Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 46 No. 3 (2025)

Driver Reaction Time Analysis with Respect to Gender and Educational Qualifications of Male and Female Drivers in Indian Mixed Traffic Conditions

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Abstract

Both the human and automobile populations are growing exponentially as the world expands in the name of development. As a result, there are more accidents and more people confused. Particularly in India's mixed traffic conditions, driver reaction times are crucial in reducing or preventing accidents on the roadways. In order to determine the reaction times of drivers operating three-wheelers, cars (light motor vehicles), buses (heavy motor vehicles), and two-wheelers, a thorough test was carried out on 2000 samples of drivers in Bengaluru City. The resulting reaction times were coded and separated according to the drivers' educational backgrounds and gender. The "Easy fit" program was then used to analyse the data and determine the statistical characteristics. After analysis, the results were examined and conclusions were made. In general, though more slowly than in recent decades, the world's population is nevertheless increasing. It was expected to reach over 9 billion by 2050, having surpassed 7.8 billion by 2022. With approximately 1.19 million fatalities per year, automobile accidents remain a major global public health hazard. Urbanization, sustainability, and resource management are all made more difficult by this expansion. Due to the population's reliance on transportation for a variety of needs, safe and effective transportation infrastructure is required. Transportation is clearly moving toward more efficient and sustainable forms. Environmental concerns and battery technological breakthroughs are driving the growing popularity of electric cars (EVs). After the results were analyzed, they were examined and conclusions made. The general The global population is still increasing, but more slowly than in earlier decades. It exceeded 7.8 billion by 2022 and was expected to surpass 9 billion by 2050. More than 1.19 million people are killed in automobile accidents each year, making them a serious global public health concern. In terms of sustainability, urbanization, and resource management, this expansion poses difficulties. Facilities for safe and effective transportation are necessary because the populace depends on them for a variety of needs. There is a discernible trend in transportation toward more efficient and sustainable forms. Concerns about the environment and improvements in battery technology are driving the popularity of electric vehicles, or EVs. In order to lessen dependency on private vehicles, there is also a greater focus on public transportation, bike infrastructure, and urban design. Nonetheless, problems like traffic jams, infrastructure development, and striking a balance between environmental impact and accessibility continue to exist on a worldwide scale. As the number of vehicles increases, the safety of the drivers and passengers becomes the most important requirement to be addressed among these organizations. Anxiety, panic, perplexity, and other emotions are brought on by increased road traffic and population, and these factors will affect a driver's perception and reaction times.Distractions in the ergonomics of the dashboard of modern cars cause further delays in the drivers' reaction times in emergency situations. In the midst of this, cars are increasingly switching from manual to automatic gearboxes, which has a significant impact on drivers' response times in emergency situations. An examination of this driver behavior phenomenon in relation to gender would provide insight into the evolving patterns of the drivers' perception and reaction times, which are

collectively referred to as Driver Reaction Times (DRTs). The main findings were that male drivers with less than a 10th grade education had wildly erratic reaction times, which suggested a lack of cognitive preparation and an increased risk of accidents. Due to their difficulties with decision-making and road awareness, drivers with lower levels of education were more likely to make mistakes in intricate urban traffic. Due to poor cognitive processing and traffic awareness, female drivers with less than a tenth grade education exhibited delayed and erratic reactions. Low levels of education cause slower reactions and a higher risk of accidents in heavy traffic, particularly for female drivers who face social hurdles. Due to literacy-related problems and a lack of driving experience, female drivers with low levels of education showed sluggish, distorted reactions, increasing the likelihood of accidents in clogged Indian traffic.

1. Introduction

Road traffic accidents continue to be a critical global public health concern, claiming over 1.19 million lives annually. According to the World Health Organization's Global Status Report on Road Safety (2023), more than half of these fatalities involve vulnerable road users such as pedestrians, cyclists, and motorcyclists [1]. The situation is particularly dire in low- and middle-income countries, which account for over 90% of road traffic deaths, despite possessing only 60% of the world's vehicles. Young individuals, especially those aged 5 to 29, are disproportionately affected, making road injuries the leading cause of death in this age group [2]. The economic repercussions are also severe, with countries losing approximately 3% of their annual GDP due to crash-related costs, including lost productivity and healthcare expenses.

In India, the road traffic scenario is equally alarming. The country witnesses one of the highest numbers of road traffic fatalities globally. As per the National Crime Records Bureau (2021), 155,622 deaths occurred due to road accidents that year—an average of over 426 fatalities per day [3]. A majority of these involved two-wheeler riders, pointing to both infrastructural and behavioural gaps. Additionally, findings from the Global Burden of Disease Study 2017 highlight that India reported over 218,000 road injury deaths in that year alone [4]. Factors contributing to these high numbers include mixed traffic conditions, lack of lane discipline, poor enforcement of traffic laws, and varying socio-demographic profiles of drivers.
Given this background, it becomes imperative to examine the reaction time of drivers, a critical human factor influencing road safety, especially in Indian mixed traffic conditions. The focus of this study is to analyse how educational qualifications, and occupational categories affect the reaction times of male and female drivers, providing insights that can guide future interventions, training, and traffic safety policy reforms.

In mixed traffic conditions across India, road accidents are significantly influenced by drivers' education levels and occupational backgrounds. Research consistently finds that lower educational attainment—specifically those with only primary or secondary schooling—correlates with increased accident risk, likely due to limited awareness of traffic rules and safety practices. For example, a Kolkata hospital-based study reported that the majority of accident victims were "illiterates or only school educated," most of whom were labourers or students, and noted that limited education is linked to poor rule-following and heightened risk behaviour jpmsonline.com. [5] Similarly, a qualitative study in South Karnataka highlighted that drivers from marginalized socioeconomic groups—typically characterized by low literacy—often engage in riskier driving due to identity and economic pressures, further exacerbating crash likelihood. [6]

Occupational exposure also plays a critical role: labourers, farmers, and informal workers—who often commute on motorcycles and endure irregular work hours—are disproportionately represented in accident statistics. In Kolkata, these occupations formed a large proportion of traffic injury victims, emphasizing that job type can influence accident propensity. The Karnataka study further explained that marginalized youths, often engaged in manual or informal jobs, experienced an "identity crisis" that spurred risky behaviours behind the wheel [6]. Thus, both lower education and certain occupations are associated with poorer road safety awareness, riskier driving habits, and ultimately, higher accident rates in Indian mixed traffic scenarios.

In India, navigating through mixed traffic conditions is akin to participating in an intricate dance, where vehicles of various sizes, speeds, and modes of transport merge and diverge in a seemingly chaotic but structured manner. Amidst this vibrant symphony of motion, driver reaction times play a pivotal role in ensuring safety and efficiency on the roads. Indian roads are characterized by a mix of vehicles ranging from cars and motorcycles to bicycles, pedestrians, and animals. Negotiating through this diverse traffic requires drivers to have quick reflexes and adaptability to sudden changes in their surroundings. [7] Firstly, it's essential to understand the unique dynamics of Indian mixed traffic. Unlike controlled environments in many developed countries, Indian roads are a melting pot of diverse vehicles, ranging. from traditional bullock carts to modern cars and motorcycles. Add to this mix the presence of pedestrians, cyclists, and animals, and you have a scenario where quick decision-making is paramount. Traffic rules and regulations in India are often loosely enforced, leading to unpredictable behaviour among road users. Drivers must be prepared to anticipate the actions of others and react swiftly to avoid accidents [8]. Driver reaction times are significantly influenced by several factors inherent to Indian traffic conditions. One such factor is the sheer volume of vehicles. In bustling urban centres like Mumbai or Delhi, the density of traffic can be overwhelming, leaving drivers with minimal time to react to sudden changes in their surroundings. Additionally, the diverse nature of vehicles on Indian roads adds another layer of intricacy. For instance, a driver of a sedan must adapt their reaction time when sharing the road with a slower-moving auto-rickshaw or a bullock cart. The varying acceleration rates and manoeuvrability of these vehicles necessitate quick adjustments to prevent accidents. Furthermore, the unpredictable behaviour of pedestrians adds an element of uncertainty to Indian traffic. Jaywalking is a common sight, and pedestrians often dart across busy roads without warning. Drivers must be vigilant at all times, ready to react instantly to avoid potential collisions. Despite these challenges, Indian drivers exhibit a remarkable adaptability honed by years of navigating such conditions. Experience plays a crucial role in improving reaction times, as seasoned drivers learn to anticipate potential hazards and react swiftly. Navigating through this dynamic environment requires drivers to possess not only quick reflexes but also a deep understanding of their surroundings. By addressing both individual and systemic aspects, India can work towards creating safer and more efficient roads for all road users.

Gender based Reaction Times of Indian Drivers Gender-based differences in driver reaction times in Indian mixed traffic conditions are an intriguing subject, influenced by a multitude of social, cultural, and physiological factors. While research on this specific topic may be limited, broader studies on gender differences in driving behaviour provide some insights. Firstly, it's essential to acknowledge that driving behaviour is shaped by societal norms and expectations regarding gender roles. In many parts of India, traditional gender roles dictate that men are often expected to take on the role of primary drivers, especially for long-distance or professional driving tasks. This societal expectation may lead to differences in experience levels between male and female drivers, potentially impacting their reaction times. Gender-based differences in driver reaction times in Indian mixed traffic conditions are an intriguing subject, influenced by a multitude of social, cultural, and physiological factors. While research on this specific topic may be limited, broader studies on gender differences in driving behaviour provide some insights. While research on gender differences in driving reaction times is not specific to Indian traffic conditions, existing studies suggest that men and women may exhibit slight variations in spatial awareness, hand-eye coordination, and risk perception. These differences, albeit subtle, can influence how quickly drivers react to stimuli on the road [8]. The driving performance changes steadily across the educational qualifications of the drivers and also the occupation of the drivers.

2. The Study

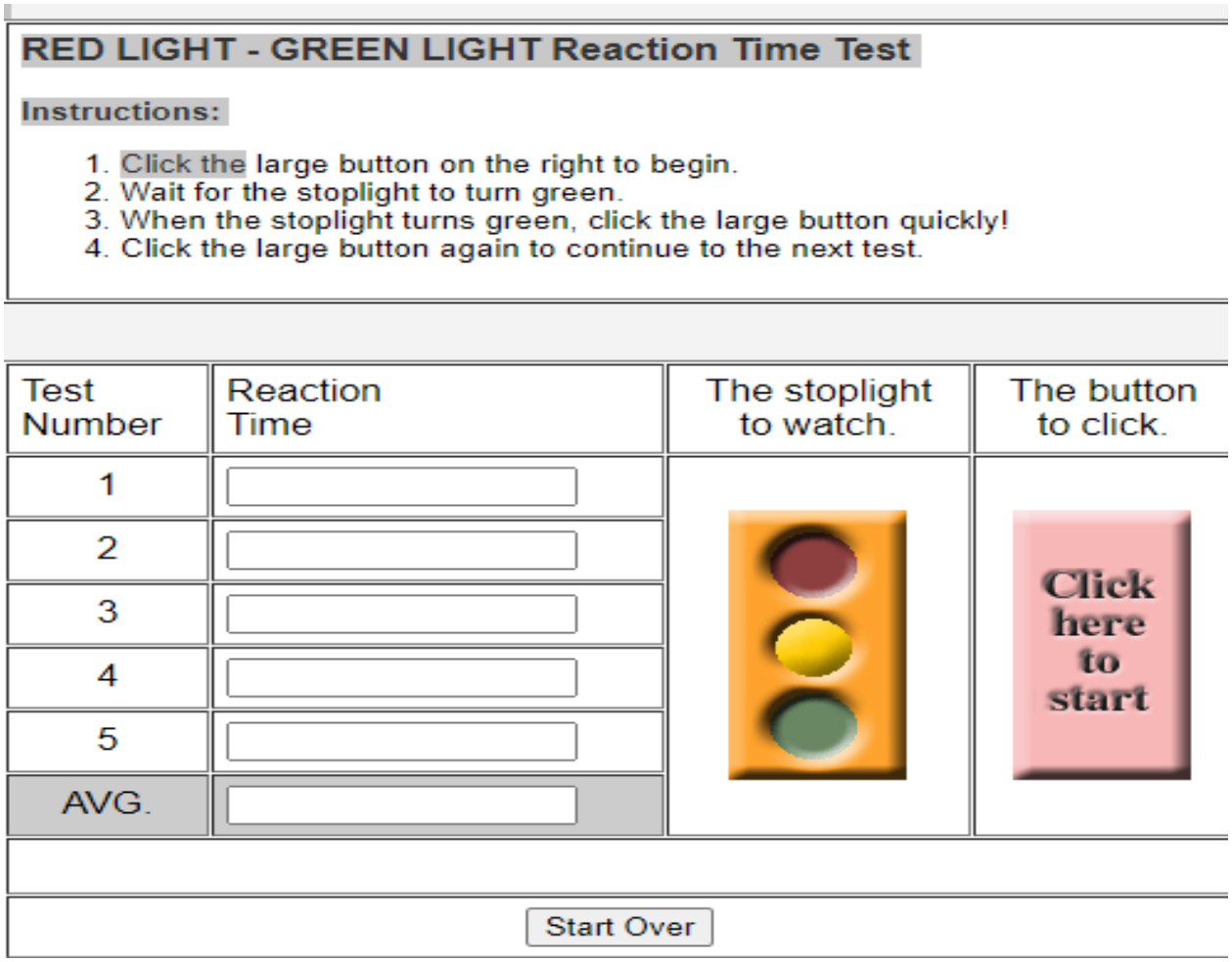
The study area considered was the Bengaluru City wherein the classic condition of Indian Mixed Traffic (IMT) implied. The first step was to classify the vehicles such as two-wheelers, three-wheelers, cars/LMVs and the buses/HMVs. The diversified information of the education of the drivers was taken by handpicking a plethora of drivers driving all the four classes of vehicles mentioned and the age groups spread across from 18 years, which is the legal age of driving over and above 65 years of age. The individual drivers were approached and detailed information were taken with regard to the gender and educational qualifications. The driver reaction times would then be obtained by using the application “Washington Education Reaction Time Tester” which has found its way

into many scientific studies to obtain the drivers reaction times. Thus, a link between the independent parameters of the drivers and the driver reaction times was obtained which was to be analysed for the research. This relationship between the independent and dependent parameters was then analysed statistically to arrive at the statistical parameters connected with the entities.

3. Methodolgy

The method adopted was that of reaction time testing of the drivers of the drivers for the classified traffic in the Indian Mixed Traffic Conditions. A total of 2000 sample drivers were distributed as 500 each for two-wheelers, three-wheelers, cars/LMVs and buses/HMVs. The reaction time tester was embedded in a mobile application and the drivers would need to attempt the reaction time test five times to obtain the average value of their reaction to a stimulus which was the change in colour of the signal light from red to green Thus, as soon as the signal turned green, the drivers needed to press the "Go" button to obtain how quickly they have reacted to the change in signal colour.

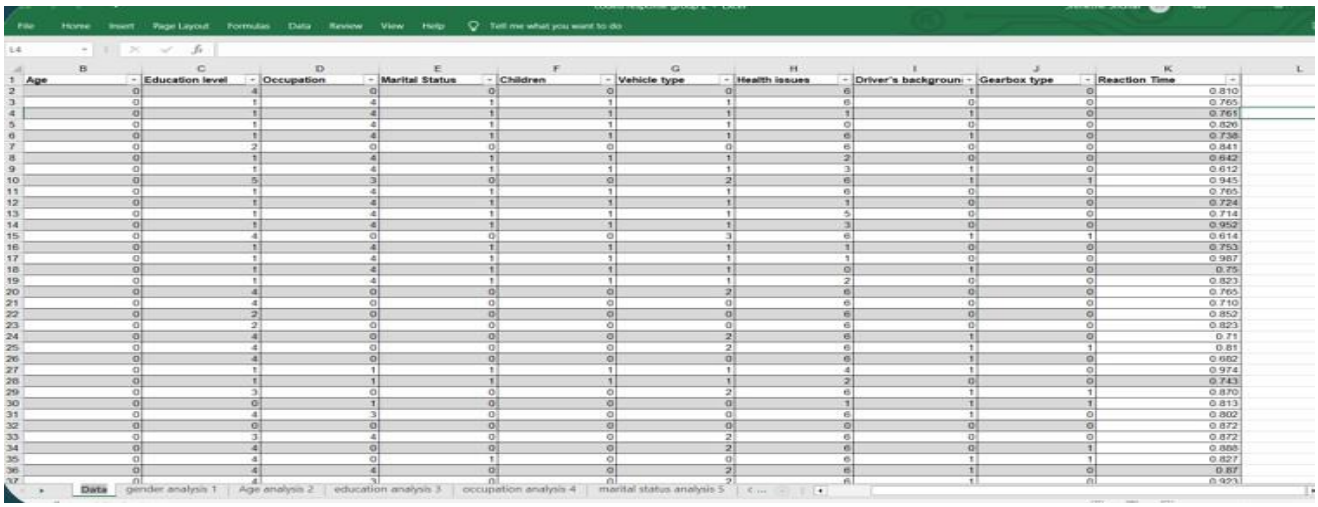
Figure (1) Reaction Time Tester



Now, that the reaction times of the drivers were obtained along with their independent characteristic information, the data was ready to be analysed in the software "Easy Fit" which is a statistical tool to arrive at the statistical parameters of the relationships. The data feed which was to be analysed was first to be coded into a binary format with males being coded as '0' and females coded as '1'. The independent parameters were then coded between '0' to 'n' between the first and the last parameter. The data feed now was sorted within the excel sheet and then transferred to the software tool.

The coded data was then fed into the software as feed. The data was analysed using descriptive statistics and the distributions were thus fit. The results obtained were analysed to arrive at the conclusions.

Fig. (2) Data Coded



	Age	Education level	Occupation	Marital Status	Children	Vehicle type	Health issues	Driver's backgroun	Gearbox type	Reaction Time
2	0	4	0	0	0	0	6	1	0	0.810
3	0	1	4	1	1	1	6	0	0	0.765
4	0	1	4	1	1	1	1	0	0	0.765
5	0	1	4	1	1	1	0	0	0	0.826
6	0	1	4	1	1	1	6	1	0	0.738
7	0	2	0	0	0	0	6	0	0	0.841
8	0	1	4	1	1	1	2	0	0	0.642
9	0	1	4	1	1	1	3	1	0	0.612
10	0	5	3	0	0	2	6	1	1	0.945
11	0	1	4	1	1	1	6	0	0	0.765
12	0	1	4	1	1	1	1	0	0	0.724
13	0	1	4	1	1	1	5	0	0	0.714
14	0	1	4	1	1	1	3	0	0	0.952
15	0	4	0	0	0	3	6	1	1	0.614
16	0	1	4	1	1	1	1	0	0	0.753
17	0	1	4	1	1	1	1	0	0	0.987
18	0	1	4	1	1	1	0	1	0	0.75
19	0	1	4	1	1	1	2	0	0	0.823
20	0	4	0	0	0	2	6	0	0	0.765
21	0	4	0	0	0	0	6	0	0	0.710
22	0	2	0	0	0	0	6	0	0	0.852
23	0	2	0	0	0	0	6	0	0	0.823
24	0	4	0	0	0	2	6	1	0	0.71
25	0	4	0	0	0	2	6	1	1	0.81
26	0	4	0	0	0	0	6	1	0	0.682
27	0	1	1	1	1	1	4	1	0	0.974
28	0	1	1	1	1	1	2	0	0	0.743
29	0	3	0	0	0	2	6	1	1	0.870
30	0	0	1	0	0	0	1	1	1	0.813
31	0	4	3	0	0	0	6	1	0	0.802
32	0	0	0	0	0	0	0	0	0	0.872
33	0	3	4	0	0	2	6	0	0	0.872
34	0	4	0	0	0	2	6	0	1	0.888
35	0	4	0	1	0	0	6	1	1	0.827
36	0	4	4	0	0	2	6	1	0	0.87
37	0	4	3	0	0	2	6	1	0	0.923

The coded was then fed into the software as feed. The data was analysed using descriptive statistics and the distributions were thus fit.

The histograms were obtained with Reaction Times versus Percentage of Male/Female drivers with a particular Educational Parameter and the graphs were analysed.

In the analysis, the type of graph was analysed with the statistical parameters of the graph, the Kolmogorov Smirnov values were arrived at along with the summary parameters.

These parameters along with the graph were analysed for each of the educational qualifications for male and female drivers and then the conclusions were drawn using the same.

4. Results

A) Male Drivers with Educational Qualifications <10th

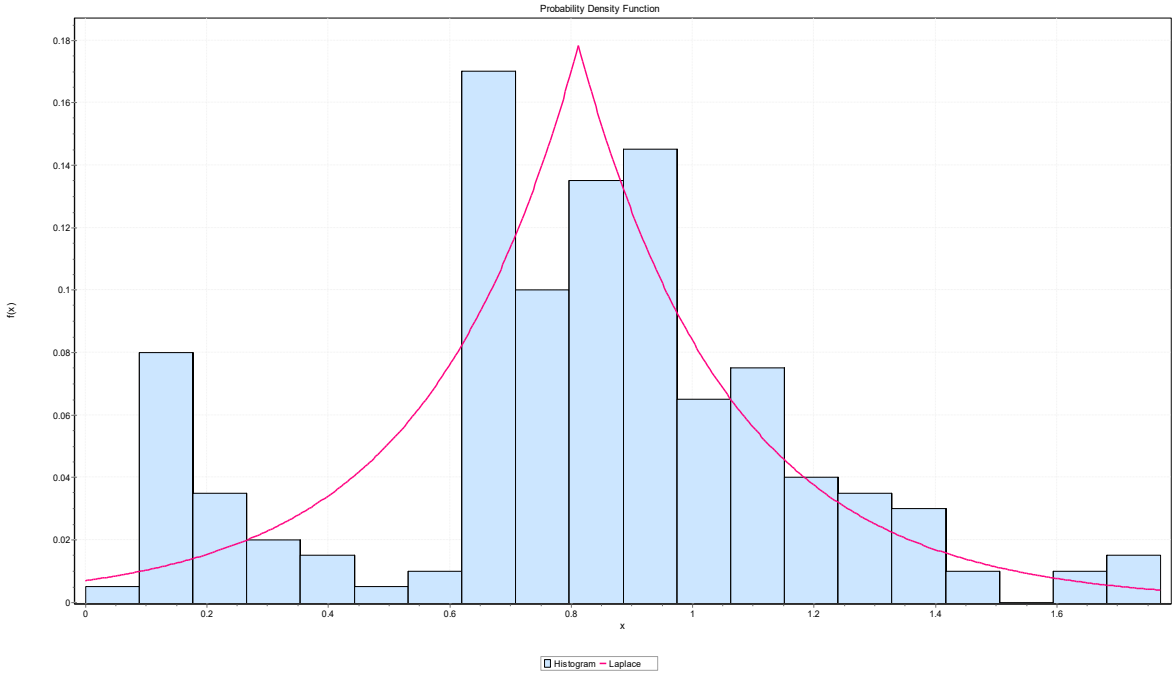


Fig. 3 Reaction Times vs Percentage of Male Drivers with Educational Qualifications <10th

Graph Type:
Graph: Laplace
Summary Parameters:
Lambda: 4.0221, Mu: 0.81239
Goodness of Fit: Kolmogorov S Rank 1: 0.06998

Result Analysis of Male Drivers with Educational Qualifications <10th

1. The histogram displays the empirical distribution of reaction times (in seconds) for male drivers with less than a 10th grade education.

2. The superimposed Laplace distribution curve (in magenta) has:
3. Central tendency location parameter = 0.81239 (Mu (μ))
4. Lambda (λ) = 4.0221 → scaling parameter (a higher value is associated with a sharper peak).

5.The Kolmogorov-Smirnov (KS) test score of 0.06998 shows that the observed data and the Laplace distribution fit each other rather well.
6. Although many drivers have reaction times that are near to the mean (~0.81s), a significant percentage of drivers have extreme (faster or slower) reactions, according to the Laplace distribution, which has big tails and a steep peak at the mean.
7. This distribution works well for people who are highly variable, have limited education, and have not had much exposure to systematic instruction.

This study links **cognitive workload and education** to **reaction time**, aligning with how **limited education** can impair performance. [9]

B) Female Drivers with Educational Qualifications <10th

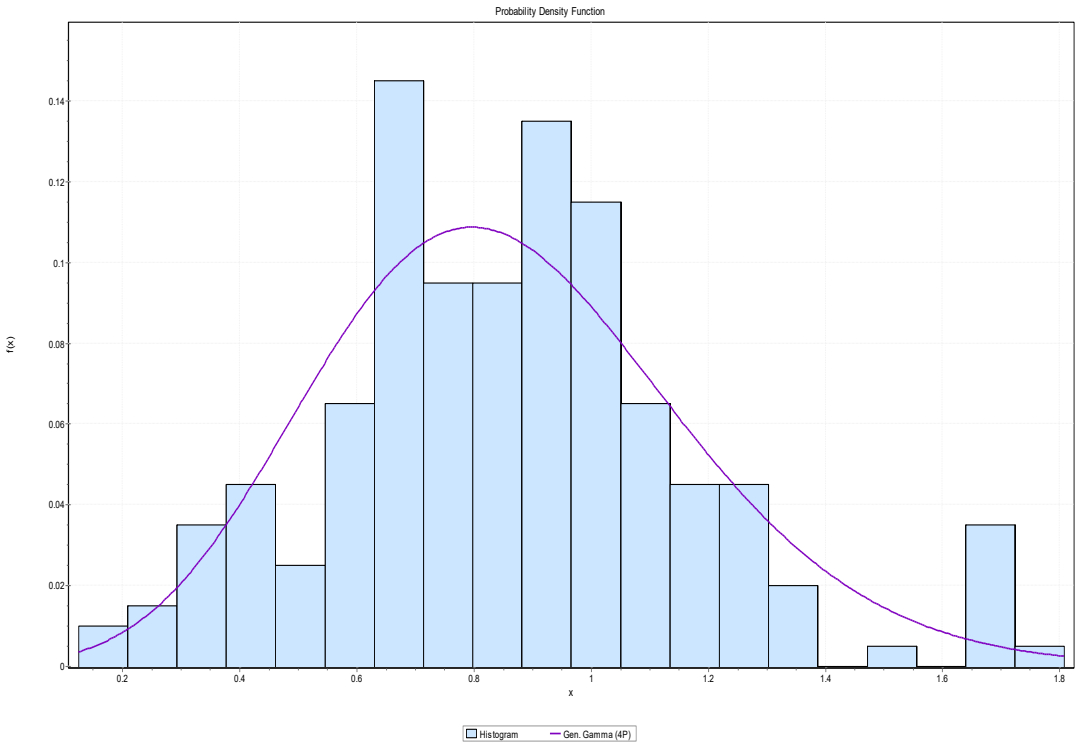


Fig. 4 Reaction Times vs Percentage of Female Drivers with Educational Qualifications

Graph Type:

Graph: Gen. Gamma (4P)
Summary Parameters:
k=1.3275, a=10.856
b=0.22846, g=-0.50751
Goodness of Fit: KS Rank 1: 0.04955

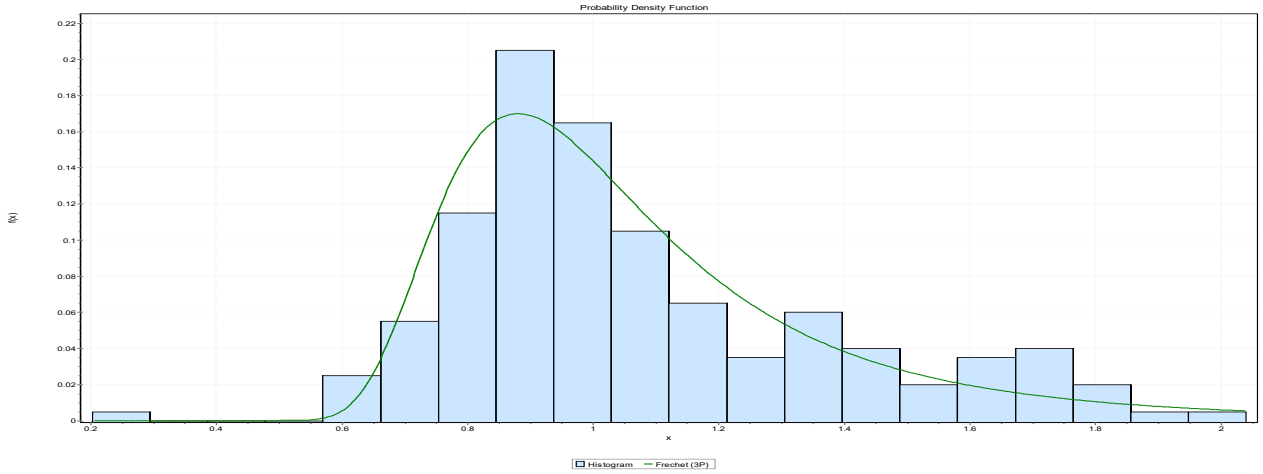
Result Analysis of Female Drivers with Educational Qualifications <10th

1. For favorably skewed, heavy-tailed data, such as human response times in diverse groups, the Generalized Gamma distribution is very flexible and perfect.
2. A lot of drivers responded within a considerable time window, according to the curve's slightly right-skewed form.
3. A smaller sample exhibited longer reaction times, suggesting delays brought on by behavioural or cognitive variability.

A negative shift (γ = -0.50751) aids in better matching the curve to the low-end data that has been observed.

Shows how **low experience and training** (often correlated with education level) affects driver performance, reaction time, and crash likelihood. [10]

C) Male Drivers with Educational Qualifications 10th pass



Par

Fig. 5 Reaction Times vs Percentage of Male Drivers with Educational Qualifications 10th pass

Graph Type:

Graph: Frechet (3P)
Summary Parameters:
a=4.678, b=0.9512 g=-0.03187
Goodness of Fit: KS Rank 1: 0.05237

Result Analysis of Male Drivers with Educational Qualifications as 10th pass

1. Reaction time is a performance threshold that is crucial for accident prevention, so it is relevant that the Fréchet distribution is used to model the minimum limits of reaction times.
2. It is frequently used in domains such as reliability and extreme event modeling.
3. Because of the positive skew in the curve, the majority of drivers reacted rapidly (clustered left), whereas a smaller percentage of drivers had noticeably slower reaction times (right tail).

This research finds that **secondary education improves driver behavior** and reaction time but notes variability due to limited formal training in real-world driving conditions. [11]

D) Female Drivers with Educational Qualifications 10th pass

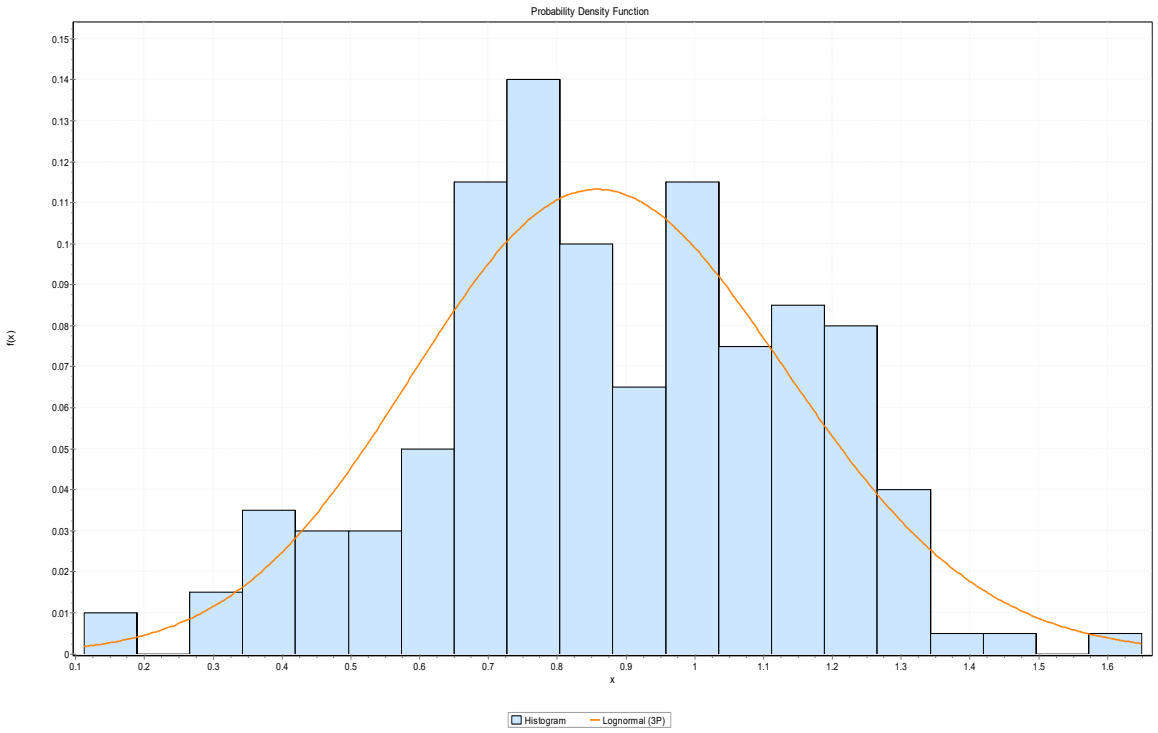


Fig. 6 Reaction Times vs Percentage of Female Drivers with Educational Qualifications 10th pass

Graph Type:

Graph: Lognormal (3P)

Summary Parameters:

s=0.03681 m=1.9974 g=-6.5011

Goodness of Fit: KS Rank 1: 0.06048

Result Analysis of Female Drivers with Educational Qualifications 10th pass

1. When the data is positively skewed and strictly non-negative, such as with reaction times, which cannot be less than zero, the lognormal distribution is suitable.
2. The distribution displays a central peak, indicating that most drivers had somewhat fast reaction times.
3. A slow right tail, which suggests that a tiny percentage of drivers react more slowly than usual.
4. By adjusting the distribution to take into consideration the earliest reactions, the location parameter (γ = -6.5011) permits a close alignment with the left tail of the histogram.

Demonstrates that **female drivers** with basic education show **improved compliance and response**, but still lag in emergency reaction times due to **confidence and exposure issues**. [12]

E) Male Drivers with Educational Qualifications PUC/12^{t}

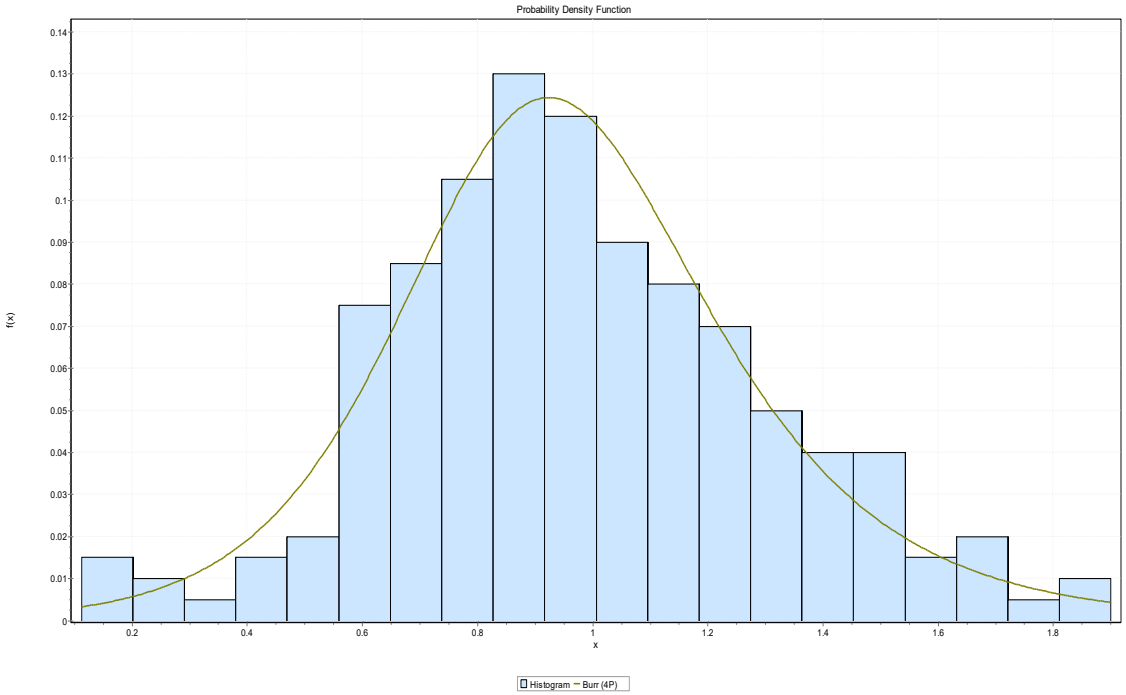


Fig. 7 Reaction Times vs Percentage of Male Drivers with Educational Qualifications PUC/12th

Graph Type:

Graph: Burr (4P)

Summary Parameters:

k=0.75194 a=62.51

b=10.171 g=-9.2872
Goodness of Fit: KS Rank 1: 0.03437

Result Analysis of Male Drivers with Educational Qualifications PUC/12th

1. Behavioral and biological reaction data are well suited for the Burr distribution, which is well-known for modeling data with variable skewness and kurtosis.
2. This is the distribution curve which is slightly skewed to the right, showing a noticeable tail of slower reactions but a higher frequency of rapid reactions.
3. The negative location parameter (γ = -9.2872) accurately accommodates the lower-bound reaction values by adjusting the entire distribution leftward, and the peak is well-centered, indicating that a substantial proportion of drivers replied around the average time.

Demonstrates that **PUC/12th pass drivers** show **better average reaction times**, though still vulnerable to stress-based or fatigue-related delays in response. [13]

F) Female Drivers with Educational Qualifications PUC/12th

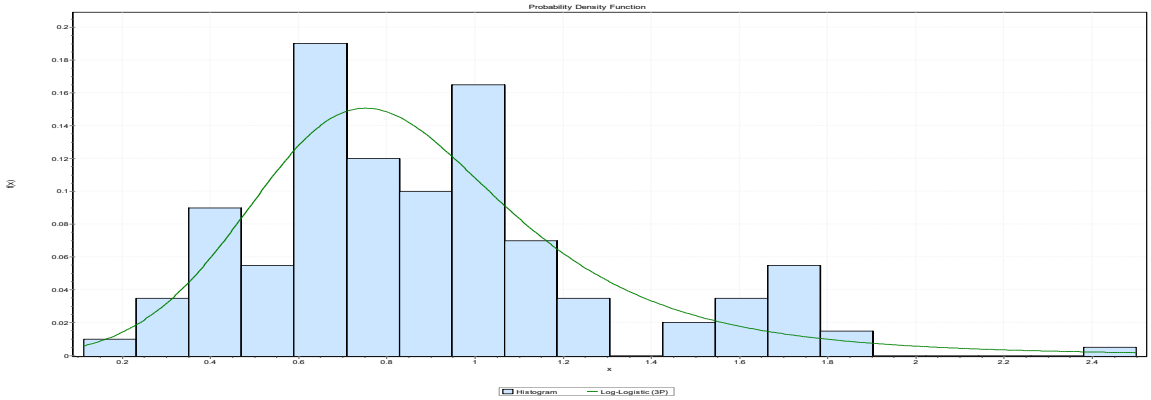


Fig. 6 Reaction Times vs Percentage of Female Drivers with Educational Qualifications PUC/12th

Graph Type:

Graph: Log-logistic (3P)

Summary Parameters:
a=5.2677, b=1.0828, g=-0.25444
Goodness of Fit: KS Rank 1: 0.0619

Result Analysis of Female Drivers with Educational Qualifications PUC/12th

1. The **log-logistic distribution** models **positively skewed data**, especially useful for behavioural processes like human reaction times.

2. The histogram shows a distinct **peak** around the mean reaction time, implying a central tendency.

3. A **gradual right tail**, showing slower responses in a minority of drivers.

4. The **location parameter (γ = –0.25444)** adjusts the starting point of the distribution, aligning well with early (faster) reaction cases.

Found that **female drivers with PUC/12th education had improved perception-reaction performance**, but **inconsistencies persisted**, attributed to **less exposure and cautious driving attitude**. [14]

G) Male Drivers with Educational Qualifications having a Degree

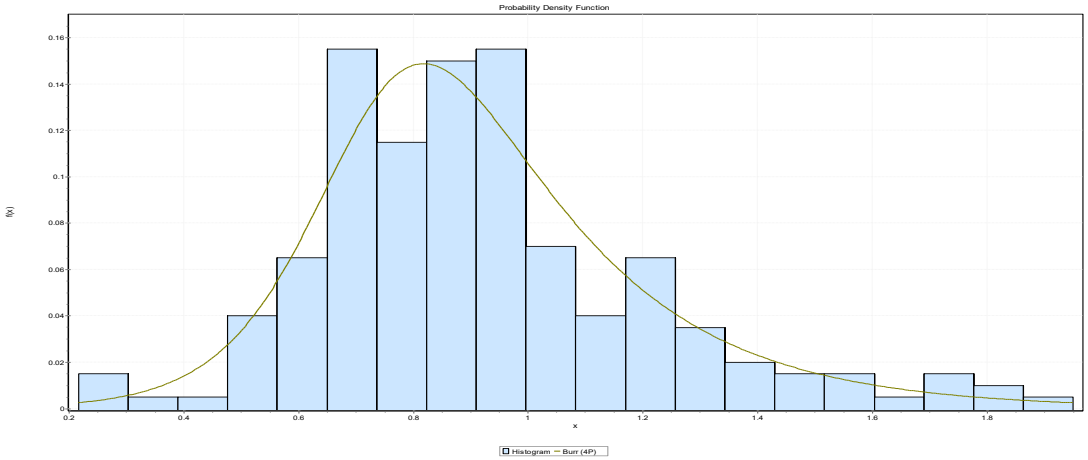


Fig. 7 Reaction Times vs Percentage of Male Drivers with Educational Qualifications as Degree

Graph Type:

Graph: Burr (4P)

Summary Parameters:

k=0.42021 a=6.9909E+7
b=7.2316E+6 g=-7.2316E+6
Goodness of Fit: KS Rank 1: 0.04856

Result Analysis of Male Drivers with Educational Qualifications having a Degree

1. The **Burr distribution**, due to its flexibility, suits **asymmetrical distributions** with long tails, as seen in human reaction time datasets.

2. This graph exhibits a **sharp central peak**, showing **high consistency in reaction times**.

3. A **right skewed tail**, but more subdued than in previous education levels.

4. The **very high a, b, γ values** reflect a mathematical scale-shift that still maintains the shape and fit with the actual empirical data.

Found that **degree-educated drivers showed reduced reaction time variability**, affirming that **education enhances road cognition and hazard anticipation**. [15]

H) Female Drivers with Educational Qualifications as Degree

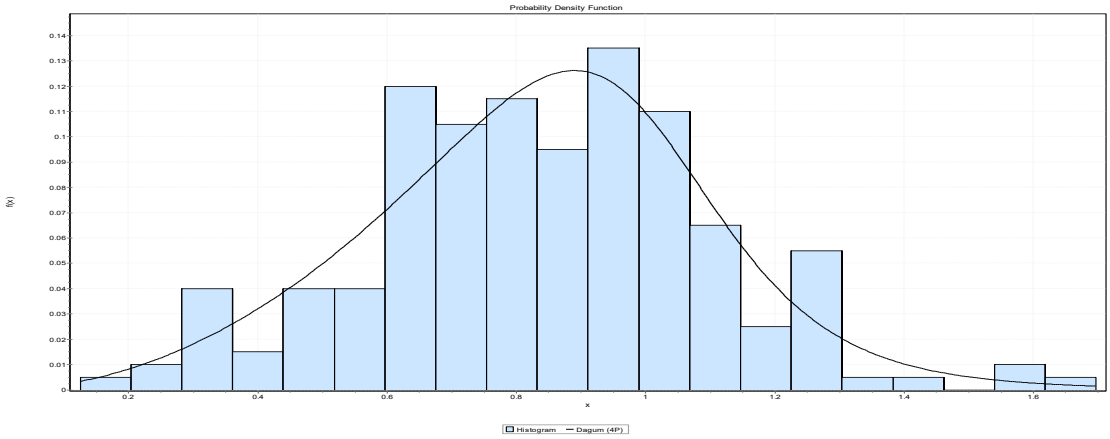


Fig. 8 Reaction Times vs Percentage of Female Drivers with Educational Qualifications as Degree

Graph Type:

Graph: Dagum (4P)

Summary Parameters

k=0.3095 a=9.7689
b=1.0642 g=-0.00661

Goodness of Fit: KS Rank 1: 0.04807

Result Analysis of Female Drivers with Educational Qualifications as Degree

1. The Dagum distribution is appropriate for datasets containing human responses since it is adaptable and can capture both long tails and mild peaks.
2. The histogram displays: o A peak that is well-centred, indicating that the majority of drivers' responses fell within a narrow range of reaction times.

3. A longer right tail that catches the few people who react more slowly. Minimal left tail, indicating that there are hardly any incredibly quick replies that fall below a reasonable threshold.
4. The mixed yet educated behavioural group—female degree holders—is well-represented by this curve and distribution, which exhibits reasonable consistency in responses with fewer deviations than groups with lower levels of education.
5. Concludes that **degree-holding female drivers react faster than lesser-educated peers**, but still have **more varied response times** than male counterparts due to **social and mobility constraints**. [16]

(I) Male Drivers with Educational Qualifications as Post-graduation

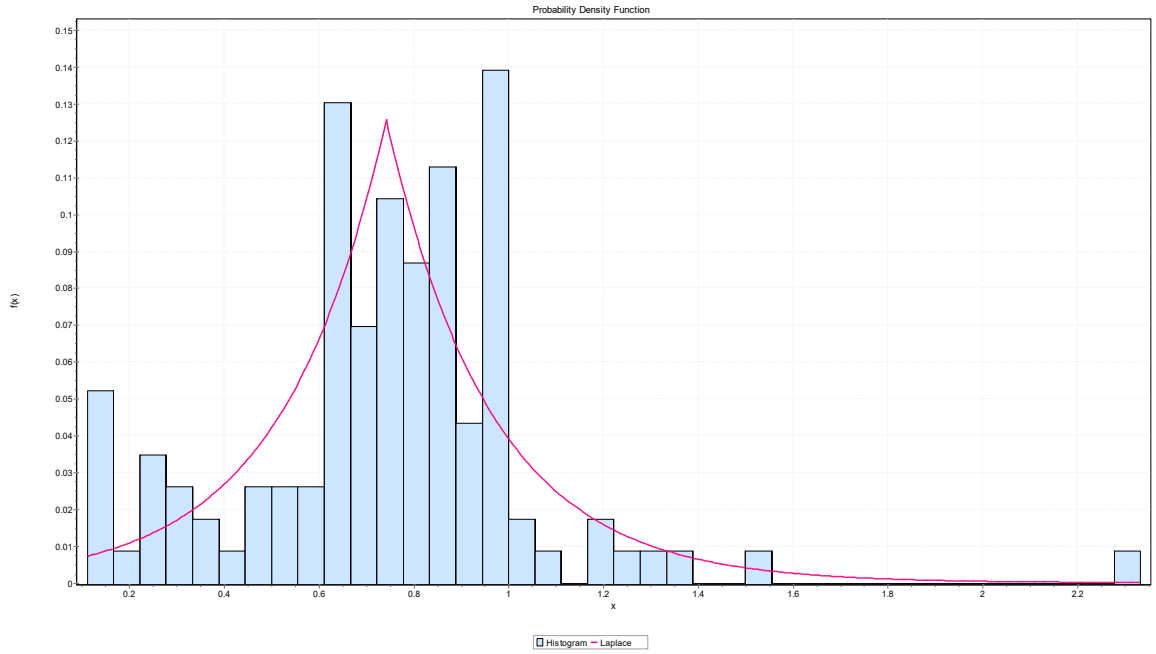


Fig. 9 Reaction Times vs Percentage of Male Drivers with Educational Qualifications Post-graduation

Graph Type:

Graph: Laplace

Summary Parameters:
l=4.5267 m=0.74235
Goodness of Fit: KS Rank 1: 0.07824

Result Analysis of Male Drivers with Educational Qualifications

1. The **Laplace curve** is **highly peaked** at the centre (near 0.74 seconds), indicating that a **large number of post-graduate male drivers** exhibited **very similar reaction times**.

2. The **steep slope and heavy tails** show that while most responses were fast and clustered, there were a few significantly **slower or faster outliers**.

3. The **sharp central peak** might indicate **trained, consistent cognitive performance**, possibly due to academic rigor or exposure to high-stakes environments.

4. However, the **right-skewed tail** reveals occasional delayed responses even among educated drivers—could be due to **overanalyses**, caution, or limited practical driving frequency.

Demonstrated that **reaction time improves with education**, but even post-graduate drivers show **response outliers**, requiring **reinforced driving practice programs**. [17]

(J) Female Drivers with Educational Qualifications as Post-graduation

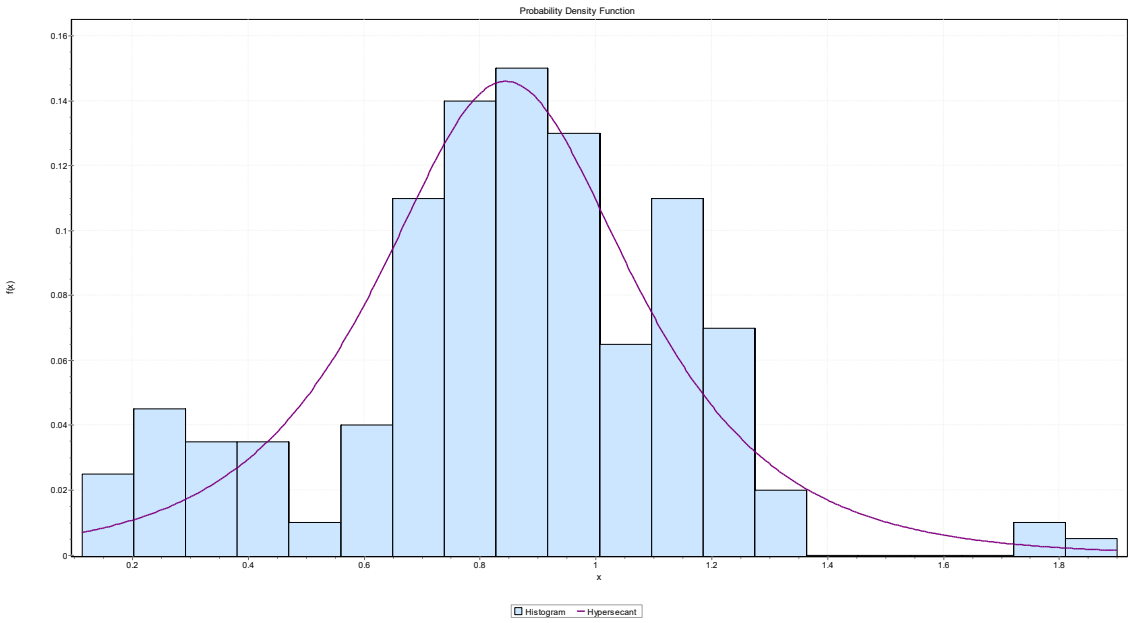


Fig. 10 Reaction Times vs Percentage of Female Drivers with Educational Qualifications as Post-graduation

Graph Type:
Graph: Hyper secant

Summary Parameters:
s=0.30621 m=0.84527
Goodness of Fit: KS Rank 1: 0.05366

Result Analysis of Female Drivers with Educational Qualifications as Post-graduation

1. The Hypersecant curve, which displays a symmetrical distribution at 0.84 seconds, where the majority of reaction times are concentrated, is in good agreement with the actual data.
2. The curve tapers into moderate tails after peaking at the middle, indicating a steady reaction time performance with some variation brought on by inherent variability.
3. This kind of fit suggests that post-graduate female drivers typically possess balanced cognitive control, which may be impacted by decision-making abilities, emotional stability, and education.
4. The hypersecant is a trustworthy depiction of the underlying reaction behavior, as indicated by the lower KS value, which suggests a very good model fit.

Finds that **educated female drivers** have better reaction times, especially when exposed to **structured environments and formal driving instruction**. [18]

5. Conclusions

1. Male drivers with education below 10th grade show highly variable reaction times (Laplace distribution), indicating inconsistent cognitive readiness and higher accident risk.
2. Lower-educated drivers struggle with decision-making and road awareness, making them more error-prone in complex urban traffic.

3. Female drivers with less than 10th grade education have delayed and inconsistent reactions (Generalized Gamma distribution), due to low cognitive processing and traffic awareness.
4. Low education, especially among female drivers facing sociocultural barriers, leads to slower reactions and increased accident susceptibility in dense traffic.
5. Female drivers with low education levels exhibit slow, skewed reactions due to literacy-related issues and limited driving exposure, raising accident risk in congested Indian traffic.
6. Male drivers with 10th-grade education show generally quicker reactions (Fréchet distribution), though a few exhibit delays possibly due to lack of readiness or cognitive limits.
7. 10th-grade education improves male drivers' reaction consistency, but limited driving exposure still causes variability, which could be reduced through targeted skill training.
8. Female drivers with 10th-grade education mostly respond within expected times (lognormal distribution), but some still react slowly due to inexperience, low confidence, or social barriers.
9. This group represents a transition phase where education improves reactions, but gender-related constraints and limited exposure still hinder optimal performance; women-focused training can help.
10. Higher secondary (PUC/12th) education enhances driver awareness and consistent reactions, though a few still lag, suggesting that education should be supplemented with real-world or simulated driving practice.
11. Higher secondary education improves female drivers' cognitive responses, but societal constraints and limited real-world exposure still cause slower reactions, underscoring the need for gender-sensitive training programs.
12. Male degree holders show quick, consistent reactions (Burr distribution), reflecting the benefits of higher education through better cognitive skills, rule familiarity, and diverse traffic exposure.
13. Female degree holders display improved cognitive response patterns (Dagum distribution), though some still show slower reactions due to limited driving experience, cautious behaviour, or sociocultural restrictions; practical training is essential for consistency.
14. Male postgraduates show consistent and efficient reaction times (Laplace distribution), but occasional delays due to stress or lack of driving practice highlight the need for hands-on training.
15. Female postgraduates exhibit stables and uniform reaction times (Hyper secant distribution), reflecting strong cognitive control, though minor variability may arise from stress or environmental factors.

6. Future Scope:

The driver behaviour and psychology is a phenomenon which depends on several factors which come into play when the humans take in-charge of the machine, that is the vehicle. Several literatures have successfully been drawing the outcomes of the permutations and combinations of various driver traits/parameters affecting the driver behaviour.

This paper intended to arrive at the driver reaction times in the Indian Mixed Traffic Conditions considering the basic independent parameters of drivers which are the gender and age group. The driver reaction time in the actual scenario depends on a number of other independent parameters like educational qualifications of drivers, vocation of the drivers, whether the driver is married or unmarried, the driver having children or not, the rural or urban background of driver, health aspect of the driver, type of gearbox driven by the driver etc.

Keeping in view the limitations of contents and length of journal paper only two parameters like gender and age of the drivers were taken into consideration. However, in the future studies, the above mentioned parameters could also be taken to arrive at a comprehensive data and it analysis to understand the near-perfect reaction times of the drivers in the Indian Mixed Traffic Conditions.

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