

Comprehensive Traffic Study and Improvement Strategies for Paripally - Paravoor Road

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Abstract— This study evaluates the existing traffic conditions on the Paripally–Paravoor Road and proposes appropriate improvement strategies to enhance safety, efficiency and mobility. The corridor serves as an important link between Paripally and Paravoor carrying a significant volume of heterogeneous traffic including two-wheelers, cars, buses, goods vehicles and pedestrians. Traffic data were collected through detailed volume surveys classified vehicle counts and peak hour analysis. Passenger Car Unit (PCU) values were computed to standardize traffic flow characteristics. Congestion points and accident-prone locations (black spots) were identified through field observations and supporting data. In addition, key roadway features such as geometric design, intersection conditions and roadside characteristics were assessed to determine their influence on traffic performance and safety. Based on the analysis, suitable traffic engineering and management measures are proposed including road widening at critical sections, improved traffic signage, provision of pedestrian safety facilities and signalization at major intersections. The proposed measures aim to improve traffic flow, reduce congestion and enhance overall road safety. The study offers practical and Cost-effective recommendations that can support local authorities in planning and implementing sustainable traffic management strategies for future traffic growth.

Index Terms: Traffic Volume Survey, Passenger Car Unit (PCU), Peak Hour Analysis, Black Spot Identification, Road Safety, Traffic Congestion, Traffic Management Strategies, Roadside Distance, Sustainable Transportation.

I. INTRODUCTION

Transportation systems play a crucial role in shaping the economic growth and social connectivity of a region. In India, road networks form the backbone of transportation, accommodating a significant share of both passenger and freight movement. However, rapid urbanization, population growth and a steady rise in vehicle ownership have placed increasing pressure on existing road infrastructure often resulting in congestion, delays and safety concerns. The Paripally–Paravoor Road in Kollam district, Kerala, serves as an important corridor connecting residential areas, commercial centres, educational institutions and healthcare facilities.

Due to its strategic importance, the road experiences high traffic demand throughout the day with pronounced congestion during peak hours. The presence of mixed traffic including two-wheelers, cars, buses, auto-rickshaws and goods vehicles further complicates traffic flow and management. Additionally, factors such as roadside activities, improper parking and inadequate traffic control measures contribute to reduced operational efficiency and increased accident risk. In this context, conducting a comprehensive traffic study becomes essential to evaluate the existing roadway conditions and identify critical issues affecting performance. Such a study enables systematic data collection on traffic volume, composition, peak hour characteristics and accident-prone locations. The insights obtained can support the development of effective, data-driven improvement strategies aimed at enhancing traffic flow, reducing congestion and improving road safety. Ultimately, this study seeks to provide a technical foundation for sustainable transportation planning and infrastructure development along the Paripally–Paravoor corridor.

II. LITERATURE REVIEW

Kumar et al. (2023) investigated urban arterial roads in Delhi and highlighted that increasing traffic demand, inefficient signal timing and poor intersection design significantly contribute to congestion. Their study emphasized the importance of traffic volume analysis, speed–delay studies and Level of Service (LOS) evaluation in identifying operational deficiencies and improving road performance.

Sharma and Patel (2023) focused on congestion management in Ahmedabad using Intelligent Transportation Systems (ITS). Their findings demonstrated that real-time traffic monitoring and adaptive signal control can effectively reduce congestion and improve mobility. The study identified rapid vehicle growth and poor signal coordination as key factors affecting traffic efficiency and recommended technology-driven solutions for better traffic management.

Reddy et al. (2024) who conducted a road safety audit in Hyderabad. Their research identified black spots through crash data analysis and field inspections revealing that poor road geometry, inadequate signage and lack of pedestrian facilities were major causes of accidents. The study highlighted the importance of systematic safety audits and infrastructure improvements in reducing accident rates.

Singh et al. (2024) analysed traffic flow characteristics in Lucknow and found that heterogeneous traffic composition and lack of lane discipline significantly affect road capacity and performance. Their study emphasized the need for improved lane management and road widening to enhance traffic flow.

Nair and Joseph (2024) examined sustainable traffic management strategies in the Kochi suburban corridor identifying unregulated parking and inefficient intersections as major contributors to congestion. They recommended integrated transport planning and improved public transportation systems.

Rao and Mehta (2025) highlighted the importance of service roads, proper median design and speed regulation in improving highway safety and efficiency. Collectively, these studies underscore the need for comprehensive traffic analysis and data-driven strategies to enhance traffic flow and road safety.

III. METHODOLOGY

3.1 General

Methodology refers to the systematic procedure followed to carry out the study and achieve the objectives of the project. In this study, various traffic engineering techniques were used to analyze the existing traffic conditions on the Parippally–Paravoor Road. This methodology mainly includes identifying the study area, collecting necessary data, conducting traffic surveys, analyzing the collected data and suggesting suitable improvement measures. Both primary and secondary data were used for the study. Primary data were collected through field surveys such as traffic volume count and opinion survey while secondary data such as accident records were collected from police station FIR reports. The collected information helps to understand traffic flow, congestion levels, accident-prone areas and other issues affecting road safety and efficiency.

3.2 Method adopted for the study

The method adopted for this study includes several systematic steps to analyze traffic conditions. First, the study area along the Parippally–Paravoor Road was selected and important junctions and road characteristics were identified.

After that, data collection was carried out by observing road conditions, roadside activities and existing traffic control measures. Accident data were collected from FIR records to identify black spots. An opinion survey was conducted among road users and local people to understand the major problems faced on the road. A traffic volume count survey was then carried out to determine the number and types of vehicles using the road at different time intervals. Finally, the collected data were analyzed using appropriate traffic engineering methods to evaluate traffic conditions and propose suitable improvement strategies.

3.3 Cause identification from opinion survey

An opinion survey was conducted to identify the major causes of traffic problems on the Parippally–Paravoor road. In this survey, road users such as drivers, pedestrians, shop owners and residents were asked about the difficulties they face while using the road. The survey helped to identify common issues such as traffic congestion, improper parking, lack of traffic signals, narrow road width, pedestrian crossing problems and roadside encroachments. The information collected through the opinion survey provides valuable insights into the real problems experienced by road users. This helps in understanding the reasons behind traffic congestion and accidents and assists in planning effective traffic management and improvement measures.

3.4 Traffic volume count survey

Traffic volume count surveys is an important traffic engineering study used to determine the number and types of vehicles passing a particular point on a road during a specified period. In this study, traffic volume data were collected at selected locations along the Parippally–Paravoor road. The survey was conducted by manually counting different categories of vehicles such as cars, buses, two-wheelers, auto-rickshaws and minivans at regular time intervals. The collected data help in understanding traffic flow patterns, traffic composition and peak hour traffic conditions. The traffic counts are also converted into Passenger Car Units (PCU) to analyze mixed traffic conditions effectively.

3.5 Need for volume counts

Traffic volume count is an essential part of traffic engineering studies as it helps in determining the number and types of vehicles using a particular road during a specific period. The main purpose of conducting a traffic volume count is to understand the traffic flow characteristics and evaluate whether the existing road infrastructure can handle the present traffic demand.

On the Parippally–Paravoor Road, traffic consists of a mixture of different vehicle types such as cars, buses, two-wheelers, auto-rickshaws and minivans. Since these vehicles vary in size, speed and operating characteristics, analyzing them directly in terms of number of vehicles may not provide an accurate representation of traffic conditions. To overcome this problem, traffic engineers convert different vehicle categories into a common unit called Passenger Car Unit (PCU). The PCU equivalency factor represents the relative effect of a particular type of vehicle on traffic flow compared to a standard passenger car. A passenger car is taken as the reference unit with a value of 1 PCU. Larger and slower vehicles such as buses or trucks occupy more road space and influence traffic more significantly; therefore, they are assigned higher PCU values. On the other hand, smaller vehicles such as two-wheelers occupy less space and have lower PCU values.

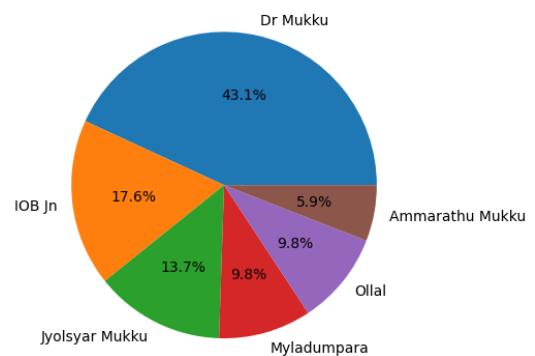
Sl. No.	Vehicle Type	PCU Equivalent Factor
1	Car / Jeep / Van	1.0
2	Bus	3.0
3	Two-Wheeler	0.5
4	Auto Rickshaw	1.2
5	Minivan / LCV	1.5

By converting the counted vehicles into PCU values, it becomes easier to analyze mixed traffic conditions and determine the actual traffic load on the road. The PCU calculation helps in identifying peak hour traffic, evaluating road capacity and planning suitable traffic management strategies such as road widening, signal control or parking regulation.

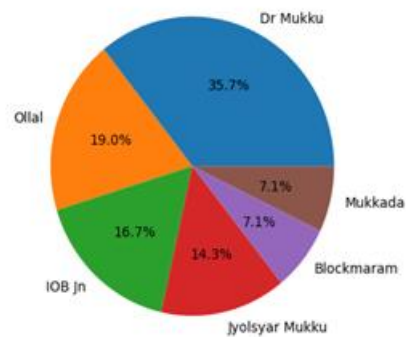
Therefore, traffic volume count along with PCU equivalency factors plays a crucial role in assessing the performance of the Parippally–Paravoor road and in proposing effective improvement measures for smoother and safer traffic movement.

IV. ACCIDENT DATA ANALYSIS

Accident Distribution by Area (2025 - Top 6)



Accident Distribution by Area (Top 6)



The accident distribution along the Parippally–Paravur road corridor indicates a pronounced spatial concentration at selected junctions. Dr Mukku accounts for the highest share of accidents, increasing from 35.7% to 43.1% in 2025 thereby confirming its identification as a major black spot. IOB Junction and Jyolsiyar Mukku exhibit moderate accident frequencies reflecting localized traffic conflicts and operational inefficiencies. In contrast Ollal and Myladumpara contribute relatively lower shares but remain significant from a safety perspective.

The observed trend suggests that traffic volume geometric design and inadequate control measures are primary influencing factors emphasizing the need for targeted engineering improvements and effective traffic management interventions.

Additionally, obstruction of the shoulder contradicts IRC:73 recommendations for safe vehicle movement. Recommended measures include removal or regulation of unauthorized signboards, clearing vegetation, maintaining clear sight distance, provision of paved shoulder and installation of standardized traffic signs to improve safety.

TABLE 4.1: TOTAL ACCIDENT REPORT OF 2024 AND 2025

Sl. No.	Parameter	2024	2025	Interpretation
1	Total Number of Accidents	62	70	Increase indicates rising traffic volume and safety concerns
2	Serious Accidents	High	Very High	Severity increased in 2025
3	Minor Accidents	Few	Moderate	Slight rise due to traffic growth
4	Fatal Accidents	Very Few	Increased	Indicates worsening safety conditions
5	Major Vehicle Involved	Two-wheelers	Two-wheelers	Most vulnerable category in both years
6	Pedestrian Involvement	Present	Increased	Reflects inadequate pedestrian safety measures
7	Peak Accident Time	Evening/Night	Evening/Night	Consistent trend (6 PM – 10 PM)
8	Major Black Spot	Dr Mukku	Dr Mukku	Most critical location in both years
9	Other Black Spots	Jyolsiyar Mukku, Ollal, IOB Jn	Dr Mukku, Jyolsiyar Mukku, IOB Jn	Expansion of high-risk zones
10	Traffic Condition	Congested	More Congested	Increased vehicular load
11	Road Safety Condition	Moderate	Poor	Decline in safety performance
12	Overall Trend	High accidents	Increasing accidents	Situation worsening; requires urgent intervention



Fig: Dr. Mukku

The location shows a horizontal curve with roadside hazards such as trees, utility poles and materials placed close to the carriageway reducing sight distance and effective shoulder width. As per IRC:38, adequate stopping sight distance is not maintained due to these obstructions. The presence of fixed objects within the clear zone violates IRC:79 and IRC:119 guidelines requiring removal or protection using crash barriers. Inadequate shoulder width also contradicts IRC:73 recommendations. Additionally, proper warning signs and curve delineation as per IRC:67 is insufficient. Recommended measures include clearing obstructions, providing paved shoulders, installing chevron boards and signage and implementing speed control measures as per IRC:99 to improve safety.

V. OBSTACLES IDENTIFIED AT DR MUKKU



Fig: Dr. Mukku

Location shows a roadway safety issue due to unauthorized roadside advertisement boards and vegetation placed close to the carriageway obstructing visibility and reducing effective shoulder width. As per IRC:67, traffic signs and roadside elements must not obstruct driver visibility, but these boards create distraction and sight distance issues. The presence of objects within the roadside clear zone violates IRC:79 guidelines.



Fig: Dr. Mukku

Shows a roadside safety issue due to electric poles placed very close to the carriageway and vegetation encroaching into the shoulder reducing effective road width and posing collision risks. This violates IRC:32 requirements for adequate horizontal clearance and IRC:79 guidelines for maintaining a safe clear zone. The unpaved and uneven shoulder also contradicts IRC:73 recommendations. Additionally, lack of proper hazard markings and signage as per IRC:67 increases accident risk. Recommended measures include relocating poles or providing crash barriers (IRC:119), clearing vegetation, developing a paved shoulder and installing proper warning signs and markings to enhance safety.



Fig. 5.1 DR MUKKU



Fig. 5.2 DR MUKKU

VI. TRAFFIC VOLUME AND PCU ANALYSIS OF DR MUKKU

The traffic volume assessment at Doctor Mukku conducted on 17th January 2026 indicates a cumulative load of 11674.5 PCU over a 12-hour observation period reflecting a persistently high traffic demand along this corridor. The peak hourly volume of 1204.5 PCU/hr recorded between 7:00–8:00 pm clearly signifies the presence of a critical evening peak primarily attributed to commuter return trips commercial activity and increased interaction between motorized and non-motorized traffic. The dominance of cars and two-wheelers within the traffic stream highlights the heterogeneous nature of flow which contributes to reduced operational efficiency and frequent speed fluctuations. Furthermore, the sustained high PCU values throughout the day suggest that the roadway is operating close to or beyond its practical capacity for extended durations. This condition is aggravated by factors such as inadequate lane discipline on-street parking roadside commercial encroachments and frequent pedestrian crossings. The lack of effective traffic control measures further intensifies congestion levels leading to increased travel delays and a higher probability of conflict points.

Overall, the analysis emphasizes that Doctor Mukku functions as a critical bottleneck within the study corridor. The findings underline the urgent need for capacity enhancement measures improved traffic regulation and infrastructure modifications to ensure smoother traffic flow and enhanced road safety.

**TABLE 5.1:
TOTAL PCU COUNT OF DR. MUKKU**

Time	Car	Bus	Two-Wheeler	Rickshaw	Mini Van	Total PCU / Hour
8am-9am	285	111	420	124.5	79.5	1,020
9am-10am	276	126	396.5	130.5	63	992
10am-11am	287	123	352.5	157.5	75	995
11am-12pm	279	114	338.5	127.5	69	928
12pm-1pm	270	117	317.5	120	61.5	886
1pm-2pm	255	114	297.5	114	57	838
2pm-3pm	242	123	276.5	112.5	52.5	806.5
3pm-4pm	252	132	302	103.5	60	849.5
4pm-5pm	278	150	336	123	72	959
5pm-6pm	350	159	383	111	75	1,078
6pm-7pm	375	171	400	120	82.5	1,148.5
7pm-8pm	390	180	420	127.5	87	1,204.5
Total (12 Hours)	3,539	1,620	4,240	1,441.5	834	11,674.5 PCU

**TABLE 5.2:
PEAK HOUR PCU COUNT OF DR. MUKKU**

Time Interval	Car	Bus	Two-Wheeler	Rickshaw	Mini Van	PCU / Hour
7:00 PM – 8:00 PM	390	180	420	127.5	87	1,204.5

Time Interval	Car	Bus	Two-Wheeler	Rickshaw	Mini Van	PCU / Hour
7:00 PM – 8:00 PM	390	180	420	127.5	87	1,204.5

VII. SOLUTIONS AND MEASURES FOR BLACK SPOT

The identified traffic and safety issues along the Parippally-Paravoor Road particularly near Doctor Mukku necessitate a phased approach comprising short-term, mid-term and long-term interventions based on urgency cost and impact.

Short term measures focus on immediate low-cost improvements aimed at enhancing road safety and visibility. These include the installation of appropriate warning signs such as curve indicators junction signs and speed limit boards in accordance with Indian Roads Congress guidelines. Hazard markers should be provided on roadside trees, electric poles and transformers to improve nighttime visibility. Proper road markings including centerlines, edge lines and pedestrian crossings must be applied to guide traffic movement effectively. Additionally, overhanging vegetation should be trimmed regularly to improve sight distance and temporary obstructions such as debris and waste should be removed. The installation of delineators, reflectors and temporary rumble strips will further help in controlling vehicle speeds and alerting drivers.

Mid-term measures involve moderate investments aimed at improving road functionality and safety. Provision of paved shoulders with a width ranging from 1.5 m to 2.5 m is recommended to accommodate breakdowns and non-motorized users. Installation of W-beam crash barriers at critical locations will enhance roadside safety. Junction improvements through proper STOP or GIVE WAY control measures are necessary to regulate traffic flow. The development of designated bus bays will reduce roadside congestion caused by stopping buses. Footpaths should be constructed in built-up areas to ensure pedestrian safety while improved street lighting at curves and junctions will enhance visibility during nighttime. Where feasible utility poles should be relocated or managed to reduce roadside hazards.

Long term measures include permanent and high impact interventions aimed at addressing fundamental infrastructure deficiencies.

Geometric improvements of curves including increasing the radius and providing adequate widening are essential for safe vehicle maneuvering. Trees and utilities should be relocated outside the clear zone to minimize accident risks. Road widening projects should be undertaken to increase capacity and accommodate future traffic growth. A well-designed drainage system must be implemented to prevent waterlogging and pavement deterioration. Additionally, the development of service roads and organized parking zones will help in reducing main carriageway congestion. Finally, the implementation of a comprehensive black spot rectification plan and if necessary, the introduction of smart traffic management systems will ensure sustainable and efficient traffic operations.

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