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The Engineering Deficit Exacerbating the Flood Problem in Vadodara City and Its Solutions

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Abstract: *The frequent occurrence of flooding in Vadodara city is attributed by the authorities responsible for flood mitigation to excessive rains, floods in rivers or streams that cross cities, and water left from Ajwa Dam during heavy rains. While these explanations are no doubt valid, they lack the underlying nuances that contribute to flooding. Additionally, it can be seen that there are extant resources of the Engineering that would allow the flood control. The problem exists, therefore, not because of the lack of engineering techniques capable of solving it. The problem is one of lack of long term vision and continued interest of the decision makers at governments (federal, state or municipal) in implementing the right solutions to the problems. Thus, this paper suggests important structural measures that the Government must pursue to minimize flooding in Vadodara city.*

Key Words: *Vadodara City, Urban Floods, Structured Measures, Ajwa, Vishwamitri, VMC.*

1. INTRODUCTION:

Flood is a state where a land area, which is typically not submerged, is inundated with the waters from an adjoining water body such as canal, river, dam, lake, pond, reservoir, sea, ocean because of unusually high level of waters in it. If the aforementioned land area happens to have high density of human population and infrastructure, the resulting floods are called as 'Urban floods. While India is prone to several natural disasters such as Earthquakes, storms, and others, floods hold a special significance. Of the top 10 most expensive natural disasters that has happened in India since 1990, floods topped the list with 7 occurrences amounting to 75% of the total $50 billion USD loss from those disasters[1]. Major floods India has witnessed since 1990 span across multiple states such as J&K (September 2014), Uttrakhand (June 2013), Bihar (August 2008), Gujarat (June 2005, June 2015), Maharashtra (July 2005), Assam (1998, July 2016) and more[2]. This shows that flooding is a key problem for a large number of states in India and requires critical attention at national as well as individual state level. The major flood prone regions in India are Punjab, Haryana, most of the Gangetic plains including Uttar Pradesh, North Bihar and West Bengal, the Brahmaputra valley, coastal Andhra Pradesh and Orissa, and South Gujarat.

In Gujarat, Vadodara district which is surrounded by major rivers like Mahi on the north-west and Narmada on the south-east and minor rivers like Vishwamitri, Dhadhar and others is one of the key regions prone to floods. In fact, as per Vadodara district's Disaster Response Plan 2016-17, flooding tops the list of all the disasters in terms of probability of occurrence and district's vulnerability to it. Since 1990, Vadodara has witnessed 4 major flooding events - July 2005, July 2006, September 2013 and June 2014[3]. In addition to these district-wise flooding events, severe water-logging affect the low lying areas of the district almost every year. This makes Vadodara city - a home to 1.5 million people, a strong candidate for the detailed study of flood-risks and its management. This paper explains the engineering loops in preventing floods and the mitigation measures to manage it well in future.

2. LITERATURE REVIEW:

A large volume of papers published The Dutch are regarded as pioneers in modern flood management. To Dutch an intelligent city needs to have a comprehensive and all-encompassing approach that extends beyond the commonly deployed flood-gates and dikes approach. Examples of such modern approaches include the parking lots that become emergency tanks for storm water storage to avoid the overflow of sewage treatment plants because of the five or ten year storms. Netherlands also has squares, gardens, football, basketball courts in appropriate neighbourhoods that also function as retention ponds during surges.[4] In United Kingdom, the Thames Barrier is a 520 meters wide unique flood control structure on the River Thames at Woolwich Reach in East London protecting it against storm surges and rainfall caused Thames swelling. In Australia, over 200 retarding basins have been built across Greater Melbourne that has many recreational areas for the community. The landscapes are designed to hold back storm water to reduce flood risk to homes and businesses in the vicinity. During the time of inundation, recreational areas may be affected. The stored water is then gradually released into the downstream water way. Tokyo's the Metropolitan Area Outer Underground

Discharge Channel, the world's largest underground flood water diversion facility, helps mitigate over flow from the city's major waterways during heavy downpour. [5]

While a tier 1 city like Vadodara may not have adequate funds to implement high investment infrastructure schemes such as those deployed in developed countries, a closer look at the case-specific engineering problems faced by the city can help solve a lot of issues. The aim of this paper is to provide nuanced understanding of the engineering loop-holes that contribute to recurrent flooding in the Vadodara city. The paper also suggests certain technical solutions Government should implement to control the floods in the context of Vadodara city, Gujarat, India.

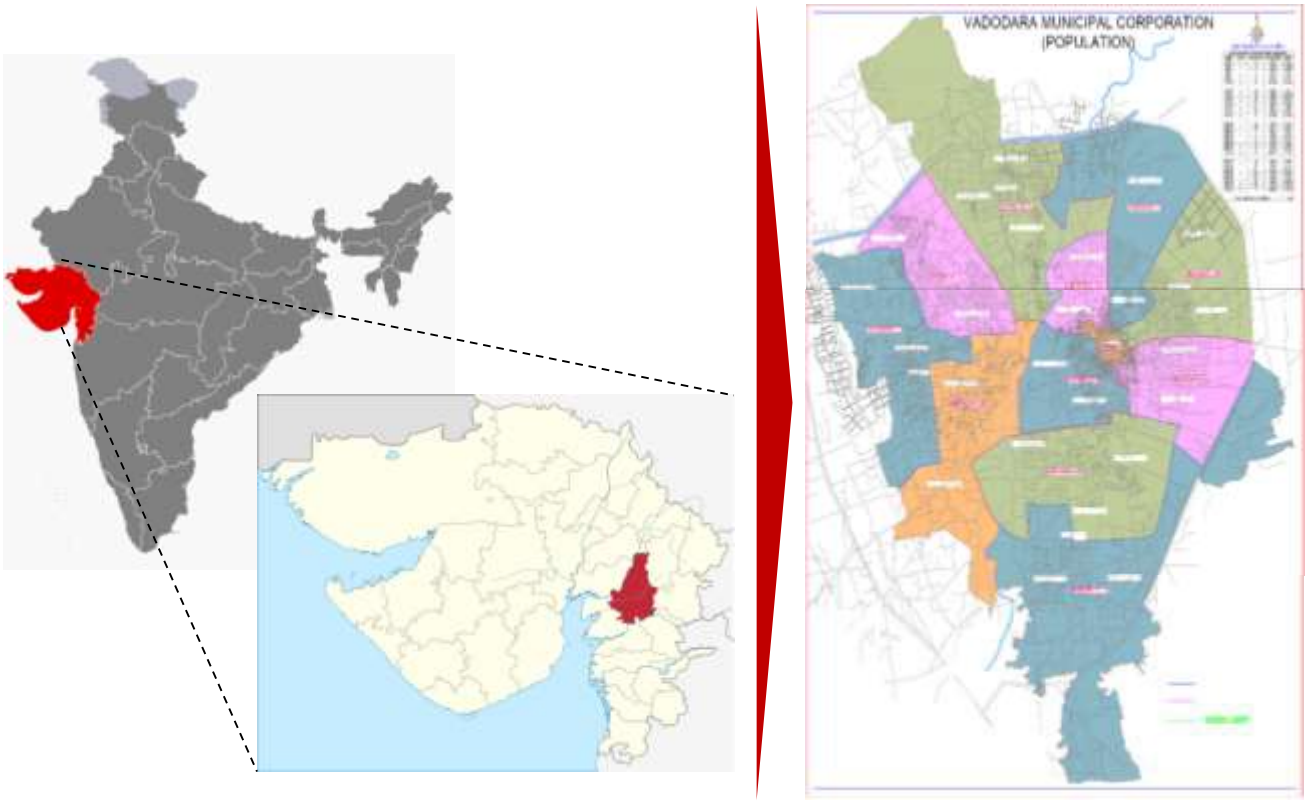

Figure 1: Geographical location of Vadodara City - The focus area of this discussion

3. MATERIALS AND METHODS:

In the current study regular surveys were carried out in flood prone areas of Vadodara city to understand citizens' perspectives on the causes of flooding. The field study was conducted in 12 wards of VMC which are prone to flooding and water logging and are affected by floods in every monsoon. The surveys were carried out using the questionnaire. All the interviews were conducted at site over a pre- defined study period of six months. Additionally, the stakeholders from Vadodara Municipal Corporation and Ward Offices were interviewed to lend credence to the insights from analyses of the survey responses.

4. DISCUSSION:

Vadodara has a very poor drainage system and a lot of work of laying storm water drains and replacing the older low capacity drains with new high capacity drains having bigger Diameters has been pending. The smaller diameter drains get choked frequently and create flood like situation during heavy rains. Drains clogged for prolonged duration result into siltation inside the drains. This siltation is extremely difficult to remove from small diameter RCC Drains.

In certain areas, the ground and road slopes are so faulty that laying of storm water drains with correct slopes is impossible. Hence such areas, for example area behind Inorbit Mall in Ward 10 of VMC in Vadodara City, do not have storm water drains laid. Laying of catch pits and storm water drains is so improper that in certain areas water keeps the road submerged for more than 2 weeks as the positions and slopes are faulty to recede the water from the water-logged spot.

Sewage water connections have been made with storm water drains by the Government as well as individuals. This has led to discharge of sewage as well as rain water run-off in storm water line and subsequently storm water pumping station becoming the bottleneck. The capacity of STP for water treatment has not kept pace with the growth of population. This has contributed to running of primary and auxiliary pumps without the break necessary for periodic preventive maintenance. As a result, some of the auxiliary pumps have become dysfunctional posing great danger to the overall reliability of the STP.

At Vadsar Municipal solid waste dumping site located on the bank of Vishwamitri River, burnt and unburnt MSW gets washed away during rains and get deposited on the bed of Vishwamitri River reducing its capacity. Scientific disposal of MSW is crucial to prevent the Vishwamitri River from choking near the dumping site.

Authorities construct new roads over existing layers of road. This leads to progressive increase in the road levels higher than the neighboring residential areas. The increased height of the road either covers the drain's catch-pits under asphalt or at best lends it redundant since the increase level of road ensures that water doesn't collect on the road and hence conveyed to storm water drains through catch-pits but in the neighboring residential areas.

The Ajwa dam discharges its water directly into the Vishwamitri River once the dam gates are opened. This results into spurts of high levels in the Vishwamitri rivers. Additionally, the curls of meandering Vishwamitri River have not been corrected to prevent the flood waters from spilling over the land surface beside the banks. There are certain points were the Levee or walls have constructed along the Vishwamitri river edge. However, these structures constructed to constrain the Vishwamitri flow during floods themselves get washed away when the water level rises and flow rate increases at the peak of floods. This indicates that the foundations of these structures are not designed factoring in the worst case plausible scenarios.

5. FINDINGS:

The Engineering Deficit is worsening the flood impact in Vadodara city. However, not all solutions to these problems have to necessarily be capital intensive and hence unviable. Some structured measures specifically suitable for the Vadodara city, given the nuanced problems it faces, have been recommended below.

6. RECOMMENDATIONS:

The revamping work of replacement of old smaller diameter drainage lines with new bigger diameter storm water drains must be taken up on priority. The services of Door-to-Door Garbage collection, closed-type community dustbins, and city cleaning must be extended to unaddressed areas too to ensure that the garbage doesn't end-up into storm water drains or water bodies. In areas where faulty slope lend laying of storm water drains unfeasible, alternate solutions such as underground water storage and deep aquifer recharging must be implemented. The improperly placed catch pits must be rendered usable again by connecting it to the new water-logging spots in the surrounding regions through water channels (such as multiple small diameter pipes). The regions where old sewerage line carrying capacity has become bottleneck or where main sewerage channels aren't available in the vicinity, decentralized community level under-ground sewage treatment plants or septic tanks must be installed. The maintenance of primary and auxiliary pumps is key to ensure reliability of the STP infrastructure. Additional pumping capacity must be added as a redundancy measure to ensure uninterrupted functioning of STP. The disposal of MSW, either as is or burnt, must be done in a landfill compliant to environmental safety norms both in construction and operation. Old layers of roads must be removed before the new surface of road is laid down to prevent the increase in road levels. The discharge capacity (depth and breadth) of Vishwamitri must be increased at the curls of the meandering Vishwamitri River. This would ensure that the water level and flow velocity does not cross the design threshold of the levees or walls. Vegetation cover must be increased along the riparian edge of Vishwamitri wherever possible to provide a buffer between Vishwamitri River and inhabited areas along the bank. A rerouting of Ajwa dam discharge to share the discharge load between Vishwamitri and alternate routes is suggested to prevent flooding. [6]

7. CONCLUSION:

Specific engineering loop-holes contributing to worsening of flood impact in Vadodara City have been laid out in this paper. The possible structured solutions to plug these engineering gaps have been pointed out. However, the implementation of these solutions requires authorities adopting a long term strategic view and having a genuine and continued interest towards solving flooding problem of this wonderful city well-known for its art, culture, and education.

REFERENCES:

1. "Centre for Research on the Epidemiology of Disasters." [Online]. Available: emdat.be/country_profile/index.html.
2. Indiatoday, "Kerala drowning in floods: 6 deadliest floods in Indian history."
3. Vadodara Municipal Seva Sadan (VMSS), "Vadodara District Disaster Response Plan 2016-17," 2017.
4. F. Alcoforado, "THE ENGINEERING DEFICIT IN THE SOLUTION OF THE FLOODS PROBLEM IN BRAZIL."
5. S. J. and N. Chandar, "Chennai Floods (2015) and Possible Solutions from Developed Countries," *Int. J. Sci. Res.*, vol. 4, Dec. 2015.
6. N. Verma, "Urban Flooding and its Management - A Case Study of Vadodara City," Veer Narmad South Gujarat University, 2019.