Train Schedule Delays Leading to Overcrowding, Injuries and Fatalities

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Abstract. Rail industry in South Africa is facing a dilemma in connection with trains overcrowding causing injuries and fatalities. This paper emphasized this topic analysis to reach the understanding of the problem to an eventual solution that will benefit both the train user and the operator. One of the priority insights look was at the annual train planned schedule versus the actual state of trains given to run. The overall objective of the paper's study was to analyze the existing train schedule that is currently in use and whether addressing the needs of the commuter. The paper highlighted that the found-out train planned schedule are not always met due to technical issues. The paper also investigated the number of healthy trains versus the commuter demand per peak, because operationally fit trains are required to avoid service distraction that can lead to overcrowding of trains.

Keywords Railway transport reliability, Train schedule, Train overcrowding, Train deployment versus availability.

1.   Introduction

Overcrowding of passenger trains in Gauteng Province is bad and is likely to get worse. It must be taken far more seriously than at present managements that accept overcrowding as inevitable are not only short changing the travelling public, they are also failing to run the system properly by not providing trains with expectancies required for rendering the service needed. Occasional crowding may be a sign of success if the organization is doing well [1]. However, the current chronic overcrowding is in the entire major train metropolis with huge number of passengers as boarding during peak hours [2]. Overcrowded of trains is due to inconsistent availability of trains. States that overcrowded trains maybe contributed by the unavailability and unreliability of rolling stock and infrastructure. The unavailability of trains put more strain to the lives of ordinary people in the country who are relying on the rail transportation [3]. The paper suggests excellence methods and techniques that one can introduced to better the situation or resolve the issues completely [4]. Best practices and efficiency improvement models can be articulated with a view of delivering an efficient and reliable commuter train transportation system that improves the strain

and inconvenience experienced by ordinary South African rail transportation commuters [5]. All these aspects were investigated to deliver the ultimate goal of an efficient and reliable rail transportation system. The purpose of the study was to investigate problem that causes unavailability and leads to train overcrowding. The interventions will assist to get to the root cause of the problem and came up with recommendations, as the industry is currently not coping and losing a lot of money due to train sets that are burned and vandalized by frustrated commuters longing for availability.

2.   Background

The rail industry in South Africa barely meet the customer's needs due to so many factors that are contributing to the matter that could be due to un-proper maintenance of both infrastructure and rolling stock. The achievements of excellent results and delivering product with high quality standard is still hard to achieve on daily service within rail industry. The overcrowding of trains can cause by either the unavailability of trains during peak hours and when one train arrives at the station all commuter wants to be inside the train in other to reach their destinations. Scheduling enough trains during pick is more important, that can reduce overcrowding, and injuries we see most of the time in the passenger rail, and that might cause the train not to perform the way I should perform with a minimum full load that each coach should carry. Some failures might occur due to commuters stepping on some equipment that they should not tempered. Ordinary South African are compromised the most with the unreliable rail transport as that is the only transport they could afford, as rail transport in South Africa is less cheap and affordable to all citizens than any other transport and using train from home to work is much safe to the environment compare to cars, as our roads are congested. An improved railway system, long-term sustainable transport system and reliable transport system is a priority in South Africa. This study will help in reaching that goal operational occurrences and people hanging on the sides of carriages overcrowding has gone to the media criticizing the rail industry in Europe that passenger trains are forever overflowing and that causes injuries and fatalities when passengers must offload at various train stations. Fatalities and injuries are due to overcrowding; however, other commuters are strike by overhead feeder that carries over 3000V by walking on top of the roof of the trains that is in-motion.

3.   Methodology and Data Collection (Participant Observation)

A trickier threat to the reliability and validity of data collected through observation relate to the presence of the observer. Saunders [6] and Kim [7], states that an observer gets a first-hand information during the exercise as you are treated like one of the passengers. According to Susan [8], observer states that to increase the validity, participant observation must be used as it has been a hallmark for both anthropological

and sociological studies, therefore this type of data collecting method technique best suited the study.

- Observation
- Document Analysis (schedule)

4. Research Scope

- For the purpose of this study, only morning and afternoon trains were observed, "Peak"
- Trains from Johannesburg Park Station to Pretoria was observed during morning peak (7h30 to 8h30)
- Trains from Germiston to Park Station were observed during morning peak (7h15 to 8h30).
- For afternoon peak, trains from Johannesburg Park Station to Vereeniging were observed between (16h00 to 17h30)
- Trains from Johannesburg Park Station to Pretoria and Germiston.

5. Findings, Discussion and Results

A table was used to illustrate the current situation at Passenger Rail Agency of South Africa (Table.1) shows the current daily performance of trains at PRASA, Table 1, only accommodates the Gauteng Province where the sample was taken as it is the most populated region in South Africa [10].

Table 1: Daily Performance of Trains
Train Availability

Corridor	Scheduled	Run	Cancelled	Delayed	On-time	Percentage
Gauteng South	178	157	21	35	122	77.99%
Gauteng North	82	67	15	10	57	85.07%
Total	260	224	36	45	179	80.11%

The table above illustrate the current situation with the performance of trains on daily basis. Gauteng South in the biggest service provider of rail transport is South Africa. When train is delayed or cancelled lot of passengers gets affected. Delays and cancellations may be due to various issues, one of the reasons why trains are overcrowded in this corridor. Dmitriy, et al. [11], stated that a schedule needs to be reviewed now and again to ensure that is it meeting the demand. The case of rail the planned scheduled must first be met by reducing cancellations and delays, and then they can start thinking on revising the schedule if trains are still overflowing. Olof, et al. [12], stated that the overcrowding could sometimes cause by employees who want to be closer to their

workplaces. Therefore, passengers move closer to the cities for easy access to the public transport that is affordable and available most of the time, hence it is important to check the demand and allocate enough for each pick e.g. morning pick and afternoon pick as people are going and coming back from their work places.

Table 2: PRASA 2017 Current Schedule during Pick, Gauteng Province

Pick Type	No. of Trains per Pick	Pick Times	No. of Trips per Train	No. of Coaches/Set	No. of passengers per Trainset
Morning Pick	260	3h30 to 8h30	3 to 4	12 Coaches	±600,000
Afternoon Pick	266	15h30 to 18h30	3 to 5	14 Coaches	±800,000
Total Number of Trips a day			1554		

Passenger rail agency transports national up to 2million passengers daily, and the majority being Gauteng Province and the biggest depot is Braamfontein where 80% of trainsets get serviced for different maintenance and given ready to operations to transport commuters of South Africa. The Passenger Rail Agency has 317 working stations national out of 468 and 151 train stations owned by Transnet Freight Rail, whereby long-distance trains and locomotives are sharing the line with Transnet fleet, the maintenance of those train stations is conducted by Transnet Freight Rail to ensure that the service continues as normal daily. Passenger Rail Agency of South Africa have over 400 trainsets, that is scheduled to run daily to promote rail as the primary mode of mass commuter transport. Where each coach within a trainset carries more than 100 people and each trainset have 8 to 14 coaches on each trainset, the number of coaches is determined by number of commuters that uses train service on that specific corridor. Train scheduling is determined by the customer demand that is conducted yearly by customer services department. Zandleh, et al. [13], conducted a study about scheduling where it was proved that both production schedule and maintenance planning are important because they both aim to increase but not only productivity but also some performance indicators. However, based on his study he further indicates the problems associated with scheduling and the reliability of the assets, that is evident in the rail industry whereby a train is scheduled to run at the certain time and when that time comes maintenance is still taking place on a specific train.

Passenger Rail states that they are carrying from 60 000 to 80 000 passengers per hour daily in Gauteng province on a mix service, whereby express trains and all stop trains are sharing the track. This becoming a challenge during pick hour because all type of service is running, and the ones that are affected the most are all stop trains. All station-stop train takes longer to reach the destination due to stopping at all stations. According to Peens & Onderwater [14], practically, Metro-rail trains can carry from 35 000 to 50 000 maximum capacity of passengers per hour per day, due to one-way single tracks they have. He continued saying that to be able to accommodate 60 000 to

80 000 passengers per hour, four tracks will have to build with mix of all stop and express services. A pictorial representation of the effect of overcrowding within Gauteng is shown in Figure 1.

**Figure1:** Example of overcrowded Trains [15].

Precise estimation of railways congestion during operations is of great significance for the efficient use of commuters, and therefore it must be arrested by finding ways to please passengers. Alireza, et al. [16], alluded that metropolitan trains are crowded due to the high volume of passengers using railways. The main reason is that it is more affordable compare to using your own vehicle and most trains in the cities are closer to the workstations. South African's trains are using one rail track per direction for both express and all stop trans, and that can cause congestion when one train fail in-section. Delays and cancellation of other trains that are following the one that fail and blocked the system. Shigeki, et al. [17], stated that a model to simulate delays to the passengers should be in-place to ensure that passengers do not panic. The frustration on passengers leads to confusion, pushed them to climb on one train that is at the station because they are not sure whether the next train will arrive on not. Researcher further suggested that a schedule be reviewed judiciously to ensure the allocation of trains meets the number of passengers per corridor. Preston, et al. [18], supported this statement, who stated that schedule must be as per the demand that should be reviewed regular depending on the demand of passengers because crowded trains are a feature of many railways networks and adversely affect both train passengers and train operators. For passengers it can lead to difficulties in boarding and alighting that increase dwell times and make it harder for operator to provide a reliable service. Passengers can end up losing their belongings and some being injured as other passengers are getting off the train, it has been evident that others get the opportunity of pickpocketing as the train is full and no one is paying attention to their belongings except that they want to get off the train safely. Peens & Onderwater [14], who conducted a study on the Passenger Rail Agency of South Africa who suggested a double track infrastructure per direction be built to ensure an easy flow of trains during pick. Whereby all stop trains and express trains like Business Expresses can flow, and if it

happens that a train fails in the section during pick that train can be overtaken by others that a due to run. Due to poor infrastructure and Rolling Stock delays and bound to happen daily and that is one of the factors that causes overcrowded of trains, crime and abuse of women and children seem to take a turn in the rail transportation. PRASA is in the process of revamping all their train stations for better communication and started receiving new trains that are currently running during off pick in Gauteng North due to preference from passengers of which can lead to overcrowded of new trains and vandalism. Passenger Rail Agency of South Africa is certain that this issue of overcrowded trains and unavailability of trains will be laid to rest with the new interventions the organization is embarking on currently.

Table 2: Delays and Cancellations [19]
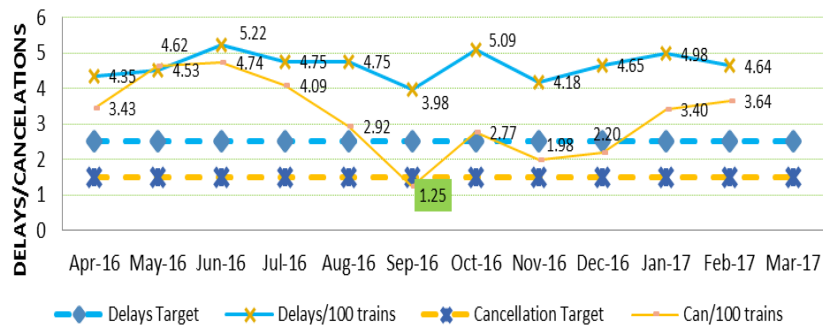
A proper and safe operating asset is as goal for both train operator and train passengers. Dmitriy, et al. [11], concluded in their study that itg is important to adhere to the maintenance schedule for both infrastructure and rolling stock thus, ensuring service delivered to the commuters and to ensure that trust is regained. Table 2 clarifies the fleet reliability currently versus the target. It was evident that the number of train that are on operations are not reliable. The statement is further supported by [20] and [21] who stated the importance and the big role rail maintenance does with regards to reliability, and this applies to both infrastructure and rolling stock. Because adhering to one maintenance schedule and ignoring the other it will not give justice to the reliability of trains that passengers require on a daily. Reliable trains automatically address availability of trains that will drastically address overcrowded trains and unhappy commuters. According to Fahimeh & Anders [22], flexible time table to allow more trains into the process is viable, that will help in case the maintenance was not completed on time to allow another train to take over. Passenger Rail Agency of South Africa pointed another important aspect about blocking and unblocking of sets. When one train is faulty they can remove that coach and replace with another train to run the service, However, the issue comes when a refurbished train is combined with old

trains and that can cause a huge impact on the performance of the trainset. Dalkilic's [23], study talks about one other factor that contributes to failures accidents and delays and even cancellation of trains is due to un-proper maintenance, so training is important. It is realized that great deal of money could be saved by ensuring healthy trains in South Africa. Trains still seems to be leading in terms of being number one preference in the country, though PRASA might have lost some commuters, but those commuters are still in the rail industry using express train (Gautrain). Baek [24], further indicate that proper maintenance and keeping maintenance data assist when analysing failures of an asset, and even better when an organization invest on intelligent system that will monitor the performance of a train and store data. Kevin [25], further indicated to say, the implementation of the system can be successful provided the time-varying values of machine condition and the attributes influencing the machine condition can be periodically observed and accumulated in a database, this is to ensure reliable assets from train to components and parts that address overcrowding.

6.   Conclusion

Some crowding can be inevitable at peak times, but the study has convinced us that the level of overcrowding is so great that many travellers face daily trauma on their journeys. Passengers are unable to board trains, or if they can, are forced into intolerable conditions. There should be immediate and urgent plans to improve the situation by improving reliability of trains to be used on a daily service schedule. It is far from clear that the levels of service currently specified in the scheduled plan is been delivered, PRASA hardly reach 90% performance of trains allocated to run daily. The service provider should start adhering to the service plan; ensure that delays and cancellation of service is monitored to arrest to address the issue of overcrowding. The fact that new trains are being delivered to Passenger Rail Agency of South Africa should, in principle try to accommodate the overcrowding by bringing new fleet that is reliable to run the service. However, these can still cause another problem as all passengers would want to use new trains and abundant old fleet. It is however right to encourage more flexible travel patterns, but these will have only a marginal effect on journey patterns in the short to medium term. Public transport will only be attractive if it meets people's real needs. That means that there must be adequate capacity at peak periods, and it is evident that Passenger Rail Agency of South Africa does not have enough capacity to carry 2 million passengers as promised, especially during peak. Although passengers can be encouraged to travel outside peak periods, it is most unlikely to happen in South Africa as most people have working patterns, which requires them to work at certain period.

7.   Recommendations

Railway industry should always strive for a robust transport system that is able to cope with both expected and unexpected events, and the infrastructure of rail must be designed in a way that it minimizes the stoppages and the distractions resulting from in-service failures and incidents. Overcrowding on railway is the manifestation of many underlying problems, lack of track capacity, a substandard and unreliable network and signalling. Lack of coaches to build up healthy sets, lack of communication during service to commuters, it is unfortunate that the problem is not being treated with anything like sufficient urgency, however, overcrowding cannot be tackled unless there is enough rolling stock readily available to replace defective coaches promptly 26}.

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