Urban Flood Risk in India

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India, a peninsular country surrounded by the Arabian Sea, Indian Ocean and the Bay of Bengal on three sides, faces a big flood risk due to an erratic monsoon season, huge coast line that is exposed to cyclones and innumerable rivers. Out of a total geographical area of 329 million hectares, 40 million hectares is prone to floods. Almost every year, multiple floods of varying magnitude hit some part of the country, causing significant damage to property and lives. On an average, every year 7.5 million hectares of land is affected, 1600 lives are lost and the damages of Rs. 18 billion are caused to crops, houses and public utilities (NDMA, 2008).

In last two decades, there has been a significant surge in urban floods across cities in India - Ahmadabad (2001), Delhi (2002, 2003), Chennai (2004, 2010, 2015), Mumbai (2005), Bengaluru (2005), Surat (2006), Kolkata (2007), Jamshedpur (2008), Srinagar (2014). The urban floods cause considerable damage to the property and life which in turn triggers large insurance claims. The Mumbai 2005 and Surat 2006 events are a case in point, with estimated claims of about INR 5000 Cr and 3500 Cr respectively. The most recent Chennai Floods in 2015 is also expected to generate claims between INR 3500 to 5000 Cr.

Urban floods are a result of combination of one or more of the following reasons:

Meteorological Factors

- Rainfall
- Cyclonic storms
- Climate change affects magnitude and frequency of rainfall and resulting into flood

Hydrological Factors

- Soil moisture conditions
- Ground water level before storm
- Surface Infiltration capacity
- Slope and surface roughness High tide

Human Factors

- Change in land use
- Obstructions in flood plain
- Lack of flood control measures
- Improper and poor maintenance of drainage

The Chennai Event

To understand the flood risk to prevailing in major urban agglomerations in the country, RMSI used its India FloodRisk™ model to simulate the flood extent and flood depth losses for the Chennai event on real time basis. The same was shared with the Indian Insurance industry through event advisories. Using the final extents RMSI estimated a loss of about INR 3,500 Cr from the event. The event loss map shows maximum losses in MGR Nagar, Thygarayanagar, Chennai central and Parry's corner. Tidel Park, Taramani, Triplicane, Royapettah, Guindy, K.K Nagar, Anna Nagar and Tondiarpet are expected to have suffered losses ranging between ₹90-110 crores each. While Tidel Park and Taramani are home to major IT parks in the state with well developed residential exposure, Tondiarpet, Triplicane and Royapettah have commercial and residential exposure, and K Nagar and Guindy have all types of exposure.

Post Disaster Survey

After the event RMSI conducted a post disaster survey by a team of

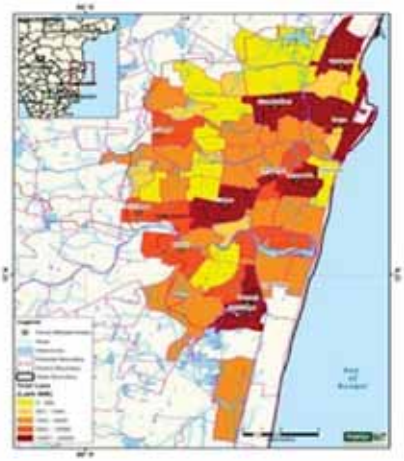

Fig.1: Modeled Chennai Flood Losses

experts comprising civil engineers and flood modelers. The objective of the survey was to capture flood depths at various places using the high water marks left on the buildings and get a better understanding of the business interruption to calibrate and validate our flood loss model (India Flood Risk™). Over 100 post disaster survey samples covering 30 locations in and around Chennai were collected. The Modeled v/s Observed Flood Depths map shows a comparison between the observed flood depths as recorded at various locations on the ground and the modeled flood depths. At Perumbakkam, Tambaram, Santhome, IT parks/East coast road, and Adyar locations there is an exact match between the modeled and observed flood depths. At all other locations the variation between the modeled and observed flood depths is within 10%.

Reasons for flooding in Chennai

Based on the survey findings, Chennai flooding could be attributed to the following reasons:

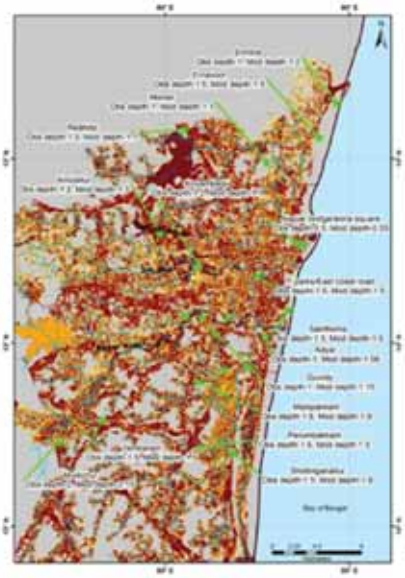

Fig. 2: Modeled v/s Observed Flood Depths Map

- Heavy rainfall associated with depressions or cyclonic storms
- Two major rivers with reduced water carrying capacity
- Failure of drainage systems
- Increased impervious surface
- Water bodies reduced from 150 in 1923 to 27 by 2015
- Encroachment along major waterways (River Cooum, River Adyar and Buckingham canal)

In addition to Chennai, RMSI used its India FloodRisk™ model to simulate 100 year return period flood losses for major cities in India. The figure shows the loss estimates for Top 10 cities in India.

Minimizing Future Losses

It is possible to mitigate the impact of such catastrophes, by adopting NAT CAT modeling and adopting better risk management practices. This includes:

Fig. 3: Top 10 City 100 year scenario Losses

- Exposure modeling for optimal retention – optimal target portfolio design, setting accumulation limits, monitoring of limits
- Stress testing of net retention scenarios – PML scenarios, combined loss scenarios from different perils
- Development of NatCat Loss Cost by peril, occupancy and type of structure
- Early intelligence on NatCat losses from events for better claims handling
- Detailed risk location and attribute information for better risk estimation
- Developing rating zones and designing products basis the estimation

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