**EVALUATION ON THE IMPACTS AND ALTERNATIVES OF PASSENGER TRAIN TOILETS IN BANGLADESH**

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**ABSTRACT**

*This paper discusses the existing toilet system (Hopper toilet) of trains in Bangladesh. It analyzes the negative impact of Hopper toilet on environment and proposes better alternatives. Toilets are important part of long route trains journey. In Bangladesh, trains use Drop Chute toilets or Hopper toilets. It is also used in India, but they’ve started to implement alternative toilets due to its harmfulness. These type of toilets discharges human waste directly on the rail tracks. Discharged untreated human wastes pollute nearby environment and waterbody. Hopper toilet is getting replaced with improved toilet system (such as Multrum toilet, Chemical toilet, toilet with storage, Bio toilet etc.) in many countries. Study was conducted on Chitra train (Khulna to Jessore route). The existing toilet system, discharge rate and impacts was surveyed under this study. The proposed alternative is based on chemical retention tank, which can be easily implemented in trains with Hopper toilet.*

**INTRODUCTION**

Train is a main mode of transportation in Bangladesh. In 2014, 65 million passengers traveled in train (Asian Development Bank, 2016). All the passenger trains have toilet facilities in Bangladesh. Usually they’re installed at the end of carriages. As often train journey takes long time, toilet is an essential feature for train for passengers.

 In Bangladesh passenger trains usually have toilets which are called Drop Chute Toilets or Hopper Toilets. The term "Drop Chute Toilet" or “Hopper Toilet” is obviously descriptive: the toilet bowl opens into a vertical open-bottomed chute or tube about 4-5" or 10-12 cm in diameter dropping the waste onto the tracks beside one of the rails. The toilet dumps directly onto the track just like a hopper car used to transport grain. A flapper is founded in the drop chute, limiting the air flow outside flushing times, but sometimes if someone simply look down the tube and see that the tracks rushing past. The lower opening of the drop chute should be shaped in such a way as to draw air down the chute by means of the Bernoulli Effect. (Bernoulli's principle states that fluids in an area moving faster than the surrounding area possess less pressure. Faster-moving fluid, lower pressure.) This usually works just fine as it's simple technology. But the problem is that the drain pipe seems to be directional. It is supposed to draw air down the pipe like a chimney, pulling waste and air down the toilet, out of the compartment, and onto the tracks. Full speed operation of train forced a very brisk air flow up the pipe. The result is a high-speed urine fountain. Thus, it is disgusting and annoying.



Source: (toilet-guru.com, 2016)

Figure 1 Drip Chute Toilet

 The principal disadvantage is that it can be considered crude or unhygienic and dangerous to health and the environment - it litters the railway lines and can convey serious health risks when the train passes over or under a navigable waterway. Passengers may be discouraged from flushing or using toilets while the train is at a station or standing at a red signal (toilet-guru.com, 2016).

 The main criteria of sanitary latrine are: Excreta should not contaminate the ground or surface water, it should not pollute the soil; it should not be accessible to flies, rodents or animals, it should not create bad odor or ugly appearance (Lisha, n.d.). Hopper toilet doesn’t meet any criteria stated.

 There’s no mechanism in place to clean the tracks as trains traverse vast expanses of uninhabited land. Here, nature takes care of waste as it has for centuries. The bigger problem is when the trains hit cities. Despite signs and directives to avoid using the toilet when the train is slowing down or stationary, the maximum use - and damage - occurs in urban areas (Sachdev, 2016).

 Since the 90s, most American trains have holding tanks: All waste is collected in a compartment below and then discharged into special trucks at certain stations. Some high-speed trains in Europe and the US also have vacuum flushes, which use pressurized air and very little water to sweep waste out of the commode. In the UK, for the last 20 years, all new carriages have been built with holding tanks (Sachdev, 2016).

**OBJECTIVES AND METHODOLOGY OF THE STUDY**

The main objectives of this study are:

* To investigate train toilet and usage in Bangladesh
* To discuss the problems of hopper toilet.
* To discuss better alternatives for train toilet

Primary data was collected to perform analysis for this study. For performing investigation on train toilet, Chitra Express was selected. Toilet usage data was collected in three trips Chitra express between Khulna and Jessore stops.

 Questionnaire survey was conducted on two groups of stakeholders. Firstly, the 30 toilet users were surveyed to have toilet usage data and user opinion. To conduct this survey, carriage and toilet user was chosen randomly in each run.

 The next group of stakeholders were slum dwellers along rail tracks. These were the vulnerable group due to discharged waste. Total 30 individuals from slums at the side of railway tracks of Noapara railway station (near Kolatola bus stand) and slums at the side of railway tracks of Khulna railway station (Joragate and slum beside BIWTA ghat). The data focused on type of harm slum people suffer, caused by these waste.

 The questionnaire survey data was interpreted and analyzed using IBM SPSS and Microsoft Excel software.

 Alternative toilet was proposed based on secondary data analysis and literature review.

**DISADVANTAGE OF HOPPER TOILET**

**Air Pollution**

 Open feces releases methane gas into the atmosphere which is part of the greenhouse gasses. It is a potential source of odor pollution in stations and dense urban area along railway track.

**Health Impact**

 Open human waste—and lack of sanitation and hygiene in general—is an important factor in causing various diseases, most notably diarrhea and intestinal worm infections but also typhoid, cholera, hepatitis, polio, trachoma, and others (Ghosh & Cumming, 2013). Germs can spread when human waste gets mixed with water. In urban area, human waste can spread germs in nearby areas. Open human waste also causes respiratory infections.

 Open feces work as breeding ground of flies. They spread the germs present in feces in nearby food items.

**Erosion of Railway Tracks**

 Open feces cause erosion in train tracks.

Specially in train stations, germs can spread in nearby crowded area. This puts the children travelling in station at risk of getting infected.

**DATA COLLECTION AND INTERPRETAION**

**Survey Data Analysis of Train**

 The data shows that frequency of per hour toilet usage isn't same in all records during different runs. The median toilet usage is 2 people use toilet for excreting feces and 5 people for urination per hour.

Table 1 Number of toilet user with purpose

|  |  |
| --- | --- |
| For Excreting Feces (No. of usage) | For Urination (No. of usage)  |
| 2 | 5 |

Source: Field survey, 2016.

According to literature, daily a normal person urinates about 250ml and excretes 128 g feces.

 There were total 17 carriages in Chitra Express during the period of this study. The number of toilets in those carriages was 20 (Survey, 2016).

 From this data, amount of urine and feces discharged in rail track in 2 is being calculated.

TOTAL AMOUNT OF DISCHARGE = TOILET USAGE PER HOUR \* TOTAL HOUR \* AMOUNT OF DISCHARGE IN SINGLE USE (250 ml for urination and 128 gm for excreting feces) (1)

TOTAL AMOUNT OF DISCHARGE IN TRAIN = TOTAL AMOUNT OF DISCHARGE \* NUMBER OF TRAIN TOILET (20) (2)

Table 2 Amount of discharge from a single toilet and total train

|  |  |  |
| --- | --- | --- |
| Place | Urine (ml) | Feces (gm) |
| In Single Train Toilet | 5 \* 2 \* 250 = 2500 | 2 \* 2 \* 128 = 512 |
| In Total Train | 2500 \* 20 = 50000 | 512 \* 20 = 10240 |

In Khulna, there are six intercity train services including Chitra express and four mail train services. Among these six intercity and two mail service total eight trains run through Khulna-Jessore route. Discharge from these trains between Khulna and Jessore stoppage is estimated below.

Table 3 Discharge from Trains from Khulna to Jessore

|  |  |
| --- | --- |
| Urine (ml) | Feces (gm) |
| 50000 \* 8 = 4,00,000 | 51200 \* 8 = 4,03,600 |

Total train 30 toilet users were surveyed to find the user friendliness of train toilet. According to survey results, current toilets are of moderate to low quality.

Table 5 User friendliness of toilet

|  |  |
| --- | --- |
| Class | Amount (Number of respond) |
| Low | 9 |
| Moderate | 18 |
| High | 3 |

Source: Field survey, 2016.

**Survey Data Analysis of Slum Area:**

Under this study individuals from slums at the side of railway tracks of Noapara railway station (near Kolatola bus stand) and slums at the side of railway tracks of Khulna railway station (Joragate and slum beside BIWTA ghat). Total 30 people was randomly surveyed for collecting data about the problems they face due to discharged waste. The results show that the main vulnerable group is children. They usually play along the tracks, and gets affected most. Among the problems suffered by them, dysentery and skin disease is prominent. Total 11 persons was suffered from problems among the 30 people. That indicates about 36.67% affected rate.

Table 6 Number of affected person in slum

|  |  |  |
| --- | --- | --- |
| Criteria | Group | Number of Person Affected |
| Vulnerable Group | Children | 9 |
| Middle Aged | 1 |
| Old | 1 |
| Health | Dysentery | 6 |
|  | Skin Disease | 4 |
|  | Typhoid Fever | 1 |

Figure 2 Affected Person and type of Health Problem due to Discharged Waste

**ALTERNATIVE SANITARY TRAIN TOILET SYSTEM**

**Bio Toilet**

 A Bio Toilet is a next generation eco-friendly waste management solution, which reduces solid human waste to biogas and pure water, with the help of a bacterial inoculum. It converts human waste and all organic waste into clean reusable odor free water and bio Gas. Here the anaerobic process inactivates the pathogens responsible for water-borne diseases and treats the fecal matter without the use of an external energy source. The by-products of the waste treatment process are pathogen-free water, which is good for gardening, and bio-gas, which can be used for cooking. In bio tank, there are three or four chambers, firstly in chamber one the massive human wastes are broken by charged bacteria colonies and then the broken wastes and waste water goes two second and by same process it goes to last chamber where all that remains are water. Which can be discharge by outlet into rail tracks with not harming the environment. Maximum Indian railways are now using it (Banka, 2017).

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Figure 2 Bio-Toilet in train in India.

[Source (Erewise, 2013)]

**Vacuum Toilets**

India has started a trial run in 2015 in the First AC coach of the Dibrugarh Rajdhani train with vacuum toilets. The cost of this project was around $4500 USD. Vacuum toilets are currently used in aircrafts. In the train toilets, the excreta are sucked out with the use of minimum water (0.5 to 1.5 liters), and the waste hence collected is discharged in closed drains at railway stations. These eco-friendly toilets consume much less water as compared to the normal toilets used in our trains currently (Singh, 2015).

**Controlled Discharge Toilet Systems (CDTS)**

 Some trains also have Controlled Discharge Toilet Systems (CDTS). With the help of this system, disposal of waste at railways stations can be prevented as the waste is discharged automatically when the train gains a minimum speed of 30km/hour (Singh, 2015).

**Composting Toilet**

Composting toilet tanks is such kind of tank which use bacterial action to break down solid and liquid waste before releasing it to the tracked by way of a chlorine sanitizing tank. A composting toilet is a type of dry toilet that uses a predominantly aerobic processing system to treat human excreta, by composting or managed aerobic decomposition.

**CONCLUSION**

Among the different alternatives, Bio-Toilet is the best alternative. It doesn’t cost too much, provides best output. The gas generated in this toilet can be stored and the water can be discharged in track without major environmental threat.

 Train toilet is an important part of train journey, but it can lead to environmental degradation and create public hazard. So, there should be proper steps taken to install better toilet system in trains so that it doesn’t harm environment.

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