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An Empirical Study on the Drainage System in Dimapur: Current Status and Future Solutions

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Abstract

This is a qualitative study on the drainage system of Dimapur. Areas of Dimapur are regularly flooded during rainy season, largely due to poor drainage infrastructure. Sub-surface drainage systems in Dimapur collect rain water but potentially cause a lot of damage to people and to the environment. The purpose of this study is to explore the current condition and examining various flooding areas during rainy season in Dimapur. The results of this study and subsequent analysis can be used to propose conceptual modification of the inadequate and poorly maintained drainage systems. The outcome of the study shows the need for significant changes in the urban drainage system in Dimapur.

Introduction

Historically, urban drainage systems have been viewed with various perspectives. During various time periods, and in different locations, urban drainage has been considered a vital natural resource, a convenient cleansing mechanism, an efficient waste transport medium, a flooding defense mechanism.¹ Topology, geology, scientific knowledge, engineering and construction capability, societal values, religious beliefs, and other factors have influenced the local perspective of urban drainage. For as long as humans have been constructing cities, these factors have guided and constrained the development of urban drainage solutions.²

Proper drainage systems are a very important part of any city's development. Defined briefly, drainage is the natural or artificial removal of a surface water and sub-surface water from an area.³ According to World Health Organization, A proper drainage system can prevent standing water that can lead to flooding and damage to infrastructure, prevent spread of waterborne disease, and also stop mosquito breeding. In areas where drainage and sanitation are poor, water runs over the ground during rainstorms leading to flooding, property loss and evacuation of people.⁴ Flooding may also damage water supply infrastructure and contaminate domestic water sources. Urban flooding has an adverse impact on the performance of urban infrastructure and the life of the residents. Such floods may cause significant damage and perturbation in the serviceability of urban infrastructure such as transportation. In recent years, climate change and its consequences have affected many components

¹ Burian Steven and Edwards Findley (2002) "Historical Perspectives of Urban Drainage" *Journal of Global Solution for Urban Drainage*, 10.1061/40644-284.

² Ibid.

³ <https://en.m.wikipedia.org/wiki/Drainage>.

⁴ Drainage World Health Organization.

of the water cycle as well as flooding. The disposal of sediments and solid wastes into drainage channels can significantly decrease the channels' safe carrying capacity. Urban drainage system studies could help to achieve more reliable results and be applied in real time planning of urban areas through selection of best management practices.⁵

Statement of the problem

Insufficient drains and drainage systems in Dimapur not only cause flash floods but also lead to water pollution in Dhansiri River. During the annual monsoon season, residents face problems due to flooding when water from clogged drains inundates colonies. Poor waste management and lack of civic sense in the local population also results in garbage blocking drains, which significantly contributes to flooding. Due to the poor drainage system, rain water floods the roads and carries additional garbage and dirt from roads, which further deteriorates the quality of water, exacerbating the issue. Poor drainage systems not only risk the likelihood of flooding but also increase the volume of sediments and solid wastes entering the drains that can further aggravate flooding. As a result, besides damaging the roads by way of water logging, it becomes more hazardous to the people living around the drains.

There are currently no major manufacturing or processing industries in Dimapur city that had cause serious contamination, as such, the pollution is mainly caused by domestic and municipal wastes that are usually dumped into the drains. The buildup of such wastes can be attributed to the fact that the water is often stagnant and without sufficient flow, the solid waste settles or -get clogged in the drains. An important consideration

⁵ Karamouz Mahammad, Hosseinpour Ana, Nafiz Sara (2011), "Improvement of Urban Drainage System Performance Under Climate Change Impact: Case Study" *Journal of Hydrologic Engineering*, 16 (5), 1084-0699, pp. 395-412.

for the capacity of drainage channels is the buildup of sediments and solid wastes. The self cleansing velocity, which is a term commonly used in civil engineering, is the speed of water flow required to maintain a clean drain. In reality, however, very few drains are self cleansing due to the solid loading across a long period and mismanagement.

Need for Study

The drains that exist in Dimapur city, whether natural or artificially created are not able to carry the huge amount of water accumulated due to heavy rains, leading to water logging in different parts of Dimapur. Flood waters are liable to contaminate local drinking water making it unsuitable for consumption. Additional health hazards faced by people living close to drains include mosquitoes, which breed in the stagnant water, and water borne diseases. Rapid urbanization and population growth has contributed to drainage systems getting congested and overburdened. Poor drainage causes early pavement distress leading to structural failures of roadways. Such damages have the potential to impact the economy both in terms of productivity and motor maintenance. In order to minimize premature pavement failure and enhance the road performance, it is imperative to provide adequate drainage systems in the city. Therefore, the present study has been carried out in Dimapur city with the objective.

1. To identify existing conditions of drainage systems and the problems faced by localities in Dimapur town.

Methodology

Study Area: The study has been carried out in Dimapur city which is the largest city in Nagaland, India. The city district comprises of four blocks and seven circles with an area of 927 sq. km. The total population of the district as per 2011 census

is 3, 79, 769, out of which 1, 82,479 is in urban and 1, 97, 290 is rural population with a population density of 410 per square km. The drains constructed in Dimapur town have presented two categories of drainage system i.e. natural drainage system and artificial drainage system. According to the report of Central Groundwater Board, North East Region (2013), the district drained by two major River systems viz- Dhansiri river flowing from South West to North East direction on the South West part of the area and Diphu river flowing from South to North and on the South Western part later on meandered with Dhansiri river in Dimapur Valley. These two rivers viz - Dhansiri and Diphu and their tributaries serve as the main surface water sources for irrigation and drinking water in Dimapur district. The drainage pattern are sub parallel branches controlled by the structures and lithology of the area. So far it was not possible for researcher to get accurate number of artificial drains that are constructed and under construction from any relevant sources.

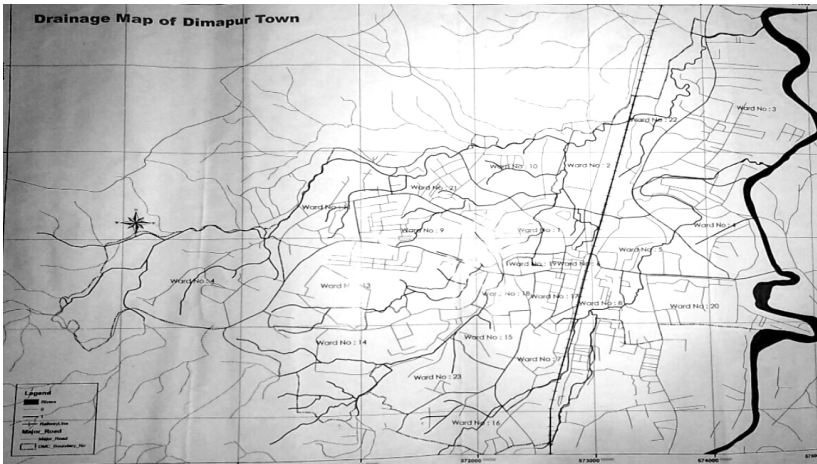


Illustration 1: Map showing drain constructed in Dimapur City.
Source: Dimapur Municipal Council.

Sampling: A total 10 numbers of drains have been selected within Dimapur town mainly focused on the Rajbari, New

market, Zeliangrong village, Thakurbari, Signal Bazaar and Super Market areas including footpaths, open and close drains, new drains under construction and old drains by convenient sampling method for the study. The researchers have used this sampling method as per ease of access, readiness, availability at a given time slot of the research.

Tools and techniques of data collection: The study is descriptive and explorative in nature. Qualitative data have been collected for the study. Because of the nature of the problem and difficulties involved in the collection of data, the researchers have used only qualitative data. Primary data have been collected in order to study drainage system attached in the city. Field observations, interview with local people and case study methods have been used as tools for data collection. Secondary data have been collected from books, journals, web sites and published and unpublished research studies, official records of Municipal and also from other departments of Dimapur.

Field work: The field work is categorized into 2 phases.

The first phase of field work was conducted during the month of June, July and August of 2018. During this phase, feasibility of the study was verified by observing the study area. The researchers identified the locations where frequent water logging occurs in Dimapur town. The second phase continued from beginning of winter season i.e. January 2019 to the end of February 2019. During second phase, the researchers visited some of the areas of Rajbari, New Market, Zeliangrong Village, Thakurbari, Signal Bazaar and Super Market to observe the conditions of the infrastructure and to collect data.

Study Results

The study on drainage system in Dimapur revealed that in most of the areas where flood occurs excessively, the rate of flooding

and water levels are increasing year by year. Few areas are listed below where the researchers have identified existing conditions of drainage systems and the problems faced by localities in those areas.

Rajbari: This is primarily a residential area of the city. The main drain in this area is totally covered by solid waste and sediments; it is because the outlet of this drain has not been cleared for a long time. Even during the dry season, the water in the sub-drains gets clogged which results in the contamination of other water sources. Interactions with the local residents revealed that the drain has not been cleared for the last 5 years which may explain the yearly accumulation of solid wastes resulting in incidences of water logging in the drain. Furthermore, the lack of advance machinery has rendered the locality's efforts unproductive in cleaning the drain. The blockade of the drain by solid wastes primarily that of plastic wastes causes flooding with water rising to a maximum of 5 feet during the peak rainy season, this result in the evacuation of the local residents every year.

New Market area: It is a commercial area in the middle of Dimapur town. The width of the drain is uneven due to which the solid wastes get blocked in the part where the width is narrow. No proper maintenance is taken for clearing the drains within the required interval of time. The drain is totally covered by solid wastes which are mostly produced by illegal dumping of commercial waste and kitchen wastes.

Zeliangrong village beside Dhobinalla: It is a low lying residential area, where water logging problem arises very frequently. In this area, a natural water stream passes, which comes from a hilly part of Dimapur (Rangapahar). The drain is partially covered by solid waste which disturbs the proper flow of water. As a result, the water flows over the drains and causes regular flooding in the residential areas. The width of the drain

is not adequate to carry the volume of the water during the rainy season.

Thakurbari area: It is a highly packed residential area beside Ram Janaki Higher Secondary School. There are many sub-drains in this area. Construction of buildings over the drains creates unevenness that expedites clogging of the drains by solid wastes. As a result, the area faces water logging problems during the rainy season.

Super Market area: This area lies beside Supermarket; it is a commercial area covering a part of the major transport system of Dimapur. In this area, major water logging problems happen even with minimum precipitation. Usually the water level rises up to a level of 2-3 feet above the ground. The width of the drain is totally insufficient to carry the flow of water in normal condition. The drain in this area is cleared by the state management and locals on a regular basis. The drain is in lower level than the main outlet due to which, during heavy precipitation, the water level in the main drain raises and results in the water flowing in the reverse direction through the outlet into the area. This major flaw in design and construction causes severe water logging problems.

Signal Bazaar: In this area, the water levels raise up to a level of 1-2 feet during the monsoon. Again the infrastructure of the drain of this area is insufficient to handle the flow of water. In the monsoon season, the water comes in the drain from higher to lower level. There is a U-turn in the passage by which the water flows to the main outlet. However, the ground level in that particular point is lower and impedes the smooth flow of water through the gutter, causing water logging.

Footpaths: The design of the footpaths which are constructed in the town is not properly planned. The absence of provisions to access the drains underneath the footpaths prevents cleaning at required intervals resulting in blockade of the drain causing

water to flow through the inlets into streets. To solve these problems, there should be some opening lids at regular intervals so that clogged matters inside the drains can be conveniently removed.

New drainage construction: There is ongoing construction of drainage systems adjacent to the four lane highway construction in Dimapur. The pavements over the drains are being built with gaps at fixed intervals which will be covered by removable slabs allowing easy maintenance. This should prevent the same problems seen in footpaths occurring and will increase the lifetime of the road.

Findings

1. Every year the quantity of solid waste in the drains is increasing rapidly. Many drains are totally covered by solid wastes which are mostly produced by illegal dumping, commercial waste and household goods.
2. Due to the solid wastes and sediments, blockages happen resulting in the rise of water levels.
3. The drains carry the water of the hilly regions down and, as a result of blockages and substandard infrastructure, the water overflows from the drains causing flooding in the low lying residential areas.
4. Construction over drains makes the drains uneven and results in the blockage of the drain by the solid waste which gathers on these uneven surfaces. Again this leads to the flow of water over the drain during the rainy season.
5. The footpaths also contribute to water logging due to their inappropriate construction and limited access for cleaning.
6. Flooding resulting from blocked drainage leads to contamination of the ground water, resulting in an adverse

effect on the drinking water quality of the areas causing various water borne diseases.

7. Many drains have not been cleared for years.
8. Flooding in residential areas, where the water level may rise to 3 to 4 feet from the ground level requires the evacuation of residents every year during the rainy season.
9. In many instances, the basic infrastructures of the drains are inappropriate to meet its requirement. Many drains do not have sufficient capacity to carry the volumes of water commonly seen during rainy season. Drains have not been expanded or supplemented in line with population growth. Additionally, most of the drains have uneven width and there is a lack of proper maintenance.
10. In some low lying areas such as “*Zeliangrong village*” the width of the drain cannot be increased as there is no space left due to the construction beside the drain. In “*Thakurbari*” and “*New Market*” the width and the drainage is inappropriate and there lack of proper maintenance. In “*Supermarket*” and “*Signal Bazaar*” areas, the problem is due to the unplanned drainage systems where the infrastructure developed for drainage is inappropriate according to the ground level and the flow of the water.

Solutions and Recommendation

Dimapur is a developing city and there is a rapid population growth in recent years but the drains still follow the old system and should be upgraded to match the growing needs using proper planning and modern techniques. Based on the study, the following have been recommended:

1. There is a significant need for cleaning drains on regular intervals keeping in mind health and hygiene of the localities.

2. The government bodies should invest in advanced machinery for clearing drains.
3. There is a need for advanced planning before construction of drains.
4. The DMC and administration need to take strict action to create a plastic free city.
5. There is a need for allocation of more dumping areas to dispose waste materials, or regular collections by DMS.
6. There is need to increase the depth of the main outlets towards the outflow.
7. The width and depth of drains should be uniform with limited sharp bends so that solid waste and sediment does not build up in these areas.
8. Periodic maintenance and inspection of the surface drainage system should be carried out and stretches where water stagnates either in the side drain or on the pavement surface should be identified for immediate corrective measures.
9. There is a need to study planning and construction techniques of drainage systems in other cities which have succeeded in upgrading their drainage systems.

Conclusion

The drainage system is at its best when it is well designed and maintained properly. For these purposes, it is necessary that the drains keep their shape and slope in the designed manner during their lifetime. It is also necessary to ensure that the drains retain their full cross section, particularly for the monsoons. An important consideration for the capacity of drainage conduits is build up of sediments and solid wastes.

The drainage systems in Dimapur town are in a very poor condition and in a critical state in some areas. Most of the

drains are clogged with significant volumes of solid wastes and sediments which results in water logging. The drains have largely been built unplanned in an ad hoc fashion without keeping a clear view of future needs. There is an urgent need for proper construction of new drains with modern techniques. From the study, it was found that the maintenance of the drains is lacking in many aspects. There is also a lack of civic sense in the public as most of the solid wastes are domestic and commercial so there is a need of more awareness programs.

PHOTOGRAPHIC EVIDENCE OF THE PROBLEM

Plate 01: Rajbari



Drain covered by solid waste and sediments

Plate 02: Dimapur



Contamination of ground water

Plate 03: Bata Charali



Over flow of water from the drainage due to blockage

Plate 04: Signal Bazaar



Flood affected area

Plate 05: Thakurbari



Construction of building over the Drain

Plate 06: Zeliangrong village



Area is covered with solid waste

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