

Original Article

Navigating Urban Congestion: Exploring Parking Dynamics and Challenges in Pune, Maharashtra

Anuradha Anil Pore¹, Pravin D. Nemade², Shobha Rani Nadupuru³

^{1,3}Dr. D. Y. Patil Institute of Technology, Pimpri, Pune, Savitribai Phule Pune University, Pune, Maharashtra, India.

²Department of Civil Engineering, MVP'S KBT College of Engineering, Nashik, Savitribai Phule Pune University, Pune, India, India.

Corresponding Author : anuradhapansare@gmail.com

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Abstract - Pune City, Maharashtra, India's urban landscape is distinguished by its quick development, growing population, and variety of lifestyle choices. The management of vehicle parking becomes a major task in this dynamic context. This essay explores the complex dynamics, local peculiarities in edifices and difficulties related to parking in Pune. It looks at several things, including the city's changing infrastructure, transportation patterns, planning by local authorities, and cultural influences. The study highlights the necessity for creative solutions and strategic planning by illuminating the intricacies of parking management through a thorough analysis. Based on the distinctive features of Pune's development, the study suggests improving parking effectiveness and reducing traffic. The dynamism and sprightliness of effective parking management must match healthily with increasing private vehicle rates and urban development styles. It seeks to support Pune City's sustainable growth and higher living standards by tackling these issues.

Keywords - Parking index, Town planning, Traffic congestion, Urban land use, Vehicle Parking.

1. Introduction

Pune, a thriving city in the Indian state of Maharashtra, provides evidence of how quickly modernization and urbanization are occurring. The dynamics of vehicle parking have grown more complex and difficult as the city keeps growing and accommodates a growing population. Effective parking space management is essential and, at the same time, challenging for maintaining efficient traffic flow, reducing congestion, and supporting sustainable urban growth in this age of urban sprawl and increased mobility. Thus, investigating Pune City's parking dynamics and difficulties is an important project that needs careful consideration. There is much research from other countries regarding spotting vehicle parking, minimum parking slots, and the role of parking in interchanging private to mass public modes of sustainable transportation. In India, the focus is very low. Another major reason for this study is recently the Indian government has recently launched a smart city project in Pune city. It has one of the prominent features of achieving comprehensive mobility of people, and effective parking management is a way to make it smoother and better.

This study will help to evolve and highlight the research area of private vehicle parking management in India and the benefits of outcome from same and further growth of same.

The present introduction establishes the framework for an exhaustive analysis of the diverse aspects of parking management in Pune and developing Indian cities. The key problem is that parking management has never been considered a regulating or controlling tool for smooth traffic flow and a major striking factor in planning infrastructure facilities in Indian studies. Several elements, ranging from the city's changing infrastructure to its cultural landscape, affect parking behavioral patterns and overcome serious obstacles to its effective administration.

This study aims to provide insights that can guide the decision-making of policies, rules, decisions, urban land, zone planning initiatives, and technological interventions that improve parking efficiency and reduce traffic congestion in Pune by exploring these complications. This project intends to contribute to creating sustainable, fast and livable urban environments in Pune through a methodical analysis of the dynamics and difficulties surrounding parking in the city.

In short, the study will address the following problems

- Tracking count and keeping tabs on side-road parking slots and their occupancy is important.
- The role of parking spots (location and volume) in old landscaped and old building types (wada) congested



structures is highly recommended in preserving cultural heritage sites.

- Role of public parking in smoothing and maintaining traffic flow.
- Role of Public parking in multimodal and multi-directional inter-urban commuting.
- Need to create weightage of parking in the hierarchy of infrastructure traffic planning like other elements of 'grade separator, underpasses traffic network.
- Pune's cultural and social gatherings and its relationship in planning parking places.

2. Literature Review

Various parking census such as parking demand, demand-capacity (D/C) ratio, parking load, parking efficiency, and usage are considered to demonstrate the parking conditions in the Indian scenario of vehicle parking management at the central business area in the city places, illustrated by Pritikana Das et al. [6] in the studies. The rapid urbanization of cities, especially in emerging nations like India, is accompanied by serious problems such as parking dynamics and urban congestion. Pune, a rapidly developing city in Maharashtra, provides an interesting case study to examine these issues. The research on Pune's parking drifts and urban congestion emphasizes a number of themes, including the city's rapidly increasing motorization, its poor parking infrastructure, and the socioeconomic effects of parking issues.

Pune has experienced a significant increase in private vehicle ownership along with its rapid urbanization.[10] also emphasize how the number of motor vehicles has increased faster than the development of road infrastructure, causing extreme traffic congestion in urban areas. The city's expanding affluence and the lack of good public transportation choices have been blamed for increasing dependency on private vehicles. The number of vehicles in Pune grew from 0.2 million in the 1980s to over 4 million by 2020, suggesting an abrupt rise in the need for parking spaces.

Local parking regulations [2] frequently rely on imitating descriptions of alternatives. Globally, a common strategy that emphasizes minimum parking regulations has taken effect. But breaking from this overused approach might be difficult. In order to reclaim this shortcoming, a novel approach to categorize parking regulations is proposed. The most recent classifications other than the major norm consider parking as an entity that should be primarily constructed based on "engineering" ordinances intended to prevent market business practices (such as restaurants or meeting rooms) from viewing parking as an object/product. Locals generally oppose new projects or circumstances that require briefing, where updating parking techniques is an urgent matter for government bodies and public work departments. According to Franziska Kirschner et al. [3], most research on parking focuses on theoretical experiments, and they found that very

few of these studies address the practical effects of parking on collective standards of life. This is actually this paper's approach to emphasize Pune vehicle parking peculiarities. Therefore, more investigation is necessary into the connection between parking, livability, comfort, and easy movement among different suburbs. The study concluded that the public works department must create a mobility view for the town to implement the correspondent parking methods in neighborhood regions.

This paper highlights how the city's livability, comprehensive mobility and parking policies complement one another. Research indicates that parking layouts in a civic zone might be evaluated to improve living standards and promote lifelong mobility in the surrounding communities. A few key points need to be thoroughly examined first, such as the alternatives to the current parking strategy and the anticipated and assessed effects on increased livability and continuous mobility in metropolitan areas. The second one concerns potential problems with parking plan implementation: (a) considering the appropriate national framework and (b) sticking to regional implementation.

According to Michael Manville [1], if parking is strictly required, it must significantly impact local development projects. The severity of the demand for parking will also depend on two other factors: the quantity of parking required and the location of the required parking. The article focuses on the distribution of parking spots in residential developments according to the building's convertibility. In the event that the builder decides to convert an underutilized structure, what options does he have for parking space ownership in addition to the same home development? Whether he can separate the property for parking, select a plot with or without parking spots, and, if so, where those spaces should be located. Construction in already-underutilized buildings and, if such construction is near one another, newly constructed buildings in already-dispossession regions are the outcomes of the discarding count and location required for off-street parking. This study could be an ideal setting example if the central busy core area of an old wada landscaped Pune area (if we consider redevelopment of the area where the practically available built-up area is very little to rebuild per unit per family habitable area additionally parking area for each family unit) has to be redistributed resize according to newly updated floor space ratio aiming better bylaws for traffic rules and parking spaces.

Vinit Mukhija et al. [4] studied the differences in parking practices across the United States. Overall, the article prioritizes the quality of parking place design over parking lot quantity. It can be subjective, but in general, all governments place greater importance on the quantity of parking spaces than on the design and ambience of the parking structure. The placement, orientation, and visibility of on-street parking from the pedestrian walkway greatly enhance pedestrian mobility.

How a parking lot is designed and landscaped greatly affects how connected and mobile pedestrian spaces are on the streets. This article identifies locations prioritizing quality over parking allocation, setting an example for Pune smart communities. According to the study, there are five common ways to improve urban growth through creative off-street parking necessities: restricting parking lot numbers, improving parking locations, and requiring creative solutions for parking spaces, parking buildings, homes, and garages.

As William Young et al. [5] stated, the quantity and packing methods are crucial in managing the transportation infrastructure in densely populated urban areas. The quantity and location of parking have a significant impact on the following: the flow of people and resources on central urban and incursion roads; the efficiency, effectiveness, and commercial execution of public transportation; the amenities, safety, and environmental responsibility of the urban area and its surrounding areas; and the structure and operation of the municipal zone as a whole.

Although it is clear that the governing regulations for the provision and operation of parking management and its smooth execution have a significant impact on the efficiency of urban transportation networks, their resolution has to be determined with careful study. The authors have covered four kinds of parking models in this study. This study highlights the need to evaluate several factors, including financial costs and timeliness while providing parking jobs and services individually, as well as ecological rules and regulations, to portray anomalies in parking strategies and services. All these factors need to be considered before setting up the smart city aims for Pune.

Pune has attempted various parking management strategies, such as pay-and-park programs, multi-level parking constructions, and smart parking systems. However, these policies have not worked well because of bad execution, low public awareness, resistance from nearby businesses, and anomalies between the assumed data set and the practically existing private vehicle and traffic network.

There are significant socioeconomic implications to Pune’s parking problems. Many adverse consequences have been identified in the literature, such as decreased efficiency due to traffic jams, increased fuel costs, and air pollution. In addition, the lack of parking spots has caused real estate values to rise in some locations, increasing socioeconomic inequality. Smart parking solutions, which leverage technology to optimize parking space utilization, have also been proposed. These solutions include real-time parking availability information, automated payment systems, and parking reservation platforms. However, the success of these interventions depends on effective governance, public participation, and adequate funding. The literature on parking dynamics and urban congestion in Pune emphasizes the

intricate interactions between rapid urbanization, insufficient infrastructure, and socioeconomic issues. Although a number of policy solutions have been put forth, effective implementation of public involvement is necessary for its effectiveness in solving Pune’s parking issues.

3. Statistics of the Parking Study

Till March 31, 2018, the RTO has observed a surge of over 280,000 vehicles, with two-wheelers having the major share. This results in the count of registered vehicles in Pune (as shown in Figure 1) to 36.27 lakhs, from 33.37 lakhs in the antecedent year (2016-2017), in comparison with 2017, the count of cars certified surged from 5.89 lakhs to 6.45 lakh in 2018 and the census of registered.

Two-wheelers increased from 24.97 lakh to 27.03 lakh currently. The certification of cars in 2018 reached a growth of 9.57%, and bikes by 8.24 per cent over 2017. The total count of population growth is +3% per year and the current population is 6.8 million. The population growth rate of Pune from 2010 to 2020 shows that vehicles here have more numbers than humans. The city has a citizen density of 5,600 persons per square km.

Parking in Pune for such substantial numbers of vehicles in one place in the same time slot is certainly not advisable. However, the minimal fraction of this number of vehicles accommodated in the vehicle parking slot is not easily technically possible in the currently available Pune parking facilities. Some areas in some cities of India have enough parking capacity but suffer from congestion because of bad management and unavailability of required signage, unclear marking of bays and other smart techniques [7]

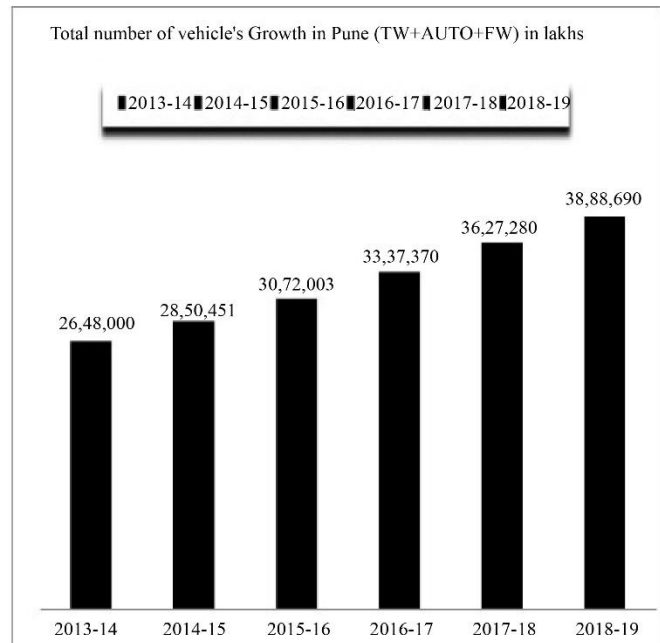


Fig. 1 Statistics of vehicular growth in pune

The smart city project launched by President Modi recently divulged the necessity of developing an urban vehicle parking system. Compared to the other subjects, the analysis study of transport and mobility of vehicle parking, traffic engineering and transport planning, problems that arise from parking and the effects of parking policy implementation is quite limited in India. [8]

Vehicle parking and its management are crucial from a point of view to keep traffic flow smooth in busy central areas. Vehicle parking management is equally responsible for safety against accidents and overall surveillance, prompt entry and exit of vehicles,[9] off and on traffic currents.

Parking must be treated as an integral part of traffic planning; without logically good parking management, the aim of traffic management is directionless, and one cannot accelerate the success rate of undistruptive traffic flow. In Pune, designing the vehicle parking system and its management has main dynamic challenges, such as the variation between the peak count and the average parking demand of vehicles for parking in the area. The culturally highly active period generally starts in the month of August with the Ganapati social festival started by freedom fighter Mr Tilak and ends in November with the Diwali festival. This Ganapati festival and its celebration volume are the unique characteristics of Pune city, above all other cities. In this period, central Pune has demanded more private and public vehicles. At the same time, it expects more and more devotees and land area (temporary pandals of size (min 20 ft x 20 ft maximum 4000 ft or more) it can be for 15-12 days in the middle of roads) for celebration. The time duration of August to November central Pune vehicle parking management faces land parcel limitations, and the same time surge of vehicles within peak periods is a major constraint. Mix culture population and traditional practices have a very deep effect on Pune's traffic movement.

Effective and rational planning of the smart parking management system also depends on the selection of the kind of parking like closed, open-ended, off the road, on the roadside, dynamic information sharing, convenience and ease of movement of vehicles, the rate of placing in and placing out of the vehicle. The parking would be more comfortably utilized if its detailing and design and status sharing to the public were more dynamic, convenient, user-friendly, and easily accessible to the common person. The location of the parking lot and station greatly influences the driver's approach when selecting the parking station.

The decision to select vehicle parking majorly depends on its accessibility to the major marketplaces and city attractions. In a country like India, the user rate of vehicle parking mostly depends on the kind of parking, paid or unpaid parking. The planner must consider the capacities of nearby existing parking stations, the popularity and versatility of the

area under consideration, and future expansions of the area. Dynamic updating of vacant vehicle parking from the parking station slot is needed to avoid undue delay.

4. Methodology

The methodology included following detailed surveys after considering Pune city's unique nature.

- Actual on-street parking accumulation survey at J.M Road.
- Actual in-out vehicle parking survey on J.M. Road
- Physical landscape building and infrastructure pattern studies near the vicinity of J.M road.
- Document and map surveys of the old development plan and its revision studies.
- Physical Existing off-street parking surveys in the vicinity.
- Cultural events and their peak vehicle parking demand.

4.1. Case Study Area and its Structural Complexities

The areas selected for the study are J.M. Road and Laxmi Road surroundings, Pune, as shown in Figure 2. Here, the type of buildings and geospatial aspects of the gaothan or old area was surveyed and studied. Fundamental consideration for the scope of modernization, upgrade, or relocation of parking management in the master plan from the old development plans of the city is extraneous. (originally introduced in 1966, sanctioned in 1987, huge time difference in studies and execution) [10] The same needs to be studied deeply to allocate the demand for vehicle parking in the high-density and commercial areas from tiny packed gaothan areas. Parking slots need to place more elucidated around the old important markets, which are aimlessly placed, currently creating disorders in tiny packed gaothan areas. In the core of Pune city, it's all small-width roads (less than 3m) in old gaothan areas, which are incapacity of carrying capacity and revolutionary vehicle positive growth in the city (shown in Figure 3).

In field surveys, a few parking slots (designed and placed by governing bodies) were chosen on the street parking of J.M Road, and a survey was conducted during peak hours. For each 15-minute time interval in and out, cars and motorcycles were noted at each parking slot, respectively. All roadside parking slots were covered in the survey after the survey output was calculated. (Table 1)

An inventory of the vehicle parking spaces allied with BRT routes at a few locations, such as BRT stops provided by PMC (Pune Municipal Corporation), in the comprehensive mobility plan report is available on their online reports (but not on any dynamic page, i.e. gap in information not user-friendly only assimilation of information part been taken care it has not reached to the targeted user group). Private vendors take care of many parking station operations under the Pune corporation's guidance, so those are not permanent modes of

operation. They were conducted to examine and contrast the current and future smart parking management systems in the central area of Pune. “Video-vehicle” count survey was conducted on J.M Road to get the number of total passing vehicles the whole day passing.



Fig. 2 Map of laxmi road and the surrounding area

Parking facilities studies must embrace the following points in the case of Pune.

- Old fashioned buildings, infrastructure development at the gaothan or old area, geospatial distribution of different suburbs
- Dynamic information availability at parking centers
- Town and city development planning-wise
- Design and Detailing of the parking slots
- Inventory and commuting arrangements for physically challenged people
- Filtering and categorizing vehicles on a particular road
- Pune’s cultural practices and social and behavioral patterns
- Discipline and control action



Fig. 3 Old wada structure from pune ‘wada’

It’s essential to consider traffic flow, road width, and pedestrian areas. In Pune’s core, narrow lanes (maximum 3 meters wide) and old “Wada” cultural buildings (Figure 3), each house with a minimum 40 people (and their vehicles), create a conflict between pedestrian and vehicular movement. Many Wadas have been converted into commercial spaces, increasing both vehicle and human traffic. Some buildings now serve as storage facilities, attracting different types of

vehicles, further complicating the original residential purpose of the area.

Laxmi Road is a popular and oldest market hub in Pune, offering a range of goods, from gold ornaments to clothing. Another road, Kumthekar Road, is nearby and is known for its wholesale market for medical supplies. This area is crowded with theatres, marriage halls, school book markets, and open street markets, including Tulshi Baugh and Phule Vegetable Market. The narrow roads are around 6 meters wide, making traffic and parking challenging. Parking slots are limited and poorly designed (Figures 4, 7), often obstructing traffic flow. Footpaths are insufficient and occupied by hawkers, reducing pedestrian space.

Additionally, open gutters are narrow for two- and four-wheelers. These parking slots lack standardization, demarcation lines, and proper signage, leading to overcrowding and chaos. Inconsistent parking angles (shown in Figure 4), inadequate lighting, drainage, and security further worsen the situation, causing confusion between pedestrians and vehicle owners. Advancement in vehicle architecture, automated vehicles, and growth in owning such luxurious vehicles. At the same time, available places to park such vehicles are so short or not classified appropriately based on the type of vehicles, as shown in Figure 4.

Anatomical preplanning is crucial to avoid future traffic issues when designing parking slots. The core Pune area suffers from poor vehicle parking management due to a scattered and incongruous land use arrangement. On J.M. Road, a busy and relatively newer road, the local municipal corporation has allocated random roadside parking. Its big contradictory picture, on the one hand, entrances to old buildings further complicate navigation and parking. Electric poles and DP boxes along the roadside add to the congestion. Parking slots are limited and poorly designed, often obstructing traffic flow. Footpaths are over-occupied by hawkers, reducing pedestrian space. Additionally, open gutters and narrow entrances to old buildings further complicate navigation and parking. Electric poles and DP boxes along the roadside add to the congestion.



Fig. 4 Roadside disordered non categorized parking scenario

4.2. Need for Dynamic Information on Vacant Spaces

There are five off-street, well-constructed parking stations in the case study area, some permanently well thought ahead -built and others temporary, using open land or unused buildings for solving purposes. Managed by PMC contractors, these stations charge hourly rates. Some display parking slots availability, but updates are not dynamic (shown in Figures 5 and 6), leading to inefficiencies. At certain locations, drivers must park outside and manually inquire about space availability, causing long waiting lines and road chaos. This results in wasted time for both the waiting driver and others stuck behind in waiting. No system dynamically updates parking availability area-wise, making it difficult to plan parking activity efficiently. A real-time, easily accessible platform for parking slot availability is strongly needed to reduce journey times, minimize parking wait times, and prevent road chaos.



Fig. 5 off-street parking near laxmi road

Table 1. Vehicle parking slot characteristics at J.M. road

Sr.No.	Parking Lot No.	Vehi. Type of Lot	Avg. Parking Index (%)	Parking load per Hr.	Ideal Cap of Parking Lot
1	P1	TW	88.10	10.57	12
2	P2	TW	123.81	14.86	12
3	P3	FW	90.48	10.86	12
4	P4	FW	80.95	9.71	12
5	P5	TW	77.14	3.86	12
6	P6	FW	73.02	10.22	14
7	P6	TW	100.69	48.33	48
8	P7	TW	113.38	74.36	72
9	P8	FW	110.00	11.00	10
10	P8	TW	90.48	32.57	36
11	P9	FW	132.29	10.58	8
12	P9	TW	116.44	41.92	36
13	P11	TW	227.78	82.00	36
14	P11	FW	975.00	585.00	NA
15	P12	TW	88.75	8.88	10
16	P12	FW	171.88	6.88	4
17	P13	TW	103.75	20.75	20
18	P13	FW	300.00	3.13	NA
19	P14	TW	110.42	33.13	30
20	P14	FW	750.00	7.50	NA
21	P15	TW	440.00	22.00	20
22	P15	FW	931.25	18.63	8
23	P16	TW	269.29	53.86	20
24	P16	FW	1157.14	11.57	NA
25	P18	TW	97.92	11.75	12
26	P18	FW	100.00	2.00	2
27	P19	TW	74.44	44.67	60
28	P19	FW	106.60	25.58	24
29	P21	TW	100.00	12.13	15



Fig. 6 Vacant vehicle parking slots display at off-street parking



Fig. 7 Dual Parking lanes on J.M road

5. Observation and Analysis

The study of the area of the on-side road vehicle parking slots is summarized and mentioned in Table 1. In Table 1, “N. A” (not applicable) indicates areas where no parking slots have been allowed. TW is a two-wheeler. FW is a four-wheeler. The survey reveals that in these no-parking zones, people still park freely, leading to overcrowding and creating unsafe conditions that increase the risk of accidents. Parking slots P11, P13, P14, and P16 mentioned above are designated as no-parking zones. However, the parking index in these areas exceeds 100%, indicating that roadside space is fully utilized for parking despite the parking restrictions. (Figure 8 and Table 2)

This highlights a significant shortage of on-street parking and raises serious concerns for pedestrian safety at both signalized and unsignalized intersections. From Table 1 and Figure 8, it can be inferred that the average parking index is nearly 100% for most parking slots, indicating they are almost always over-utilized and full. Of the 29 slots, 21 exceed 100% of the average parking index, with all slots showing more than 75% occupancy. Essentially, if a parking slot has 12 spots, they remain occupied most of the day. The local municipal corporation can assess the studied areas for future parking development based on the methodology outlined. By conducting preliminary surveys and evaluating impact factors, as shown in the matrix (Table 2), planners can rank each area’s development plan, modernization needs, and popularity. This cumulative analysis can guide decisions on expanding vehicle parking infrastructure.

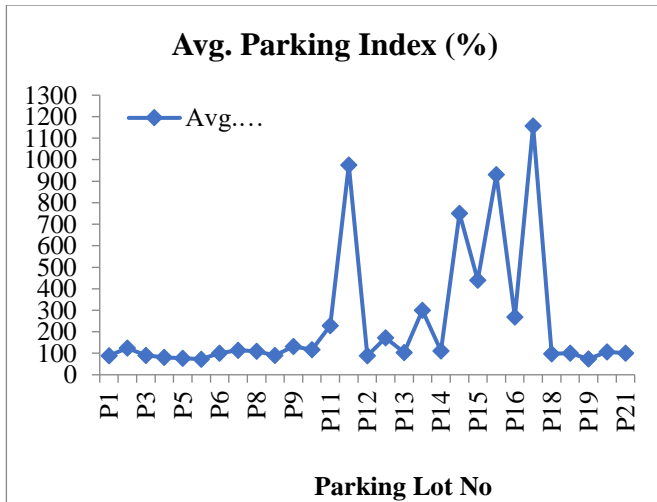


Fig. 8 An avg. parking index is more than 100% on J.M road

In the Table 2 matrix (illustrative, using preliminary elements), planners can refine the analysis on a micro level by creating subcategories of the affecting factors on the parking design of the particular area, ranking them, and assigning values to calculate the impact on vehicle parking management for a specific planning period if any triggering factor they choose values to calculate the impact on vehicle parking

management during a specific planning period. These values could range from Low = 1, Low Medium = 2, High = 3, Medium High = 4, to Highest = 5. The planner can rank hierarchies of the affecting factor and select them as and when needed to compute the output matrix. This matrix should be calculated periodically, as factors like road networks, commuting options, and frequency change over time, affecting vehicle parking management. The higher the output matrix value, the more attention is required for parking management in that area, necessitating urgent action by local authorities. [5]

Table 2. Decision matrix to show the impact of change in the development plan (the addition of the metro route in the central Pune area) and its impact on vehicle parking management in the area as an example

		Impact on Vehicle Parking Management				
		Negligible	Minor	Moderate	Significant	Severe
Likelihood change in D.P	Very Likely	Low	Low Medium	Medium	High	High
	Likely	Low Medium	Low Medium	Medium high	High	Very High
	Possible	Low Medium	Medium	Medium high	Medium high	Very High
	Unlikely	High	High	High	Medium high	Medium high
	Very Unlikely	High	High	High	Low Medium	Highest

The Pune Municipal Corporation (PMC) area has expanded fourfold in a short period [10]. However, there is often a significant gap between drafting and implementing development plans in India. For instance, the PMC drafted a plan in 1958, which the government approved in 1966, and only then was it implemented. Pune has undergone significant changes, from transitioning from Wada culture to cooperative societies to developing roads and overbridges alongside government slum rehabilitation programs. This delay in implementation leads to disparities between the plan’s original intentions and its eventual execution.

6. Conclusion

6.1. Area and its structural complexities

6.1.1. Roadside Parking in the Gaothan Area

On older and narrower roads (Laxmi Road, Narayan Peth), maneuvering large vehicles from roadside parking like bus cars is critical. So, in the core area, the practice of roadside

vehicle (TW/FW) parking must be refrained from so that it can help prevent slowing down traffic flow speed without interfering in and out vehicles moving along road banks. The current parking practice is the odd date and even date alternate day side of road parking or at some stretches both sides parking is allowed for two-wheelers where maneuvering disturbs a lot to the moving traffic and when we consider the visitors finding free street parking, especially in central Pune, is difficult during business hours or weekends.

6.1.2. Lack of Signage and Boundaries

On J.M. Road, the ratio of vehicles to parking spaces is low, with the parking index exceeding 100% in some “No Parking” zones. (Table 2. Figure 8). The lack of clear design, segregation in different kinds of vehicles, and boundaries for different vehicle types lead to confusion and disrupt traffic flow. (Figure 7).

6.1.3. Lack of clarity between road Aesthetics and Roadside Parking Area Management

J.M Road side renovations and rearrangement under the smart city movement in Pune focus more on aesthetics than technical improvement in parking management. The absence of advanced parking technologies and omission of clear individual vehicle boundaries adopted less than 1 in 10 places. Parking regulations have not yet been fully neither for TW nor for FW. Implementing technologies and operating parking places need uniqueness and standardization in all parking slots and locations. Random parking orientations, unclear signage, irregular length spans of parking slots and a lack of service lanes further complicate parking and traffic. Drivers face unnecessary waiting and trauma.

6.2. Need for Dynamic Information on Vacant Spaces

6.2.1. Absence of Automation

Everywhere, whether off-road or roadside parking, manual intervention in the process of allotting and taxing at parking stations is still very time-consuming, leading to substandard service, unequal time response and disarrayed processing of allocation. Sometimes, mood swings of human employees affect the whole process. Also, manual involvement involves disadvantages of chances of corruption, theft, misbehavior, and mistreatment of the vehicle owner. The manual behavioral pattern generally induces errors. Automation can adapt to changing demands and scalability of the increasing number of vehicles on this road, ultimately increasing productivity. Automation can help register complaints and improve quality divulgence.

6.2.2. Existing Parking and its Allocated Location

In the Comprehensive Mobility Plan (CMP) report of PMC (2008 submitted), it is mentioned that there are seven plots reserved for parking; out of that, only two plots were partly developed as multistoried parking. Only 4 plots out of

7 plots PMC (Pune municipal corporation) could acquire soon there will be automated parking facilities. It is 2024, and about to finish, but this information has not converted into reality. Though the report says two places with multi-story parking are already operating, this information is only limited to digital reports, as its location capacity has not been publicly displayed. So, for the common man, parking facilities have not been advertised. The data is not converted into sellable commodities, so end users can use and benefit from this facility.

6.3. Need for Complementary Infrastructure and Commutation Facilities

CMP 2008 itself states that the performance index of parking is 23% out of 100%; it shows a lot of scope for improvement. The facility also states cyclability is 0%, and walkability has a 53% performance index. If proper planning and design of cycling tracks and hawker-free footpaths can be maintained, people will tend to use fewer vehicles and ultimately, parking demand and construction costs can be saved. The same thing can be applied to the feeder system of BRT and public bus transportation. In most parts of Pune three, wheeler auto rickshaws are used for the same purpose, but the main drawback of the auto-rickshaws is that they are private means, small tiny size, so instead of being replaced by buses that will be more economical better in carrying capacity so lesser volume of parking place will be in demand.

6.4. Inventory and Commuting Arrangements for Physically Challenged People

There are no special or smart arrangements for physically challenged or mentally retarded people, and this may create challenges of time and maneuvering for the general population as well as this kind of people. There must be proper logical maneuvering for these people.

6.5. Cultural Spectrum of Pune

Ganpati festival temporary pandals must be executed, and different kinds of temporary parking arrangements must be planned for these 2 months.

6.6. Discipline and Mental Attitude of Local People

People are parking their vehicles on footpaths [9]. People won't get parking places, so they tend to find shortcuts when parking their vehicles. This is causing problems for pedestrians. To avoid further disturbance for walking persons, proper action must be taken, such as parking vehicles on footpaths. Proper measures and fines must be ruled down and communicated to the general public.

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