Paper ID: CE 0350

Urban Sanitation Facilities and Its Management in Rajshahi City

M. N. Bari[1], M. R. Kabir[2]

[1]Department of Civil Engineering, RUET, Bangladesh (niamulbari@gmail.com)
[2]Department of Civil Engineering, RUET, Bangladesh (engrraihan8@gmail.com)

Abstract

The existing sanitation facilities and its management practice of Rajshahi city has been investigated in this study. The primary and secondary information were collected through field investigation and personal communication with respective department of Rajshahi City Corporation. It is found that 100% people use onsite sanitation system and no open defecation in the city. Among the household sanitation facilities 98% is pour flush latrine and 2% is ventilated improved pit (VIP) latrine. As a part of management of sanitation facilities RCC only provide the septic tank emptying and collection of faecal sludge, transportation and disposal without prior treatment. About 65% septic tanks or pits are cleaned manually by sweeper and they throw it nearby drain and remaining 35% septic tanks or pits are cleaned by mechanically by RCC with septic tank cleaning machine "Vacutag". RCC disposes the faecal sludge at solid waste damping yard that creates serious threat to environment as well as human health. As a result the achievement of countrywide zero percent open defecation has been spoiled. Therefore, immediate action needs to be taken to install the faecal sludge treatment facilities to improve and maintain the healthy environmental condition of the city.

Keywords: *Urban; sanitation; facilities; management; septic tank.*

1 Introduction

The 172.95 (at the year 2023) million-person nation of Bangladesh has made great strides in sanitation during the course of the 15-year Millennium Development Goals (MDG) timeframe. The admirable accomplishment was made possible by a tremendous expansion of on-site sanitation (OSS) facilities, on which nearly 98% of the nation's population depends. A system known as on-site sanitation (OSS) typically stores, processes, and disposes of feces inside the walls of a home or small community. Pit latrines, privies, and dry toilets are examples of onsite technology (Bari, et al., 2018; Bari, 2017). Septic tanks (with or without soakage pits) and various pit or pour-flush latrines are typical OSS systems in urban settings. These OSS systems' generated sludge must be evacuated and treated off-site at specific intervals (Rahman, et al., 2015). Hazardous substances like sludge threaten both the environment and human health, including soil, air, and marine systems. OSS facilities are becoming significant contributors of surface and groundwater pollution. The sole source of support for residents of low-income neighborhoods and densely populated urban slums is OSS infrastructure. The majority of OSS facilities, including septic tanks, are constructed using no engineering design principles, which results in subpar performance. The Rajshahi City Corporation's sanitation services and Faecal Sludge Management issue, however, have received very little research. There are not many private NGO programs that analyze the hygienic conditions (Rahman, et al., 2015). Rajshahi, an important metropolitan region with a total area of roughly 97.18 square kilometers, its population is 449756, total holding no is 99545 and consisting of 30 administrative wards (RCC, 2023). On the basis of population, it is the fourth-largest city in Bangladesh and significant funds are raised each fiscal year to improve the sanitation system. The situation of faecal sludge management in Rajshahi city, which is currently expanding quickly and only relying on on-site sanitation, is becoming more and more urgent every day. Inadequate sanitation infrastructure declines the city's ecology and residents' quality of life (Rahman and Jakia, 2017). Now it is essential to evaluate the sanitation facilities, structural strength, management planning and facilities.

2 Methodologies

A comprehensive random field survey was conducted using a well-designed questionnaire among 200 households in Rajshahi City for the present research work to determine the different types of sanitation facilities, their

locations, accessibility, septic tank or pit emptying method and way of management. The information of existing public sanitation facilities and community sanitation facilities were collected from RCC and investigated in the field level. The necessary information regarding management of sanitation system was also collected from respective department of RCC. Finally collected information was analyzed to fulfill the goal of this study.

3 Results and Discussion

The results of the study are discussed in two steps one is sanitation facilities which enjoyed Rajshahi city dwellers and another is the management systems. The findings are discussed in the following sections.

3.1 Sanitation Facilities

Rajshahi city do not have any sewerage line. Rajshahi city dwellers mainly depends on onsite technologies include flush/pour flush latrine connected with covered pit or septic tank, ventilated improved pit latrine with cover slab. The field study shows that the city dwellers enjoyed defecation types of sanitation facilities. Sent percent people use any form of sanitation facilities and there is no open defecation in Rajshahi city. Among the entire sanitation facilities 98% are pour flush latrine with septic tank and 2% are ventilated improved pit (VIP) latrine.

Rajshahi development Authority (RDA) formed at 1976 is the authority for approving the any types of building including residential, commercial and industrial. RDA ensures septic tank and soak pit as a mandatory components of structure during the approval of architectural and structural plan. They also ensure the connecting road that will ensure the collection, transportation and disposal of faecal sludge.

Rajshahi City Corporation authority provided public toilet for pedestrian at crowded areas of the city. Rajshahi City Corporation has total 10 nos. public toilet complex, each toilet complex contain 4 to 12 toilet. The existing Public toilet facilities are presented in Table 1. It is observed that total 68 public toilets of which 50% is for female and remaining 50% is for male in different ten locations are available in the city.

Table: 1 Public toilet facilities in Rajshahi city

Name	Ward	Female toilet	Male toilet	Type of toilet
Kashiadanga public toilet	1	3	3	Pour Flush with septic tank
Terokhadia public toilet	14	2	2	Pour Flush with septic tank
Medical college public toilet	8	8	8	Pour Flush with septic tank
Saheb bazar bomb public toilet	12	6	6	Pour Flush with septic tank
Fudkipara public toilet	12	2	2	Pour Flush with septic tank
P.N Govt Girls High school public toilet	22	3	3	Pour Flush with septic tank
New market public toilet	13	3	3	Pour Flush with septic tank
Nowdapara Amchattar public toilet	17	2	2	Pour Flush with septic tank
Meherchandi public toilet	26	2	2	Pour Flush with septic tank
Talaimari public toilet	27	3	3	Pour Flush with septic tank
Total		34	34	

Rajshahi City Corporation constructed some community sanitation facilities at under developed slum area for low income people. These people are not conscious about sanitation and also they are not able to construct sanitary toilet. This type of sanitation facilities were provided at three areas, each sanitation facility contains 5 to 6 toilet which is presented in Table 2.

Table 2: Community sanitation facilities in Rajshahi city

Name	Ward No.	Female toilet	Male toilet	Type of toilet
Hetem Kha sweeper colony	11	2	2	Pour Flush with septic tank
Hetem Kha sweeper colony	11	3	3	Pour Flush with septic tank
Borokuthi slum area	12	2	2	Pour Flush with septic tank
Ghospara camp	22	2 with 1 bath room	2 with 1 bath room	Pour Flush with septic tank

There are two community sanitation facilities composed of 5 and 6 toilets and one community sanitation facility having 5 toilets are available in Hetem Kha sweeper colony and Borokuthi slum area, respectively where low income and disadvantageous people are living. During the field investigation it was observed that there were some community sanitation facilities in the Talaimari and Panchaboti slum areas. However, presently those were become unusable due to damage of septic tank and some were already demolished.

3.2 Sanitation Management

From above discussion it is found that 100% people are under hygienic excretion facilities. However, they are facing terrible situation for emptying of sanitation facilities and disposal of faecal sludge when filled up the septic tank or pit. The major components of management system are septic tank emptying and collection of faecal sludge, transportation, treatment and disposal or end use. The conservancy department of city corporation authority is responsible to provide this service. The organization of conservancy department is given in Figure 1.

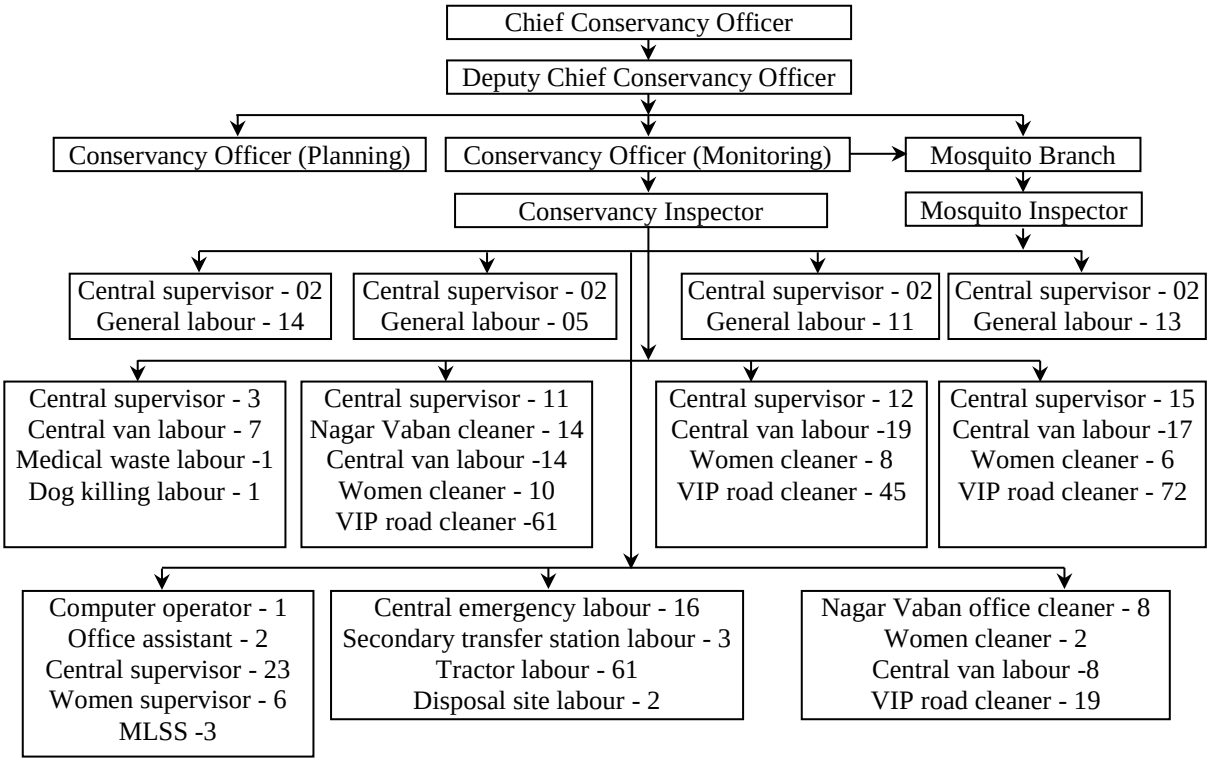

Figure 1: Flow diagram of conservancy department

3.2.1 Septic tank emptying and collection of faecal sludge

Generally house owners contact with sweeper for emptying their septic tank or pit. Some plumbing workers also provide this service on payment. Usually they use bucket for emptying manually the septic tank or pit. Almost 65% emptying service is provided by the local worker in private level. Rajshahi City Corporation also provides the faecal septic tank or pit emptying, faecal sludge collection, transportation and disposal services since 2011 by mechanical means with vacuum cleaner machine which name is “vaccutag” (Figure 2). The capacity of vaccutag is 2000 liters with long hose pipe of 100 mm diameter and operated by tractor engine. Generally RCC owned public and community toilets are cleaned with vaccutag machine. The vaccutag service for private household is provided on payment with advance booking. The private house owners have to communicate with RCC conservancy department and pay the approved fees to receive the service. The septic tank emptying service by RCC is presented in Figure 3.

Information provided by RCC on septic tank emptying service presented in Figure 2 shows that the number of septic tank emptying initially was very small during 2011 to 2014. At the initial septic tank emptying service by RCC was not known to the entire citizen. Whenever it is become known the service sharply increased in 2015 and then it is gradually climbing up except in 2016. Furthermore, there was no service in 2020 and it is might be due to the Covid pandemic situation. Now it can be said that everyday septic tank emptying service is provided by RCC.

Figure 2: Vacuum cleaner machine (Vaccutag)

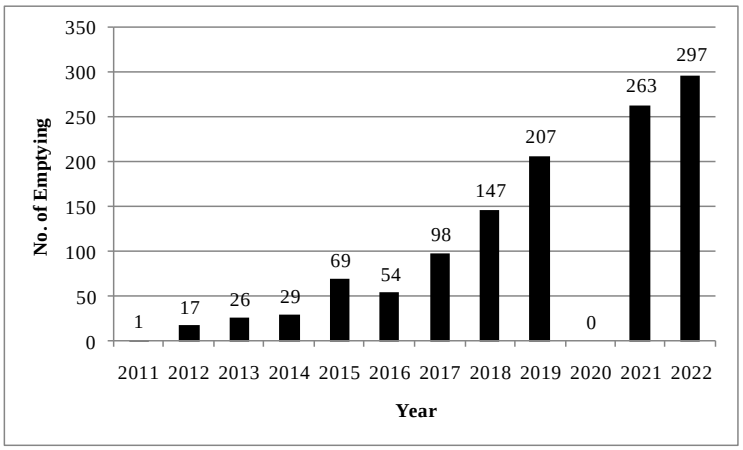

Figure 3: Trend of septic tank emptying service in Rajshahi city

3.2.2 Transportation

After emptying the septic tank and collecting the faecal sludge it needs to be transported to the treatment plant or disposal site. Rajshahi City Corporation transports the collected faecal sludge from homes to the disposal site with desludging vacuum tanker driven by tractor. The desludging vacuum tanker and tractor traveled from the city corporation garage to the client house. The tractor then moves to the disposal site after collecting the faecal sludge from the septic tank in accordance with the desludging vacuum tanker. Generally speaking, the city's traffic situation is mixed. The distances of disposal site located at City Hut solid wastes disposal site from different key locations of the city were estimated from a Google Earth map. The required travel time based on an average vehicle speed of 30 km/hr was computed and is shown in Table 3.

Table 3: Important points of Rajshahi City and their distance

Key locations	Distance of disposal site (km)	Estimated required time (min)
Rajshahi court	8.0	16.0
Court station	6.8	13.6
Binodpur bazar	11.9	23.8
CNB mor(N6)	6.6	13.2
Horogram bazar	8.1	16.2
Laxmipur mor	6.2	12.4
Saheb bazar zero point	8.4	16.8
Kasiadanga	5.6	11.2
Naodapara	1.9	3.8
Alu pottir mor	9.2	18.4

It is observed that highest travel distance is 11.9 km and required travel time is about 24 min. However, actual required time is more than the estimated time most of the time and it is due to the traffic conditions of road and service time of the day.

3.2.3 Faecal sludge treatment and disposal

Rajshahi City Corporation does not have any faecal sludge treatment facilities. As a result, the faecal sludge collected by local cleaners is disposed of by discharging into the nearby open drains. In some cases, they also disposed of by burial in an excavated pit depending on the availability of land. Similar findings were also observed in other studies carried out during 2016 to 2018 in Rajshahi city (Bari, et al., 2018; Bari, 2017). On the other hand, RCC disposed the collected faecal sludge directly without any treatment either into the primary drain or to the solid waste dumping site of 400 acres at City Hut (Figure 3). RCC has sixteen primary drains located at Chalna, Darusha, Keshobpur, Srirampur (Boalia), Circuit House, Dargapara, Fudki para, Kumarpara, Kalpona hall, Kharbona, Kazla, Satbaria, Court, Bolonpur, Pathanpara and Masterpara. Among these, thirteen drains are connected with the BWDB regulators lying on the town protection embankment along the bank of River Padma. The rest three are without regulators and north-going drains, discharging into the lowlands/beels on the north-east and north-west corners of the city. Ultimately the faecal sludge goes to the low laying land, surrounding cultivable land and water bodies. This situation creates very harmful conditions to the environment, public health, surface water and underground resources. The conservancy department of RCC has instruction to bury the sludge below 1 to 1.2 m from earth surface but most of the cases they do not obey the instruction. Therefore, the credits of zero percent open defecation achievement have been destroyed through the disposal of faecal sludge directly to the open place without any prior treatment.

Figure 4: Solid wastes disposal yard at City Hat

3.2.4 Cost of service

The rate of service charge during the year of 2011 to 2013 was BDT 2000 for a septic tank. House owner had to pay the fee to the RCC to empty a septic tank. The rate has been reduced time to time to encourage the people to receive the service from RCC. The service charge for emptying per septic tank was reduced to BDT 1400 during 2013 to 2014 and has further reduced to BDT 1200 after 2014. Presently service charge has to pay by depositing money to the Agrani Bank, a schedule bank of Bangladesh, with additional vat of 15% of the total amount. Along with this cost there are some additional costs such as fuel cost, laborer and driver fee, Chemical cost etc will be added. That has to be paid by the house owner. According to the distance from septic tank to the disposal site the amount of fuel cost has to be paid by the house owner. The desludging vacuum tanker needs one liter diesel for each 3 Km up and down distance. Each liter diesel costs BDT 100.00. At least two laborers are required for this operation and each laborer demands BDT 500. The driver's fee is same as laborer. The additional cost varies according to the size of the septic tank. Now a day for cleaning a septic tank a house owner has to pay from BDT 6000 to BDT 7000.

3.2.5 Revenue

RCC authority has opportunity to earn some revenue from lease public toilet and sell of fertilizer from damping site. The earning of last three year revenue has been collected from RCC and presented in Table 4. The results shows that the revenue collection for the last three financial years of 2020-2021, 2021-2022 and 2022-2023 are BDT 18,14,894.00, BDT 20,38,140.00 and BDT 22,51,850.00, respectively. The encouraging matter is that the revenue earning is gradually increasing in every year.

Table 4: Earning of last three year revenue by RCC

Name	Earning of revenue (BDT)		
	2020-2021	2021-2022	2022-2023
Kashiadanga public toilet	14900	16390	18029
Terokhadia public toilet	6167	6783	7461
Medical college public toilet	681667	749833	824816
Saheb bazar bomb public toilet	406554	447209	491929
Fudkipara public toilet	2767	3043	3347
P.N Govt Girls High school public toilet	154734	170207	187227
New market public toilet	113334	124667	137133
Nowdapara Amchattar public toilet	9400	10340	11374
Meherchandi public toilet	15600	17160	18876
Talaimari public toilet	50500	55550	61105
Fertilizer from RCC Damping Site	110871	121958	134153
Rent Fee of Vacuum Cleaner	248400	315000	356400
Total Revenue (BDT)	18,14,894	20,38,140	22,51,850

4 Conclusions

From the above discussion it can be concluded that, cent percent people have access to any form of sanitation facilities. The city corporation authority has provided some public sanitation facilities in important crowded places and community sanitation facilities in slum areas both for male and female with sufficient privacy. The local sweepers and plumbing workers are involved in septic tank emptying service along with the RCC authority. The collected faecal sludge is disposed mainly in drain and solid wastes dumping site without prior treatment. The RCC authority does not have any faecal sludge treatment plant (FSTP) for the proper management in sanitary means. As a result the achievement of countrywide zero percent open defecation has been spoiled and creating threat for human health through the contamination of surrounding land, surface water and groundwater. The RCC has well structured conservancy department with sufficient manpower and they are earning handsome revenue from the existing service facilities in every year. Therefore, Rajshahi City Corporation authority should take immediate initiative for establishing a faecal sludge treatment plant that might open the scope of proper management of sanitation facilities and also can earn more revenue.

Acknowledgements
The authors would like to acknowledge the valuable support and information provided by Executive Engr. Nilufar Yasmin, Chief Conservation Officer Engr. SK. Md. Mamun, and Town Planner Md. Boni Amin of RCC.

References

Bari, M.N. (2017). Study on Existing Faecal Sludge Management Situation in Rajshahi City. Proceedings of the WasteSafe 2017 – 5th International Conference on Solid Waste Management in South Asian Countries, 25-27 February 2017, Khulna, Bangladesh. (Citation: GS-0/RG-2)

Bari, M.N., Bushra, A., Zaman, J. (2018). Management of faecal sludge by Rajshahi City Corporation. Proceedings of the 4th International Conference on Civil Engineering for Sustainable Development (ICCESD 2018), 9~11 February 2018, KUET, Khulna, Bangladesh (ISBN-978-984-34-3502-6).

Rahman, M.M. and Jakia, T. (2017). Solid Waste Management of Rajshahi City in Bangladesh and Its Impacts on Human Health and Environment. Semantic Scholar. Corpus ID: 170076641. https://www.semanticscholar.org/paper/Solid-Waste-Management-of-Rajshahi-City-in-and-Its-Rahman-Jakia/70f94d91ec20e002c0713f0a08d12ea55ec2aeb5#extracted

Rahman, M.M., Ali, M.A., Choudhury, M.R., Rahman, M.A., Redwan, M.A., Noor, N.F. and Sohan, A.I. (2015). Fecal Sludge Management (FSM) Scenario in Urban Areas of Bangladesh. ITN-BUET, Bangladesh. https://itn.buet.ac.bd/web/resources/case-study-fecal-sludge-management-fsm-scenario-in-urban-areas-of-bangladesh/ DOI: 10.13140/RG.2.2.25766.73280

RCC (2023). Information collected from conservancy department of Rajshahi City Corporation, Personal communication.