

# A Statistical Study on the Impact Of 50% Concession Half Hick Scheme in MSRTC Bus Service

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**Abstract:** This report gives an in-depth statistical analysis of the "Mahila Samman Yojana" (the scheme) that was launched by the Government of Maharashtra on March 17, 2023, and offered all women passengers a 50% discount on fares for travelling on all buses in the Maharashtra State Road Transport Corporation (MSRTC). The main aim of this study was to explore the changes in women's travel patterns, frequency of travel and amount spent to evaluate how effective this scheme has been at improving women's mobility and financial independence. Data was collected through a structured questionnaire which was administered to a wide variety of female passengers including female students, employed women and women workers who earn their wages on a daily basis). The research employed a range of statistical approaches including the use of Z-tests for proportions, Chi-square tests for independence and Wilcoxon signed rank tests to compare travel behaviour prior to the scheme with that after the launch of the scheme. Graphical methods including bar graph and line graph were used to illustrate the level of satisfaction and usage trends over time. The statistical results indicated that there was a statistically significant ( $p < 0.05$ ) increase in the average number of trips made by women on a weekly basis. This confirms that the reduction in fare price has resulted in women/users being able to take advantage of previously suppressed travel demand. Also, there was a statistically significant ( $p < 0.05$ ) increase in the average distance travelled by women which provides evidence that the economic benefits provided through this scheme has enabled women to access educational and employment opportunities that are located further away from their home than previously possible. Wilcoxon Signed Rank Tests were performed. According to a recent survey investigating the effects of Mahila Samman Yojana on transport workers, most of whom are conductors, it was determined that although the scheme propelled a dramatic increase in passenger volumes, it also greatly increased both stress levels and mental fatigue amongst these workers. Statistical data indicates an operational burden for the entire system as the same amount of overcrowding as well as similar levels of mental fatigue can be found on both urban and rural as well as semi-urban routes. While there seems to be an equal amount of both physical and mental stressfulness for all employees, a statistically significant relationship was determined between an employee's job classification as well as their overall perception of the scheme's impact. Conductors almost exclusively report having a positive view of the scheme because they feel seeing the actual social benefits to the concession policy offsets the additional burden of working up to 50% more than they previously did prior to this scheme taking effect.

**Keywords:** Mahila Samman Yojana, Mental exhaustion, Bus overcrowding, Behaviours, MSRTC Bus services, 50% ticket concession, women's Mobility



## **I. INTRODUCTION**

Bus Service" this proposal aims to improve women's access to public transport and enhance their prospects for economic participation. By providing a fare concession of 50% on MSRTC buses, the scheme offers substantial savings on daily commuting and work-related travel costs, allowing women to travel more frequently and help provide a better standard of living for their families.

The 'Half Ticket' scheme may be a significant step forward in supporting women's incomes. Not only does it give women the ability to save on commuting to and from work daily, but it also opens previously unavailable opportunities for women to participate in economic or educational activities and gain valuable experience. By being able to use public transportation regularly, women can build work-related skills and qualifications and, in turn, enhance their success in the workforce. In addition, the 'Half Ticket' scheme will allow the government to encourage more women to access job training and education programs designed specifically for women. By allowing women to affordably access public transportation, the state may ultimately be able to increase the number of women in the workforce and improve women's economic and social status in society. Further, the 'Half Ticket' policy will allow the state to ensure that women are not discouraged from entering, completing, and maintaining employment due to the high cost of transportation to and from work. This report is a statistical evaluation of Mahila Samman Yojana as a programme and its operational effects on transport department employees. Visual analysis tools including bar graphs and pie charts will be used to show survey results gathered from the workers. The main findings highlight the bus conductors' (the majority of survey respondents) daily experiences and point of view. While the concession policy had a positive, measurable impact on increasing the number of bus passengers, it also contributed to increased employee stress levels and employee mental fatigue. This report describes how this new workload is distributed across employee job types and employee routes.

## **II OBJECTIVES**

- To statistical analysis the impact of the 50% concession scheme on woman passengers.
- To compare travel cost and travel frequency after and before the scheme.
- To identify challenges and limitations faced by woman during service half ticket facility.
- To examine the usage pattern of the scheme among different groups of women such as students, employed women, homemakers and self-employed women.
- To identify the challenges and limitations faced by women while using the half-ticket facility.
- To analyse the financial savings experienced by women due to the concession scheme.
- To study the effect of the scheme on the workload and stress level of MSRTC employees.
- To evaluate the overall satisfaction level of women passengers regarding the scheme.

## **III. LITERATURE REVIEW**

Public transportation plays an important role in improving mobility, economic participation, and social inclusion in society. Many studies have shown that affordable transportation policies can significantly improve women's mobility and access to education, employment, and healthcare services. Uteng and Turner studied the relationship between gender and transport systems in developing countries. Their study showed that women depend more on affordable public transportation compared to men. They also found that transportation cost is one of the major barriers that restrict women's mobility. The researchers concluded that government policies providing fare concessions can significantly improve women's travel opportunities and economic participation [1].

Similarly, Anand and Tiwari examined gender differences in public transport usage in Indian cities. Their study found that women use public transportation more frequently for education and employment purposes. However, high travel costs and limited transport accessibility reduce their mobility. The study suggested that transportation policies should focus on affordability and accessibility in order to support women's mobility [2].

Cats, Susilo, and Reimal analyzed the concept of fare-free public transport and its effect on passenger demand. Their research indicated that reducing transportation fares significantly increases public transport usage. The study also showed



that fare concessions improve accessibility for low-income passengers and encourage more people to use public transportation services [3]. Busch-Geertsema and other researchers conducted a review of fare-free public transport policies in different countries. Their findings suggested that reduced fares improve social inclusion and mobility for disadvantaged groups, including women and students. However, the study also mentioned that such policies may increase passenger load and create operational challenges for transport systems [4].

Dasgupta studied the impact of transportation subsidies for women using the example of the Delhi Pink Pass scheme. The study found that free bus travel significantly increased women's participation in employment and economic activities. It also allowed women to travel longer distances to reach workplaces and educational institutions [5].

Premkumar and colleagues examined the impact of the free bus travel scheme implemented in Tamil Nadu. Their study found that the scheme significantly increased travel frequency among women and reduced their transportation expenses. The research also highlighted that the policy improved women's access to education and healthcare facilities [6].

Manikandan and other researchers analyzed the economic benefits of free or zero-ticket bus travel schemes for women passengers. Their findings showed that transportation subsidies resulted in considerable monthly savings for women, especially for those who travel frequently for work or business purposes [7]. Cosar and colleagues investigated the relationship between transportation costs and women's participation in economic activities. Their study revealed that lower transportation costs encourage women to travel more frequently and participate actively in labour markets and economic activities [8].

Overall, the existing literature suggests that transportation concession policies have a positive impact on women's mobility, economic participation, and social inclusion. These studies also highlight that reduced transportation costs encourage women to travel more frequently and access opportunities located far from their homes. The results of the present study are consistent with previous research findings. The statistical analysis conducted in this study indicates that the MSRTC 50% concession scheme has reduced travel expenditure and increased travel frequency among women passengers. The study also shows that the scheme has improved women's mobility and accessibility to employment and educational opportunities.

#### **IV. METHODOLOGY**

The research employs extensive and quantitative methods to analyse how the "Half-Fare" or 50% fare discount affects women and bus workers. Data was gathered through structured questionnaires administered both to female passengers who utilized the bus transport service and employees of the Maharashtra State Road Transport Corporation (Maharashtra Government) who used that transport service, on urban, rural, and semi-rural bus routes. Descriptive statistics were computed to describe demographic characteristics, travel behaviour, and employee levels of stress using bar graphs, pie charts, and box plots. To compare travel frequency and cost prior to and after the implementation of the scheme, comparative statistics were computed. Rigorous hypothesis testing was used to verify the results of this study, including Z-tests for proportions to compare the growth in women's mobility and the difference in satisfaction levels. Chi square tests of independence were used to compare the relationship between the residency of the female passengers and the perception of the fare concession scheme, and the role of the bus employees in their view of the impact of the scheme on their job. The Wilcoxon signed-rank test was used to examine significant changes in median travel expense and miles travelled. The Kruskal-Wallis H-test was also used to compare levels of mental exhaustion of employees over different types of bus routes. The research data was processed and analysed using MS Excel, MS Word and Python with the Seaborn library.

#### **V. STATISTICAL ANALYSIS**

##### **A) Woman's section:**

##### **a) Wilcoxon signed rank test**

##### **1. Hypothesis:**

**H<sub>0</sub>** : There is no difference in the median travel expenditure before and after the scheme implementation



Test statistic:  $Z = \frac{W - \mu}{\sigma}$  Where  $\mu = \frac{N(N+1)}{4}$  and  $\sigma = \sqrt{\frac{N(N+1)(2N+1)}{24}}$ , N is large LOS: 5%

**TABLE I**

Statistics	Calculated value
Test statistics	25
Expected mean	6440
Standard deviation	378.8
Z-score	-16.9
Alpha level	0.050
<b>p-value</b>	<b>&lt;0.0001</b>

**Conclusion:** The calculated p-value is strictly less than stander significance level of 0.05. Therefore, we reject null hypothesis. (There is statistically significant evidence to conclude that the 50% concession scheme has successful and drastically reduced the average travel expenditure per trip for the woman surveyed)

## 2. Hypothesis:

$H_0$ : the median difference in average travel distance before and after this scheme is zero

**TABLE II**

Statistics	Calculated value
Test statistics	20
Expected mean	315
Standard deviation	61.05
Z-score	-4.83
Alpha level	0.05
<b>p-value</b>	<b>&lt; 0.0001</b>

**Conclusion:** The calculated p-value is strictly less than stander significance level of 0.05. Therefore, we reject null hypothesis. While a large majority of women did not change their standard travel routes (resulting in many ties), among those whose travel distance did change, there is a statistically significant increase. This suggests that the financial relief of the scheme has enabled a specific subset of women to accept opportunities (like employment or education) situated further away from their homes.

### b) Chi square test of Independence:

$H_0$  : The residency status and the government scheme is independent

L.O.S: = 5%

Test statistics:

$$\chi^2 = \frac{(O_i - E_i)^2}{E_i}$$

Where,  $O_i$  =Observed value,  $E_i$ =Expected value,  $E_i=N*P_i$

**TABLE III**

	Agree	disagree	Neutral	Strongly disagree	Total
Rural	95	4	18	3	120
Urban	46	1	1	0	48
Total	141	5	19	3	168



**Conclusion:** At 5% LOS, here  $Cal.\chi^2 \leq tab.\chi^2$ , i.e.  $6.7159 \leq 14.067$ , hence accept the null hypothesis and conclude that, the residency status and the government scheme is independent.

**B. employee section:**

**a) chi –square test**

Test 1: Employee Role vs. Perception of Scheme's Overall Impact

$H_0$ : There is no association between the employee's role and their perception of the scheme's overall impact.

TABLE V

Role	Negative	positive	Very positive
Conductor	1	53	3
Driver	0	8	3
Inspector/Supervisor	0	0	1

**Conclusion:** At 5% LOS, here  $Cal.\chi^2 \leq tab.\chi^2$ , i.e.  $9.488 \leq 14.0140$ , hence accept the null hypothesis and conclude that, there is no association between the employee's role and their perception of the scheme's overall impact.

**Kruskal: Wallis H Test:**

Independent Variable (Groups): Type of route mostly handled (Urban, Rural, Semi-urban, Mixed routes).

Dependent Variable (Ordinal): Mental exhaustion level. To perform the test, the text responses were mapped to numerical ranks indicating increasing severity:

Sometimes = Rank 1, Often = Rank 2, Always = Rank 3

Hypotheses:

$H_0$ : The median level of mental exhaustion is the same across all types of routes.

**Test statistic:**

$$H = \frac{12}{n(n+1)} \sum \frac{R_i^2}{n_i} - 3(n+1)$$

**Statistical Results:**

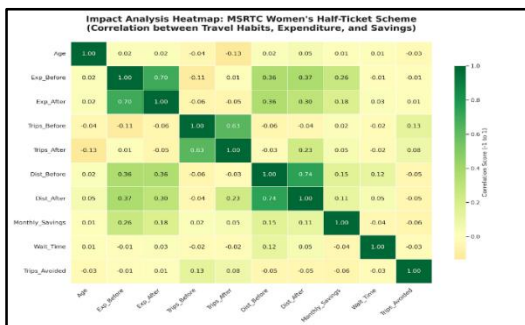
Kruska l-Wallis H-Statistic: 4.7798

P-value: 0.1886

Degrees of Freedom: 3

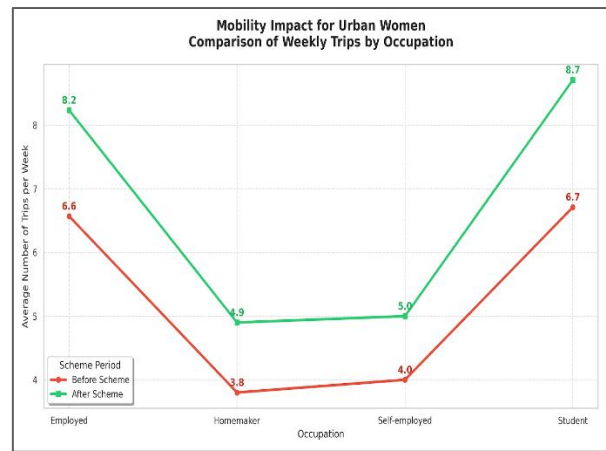
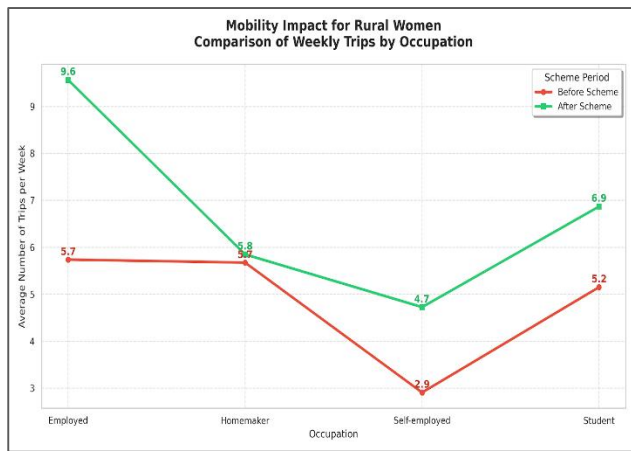
**Conclusion:** Since the p-value 0.1886 is greater than the standard alpha level of 0.05, we fail to reject the null hypothesis. The statistical evidence suggests that there is no significant difference in the distribution of mental exhaustion levels across the different route types. The transport workers are experiencing similar degrees of mental fatigue regardless of whether they are assigned to urban, rural, semi-urban, or mixed routes.

**VI. GRAPHICAL ANALYSIS**

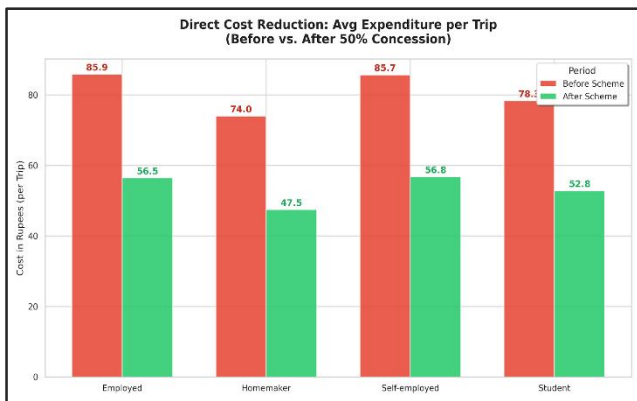


**Interpretation:** The MSRTC half-ticket scheme offers notable financial benefits for women. Self-employed women save over ₹1,740 monthly on travel for business, while employed women see an increase of ₹1,280 in their net income. Students gain around ₹940, helping them afford higher education. Additionally, homemakers enjoy a cost-of-living cut exceeding ₹460. Overall, the scheme effectively aids women from various occupations.



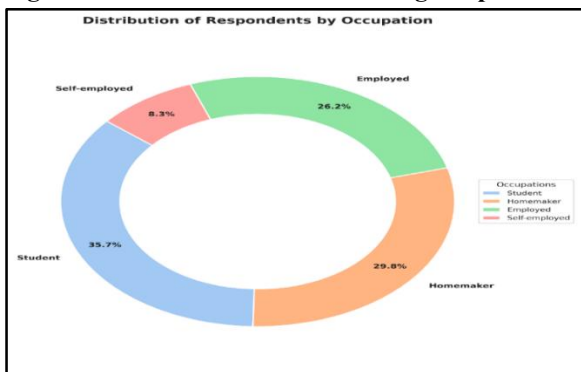


**Interpretation:** The MSRTC scheme has significantly increased mobility by making travel more affordable, particularly helping rural employed women and urban students reach work and education more frequently. While rural homemakers use the discount for essential household needs, urban homemakers have utilized it to surge their social visits and local errands. Overall, the program successfully offsets high commuting costs, empowering women and students across both regions to travel more for professional and personal growth.



**Interpretation:** The transportation program has significantly reduced the average per-trip expenditure for women across all occupational demographics. Commuting costs for employed and self-employed women decreased to approximately ₹56, while essential travel for students and homemakers fell below ₹53 per trip.

**Fig.7: Direct Cost Reduction: Average Expenditure per Trip**

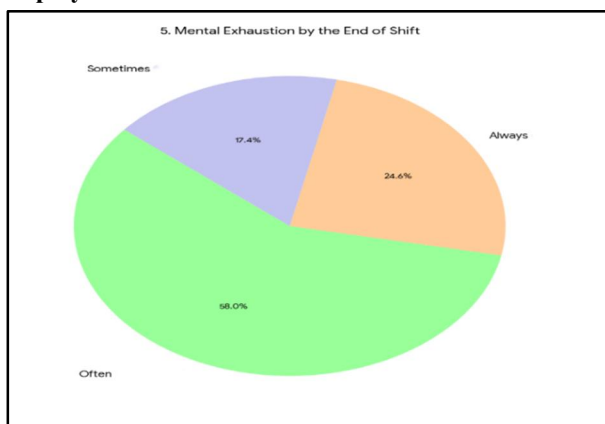


**Fig.11 Distribution of Respondents by Occupation**

**Interpretation:** The transportation program has significantly reduced the average per-trip expenditure for women across all occupational demographics. Commuting costs for employed and self-employed women decreased to approximately ₹56, while essential travel for students and homemakers fell below ₹53 per trip.



**B.) Employee section:**



**Interpretation:** This pie chart reveals how often the employees feel mentally exhausted by the end of their workday. A large portion of the staff experiences regular mental exhaustion. About 58% (40 respondents) feel exhausted "Often" and almost 24.6% (17 respondents) feel exhausted "Always" (Only a small fraction (about 17.4%) feel it just "Sometimes." This highlights a significant need for measures to reduce workload or provide better support to the staff on duty

Fig Mental Exhaustion by the End of Shift

**VII. CONCLUSION**

The implementation of the "Mahila Samman Yojana," which provides a 50% fare concession on MSRTC buses, has proven to be a highly successful initiative in enhancing women's mobility and financial independence. Rigorous statistical analysis, including Wilcoxon signed-rank tests, confirms a significant reduction in the average travel expenditure per trip across all demographics. Specifically, per-trip commuting costs decreased to approximately ₹56 for employed and self-employed women, and fell below ₹53 for students and homemakers. This direct cost reduction translated into substantial monthly savings: self-employed women saved over ₹1,740, employed women saw a ₹1,280 increase in net income, students saved around ₹940, and homemakers cut costs by over ₹460. Consequently, there was a statistically significant increase in both the average number of weekly trips and the average distance traveled. This financial relief has empowered women across both rural and urban areas to access educational and employment opportunities situated further from their homes, while also facilitating essential household errands and social visits.

However, the scheme's immense success in stimulating previously suppressed travel demand has simultaneously introduced significant operational challenges for MSRTC employees. The dramatic surge in passenger volumes has led to increased levels of stress, bus overcrowding, and mental fatigue among transport workers. Survey data indicates that approximately 58% of employees "often" feel mentally exhausted by the end of their shift, while nearly 24.6% experience this exhaustion "always". Furthermore, Kruskal Wallis test results demonstrate that this mental fatigue is uniformly experienced across urban, rural, semi-urban, and mixed routes, showing no statistically significant difference based on the type of route handled.

Despite this substantial increase in workload with some staff working up to 50% more than they did prior to the scheme Chi-square testing revealed no association between an employee's role and their overall perception of the policy's impact. In fact, conductors almost exclusively maintain a positive view of the initiative; they report that witnessing the tangible social and economic benefits provided to women offsets the burden of their heightened operational duties. Ultimately, while the scheme has successfully achieved its primary objective of empowering women through affordable public transportation, ensuring its long-term sustainability will require administrative measures to manage passenger overcrowding and better support the mental and physical well-being of the on-duty staff.

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