

Study on the Drainage System of Dhanmondi Residential Area in Dhaka City

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Abstract

A drainage network is an important element for any area. The drainage system helps to remove stormwater and sullage preventing waterlogging and environmental pollution. It is an important utility service for a community. Dhanmondi residential area is a well-known place of Dhaka city and the oldest residential area of the country. The area has severe drainage problems and the inhabitants suffer from water logging during the monsoon. The area of Dhanmondi is 4.5 square kilometers. It has about 19 kilometers of the road having about 38 kilometers of drains. There are 1625 inlets and 486 manholes involved with the drainage system. 1036 inlets are in running condition and the rest 589 are blocked. Dumping wastes in front of inlets and irregular maintenance contributes to drainage congestion. To ensure better performance of drains the blocked inlets should be repaired and cleaned. An effective regulatory body to control waste disposal and keep the road surface clean is essential. Increasing public awareness and enforcement of penalization should be carried out. DCC and DWASA are mainly responsible for water discharge and maintenance of the drainage system across Dhaka city. Improper maintenance of drains and disposal of solid wastes into drains, filling of canals and water bodies in and around Dhaka city has worsened the situation.

Keywords: *drainage, inlets, manholes, waste, water-logging*

Introduction:

The total population of the municipality comprising Dhaka and Greater Dhaka area is over 18 million and the population has increased by about 4.2% annually. The city faces numerous challenges such as water logging, inadequate service facilities, depletion of groundwater, polluted water, unplanned urban development and the existence of large slums. An extraction and drainage network is an important element for any community. Artificial and natural drainage helps to remove showers and storm water from the surface and prevents many problems like waterlogging, environmental pollution etc. So in addition to natural results, it is also important in our daily lives. In addition, it is an important utility service for a community. A proper drainage system is a problem for the people of Dhaka city to

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understand and a cry. Solid waste is blocking the drains. The canals in and around the city have been occupied and filled. The city of Dhaka had 65 canals which drain rainwater from the surrounding rivers including Buriganga, Turag, Balu and Shitalakshya. But this number has come down to only 42, other canals are being occupied as well as the existing canals are being illegally occupied.

Dhanmondi residential area is a well known place in Dhaka city which is the most important and oldest residential area of the country. Currently this area is affected by drainage congestion. Currently, the residents of Dhanmondi area are suffering from severe floods and waterlogging during the monsoon season. Construction of roads and other infrastructure changes the pattern of drainage flows. As a result some drains fail to carry the increased drainage water. Many reservoirs are filled in an unplanned way for building construction and other uses that previously played an important role in the drainage system of the area. In addition, surface drains in many areas are clogged with solid waste and construction materials, which contributes to drainage congestion and results in waterlogging.

Due to the poor drainage system in Dhaka city, where most of the canals are grabbed or choked up or filled up with illegal dumping of solid and construction wastes, waterlogging remains persistent. The DCC (Dhaka City Corporation) and DWASA (Dhaka Water Supply and Sewerage Authority) are mainly responsible for water discharge and maintenance of drainage lines across the city. According to the DCC statistics, there are around two-and-a-half thousand ditches and water bodies across Dhaka city. But these spaces are either being grabbed or filled up with waste.

The study presents a realistic picture of the drainage network in the study area and attempts to find out the causes of drainage congestion. The study collected data by following the primary and secondary data collection methods. And finally some suitable solutions have been recommended for improvement of drainage system of Dhanmondi residential area through direct field investigation and this study has tried to propose some effective waste management solutions which can be expected to lead to improvement of drainage conditions and environmental sustainability. The study also focuses on some solutions for the conservation of natural water bodies.



Figure 1: Dhanmondi main road during waterlogging

Most third world countries are experiencing rapid population inflation. And because of the random over-urbanization, drainage has become significant in human settlements. Failure to provide adequate drainage is directly linked to recurrence of malaria, spread of diarrhea, loss of habitat and property, disruption of communication and environmental degradation.

According to a study by BRAC University, the capital Dhaka is producing 6,110 tons of household waste per day. Of this, every citizen of Dhaka produces 377 grams of waste, of which 97 percent is organic matter. The remaining 3 percent waste is inorganic. In the last 10 years, waste production in this metropolis has almost doubled. Ten years ago, 1,376 tonnes of waste was removed at a rate of 43 per cent as against 3,200 tonnes per day. At present, 4,582 tons of waste is removed against the daily production of 6,110 tons. In addition to the waste drainage systems solid waste is taken directly to dumping. However, when water collects in the rain, solid and liquid waste becomes monotonous.

Drainage congestion is a very common issue like the other regular problems of Dhaka City. But very few studies have been conducted on the drainage system of the city and there is no study has been conducted to find out the causes of such problems and impacts on human life as well as the economy. The drainage system of Dhaka city failed as the city sees frequent water logging even after a brief shower. The issue has become seemingly permanent in some areas while the huge expenditure of the concerned authorities has proven disastrous. Initiatives for sustainable development through channeling the rainwater out are in dark, and the authorities are shrugging off the responsibilities putting the city dwellers in a fix without any quick solution to the issue.

Due to the poor drainage system in Dhaka city, where most of the canals are grabbed or choked up or filled up with illegal dumping of solid and construction wastes, water-logging remains persistent. The DCC and WASA are mainly responsible for water discharge and maintenance of drainage lines across the city. Improper maintenance of existing drainage systems and the disposal of solid waste into the drains are also responsible for the blockage of a drainage system and waterlogging. To remove the city's waterlogging problem permanently, the natural drainage system has to be restored. It is only a well-planned drainage system that can solve the mega city's waterlogging problem.

Two Dhaka city corporations, Dhaka WASA, Water Development Board, Dhaka Cantonment Board, Rajdhani Unnayan Kartripakkha (RAJUK), and private residential sectors are responsible to channel rainwater out of the city. WASA has 400 kilometers of drainage lines while its pipeline covers some 370 kilometers. Two Dhaka city corporations have about 2,000 kilometers of drainage lines. Dhaka District authority owns the 26 canals of the metropolis and DWASA is responsible to clean up those.



Figure 2: Blocked Drains and Manhole at Dhanmondi residential area

Drainage required in urban areas:

During rainfall, most of the water in underdeveloped lands gets soaked in topsoil and is gradually transferred through the soil to the nearest stream of water or groundwater. A small proportion of precipitation, usually 15 to 20 percent, turns into a direct surface flow that slowly flows into the water because the land surface is rough. This means that the effects of rain spread over several hours. Even, in short, heavy storms can have a slight effect on the flow rate of the receiving water as most of the rainwater can be absorbed into the soil. When catchments are developed, the proportion of land covered by impenetrable surfaces such as roads, parking areas, roofs, driveways, etc. will increase, which will prevent the natural penetration of rain into the soil. In advanced catchments, direct waterlogging can exceed 80 percent of rainfall. At the same time, since paved surfaces may be less rough than natural surfaces, water can travel faster through them, and as a result, the water flow will reach the receiving water more quickly. The rate of flow of receiving water is therefore much more sensitive to the intensity and volume of rainfall in developed areas than in undeveloped catchments.

The field gets wet in the rain. The water infiltrates into the soil and is stored in its pores. When all the pores are filled with water, the soil is said to be saturated and no more water can be absorbed. The remaining water flows overland towards the mainstream channel and is called the surface run-off. The storm drainage design primarily concerns this surface runoff. The primary objective of this drainage system designed is to drain out the stormwater either through open surface drains or through underground sewers. An important parameter for the design of a stormwater system is the rate and volume of runoff to be conveyed through the system as a consequence of storms. Runoff estimates are carried out based on knowledge of the occurrences of heavy rainstorms and the relation between rainfall and the corresponding runoff. The quantity of runoff depends on the geometry and physical properties of the catchments. Rainfall occurs at irregular intervals and intensities and frequencies and duration vary within catchments. Due to this random nature of occurrence of rain, the storm drainage system is designed considering estimated runoff based on the analysis of past rainfall records.

All household waste water except human excreta. The amount of odor produced depends on the type of water supply. When the water supply is carried by hand, a small amount of sore throat is usually disposed of by throwing it on the ground around the house without too much worry. But when the amount of sludge is large with backyard faucet or indoor water supply, inadequate disposal can cause considerable nuisance and health risk.

Different types of drainage systems:

Drainage can be natural or artificial. Many areas have some natural drainage which means excess water flow in lakes and rivers. Natural drainage, however, is often inadequate, and requires artificial or man-made drainage. The artificial drainage system of the study area can be divided into two groups. These are wastewater drainage and storm water drainage.

Wastewater drainage:

Wastewater drainage is the liquid waste conveyed by a sewer and may include domestic and industrial discharges as well as storm sewage, infiltration, and inflow of the study area.

Storm Water Drainage:

All the Sullage and stormwater are carried by the storm drain. Dhaka WASA is responsible for the stormwater drainage of Dhaka city. The operation and maintenance of the stormwater drainage system are organized by the Dhaka WASA Drainage Circle. ”

Surface Drainage:

Dhaka City Corporation is the responsible authority for the surface water drainage of Dhaka city. Surface drainage is the removal of excess water from the surface of the road. This is normally at the side of the road, also called open drains. The roads are sloped toward the surface drain and the surface drain is connected with the storm drainage network. Following are the four shapes that are commonly adopted in the construction of surface drains: Rectangular surface drains, Semi circular surface drains, U-shaped surface drains, and V- shaped surface drains.

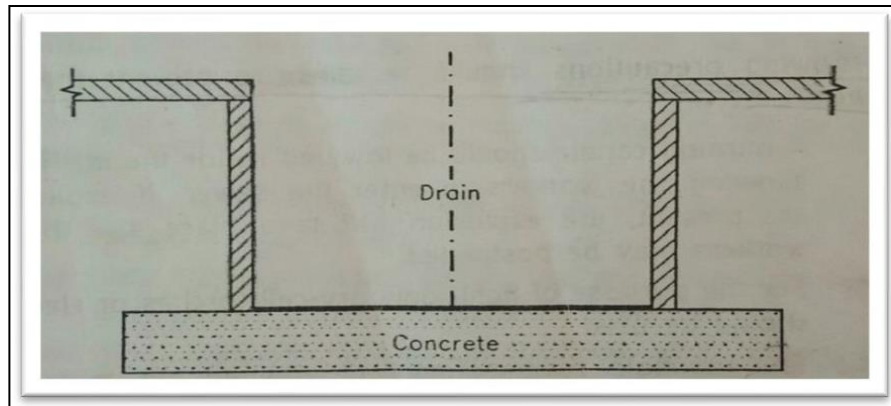


Fig 3: Rectangular surface drain

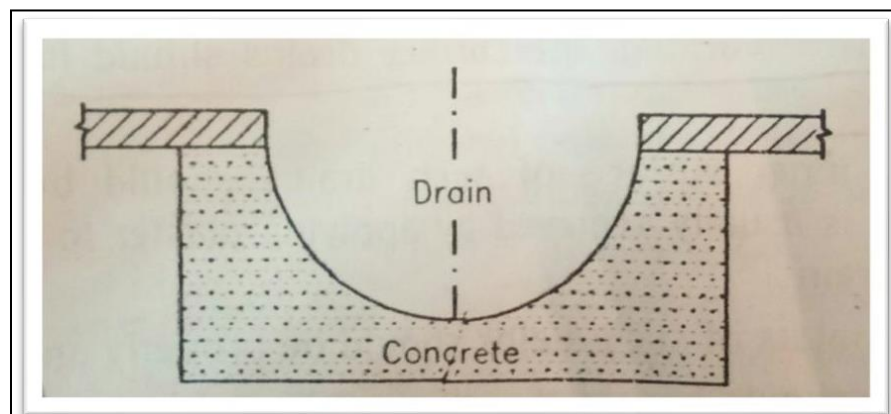


Fig 4: Semi-circular surface drain

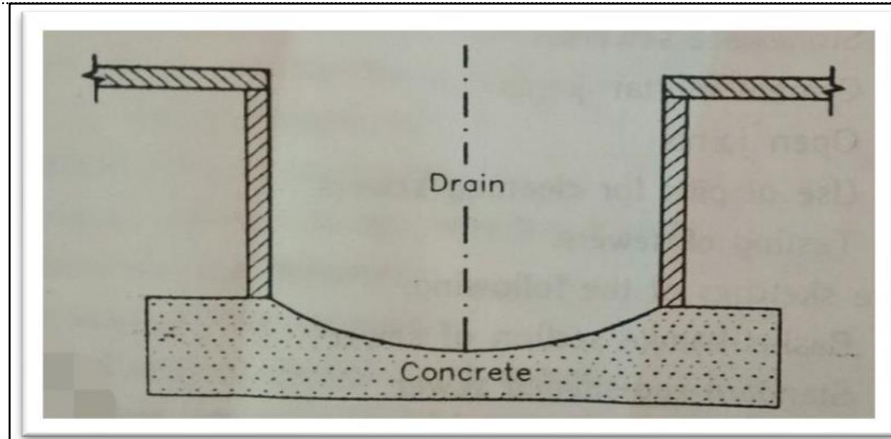


Fig 5: U-shaped surface drains

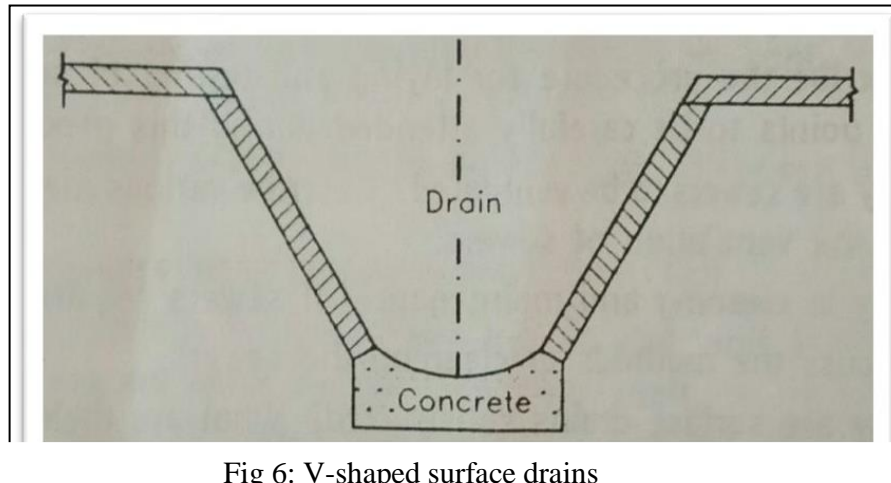


Fig 6: V-shaped surface drains

Drain Inlet:

Drain inlets collect water from roads and parking lots and convey it to an underground storm drain system.



Fig 7: Drain inlet

Drain outlets

Drain outlets can provide outfall for runoff generated from rainfall and isolated catchments. Most drains have a single large exit at their point of discharge into a canal, lake, or river.



Fig 8: Drain outlet

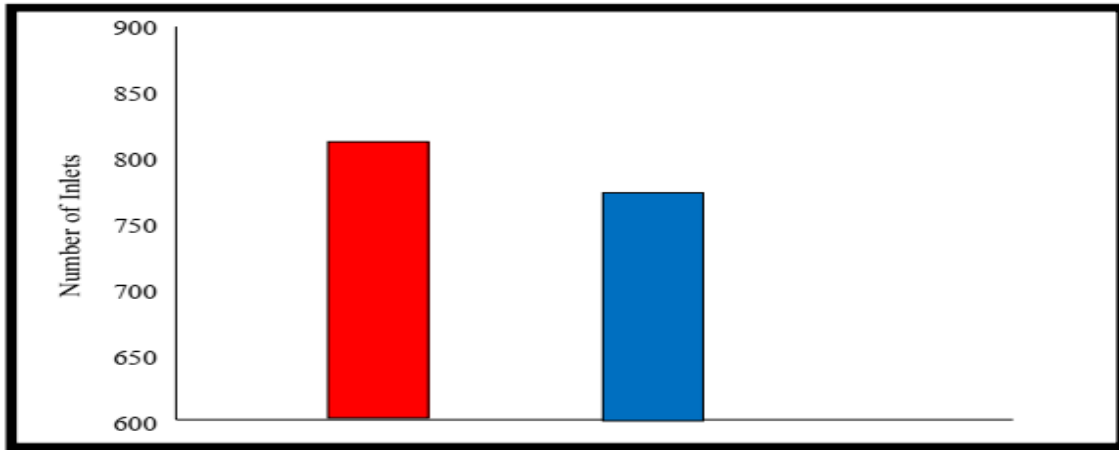
Methodology:

To facilitate the study, the Dhanmondi area has been divided into two segments: Dhanmondi 27 to Dhanmondi 8/A is considered as the 1st segment, and Dhanmondi 8/A to Dhanmondi 1/A as 2nd segment.

Table:1 Segments in Dhanmondi Area.

Segment	From	To
1 st	Dhanmondi Road no 27	Dhanmondi Road no 8A
2 nd	Dhanmondi Road no 8A	Dhanmondi Road no 1A

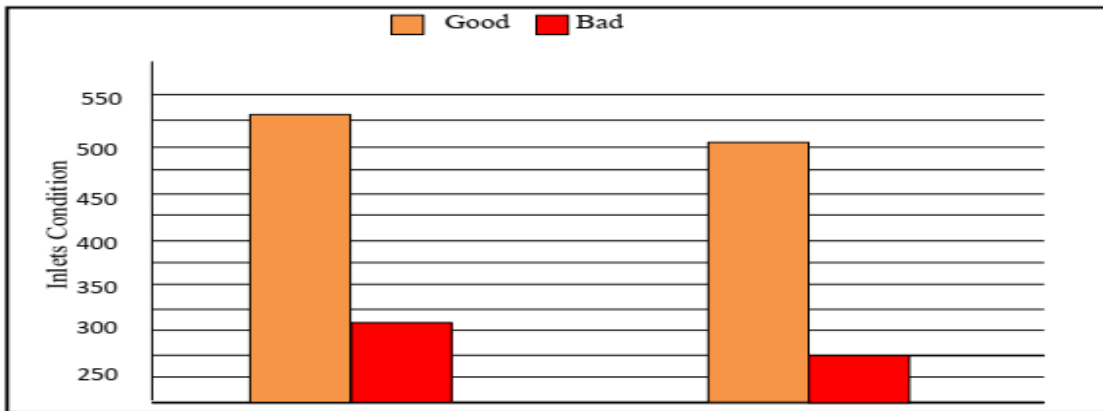
Data Analysis



Segment 1
847Inlets

Segment 2
778 Inlets

Fig 9: Number of Inlets



Segment 1: 532 315

Segments 2: 504 274

Fig 10: Inlets Condition



Fig 11: Inlet Condition

Table 2: Particulars of segment -1

SI No.	Road No	Length (m)	No. of Inlets	No. of Manholes	Inlet Condition	
					Good	Bad
1.	Mirpur Road (Dhanmondi 27to Kalabagan)	1100	40	12	27	13
2.	Dhanmondi 16	1060	88	19	48	40
3.	Dhanmondi 15/A	450	55	14	41	14
4.	Dhanmondi 14/A	290	38	11	30	8
5.	Dhanmondi 13/A	635	72	14	36	36
6.	Dhanmondi 12/A	1150	98	28	67	31
7.	Dhanmondi 15	616	56	10	31	25
8.	Dhanmondi 14	850	71	26	42	29
9.	Dhanmondi 13	400	48	9	26	22
10.	Dhanmondi 12	370	39	8	19	20
11.	Dhanmondi 11	788	66	15	37	29
12.	Dhanmondi 11/A	842	69	29	49	20
13.	Dhanmondi 10/A	490	38	18	36	22
14.	Dhanmondi 9/A	491	40	18	26	14
15.	Dhanmondi 8/A	300	29	11	17	12

Source: Field Survey, 2019.

Table 3: Particulars of segment -2

SI No.	Road No	Length (m)	No. of Inlets	No. of Manholes	Inlet Condition	
					Good	Bad
1	Mirpur Road (Kalabagan to Labaid)	1230	46	14	33	13
2	Dhanmondi 7/A	527	50	18	34	16
3	Dhanmondi 6/A	493	40	16	27	13
4	Dhanmondi 5/A	248	26	11	16	10
5	Dhanmondi 4/A	232	23	10	18	5
6	Dhanmondi 3/A	183	18	7	11	7
7	Dhanmondi 2/A	144	16	4	10	6
8	Dhanmondi 1/A	730	70	18	39	31
9	Dhanmondi 10	563	53	20	28	25

10	Dhanmondi 9	283	30	12	20	10
11	Dhanmondi 8	632	48	16	32	16
12	Dhanmondi 7	537	40	12	28	12
13	Dhanmondi 6	299	26	10	16	10
14	Dhanmondi 5	528	45	13	30	15
15	Dhanmondi 4	621	52	16	35	17
16	Dhanmondi 3	532	48	15	31	17
17	Dhanmondi 2	712	68	23	48	20
18	Dhanmondi 1	547	50	12	31	19

Source: Field Survey, 2019

Summary of results

Table 4: Details of Segment 1

Total Road Length	9.8 km
Total inlets	847 Nos.
Good Condition Inlets	532Nos. or 63 %
Bad Condition Inlets	315Nos. or 37 %
Manholes	242 Nos.

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Table 5: Details of Segment 2

Total Road Length	9.4km
Total inlets	778Nos.
Good Condition Inlets	504 Nos. or 65 %
Bad Condition Inlets N	274Nos.or 35 %
Manholes	244Nos.

Conclusions:

In conclusion, there are two ways to drain water One. Absorption of groundwater and two. Going to the river through canals, beels and drains Neither of these two paths is effective in Dhaka Due to this waterlogging is increasing. Out of a total of 1625 inlets in Dhanmondi residential area 1036 inlets i.e. 64% are in good condition and 589 inlets i.e. 36% are blocked. There are 486 manholes and those are in workable condition. The following conclusions can be drawn in the light of the analysis obtained in the study:

- People throw out their wastes into the road in front of the inlets.
- Street food cookers pour up their waste material beside the inlets.
- Road reconstruction and increase of carpeting height make inlet blocked.

- Road surface dust gradually accumulates in front of inlets.
- Regular maintenance of inlets and drains is not done.
- Awareness of inhabitants of the area regarding disposal of wastes is lacking.
- Canals and water bodies in and around the city have been grabbed and filled up.
- Unplanned urbanization is a major cause of waterlogging due to water logging and illegal occupation.

Recommendations:

The following recommendations are made based on the findings of the study:

- The first condition for eliminating waterlogging in the city is that the entire road from the roadside drain to the river must be wide and deep as required and most importantly, the waterway must be uninterrupted. Where there is a sluice gate to control the flow of water, its regular maintenance, timely opening and closing. Where there are pump stations, create reservoirs and operate pumps at proper capacity at appropriate times.
- To ensure better performance of drains regular repair and renovation of the blocked inlets is essential, and when it is raining, the drains /sewer has to be cleaned.
- Creation of an effective regulatory body to ensure proper use of inlets and to penalize for disposal of waste in front of inlets.
- Throwing waste into the roads must be stopped and roads should be regularly cleaned of dust.
- Strict restrictions for street cookers must be applied.
- Daily, weekly and monthly maintenance for preventing inlet block must be ensured.
- An increase of public awareness by the campaign through print and electronic media should be carried out.
- Many water bodies are filled for the construction of buildings and other uses in an unplanned way that previously played an important role in the drainage system. These water bodies and low-lying areas should be cleared for the accommodation of stormwater.
- There is no alternative but to recover lost canals, increase mobility and capacity to overcome waterlogging. The ownership of the city's surface drains, underground storm water drains and canals is vested in various agencies. The development and management of all canals within the city corporation should be under the mayor's office. The manpower, money and equipment currently employed in the management of these canals can be transferred under the mayor accordingly.
- Drainage system should not be damaged in any way due to the large scale infrastructure projects underway in the city. Take appropriate action in this regard and inform the City Corporation regularly. A strong task force needs to be formed with WASA, Water Development Board, District Administration and professional organizations in the role of 'Chief Coordinator' of the mayors. Once the city government is introduced, the task becomes easier.

Finally, it can be said that without political goodwill and good governance, it is not possible to solve the water shortage in Dhaka city. The recommendations of the drainage master plan of the metropolis need to be implemented quickly to reduce waterlogging. If you can't take the projects in time, it becomes very expensive to solve them later. The livability of Dhaka city is under threat today. Therefore, the livability of our beloved city cannot be improved without solving the problem of waterlogging.

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