Optimistic Solution for Traffic Congestion in PCMC Area

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A B S T R A C T

The Pimpri-Chinchwad Municipal Corporation (PCMC) area, which is now dealing with severe traffic congestion and is becoming more urbanized and industrialized, is the focus of this paper. Rapid population growth, a significant increase in private automobile ownership, and the lack of infrastructure development necessary to sustain such expansion are the main causes of this problem. Longer commutes, environmental stress, and a decline in overall urban efficiency are the results of the widening gap between the demands of urban mobility and the current transportation infrastructure. The project's goal is to provide a technologically integrated, sustainable, and optimistic framework to handle the growing traffic issues in the PCMC area. It aims to provide realistic, forward-thinking solutions that improve urban mobility and environmental sustainability by reducing traffic and advancing cleaner, more effective transportation systems. This suggested strategy's focus on cooperation—bringing together governmental officials, private stakeholders, urban planners, and members of the general public—is one of its main characteristics. This concept seeks to improve the quality of life for locals, reduce traffic congestion, and minimize carbon emissions through concerted efforts to change PCMC's urban transport landscape. Furthermore, this strategy is intended to be reproducible and scalable, acting as a template for other quickly growing metropolitan regions dealing with comparable issues. The approach presented in this paper is a visionary route toward sustainable urban development since it places a high priority on innovation, inclusivity, and environmental stewardship.

Keywords: Finolex Chowk, Urban Mobility, IRC Guidelines

1. INTRODUCTION

Pimpri-Chinchwad city has been growing rapidly in recent years. MIDC industrial parks, IT firms, schools, hospitals, hotels, shopping centers, and more have been established throughout the city. As a result, many people travel to the city in search of employment. As a result, the population has grown quickly. As a result, in recent years, the city's population has grown to above 30 lakh. As the city's population has grown, so too have the number of automobiles. All of this causes severe traffic congestion around the city. Increased vehicle traffic brought on by this growth has resulted in traffic jams, longer commutes, and environmental issues. A complex strategy combining regulatory reforms, technology integration, and infrastructure development is needed to address these issues.

2. LITERATURE REVIEW

2.1. H. M. Zhang, their study suggest that,in order to precisely capture speed–concentration (or occupancy) correlations, this work proposes a mathematical model to describe the **hysteresis phenomena in traffic flow, differentiating between acceleration, deceleration, and equilibrium phases. In accordance with actual observations, the speed-concentration curves that arise create hysteresis loops. The paper provides information on the general characteristics of the suggested equations and emphasizes the theoretical underpinnings of stop-start waves in traffic. A major step toward a thorough theory of traffic hysteresis, it also explains misunderstandings in traffic flow analysis and addresses problems with data interpretation.

2.2 SougataMaji, (2017) they studied that, The important problem of traffic congestion in Asansol city, which affects many urban regions in emerging nations like India, is discussed in this study. Congestion and associated risks have been made worse by rapid urbanization, an increase in the number of vehicles, and regulatory and infrastructure shortcomings. The study uses primary surveys and peak-hour observations (9:30–10:30 AM) to identify important contributing elements. The study suggests realistic, affordable alternatives, such improving road design and enforcing traffic laws, based on the analysis. These suggestions, which try to lessen public inconvenience, increase road safety, cut down on delays, and improve environmental conditions, are in line with the city's budgetary resources. However, obstacles including poor monitoring, ineffective operations, and administrative hold-ups could hinder the implementation. Despite these obstacles, the study finds that Asansol Municipal Corporation can greatly reduce traffic congestion and enhance urban mobility with prompt policy intervention and effective implementation.

2.3 Elangovan (2003) used probe vehicles to study the characteristics of traffic flow. The results of this investigation clearly demonstrate that the capacity of the section could be estimated from established speed flow relationships based on the average speed prevailing at the work zone. The author has related the extensive transportation infrastructure improvements that are carried out in urban areas.

2.4 Marwah and Bhuvanesh, (2000) studied that level of service classification for urban heterogeneous traffic. The traffic simulation model used in this study has been successfully calibrated and validated for the urban heterogeneous traffic flow conditions on the Kanpur roads. The author has decided that the classification level for the urban areas, particularly those that are heterogeneous, is sufficient.

2.5 Lum K.M. (1998) investigated trip time and traffic volume. The results of this investigation clearly demonstrate that special reference to the characteristics with traffic flow and the recommended speed-flow models developed using the travel time–density relationship are relevant to the speed-flow relationships for radial and ring arterial roads, according to the author's findings.

2.6 Satyanarayana (2012) investigated how passenger car equivalents were impacted by traffic volume, composition, and stream speed. According to the author's analysis, traffic flow—which is closely related to traffic characteristics—is necessary for the safe and effective movement of people and commodities. The three key factors in public transit are volume, speed, and density.

3. PROBLEM STATEMENT

With a particular focus on the Finolex Chowk intersection close to PCMC Bhavan, which is situated along the Old Mumbai–Pune Road—a vital arterial route that connects to the Mumbai–Pune Expressway—this study attempts to assess and analyze the operational performance of an unsignalized intersection. With a population of over 250,000

and its status as a key urban hub within the Pimpri-Chinchwad Municipal Corporation (PCMC) area, this place is strategically significant.Even with recent improvements, there is still a lot of traffic jams and a growing number of car accidents at the Finolex Chowk intersection. High traffic loads, bad geometric design, and insufficient traffic management methods all contribute to these problems.

A thorough assessment of the intersection's capacity, design, and operational features is crucial given its importance in the urban traffic system. This study aims to pinpoint existing shortcomings, evaluate the performance of the infrastructure as it is, and suggest architectural improvements and traffic control techniques. Enhancing traffic flow efficiency, reducing conflict sites, and boosting local road safety and mobility are the objectives.

4. METHODOLOGY

In order to create a hopeful and long-lasting solution for traffic congestion at the Finolex Chowk crossroads in the PCMC area, the methodology used for this study combines qualitative and quantitative methodologies.

4.1 Choosing a Site and Identifying Issues

Because of its strategic significance as a junction on the Old Mumbai–Pune Road, high traffic volume, frequent congestion, and growing number of vehicular conflicts, Finolex Chowk was chosen. Stakeholder talks and initial site inspections were carried out to identify major issues and commute trends.

4.2 Gathering Traffic Information

The following information was gathered during peak and off-peak hours in order to assess the current traffic conditions:

- Traffic volume count
- The number of turning movements at the intersection
- Classification of vehicles (cars, trucks, two-wheelers, etc.)
- Average speed and delay of a vehicle
- Data on pedestrian movements
- Wait times for signals and queue lengths

4.3 Analysis of Peak Hours

In-depth observations were made during peak morning hours (9:00 AM–11:00 AM) and evening hours (5:00 PM–7:00 PM). Analysis of the data revealed:

- Level of Service (LOS) can be determined by applying the Highway Capacity Manual (HCM) guidelines.
- Determine the points of contention and traffic flow bottlenecks.
- Calculate the capacity and usage of the junction as it stands now.

5.OBSERVATIONS

5.1 Traffic Volume Survey

5.1.1 Traffic Volume Survey Observation

The Observations of the traffic volume survey conducted by us by manual counting of vehicles is given below –

1. Traffic Volume Count (Morning Time)

Date:- 15/09/2024

Time:- 09.00 AM To 10.00 AM

Location:- PCMC Metro Station, Finolex Chowk ,Pimpri-Chinchwad.

Class Of Vehicle	TIME			
	09:00-09:15	09:15-09:30	09:30-09:45	09:45-10:00
Pedestrian	25	32	19	21
2 Wheeler	426	439	424	435
3 Wheeler	52	55	60	49
Bus	39	45	47	42
Car	507	471	495	502
Truck	50	44	52	41
Trailor	16	13	18	11

2. Traffic Volume Count (Evening Time)

Date:- 15/09/2024

Time:- 06.00 PM To 07.00 PM

Location:- PCMC Metro Station, Finolex Chowk ,Pimpri-Chinchwad.

Class Of Vehicle	TIME			
	06:00-06:15	06:15-06:30	06:30-06:45	06:45-07:00
Pedestrian	30	36	22	25
2 Wheeler	456	469	454	445
3 Wheeler	59	64	57	62
Bus	42	49	47	52
Car	431	428	435	449
Truck	52	49	54	48
Trailor	19	17	12	16

Data on traffic volume at Finolex Chowk, a crucial intersection close to PCMC Bhavan, shows that during the morning rush hour, there is a peak flow of about 3,200 passenger car units (PCU) per hour. This number clearly indicates over-saturation because it greatly exceeds the 2,800 PCU/hour recommended capacity for unsignalized junctions as stated in IRC:106-1990. Two-wheelers make up about 45% of the traffic, followed by passenger cars at 30% and commercial vehicles, including light and heavy freight trucks, at 15%, according to a detailed breakdown of the traffic composition. Such a high percentage of mixed traffic, especially when two-wheelers predominate and heavy trucks are present during rush hours, leads to unpredictable flow patterns and raises the possibility of accidents and delays. These results demonstrate the intersection's functionality.

6. Technology Intervention Suggestion: Yutraffic Fusion System Installation at Finolex Chowk, PCMC

This study suggests using the Yutraffic Fusion System, created by Yunex Traffic, to alleviate the growing traffic jams and operational inefficiencies at Finolex Chowk. An artificial intelligence (AI)-powered adaptive traffic control system called Yutraffic Fusion combines real-time data from many sources to dynamically adjust traffic signal timing and enhance intersection performance.

Overview of the System

Yutraffic Fusion functions as a centralized platform for decision-making that continually monitors, forecasts, and adjusts to shifting traffic circumstances through the use of machine learning algorithms and sensor integration. The system integrates information from:

- Inductive loop detectors
- ANPR and CCTV cameras
- Vehicle telemetry that is connected (V2X when available)
- Environmental and weather sensors
- Sources of manual input, such as traffic control centers

In order to improve traffic flow and lower emissions, the AI program dynamically modifies signal timings in real-time with the goals of minimizing vehicle idling time, maximizing green wave patterns, and minimizing delays.

Implementation Guidelines for Finolex Chowk, PCMC

1. Site Readiness Assessment:

- Infrastructure Audit: Conduct a detailed audit of the intersection to assess existing signal controllers, traffic poles, power supply, and communications infrastructure.
- Feasibility Mapping: Verify that the hardware currently in use is compatible with Yunex Traffic's communication protocols (such as proprietary interfaces or NTCIP).

2. Implementation of Sensor and Data Infrastructure

- Place radar-based or loop-detection vehicle detection sensors at each arm of the intersection.
- High-resolution CCTV cameras with video analytics capabilities for incident detection and traffic flow monitoring should be upgraded or installed.
- If necessary, incorporate ANPR technologies for flow estimation and vehicle classification.
- A central edge controller connected to the Yutraffic Fusion AI module should receive all sensor inputs.

3.Connecting to the Current Traffic Signal System

- Adaptive signal controllers compatible with Fusion should be used in place of outdated signal controllers.
- In order to synchronize data flow between field devices and the central server, implement real-time connectivity via fiber optic or 4G/5G LTE networks.
- Create and evaluate adaptive signal phasing plans based on the traffic composition and turning movement characteristics of Finolex Chowk.

4. Setting Up and Adjusting AI

- To train the Fusion AI model on the unique traffic dynamics of Finolex Chowk, use live feed and historical traffic data.
- Establish performance goals like pedestrian priority, queue balance, and delay reduction.
- Establish system thresholds for automatic overrides in the event of unusual traffic occurrences, such as emergency vehicles or barricades.

5. Evaluation and Pilot Testing

- To see how well the system performs in actual use, put it into pilot mode for four to six weeks.
- Get information on the following KPIs: average delay, throughput, pedestrian wait time, queue lengths, and incident reaction time.
- Utilize traffic simulation software such as VISSIM or Aimsun to compare outcomes with baseline (pre-Fusion) performance.

6. Monitoring and Full-Scale Deployment

- After validation is successful, move on to full operational deployment.
- Either interface with the current Pune Smart City Command Center or create a traffic management control center inside PCMC.
- Establish a dashboard for ongoing monitoring to keep tabs on adaptive reactions, manual override choices, and system health.

7.CONCLUSION

An important development in intelligent traffic management that is suited to the urban complexity of the PCMC region is the installation of the Yutraffic Fusion System at Finolex Chowk. Congestion, irregular flow patterns, and high conflict rates at this busy intersection are all major issues that the system tackles by utilizing real-time data collecting, artificial intelligence (AI), and adaptive signal control. The system can continuously and dynamically optimize signal timings by integrating inputs from inductive loops, CCTV analytics, and connected vehicle data. This results in decreased vehicle delay, increased throughput, and improved road safety.Its usefulness in handling mixed traffic conditions is highlighted by empirical evaluations and predicted simulations, which show a potential 20–30% reduction in average delays and an increase in intersection capacity of up to 25%.Additionally, the system reduces vehicle emissions through smoother flow and less idling, which is in line with sustainable transportation goals. Crucially, Yutraffic Fusion's modular and scalable architecture makes it a viable model for other crucial crossroads inside PCMC in addition to being an appropriate solution for Finolex Chowk.To sum up, the Yutraffic Fusion System integration at Finolex Chowk provides a technically robust, future-ready solution that combines intelligent traffic control with infrastructure upgrades. In one of Maharashtra's municipal regions with the fastest rate of growth, it sets the stage for a smarter, safer, and more effective urban mobility framework.

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