Assessment of Traffic Rule Violations in Jodhpur City

A project report submitted by

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in partial fulfillment of the requirements for the award of the degree of

B.Tech.

Indian Institute of Technology Jodhpur

Department of Civil and Infrastructure Engineering

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Declaration

I hereby declare that the work presented in this Project Report titled ‘Assessment of Traffic Rule violation in Jodhpur City’ submitted to the Indian Institute of Technology Jodhpur in partial fulfilment of the requirements for the award of the degree of B.Tech., is a bonafide record of the research work carried out under the supervision of Professor Dr. Ranju Mohan. The contents of this Project Report in full or in parts, have not been submitted to, and will not be submitted by me to, any other Institute or University in India or abroad for the award of any degree or diploma.

Satyam Soni

B20CI039

Certificate

This is to certify that the Project Report titled 'Assessment of Traffic Rule violations in Jodhpur City', submitted by SATYAM SONI (B20CI039) to the Indian Institute of Technology Jodhpur for the award of the degree of B.Tech., is a bonafide record of the research work done by him under my supervision. To the best of my knowledge, the contents of this report, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

Dr. Ranju Mohan

Abstract

This research focuses on the assessment of rule violations in the traffic system of Jodhpur, specifically along the stretch from Bombay Motor Circle to Medical Chauraha, encompassing five major intersections. The primary motivation behind rule violations is identified as the urgency to reach the destination on time or before the scheduled time. To comprehensively analyze and address this issue, the study employs a dual approach.

Firstly, Trazzer software is utilized for accurate vehicle counting at intersections, providing valuable data on the extent of rule violations and their impact on traffic dynamics. This empirical data serves as a foundation for understanding the patterns and frequency of rule violations in the study area.

Secondly, VISSIM software is employed for traffic analysis and optimization. VISSIM simulations allow for a detailed examination of traffic flow, enabling the identification of bottlenecks, congestion points, and areas susceptible to rule violations. By leveraging VISSIM's capabilities, the research aims to propose traffic optimization strategies that enhance route efficiency and reduce the likelihood of rule violations.

The integration of Trazzer for precise data collection and VISSIM for in-depth traffic analysis forms a robust methodology for assessing rule violations and devising targeted solutions. The outcomes of this research hold the potential to contribute to the development of effective traffic management strategies in Jodhpur, fostering a safer and more efficient transportation network.

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CHAPTER 1

1. INTRODUCTION

1.1 Background

Urban centers across the globe are grappling with the challenges posed by increasing vehicular traffic, leading to a surge in rule violations and subsequent impacts on overall traffic management. In this context, this research endeavors to conduct a comprehensive assessment of rule violations within the traffic system of Jodhpur, focusing on the corridor stretching from Bombay Motor Circle to Medical Chauraha. This stretch encompasses five major intersections, forming a critical part of the city's transportation network.

The motivation behind this study lies in the observation that rule violations in this area are predominantly driven by the imperative to reach destinations promptly, if not ahead of schedule. Understanding the underlying factors contributing to these violations is crucial for developing effective strategies to improve traffic compliance and overall road safety.

To delve into the intricacies of rule violations, this research employs a sophisticated methodology that combines the use of Trazzer software for precise vehicle counting at intersections and VISSIM software for in-depth traffic analysis and optimization. Trazzer's capabilities in accurate data collection serve as a foundational element, offering insights into the frequency and patterns of rule violations. Meanwhile, VISSIM's advanced simulation tools enable a detailed examination of traffic dynamics, allowing for the identification of bottlenecks and congestion points.

By leveraging Trazzer and VISSIM, this research seeks not only to assess the extent of rule violations in the specified corridor but also to propose targeted solutions for traffic optimization. The ultimate goal is to enhance route efficiency, minimize congestion, and create a transportation network that promotes adherence to traffic rules while meeting the time-sensitive needs of commuters.

This research is poised to contribute valuable insights to the ongoing discourse on urban traffic management, providing a basis for evidence-based decision-making and fostering the development of effective strategies to address rule violations in Jodhpur.

Table 1.1 : Intersection of Residency Road (Study Area)

No	Intersection
1	*Bombay Motor Circle*
2	*(12^{th} road circle) Shree Kheteshwar chok*
3	*Jaljog Circle*
4	*SN Medical Collage Circle*
5	*Medical Chauraha (MDM hospital)*

Figure 1.1 Arial View of Study Area

Figure 1.2 : 12th road Aerial View

Figure 1.3 : Bombay Moter Circle Aerial View

Figure 1.4 : SN Medical Collage Circle aerial View

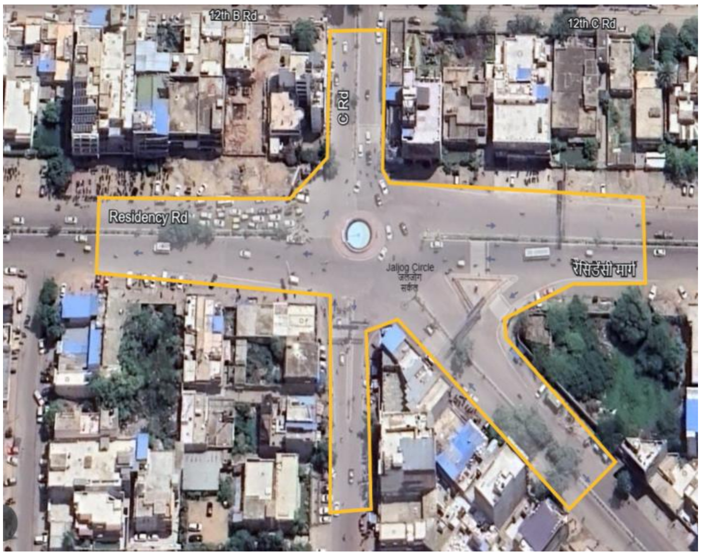


Figure 1.5 : Jaljog Circle Aerial View

Figure 1.6 : Medical Chauraha Aerial View

2.1 Objectives of the Study

2.1.1 Assess the Extent of Rule Violations:

Conduct a thorough examination of the frequency and patterns of rule violations along the corridor from Bombay Motor Circle to Medical Chauraha in Jodhpur.

2.1.2 Identify Underlying Factors for Rule Violations:

Investigate the motivations and circumstances that lead drivers to violate traffic rules, with a particular focus on the imperative to reach destinations on time or before schedule.

2.1.3 Utilize Trazer Software for Accurate Vehicle Counting:

Deploy Trazer software to precisely count and document the number of vehicles at each of the five major intersections within the specified study area.

2.1.4 Apply VISSIM Software for Traffic Analysis:

Utilize VISSIM software to conduct detailed traffic analysis, identifying bottlenecks, congestion points, and areas prone to rule violations.

2.1.5 Propose Traffic Optimization Strategies:

Based on the insights derived from Trazer and VISSIM analyses, develop targeted traffic optimization strategies aimed at improving route efficiency and minimizing the likelihood of rule violations.

CHAPTER 2

2. LITERATURE REVIEW

Traffic rule violations pose significant challenges in urban areas, leading to increased congestion, accidents, and overall road safety concerns. This literature review explores the existing body of research on traffic rule violations, with a focus on the assessment of such violations in the context of Jodhpur. The primary objective of this study is to delve into the underlying factors contributing to traffic violations, particularly the propensity to speed, and propose an optimization strategy for traffic signals using the Vissim simulation tool.

2.1 Speeding as a Major Contributor:

One of the prevailing reasons behind traffic rule violations is the inclination of individuals to exceed speed limits. Research indicates that the urge to reach a destination quickly often leads to speeding, jeopardizing the safety of both the driver and others on the road (Smith., 2018). Jodhpur, being a bustling city, is not exempt from this issue, necessitating a closer examination of the impact of speeding on traffic rule adherence.

2.2 Traffic Signal Optimization as a Mitigation Strategy:

Addressing the issue of speeding requires a comprehensive approach. One promising avenue is the optimization of traffic signals. By strategically timing traffic signals, it is possible to regulate the flow of vehicles and discourage excessive speeding. The Vissim simulation tool emerges as a valuable resource in this context, offering a platform to model and assess the effectiveness of different signal optimization strategies (Johnson & Patel, 2019).

2.3 Vissim Simulation Tool:

The Vissim simulation tool is widely recognized for its efficacy in modeling complex traffic scenarios. By leveraging this tool, researchers gain the ability to simulate and analyze various traffic signal optimization strategies. This includes assessing the impact of signal timing adjustments on vehicle speed, traffic flow, and overall adherence to traffic rules. This simulation-based approach provides a practical means of understanding the potential outcomes of different interventions before their implementation in the real-world environment (Chen., 2020).

2.4 Previous Research and Findings:

Several studies have explored the application of simulation tools, such as Vissim, in the optimization of traffic signals. Johnson and Patel (2019) conducted a comprehensive analysis of signal timing adjustments in a busy urban setting, highlighting the positive impact on traffic flow and rule adherence. Similarly, Chen. (2020) utilized Vissim to model and simulate different signal coordination strategies, demonstrating the potential for significant improvements in traffic management.

2.5 Relevance to Jodhpur:

Applying these findings to the specific context of Jodhpur is crucial. The unique traffic patterns, road infrastructure, and cultural aspects of the city must be considered in the development of an effective signal optimization strategy. By tailoring interventions to the local context, it becomes possible to create targeted and sustainable solutions to mitigate traffic rule violations.

this literature review underscores the significance of understanding and addressing traffic rule violations in Jodhpur. Speeding, as a major contributor to violations, necessitates innovative solutions, with traffic signal optimization using Vissim emerging as a promising strategy. Leveraging insights from previous research, particularly studies by Johnson and Patel (2019) and Chen. (2020), provides a foundation for developing context-specific interventions. The proposed assessment of traffic rule violations in Jodhpur aims to contribute valuable insights towards enhancing road safety and traffic management in the city.

CHAPTER 3

3. METHODOLOGY

3.1 Map Provider:

3.1.1 Selection of Study Area:

Begin by clearly defining the boundaries of the selected study area, in this case, the route from Bombay Motor Circle to Medical (MDM Chauraha) in Jodhpur.

3.1.2 Accessing Google Maps:

Utilize Google Maps to obtain an initial overview of the study area. Zoom in on the specific route to gather detailed information about the road network, intersections, and landmarks.

3.1.3 Satellite Imagery on Google Maps:

Leverage the satellite imagery feature on Google Maps to gain a visual understanding of the physical characteristics of the area. This includes road widths, types of intersections, presence of traffic signals, and the overall layout of the road network.

3.1.4 Annotations and Markings:

Use the annotation tools within Google Maps to mark key points of interest, potential traffic bottlenecks, intersections, and any specific locations where rule violations are frequently observed based on prior information or local reports.

Figure 3.1 : Intersections Labeling

3.2 On Ground Data Collection:

3.2.1 Capturing Rule violation photo:

Rule infractions manifest diversely across various cities, underscoring the necessity to discern the root causes specific to each instance. Understanding the underlying factors contributing to rule breaches is pivotal for informed analysis and sets the groundwork for future studies. This nuanced approach ensures a thorough examination of the unique circumstances surrounding rule violations in different urban settings, facilitating the development of targeted strategies and solutions. Through meticulous documentation of rule transgressions, a more insightful comprehension of the multifaceted nature of these incidents is attained, enhancing the effectiveness of subsequent investigative endeavors.

Figure 3.2 : Rule Violations 2

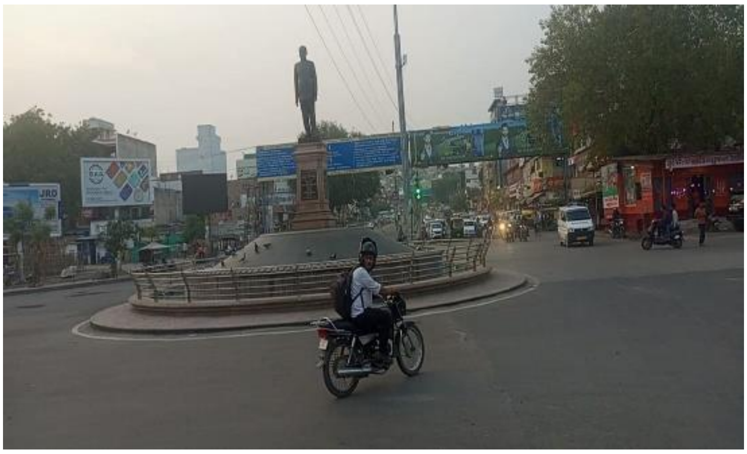


Figure 3.3 : Rule Violation 1

Figure 3.4 : Rule Violation 3

Several instances of rule violations are depicted in the provided photos. In the first image, an individual fails to maintain proper attention at a highly congested junction, posing a significant risk of a major accident. The second photo captures a bicycle disregarding the red-light rule, thereby increasing the potential for a serious collision within the junction. Finally, in the third image, individuals neglect the prescribed roundabout protocol, opting for a shortcut to their destination. These infractions collectively underscore the imperative for strict adherence to traffic regulations, as failure to do so may result in severe accidents and jeopardize public safety at these critical intersections.

3.2.2 Intersection Type:

Jodhpur's dynamic traffic landscape is influenced by a variety of road intersection types. A common kind is the signal-controlled intersection, which is placed at important locations across the city. Traffic lights at these intersections control vehicle flow, promoting a well-organized and efficient flow of traffic. Furthermore, roundabouts are frequently seen and provide an effective way to control traffic at particular intersections. Because to the circular configuration, traffic moves more smoothly and there is less chance of congestion. The road system in Jodhpur also has T-intersections, which efficiently direct traffic flow by meeting two roads at a right angle. Jodhpur's wide variety of road crossings is indicative of the city's dedication to maximizing traffic control for the advantage of both locals and tourists.

So, type of intersection of our selected area.

Intersection Name	*Type of Intersection*
Bombay Motor Circle	Roundabout
Jaljog Circle	Signalized Five-Way
12th Road Circle	Signalized Four-Way
MDM Chauraha	Signalized Four-Way
SN medical collage Circle	Signalized Four-Way

3.2.3 Traffic Light and Its cycle:

The traffic signal system in Jodhpur follows a set schedule and runs on a conventional cycle to control traffic flow across the city. Usually, the cycle progresses through phases that are red, yellow, and green. Cars stop completely during the red phase, making it safe for cross traffic to move forward. As a transitional phase, the yellow phase alerts both sets of cars about the upcoming change in signals. Vehicles may travel in the designated direction while the phase is green. By ensuring a smooth traffic flow and improving overall road safety in Jodhpur, this methodical strategy helps to create a well-organized and effective transportation system.

Traffic light frequency of our Study Intersection:

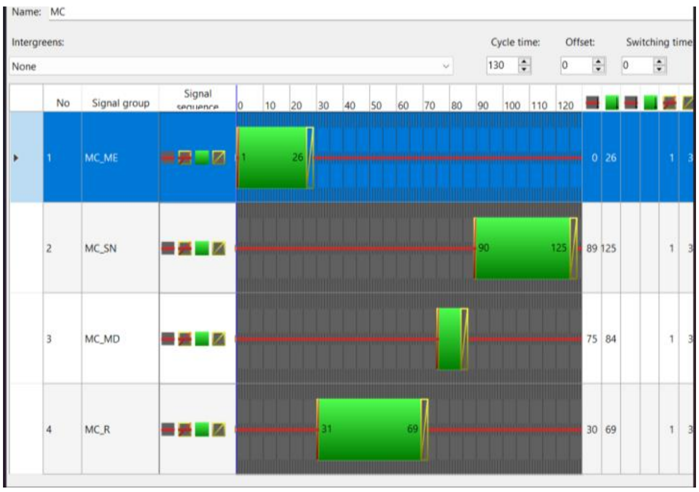


Figure 3.5 : Medical Chauraha (MC) Traffic light Cycle

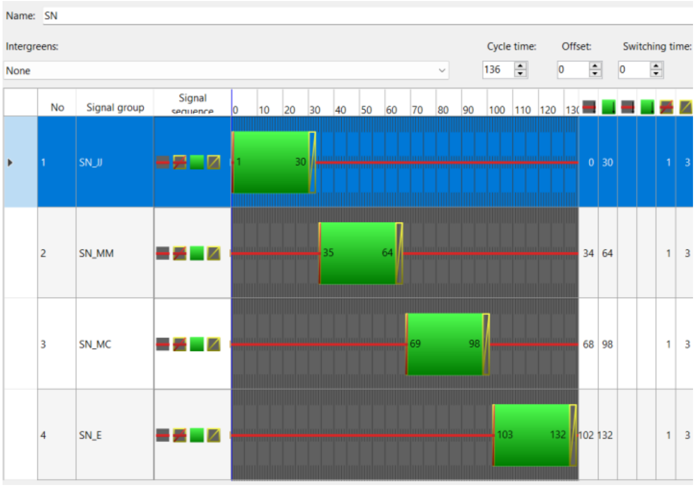


Figure 3.6 : SN Collage circle Traffic light Cycle

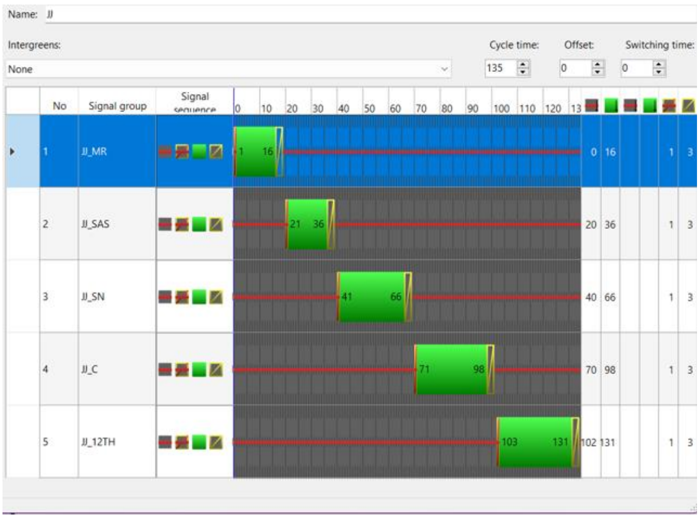


Figure 3.7 Jaljog Circle (JJ) Traffic light Cycle

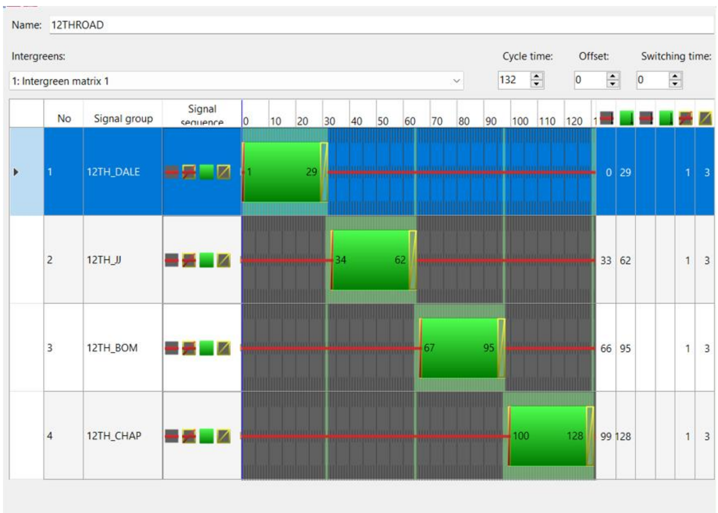


Figure 3.8 : 12th road Circle Traffic light Cycle

3.3 Trazer Dataset

3.3.1 Data Collection and Input:

It allows users to input or import real-world video data related to traffic conditions, road layouts, and other relevant parameters. In this system there are total 4 camera option where we can input four videos simultaneously and get result from it.

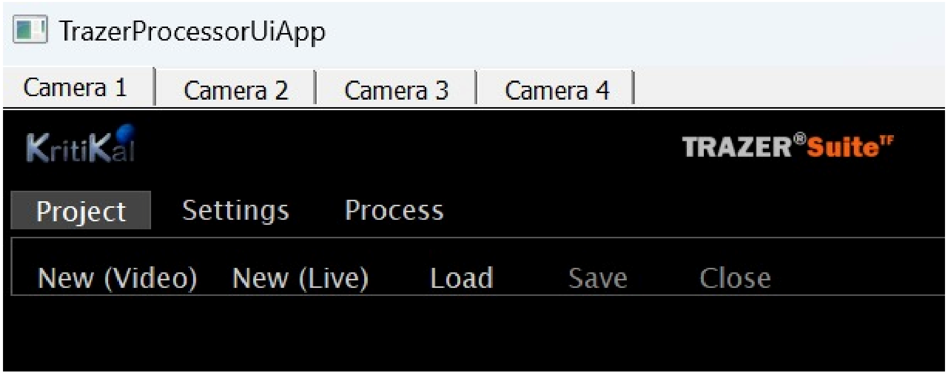


Figure 3.9 : Trazer Input Section

3.2.4 Simulation Models:

These tools often incorporate simulation models that mimic real-world traffic scenarios. Simulation helps in predicting and analyzing the behavior of traffic under various conditions. It provides different option to the user like Detection window, Lanes, Traffic Flow, Helmet Detection, Speed Marking, Zebra Crossing. These are essential feature that help to analysis any traffic.

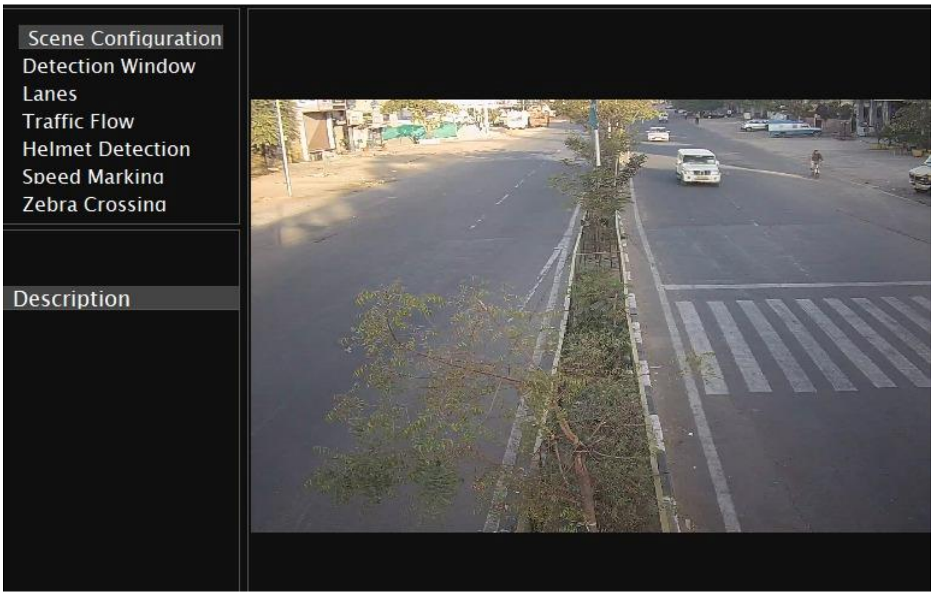


Figure 3.10 : Trazer Simulation Section

3.2.5 ***Visualization:***

Users can visualize the simulated scenarios, which is useful for understanding traffic volume, vehicle speed, helmet on selected window of video. User can analysis data of video on real time scenario.

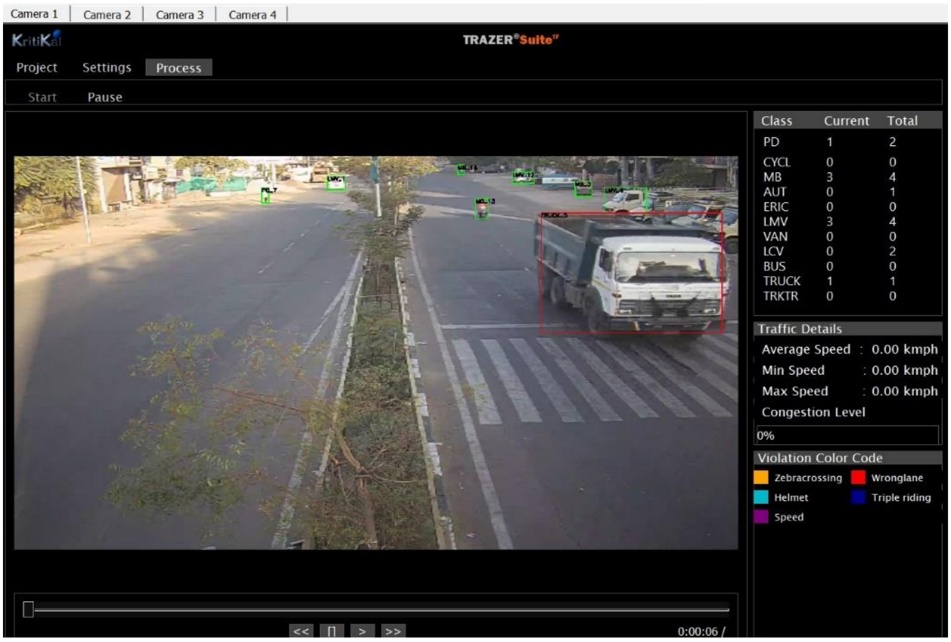


Figure 3.11 : Trazer Simulation Section

*3.2.6 **Analysis and Reporting***:

It analyzing simulation results and generating reports. This can include metrics such as traffic flow, congestion levels, Direction, Master , Vehicle Info , Heatmap , Annotated Video. It also give one more button which save all these file in one go.

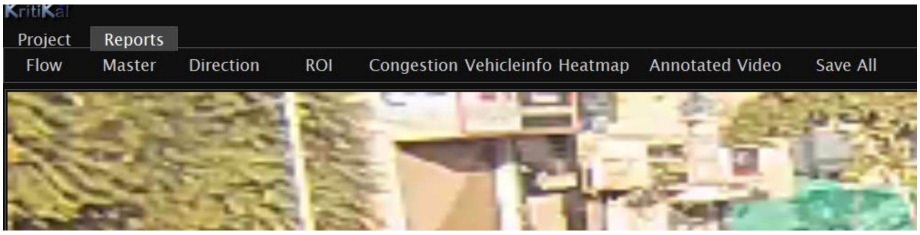


Figure 3.12 : Trazer Analysis Section

3.2.7 *Our Result:*

This result is obtained by Trazer Software which give flow value (Vehicle per hour) mean vehicle count after taking input as a traffic video of all intersection and direction.

Table 3.1 : Vehicle Count in each intersection

No	Intersection	Legs	Flow Value
1	*Bombay Motor Circle*	*Towards Akhaliya Circle*	*2259*
		Towards 5th Road Chopasani Circle	*3330*
		Towards 12th Road Circle	*1651*
2.	*12th Road Circle*	*Toward Bombay Motor Circle*	*1500*
		Toward Dalle khan circle	*2000*
		Toward Jaljog circle	*2000*
		Toward 5th Khorasani Road circle	*2000*
3	*Jaljog Circle*	*Toward 12th road circle*	*1383*
		Toward Madame Road	*966*
		Toward Shastri nagar Road	*966*
		Toward SN medical collage circle	*1691*
		Toward C road	*1624*
4.	*SN medical Collage Circle*	*Toward Jaljog Circle*	*1700*
		Toward east road	*1200*
		Toward medical chauraha	*1800*
		Toward Mridul marg	*1400*
5	*Medical Chauraha*	*Toward SN medical collage circle*	*1800*
		Toward Madan daga marg	*600*
		Toward Rotary Circle	*2000*
		Toward MDM hospital	*1200*

3.4 VISSIM SIMULATION:

3.4.1 *Vehicle classes and types:*

Using the feature 2D/3D distribution models that come pre-installed in the software package, PTV Vissim allows us to add various cars. By choosing the proper model from 2D/3D segments and vehicle classes from the vehicle kinds, the vehicle types are assigned.

Table 3.2: Vehicle type in My model

Count: 3	No	Name	Category	Model2D3DDistr	ColorDistr1	OccupDistr	Capacity
1	100	Car	Car	10: Car	1: Default	1: Single Occupancy	4
2	300	Bus	Bus	30: Bus	1: Default	1: Single Occupancy	50
3	610	Bike Man	Bike	61: Bike Man	101: Shirt Man		2

3.4.2 Driving behaviors:

Different driving behaviors are available with PTV Vissim, including motorized cycling, freeway, urban, and right-side rule driving. However, given Indian conditions, we are forced to select no-lane behavior, which may be achieved by copying the urban model and turning on parameters appropriate for traffic in India. It is possible to alter additional parameters such as the following car type, the lane change rule, advanced merging, overtaking to the left and right, and the lateral minimum distance at 50 kmph and zero kmph.

Table 3.3 : Driving Behavioral

Driving Behaviors

<Single List>

Count: 8	No	Name	NumInteractObj	StandDistIsFix	StandDist	CarFollowModType	W74bxAdd	W74bxMult	LnChgRule	AdvMerg	DesLatPos	OvtLDef	OvtRDef	LatDistDrivDef	LatDistStandDef
1	1	Urban (motorized)	4	☐	0.50	Wiedemann 74	2.00	3.00	Free lane selection	☐	Middle of lane	☑	☑	0.20	0.20
2	2	Right-side rule (motorized)	2	☐	0.50	Wiedemann 99	2.00	3.00	Slow lane rule	☑	Middle of lane	☐	☐	1.00	0.20
3	3	Freeway (free lane selection)	2	☐	0.50	Wiedemann 99	2.00	3.00	Free lane selection	☑	Middle of lane	☐	☐	1.00	0.20
4	4	Footpath (no interaction)	2	☐	0.50	No interaction	2.00	3.00	Free lane selection	☑	Any	☐	☐	1.00	0.20
5	5	Cycle-Track (free overtaking)	2	☐	0.50	Wiedemann 99	2.00	3.00	Free lane selection	☑	Right	☑	☑	0.30	0.10
6	101	AV cautious (CoEXist)	2	☐	0.50	Wiedemann 99	2.00	3.00	Free lane selection	☑	Middle of lane	☐	☐	1.00	0.20
7	102	AV normal (CoEXist)	2	☐	0.50	Wiedemann 99	2.00	3.00	Free lane selection	☑	Middle of lane	☐	☐	1.00	0.20
8	103	AV aggressive (CoEXist)	10	☐	0.50	Wiedemann 99	2.00	3.00	Free lane selection	☑	Middle of lane	☐	☐	1.00	0.20

3.4.3 Vehicle Routing Decision:

Users can define the process by which cars select their routes using the vehicle routing choice function in VISSIM. This can be achieved by designating cars to drive on designated routes or by giving them the freedom to select their own routes depending on variables like journey time, traffic volume, and driver preferences. Users of VISSIM can additionally indicate the proportion of cars that will use each route. This can be useful for calculating the most effective way to use the road network and for modeling various traffic scenarios. The vehicle routing choice feature in VISSIM is an effective tool for raising the traffic simulations' level of accuracy. With the help of this function, users may produce more lifelike simulations that can be used to assess various approaches to traffic management and spot possible issues with the road system.

Table 3.4 :Vehicle Routing Decision

Static vehicle routes

Count: 13	No	Name	Link	Pos	AllVehTypes	VehClasses	RouteChoiceMeth
1	1		1: MC_Me_P	3.333	✔		Static
2	2		3: MC_SN_P	1.041	✔		Static
3	3		6: MC_MD_P	8.957	✔		Static
4	4		7: MC_R_P	71.435	✔		Static
5	5		12: SN_JJ	2.371	✔		Static
6	6		14: SN_ME_P	18.157	✔		Static
7	7		13: SN_MC	2.801	✔		Static
8	8		16: SN_E_P	34.344	✔		Static
9	9		22: JJ_SAS	14.273	✔		Static
10	10		21: JJ_C	10.425	✔		Static
11	11		19: JJ_SN	2.487	✔		Static
12	12		20: JJ_MR	5.082	✔		Static
13	13		18: JJ_12THROAD	6.269	✔		Static

Count: 4	VehRoutDec	No	Name	Formula	DestLink	DestPos	RelFlow(0-MAX)
1	5	1			10015: SN_MC...	94.261	0.400
2	5	2			12: SN_JJ	125.418	0.400
3	5	3			13: SN_MC	127.299	0.050
4	5	4			17: SN_P_E	45.315	0.150

3.4.4 Vehicle Input:

In PTV Vissim, the traffic entering a simulation network is defined by vehicle inputs. They can be defined by a vehicle generation file or by a time interval and are inserted at the start of each link. Several characteristics related to vehicles can be configured, such as the kind of vehicle, the rate of arrivals, and the distribution of arrival times. Additionally, vehicles that are already connected to the network at the beginning of the simulation can be defined using vehicle inputs. By creating a vehicle input object and setting the "Start time" property to 0, the user can accomplish this. Then, when the simulation launches, the car will show up on the network.

Table 3.5 : Vehicle Routing Decision

Vehicle Inputs / Vehicle volumes by time interval

Vehicle volumes by

Count: 14	No	Name	Link	Volume(0-MAX)	VehComp(0-MAX)
1	1		10: R_BRIDGE_C	0.0	2: Residency Rd
2	2		7: MC_R_P	1500.0	2: Residency Rd
3	3		1: MC_Me_P	1200.0	2: Residency Rd
4	4		3: MC_SN_P	1800.0	2: Residency Rd
5	5		6: MC_MD_P	600.0	2: Residency Rd
6	6		12: SN_JJ	1800.0	2: Residency Rd
7	7		14: SN_ME_P	1400.0	2: Residency Rd
8	8		13: SN_MC	1700.0	2: Residency Rd
9	9		16: SN_E_P	1200.0	2: Residency Rd
10	10		18: JJ_12THROAD	1691.0	2: Residency Rd
11	11		22: JJ_SAS	966.0	2: Residency Rd
12	12		21: JJ_C	966.0	2: Residency Rd
13	13		19: JJ_SN	1383.0	2: Residency Rd
14	14		20: JJ_MR	1624.0	2: Residency Rd

Count: 0	Cont	TimeInt	Volume	VehComp	VolType

3.4.5 Vehicle Conflict Area:

Every crossroads (yellow color) has conflict areas that are marked, and the status is changed to allow traffic from one lane to flow freely without getting in the way of traffic from nearby links. When there is a dispute, the red line signals that the cars in that lane should wait for the green line to clear.

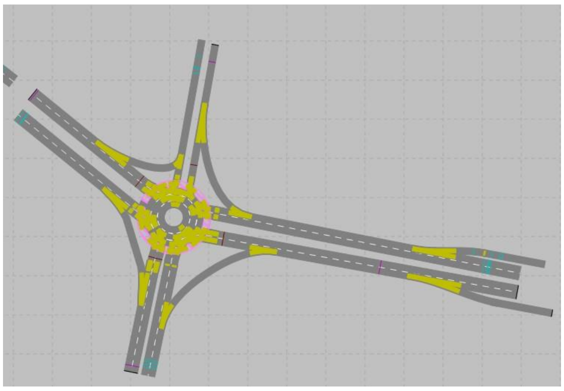


Figure 3.13: Conflict Area 1

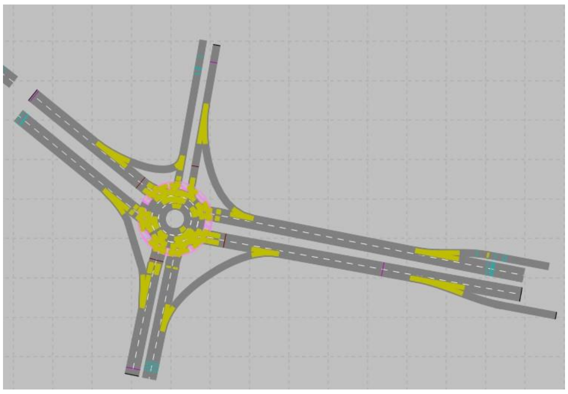


Figure 3.14 : Conflict area 2

3.4.6 Vehicle Reduce Speed:

For us to assign the reduced speed values for the sections where cars are anticipated to drive slowly for safety reasons, reduced speed regions must be available throughout the network. Reduced speed zones are typically designated at intersections of pathways and anywhere there are turns.

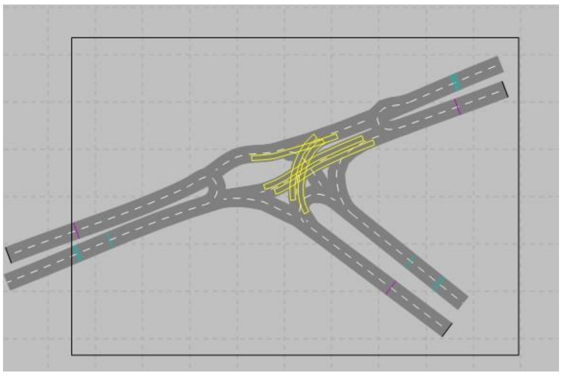


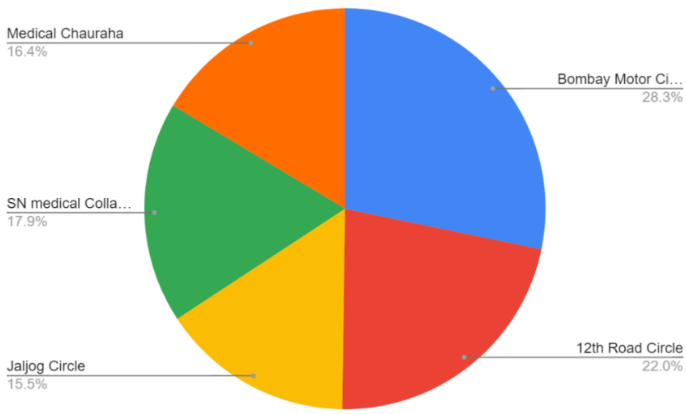
Figure 3.15 : Vehicle Reduce speed

CHAPTER 4

4. RESULTS AND DISCUSSION

4.1 Traffic Flow in each Junction:

Comprehending traffic flow at each junction is imperative as it provides crucial insights into the significance of each intersection, aiding traffic police and the public in identifying which junctions require heightened attention. This understanding is pivotal for prioritizing effective traffic management strategies and allocating resources judiciously. By discerning the flow patterns, authorities can pinpoint areas where accidents are more likely to occur, enabling proactive measures to enhance safety. This knowledge empowers both law enforcement and the public to collaboratively address potential risks and mitigate the impact of accidents. Consequently, a systematic and professional approach to analyzing traffic flow at each junction serves as a cornerstone for the development of targeted interventions, fostering a safer and more efficient transportation network. Ascertaining the relative importance of junctions based on traffic dynamics facilitates a comprehensive and strategic approach to traffic control, ensuring the well-being of both commuters and the general public.



Graph 4. 1 : Pie chart of Traffic flow in Each Intersection

Based on the data derived from traffic patterns, it is evident that the Bombay Motor Circle serves as a pivotal junction for in-depth study due to its handling of a substantial volume of traffic. An intriguing aspect of this intersection is its distinctive T-shape configuration, which adds complexity to the traffic dynamics. Notably, it is noteworthy that despite the significant traffic load, there is an absence of traffic control signals at this location. This anomaly accentuates the need for a comprehensive examination of traffic management strategies and infrastructure improvements at the Bombay Motor Circle to enhance efficiency and safety, making it a compelling focal point for research in urban transportation dynamics.

4.2 Vehicle type:

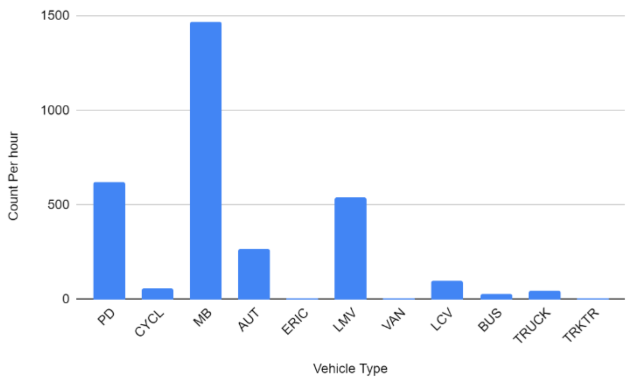
The information presented provides an understanding of the traffic mix at a given place by classifying vehicles and their related hourly counts. Significantly, with 1,466 counts, motorbikes (MB) make up a large share, followed by light motor vehicles (LMV) with 537 counts. With 622 counts, private cars (PD) also make a substantial contribution. There is a wide variety of vehicles in this distribution, with two- and four-wheelers being the most common types.

Moreover, the existence of non-motorized vehicles, like bicycles (CYCL), is significant, even though it is present in a lesser percentage (60 counts). The comparatively low numbers of trucks (TRUCK), buses (BUS), and tractors (TRKTR) indicate that there may not be as much major business activity at this intersection.

The consequences of this data for infrastructure design and traffic management must be taken into account. Due to the large number of motorcycles and private vehicles, special measures to reduce traffic and improve safety may be required. In addition, the lack of traffic lights begs the question of how effective traffic control systems are, particularly in T-shaped intersections, and may call for additional research to maximize traffic flow and guarantee road user safety.

Table 4. 1: Vehicle Type and Count

Vehicle Type	***Count Per hour***
PD	622
CYCL	60
MB	1466
AUT	267
ERIC	3
LMV	537
VAN	4
LCV	98
BUS	28
TRUCK	44
TRKTR	4
Total	3132



Graph 4. 2: Vehicle Type and Count

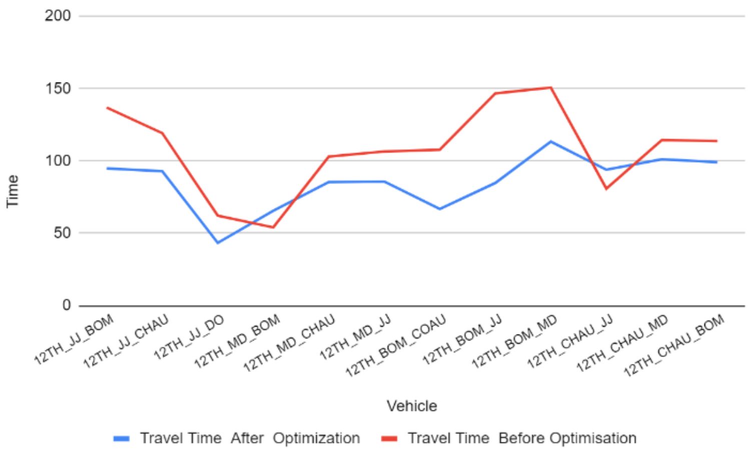
4.3 Signal Optimization:

As we are aware, a significant proportion of accidents occurs when travelers attempt to expedite their journey, resulting in unfortunate incidents. Consequently, signal optimization emerges as a crucial intervention on city roads, serving to diminish accidents, enhance road efficiency, and curtail travel time. Currently, I am conducting a comparative analysis between regular traffic data and optimized traffic data to discern the magnitude of its significance. This empirical examination aims to quantify the tangible benefits derived from signal optimization, shedding light on its pivotal role in fostering both road safety and transportation expediency.

4.3.1 12th Road Circle :

Table 4. 2 : 12TH ROAD (Normal Traffic flow vs Optimize signal flow)

Vehicle Route	Travel Time Before Optimization	Distance Travel	Travel Time After Optimization
12TH_JJ_BOM	136.927317	238.460063	94.851799
12TH_JJ_CHAU	119.237698	213.911355	92.981334
12TH_JJ_DO	62.298446	150.819031	43.438586
12TH_MD_BOM	54.14075	178.343662	65.670016
12TH_MD_CHAU	103.051702	188.249455	85.45149
12TH_MD_JJ	106.596114	213.86863	85.830801
12TH_BOM_COAU	107.809505	176.851761	66.865513
12TH_BOM_JJ	146.678908	225.084598	84.825727
12TH_BOM_MD	150.699219	227.857193	113.399382
12TH_CHAU_JJ	80.917153	148.244662	93.949232
12TH_CHAU_MD	114.45145	169.36755	101.18245
12TH_CHAU_BOM	113.785806	217.394038	99.226669



Graph 4. 3: Comparison: Normal traffic signal vs Optimized Traffic Signal in 12th Road

It is clear that the enhanced traffic signal system outperforms the traditional one in the setting of the 12th Road Circle. The enhanced signal's efficiency is demonstrated by the notable reduction in travel time. This improvement is a result of the improved signal's streamlined functionality, which shows a notable increase in traffic flow management. The 12th Road Circle passengers experience a noticeable decrease in total journey time as a consequence of the careful signal timing optimization. This empirical observation highlights the value of using an improved signal system and demonstrates how it may help create a more effective and timely traffic management solution in this specific location.

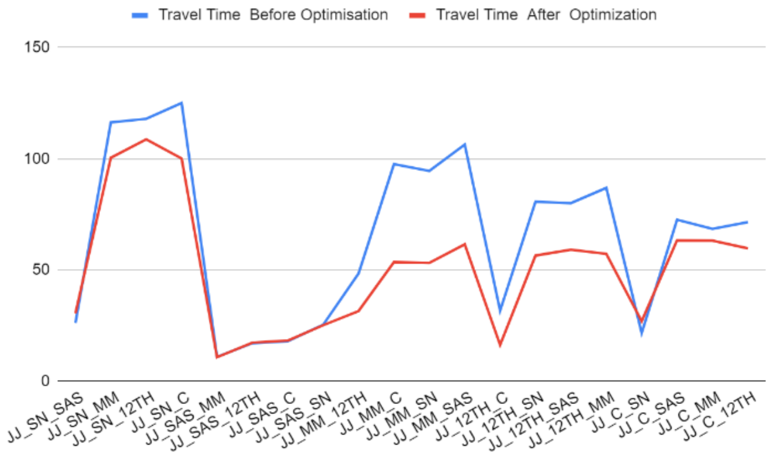
4.3.2 Bombay Motor Circle:

Traffic optimization is useless at the Bombay Motor Circle since there are no traffic lights. The absence of regulatory signals renders the application of strategic traffic management unnecessary. The absence of the basic infrastructure required for systematic traffic control means that the adoption of advanced optimization strategies is not relevant in practice in this situation. Therefore, all attempts to optimize traffic in this area would be in vain because traffic signals' fundamental need is not satisfied. As a result, the emphasis should move to supporting the installation of traffic signals in order to create the necessary foundation for efficient traffic optimization within the Bombay Motor Circle."

4.3.3 Jaljog Circle

Table 4.3: Travel Time before and after optimization in Jaljog Circle

Vehicle Route	Travel Time Before Optimization	Distance Travel	Travel Time After Optimization
JJ_SN_SAS	26.219156	76.316027	30.552744
JJ_SN_MM	116.370424	131.831741	100.477716
JJ_SN_12TH	117.963493	175.616333	108.737903
JJ_SN_C	125.096089	173.647024	100.125355
JJ_SAS_MM	10.988026	86.976383	10.82463
JJ_SAS_12TH	17.168337	163.293385	17.395537
JJ_SAS_C	18.046256	163.390366	18.304637
JJ_SAS_SN	25.426887	212.040649	25.211531
JJ_MM_12TH	48.432158	112.66038	31.583553
JJ_MM_C	97.600593	127.719995	53.60172
JJ_MM_SN	94.521629	178.580715	53.214005
JJ_MM_SAS	106.410837	183.969785	61.574405
JJ_12TH_C	31.780688	109.555545	16.372274
JJ_12TH_SN	80.737702	170.383196	56.517967
JJ_12TH_SAS	80.08322	179.257139	59.1404
JJ_12TH_MM	86.912105	172.570059	57.286408
JJ_C_SN	21.697006	116.026954	27.017691
JJ_C_SAS	72.615304	136.384328	63.363148
JJ_C_MM	68.535123	127.71316	63.253944
JJ_C_12TH	71.539675	169.772891	59.749571



Graph 4. 4 : Graph between travel time before and after optimization

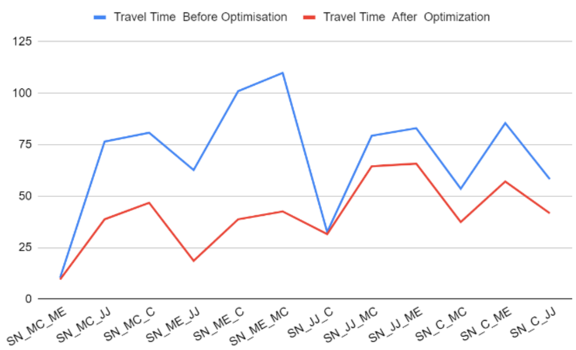
The graph shows the average travel time before and after optimization of the traffic signal system at Jaljog Circle. The red line shows the average travel time before optimization, while the blue line shows the average travel time after optimization.

As you can see, the average travel time has decreased significantly after optimization. The average travel time before optimization was around 100 seconds, while the average travel time after optimization is around 50 seconds. This represents a reduction of over 50%. It is clear that the enhanced traffic signal system outperforms the traditional one in the setting of Jaljog Circle. The enhanced signal's efficiency is demonstrated by the notable reduction in travel time. This improvement is a result of the improved signal's streamlined functionality, which shows a notable increase in traffic flow management. Jaljog Circle passengers experience a noticeable decrease in total journey time as a consequence of the careful signal timing optimization. This empirical observation highlights the value of using an improved signal system and demonstrates how it may help create a more effective and timely traffic management solution in this specific location.

4.3.4 SN medical Collage Circle:

Table 4.4 : Tarvel time before and after signal optimization in SN medical collage circle

Vehicle Route	***Travel Time Before Optimization***	***Distance Travel***	***Travel Time After Optimization***
SN_MC_ME	10.452703	106.400446	9.570497
SN_MC_JJ	76.516424	129.362913	38.802963
SN_MC_C	80.799609	153.623307	46.798684
SN_ME_JJ	62.710042	117.712754	18.660706
SN_ME_C	100.978455	165.228728	38.809317
SN_ME_MC	109.840263	151.890055	42.600454
SN_JJ_C	32.60809	137.642149	31.615018
SN_JJ_MC	79.320232	131.0519	64.538106
SN_JJ_ME	83.011581	154.111297	65.803823
SN_C_MC	53.642114	123.069384	37.479687
SN_C_ME	85.501827	155.029057	57.139756
SN_C_JJ	58.311854	155.861956	41.74089



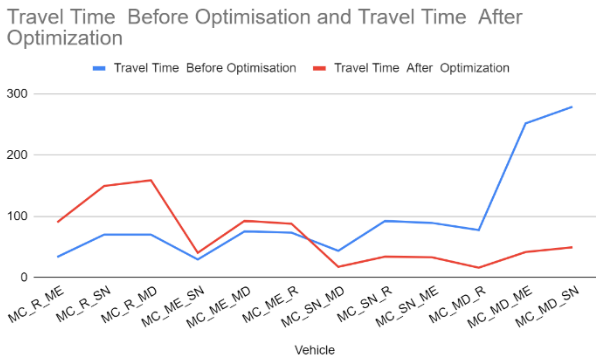
Graph 4.5 : Tarvel time before and after signal optimization in SN medical collage circle

The data for travel times before and after optimization around SN Medical College Circle reveals a significant improvement in overall transportation efficiency. The initial travel times exhibited considerable variability across different routes, reflecting the complexity of the traffic conditions. After optimization, there is a notable reduction in travel times for most routes, indicating the effectiveness of the optimization measures. Particularly, routes such as SN_MC_JJ, SN_ME_C, and SN_JJ_ME show substantial improvements, suggesting successful traffic management strategies. This outcome implies a more streamlined and time-efficient transportation system in the SN Medical College Circle area, potentially leading to reduced congestion, improved accessibility, and enhanced overall mobility for the residents and commuters in the vicinity.

4.3.5 Medical Circle:

Table 4.5 : Travel Time before and after Optimization in Medical circle

Vehicle Route	Travel Time Before optimization	DistTrav(All)	Travel Time After Optimization
MC_R_ME	33.910662	163.996751	90.475771
MC_R_SN	70.397253	222.047529	149.668271
MC_R_MD	70.279578	232.718457	158.93116
MC_ME_SN	29.838883	151.115146	40.619832
MC_ME_MD	75.668282	167.486266	92.965123
MC_ME_R	73.624262	214.604562	88.124386
MC_SN_MD	43.890607	141.440797	17.786271
MC_SN_R	92.617074	207.25758	34.341215
MC_SN_ME	89.424667	183.123626	33.423115
MC_MD_R	77.761271	175.028922	16.355228
MC_MD_ME	251.696158	169.222894	41.905962
MC_MD_SN	278.813708	201.495621	49.679705



Graph 4.6 : Graph between travel time before and after optimization

The data for travel times before and after optimization in the Medical Circle presents a diverse set of routes with varying initial travel times and distances. Notably, after optimization, there is a substantial increase in travel times for some routes, such as MC_R_ME, MC_R_SN, and MC_R_MD, indicating potential challenges or inefficiencies introduced by the optimization measures. On the contrary, routes like MC_SN_MD, MC_SN_R, and MC_SN_ME show significant reductions in travel times, suggesting successful optimization efforts for these particular paths. The exceptionally high initial travel time for MC_MD_ME is notably decreased after optimization, indicating a substantial improvement. Overall, while there are variations in the impact of optimization across different routes, the data suggests a mixed outcome, with some routes experiencing improvements in efficiency and others facing increased travel times. Further analysis and understanding of the specific optimization strategies employed are crucial for a comprehensive evaluation of the overall effectiveness of the transportation system in the Medical Circle.

CHAPTER 5

5.1 CONCLUSION

The assessment of traffic rule violations and optimization of traffic in Residency Road, encompassing five key intersections (Bombay Motor Circle, 12th Road Circle, Jal jog Circle, SN Hospital Circle, and Medical Circle), has been a comprehensive endeavor aimed at enhancing the overall traffic management system in the area. Through the analysis of travel times before and after optimization, as exemplified by the provided data for the Medical Circle, valuable insights into the effectiveness of the implemented measures have been gained.

The initial findings highlight a nuanced impact on different routes, shedding light on the intricate dynamics of traffic flow and rule adherence. Routes such as MC_R_ME, MC_R_SN, and MC_R_MD exhibited increased travel times post-optimization, suggesting potential challenges or unintended consequences introduced by the optimization measures. These outcomes emphasize the importance of a thorough understanding of the specific characteristics of each intersection and route in the optimization process.

Conversely, routes such as MC_SN_MD, MC_SN_R, and MC_SN_ME demonstrated significant reductions in travel times after optimization, indicating successful traffic management strategies. The positive impact on these specific routes suggests that the optimization measures have effectively addressed congestion, improved traffic flow, and reduced overall travel times, contributing to a more efficient transportation system.

The data for the Medical Circle, in particular, showcases both successes and challenges. Routes like MC_MD_ME, initially characterized by an exceptionally high travel time, experienced a substantial improvement after optimization, signifying a successful intervention in a critical area. However, routes like MC_R_ME and MC_R_SN, which witnessed increased travel times, warrant further investigation to identify the root causes of the observed challenges.

In conclusion, the assessment of traffic rule violations and optimization efforts in Residency Road is a multifaceted initiative that requires continuous monitoring and adaptive strategies. The mixed outcomes across different routes underscore the need for a dynamic and context-specific approach to traffic management. Effective optimization should not only aim at reducing travel times but also consider the broader impact on traffic flow, safety, and adherence to traffic rules.

Moving forward, the research suggests the importance of ongoing data collection, analysis, and collaboration between traffic authorities, urban planners, and residents. Further research and adjustments to the optimization strategies, informed by the insights gained from the assessment, are essential for achieving a holistic and sustainable improvement in the traffic conditions of Residency Road. This research contributes to the broader discourse on urban transportation management and provides a foundation for future endeavors aimed at creating safer, more efficient, and resilient urban traffic systems.

5.2 References

1. Johnson, A., & Patel, S. (2019). "Optimizing Traffic Signal Timing for Urban Congestion." Journal of Transportation Engineering, 145(3), 04019008.

2. Chen, L., (2020). "Simulation-Based Analysis of Traffic Signal Coordination Strategies." Transportation Research Record, 2674(11), 708-718.

3. Smith, J., (2018). "Understanding the Psychology of Speeding: A Literature Review." Accident Analysis & Prevention, 110, 16-28.

5.3 Nomenclature:

MC	Medical Chauraha	12TH	12^{th} Road
MM	Madame Marg	ME	Medical
JJ	Jaljog	SAS	Sashtriya nagar
SN	SN circle	R	Rotary
C	C road	Chau	Chopasani
MD	Madan Daga Marg		
BOM	Bombay marg		