"Assessment of Tactical Urbanism Strategies for Junction Design: A Case Study of Pune City"

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Abstract

Urban junctions in rapidly growing cities like Pune often experience severe congestion, safety risks, and inadequate pedestrian infrastructure. Traditional planning approaches are typically time-consuming and expensive, making them less effective in addressing immediate urban challenges. This study explores the application of tactical urbanism as a flexible, low-cost, and people-centric approach to improve junction design. Focusing on Chandrama Chowk in Pune, the research analyses traffic movement, pedestrian behavior, conflict points, and Level of Service (LOS) through primary surveys and field observations. The findings reveal high vehicular conflicts, poor walkability, and inefficient traffic flow, indicating a need for immediate intervention. Tactical solutions such as curb extensions, refuge islands, improved signage, and lane reconfiguration are proposed to enhance safety and efficiency. The study concludes that tactical urbanism offers a practical and scalable strategy for transforming congested intersections into safer, more accessible, and user-friendly urban spaces.

Key Words: Level of Service, Tactical Urbanism, Junction , Traffic, Safety, Pune City

1. INTRODUCTION

Tactical urbanism is a progressive approach within urban planning and design that emphasizes short-term, low-cost, and scalable interventions to transform public spaces and address pressing urban challenges. It is rooted in the idea of "lighter, quicker, cheaper" planning, where cities do not wait for large capital-intensive projects but instead test solutions at a smaller scale, learn from real-time feedback, and refine them into permanent strategies. Globally, tactical urbanism has emerged as an innovative response to complex urban issues such as congestion, unsafe streets, and the lack of inclusive spaces, with interventions like New York's Times Square pedestrianization, Bogotá's Ciclovía, and Barcelona's Superblocks demonstrating how temporary trials can lead to long-lasting change. These interventions typically include measures such as pop-up crosswalks, painted curb extensions, temporary bike lanes, bollards, parklets, and pedestrian plazas, all designed to improve safety, accessibility, and livability of streets and junctions.

In the Indian context, tactical urbanism has gained significant momentum in recent years due to the country's rapid urbanization, rising vehicular dependency, and deteriorating conditions for pedestrians and non-motorized transport users. Most Indian cities struggle with congested junctions, encroached footpaths, lack of safe pedestrian crossings, and high accident rates, particularly at major intersections where multiple mobility streams conflict. Traditional planning methods, though systematic, are often time-consuming, resource-intensive, and bureaucratic, making it difficult for cities to respond quickly to urgent safety and mobility needs. Tactical urbanism fills this critical gap by offering immediate, low-cost, and adaptable solutions that not only improve the usability of spaces but also help in data collection, impact assessment, and community engagement. For example, the Chennai Smart City initiative in T. Nagar, the pedestrianization of Pune's JM Road and Jangli Maharaj Road, and tactical trials in Bengaluru's Church Street are prominent cases where short-term interventions such as street painting, extended sidewalks, seating, and bollard installations were used to reclaim space for people. These projects, often supported by organizations like ITDP India, WRI India, and local NGOs, have demonstrated that small changes can significantly improve safety, encourage walking and cycling, and create more vibrant public spaces.

From a planning perspective, tactical urbanism is closely linked with transport planning, urban design, participatory governance, and sustainable development. It allows planners to experiment with different street configurations, evaluate their effects on traffic movement, pedestrian comfort, and safety, and refine interventions before scaling them up as permanent infrastructure. Unlike traditional top-down approaches, tactical urbanism promotes participatory planning by involving citizens, shopkeepers, street vendors, resident welfare associations, and civic authorities in the design and decision-making process. It also contributes to larger planning goals, including reducing traffic conflicts at junctions, improving Level of Service (LOS) for pedestrians, reclaiming streets as public spaces, and aligning with the Sustainable Development Goals (particularly SDG 11: Sustainable Cities and Communities). Most importantly, tactical urbanism highlights a paradigm shift in Indian urban planning— from designing cities primarily for vehicles to designing cities for people.

2. Introduction

Urban intersections are critical nodes in transportation networks but are often associated with congestion, safety risks, and inefficient traffic management. In rapidly growing cities like Pune, increasing vehicular dependency and mixed traffic conditions have intensified these issues. Traditional infrastructure solutions such as road widening and flyovers are costly and time-consuming, making them less adaptable to immediate urban challenges.

Tactical urbanism has emerged as an innovative planning approach that emphasizes short-term, low-cost, and scalable interventions. It follows the principle of "lighter, quicker, cheaper," allowing planners to test solutions before implementing permanent changes. Globally, cities such as New York and Barcelona have successfully used tactical urbanism to improve street functionality and safety. In India, cities like Chennai and Pune have begun adopting similar approaches to enhance pedestrian environments and optimize traffic flow.

This study aims to assess the effectiveness of tactical urbanism strategies in improving junction design, focusing on safety, accessibility, and operational efficiency.

2.1 NEED OF STUDY

- Helps people feel safer while walking, cycling, or waiting at junctions by reducing conflicts with vehicles.
- Creates temporary solutions to urgent problems like traffic chaos, unsafe crossings, and lack of shade, which can later evolve into permanent infrastructure.
- Makes planning visible and tangible for common citizens, so they can actually see and experience proposed changes rather than only reading policy documents.
- Strengthens the bond between planners and communities, as people directly participate in co-creating their streets.
- Provides low-cost solutions in resource-constrained cities, ensuring that even small budgets can bring big improvements.
- Encourages innovation and creativity in city planning, moving away from rigid, traditional designs.
- Builds a culture of experimentation in governance, where mistakes are acceptable and learning is continuous.
- Promotes active lifestyles by making walking and cycling more attractive, healthy, and safe.

2.2 AIM

To asses the existing conditions and challenges of junctions in Pune City and develop tactical urbanisms strategies to enhance safely, accessibility and traffic.

2.3 OBJECTIVE

1. To study traffic movement pattern at selected junction and coridoors.
2. To identify key challenges related to congestion , safety and usability at junctions.
3. To propose tactical urbanism based design strategies that enhance traffic flow, pedestrian safety and place making potential.
4. To evaluate the effectiveness of proposed strategies through pilot interventions, low cost designs and level of services

2.3 SCOPE

The project focuses on selected junctions within Pune city, giving priority to locations with high pedestrian activity and a history of accidents. These sites are identified through traffic data, accident reports, and field surveys, with special attention to areas near markets, schools, transit hubs, and commercial zones. The aim is to understand the local context and how people interact with these spaces.

Thematic interventions include short-term, low-cost, and scalable tactical urbanism strategies such as temporary pedestrian crossings, extended sidewalks, paint-based road diets, bollards, seating, and signage. The solutions are designed to be flexible and reversible, allowing adaptation based on observed performance and community feedback.

From a disciplinary perspective, the project integrates urban planning, transport planning, and urban design principles to enhance pedestrian safety, cyclist convenience, and vehicle management. Public space activation is a key focus, ensuring that junctions are not only functional but also vibrant and socially engaging.

Analytical and implementation efforts include studying traffic flow, congestion patterns, accident hotspots, and pedestrian behavior. Pilot interventions will be tested and evaluated for effectiveness, with lessons documented for potential replication. The overall approach is **people-first,** promoting inclusivity, safety, and livability for all users, including children, the elderly, and differently-abled individuals.

2.4 LITERATURE REVIEW

In recent planning discourse, tactical urbanism has emerged as an innovative and people-centric approach to address such challenges. It involves low-cost, temporary, and scalable interventions—such as painted curb extensions, temporary crossings, bollards, and lane reallocation—to test and implement design solutions quickly. These strategies allow planners to evaluate real-time impacts on safety, traffic flow, and user behavior before adopting permanent infrastructure. Global examples such as pedestrianization projects and open street initiatives demonstrate the effectiveness of tactical interventions in improving urban mobility and public space utilization.

The literature highlights that tactical urbanism plays a significant role in enhancing junction performance by reducing pedestrian exposure, minimizing conflict points, and improving visibility. Measures such as refuge islands, compact turning radii, and clear lane demarcations contribute to safer and more efficient intersections. Unlike conventional approaches focused solely on vehicular speed, tactical strategies aim to balance traffic efficiency with pedestrian safety and accessibility, thereby promoting sustainable and inclusive mobility systems.

Another important aspect discussed in research is the "test-before-you-commit" approach of tactical urbanism. Temporary interventions generate empirical data—such as traffic volume, delay, queue length, and conflict frequency—which supports evidence-based decision-making. This reduces the risk of costly design errors and enables planners to refine solutions based on observed performance and user feedback. Additionally, such interventions encourage community participation, fostering a sense of ownership and improving compliance with new traffic arrangements.

The performance of urban junctions is typically evaluated using both operational and safety indicators. Common measures include Level of Service (LOS), delay, queue length, and degree of saturation, while safety is assessed through pedestrian exposure time, conflict analysis, and crash data. Studies emphasize the importance of integrating both operational efficiency and safety parameters, particularly in heterogeneous traffic conditions prevalent in Indian cities. Analytical tools such as SIDRA and VISSIM are widely used to simulate traffic behavior and assess the impact of design interventions, with SIDRA offering quick capacity analysis and VISSIM enabling detailed microsimulation of traffic interactions.

Furthermore, literature on Indian traffic conditions indicates that conventional LOS thresholds based on international standards may not accurately reflect user perception due to higher tolerance for delays and complex mixed traffic scenarios. Research suggests adapting LOS evaluation using perceived waiting time and local traffic characteristics, ensuring more context-sensitive planning outcomes. This highlights the need for localized models and flexible evaluation frameworks in intersection design.

Low-cost junction improvement measures frequently identified in literature include painted bulb-outs, high-visibility crosswalks, temporary refuge islands, bollards, and leading pedestrian intervals. These interventions have shown significant potential in reducing conflicts, calming traffic, and improving pedestrian safety. However, studies also note the lack of standardized long-term evaluation frameworks in Indian contexts, emphasizing the need for combining quantitative metrics with qualitative assessments such as user perception and behavioral changes.

Overall, the reviewed literature establishes tactical urbanism as a practical, adaptable, and cost-effective approach for improving junction design. It supports a paradigm shift from vehicle-centric planning to people-oriented urban design, promoting safety, inclusivity, and sustainability. However, gaps remain in long-term evaluation, standardization of methodologies, and integration of tactical interventions into formal planning frameworks—areas that require further research and empirical validation.

2.4 METHODOLOGY

The study adopts a mixed-method approach combining primary field surveys and secondary data analysis to assess junction conditions and develop tactical urbanism strategies. Primary data was collected through traffic volume counts, pedestrian counts, conflict point mapping, and site observations, while secondary data was obtained from PMC reports and traffic police records. The analysis involved evaluating traffic flow, Level of Service (LOS), and safety indicators using tools such as SIDRA and VISSIM simulation. Based on identified issues, low-cost tactical interventions were proposed and tested through design simulations, followed by evaluation and validation of their effectiveness in improving safety, accessibility, and traffic efficiency.

2.5 ISSUES

Urban junctions concentrate competing movements - turning vehicles, through traffic, buses, cyclists, pedestrians and informal activity - making them frequent sites of delays, unsafe crossings and conflict. In Indian cities (including Pune) mixed traffic, encroached footpaths, inadequate pedestrian refuges, large turning radii and ad-hoc parking exacerbate delay, increase pedestrian exposure time and raise collision risk. Studies of urban intersections emphasise that junctions are not just capacity nodes but also safety and public-space problems: poor design increases vehicle speeds on turns, lengthens pedestrian crossing distances, and reduces comfort for non-motorized users.

2.6 STUDY AREA – KATRAJ CHOWK , PUNE

2.6.1 INTRODUCTION

Katraj Chowk is a major road intersection located in the southern part of Pune, Maharashtra, serving as a key junction that connects central Pune with its southern suburbs and outbound highways. Positioned near prominent landmarks such as the Rajiv Gandhi Zoological Park, Katraj Lake, and Bharati Vidyapeeth University, it links important roads like Satara Road (NH-65), Katraj–Kondhwa Road, and the Katraj–Dehu Road Bypass.

Fig.1: Key Map

2.6.2 LANE CONFIGURATION STUDY

A lane configuration study at Katraj Chowk focuses on evaluating the existing lane layout and identifying improvements needed to manage the high traffic volumes and complex turning movements at this major intersection in southern Pune.

Fig. 2: Existing Lane configuration Map

Katraj Chowk, a busy four-arm intersection in southern Pune, features varying lane configurations on each approach due to differences in road function and width. The NH-65 (Satara Road) approaches from both the Swargate (north) and Khed Shivapur (south) sides typically have around three lanes in each direction, accommodating high through and turning volumes, especially from long-distance and city-bound traffic. The Katraj–Kondhwa Road, approaching from the east, is narrower with approximately two lanes per direction, often experiencing congestion due to mixed traffic and limited space.

Table 1: Road Inventory Data

Road Arm	ROW	DP Width	BRTS lane	Lane Configuration	Service Lane
Swargate road	48.5 m	64 m	Yes	Six-lane divided two-way MV lane	N.A
Kondhwa	22 m	66 m	No BRTS	Six-lane divided two-way MV lane	N.A
Katraj Ghat	45 m	78m	No BRTS	Six-lane divided two-way MV lane	N.A
Nawale Bridge	60 m	62 m	No BRTS	Four-lane divided two-way MV lane	Yes

2.6.3 CONFLICT POINT AND ROAD SAFETY ASSEMENT

Conflict point assessment is crucial in traffic engineering because it helps identify where and how vehicles may collide, merge, or diverge — which directly impacts road safety, traffic efficiency, and intersection design.

At road intersections, conflict points are locations where vehicle paths cross, merge, or diverge, leading to potential collision risks. These conflicts can be categorized into three main types:

- **Crossing Conflicts** (Right-Angle or Perpendicular Conflicts)
    - Occur when two vehicle paths intersect at right angles.
    - Common at signalized and Non-signalized intersections.
    - High risk of side-impact (T-bone) collisions.
- **Merging Conflicts (Converging)**
    - Happen when vehicles from different approaches enter the same lane.
    - Common at entry ramps, uncontrolled intersections, and merging lanes.
    - Risk of rear-end or side-swipe collisions.
- **Diverging Conflicts**
    - Diverging conflict - Occur when vehicles split into different lanes or exit an intersection.
    - Can cause sudden braking or lane-changing manoeuvres.
- **Pedestrian-Vehicle Conflicts**
    - Happen at crosswalks and intersections where pedestrian movement overlaps with vehicular flow.
    - High risk for pedestrian accidents in poorly designed intersections.

At **Katraj Chowk**, the presence of four major arms—NH-65 from Swargate (north), NH-65 from Khed Shivapur (south), Katraj–Kondhwa Road (east), and the Katraj–Dehu Road Bypass (west)—creates a complex and high-risk conflict zone due to the mix of through movements, turning traffic, and pedestrian crossings. The chowk handles a heavy volume of vehicles, including interstate buses, freight trucks, two-wheelers, and local traffic, all converging at a single grade-level intersection.

being **right-turn and crossing conflicts**, especially between high-speed traffic from NH-65 and the more constrained movements from Katraj–Kondhwa Road. A proper conflict point analysis at this chowk justifies the need for **channelization**, **signal coordination**, and potentially a **grade-separated solution** to minimize crashes and improve traffic flow.

Fig.3: Conflict Diagram

Above mentioned figure is a conflict diagram based on all possible movements that could be considered after construction of fly-over would be completed (this diagram is not exact representation of future vehicular movements) further assessment need to done once the fly-over is in operation. Current as it seems 16 crossing conflict points, 8 diverging points and 8 converging points can be observed making the intersection accident prone zone.

Fig.4 : Conflict diagram on the southern arm

2.6.4 PEDESTRIAN AND PARKING STUDY

Fig. 5 :Pedestrian Movement Diagram

Pedestrian movement assessment is a critical component in road intersection improvement projects, ensuring safety, accessibility, and efficiency for all road users. Understanding pedestrian behavior helps in designing intersections that reduce conflicts, enhance walkability, and improve traffic flow.

For the assessment of pedestrian infrastructure following components were assessed on site

- Footpath continuity and walk able space
- Refuge Island for safe pedestrian crossing
- Pedestrian Crossing Signage
- Sloping ramp provision to footpath
- Pedestrian crossing signal phase availability
- Road marking
- Pedestrian travel pattern

It has been observed that pedestrian movement occurs on all arms. Ramps and well-planned refuge islands are missing, road markings are faint, Pedestrian signage on all arm found missing.

Pedestrian Movement across the intersection were tracked and the map below shows the frequent and most common routes pedestrians use to get across the intersection. As per observation during site visit high volume of pedestrians were observed moving from Northern arm to Southern arm towards the Bus stand, so most of the pedestrian volumes are generated from Katraj Bus stand and towards it.

2.6.5 TRAFFIC STUDY

The Traffic Volume Count Survey at Katraj Chowk aims to assess vehicular movement patterns, peak-hour traffic flow, and modal share distribution. The data helps in identifying congestion points, conflict areas, and the need for traffic management improvements.The tables below show the total TVC both ways (merging volume and diverging volume) on the respective arm of the junction.

Table 2:Traffic Volume Count - Arm 1(Towards Mumbai - Pune Bypass Rd)

			Katraj Chowk					
Arm 1	2W	3W	4W	Bus	LCV	HCV	PED.	Total
Total Morning Count	3723	626	1465	207	590	196	15	6,822
Total Count %	51.4	8.6	20.2	2.9	8.1	2.7	0.2	
Total PCUs	2792	751	1465	455	826	431	6	6,726
Total PCUs %	36.4	9.8	19.1	5.9	10.8	5.6	0.1	
Total Evening Count	4136	669	1722	215	638	222	13	7,615
Total Count %	51.2	8.3	21.3	2.7	7.9	2.7	0.2	
Total PCUs	3102	803	1722	473	893	488	5	7,486
Total PCUs %	36.4	9.4	20.2	5.6	10.5	5.7	0.1	

Table 3: Arm 2 (Katraj – Kondhwa Rd)

Katraj Chowk (Towards Kondhwa)								
Arm 4	2W	3W	4W	Bus	LCV	HCV	PED.	Total
Total Morning Count	2520	419	1015	139	432	218	13	4,756
Total Count %	51	8.5	20.5	2.8	8.7	4.4	0.3	
Total PCUs	1890	503	1015	306	605	480	5	4,804
Total PCUs %	36.2	9.6	19.4	5.9	11.6	9.2	0.1	
Total Evening Count	2852	463	1238	148	475	252	9	5,437
Total Count %	50.5	8.2	21.9	2.6	8.4	4.5	0.2	
Total PCUs	2139	556	1238	326	665	554	4	5,482
Total PCUs %	36	9.3	20.8	5.5	11.2	9.3	0.1	

Table 4: Arm 3 (Towards Katraj Ghat)

Katraj Chowk (Towards Katraj Ghat)								
Arm 2	2W	3W	4W	Bus	LCV	HCV	PED.	Total
Total Morning Count	3342	525	1233	143	494	175	12	5,924
Total Count %	53	8.3	19.6	2.3	7.8	2.8	0.2	
Total PCUs	2507	630	1233	315	692	385	5	5,767
Total PCUs %	38	9.5	18.7	4.8	10.5	5.8	0.1	
Total Evening Count	3690	606	1404	142	560	192	13	6,606
Total Count %	52.5	8.6	20	2	8	2.7	0.2	
Total PCUs	2768	727	1404	312	784	422	5	6,422
Total PCUs %	37.7	9.9	19.1	4.3	10.7	5.8	0.1	

Table 5 : Arm 4 – Towards Swargate

Katraj Chowk (Towards Swargate)								
Arm 3	2W	3W	4W	Bus	LCV	HCV	PED.	Total
Total Morning Count	2867	470	1059	111	450	143	12	5,112
Total Count %	52.8	8.7	19.5	2	8.3	2.6	0.2	.
Total PCUs	2150	564	1059	244	630	315	5	4,967
Total PCUs %	38	10	18.7	4.3	11.1	5.6	0.1	.
Total Evening Count	3272	516	1232	95	471	154	9	5,749
Total Count %	53.8	8.5	20.2	1.6	7.7	2.5	0.1	.
Total PCUs	2454	619	1232	209	659	339	4	5,516
Total PCUs %	39.2	9.9	19.7	3.3	10.5	5.4	0.1	.

Arm 1 (Mumbai → Pune Bypass/Flyover) handles the **highest volumes (AM - 7,247 and PM - 8085)**, supporting its role as a major intercity bypass for through-traffic, especially during peak hours.

- **Arm 3** (toward **Katraj Ghat**) also sees significant movement, indicating frequent usage for hill-bound or outer suburb travel, likely by commuters and freight vehicles.
- **Arm 4** (toward **Swargate**) and **Arm 2** (Kondhwa side) serve as **key intra-city connectors**, carrying moderate traffic but playing an important role in local circulation.
- The orientation suggests **Arms 1 and 3 are radial/arterial routes**, while **Arms 2 and 4 serve urban distribution**, reinforcing the traffic volume patterns observed.

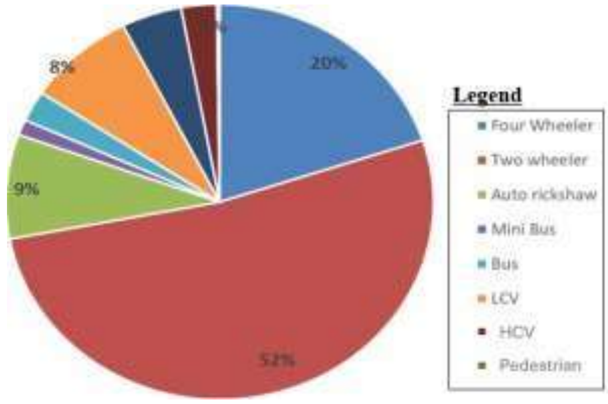

Chart 1 :Vehicle Composition at the Junction during Peak Hours

- **Heaviest Traffic Flow**: West and South bound approaches (**Arm 1 & 3**), with traffic mostly going through intercity bypass and easy connectivity to different parts of the city.
- **ARM 2 (West)**: Low volume but high proportion of through movements from Kondhwa.
- **ARM 4 (North)**: Experiences moderate traffic, heavy right and through movements.
- **Evening Congestion**: All approaches show increased traffic, suggesting outbound peak-hour flows.

Flow shows mixed purpose of travel – Inter-city trips to Mumbai & Satara, work based trips and intra-city connectivity to zones such as Kothrud, Bavdhan, Baner -Balewadi with direct connectivity via Mumbai-Pune Highway

2.6.6 CONTROLLED DELAY ANALYSIS

Controlled signalized road intersection capacity analysis refers to the process of evaluating how much traffic (vehicles per hour) a signalized intersection can **efficiently handle** under **traffic signal control**. This analysis helps determine delays, queue lengths, and level of service (LOS) to optimize traffic flow and reduce congestion.

Level of Service (LOS) is a qualitative measure of traffic operating conditions and driver comfort at an intersection.

It ranges from **A (best)** to **F (worst)** and can be defined based on several parameters like:

1) **Control delay** (sec/vehicle)
2) **Volume/Capacity ratio (v/c)**
3) **Degree of Saturation (X)**

Control Delay

Control delay is the extra time a vehicle spends at an intersection because of a traffic control device, such as:

- **Traffic signals**
- **Stop signs**
- **Yield signs**

It includes:

1. Deceleration delay (slowing down as you approach the intersection)
2. Queue delay (waiting behind other vehicles)
3. Stopped delay (waiting at a red light or stop sign)
4. Acceleration delay (time to speed up after getting a green light)

Control delay = time lost due to traffic control (not just the red light)

Formula for Control Delay (Simplified HCM Model)

From Highway Capacity Manual (HCM) and India HCM, control delay per vehicle can be calculated as:

$$d = \frac{0.5 \cdot C \cdot (1 - g/C)^2}{1 - \min(X, 1) \cdot g/C}$$

Where:

- d= control delay (seconds/vehicle)
- C = signal cycle length (seconds)
- g = effective green time (seconds)
- X= degree of saturation (volume/capacity ratio)
- g/C = green ratio

Table 6: LOS classification Based on Control Delay (As per India HCM and HCM 2010)

LOS	Average Control Delay (sec/PCU)	Quality of Service
A	20	Free-flow, no delays
B	20 – 40	Reasonable free flow
C	40 – 65	Acceptable/ Stable flow
D	65 – 95	Approaching Unstable flow
E	95-130	Unstable flow
F	>130	Over saturated flow condition

Volume to Capacity ratio
V/C Ratio shows how much of an intersection's capacity is being used by current traffic demand.

It is a **core metric** for evaluating traffic performance and determining **Level of Service (LOS)**, especially in the **IRC guidelines**.

$$\text{V/C Ratio} = \frac{\text{Traffic Volume (v)}}{\text{Capacity (c)}}$$

- v = Actual volume of traffic (in vehicles/hour or PCU/hour)
- c = Capacity of that movement/lane group at the intersection

Table 7: LOS Classification Based on V/C Ratio (As per IRC:106-1990)

LOS	V/C Ratio Range	Description
A	≤.45	Free flow, no delays
B	0.26 – 0.75	Reasonably free flow
C	0.76 – 0.95	Stable flow, slight delays
D	0.96 – 1.05	Approaching unstable, moderate delay
E	1.06 –1.10	Near capacity, delays likely
F	>1.10	Oversaturated, long delays & queues

- As per the current traffic conditions, all arms have V/C ratio over 1.0 depicting Oversaturated, breakdown or heavy delays.
- This means the infrastructure as in the carriageway or number of lanes for each arm are not sufficient for the current traffic conditions.
- LoS worsens during Evening peak hour as compared to morning peak hour.
- Arm 3 seems to be overly saturated with ratio over 2 in the evening, suggesting longer delays on the arm with bottle-neck experienced ahead on the arm.

Table 8: Level of Service based on V/C ratio of the intersection

Arm	V/C Ratio(Worst)	LOS
1	1.58	F
2	1.65	F
3	2.04	F
4	1.16	F

Degree of Saturation (X)

- **Formula:**

$$X = \frac{v}{c}$$

Where:

- V = actual **traffic demand volume** (vehicles/hour or PCU/hour)
- c = **capacity** of the movement/lane group (vehicles/hour or PCU/hour)

This ratio shows how much of the capacity is being utilized.

Table 9: LOS classification based on Degree of Saturation (As per IRC:106-1990 and IRC:SP:41) :

LOS	Degree of Saturation (X = v/c)	Interpretation
A	0.00 – 0.20	Free flow
B	0.21 – 0.40	Reasonably free flow
C	0.41 – 0.60	Stable flow
D	0.61 – 0.80	Approaching unstable flow
E	0.81 – 1.00	Unstable, nearing capacity
F	>1.00	Forced flow, oversaturated

Tactical Urbanism Strategies

Sr. No	Parameter	✓ / ✗
1	Proper lane markings available?	✗
2	Road surface condition good?	✗
3	Median / divider present?	✓
4	Channelization islands available?	✗
5	Traffic signals working properly?	✓
6	Zebra crossing provided?	✗
7	Pedestrian signal available?	✓
8	Continuous footpath available?	✗
9	Footpath free from encroachment?	✗
10	Pedestrian refuge island present?	✗
11	Cycle lane available?	✗
12	Bus stop located near junction?	✓
13	Bus bay available?	✓
14	On-street parking present?	✗
15	Illegal parking observed?	✓
16	Clear traffic signage available?	✗
17	Street lighting adequate?	✓
18	Traffic calming measures present?	✓
19	Safe turning radius provided?	✓
20	blind spots for drivers?	✓
21	Pedestrian crossing safe?	✗
22	Informal pedestrian crossing?	✓
23	Hawkers / vendors affecting movement?	✓
24	Junction free from bottlenecks?	✗
25	Tactical urbanism intervention possible?	✓

3. CONCLUSIONS

The study concludes that urban junctions in Pune face significant challenges related to congestion, unsafe pedestrian conditions, inefficient traffic movement, and poorly defined spatial organization. The analysis of selected junctions reveals that high conflict points, inadequate pedestrian infrastructure, and unregulated traffic behaviour contribute to reduced Level of Service (LOS) and increased safety risks. Traditional infrastructure-heavy solutions are often time-consuming and costly, making them less effective in addressing immediate urban mobility issues.

In this context, the research establishes that tactical urbanism offers a practical, low-cost, and flexible approach to improve junction performance. The proposed interventions—such as painted curb extensions, channelization, temporary pedestrian crossings, bollards, and improved signage—demonstrate potential in reducing conflict points, enhancing pedestrian safety, and streamlining traffic flow. Simulation and evaluation using tools like SIDRA and VISSIM indicate measurable improvements in operational efficiency and user experience when these strategies are applied.

Furthermore, the study highlights the importance of a people-centric planning approach, where pedestrian needs and public space quality are prioritized alongside vehicular movement. Tactical urbanism not only acts as a short-term solution but also serves as a testing mechanism for long-term infrastructure planning. The research ultimately recommends integrating tactical urbanism into city-level policies and planning frameworks to create safer, more inclusive, and sustainable urban junctions in Pune and similar Indian cities.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to all those who have supported and guided me throughout the completion of this research paper. I am especially thankful to my guide, Ar. Aishwarya Tupe, for her constant guidance, valuable insights, and constructive feedback, which greatly contributed to shaping this study.

I extend my appreciation to the faculty and staff of the Department of Planning, COEP Technological University, Pune, for their academic support and encouragement. I am also grateful to the officials of Pune Municipal Corporation (PMC) and the Traffic Police Department for providing necessary data and assistance during field surveys.

I would like to thank my peers and colleagues for their support and helpful discussions. Finally, I express my heartfelt gratitude to my family for their continuous encouragement, patience, and unwavering support throughout this work.

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