

BUILT ENVIRONMENT & URBAN FLOODING: A CASE STUDY OF GURGAON

Rahul Marok

Abstract

Indian cities are now attracting foreign investments in full swing and are in the race of becoming global cities. One such case in point is Gurugram. The city is personified with its multinational corporate working economy, a high priced residential market and an internationally competitive commercial sector. Irony to this development is when the city makes headlines for 18-hour long traffic jam during monsoons, overcrowded junctions and high rise high density development.

This paper shall be focused on the development of Gurgaon and the consequential problems. This shall also highlight the issues related to the transportation network and the resulting urban flooding. The paper shall address the recommendations and strategies for the traffic management in the city.

Key Words: Urban Flooding, Urbanization, Infrastructure.

1. Introduction

In the current scenario Indian cities are subjective to the ascending pace of urbanization. Post liberalization the nation witnessed a consolidated change in terms of development. The rapid industrialization, accelerated the housing demand along with amplified need of commercial areas consequently demanded change in the development pattern. To stride with the other global cities and in order to surface as a global economy, India invested in multi sectoral development. This progression of development led to a state of affairs where the spatial planning of cities was just confined on paper and a contrary situation was on the grass root level.

Urbanization in India gained momentum due to population influx at the time of Independence, when there was cross border migration as well as rural to urban migration. The population residing in urban areas in India has increased from 25.8 million in 1901 to 377.1 million in 2011(Census of India, 2011). During the years after Independence, industrialization resulted in urbanization when people moved from agrarian activities to manufacturing jobs in cities, especially in the decade

1971-81. With a slight decline in urbanization in the next decade (1981-91), India, again has been experiencing an increase in urban population from 1991 till 2011. This can be attributed to liberalization policies of the government in 1990s, IT boom and focus on urbanization for economic development in the 11th and 12th national Five Year Plans of the nation.

The biggest challenge because of urbanization is the increased demand for infrastructure. The situation is further scared with the restricted availability of land. This has led to the development of the urban areas with the issues like high density built up areas, slums, mismanagement of solid waste and transportation, unfettered urban expansion, growth of high density urban villages, shortage of drinking water, sanitation and urban flooding, all leading to environmental degradation. The cities have developed beyond their limits and have penetrated into the sub-urban areas creating an imbalance between the built up and open areas.

2. Urban Flooding

Urban flooding, which is the emphasis of this paper, is inundation of land or property in an urban area caused by excessive rainfall, more than the capacity of the natural and man-made drainage system. Flooding in urban areas is not a recent phenomenon, though the reasons remain the similar across most urban areas. As recorded by NIDM Kolkata has suffered heavy floods since 1970s due to mindless urbanization, encroachment and numerous illegal and planned colonies have emerged in the urban areas without due consideration to the drainage pattern and topography of the area, which remain the main cause of urban flooding. Urban flooding is significantly different from flooding in rural areas. Whereas in rural areas flooding is mainly due to breach of river or coastal flooding deluging the agricultural land and settlements, in urban areas impermeable surface cause flood. Urban flooding is due to a combination of factors that can be clubbed into three broad categories, namely, planning, meteorological and policy. Encroachment of the low-lying areas, ponds and reservoirs and drainage channels mainly due to construction in these areas, increasing imperviousness leading to increased surface runoff and improper waste disposal leading to clogging of drains are the planning factors leading to flooding. As stated urban heat island

effect adds to the cause for extreme rainfall events and the lack of integrated flood control implementing agency magnifies the problem.

There has been a distinguished increase in urban flooding with major cities experiencing floods not once, but repetitively over the years since the turn of the century. Instances vary from Hyderabad in 2000, Ahmedabad and Hyderabad in 2001, Delhi and Hyderabad in 2002 and 2003, Chennai and Bharuch in 2004, Mumbai and Bangalore in 2005, Surat, Vishakhapatnam and Hyderabad in 2006, Kolkata and Mumbai in 2007, Jamshedpur and Hyderabad in 2008, Delhi and Bangalore in 2009, Guwahati and Delhi in 2010, Guwahati in 2011, Ludhiana in 2012, Surat, Mumbai, Delhi, Bangalore and Kolkata in 2013, Srinagar in 2014, Chennai, Srinagar and Mumbai in 2015 and Gurgaon, Delhi, Bangalore and Ludhiana in 2016.

Earlier excessive rainfall used to result in water logging in some low-lying areas; but in recent years' roads become water channels during monsoons, with many areas of the cities either getting partially or completely submerged causing not only massive loss to life and property but brings all activities to a complete halt filling up natural drainage channels.

Urban flooding is caused by heavy rainfall overwhelming drainage capacity. It already has hefty economic and social impacts. These are very likely to increase if no changes are made to the management of urban drainage. 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. The water level slowly rises on the city streets. When the city is on flat terrain the flow speed is low and one can still see people driving through it. The water rises relatively slow and the water level usually does not reach life endangering heights. Then, if an intense rainfall burst occurs, causing a large amount of rain within a brief period, flash flooding may occur with little or no warning.

A series of storms moving over the same area can cause areal flash flooding. A muddy flood is produced by an accumulation of runoff generated on cropland. Sediments are then detached by runoff and carried as suspended matter or bed load. Muddy runoff is more likely detected when it reaches inhabited areas.

Major part of sewerage and drainage network is old and it's in dilapidated condition. The system cannot cope with the volume of water or are blocked by solid waste and by non-biodegradable plastic bags. Sewers overflow because of illegal connections and the sewer system cannot cope with the increased volumes.

As new developments cover previously permeable ground, the amount of rainwater running off the surface into drains and sewers increases dramatically. Developments encroach floodplains, obstructing floodways and causing loss of natural flood storage. Unrelenting development and redevelopment to higher density land uses by high land costs. The proportion of impermeable ground in existing developments is increasing as people build patios and pave over front gardens. Increased impervious areas such as roads, roofs and paving, due to increasing development densities means more run-offs. Some of the major hydrological effects of urbanization are: (1) increased water demand, often exceeding the available natural resources; (2) increased wastewater, burdening rivers and lakes and endangering the ecology; (3) increased peak flow; (4) reduced infiltration and (5) reduced groundwater recharge, increased use of groundwater, and diminishing base flow of streams. According to natural hydrological phenomena, due to increased impervious area precipitation responds quickly reducing the time to peak and producing higher peak flows in the drainage channels.

Urban Floods results in stagnation of water on roads, railway tracks and in few cases even at airports because of the inadequate storm water drainage capacity. This results in traffic jams and traffic diversions resulting in loss of man hours. In the events of heavy rainstorms air traffic gets diverted. Telecommunication gets disturbed and maintenance of supply of essential commodities becomes challenge. As communications is disrupted industrial production gets hampered. Prices of essential commodities shoot up. During and after urban floods the immediate task is restoration of damaged roads, railway tracks, damaged buildings (which is very common for over lived buildings) and other structures and rehabilitation of residents from low lying areas and collapsed buildings. Damages of assets are significant in warehouses and buildings due to flooding by storm and sewage water. Perishable articles add to economical loss. Accidents and fire due to short circuit are also common. Hence there are a lot of financial burdens on relief measures. There is a psychological stress as safe returns of family members are not sure. Schools and colleges get closed. Displacement of population in low lying areas and collapsed structures generally meets stiff resistance. Disruption in supply of essential commodities including power supply results in unrest. Water bodies get polluted. Waste disposal gets hampered due to traffic disruption. The stagnation of water, pollution of potable water and accumulation of waste at dustbins result in epidemics. Accidents due to open pits, manholes hidden under accumulated water adds to

problem. As traffic gets disrupted it is challenging to assist medical assistance.

The millennium city 'Gurgaon' is located in proximity to New Delhi, India's capital. Lying in the state of Haryana, Gurgaon falls within the National Capital Region. It has grown to be the financial and technical hub of North India. Gurgaon is among the few Indian cities to have experienced unprecedented growth. The settlement of Gurgaon has been in existence since the times of Mahabharata (Government of Haryana, 1983). It has been under the rule of various rulers and became the East India Company's territory through a treaty of Surji Arjunaon in 1803 (Government of Haryana, 1983).

After India's independence, Gurgaon continued to be a part of the state of Punjab until 1966 when Haryana formed a separate state. After the bifurcation of the state of Punjab, Gurgaon became an important market hub of Haryana within the old economic setup. By 1965, the authorities saw the potential evolutionary prospect of Gurgaon in relation to the power center of Delhi, and developed the first master plan. Throughout these slow but major economic and administrative changes Gurgaon remained an agro-based feudal society, which depended heavily on the land for economic sustenance (Times of India, 2003). 1970s mark the beginning of the city's growth and development journey. But it has been since 1990s onwards that the huge population has moved into the city and giving it a growth spurt. This growth spurt has been an outcome of the new liberal system in the 1990s. As the city exists today, its anatomy can be divided into three parts, Old Gurgaon, lying on the left (when facing north) of the National Highway number 8 (NH-8).

Urbanization of Gurgaon has seen the change in the land use in the areas adjoining the town. As the town grew, the villages in the vicinity of the municipal area were converted from primarily agriculture and pasture lands to predominantly built-up consisting of housing colonies, roads and commercial spaces. As the land use of the area changed from having about 9 percent of area under built-up to more than 66 percent built-up in 2008, the fact drainage pattern of the area has not been taken into consideration is evident. While the master plan prior to 2001 indicated the preservation of major water channels (nallahs/drains) for rainwater harvesting and providing drainage in the city, the subsequent master plans have negated this aspect. During the period of real-estate boom between 2002 until 2012, construction activities were not controlled and blocked the drainage channels and ponds.

The drains, bunds and ponds around the villages like Ghata, Jharsa, Chakkarpur, Nathupur exist partially as these were zoned as protected forests.

Among these, specially, the pond of Chakkarpur has completely dried up, with the pond area being filled up with construction and other waste. The storm water drain built in the area is either clogged or of insufficient capacity to carry the heavy surface runoff during monsoons leading to submergence of the roads. The main nallah, Badshah Kost has been abandoned between Sectors 66 to 62 under the new master plans and channel of the drain exists in disjointed state between the sectors 55, 56, 61 and 62. An artificial linear storm water drain has been constructed along the southern peripheral highway to cater to the rain water drainage. Ghata, the deepest bandh in the south-eastern part of the city that had a submergence area to collect the rain water as large as 100 hectares and functioned as the natural flood water storage site, has been converted to primarily residential area of sector-58. Many sectors along the Dwarka Expressway fall in the high flood level of the Najafgarh drain which may get submerged during extreme rainfall events in the future. Ponds of varying sizes, have been an integral part of the village settlement, generally in the periphery of the settlement, act as recharge zones and help sponge flood water. All these natural low lying areas should be left vacant and not filled up with sewer, construction and solid waste. In Gurgaon master plan area (Gurgaon-Manesar Urban Complex Development Plan 2031), there are 120 villages and each village has had at least one such pond. However, as of date, with rampant land use conversion, there remain only 56 such water bodies. Over the last 15 years the natural channels have been blocked and the ponds have been filled up for real estate development. Major drains like Badshahpur, Kadarapur and Nathupur have been reduced in their water carrying capacity due to construction activity or dumping of garbage and construction material. The impact of this is being experienced almost every year since 2011 in the form of flooding by the residents. The intensity and frequency of these events is increasing year on year. July 2016 heavy rainfall impacted nearly all of Gurgaon. The main effected areas were sectors 14, 15, 17, 21, 38, 44, 46, Sushant Lok and DLF areas, Sohna Road, Gold Course Road, IFFCO Chowk, Sheetla Mata Mandir area, Civil Lines and Old Delhi Road. The NH-8 and Delhi – Gurgaon Expressway was too submerged under water at many places. Gurgaon falls among the top 5 cities in the country that are prone to flooding. Gurgaon city lies in a low-lying region and receives water that flows down both from the Aravalli hills and Delhi's Chhatarpur area. Encroachments along the main Badshahpur drain and patchy concretization of drains has intensified the problem of flooding over the last decade and a half. Real estate driven urbanization has led to drying up of the natural

drains and ponds which have acted as sponge during the monsoons in absorbing the rain water and recharged the ground water. Rampant construction has led to total loss of the natural drainage channels and reservoirs. The floods have every time caused traffic jams, damage to public and private property, mixing of solid waste in flood waters causing further choking of drains and mixing of fecal matter in the flood water due to open defecation resulting in vector and water borne disease. There has been long hours of disruption of power supply and telecommunication. The loss due to floods caused by heavy rainfall was estimated to be 500 crores with hours of overnight traffic jam on NH-8. Measures need to be adopted by the authorities to take corrective actions to prevent loss and damage to life and property. The approach needs to be holistic and not piecemeal.

Planning needs to regards water as collective public resource and manage it in a sustainable manner. There is a paramount need to change the approach of making development plans. A shift in approach from making a prospective land use plan is required to make an environmentally integrated development plan wherein water resources are in ways that do not impair their present and future value, with policies that address both the current and long-term needs of humans and the environment. An integrated approach combining watershed and land use management with development planning, engineering measures, flood preparedness, and emergency management should be adopted for controlling urban floods with the Smart Cities initiative of Government of India, it is imperative that the plans for the cities be wholesome and well-integrated with physical, environmental, social, cultural and economic milieu of not only the urban limits of the city but the region as well using geospatial technology. The approach to the urban flooding problem of the cities like Gurgaon needs to be two pronged, one corrective (as much as possible) and secondly proactive, which will be for long-term. The corrective approach is to revive the natural flood protection systems consisting of natural drainage channels and ponds. In Gurgaon, where the channels have been disconnected due to construction of roads, the need is for building these connections so as to make the flow channels continuous and unobstructed. These areas can be further developed as green areas of the city, which shall eventually function as recharge zones and recreational area and be the lungs to the city. Where the revival of the channels and ponds is not possible due to the building having being constructed upon, attempt should be made to increase the porosity of the area by reducing the concrete surface like mixed pavements (grass/soil and concrete). Attempts should be made to increase the vegetation cover of varying

types and height so that the surface run-off reduces to some extent. The long-term approach is to integrate the existing water bodies and drains into the development plan in such a manner that these are not treated as sore and defunct areas that can be filled up to build upon. Even if, the existing ponds are not in a healthy state, attempts need to be made to revive these areas and made a part of green open spaces, which are mandatory in any city plan. As much there is a need for a regional perspective in urban plans, it is imperative to create a national urbanization policy as well at the national level, which essentially needs to define the direction in which urbanization in the country should take place. This approach may control the over-crowding in the urban areas, which in recent years has created a demand of rampant urbanization of the productive agricultural lands.

Conclusions

Urbanization is imperative for the growth and development of the city. The process has been experienced by many cities in India, Gurgaon being among these. Though the changes brought about by urbanization has provided access to amenities and facilities to a larger population, rampant development has not been bereft of degradation of the environment, specially disappearance of natural drainage channels and ponds that have acted as sponges soaking water and recharging the ground water. With these natural flood sinks disappearing, there has been frequent flood of the city and its intensity has increased over the years. Corrective actions are required in preventive and proactive manner by ways of adopting integrated environmental approach to planning which is smart. Efforts are needed at city, regional as well as national levels to address the issue of urban flooding. While at the city level, corrective actions like revival of the drains and ponds is required, a regional approach is essential in planning for the future and steps are needs for a sound urbanization policy that may intend to curtail migration to urban centers. It is required to make not only Gurgaon but other cities safe, resilient and sustainable.

1. About the Author(s)

Assistant Professor at Amity School of Architecture & Planning. Pursued Bachelor's in Architecture with specialization in Infrastructure Planning. Worked as project architect for various residential and commercial projects. Contributed towards the report formulation of water management for Jaipur City. Key research interest is in the subjects of environmental planning, urban housing and water management.

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