



## Sewage Disposal System for Trains: Current System and Future Prospects

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**ABSTRACT:** Indian Railways coaches are designed to disposed off the human excreta and water from toilets directly onto the tracks which becomes a potential source of environmental and health hazards. New technologies are being developed to tackle and curb this problem and this paper looks into the prospect of one such technology i.e. Chemical Retention Tanks coupled with a technology called Automatic Train Discharge System.

### I. INTRODUCTION

Indian Railways boasts of being one of the largest transport networks in the world that is under a single governing body. It has been in existence since 1853 and is the chief mode of transport for the people of India even today. The expansion of Indian Railways was carried out by Robert Maitland Briton. The Allahabad-Jabalpur branch line of the East Indian Railway had been opened in June 1867. By 1875, about ₹95 million were invested by British companies in India guaranteed railways. The most important thing to note is the fact the British made optimal development of Indian Railways. They were never concerned with the people in general. The thing to note here is that there were no toilet provisions in the trains in the initial years. On July 2, 1909, an aggrieved Babu Okhil Chandra Sen lodged a complaint to the then Transportation Superintendent, Sahibganj. After this, the railway authorities introduced toilets in all lower class carriages in trains running more than 50 miles. Today, the rule is that the trains running more than 150 kilometers have to provide toilets in all compartments. Babu Okhil's letter is one of its kinds.

### II. CURRENT SYSTEM

The current system of sewage disposal from railway coaches is known as the "Hopper Toilet" system. The traditional method of disposing human waste from trains is to deposit the waste onto the tracks using what

is known as a hopper toilet. This ranges from a hole in the floor to a full-flush system (possibly with sterilization). The 'hole in the floor' (also known as a drop chute toilet) system is still in use in many parts of the world. Although passengers may be discouraged from flushing or using toilets while the train is at a station, it is seldom seen.

### III. ROUGH ESTIMATE OF THE AMOUNT OF WASTE DISPOSED

As per a report from 2008, there were about 38,000 non suburban carrying coaches, which amount to an average of 152,000 train toilets on the IR system, of which about 60 per cent (about 90,000) would be on the move as part of a train. The amount of sewage discharged from every train would vary depending on the route, passenger capacity and the schedule of the trains.

According to a study by G. Raghuram of IIM, Ahmedabad, it is estimated that the total toilet usage is about 2 million times every day. This is roughly about 22 toilet uses per day per coach. According to other researches, it is estimated that one person produces about 500 litres of urine and 50 litres of faecal matter in a year. So per day usage comes out to be approximately 0.14 litres per day. Hence we can say that approximately 275000 litres of faecal matter is discharged daily from trains every day.

The above staggering numbers bring out the enormity of the task of disposal of waste from the railway coaches. This highlights the need of an improved and efficient system that cause minimal pollution and one that can optimally utilize the potential energy source in the bio matter which is let out.

#### IV. LIMITATIONS OF THE CURRENT SYSTEM

**Some of the most common limitations of the current hopper toilet system are:**

**(i) Health Concerns:** Human waste contains a large number of germs that cause diarrhea, cholera, typhoid, hepatitis, other water-borne diseases and parasitic infections. parasites like hookworm, tapeworm, roundworm and pinworm are spread mainly through human waste that results in the spread of communicable diseases.

**(ii) Environmental Concerns:** Indian railways dispose off human excreta into open throughout the length and breadth of country through its toilets becoming the biggest mobile source of environmental pollution by transporting the various harmful, deadly disease causing microorganisms by spreading them on tracks, rivers, streams etc.

**(iii) Deterioration of the Tracks:** The Indian railways disposes of human excreta into open throughout the length and breadth of country through its toilets becoming the biggest mobile source of environmental pollution by transporting the various harmful, deadly disease causing microorganisms by spreading them on tracks, rivers, streams etc..

**(iv) Violation of Rules and Regulations:** The railway's action flouts the Environmental Protection Act, 1986, Hazardous Wastes (Management and Handling) Rules, 1989

#### V. POSSIBLE ALTERNATIVES

Railways has been constantly working towards coming up with new technologies to tackle the aforementioned problems. There are basically 3 different kinds of alternatives that have been developed so far.

**(i) Chemical Retention Tanks:** The basic concept of Chemical Retention Tank is that the excreta get collected in a tank. This Tank is emptied at the station when the train stops for a long period of time. It will be very difficult to implement this system in overpopulated country like India where Indian Railway holds over 239,281 Freight Wagons 59,713 Passenger Coaches and 9,549 Locomotives but it has a lot of potential.

**(ii) Composting Toilet:** In this type of toilet, the excreta is broken down after aerobic decomposition into solid and liquid form before releasing it on the tracks. However, there are some major limitations of this kind of toilet.

- a) Maintenance requires commitment from owner/user
- b) Improperly installed or serviced systems may produce odors or an unprocessed end product that may have health effects.
- c) Separation of end product may be unpleasant if unit is not running correctly
- d) Does not eliminate the necessity for a septic system in many cases to treat other wastes
- e) Some units require a power source for heat and/or ventilation
- f) Aesthetics may be a concern since the excrement in some units may be in sight of the user.

**(iii) Bio Toilets:** A bio toilet is typically based on anaerobic decomposition of excreta. This chemical phenomenon will generate 55% methane and 45% carbon dioxide. They have inlet for human excreta and outlet for methane. Now the problem with Bio- Toilets is it will generate Methane gas and it is a combustible gas. If the gas generated is not directed properly it may displace oxygen from an enclosed railway compartment leading to asphyxiation of passengers or at worst may cause a fire. So it also requires engineering experts to remodel toilets being installed in the Railways else would be open invitation to accident. Railways have taken significant steps in the direction of Bio Toilets. Only time can tell how efficiently it will be installed and maintained.

#### VI. PROPOSED MODEL

The model incorporates the use of the chemical retention tank technology. It involves modifications on trains as well as the railway tracks at the railway stations. The only immediate factor that will prove to be an obstacle in our proposed alternative is the investment concern. Since it would involve some construction and improvement in infrastructure at the tracks in the platform, some electrical installations on the train and the retention tank itself, it would require significant amount of initial investment.

Automatic Train Discharge System (ATDS) has been proposed since a long time. ATDS is a discharge system wherein toilet system retains the black water/toilet waste and discharges when the speed of the coach is equal to or more than the designated speed and a preprogramed number of flush cycles have been completed. Although this is a good way of tackling the sewage pollution in city areas where train runs slow but the sewage is ultimately discharged onto the track itself after all.

So, in spite of the fact that pollution gets concentrated in a smaller track area than before, it does land on the track which is not right. So the slight modification comes here, the sewage is not discharged at all when the train is on the run. This sewage gets discharged when the train reaches a big station on to the tracks.

But, like before the tracks are not as they are at the stations currently. They need to be redesigned as well. The tracks need to be restructured in such a way so that at the platform there is a canal like structure below the tracks so that water and sewage discharge can run through it. It will have outlets which may lead to a big tank or pipelines (whichever is found feasible). So when the sewage is let out of coaches at platform it is washed by water which takes sewage along with it and keeps everything clean.

The outlets of the retention tanks will open only when the driver activates it from his compartment. All it needs are simple modifications in the electrical framework that would give the driver the control to operate these tanks. Once the train reaches a station that has a stoppage time of 10 or more minutes, the driver discharges the sewage on to the canal underneath and the water system of the canal washes away the discharge either into a tank or to the city's sewage pipelines.

## VII. OBSTACLES

There are many obstacles towards implementation of the aforementioned model.

(i) Investment: High amount of investment needs to be done to restructure the tracks at „big stations and to install the required models in the train toilets

(ii) **Time:** A significant amount of time is required for the proper implementation of the model across the country. The enormity of task needs to be considered before evaluating the effectiveness of the model.

(iii) **Manpower:** Huge amount of manpower is needed to accomplish the restructuring of the toilet system.

(iv) **Maintenance:** Contracts need to be given to privately owned companies for the maintenance of the toilet system. This would ensure efficiency in the maintenance and keep the system in best conditions.

## VIII. CONCLUSION

The aforementioned model is just a prototype of what the Indian Railways can adopt to tackle the ever increasing problem of sewage and waste discharge from trains. Implementing this system will definitely need a huge amount of investment from the government's part as we have already pointed out. But what we need to look is that in today's world if we do not start caring for the welfare of nature then we will have a huge price for it in the future. So it is wise for us to spend a little more if at all it helps in nurturing and caring for the earth better.

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