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Statistical Analysis of Railway Accidents

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Abstract - During the last decade many railway accidents and fatalities have occurred in Pune and worldwide.With the commencement of urban railways in 1974, the use of railways is steadily increasing which has led to an increase in passenger traffic in railways. This results in the increase of number of railway accidents. Following these train accidents, there has been a large amount of public debate about safety management on the Indian railways. These accidents have raised issues regarding the effectiveness of the safety management of the railway system. This paper presents a summary of the results of a preliminary statistical analysis of several Pune rail accidents of central railway as well as local railway bogies, i.e. those at Pune Junction platform and on the tracks which run within the limits of Pune muncipal corporation. It is hoped that this statistical analysis will help to identify 'learning points, which are relevant for preventing accidents in the railway industry. Never the less, the potential risks of accidents are very much present today. The study of railway accidents for last 10 years in Pune will provide us the root causes of the accidents and help to come up with suitable measures to be taken to reduce the rate of these accidents.

Key Words: *Railway accidents, Statistical analysis, Safety management, Pune, Central railway.*

1. INTRODUCTION

In today's modern and fast world, the injuries and deaths due to accidents are unavoidable. The accidental deaths are mostly due to the road traffic accidents but the deaths due to railway fatalities are also not negligible, especially in the areas where railway traffic is higher. Railways make up one of the most vital types of infrastructure in society and many of them are now being operated under automated systems, but accidents are still prevalent and are being caused by station equipment, passengers, and employeesIn addition, a lack of a systematized approach on managing and recording incidents of railway-related accidents as well as an absence of safety education centers further contributed to accidents involving passengers falling off the platform, incidents involving being jammed in doors, slipping on stairs, and others. There are also a high number of delays due to malfunctioning trains and rail equipment. Consequently, in order to ensure passenger safety amid the increasing trend of railway use, steps need to be taken to analyze causes of accidents and to reduce the number of accidents.

A train accident is defined as a "collision, derailment, or any other event involving the operation of on-track equipment's." Train accidents can cause devastating damages and personal injuries including the death of the person. Trains are frequently involved in accidents that critically injured passengers and innocent bystanders. These accidents are indeed disastrous and catastrophic due to the speed that trains travel. Indeed, a train accident can definitely result in loss of one's life or his or her property as well.

The rail transport system first appeared in England in the year 1820s. The railway was first introduced to India in 1853 from Bombay to Thane. The United States has world's no. 1 largest railway network and India is on the 4th position after Russia and China. In Indian railways, more than 22.2 million passengers travelled per day or 8.107 billion passengers annually during 2015–2016. Indian railway ran, on average, 13313 passenger trains daily in 2015–16. Mail or express trains are most common type]. According to NCRB, a total of 29419 cases of railway accidents were reported in the year 2015 and 26066 cases were deaths. Fall from trains or collision with people at track constituted majority of railway accidents (72.5%). A total of 2669 cases of railway crossing accidents were reported, which caused 2650 deaths and 123 persons injured during 2015.

Pune is an important city as well as an industrial town and an educational centre of Maharashtra where large number of people migrate for the purpose of securing quality education. Pune is the second largest city of the state after Mumbai. It is the ninth most populous city in the country with an estimated population of 3.13 million. Along with its Industrial estate Pimpri Chinchwad and three cantonment towns of Pune, Khadki and Dehu road. Pune forms the urban core of the eponymous Pune Metro Politian region. According to the 2011 census, the urban area has a combined population of 5.05 million while the population of the metropolitan region is estimated at 7.27 million. The city is considered to be the cultural capital of Maharashtra. It is also called as the "'Oxford of East" due to the presence of some well-known educational institutions. Pune is also important centre for civil services training. Pune is ranked as number one in the ease of living index. Emphasising the Pune railway, the Pune Junction Railway Station is the main railway station of Pune. It is a railway junction on the Mumbai-Chennai

line and the Pune-Bengaluru line starts from here. This railway junction has six platforms and eight tracks. The Pune Railway Station serves as a stop for southbound trains from Mumbai, Gujarat, Madhya Pradesh and Rajasthan and it also forms a stop for northbound trains from Karnataka and Goa. Thus most of the parts of India can be reached from Pune. The station is a major hub for freight transportation.

The Pune suburban railway runs on two major routes, Pune junction to Lonavla and Pune junction to Talegaon. There are three trains that run on Pune-Talegaon route and 15 trains that run on Pune-Lonavla route. Important stations on these routes are Shivajinagar, Khadki, Pimpri, Chinchwad, Akurdi, Dehu Road, Talegaon and Lonavla. On an average nearly 1,50,000 passengers travel through these routes every day. Thus with an increase in the growth of population in the city there is an increase in passenger traffic which leads to the increase of railway accidents and fatalities. The Pune railway station has 6 platforms and on average 286 trains run on this platform.

Fig -1: Map of Pune Railway Routes and Stations.

2. METHODOLOGY

The study of the railway accidents for the previous ten years has been done from the data which is obtained from the sources like the Pune Division Railway Manager, Public Information Officer of Central Railway Department, Police papers and records, and from the Newspapers. This data was provided under the Right to Information Act, 2005. On the basis of this information and other sources a statistics of the accidents patterns, their number and causes are illustrated which gives us the foundation errors in the railway industry and lead us to the necessary actions which should be taken to reduce these accidents. The data is analyzed by the respective department and is recorded for public welfare and information.

3. OBSERVATION

The Accidental prone areas of Pune are Pimpri, Chinchwad, Akurdi, Ghorpuri, Shivajinagar and Khadaki because of the higher concentration of passenger traffic and the slum areas which are located near the railway tracks, where people often try to cross the railway tracks to reach to the market which is on the other side of the track. Another reason for such accidents is youngsters and children who try to cross the track with the earphones plugged in. It was also observed that 50 percent of the trespassers committed suicide. In most of the cases passengers lost their lives due to having an imbalance while jumping into a running train. Some passengers, nearly 2 percent of the total fatalities were due to getting stuck between the gap provided between the track and platform. In 2009, the total number of individuals losing their lives on track was 221. In 2016, this number raised to 350. This number of deaths was very high in the year 2015 having 450 deaths. Instead of various awareness campaigns undertaken by the officials such as, use of foot over bridges instead of trespassing on the track, following the instructions on platform for public convenience still it was observed that people were not following the rules. The Pune-

Lonavla railway route is observed to be the most accident prone route with maximum number of deaths.The total number of deaths observed from March 2017 to March 2018 is 540 which is the maximum till date. In the month of July 2018, 49 people died on track and this number has reached to 330 till the end of December 2018 and at theend of March 2018 this number reached 440.

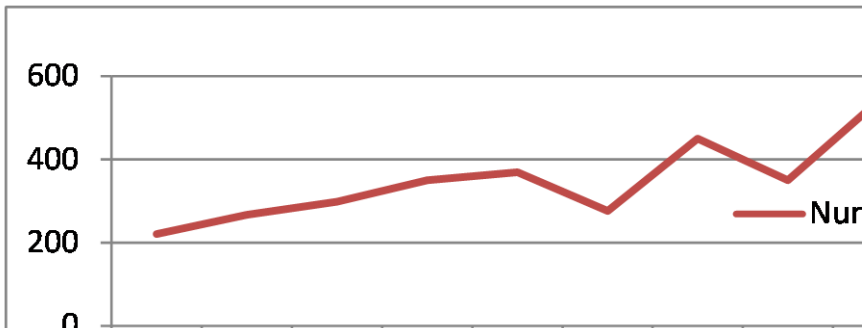

Chart- 1: Statistics of Fatalities in Pune Railway Accidents

As per the information which was provided under the RTI Act 2005, we obtained the total number of death cases on the Pune Platform and on the track during the last five years namely from 2014 to 2019. The data was provided by the Senior Divisional Security Commissioner of Railway Protection force. They mentioned that the type of accidents were mostly due to run over or knockdown by trains while crossing the track and also due to falling down from running trains. The main cause of such accidents is avoiding the use of foot over bridges and using shortcuts while crossing the railway track negligently. Other reason is that some passengers directly board on the running train and deboard from running trains due to which they often lose their balance and result into severe injuries and also death. The below table states the number of deaths on the Pune platform in the last five years.

Table -1: Number of deaths occurred on Pune Railway Station.

Year	On the Track	Near the Platform
2014	27	6
2015	29	9
2016	31	9
2017	31	9
2018	23	4
2019 (upto February)	3	3

There have been various causes of these accidents ranging from Human failure to Equipment failure to sabotage etc. In the 6-year period between2009-2015, Human failure has caused more than 86% of the total accidents.

Chart -2: Causes of Accidents.

Out of these 41% were caused due to the failure of railway staff and the rest of the accidents due to the failure of others. Equipment failure caused only 2.2% of total accidents.

The different type of accidents in railway are due to derailment, collisions, level crossing accidents, fire in train accident, as well as misc. accidents which includesome personal errors and suicides. In these accidents the maximum percentage accounts for accident due to derailment in which the train slips off the track causing large number of deaths. Followed by the accidents at level crossings where people often disobey the gate signal and rush on the track. The other causes of accidents account for very less percentage, i.e. less than 5% for collisions, fire in trains and misc accidents. Thousands of passengers commute from Lonavla, Talegaon Dabhade, Chinchwad and other stations to Pune. As per the officials there are four local trains which are operating between Pune and Lonavla. These tracks are more than 40 years old so there is a need to replace or repair these tracks to avoid further derailment of trains. A train fire is different from a fire in other places in the manner in which it breaks out, grows and spreads. Fire on a running train is more dangerous than a static one, because the fanning effect may spread the fire very quickly to other coaches and in panic the passengers might jump out of running train as it had happened in past. Fire especially in uncontrolled state is a source of very rapid destruction and this gets compounded when loss of human life is involved. Hence, taking all possible steps to prevent a fire from breaking out in coaches, and if it breaks out, to prevent it from spreading and causing further damage are being given great importance. The cases of fire in Pune railways are very rare but, its effects are very destructive if one fire incident takes place. The main reasons for fire in train are train consists of long narrow vehicles with limited exits coupled with each other. High traveling speeds prevent quick escape and assist the rapid spread of fire. Wide range of track conditions, including confined sections such as bridges, tunnels, ghats, etc., make it difficult for passengers to get off the vehicle easily in times of emergency. Restriction in movement of passengers and fast spread of fire aggravates the situation, large number of passengers traveling on trains are attended to by a small team of train crew, a delay of few initial seconds due to inadequacy of direct communication with the crew can be devastating. Even smoke emission in a confined place may lead to panic.

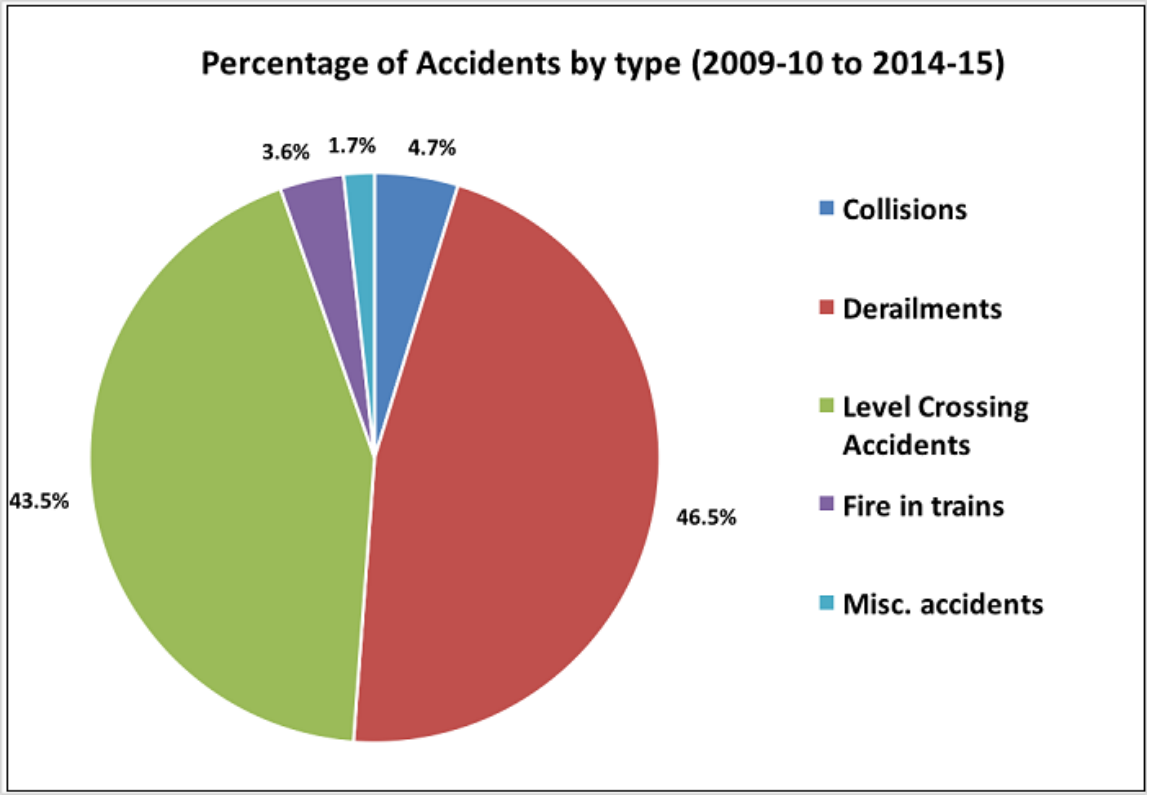

Chart 3: Percentage of Accidents by Type

3. CONCLUSIONS

Based on this statistics and analyses, this paper proposes the development of railway safety education program and the following measures which should be undertaken by the railway department for public safety. From the data which is collected, it is observed that the majority of the cases of the accidents are due to derailment and level crossings. To reduce these accidents

regular maintenance of tracks should be done by the contractors under the Pune Railway Division. Unofficial maintenance and repairs should be prohibited for any blocks and all the tracks should be inspected by the officials and superiors of Pune Railway Division. The derailment cases are not common but when they occur they are disastrous. Although there is no single cause derailments can happen due to lack of maintenance of the roadbed, track and equipment. One alternative to this is, instead of manually inspecting tracks as carried in the past, the track maintenance should be automated by using derailment detection devices. These sensors use movement and tilt to detect the possibility of train derailment before it happens. With proper integration into the braking system of the train, the instrument will minimize damage in the event of derailment by reducing the drag time of a derailed coach. Another alternative for reducing the accidents in collision and level crossing is the Rail Traffic Control. Signal boxes are an essential component of rail traffic control. The signal boxes operate at various signals and checkpoints, creating a safe path for each time. On board train location and detection systems tell the exact position of train as well as other trains which helps to increase safety on busy tracks.

Speed Monitoring and Control is another important measure for Railway safety. The Smart Railway Systems display the train velocities for drivers and reports speed back to Central Control Systems that use track conditions, safety switches and the presence of other trains to determine the need to halt a train or reduce its speed automatically.

Also the Development of railway safety education and awareness promotion programs for railway passengers in the form of manuals, books and audio visual contents.Railway safety education centers need to be established for different railway types so that people can learn and experience how to protect themselves from the risk of railway accidents.The Railway safety education standard manuals, customized textbooks (For students, adults, disabled), e-learning audiovisual contents, and other resources need to be developed so that people can have a better understanding and be able to concentrate on the material being presented.

All the above measures will help to reduce the technical failures but in order to reduce the train accidents due to human errors or human negligence can be put under control by setting up campaigns to aware the people residing near the track about the importance of Railway safety rules and regulations. They should be informed about the use of Foot over bridges for their safety and wellbeing. The Pune Railway Division should impart heavy penalties on the trespassers and the government should consider the trespassing of tracks as a serious crime so that people do not walk on the tracks without any fear or guilt. These actions will surely help to bring down the accident rates in Pune on railway tracks. Through these measures, better prevention and responses against railway accidents can be possible. Also, the level of awareness will be raised regarding railway safety among passengers and rail operators.

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