# MODERN TOILET SYSTEM FOR RAILWAYS

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**Abstract –** *In recent decades railways are used normally the conventional toilets systems. Due to this major problems are produced because of human wastes are discharged on railway platform. By using modern toilet system all this problems are totally eliminated. Also overcome the drawbacks of bio toilet system. In this system the discharge of railway Toilet is control by using the speed of railway and it is operated fully automatically.*

***Key Words***: Railway, toilet, wheel, shaft, speed, governer, main reservoir, chlorine reservoir, control unit, followers, rpm, railway track, platform etc.

## 1. INTRODUCTION

The aim of this project is to control the problems which are produced due to human wastes which are discharge on railway platform. Not only human but also protect the life of railway track due to corrosive losses. Now a day, the requirement of water as well as man power for washing and cleaning the railway platform are the major issues. Hence by using this system we overcome all this types of problems.

In this system, when railway engine is coming at platform, the reservoirs of modern toilet system are coming under working by using the speed of railway shaft. and the human wastes are store in main reservoir till the train are stand on platform. When train leaves the railway platform at a certain distance from end of platform the human wastes are discharge with chlorine action.

### 1.1 Problem Statement

Due to conventional toilet system various problems are produced like,

I. Environmental impact.
II. Platform cleaning and Corrosion of railway track.

### 1.2 Objectives

I. Minimize the air pollution at railway platforms.
II. Increase the life of railway track.
III. Reduce the cost required for cleaning of platform.
IV. Eliminate the illness problems of passengers, railway workers, railway staff, track man etc.

### 1.3 Scope

I. It provides comfort to passengers, track mans, staff member etc.
II. Eliminate the effort required for cleaning.
III. Easily install in conventional toilet system with minimum changes in their design aspect.
IV. The whole system is operated fully automatically.
V. Required Maintenance for this system is neglected.
VI. Installation cost per toilet as compare to bio toilet system is 1.11%.

### 1.4 Methodology

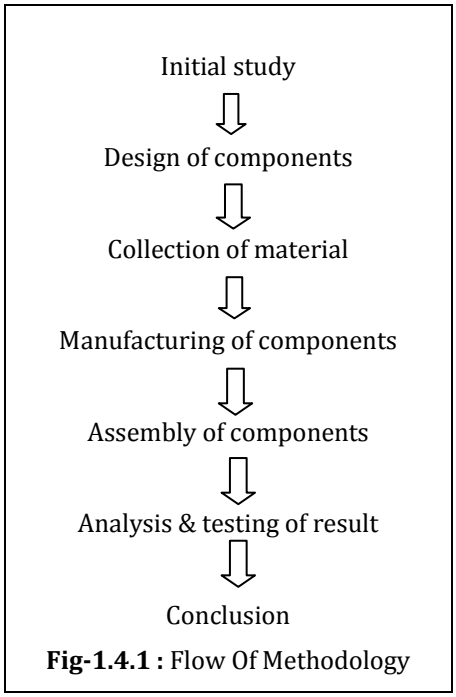


**Fig-1.4.1 :** Flow Of Methodology

### 1.4.1 Steps In Methodology

I. Study and analysis of conventional toilet system.
II. Study of different toilet system. (Bio toilet system, conventional toilet system).
III. Searching drawbacks of different toilet systems.
IV. Inventing new systems that overcome the drawbacks of early systems.
V. Design of new system.
VI. Collection of material which are required for manufacturing new system.
VII. Assembly of the different parts on unit.
VIII. Analysis and testing of new invented system.
IX. Conclusion of new invented system.

## 2. LITERATURE REVIEW

**[1]R.Rajadesing, (Mar-2015)** Open toilet system is now under usage for Indian railways. Discharges from railway toilets were more acidic and corrosive for track. Indian Railways was being roundly criticized for creating an environment hazard by discharging toilet waste on tracks.IR coaches have toilet system at the either end of coach that has hole on the floor through which human feces and urine is flush directly on the railway tracks which may cause environment hazard and unclean toilet causes bad smell which makes people uncomfortable and spreads various diseases. In order to overcome this problem Indian railways have incorporated Control Discharge Toilet System (CDTS), Bio-toilet developed by IR engineers and DRDO Bio-Technologists, Development of Zero Discharge Toilet System (ZDTS) by IIT Kanpur and Research Development and Standards Organization (RDSO) Lucknow, are some effort in this direction. Possible benefits are the minimum quantity of water to be used efficiently.

**[2] Pandya Chintan, (OCT-2015)** Bio toilet tank is human waste disposal mechanism in area with no infrastructure facilities. That is easy to operate alternative to the tradition waste disposal system. In that project are two doors in tank, the one input door and second exit door. The doors open and close by using pneumatic cylinder. if the train speed exceed 30 km/hr then exit door will open and total waste depositor drop in track and input door is closed. Input door is open when train is under 30 km/hr speed.

**[3] Abhishek Garg,(NOV-2014)** As per the 12th five year plan, 50 percent of the villages must attain ODF status by 2017 and 100 percentage by 2022. Unhygienic practice often leads to spreading of infectious diseases, and increases illness and mortality among the most vulnerable group i.e., children bio toilet which are easy to install and cost effective and offer environmental friendly solution for sustainable human excreta management and improving sanitation condition of the state.

## 3. DESIGN OF COMPONENT

### 3.1 Governer

**Input parameter:**
N=120.5306 rpm
M=0.890 kg
R=0.180 m
Where,
N=shaft speed
M=centrifugal mass
R=radial distance

**$Fc=M\omega^2 R$**

**$=0.890*(2\pi N/60)^2 * 0.180$**

**$Fc=25.5218$ N** **Calculating spring stiffness:**

**K=Force/displacement**

**For 4 springs**

**$4K=Fc/\delta$**

**=25.5218/1**

**Therefore,**
**4K=25.5218 N/m**
**∴ K=25.5218/4**
**K=6.3808 N/m**

### 3.2 Design Of Reservoir

#### 3.2.1 Design Of Main Reservoir

Following factors are assumed while designing the capacity of main reservoir.
I. Standing time of train=2.5 Hrs.
II. Time consume by 1 passenger in toilet =15 min.
III. Discharge per passenger=2.5 kg
IV. Two toilets are connected in single reservoir.

Calculate no. of peoples are use the toilet at standing time= [(2.5*60 min)/15 min] =10 passengers.
Capacity of reservoir=2*(2.5 kg * 10 passenger) =50 lit.

Capacity of reservoir=50 liters.

#### 3.2.2. Design of Chlorine Reservoir:

For Jhelum express (pune -jammutavi)

Total no. of halts: 38

Assume 10 minute per halt.

Total standing time for pune –jammutavi-pune

(38*10 min)*2=760 min

Discharge rate=0.6666 mL/min (for effective decomposition)

760 min*0.6666 mL=506.616 mL (per reservoir)

For easiness of maintenance department directly 2 liters reservoir is use per unit.

## 4. CONSTRUCTION

It consists of different components like governer assembly, slipping clutch, followers, main reservoir, chlorine reservoir, discharge control unit, different links etc.

The governer are externally clamped on main shaft of train. Slipping clutch assembly is attached to the movable end of governer. The followers are attached to the slipping clutch.

Both main discharge control unit and chlorine control unit are connected to the slipping clutch with the help of flexible link as shown in figure.

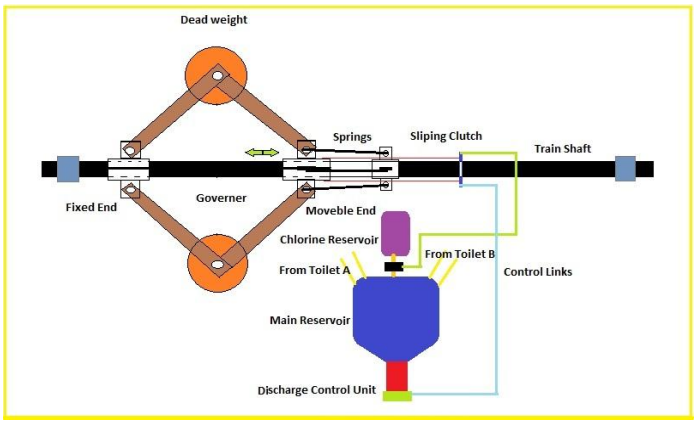


**Fig-4.1:** Modern Toilet System

## 5. WORKING

### 5.1 Operational Calculation

### 5.1.1 Speed Calculation At Partial Stage

N= (16.6666*speed)/P

P=πD (wheel periphery)

In Indian railway diameter of wheel

D=3.8 feet

=3.8*0.305

=1.159 m

N= (16.6666*30)/(π *1.159)

N=137.3208 rpm

### 5.1.2 Calculations at Initial Stage

Rpm at initial stage is obtained by practically

Therefore, N=120.53 rpm

N= (16.6666*speed)/P

120.53= (16.6666*speed)/( π *1.159)

Speed= 26.3318 km/hr

### 5.1.3 Calculations at Fully Open Stage

Rpm at fully open stage is obtained by practically

Therefore, N=153.85 rpm

N= (16.6666*speed)/P

153.85= (16.6666*speed)/ (π *1.159)

Speed=33.6619 km/hr

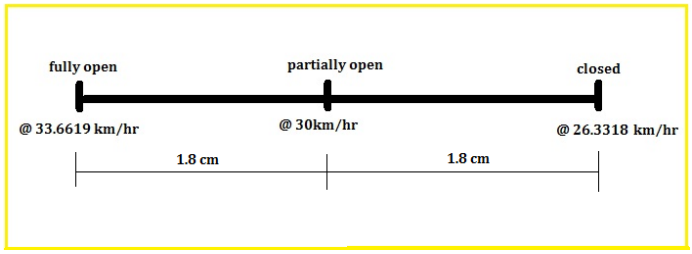


**Fig-5.1:** position of discharge control unit by using governer displacement

### 5.2 Operation

As per the rule of Indian railway the loco pilot must obey the instructions about speed limit of train before entering the railway platform. The speed limit is below 30 km/hr. Therefore in this project when trains at 30 km/hr the partial operation of discharge control unit are takes place. The train are come in below 33.6619 km/hr the reservoir start to close at 30 km/hr partial reservoir are closed. And at 26.3318 km/hr reservoir are fully closed. That means when the train is present on platform the human waste are store in main reservoir. At the same time the chlorine action are takes place for proper decomposition of human waste at discharged area.

When train are start to move from platform and after achieving 26.3318 km/hr speed the reservoir are slowly open up to 33.6619 km/hr and hence the stored

human waste are discharge at some distance from platform with chlorine action.

## 6. ADVANTAGES

I. Compact in size and shape.
II. To protect platform from solid waste and corrosion.
III. Light weight.
IV. Lower maintenance as well installation cost.
V. Eco-friendly.

## 7. DISADVANTAGES

The operation of system is totally depend on speed of train.

## 8. APPLICATION

I. For railways.

## 9. CONCLUSION

After all this the modern toilet system is one of the most efficient and we overcome the drawbacks of bio toilet system.

The system is more eco friendly as well as having fully automatic operation. The installation cost and time require for installing this system on trains are very less as compare to bio toilet system.

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