Car Parking in Indian Cities: A Review of the Impediments to Sustainable Mobility

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Abstract Irrespective of how little pollution is emitted by cars or their fuel efficiency, it is required to park cars somewhere. Poorly designed parking policies can induce vehicle ownership, urban sprawl, and less patronage for public transport. The goals it should fulfil hence come from the greater agenda of sustainable urban development that usually includes a strong and vibrant economy supported by a proficient transport system, clean urban environment, better accessibility, a safe environment, and a more equitable society. In India, a country with rising urbanization level and the concomitant induced derived demand for mobility, scanty research has been undertaken on the implications of parking policies. This study attempts to understand the current enabling policy and legal environment, institutional mechanism, existing parking strategies, and pricing and its impact on average generalized cost of trip in Indian cities and it also probes the possible policy implications for the future. This study relies on exploratory research methods based on secondary data available with various institutions and organizations and focused group discussions with different stakeholders. The study finds that India is depending on Generic Minimum-based parking approach that doesn't consider transit proximity, popularity of a particular establishment, walkability, income and parking management practices like availability of public parking lots, parking pricing, and overall peak demand. There is an urgent need to provide efficient legal support for the creation of institutional mechanism, unbundling of parking pricing, adoption of smart growth parking policies.

Keywords Parking policy · Parking pricing · Travel demand management

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1 Introduction

Irrespective of how little pollution is emitted by cars or their fuel efficiency, it is required to park cars somewhere. Since a car uses several parking spaces each week [8] and spends about 95% of its life parked on an average [14], it has a conspicuous impact on both land use and the transport network [9, 14]. Lack of curb parking became a big problem with increased vehicle ownership during the 1920s in the United States of America. Therefore, in order to address the growing demand for on street parking urban planners came up with the idea of 'Minimum Parking Requirements' for various types of land uses [11]. The system of Minimum Parking Requirements as per the land use impacted the imaginations of urban planners in many other countries. But this policy induced urban sprawl reducing the density of residential and commercial development and over supply of parking spaces thereby encouraging further car dependence [12, 13]. Various researches have established that sound and pragmatic parking strategies would ensure effective use of public transport, smart land use development, reduced GHG emissions, and equity in built environment development [1].

Parking policy should not be developed in a standalone manner; it should instead be a part of all hierarchies of initiatives from local area plan to regional built environment plans [9]. The goals it should fulfil hence come from the greater agenda of sustainable urban development that usually includes a strong and vibrant economy supported by a proficient transport system, clean urban environment, better accessibility, a safe environment and a more equitable society [8]. To deal with the issues of generic minimum-based parking and to manage the overall demand for mobility, urban planners and transport experts have developed new approaches to parking supply management. These mainly include area-specific parking and flexible parking. Under Area Specific parking standard, the entire city would be classified into various zones and each zone would have its context-specific parking requirement. Since this approach can segregate areas with lower parking demand and ensure a better range of transportation alternatives, it can make it easier to begin phasing in more progressive measures, such as parking caps or parking maximums [6]. Parking supply reduction and usage were guided by various cross elasticities involved in parking market. This is done by restricting parking through suitable charges in the urban core where the density is high [18]. The American Planning Association in 1983 published Flexible Parking Requirements, detailing out various flexible approaches, includes fees in lieu of parking, off-site parking, shared parking, and parking reductions to induce ride-sharing programs [15]. Cities have linked the minimum or maximum parking norms to site-sensitive variables such as availability of nearby offsite parking (e.g., public parking), transit accessibility, and the availability of trip aggregators [7] This approach allows having different parking supply norms for different urban development precincts according to the context-sensitivity [6].

In India, a country with rising urbanization level and the concomitant induced derived demand for mobility, scanty research has been undertaken on the implications of parking policies. This paper makes an attempt to find answers to a few pertinent

questions, namely, (i) what are the parking regulations across the states and cities in India? (ii) what have been the difficulties in the enforcement of parking regulations? (Sect. 3.2), (iii) are there any differences in the parking regulations across various statutes and codes? (iv) how parking norms in residential area and commercial area differ across states and cities? (v) what have been the emerging issues in on-street parking?

2 Methods

The present study aims to assess the current status of parking policies, regulations and management and their impact on urban mobility in India. This study relies on exploratory research methods based on secondary data available with various institutions and organizations and focused group discussions (FGD) with different stakeholders. FGDs have been conducted with concerned stakeholders like Municipal Corporations (MC), Development Authorities (DA), and commuters in the urban areas in order to get a deeper insight about the existing situation and about the issues and imperatives towards resolving the problems in parking management. Stakeholders' survey consisted of a set of open-ended questionnaire structured around the following eight aspects: (i) existing parking standards and increasing private vehicle ownership, (ii) parking pricing and its impact on the average generalized cost of a trip, (iii) current parking policy and legal enabling environment, (iv) current institutional arrangements, (v) awareness about modern parking management measures, (vi) benefits of parking maximums, (vii) cost of parking provision, and (viii) other challenges and opportunities in parking management. Accomplished through literature survey, the first stage includes the appraisal of various approaches to parking supply and the evolution of parking management policies. In the second stage, a detailed assessment of parking management policies in India is made. In this stage, the impact of minimum parking standard on built-up areas in residential and commercial zones, parking pricing, revenue of MCs, protest against the parking pricing in shopping malls, cost of parking space provision etc. are analysed in detail. In the conclusion, the possible interventions and recommendations for making parking policy complementary to travel demand strategy have been suggested.

3 Parking Management in India

As on 2011, the urban population was about 31% in India [2]. One estimate predicts that the total urban population of the country would touch 40% by 2021 [5]. The pace of urbanization in India is quite significant (as compared to the global average and average of Asia, Europe, Latin America and North America) and this has been inducing the derived demand for mobility. While the number of buses and other public passenger vehicles registered in India are on the decline, that of private cars and

motorcycles are increasing at an alarming rate despite the economy being pressurized with a higher fossil fuel import bill. The disproportionate dominance of private motor vehicles not only inflicts various negative externalities on the environment but also creates an inequitable appropriation of urban spaces.

3.1 National Urban Transport Policy (NUTP) and Parking

In 2006, the government of India adopted NUTP in order to better coordinate urban transport development [10]. The NUTP acknowledges the fact that an increase in private vehicle ownership leads to a greater damage to sustainable living in urban areas. It also highlights the issues of low parking charges, congestion, decreased use of NMT, absence of land use transport integration, and accidents and sets forth a multi-pronged agenda for improving the urban transport scenario. The objective of this policy has been to ensure integrated land use and transport planning in all cities to (i) minimize travel distances, (ii) encourage more use of public transport, (iii) ensure equity is road space allocation, (iv) introduce multimodal public transport systems so that a well-integrated, seamless travel across modes are put in place. NUTP underscores the importance of land as a valuable resource of urban areas, a large portion of which gets occupied by parking spaces. This particular fact must be acknowledged and parking fees, commensurating the value of land occupied by the parking lot, should be adopted to make the use of public transport more attractive. The policy further envisages that encouragement to park and ride facilities for bicycle users, with a suitable inter-change, would be another advantageous measure to encourage people to use public transport for their different trip purposes. But the policy loses its track when it aims to modify building by-laws in all million-plus cities to 'make sure adequate parking space' is present for all residents. Thus eventually, the rising private vehicle ownership would be adding more congestion on city roads and demanding more parking spaces across all other land uses [10].

3.2 Parking Regulation and Enforcement in India

The supply of parking places is regulated in India by minimum parking requirements. Parking standards are decided by the Indian Road Congress (IRC), National Building Codes, The Motor Vehicles Act 1988 and Development Control Regulations under Urban Development Acts. The 1997 IRC Standards recommend the provision related to parking while laying roads. While the 1988 IRC Guidelines stipulate the requirements related to off-street/building parking, the 1997 Guidelines specify the road marking requirements for parking on-street. The Motor Vehicle Act, 1988 lays down the traffic and parking area regulations as well as the enforcement architecture. It forbids parking near or at road crossings, on a footpath, hindering another vehicle. Section 117 of the Motor Vehicle Act, 1988 permits the State Government or any

other specific authority on its behalf to determine places at which motor vehicles are allowed to park in consultation with the local authority having jurisdiction in the specific area. MC and City Traffic Police are responsible for the enforcement of parking rules. Available public off-street parking spaces and major street stretches are leased out to private contractors for parking management. Although the Town Planning wing of respective MC is responsible for ensuring the provision of parking supply as per the building control regulations, indiscriminate and blatant violations of building control regulations by delinquent builders have been a routine affair. There is no proper database available with the MCs or Development DAs across the country on the parking supply actually made available against the approved building plans.

3.3 Residential Area Parking in India

All the residential parking standards presume that vehicle ownership increases with the increasing population and prosperity of the city and pay less attention to the fact that the share of public transport and proximity to MRTS routes need to be considered to fix caps on parking supply. None of the factors like transit accessibility, mixed land use, high residential or employment density is considered in deciding the parking standards. The floor space index (FSI) or total built-up areas are normally related to residential parking standards. With the spatially diverse increase in household vehicle ownership and income over time, few cities have been raising their minimum parking requirements. According to the Building Bye-Laws 1983 of Delhi Development Authority, one Equivalent Car Space (ECS) was to be provided for every 90 m^2 built-up area in group housing. But in 2013, it was amended and now it is required to provide 2 ECS for every 100 m^2. Ahmadabad DCR of 1991 made it mandatory to provide 15% of the utilized FSI for parking. However, the latest DCR of Ahmedabad Master Plan 2021 mandates that 20% of the FSI should be kept for parking for group housing and detached houses should have one ECS for more than 80–300 m^2 floor area with additional one ECS for every 100 m^2. floor area. Table 1 depicts a scenario of residential built-up area of 5000 m^2 and required parking spaces in different states and cities in India. As is evident, every authority follows a different methodology in deriving the standards. As it can be observed, some of them have segregated requirements based on the residential typology, while others have not. In the whole of Kerala State and Chennai city, the parking requirements are not based on the classification of the residential typology. Across the country, two important aspects have not been taken into consideration: (i) the cost of providing a parking space and (ii) variation in real estate market and the land availability with the location.

Parking standards are not uniform throughout the city of Mumbai regulated under the Development Control Regulations for Greater Mumbai. Though the residential typology segregation is not followed in Mumbai, it has an area or location-specific parking regulations. Plot—Area-based parking requirements are stipulated in the Chandigarh Master Plan, which is not followed in any other cities or States surveyed

Table 1 Car parking requirements for 5000 m^2 of residential area

Authorities/building rules and regulation	Total ECS	Parking area
Ahmadabad	30	750
Kolkata	28	350
Bangalore	50	687.5
Chennai	67	833.33
Greater Mumbai	84	1155
Pune	50	625
Bhopal	21	260.42
Surat	40	1000
Chandigarh	60	1500
Andhra Pradesh	60	1500
Delhi	90	1237.5
Kerala	7	175

Source Respective Development control regulations of the cities and states

under the present study. It is only under Unified Building Bye-Laws and Development Control Regulation of Master Plan for Delhi that studio apartments are mentioned as a residential typology. Although categorization based on the residential typology is followed by most of the cities and States in India, this specification is not followed in the State of Kerala, and across the cities of Mumbai, Pune, and Chennai. In these cities and State, the requirement is the same for all the types of residential buildings. Such a formulation of standards, however, is not a rational approach to follow.

In the cities of Ahmedabad, Chandigarh and in the State of Andhra Pradesh, the parking area is calculated by considering a fixed percentage of the total built-up area. Such straightforward approach is very irrational as it allows a certain percentage of land to be used by vehicles, which could otherwise have been used for housing people. This can be illustrated by the General Development Control Regulation (GDCR) of Ahmadabad, where 750 m^2 area is assigned for parking for the total built-up area of 5000 m^2. Given the standard size of Economically Weaker Section (EWS) housing being 30 m^2, it can thus be found that at least 25 EWS housing units could have been built up within the parking area as provided under the GDCR of Ahmadabad. But on the contrary, in Kolkata, if it exceeds 200 m^2, then for each additional 200 m^2, one car parking space should be provided.

3.4 Commercial Area Parking in India

The principle of 'more the car ownership more the parking space' is applied in commercial areas also. Such parking requirements make the city friendly to cars but not to people, make the city drivable but not walkable [14]. Table 2 represents

the car parking requirements for commercial buildings in some cities and States in India according to their building rules and regulations. The total built-up area of the commercial building considered here is 5000 m^2, and the comparison table is prepared accordingly. There are different types of commercial buildings, each having different parking requirements. But concerned authorities and respective building regulations of the city of Ahmedabad and the State of Kerala have not considered this fact and instead imposed a common parking requirement for all types of commercial buildings. On the contrary, several Indian cities follow specific parking requirements based on the typology and the location of the commercial building. The space required for car parking in commercial buildings of the cities and States covered under the present study varies from a minimum of 312.5 m^2. for the city of Bhopal to a maximum of 3000 m^2. for the State of Andhra Pradesh. The requirement for Bhopal is almost 10 times lower than that of Andhra Pradesh. One of the main reasons for this is that while the parking requirements and the categories of the commercial buildings are very specific in Bhopal, the parking requirements are based on a certain percentage of the built-up area irrespective of the size or location of the commercial buildings in the case of Andhra Pradesh. In Delhi, it is not mandatory to provide parking space for informal bazaar (market). Such erroneous regulations (or absence of regulation) encourage on-street parking and cruising for parking spaces and eventually cause congestion. Although the motorized two-wheelers contribute a significant share in the personalized mode of transport in India, none of the regulations referred to under the present study mentions the parking requirement for motorcycles except Chennai. As mentioned above, the parking requirements are indicated as a certain percentage of the built-up area in the States of Kerala, Andhra Pradesh and cities of Ahmedabad, and Surat. This is certainly not the appropriate method to calculate the parking requirement, which should have been based on the type, location and size of each unit of the commercial building. Segregation and specification based on these parameters should be considered while formulating the parking norms.

Only in the case of Chennai and Kolkata, no parking requirement is provided up to a certain built-up area. Under the regulations in Chennai, no parking is required up to 50 m^2 of built-up area for each commercial unit. In the case of Kolkata, this exemption is extended up to 25 m^2 of carpet area of each of the commercial unit. Area or location-specific parking norms are stated in detail only under Delhi regulations. In Bhopal Development Plan Building Regulations, only the area is specified between the upper-income group areas and other-income group areas without any reference to the locations these income groups belong to. In the case of Mumbai, location-based segregation is done only in the parking requirements for residential buildings with total disregard to the parking requirement for commercial buildings.

3.5 On-Street Parking

Most of the Indian cities have an old city core that follows a different urban development paradigm with narrow streets, highly mixed land use, heritage structures and

Table 2 Car parking requirements for commercial buildings

Authorities	Parking norms	Number of ECS	Area @25 m^2
Ahmadabad	30% of max. permissible F.S.I	112	1500
Andhra Pradesh	Multiplexes, shopping malls—60% of FSI	218	3000
Kerala	1ECS/100 m^2	50	1250
Chennai	1ECS/and 1 two-wheeler space for every 50 m^2	99 + 15	2580
Kolkata	1 ECS/35 m^2	143	3575
Bangalore	Retail business 1ECS/50 m^2	100	2500
	Multiplex integrated with shopping—1ECS/40 m^2	125	3125
Pune	1ECS/100 m^2	50	1250
Mumbai	1ECS/80 m^2	65.2	1630
Delhi	Local shopping centre 2 ECS/100 m^2	100	2500
	District centre/subcentral business district 3ECS/100 m^2	150	3750
Chandigarh	Multiplex/malls—4ECS/100 m^2	200	5000
Bhopal	1ECS/45 m^2 of floor space	111	2777

commercial activities. Many of these urban fabrics have come up before the arrival of automobiles and minimum-based car parking standards. However, sadly enough, high traffic density and illegal on-street parking in these core city areas have led to a completely chaotic situation over the years. The carrying capacity of the streets in these core areas in particular has been shrinking over the years due to the indiscriminate on-street parking posing a serious barrier for the smooth movement of public transport and non-motorized transport. In the early 1980s, the Government of India has brought out parking guidelines following which many commercial buildings have started providing parking spaces. Although the commercial establishments had provided the parking spaces as per the guidelines in those days, most of the people had converted the parking areas into other commercial uses and depots since the demand for parking was meagre owing to low ownership of private vehicle. However, the economic reforms undertaken in 1991 and the consequent liberalization, privatization and globalization of Indian economy reversed the scenario dramatically. The exponential growth in the ownership of private vehicles far exceeded the availability of off-street parking within the building thereby making the car owner end up in parking the car on the street.

3.6 Parking Pricing

Distortion in cost of trip is created by low parking charges and/or the availability of free parking space. Major share of the commuters who use personalized vehicles do not pay for the total supply cost of parking, which leads to large inadequacies in transport pricing [3]. Parking charges in India is one of the lowest in the world. Even where the parking charges are levied, it is not harmonized between off-street, on-street and multi-level car parking (MLCP). The Capital cities in each Federal States in India experience a high percentage of government employees that use either a car or two-wheeler for daily commuting. Government offices across these Capital cities provide parking space free of cost. Free parking provision at the workplace is an important factor in indirectly inducing the use of personalized modes of transport. An assessment of various trip purposes shows that close to 75% of the peak hour trips are made for work and education. As large as 90% of on-street parking in arterial and sub arterial roads are available free and since on-street parking is available free, most of the MLCPs remain largely underutilized.

There is a strong protest going on in almost all metro cities against the parking fees charged by shopping malls. Commuters are claiming that it should be provided for free. Many court cases are lying before the Consumer Courts and High Courts across India against the parking fee at shopping malls. Following the 74th Constitutional Amendment Act 1992, MCs are the statutory agencies that should ensure the earmarking, regulation and supervision of parking places. There is a huge cost associated with the provision of various types of parking, namely,—off-street, surface, stilt and multi-level parking. On average, one ECS of off-street parking would cost close to Rs 0.5 million and Rs 0.2 million in the urban and peri-urban areas respectively. Stilt or basement parking would cost about Rs 0.6 million and Rs. 0.25 million in the core urban and outskirts of the urban area, respectively. Cellar or MLCPs are the costliest parking; it costs close to Rs 1 million and Rs 0.5 Million for one ECS at the CBD areas and the suburban areas, respectively. These costs majorly include two components: the cost of land and cost of construction. Providing such a costly infrastructure free or at sub-optimal price would always bring loss to the exchequer. Mall authorities should have the natural rights to decide whether the cost of providing parking space is recovered from the retailers (storekeepers) housed in the mall or the shoppers visiting the mall or from both besides deciding the duration-wise parking levy. In view of the huge cost in the construction of parking space in malls, and in the event of the government preventing the malls from collecting parking fees, mall authorities will be forced to recover the cost by raising the rent of the leasable space. It would create a situation in which a public transport user shall indirectly pay for the parking space that they do not use. Parking management practices that indulge in sub-optimal pricing and appeasement populism may cause indirect inducement to private vehicles and the slow death of public transport.

3.7 Who Pays for Parking?

Parking price levied by the municipalities are only applicable for dedicated off-street and on-street parking. It distorts the average generalized cost of the trip for various types of commuters. It has been observed across Indian cities that while the visitors to commercial areas largely pay for parking, employees get assured parking spaces in their workplaces free of cost. If a trip by private car and metro respectively is compared having the same origin and destination, it would reveal that trip by private car is cheaper due to the mere absence of parking price at the destination. The metro users, on the other hand, have to pay the parking charges at the Metro parking plaza and take the ride.

There is a regulatory deficit with the parking regulations both in terms of space and location parameters as well as in terms of enforcement. The parking regulation that ought to have regulated and promoted the parking market has been largely dysfunctional due to the bundling of parking price in the end product or services. There are three major scenarios of bundling: (i) firstly the bundling of parking-space price with the house price; (ii) secondly, provision of free parking for the employees by the respective employers; (iii) thirdly, the bundling of parking price with the product or service price by commercial establishments. For example, if the parking space price is bundled with the price of the house by default, buyers or renters need to pay for the parking space facilities even without owning a vehicle. If the home buyers are given an option to avail a lower price of the house by charging for the parking facilities separately, they are likely to reduce their vehicle ownership or even not owning a vehicle at all (assuming that the neighbourhood enjoys a very good and affordable public transport accessibility). Similarly, if employers (office/workplace) start charging the employees for parking facilities, there is every likelihood that employees would shift to other modes of transport and save the parking charges to add on to their disposable income. If parking comes as a bonus to the employee, they would tend to use their own vehicles for office commuting. A comparison of average generalized cost (AGC) of trips by a car and car and metro reveals that a person using metro for the line haul trip and car for access trip (to metro station) will end up paying more than double the AGC of the direct trip made by car only. This substantiates the need for a comprehensive parking-pricing strategy in keeping with the bigger principles of sustainable mobility.

There is an absence of off-street parking market across different land uses in Indian cities. The high social cost associated with the exponentially growing use of personalized vehicles gets obviously ignored by an unregulated market. The Capital cities in each Indian State experience a large percentage of people working in government, commercial, institutional sectors using four or two wheelers for their day-to-day trips. Government offices, many commercial, industrial and institutional establishments across these Capital cities provide parking space free of cost to their employees as well as visitors. Provision of parking spaces for free at the workplace is an important factor in indirectly inducing the use of personalized modes of transport. Although cities like Delhi have constructed Metro with huge capital expenditure, it failed to

bring a modal shift from personalized modes to MRTS in any perceptible extent. Municipal revenue collected from parking has been abysmally low at less than 1% of the total municipal revenue across Indian cities.

4 A Way Forward: Policy Implications for the Future

From the analysis made above, the following factors seem to have afflicted the parking management in different ways in Indian cities: (i) adoption of conventional generic minimum parking approach, (ii) absence of scientific rationale in parking pricing, (iii) bundling of parking pricing as implicit subsidy, (iv) absence of legal support and (v) poor transport governance.

International experiences of maximizing social welfare and promoting sustainable urban transportation underscore the urgent need to restructure the management of parking across the cities in India. In order to achieve the goals of curtailing traffic congestion, improving air quality, reducing greenhouse gas emissions, making streets more liveable, freeing up road space for public space, and providing bicycle lanes, parking policy has been implemented in a large number of European and North American cities. Increasing attention is being paid to regulate the parking provisions to such levels that the roads can support besides ensuring the normative air quality standards. Efficient parking management is acknowledged as integral to competitive and liveable cities. Indian cities, in their endeavour to become competitive, efficient and liveable, can gain so much from the best practices of European cities. There is an urgent need to make an integrated parking and auto ownership management plan for Indian cities. The explosive increase in the ownership of private vehicles and the ensuing decrease in the level of service on the road network and other negative externalities originating from the fleet of private vehicles can be better tackled through integrated parking management strategies, particularly that of travel demand management tool.

4.1 Modifications in Parking Supply Approach

There is a need for the modifications of parking standards by adopting parking maximums, parking supply caps, and flexible supply of parking spaces. The presence of mixed land use, walkable streets, bicycle-sharing facilities, public transport accessibility, employment density, residential density etc. should be given due importance in fixing the parking rules [17]. The application of uniform standard at pan city level should be abolished and parking districts should be delineated. House registration procedures should be modified to unbundle the parking and separate registry needs to be maintained for parking spaces. For the recent largely growing private parking market, regulating the number of parking spaces can turn out to be largely helpful in parking management. As the parking standards are reduced in a building, this space

can be utilized for increasing the built-up area of that building or for a new building for low-income group housing, provided it complies with the building regulations. Hence, this can act as a significant tool in increasing the housing supply. Rather than focusing more on minimum-based parking approach, parking authorities and planners should begin to consider maximum parking [14]. Maximum parking spaces should be estimated by taking into account all the costs and benefits associated with it. The components of costs and benefits associated with parking maximum may be contextualized to a few questions: (i) whether the traffic on the adjacent road is affected due to these extra parking requirements (decline in Level of Service)?; (ii) what is the cost of polluting the environment by the vehicular flow?; (iii) how and by what extent does the parking maximum affect the real estate prices?; (iv) who will pay for this additional cost?; (v) should a home buyer pay for parking space if s/he does not require it?; (vi) what is the opportunity cost of a parking space? Through this approach, we can try to control the demand for parking by reducing its supply.

4.2 Adoption of Rational Parking Pricing

A rational parking pricing should essentially deter the use of personal vehicles. Parking price is a widely accepted and an efficient measure to manage the modal shift [13] besides reducing vehicle congestion on urban highways [9], and coping up with parking demand in high-trip attraction urban zones. Parking price makes personal vehicle users pay directly for the use of parking facilities [14]. Besides regulating parking, parking price acts as a mobility management strategy. It collects revenues to recoup the capital and operation and maintenance expenditure of the parking facility besides supplementing the municipal coffer. At present, most of the parking plazas are inefficiently priced and/or subsidized and/or just provided for free and/or bundled with home price/rentals (notwithstanding the need for parking by the home buyer/renter). Vehicle owners do not face any disincentive for the use of their vehicles as they are just required to pay mostly meagre flat monthly or annual parking fees and as a result, the likelihood of their migration to public mode of transportation is very thin [8]. Therefore, performance-based pricing should be adopted to increase the efficiency of the use of parking space which implies that almost 15% of the total parking spaces must be made available and vacant at any point of time [14]. Intelligent Transport Systems and Innovative Parking Pricing mechanisms should be followed for equitable and efficient utilization of urban land and to augment the municipal income.

4.3 Legal Provisions for Parking Management: Lessons from Best Practices

The institutions responsible for managing parking in Indian cities should emulate the best practices in parking management achieved in foreign countries besides undertaking the pertinent fiscal and administrative reforms.

The successful implementation of parking strategy requires strong legal support. Under the Japan Parking Places Law—1958, any car buyer is required to produce the certificate of availability of parking space (proof-of-parking) to register the vehicles [4]. This proof of parking regulation helps manage the street parking in residential areas. The UK Parking Places (Surcharge) Act of 1975 charges a monthly fee on non-residential parking. The UK Transport Act (2000) helped implement the workplace parking levy in Nottingham. Adopting Clean Air Laws, Santa Monica, California mandated that parking cash-out measures should be implemented in firms with 50 or more employees [14]. It also aims at eliminating haphazard night-time parking in streets and alleys. The Perth Parking Management Act, 1999 helped create an area called the Perth Parking Management Area (PPMA) within which there is a requirement to license all parking except private residential parking spaces. The Act gives powers to levy tax on all types of parking spaces except the residential parking spaces and collects revenue that can only be used in the PPMA [16]. Parking fees and fines can be a major source of revenue for MC and proper ring fencing of this revenue can help the urban local bodies achieve the goal of sustainable mobility. Suitable statutes need to be enacted and enforced to implement the workplace levy so that it can impact the average generalized cost of not only the visitors to various establishments but also that of the employees. Transport Department should ensure that vehicle registration is made mandatorily dependent on the production of certificate of availability/ownership of parking space. Registration of parking spaces can help reduce private vehicle ownership due to the spatially and dynamically efficient taxes on parking space. Japan has implemented this kind of parking strategies and achieved reduction in parking supply as well as land use—transport integration [9].

4.4 Strengthening Transport Governance

Deficit in transport governance has been one of the stumbling blocks in managing parking in India. Parking enforcement is an important aspect in parking management. In India, the responsibility to enforce the parking rules lies both with the traffic police and MC of respective cities. It, therefore, reiterates the need for United Metropolitan Transport Authorities (UMTA) for metropolitan areas and similar such institutional architecture for other cities and towns. There should be a dedicated wing in each UMTA for parking management within the overarching principle of public transport promotion and travel demand management. UMTAs should maintain the database

of the entire on-street, off-street and public and private parking supply for effective policy implementation and monitoring. Cities should be classified into different parking districts or precincts based on land use and activity characteristics to prepare separate parking management plan for each parking districts.

5 Conclusion

On society, the effects of parking go beyond the vehicle owners' costs. Most of the urban local bodies in India are not administratively and financially equipped for the efficient management of parking. Indian cities are replete with scores of examples where off-street parking is hardly strictly followed; leave alone the appropriate pricing for off-street parking. Matters worse when it comes to the enforcement of on-street parking regulations under the ambit of a wider travel demand management principle. Parking policies should be prepared in tandem with the policy objectives of transit-oriented development and metro rail. At a time when Indian cities are on the track of improving public transport, it is very much necessary to implement some other soft policy measures that induce more ridership by Mass Transit Systems. The central principle for parking policy should be to progressively reduce the demand for parking and use it as a strategy to induce a modal shift to public transport and other active modes. But at the same time, the policy should enable structured parking for all types of vehicles. Smart—urbanism-related parking methods are the new paradigm, which is a close associate of the larger sustainable development goals and equity. Selecting the suitable parking approach may depend on a city's development objectives and trajectories besides the market forces that drive parking supply. In some areas, a hybrid approach that combines several approaches might be useful. With the changes in urban growth pattern, mobility and vehicle ownership, Indian parking management plans should take into cognizance the multidimensional factors explained as above.

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