APPREHENSION STUDY OF PASSENGERS TRAVELLING BY MUMBAI SUBURBAN TRAINS

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Abstract

Since its inception, passenger traffic on Mumbai suburban trains has increased by manyfold whereas the capacity has been augmented from 9-car to 12-car/15-car rakes inadequately. The super dense crush load on the train floor is approximately 14-16 standing passengers per square meter. During 2002–2012, more than 36,000 lives have been lost on Mumbai suburban trains either due to avoidable reasons such as falling off due to overcrowding, trespassing, or getting hit by poles, etc.

Every passenger experiences great difficulties and fear to travel by suburban train during most of the time of the day; especially during peak hours. This is mainly due to undisciplined and unplanned passenger flow on the platform, while boarding/alighting and onboard train.

This is going to be continued phenomenon for next many years, as demand will always prevail over supply of local trains in Mumbai.

The findings of this study are based on the analysis of a sample of 122 respondents and their sensitivity while boarding, alighting and onboard train. The questionnaire with 5-point likert scale is used to understand the apprehensive feelings of passengers travelling in Mumbai suburban trains.

Keywords: Alighting, Boarding, Mumbai, Passenger, Suburban train

Introduction

Mumbai's suburban train service is a lifeline of people commuting throughout Mumbai. Mumbai suburban railway is spread over 319 kilometers and operates with 2813 train services with around eight million passengers daily. Mumbai local suffers from the most overcrowding in the world. Approximately 6,000 passengers travel per 12-car train during peak hours, as against the rated carrying capacity of 3504 passengers.

Though, Metro and Monorail services are inducted in Mumbai, it does not seem to have any relief for suburban train passengers.

It is a fact that income opportunities, explosion of reality estate and suburban population in and out of Mumbai is choking up lifeline of Mumbai. Mumbai suburban railway is the busiest rapid transit system in the world. rapid transit system in the world.

Objective of the study

The primary objective of this study is to comprehend whether passengers' travelling by

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Mumbai suburban train faces some kind of tension or difficulties while utilizing its services or not.

Research hypothesis

The following hypotheses can be stated for this study.
H0: The passengers does not experience any tension/difficulties/fear/threat while using Mumbai suburban trains
H1: The passengers does experience tension/difficulties/fear/threat while using Mumbai suburban trains

Literature review

Wilbur Smith Associates conducted survey for Mumbai Railway Vikas Corporation Ltd to assess the present travel pattern of suburban rail passengers, to estimate existing peak hour and peak directional flow of passengers & to assess the crowd level in suburban trains. The report also includes opinion of passengers on various aspects of the suburban rail system (2013).

Abramovic, B(2015) tries to understand integration of railways into urban transport systems through passenger survey effectively. In the survey, questions were asked about the why commuters are changing the mode of transport from private to public specially railways. The main reason of these swing users for this switchover is spending on everyday travel.

Studies associated with boarding and alighting in trains had been researched by Seriani & Fernandez (2015), Baee,S et al., (2015), Zhang,Q et al.,(2008), Harries & Anderson (2006), Harries NG(2006), Wiggenraad, P.(2001).

Pedestrians change their route choice with perceived congestion, and anticipate different route choice selection behaviour during congestion and without congestion (Widyan, F. Al, et al., 2015).

Trains have become one of the most viable alternatives, especially for daily commuting. While transit agencies are excited with the increasing ridership, they are also challenged with a higher volume of passenger flow and longer queuing lines at the existing stations (Li,J P, 2000).

Harris, Nigel et al., (2013) studied variables related to passenger numbers such as vestibule loads which were counted after completion of alighting, in order to discover the number of passengers who were blocking other passenger movements, especially ‘sentries’ standing in the doorway adjacent to the platform. When one flow is dominant, the majority of passenger movements often occur easily, whereas equal numbers of opposing passengers cause the greatest number of conflicts.

There are clear concentrations of waiting and boarding passengers around platform accesses. Stairs at the end of the platform lead to higher concentrations than locations in the middle or on one third and two thirds of the platform. There is no difference in alighting and boarding times per passenger in clusters between peak and off-peak hours. (Wiggenraad, 2001)

Daamen & Hoogendoorn (2010) studied traffic flow characteristics on a platform by comparing observations with simulation results. Both walking speed in upward direction on stairs and a possible correlation between walking speed and destination location on the platform are subject for future research.

Hibino, N et al., (2010) developed passenger flow in railway station analysis system, which is one of the sub-systems of the simulation system for analysis of train delay. During rush hours, the boarding and alighting processes are not smooth because of crowded in the train. Therefore, the train stopping time becomes longer. Secondly, the following train may have to run with gradually decreasing speeds owing to the departure delay of the forward train. The decreasing of the speeds is propagated to other following trains in consequences.

Feng Shi, et al.,(2012) developed a rational approach to quantify transfer reliability, which depicts the expectation of transfer reliability among different passenger classes.

In the recent past researchers have studied passenger flow with different models such as simulation (Daamen & Hoogendoorn , 2004) , laser technology (Sakamoto, K. et al.,) (Ozumi & Sakamoto, 2010) , ticket sales data (Peter Sels, 2011), equilibrium model (Feng Shi, et al., 2012), flow models of speed- flow, speed-density and flow-density (Shah, J, et al., 2013) , disruption management (Kroon, L, et al., 2010), etc.

Abhyankar A et al. (2012) conducted field survey on Mumbai Local trains daily travelers to have a greater insight into the socio-economic role played by this major public transport system in the widespread expansion and economic progress of the city. The study included the extent of satisfaction among the regular local train commuters with regard to the services of the trains. Passengers travel into jam pack compartments with no chance to have a place to sit and have to cover the distance all the time standing in the compartment.

Research methodology

The questionnaire was utilized to collect the primary data. The responses of 122 respondents who have travelled by Mumbai local train atleast once were utilized for this study. Out of 122 respondents, 88 were male respondent and 34 were female respondent. The five point Likert scale is used with questionnaire.

The data reliability and validity will be checked with the help of reliability analysis & factor analysis with the help of SPSS.

Data reliability and validity

The validity and reliability check was carried out with the help of Reliability analysis and factor analysis in SPSS.

Reliability Statistics	
Cronbach's Alpha	No of items
0.806808	5

Chronbach's Alpha which is above 0.8 which is considered is quite good and acceptable for the research purposes.

The factor analysis of the data has shown following results:

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.765
Bartlett's Test of Sphericity	Approx. Chi-Square	304.359
	df	10
	Sig.	.000

KMO value i.e 0.765 which lies between 0.7 to 0.8 is also quite good value. It makes principal component analysis with the help of factor analysis as appropriate for collected data.

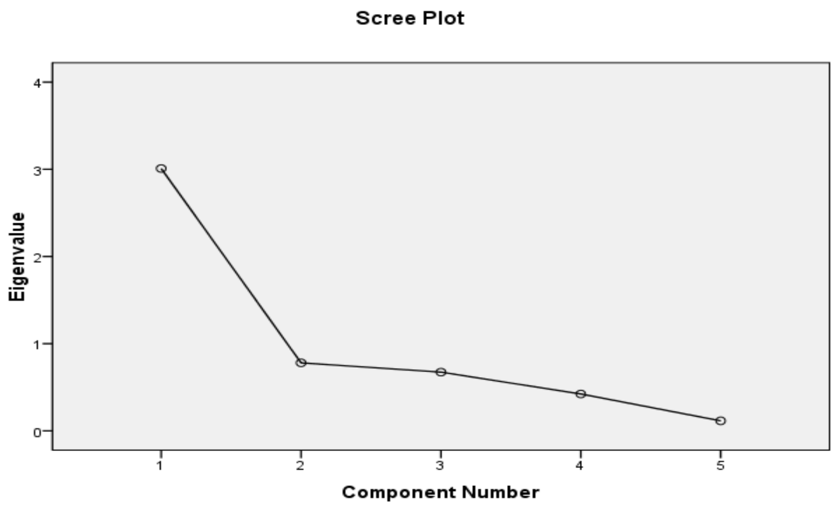
Bartlett's Test of Sphericity is significant as the value is less than 0.05 and thereby shows the validity and suitability of the responses collected to the problem being addressed through the study.

Communalities		
	Initial	Extraction
Frequency of Using Train Services	1.000	0.414
Experience Tension/Difficulties/Fear/Threat before Reaching/Starting J	1.000	0.532
Experience Tension/Difficulties/Fear/Threat while Boarding Train	1.000	0.854
Experience Tension/Difficulties/Fear/Threat while Alighting Train	1.000	0.821
Experience Tension/Difficulties/Fear/Threat while Onboard Train	1.000	0.387

The communalities after extraction of three components are above 0.5 and two components are below 0.5. But as average communalities of all variables lies above 0.60 , we can consider that variance in each of the original variables will be explained by the extracted factors.

Total Variance Explained						
Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.009	60.187	60.187	3.009	60.187	60.187
2	0.78	15.596	75.783			
3	0.673	13.469	89.252			
4	0.423	8.453	97.705			
5	0.115	2.295	100			
Extraction Method: Principal Component Analysis.						

The findings clearly suggest extracting just one factor. There is only one Eigenvalue over 1, and the Scree plot likewise levels of strongly after 1 factor.



Component Matrix	
	Component
	1
Frequency of Using Train Services	0.644
Experience Tension/Difficulties/Fear/Threat before Reaching/Starting Journey	0.729
Experience Tension/Difficulties/Fear/Threat while Boarding Train	0.924
Experience Tension/Difficulties/Fear/Threat while Alighting Train	0.906
Experience Tension/Difficulties/Fear/Threat while Onboard Train	0.622
Extraction Method: Principal Component Analysis.	

All output of factor analysis shows that all five variables clearly load on the factor, with all of them being above 0.6. As we have only one factor, there is no rotation.

Data analysis and interpretation

It has been observed that data has been not normally distributed. The non parametric test, Chi Square test applied to test the hypothesis with the following data.

	Never	Rarely	Sometimes	Frequently	Always	Total
	1	**2**	**3**	**4**	**5**	
How frequently do you use Mumbai local train services?	0	14	23	30	55	122
Do you experience tension/difficulties/fear/threat before reaching/starting your journey?	3	28	73	10	8	122
Do you experience tension/difficulties/fear/threat while boarding (getting into) local train?	2	16	43	54	7	122
Do you experience tension/difficulties/fear/threat while alighting (getting down) from local train?	2	24	42	47	7	122
Do you experience tension/difficulties/fear/threat onboard local train?	22	24	45	27	4	122

As two groups contain frequencies less than 10, regrouping is done by combining the frequencies of adjoining groups (Fo=Observed Frequency, Fe= Expected Frequency)

Fo(Fe)					**$\frac{(Fo-Fe)^2}{Fo}$**			
Variable	Never/ Rarely	Sometimes	Frequently /Always	Total	Never/ Rarely	Someti mes	Freque ntly/ Always	Total
Var 1	14(27)	23(45.2)	85(49.8)	122	6.26	10.90	24.88	42.04
Var 2	31(27)	73(45.2)	18(49.8)	122	0.59	17.10	20.31	38.00
Var 3	18(27)	43(45.2)	61(49.8)	122	3.00	0.11	2.52	5.63
Var 4	26(27)	42(45.2)	54(49.8)	122	0.04	0.23	0.35	0.62
Var 5	46(27)	45(45.2)	31(49.8)	122	13.37	0.00	7.10	20.47
Total	135	226	249	610			**Chi Square**	**106.75**

Table value of Chi Square at [(5-1)*(3-1) = 8 DOF & 5% level of significance] = 15.507

As calculated value of $\chi 2$ i.e **106.75 is** much higher than the table value of $\chi 2$ i.e **15. 507,** we **reject the null hypothesis**. Hence alternative hypothesis is accepted.

Thus, a passenger does experiences tension/difficulties/fear/threat while using Mumbai suburban trains.

Limitations of the study

- The sample study which really may not represent the whole passenger population.
- The study is limited to only 122 samples which normally travel on harbor line only.

- The respondent belongs to the age group of 20-30 only.

Conclusion

Travelling by train has become preferred mode of travel worldwide. Overcrowding into the Mumbai suburban trains has become inevitable phenomenon. The study indicates that every passenger experiences some tension or difficulties while travelling in suburban trains. Many attempts have been made to improve these situations by either adding extra coaches or adding extra lines or adding more services on the lines. This is going to be continued phenomenon for next many years, as demand will always prevail over supply of local trains in Mumbai. These studies point out; there exist greater scope for research to build tangible solution for these overcrowding, uncomfortable travelling apprehensive experiences of our life.

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