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A study on some aspects of drainage system in Rajshahi city, Bangladesh

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ABSTRACT

For the lack of proper efforts of the authorities, majority municipal areas in Bangladesh are found various mismanagement systems. As a result the city people have to live in a dirty condition and suffer a lot for want of basic amenities like water and electric supply, drainage management and sanitation. Among them, the lack of drainage facilities is very sensitive as because it has direct impact on human health. The study area of Rajshahi City is mainly affected by lack of drainage comparing with other cities in Bangladesh. The improper and unplanned drain construction has increased the unhappiness of its inhabitants. So, it is an immersing issue to identify the problems and find out the solutions regarding drainage systems in Rajshahi City, Bangladesh. To do so, data and necessary information were obtained from the secondary sources, viz. Rajshahi City Office, Development Authority, Local Government and Engineering Department, Drainage Master Plan, Department of Public Health and Engineering Office. The collected data has been used for univariate analysis, to carry out the description of the variables and their attributes on data in list. The disproportionate distribution of drainage pattern in this city created hazardous situations to flow solid and liquid wastage properly and created a harmful impact on the environment. More research is needed in this area. Modern drainage systems should be followed to minimize the existing problems in this city.

1. Introduction

The proper drainage system is vital for a sound and livable city. In the areas where the drainage and sanitation systems are poor, water runs over the ground during rainstorms, picks up faces and contaminates water sources. This makes an uneven situation significantly to the spread of diseases such as typhoid and cholera, and may increase the likelihood of contracting worm infections from soil contaminated by faces. Flooding itself may displace populations and lead to the further health problems (Kolsky, 1998). Drainage is one of the emerging and challenging issues in urban environmental management. Rajshahi is the fourth largest City in Bangladesh, but its drainage system is not well organized specially in the periphery areas. Most of the areas of this city have no planned drainage network and most of the households disposed their wastes haphazardly into the existing drains (Halder, 2011). The drainage pattern of a city has a great importance as because city's beauty, health and convenience are mostly depends on it. A sound drainage system is essential to keep a city clean and hygienic. Drainage pattern can ensure both solid and liquid waste management of a city. The drainage pattern can play a vital role to alleviate water-logging problem and to provide proper sanitation facilities in the city. The drainage pattern of Rajshahi City is in dirty condition. Although every fiscal year a huge amount of money are allocated in purpose of construction and reform drain but for want of proper planning, the drainage pattern failed to met its demand. As a result peoples of the city suffer a lot (Ali, 2002). The environment of the city and the living standard of people are deteriorated as because of leakage and unplanned drainage system (Allimuddin, 2002). It creates a lot of problems to the city dwellers and also polluted the environment.

Drainage planning was taken over by drainage engineering without any conscious endeavor to integrate drainage planning with the land use planning process. As a result engineers build drains on the basis of actual situation in the catchments they serve. They did not give much recognition to the fact that the lands remaining a flood plain today would be filled and become a jungle of masonry or concrete buildings tomorrow. Very little provisions were made for flood storage (Ashraf et al., 2009).

Different categories of drains: According to the Drainage Master Plan of Rajshahi City, there are three categories of drains in the city. These are primary drain; secondary drain, and tertiary drain. There is no any authentic definition of different types of drains. On the basis of their structure and size they are categories in to different types.

Primary drain: Actually primary drain means the main drain of an area. The drain which consist vast depth and width are normally defined as primary drain. There are 12 primary drains in Rajshahi City whose total length is 44.80km (DMP, 2005). These are: Chalna, Darusa, Kasobpur, Sreerampur, Circuit House, Dargapara, Fudkipara, Kumar para, Kalpona, Khorbona, kajla, and Satbaria drain.

Secondary drain: Secondary drains are the medium drain. This drain are inter link with primary drain to flow their wastage and water. The total length of secondary drain is 42.69km (DMP, 2005).

Tertiary drain: tertiary drains are the small and narrow in size. There are about 200 tertiary drains in the city whose total length is 41.78 km (DMP, 2005).

Rajshahi Division is one of the six administrative divisions of Bangladesh and is divided into 16 zilas (districts), 128 upazillas(sub-divisions of zilas) and 1092 Unions (BBS 2003). One of these is Rajshahi Zila, which was a sub-division of the former Greater Rajshahi District until it was upgraded to a zila in 1984 (BBS, 1993). There are 9 upazilas, 70 unions, 1858 villages and seven pourashava (municipalities), including Rajshahi City Corporation (RCC) in Rajshahi Zila (BBS, 2005). Rajshahi City Corporation was previously comprised of the whole of Boalia Thana and some of Paba Thana but by the 2001 census Boalia Thana had been reduced from 96.69 km² to 38.56km² and a further three thanas formed: Matihar, Rajpara and Shah Makdhum from its original area (BBS, 2006). The management of the city is currently based on 30 wards. There are 132.27 km drains of various categories are constructed in Rajshahi City (DMP, 2005). Waste and water cannot flow through the drains smoothly. Some drains have broken and waste passes around the locality. Most of the tertiary drains are full up by soil and different types of wastages. It creates barricade to flow but the cleaners do not clean the drain regularly and medicine are never sprinkle on the drains. The authority only takes care of drains in the core area of city. There is still some area where there not reach drainage facilities at all. Moreover, the populations are increasing day by day in the city. Several slum areas

are built on the bank of the wider drains where the slum dwellers are leading unhygienic (Hossain et al., 2010) and hazardous (Mondal et al., 2010) lives with lower life expectancy (Mondal and Shitan, 2013). To meet the demand of growing people settlement, the city area is automatically expanding. Consequently, the demand of drainage facilities is increasing. This issue is very much related with city's whole environment. The drainage system can ensure to remove the waste of city in due time. To solve the water logging problem drainage system play the main role (Ahmed and Rahman, 2000). Actually the good condition of a city is very much depending on its drainage pattern (Clemett et al., 2006). In order to preserve the beauty of this city, remove environmental pollution and ensure hygienic living of the city it need to research more about drainage pattern. Therefore the main objective of this study is to explore the present condition of drainage pattern of Rajshahi City, Bangladesh.

2. Materials and methods

Secondary data are used in the study. The data and necessary information are collected from Rajshahi City Corporation (RCC Report, 2005), Rajshahi Development Authority (RDA), Local Government and Engineering Department (LGED) Rajshahi Branch Office, Drainage Master Plan (DMP, 2005), Department of Public Health and Engineering (DPHE)Office, different project reports, and various published documents like journal, thesis, etc. Rajshahi District, which covers an area of 2407 km², of which 62 km² is river, is located in the north west of Bangladesh bordering India to the south (BBS, 1993). Rajshahi City Corporation, which was formed in 1987, covers an area of approximately 48 km² being bounded on the east, north and west by Paba Thana (subdivision of a district) and on the south by the Padma River The study area of the research is Rajshahi City, Bangladesh. It is one of the major divisional head quarters of Bangladesh. It lies between 24° 21'North to 24° 26'North latitude and 88°28' East to 88°38' East longitude (Mahmud, 2005). The population of the investigated area is 842,701 persons and its density is 8,700 persons per square km. This area is known as high 'Barind' is generally elevated with maximum of elevation 18.3 meter from sea level. The collected data has been used for univariate analysis, to carry out the description of the variables and their attributes on data in list.

3. Results

Drainage system plays the main role to remove waste, water logging and maintains sanitation of a city. The city dwellers have to suffer a lot if the drainage system is not well and sufficient. Through a questionnaire survey in study area it has found that there are 64.47% area of the city has drains, 13.60% area has no drain, 2.19% area was in past and 19.74% area under construction (Table 1). The level of waste expulsion depends on the drain type. Expulsion level of waste through pucca (bricks built) drain is more than semi-pucca and kacca (soil built) drains. Through the questionnaire survey of study area it has found that pucca drain has in 29.44% area kacca drain has in 25.38% area and semi-pucca drain has in 45.18% area (Table 2). The main purpose of drain construction is to remove waste and water logging problem. The drainage system may be ineffective if the flows of drain are stopped. The drainage flow may be stop due to various reasons. Among them one of the main reasons is, not to clean drain regularly. Through direct investigation of the research area it is found that 45.18% drains flow regularly, 35.53% drains flow sometimes, and 19.29% drains are not flow yet (Table 3). A good drainage system mostly depends on proper cleanliness of drains. In this research area, most of the drains are not clean regularly. Through the questionnaire survey it is found that 21.32% of drains are clean regularly, 39.09% of drains are clean some times 27.92% drains are clean in very few and 11.67% drains are not clean at all (Table 4).

Table 1
Existence of drain type in research area.

Existence of drain type	Number	Percentage (%)
Have drain	147	64.47
No drain	31	13.60
Exist in past	5	2.19
Under construction	45	19.74
Total	228	100%

Source: questionnaire Survey-2006.

Table 2

Drain type of research area.

Drain type	Number	Percentage (%)
Pucca	58	29.44
Kacca	50	25.38
Semi-pucca	89	45.18
Total	197	100%

Source: questionnaire Survey-2006

Table 3

Waste flow type in research area.

Waste flow type	Number	Percentage (%)
Regularly	89	45.18
Sometimes	70	35.53
not flow	38	19.29
Total	197	100%

Source: questionnaire Survey-2006.

Table 4

Drain cleaning system.

Drain clean type	Number	Percentage (%)
Regular	42	21.32
Sometimes	77	39.09
very few	55	27.92
not at all	23	11.67
Total	197	100%

Source: questionnaire Survey-2006

Table 5

Sanitation condition of Rajshahi City.

Sanitation Condition	Population	Percentage (%)
Pucca	202	67.33
Kacca	47	15.67
Semi-pucca	41	13.67
No toilet	10	3.33
Total	300	100%

Source: questionnaire Survey-2011

Table 6

Drainage system status of Rajshahi City.

Drainage system status	Population	Percentage (%)
Consist drains	214	71.34
No drains	58	19.33
Project going on	18	6.00
Was in past	10	3.33
Total	300	100%

Source: questionnaire Survey-2011.

Through the questionnaire survey, it is found that 67.33% of the toilets are pucca, 15.67% are kacha, 13.67% are semi pucca, and 3.33% have no specific place for it, which are known as hanging latrines. The people use open space as toilet (Table 5). The insufficiencies of drainage and sanitation systems of Rajshahi City create a lot of problems to the city dwellers. Through a questionnaire survey it has found that 71.34% of the total city area has

drainage facility, 19.33% area have no drains, drainage project is going on in 6.00% area and 3.33% was in the past (Table 6).

4. Discussion

In Rajshahi City, the percentage of the population without access to any form of sanitation facility was calculated in the 2001 census to be 22%. Access in urban areas is much higher than rural areas with just over 67% of urban households having sanitary facilities in 2001 compared to just 28% of rural households (BBS 2005). On the other hand, UNICEF estimated that access to sanitation facilities in Rajshahi Division was lower than in any other division in Bangladesh at just 43%. National statistics suggest that this is even lower in Rajshahi district where approximately 30% of households had sanitary facilities at the time of the 2001 Census. However this is a substantial increase since 1991 when the figure was just 12%. Using the BBS (2003) figure for the total number of households in the district, the number of household with sanitary facilities in 2001 was around 2.178 million. As with national statistics the proportion was higher in urban areas at 31% in 1991 and 49% in 2001. For quite some time, professional planning is being practiced in our cities. Unfortunately, drainage planning is the most neglected component of our city planning and management activities. Drainage engineering is done mostly on an ad hoc basis, often overtaking drainage planning. According to Rao (1995) drain refers to an artificial channel used for carrying off excess water from an area. Again drainage refers to the act of removing water from a formerly marshy area e.g., the drainage of Fens; and the discharge of the water from any area through a system natural stream. The present drainage system of Rajshahi City is not sufficient for its dwellers. The drainage network system plays the main role to discharge the solid and liquid waste of the whole city. But for want of sufficient drain and proper planning this network are failed to play effective role to dropout the wastage from the city (Rahman, 2005).

A network of drains to collect surface run-off covers Rajshahi City, running from near the Padma in the south through the city and out towards River Baraonai. The drains range from a few centimeters in width and depth between buildings, to several meters wide for the main drains. They are typically uncovered, which means that they collect a lot of solid waste, and though some of the smaller drains are lined, the main arteries are not. As Rajshahi City does not possess any sewerage system these surface run-off drains essentially act as sewers, taking the overflow from septic tanks and increasingly being linked to directly by households. They also receive a large majority of the grey water used in the city including not only domestic waste but also waste from commercial units, markets and small industries. In addition to this the units in the industrial area mostly connect directly to this system. Despite plans for treatment facilities to the north of the city there is currently no form of management. Solid waste management is also an issue for wastewater agriculture as a proportion of it ends up in the storm water drains which ultimately flow to the fields. The RCC area produces approximately 200 metric tons of solid waste per day, of which around 58 metric tons is not collected by the RCC and is therefore littered around the city. The RCC is also not responsible for collecting waste from households and in many mahallas the communities have organized themselves to collect the waste and dispose of it to the local collection points.

There are three different Phase of Drainage Project has been taken in Rajshahi City to implement the Drainage Master Plan by allotting 42.80 core taka. Among them two phase has been already completed. The third phase of drainage project has been approved and going to be started. The first phase drainage project was started at 1994 by allotment of 20.38 cores taka first time, but finally it turn to taka it 23.06 cores after three times amendment. About 34.75 km primary drain, 15.58 km secondary drains, 79 culverts 30 road-crossing and 2 flood rehabilitation centers was constructed in this project. The whole project was completed in June 2003. The second phase Drainage project was started at 1 July 2004 less than 215.95 million taka allocated. This project was supervised by LGED through Rajshahi City Corporation. About 9.40km primary drains, 9.97km secondary drains and 4 Railway culverts are constructed in this drainage project. The second phase drainage project has implemented under 215.95 million taka through LGED supervised by Rajshahi City Corporation. Third Phase Drainage Project has been approved on allotting 42 core taka to construct drains in the city. Rajshahi City Corporation has declared about this project through a press conference on last 31 May 2006. Target to implement of this project has estimated on 2020.

The city people of study area have already begun to get benefit after implementation of 1st 2nd phase Drainage Project. The first phase development project was completed in 2003 under which an effective network was developed in the city core by re-sectioning of 20 km Khal/primary drain and by simultaneous construction of 4

km primary, secondary and tertiary drains. As a result of implementation of first phase project 30% of city area has become free from water logging problem and 35% of city population has been directly or indirectly enjoying the benefits of the project. It is estimated that after completion of 2nd phase Drainage Project 60.00% city area, where density of population varies from high to medium has been completely free from major drainage problems and as a whole 70% of total city population has been benefited. As a result the environmental aspects of the whole city, i.e. the human health and productivity and betterment of the living environment will be improved. After finishing the 3rd phase Drainage Project it has been expect that about 100% of city area will be under good drainage network.

5. Conclusion

The drainage system is considered as the most important things in modern urban planning. Now a day it is considering as the criteria of a city either it is eligible to live or not. The most essential three objectives of city like beauty, health and convenience are also depend on it. The importance is increased due to rapid growth of urbanization. At present a city, without good drainage facilities is hard to imagine. The drainage condition of Rajshahi City is now reached at a standard position comparing one decade before. Especially after the implementation of 1st and 2nd phase drainage project about 60% of total area has come under the drainage network. Though the number of drains are not less but due to lack of proper observation or clean most of the drains are failed to serve its function. As a result the drainage system could not fulfill the demand of city's inhabitants. As the present drainage system of Rajshahi City is not sufficiently good and well planned. So, it keeps a negative impact on its inhabitants. It is badly need to improve this situation because the health and environment of the city are related to this issue. For the improvement of drainage system of the city the following recommendation should follow:

Firstly it needs to identify the drainage facility deprive area and then take proper step to provide such facilities; it needs to make a list of priority area, based on where drainage system is in sordid condition and then construct drain gradually.

In case of reconstruct or reformat the broken drain; to ensure proper flow of drainage waste and it needs to clean the drain regularly;

It needs to make large dustbin near residential area such as people can easily throw their domestic solid waste;

It needs to make cover of drain those on which are opened;

To solve the water logging problem it needs to interconnect with one drain to another, such as to pass the rain or excess water;

Finally it needs to give emphasize on grow people consciousness.

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