageoftotalpopulation	17.3	25.71	27.8	32.3



With increasing population, demand of houses, food, office space also increase. To cater to this demand areas, once considered not safe for inhabitation and commercial purposes, are granted permission to use. This approach solves one problem, but triggers others as many inhabitants become the work force in commercial and industrial installations and when a peril comes, their life as well as their employers – due to loss of workforce - also become vulnerable. An example of this is construction of Chennai Airport that is located in low-lying area and remained closed from Dec 1, 2015 to Dec 6, 2015 because of the flood waters of Adyar river. 35 cm rainfall was recorded between Dec 1- Dec 2 at the airport.

Shrinking / Encroachment of Water Bodies

Six biggest cities in India viz. Bangalore, Chennai, Hyderabad, Kolkata, Mumbai, and New Delhi and many other urban centers experience floods almost every year. Some of the worst flood events include 2015 Chennai Floods, 2008 Hyderabad Floods, 2007 Kolkata Floods, 2005 Mumbai Floods, and 2005 Bangalore Floods. Data from 1973 to 2007 shows decline of wetlands in Bangalore. Table below shows loss of water bodies.

Table 3 Loss of Water Bodies

Year	Bangalore City		Greater Bangalore	
	No. of Water Bodies	Area(ha)	No. of Water Bodies	Area(ha)
1973	51	321	159	2003
1992	38	207	147	1582
2002	25	135	107	1083
2007	17	87	93	918

Source: *Current Science*

A 2014 survey revealed that out of 611 water bodies in Delhi, 274 had already dried up and 190 were beyond revival. Likewise, a 2012 case study on urban flood management found that, in Chennai, there used to be around 650 big and small water bodies but only 27 were left. The others were converted /encroached for other purposes. Similar studies reflected that in last two decades, in Hyderabad, around 3,245 ha area of water bodies was lost. Likewise, Kolkata lost around 44 % existing water bodies.

Table below shows approximate insured exposure of today for Bangalore, Chennai, Hyderabad, Kolkata, Mumbai, and New Delhi. With increasing urbanization, exposure in these cities, floods in coming years may prove more costly for the insurance industry.

Table 4 Approximate Insured Exposure

City	Approx. Insured Exposure in 2016 (US\$) **
Bangalore	32,643,469,458
Chennai	36,450,420,510
Hyderabad	30,572,198,114
Kolkata	21,960,289,496
Mumbai	90,968,937,315
Delhi	37,888,106,937

** J.B. Boda internal research

Inadequate Drainage Network

Old stormwater drainage systems are not able to withstand amount of water coming to them during heavy rainfall. Further, the systems very often do not work to the designed capacities because of very poor maintenance and clogging due to solid waste etc. For example, the century old drainage network of Mumbai had been designed to carry only 25 mm of rainwater per hour while the drainage in the suburbs is mostly through the open stormwater drains. With drains clogged at several places, it proved totally inadequate for the 944 mm rain which lashed Mumbai on July 26, 2005.

Consequences of Urban Flooding

Urban Floods due to their intensity and duration impact human life and properties. Some of the consequences are:

- Shutdown of air, rail, and road transport
- Disruption of tele-communication services
- Shutdown of hospitals and disruption in medical services
- Pollution of water bodies that may trigger epidemic
- Loss of building, contents and working hours
- Price rise of essential commodities

Management of Urban Flooding

Management of urban floods worldwide is undergoing a paradigm shift from approach of 'response and relief' to 'prevention and mitigation'. Even today, the governments in India focus on distributing compensation to flood victims. Instead, they can take measures to manage such events in advance. Proactive approach of 'prevention and mitigation' would certainly reduce loss of life and property. This would include implementation of codal provisions for urban planning, designing of stormwater drainage to handle high rainfall, and generate awareness among the masses to take measures against flood risk. Table below shows insured losses for recent Urban Floods in India.

Table 5 Insured and Economic Loss in Recent Floods in India.

Date	Region	Original Economic Loss (US\$)	Original Insured Loss (US\$)	Protection Gap(US\$)
Nov –Dec 2015	Tamil Nadu	110 million (Nov), 2.2 billion(Dec) @	755 million @	>1.45 billion
September 2014	Jammu and Kashmir	5.97 billion @	237 million plus @	>5.7 billion
June 14-30, 2013	Uttarakhand	1.5 billion #	600 million #	900 million
August, 2006	Surat, Gujarat	3.39 billion #	407 million #	>2.98 billion
July 26, 2005	Mumbai	4.5 billion #	770 million #	3.8 billion

Munich Re, @ Swiss Re

Moreover, the proactive approach before the event occurs would also reduce the Protection Gap-difference between Economic and Insured Losses. With more frequent and severe floods than before and rapidly increasing exposure in urban areas, it is need of the hour to generate awareness to buying insurance cover for floods as well as other natural perils. With increase in insurance penetration, the insurance and reinsurance will have more funds to pay for flood claims; thus, reducing the burden on government which can utilize the funds for achieving development goals.

Insurance companies should contemplate before writing business situated in low lying and flood prone areas. Non –life businesses will be impacted more if a commercial and industrial unit is located in flood prone areas viz. closure of IT parks and industrial units in 2015 Chennai Floods. Likewise, life and health companies would be hit if there were human inhabitation in such areas.

Source: NDMA, IMD, Current Science

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