

**PARKING POLICY
FOR CLEAN AIR &
LIVEABLE CITIES**
A GUIDANCE FRAMEWORK



Centre for Science and Environment

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Writers: Anumita Roychowdhury and Usman Nasim

Editor: Souparno Banerjee

Cover design and Layout: Kirpal Singh

Production: Rakesh Shrivastava and Gundhar Das



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Centre for Science and Environment

41, Tughlakabad Institutional Area, New Delhi 110 062

Phones: 91-11-40616000

Fax: 91-11-29955879

E-mail: cse@cseindia.org

Website: www.cseindia.org

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List of abbreviations

AAR	Accessibility Adjustment Ratio	ITS	Intelligent Transport System
APMS	Advanced Parking Management System	JNNURM	Jawaharlal Nehru National Urban Renewal Mission
BART	Bay Area Rapid Transit	LEED	Leadership in Energy & Environmental Design
BAU	Business As Usual	LPR	License Plate Recognition
BMC	Bangaluru Municipal Corporation	MCD	Municipal Corporation of Delhi
BSEA	Brigade Shops Establishment Association	MoU	Memorandum of Understanding
CBD	Central Business District	MoUD	Ministry of Urban Development
CCTV	Closed Circuit Television	MPD 2021	Master Plan for Delhi 2021
CPWD	Central Public Works Department	NDMC	North Delhi Municipal Corporation
DAR	Demand Adjustment Ratio	NMT	Non Motorised Transport
DART	Dallas Area Rapid Transit	NSHS	National Sustainable Habitat Standards
DDA	Delhi Development Authority	NUTP	National Urban Transport Policy
DIAR	Development Intensity Adjustment Ratio	PMD	Parking Management District
DIMTS	Delhi Integrated Multi-modal Transit System	PPP	Public Private Partnership
DSR	Delhi Schedule of Rates	PTAL	Public Transport Accessibility Levels
ECS	Equivalent Car Space	RTO	Regional Transport Office
EPCA	Environment Pollution (Prevention & Control) Authority	RWA	Residential Welfare Association
ETM	Electronic Ticketing Machine	STCP	Sustainable Transport Credit Programme
FAR	Floor Area Ratio	STF	Special Task Force
FSI	Floor Space Index	SUV	Sports Utility Vehicle
GoI	Government of India	TOD	Transit Oriented Development
HMA	Hyderabad Metropolitan Authority	ULB	Urban Local Body
HSRP	High Security Registration Plate	UTTIPEC	Unified Traffic & Transportation Infrastructure (Planning & Engineering) Centre
IPT	Intermediate Public Transport	WPS 2008	Wales Parking Standards 2008
IRC	Indian Road Congress	WTP	Willingness to Pay
IT	Information Technology		

Why this guidance on parking policy?

After Delhi implemented its first generation air pollution control measures during the early part of the last decade, there was an improvement in air quality. But this gain in air quality was soon lost. While improvement of technology remained an unfinished agenda, failure to address the explosive increase in the number of vehicles threatened to undo the small increment in air quality.

Responding to this, Centre for Science and Environment had presented a statement of concern to the Supreme Court in 2005 regarding a public interest litigation on air pollution, for an action plan to control vehicle numbers and to augment public transport. This statement of concern was turned into an application; and while admitting it, the Chief Justice bench served a notice to the Delhi government directing it to formalise a strategy to control congestion and the number of vehicles.

This was consistent with the global experience demonstrating augmentation of public transport, walking and cycling options also require supportive restraint measures to control growing dependency on personal vehicles and influence commuting choices. Singapore restrained car ownership through vehicle quota system and usage through electronic road pricing. London and Stockholm introduced congestion pricing in their central business districts. Hong Kong and Tokyo enforced stringent parking measures. Several European countries adopted vehicle taxation measures related to emissions. But the most widely practiced first generation restraint measure was parking policy as a demand management tool—pricing parking, limiting parking supply and enforcing parking management rules. This seemed the most attractive option for developing country cities that already have an administrative framework for some modicum of parking management measures. This had to be reoriented to manage demand and restrain personal vehicle usage. This can be deployed city-wide and create the framework for advanced restraint measures.

Global experience demonstrates that augmentation of public transport, walking and cycling options also require supportive restraint measures to control growing dependency on personal vehicles and influence commuting choices

Emerging policy mandate

Subsequently, Environment Pollution (Prevention and Control) Authority (EPCA), responsible for monitoring directives from the Supreme Court in the ongoing public interest litigation on air pollution and also advising the court on air pollution control measures in the national capital region of Delhi, recommended that a parking policy be framed as a first step towards travel demand management measure. Key land development and municipal agencies be directed to frame composite parking policy for Delhi as a restraint measure.

The Supreme Court, in its order dated 5 May 2006, gave the following directive: “The EPCA and the Delhi Government will issue necessary directions for implementation of the parking policy.” In response, the EPCA initiated a process of consultation with the concerned civic agencies—New Delhi Municipal Council (NDMC), Municipal Corporation of Delhi (MCD), Delhi Development Authority (DDA) and the Delhi government officials. It held extensive deliberations on the action plans presented by these agencies in the Parking Policy submitted by the Delhi government to the court.

But the proposals from all land owning agencies and traffic police in Delhi continued to focus on augmenting supply of parking spaces instead of designing it as a restraint measures. The restraining effect of parking policy on personal vehicles usage and its impact on air pollution was not clear to many.

Provisions of parking for personal vehicles cannot be treated as a matter of public good. Private vehicle owners must pay the cost of using public spaces for parking

In these deliberations, EPCA recommended to the court that land is limited and there is a limit to the additional parking space that can be created in the city. Therefore, the available parking space will have to be managed well. This will also require demand-side management through a well articulated pricing policy. Provisions of parking for personal vehicles cannot be treated as a matter of public good. Private vehicle owners must pay the cost of using public spaces for parking. The full cost of providing parking in public spaces including land, capital, and operation and maintenance costs should be recovered from users. The government should not subsidise this cost. Parking policy cannot be based on the increase of parking supply, but on restricting the availability of parking in the city and strict enforcement to prevent misuse of limited resources.

National Urban Transport Policy, 2006 (NUTP)—policy mandate for demand management: The NUTP is the first policy attempt of the Central government to lay down the key principles of parking policy as a travel demand management. It states that land is valuable and the fee should reflect the market value of the land used for parking. It also directs state governments to make suitable amendments to building rules to create adequate parking spaces. Determination of parking space is a state subject and should be dealt by urban local bodies. The key principles of NUTP are as follow:

- A high parking fee should be charged to make the use of public transport attractive.
- The parking fee should reflect the value of the land that is occupied.
- Public transport vehicles and non-motorised modes of transport should be given preference in parking space allocation. This, along with easier

Off streets parking at Akshardham



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access of work places from such parking spaces can encourage the use of sustainable transport systems.

- Park and ride facilities for bicycle users with convenient interchange are a useful measure.
- Adopt a graded scale of parking fee that recovers the economic cost of the land used in such parking with the objective of persuading people to use public transport to reach city centers.
- Multilevel parking complexes should be made a mandatory requirement in city centres that have several high-rise commercial complexes and these can come up through public-private partnerships. These would be encouraged to go in for electronic metering so that there is better realisation of parking fees to make the investments viable and also a better recovery of the cost of using valuable urban space in the parking of personal motor vehicles.
- In residential areas also, the policy suggests changes in bye-laws to free public carriageways from parked vehicles impeding the smooth flow of traffic. It suggests making provisions in the appropriate legislation to prevent the use of right of way on road systems for parking purposes.

However, there is one provision in the NUTP on multi-level parking structures that is being misused by the state governments to sanction such structures in isolation from larger policy intent. The NUTP has allowed the state governments to award building bye-laws in all million plus cities so that adequate parking space is available for all residents, floor area laws are made more liberal and multi level parking is made mandatory. It goes on to say that mandatory multi-level parking complexes built through public-private partnership are needed in city centres that have several high rise commercial complexes; that such structures should also be constructed underground. In residential areas too, appropriate changes in bye-laws should be considered to free public carriageways from parking vehicles. As a result, state governments started to allocate funds under the Jawaharlal Nehru National Urban Renewal Mission scheme that was rolled out in 2009. This has become a loophole that will have to be plugged to make such investments and planning consistent with the overall principles of the NUTP.

National Sustainable Habitat Standards (NSHS)—operationalise demand management: These standards were formulated by the Union Ministry of Urban Development (MoUD) under the overall goals of the National Climate Action Plan to reduce energy and climate impacts of transportation. The section on sustainable urban transport in the National Mission for Sustainable Habitat talks about strategies, mission and action plans for moving towards sustainable mobility in urban areas. The draft policy also outlines strategies for creating a “parking policy for reducing parking demand”. The policy echoes the concerns and solutions provided by EPCA to the Supreme Court in the public interest litigation and NUTP, 2006.

Revision of Delhi Master Plan 2021—adopts demand management: At the city level in Delhi, the Delhi Development Authority (DDA) and its wing UTTIPEC revised and refined parking policy as part of its revision of the Delhi Master Plan 2021 and also part of the transit oriented development policy crafted for Delhi. This has outlined the key principles of the parking policy to be adopted as part

In areas designated for private parking, short-term parkers must be prioritised over long-term parkers in order to maximise turnover and enable economic vibrancy

of the Delhi Master Plan. The principles mostly reiterate what has already been established by EPCA, NUTP and NSHS.

They also state that in order to ensure accessibility to maximum number of people, parking for para-transport/ feeder modes is to be prioritised and subsidised. In areas designated for private parking, short-term parkers must be prioritised over long-term parkers in order to maximise turnover and enable economic vibrancy.¹

These measures have been further refined in the subsequent draft notification on transit-oriented development policy of the DDA. This has pitched for parking restraint within 500 meter radius around the metro station so that more people can be encouraged to shift to alternative commuting practices and maximise use of the transit line.

Conventional parking policies in Indian cities have always aimed at increasing parking provisions assuming that parking demand will only grow with motorisation

All cities need guidance

Though a policy mandate for parking restraint has taken shape at the national level and to some extent in Delhi, there is little experience in cities to operationalise parking policy as a demand management measure. In fact, local policies in cities have remained conservative, oriented towards increasing parking spaces to meet the ever-growing demand. Cities are only concerned with licensing policies for parking contractors, laying down rules for parking management and related traffic regulations. Being in the throes of explosive motorisation worsening pollution, congestion and fuel consumption due to growing dependence on personal vehicles, the cities must focus on the implementation of restraint policies on usage of vehicles is of critical importance. Unruly parking has also become a serious law and order problem. This is inciting road rage and even heinous murder and crime in neighbourhoods.

Urban local bodies and urban development departments across Indian cities are now expected to change the focus of parking policy based on principles of restraint. But there is very little policy or public understanding of the key elements and principles that make parking policy and can reduce parking demand and car usage to cut congestion and pollution and ensure climate mitigation.

This policy guidance is a primer that lays bare the essential elements of parking policy that can help to decongest as well as reduce pollution and fuel guzzling in cities.

This document is based on emerging principles from global experiences and practices, literature review and field assessment of local initiatives in cities.

Guiding principles for parking policy

Conventional parking policies in Indian cities have always aimed at increasing parking provisions assuming that parking demand will only grow with motorisation. Urban local bodies earmark as much public land as possible to allow parking and also construct multi-level car parks. They mandate that all buildings provide minimum specified parking spaces. Free parking is virtually allowed nearly everywhere. But this policy assumption is inconsistent with the principles of National Urban Transport Policy, National Habitat Standards for transportation and the newly emerging policies at the city level.

It is important to deepen the policy and public understanding of the guiding principles of parking policy.

Unlimited parking supply leads to more automobile dependence and congestion: Personal vehicles not only create pressure on road networks when in use but also on public land when idle. Globally, there is no evidence to establish that unlimited supply of parking spaces can help to reduce pressure and congestion on roads. On the contrary, easy, cheap or free parking induce more car usage. According to Paul Barter, parking expert from Singapore, unlimited parking acts like a fertility drug for cars.

Pressure on land: Vehicles remained parked for 95 per cent of their lifetime. This creates enormous demand for valuable urban land. Depending on the size of the cities and rate of motorisation, the annual demand for additional parking spaces can be equivalent to as much as 310 football fields in Delhi, 100 in Chennai, 58 in Chandigarh, 179 in Gurgaon and so on. This is a wasteful use of land. Surveys in key commercial areas in Indian cities indicate that personal vehicles occupy more than 85 per cent of the parking area but meet miniscule travel demand. Buses take up barely 4 to 5 per cent of the total equivalent car space (ECS) of parking spaces, but carry 20 times more people. Parking is thus taking away precious urban land from other essential services in cities.

Parking encroachment on public spaces and walkways compromise use of sustainable modes: Parking pressure is enormous on road sides, walkways and available surface areas in busy areas. Available data from the Wilbur Smith Associate Study of 2008 for the Union Ministry of Urban Development shows that a very high share of road network in most cities is under parking. This is more serious in smaller cities with close knit compact urban design. In Delhi, with the largest road network in the country, about 14 per cent of roads are under parking. In Jaipur, this share is 56 per cent while in Kanpur it is 45 per cent. Other cities including Nagpur, Surat, Patna, Kochi, Pune, Agra, Madurai, Bhopal, Varanasi, Amritsar, Shimla, Trivandram, Guwahati, Puducherry, and Ahmedabad have more than 40 per cent of their road network under on-street parking. This aggravates congestion and takes away safe walking space from people, forcing them to walk on the roads. If walking conditions continue to deteriorate, it will not only convert short distance zero emission walk trips to motorised trips but also compromise use of public transport like bus and metro as safe access to these modes will be compromised.

Cheap and free parking is a subsidy to car owners and loss to the local government exchequer: In all Indian cities, on-street parking is mostly free or is minimally priced—in fact lowest in the world. The costs of using valuable urban

As parking pressure builds up in land scarce residential neighbourhoods, brawls, road rage and even heinous killings become common

Buses, two-wheelers, cars, bicycles, emergency vehicles and para-transit must all be provided land equitably. This will encourage the use of alternate modes of public transport

land are not recovered through proper taxes and pricing. Even in expensive parking structures rates are minimal and are not adequate to recover the cost of investment. This is a subsidy. The amount of this subsidy will work out to be much larger if the rental or land cost is taken into account. Increased investment in expensive and prime areas of the city further enhances this subsidy as the parking rates are not expected to recover this cost. If pegged to the recovery of capital cost of parking structures, the parking charges will be anywhere in the range of Rs 50–60 per hour. But the existing rates in multi-level car parks are Rs 10 per hour. This also means that urban local bodies fail to garner enough revenue from this activity. Parking demand is market demand and its price should be market driven. The primary objective of parking pricing is demand management and not revenue generation. But, increasingly, these revenue heads are being listed as means to mobilise resources for public transport and local area improvement.

Parking pressures degrades the quality of life in residential neighbourhoods:

As parking pressure builds up in land scarce residential neighbourhoods, brawls, road rage and even heinous killings become common. This is the most ugly and scary social ramification of the parking crisis. This trend is likely to worsen as multiple ownership of cars increases. The residential neighbourhoods will never have enough land to provide for them. At the same time, parking is encroaching upon green areas and play grounds, and impeding approach to houses, bus stops, market places etc. Parking on road and footpath is blocking the access for emergency vehicles like ambulances, fire trucks, and police vehicles and also severely affecting safe walking and cycling by elderly people, children and differently-able people within the colonies.

Parking skews inequitous use of land: As the use of scarce urban land gets more skewed towards wasteful use of parking, there are serious concerns



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related to equitable use of urban land. A car needs about 23 to 26 sq m of land for comfortable parking and circulation space. But under the housing schemes for very poor households, the government allots only 18–25 sq m of land. Land currently devoted to parking can have more be allocated to schools, healthcare centres, old age homes etc. Space is also scarce for affordable housing in the city. But increasingly, high share of public land is ending up being used for vehicle parking to meet the need of the minority car owners. Moreover, policy obsession with finding more land for parking cars has led to the neglect of parking requirements of public transport buses, para-transit and bicycles. In fact, in Delhi, augmentation of the bus fleet has slowed down as the city is finding it difficult to find space to park the new buses.

Traffic and parking impacts of new developments in cities not accounted for: Commercial development taking place in Indian cities is without proper planning norms for access and mixed-use. Without parking restraints, this is leading to enormous traffic and parking impacts. There are no mitigation measures in place. Transit-oriented development will require densification so that more people can come closer to the transit lines and other urban services to maximise their use. This is expected to reduce dependence on personal vehicles. But densification cannot happen with an uncontrolled parking supply.

Parking supply is locking in enormous pollution and fuel guzzling and aggravating climate impacts: A low carbon and pollution growth path can be seriously compromised if unlimited parking supply continues to fan car ownership and usage. Moreover, studies have shown that cruising for parking space adds to traffic intensity and congestion that further leads to fuel wastage and higher emissions. But these impacts are not accounted for in transport planning.

Lack of awareness about parking impacts and growing hostility towards parking restraints: As the state of public transport, walking and cycling remains poor and alternatives are limited, a section of middle income and car-aspirant households in cities are becoming increasingly dependant on personal vehicles. This is creating a vested interest in car-centric policies and infrastructure. Local governments will have to take the lead in informing people about the benefits of parking restraint policies and build support for such programmes. Globally, it has been demonstrated that such measures open up a large number of alternatives for people in the form of car sharing, reducing unnecessary car trips, more efficient travel planning and sharing, and use of public transport and para-transit. Parking restraint and pedestrianisation creates a better walking environment and increases purchase decisions.

Local policies in cities largely remain conventional with the focus on providing more parking spaces. They only concern themselves with licensing of parking contractors and laying down minimal rules for parking, including parking charges.

Equity and safety: Parking provisions should be planned equitably amongst all modes of transport and users. Buses, two-wheelers, cars, bicycles, emergency vehicles and para-transit must all be provided land equitably. This will encourage the use of alternate modes of public transport. The planning of parking facilities should also consider safe and convenient interchange between various modes of transfer. At a broader level, the larger land-use planning should ensure better opportunities for better use of land, especially related to poorer households and essential services needed in neighbourhoods.

As the state of public transport, walking and cycling remains poor and alternatives are limited, a section of middle income and car-aspirant households in cities are becoming increasingly dependant on personal vehicles

Address accessibility barrier: One of the most critical features of a successful parking plan is the efficiency of its use and transfer from parking lots to actual destinations through walking and cycling or other modes of transport. To ensure this, interchanges have to be designed and maintained well. At the same time, universal access to the interchanges becomes very important. Well-designed roads, footpaths, crossovers, kerb-ramps, etc. become very important. The design and engineering specifications of these have been outlined by the Indian Road Congress Codes of India and Unified Traffic and Transportation Infrastructure (Planning and Engineering) Centre—Street Design Guidelines. The specifications for the materials have been incorporated in the Central Public Works Department—specifications and Delhi Schedule of Rates. Parking policy needs to ensure that parking does not create barrier and impede access.

Should cities anticipating explosive increase in vehicle numbers continue to provide for more parking by enhancing minimum standards? The global trend is not in favour of a yes to this question

Space efficiency and opportunity cost of land: Demand for parking spaces is an insatiable demand while availability of land in cities is a limited resource. Demand for parking spaces can only be met through efficient use of land coupled with parking pricing based on opportunity cost of land to ensure that parking spaces are provided by the city as a commodity and not as a necessity. Parking space allocated in any part of a city should be priced at the market rates of the land. We must ensure that parking provisions and pricing becomes revenue generating. At the same time, parking rates based on opportunity cost of land would safeguard it from misuse by end-users.

Protect green areas: It is clear that the increasing supply of parking spaces in a developing nation encourages people to buy more private cars and shift from the use of public transport to personal transport. Cities like Delhi, Mumbai and Bangalore have shown that such increase in demand of parking spaces has led to uncontrolled encroachment of public land and, more dangerously, public parks. In Delhi, some of these parks have either been developed into underground multi-level car parks and some into surface parking lots. Both are a source of irreversible environmental degradation. This has also led to serious opposition from the resident associations.

Reduce automobile dependence: The ultimate goal of a parking policy should be to reduce dependence on personal vehicles for daily commuting. Parking planning would have to adopt a two-fold method for use of public transport and penalty for the use of automobiles. Parking pricing should make car parking spaces a market-based commodity, supported by efficient enforcement of ‘no parking’ in areas not designated for automobile parking. At the same time, the funds generated from parking facilities should be diverted towards sustainable mobility options by improving public transport systems, workability and cycle-ability.

Change the way parking standards are set

There is considerable policy confusion today regarding the adequacy of parking supply. Across cities, urban local bodies are adopting building bye-laws setting parking standards for different building typology and land use. There is pressure to increase parking supply by reforming norms. This is the critical factor that needs reorientation.

Establish the goals of the parking policy: A parking policy should be able to reduce parking demand as well as traffic volumes and encourage use of public transport. This is possible only if parking provisions for personal vehicles are not considered to be a matter of public good. Parking for personal benefits inflicts enormous social, economic and environmental costs. Parking provisions will have to be limited to bring down pollution, congestion, improve road safety and ensure equitable use of land.

All city governments have established the convention of setting parking standards for different land use development and buildings. This is the regulatory tool that all local urban bodies enforce and all development agencies comply with. This has therefore led to the regulatory questions how parking standards are set and how this should be changed if it has to be a travel demand management tool.

The current practice of setting minimum parking requirements needs to change as this leads to unrestricted and wasteful supply of parking: The current approach is to set a minimum number of parking spaces that must be provided during any infrastructure development depending upon the zone and the type of development—residential or business. It is calculated as the ratio of number of parking space required per square foot or per dwelling unit. Indian cities have adopted different approaches for setting such standards. For example, while Delhi specifies a minimum number of parking slots per 100 sq m for different land uses, Kolkata and Pune have set a norm of slots per 75 sq m. Hyderabad on the other hand specifies a percentage of built up area. Mumbai fixes parking requirements on the basis of number of tenements and carpet area.¹ Standards are different for residential and commercial areas.

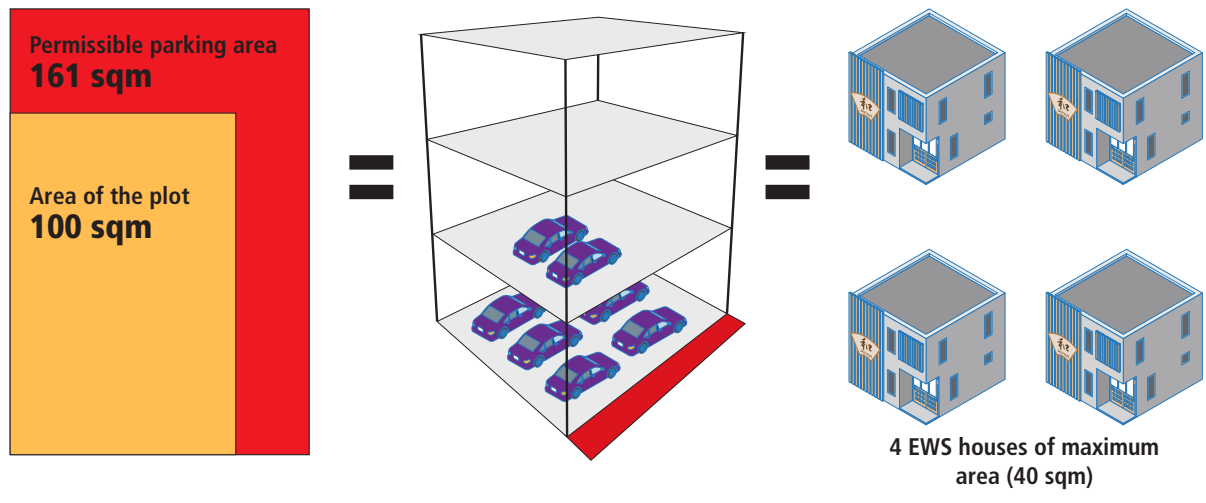
This approach has incited the trend towards unlimited supply of parking. Mumbai, for example, has witnessed an ever increasing supply of parking spaces owing to its lenient parking policy. Such a policy finds its shape in the floor space index (FSI) principle that has been long followed in Mumbai. It is calculated as the ratio of number of parking spaces required per square foot per dwelling unit. This has led to mindless development of parking lots in Mumbai, most of which remain heavily underused, raising questions about the need for such policies in the first place.

How much parking needs to be provided? There are often questions about the adequacy of parking norms. Should cities anticipating explosive increase in vehicle numbers continue to provide for more parking by enhancing minimum standards? Let us take the example of the Delhi Master Plan 2021 that provides for three parking slots per 100 sq m in commercial areas, two slots in residential areas, and 1.8 in government buildings. These are not counted towards allowable floor areas. Indian norms also allow private parking areas that cannot be shared with others. Should Delhi change this provision in view of rising

Globally, cities are now moving towards setting maximum limit to restrain unlimited supply of parking and car usage

Parking norms mandate wasteful use of valuable urban space

People must be made aware of the amount of valuable space that is wasted and is diverted from more useful purposes. For instance, as per the parking norms in Delhi, a 100 sq m plot built to the full allowable FAR (315 sq m) needs 161 sq m of parking space by law, which is more than half the area. If this is provided in the built-up area, it will gobble up one and half storey or space equivalent to four dwelling units for economically weaker sections.



motorisation? The global trend is cities reducing the parking requirements to contain motorisation. Are we ready to follow that?

Tokyo, with a higher car ownership than Delhi, allows only 0.5 parking slots per 100 sq m in its central business districts (see box: *Parking norms mandate wasteful use of valuable urban space*).

Bangkok, is finding that even after augmenting parking supply manifold it is fighting a losing battle—it has 338 parking spaces per 1,000 CBD (central business district) jobs—which is higher than almost all parts of the world other than US. Yet Bangkok is under severe pressure to provide more parking. By contrast, Singapore, Tokyo and Hong Kong together average a mere 67 parking spaces per 1,000 CBD jobs and find that quality of life and usage of space is much better. This only indicates the global best practice is moving towards limiting and not expanding normative provisions. They are reversing the policy of setting minimum standards.

Global move towards maximum standards to limit parking availability and restrain car usage: Globally, cities are now moving towards setting maximum limit to restrain unlimited supply of parking and car usage. According to Donald Shoup,² a leading parking expert in the US, urban planners typically set the minimum parking requirements for every land use to satisfy the peak demand for free parking. As a result, parking is free for 99 per cent of automobile trips in the United States. Minimum parking requirements increases the supply and reduces the price, but not the cost, of parking. They bundle the cost of parking spaces into the cost of development, and thereby increase the prices of all goods and services sold at the sites that offer free parking. Cars have many external costs, but the cost of parking in cities may be greater than all the other costs combined.

Governments are resorting to putting a cap on the absolute supply of parking spaces in the city centres. Parking maximum standards restricts the total number of parking spaces that can be constructed for any particular area. Through parking maximum, excessive supply of public parking is reduced. This also reduces the development costs.

Some cities have begun to remove minimum parking requirements for two reasons. First, parking requirements prevent infill redevelopment on small lots where fitting both a new building and the required parking is difficult and expensive. Second, parking requirements prevent new uses for many older buildings that lack the parking spaces required for the new uses.

Removing a parking requirement is not the same, however, as restricting parking or putting the city on limited parking. Parking requirements force parking spaces. Removing requirement of off-street parking gives businesses the freedom to provide as much or as little parking as they like. Cities can remove minimum requirements without imposing maximum limits, and opposition to maximum parking limits should not be confused with support for minimum parking requirements.

Indian cities have not moved in this direction yet. Only in Delhi as part of the Master Plan revision has it been proposed that a cap be put on parking provisions and anything above that be counted as part of the permissible floor area ratio. This is expected to actively delimit parking and work as a parking maximum standard.

In Seattle, a maximum of one parking space is available per 1,000 sq ft of downtown office area. The city is planning to extend the rule of maximum parking to areas outside the downtown area. The minimum parking requirements has been reduced from 1 to 0.5 spaces per unit of housing. San Francisco allows parking in only 7 per cent of the downtown building floor area. In 1975, Portland set an overall cap of approx 40,000 parking spaces downtown. During the 1980's, it was raised to 44,000. This has increased transit use from 20–25 per cent in the 70's to nearly 48 per cent in the 90's.

In Santa Monica, California, there has been a reduction in parking spaces from 2 to 1.5 for two-bedroom affordable housing units. Eugene, Oregon allows reduction of parking requirements on a case basis and documents the sufficiency of reduced amount of parking. Hartford, Connecticut allows reductions of up to 30 per cent of the required parking in exchange for implementing better and efficient transport demand management programs which include discounted carpool parking, rideshare promotions, subsidised transit passes and shuttle services to off-site parking.

London has abolished parking minimums for all boroughs and imposed maximums more uniformly. A study carried out by Fei Li and Zhan Guo found that this led to 45 per cent reduction in the number of parking spots built in the new developments and 60 per cent of such developments in inner London became car free. Sao Paulo has very recently adopted a new master plan abolishing parking minimums for the whole city.

The impact of the minimum parking requirements method of fixing the supply of parking lots/spaces, which most Indian cities follow, is not good. To prevent spill over, cities could price on-street parking rather than require off-street

There is a great potential to work with developers to incentivise transit-oriented development norms to improve overall access to property and minimise parking requirements

parking. Compared to minimums, market prices can allocate parking spaces fairly and efficiently.

Work with property developers to get the restraint strategies in place: A pilot study carried out by the World Bank shows that property developers comply with the minimum parking requirements in the hope that there will be sufficient off-street parking available to meet the actual demand for parking. Developers also want to maximise their gains from minimum parking areas. But experience in India shows that developers resent setting aside too much built-up space for parking as this is less remunerative than its use as part of the apartments. Therefore, there is a great potential to work with developers to incentivise transit-oriented development norms to improve overall access to property and minimise parking requirements. This will also improve competitiveness of the developed property.

A composite planning approach for a designated area that will comprehensively consider legal parking inventory, accessibility and connectivity of the area, modalities of shared parking, area design, pricing, restrictions, measures for spillover and overall enforcement through upgraded technical aids is required

In cities like Mumbai, developers have been provided the incentive of development rights for creating public parking facilities. This has led to indiscriminate construction disconnected from the overall area planning. In fact, some of these structures in the old mill areas have created more trouble than solutions. Entry and exist into these structures is ill-planned leading to further chaos.

Vancouver, Canada has successfully developed a flexible approach to parking management with developers. Sustainable Transportation Credit Program has already been proposed, which is based on the Leadership in Energy and Environmental Design™ (LEED™) green building rating system. Under this, the developers receive credits for reducing the number of parking stalls, providing parking spaces for car share vehicles and transit passes to building occupants.

Flexible standards: The transport community is beginning to understand the merit of setting flexible standards. Rigid and mandatory standards create more parking spaces than needed in areas that are well-connected with public transport or have travel demand management measures etc. Potential changes in parking demand after the location becomes well-connected and accessible to public transport need to be accounted for. For instance, in Connaught Place, an important business district in Delhi, parking demand dropped by 10 per cent after the introduction of the metro rail. Therefore, parking provision should be readjusted.

In many cities across the world, parking standards are now set flexibly. In Hong Kong, parking provisions are decided based on accessibility of an area. The final approval and provision of parking spaces in any proposed project is dependent on minimum parking standards, which need to be weighted with Demand Adjustment Ratio (DAR), Accessibility Adjustment Ratio (AAR) and Development Intensity Adjustment Ratio (DIAR). DAR is dependent upon the projected vehicle parking space requirement for the project. AAR is dependent upon condition of accessibility of the project site from the public transport stations. DIAR is dependent upon the intensity of the development and its vehicular trip attracting capacities. Hong Kong's parking standards ensure adequate parking supply. It limits parking supply to meet absolute demand and, at the same time, controls the increase in demand for additional parking spaces.

In several countries, residential parking requirements vary according to the level of accessibility. Cities assess parking on a case-to-case basis. For instance,

cities in Netherlands have parking standards (both minimum and maximum) that vary based on the accessibility of each location.

The Wales Parking Standards, 2008 define six parking zones, which are numbered as Zones 1 to 6. The distinction between each of the zones is largely based on varying levels of accessibility to services and facilities. The zone descriptions, and therefore parking requirements, range from Zone 1, which is applicable only to the city centres with high levels of accessibility to all services, to Zone 6, which is applicable to rural, countryside locations with low levels of accessibility. The parking requirements increase from Zone 1 to Zone 6 with the decreasing accessibility conditions.

Sign post

- Global experience has shown that parking availability will have to be limited and priced effectively to control growing dependence on personal vehicles.
- Instead of setting minimum standards that allows indefinite increase of parking supply, set maximum cap and also allow flexible standards to adjust to the change expected from demand management. This will help to prevent creation of more parking than needed which incites car ownership. It will also help keep a margin for limiting parking supply as accessibility of areas improves.

Parking: management and enforcement

Within the overall framework of restraint, the available legal parking areas will have to be managed well for optimal and efficient use of space, fare collection, and enforcement. This requires a composite planning approach for a designated area that will comprehensively consider legal parking inventory, accessibility and connectivity of the area, modalities of shared parking, area design, pricing, restrictions, measures for spillover and overall enforcement through upgraded technical aids. It is now globally accepted that all cities need delineation of parking management districts (PMD) within to address all these aspects together.

All available legal on-street and off-street parking sites need to be demarcated with proper marking and signages with number of parking slots and charges on a display board

Parking management districts are designated by the local authorities. Parking supply and rate are regulated within them. The purpose of each district is to provide, operate and maintain self-sufficient parking, along with better governance. This is very different from the spot-fixing approach that dominates the current policy under which parking congestions are identified and structured parking or off-street parking is planned in isolation in the hope that it will solve the congestions. But this does not work.

The government of India, vide its Gazette notification dated July 2015, notified modifications in the Delhi Master Plan-2021. PMDs have been introduced to manage the ever growing demand for parking. It has also been decided that revenue collected from PMDs will be used for improvement of local facilities as well as for a dedicated public transport fund. As a pilot exercise, the key components of PMD are:

- **Management strategies:** Parking supply needs to be planned and managed at the district level through development of off-street, shared parking facilities along with high-priced limited on-street parking for emergency use. Local authorities will manage all off-street parking supply through ordinances for development projects in the concerned districts. On-street parking supply will be managed through a district area plan. The management and fare collection of both on-street and off-street parking spaces should be dovetailed to encourage use of off-street parking.

The management plan will cater not only to the parking demand in the area, but also improve walkability, cyclability and use of public transport modes in the area. Facilities that are attractive, comfortable and convenient to all users must be created. An environment which maximises the accessibility and personal safety of all users and helps in overcoming fear, discourages crime and encourages people to actively use public environment must be achieved. Parking facilities must be efficient, easy to operate and maintain, space effective and have the appearance of the environment.

- **Pricing policies:** Parking pricing policy works together with improved transportation system in the designated area that also promotes local development. Revenues generated from parking facilities can be used for area improvement works of the neighbourhood. Pricing policy also helps to restrain car usage and ownership.

Paul Barter a global expert on parking strategies believes such area management will demonstrate a surprising abundance of available parking that, if managed well, can resolve local crisis.

Identify zones for area management plan

Urban local bodies should identify and develop detailed parking management plans for each designated zone including the city core, old city, residential complexes and industrial areas. Ground surveys of physical design and demarcation of spaces on ground and strict enforcement strategies must be conducted. Better enforcement will help to remove encroachments, lead to better utilisation of available road capacity and help to free up more space. The area plan will help to identify demarcated, designated, and managed parking areas. All available legal on-street and off-street parking sites need to be demarcated with proper marking and signages with number of parking slots and charges on a display board. The rest of the road stretch can be declared as 'no parking zones' in the area plan. Municipal corporation and traffic police will be responsible for penalising, removing or taking action against violators.

Street network plan for areas based on design guidelines earmarking on-street and off-street parking sites along with other street services including encroachment free pedestrians and cyclists facilities, vending zones, bus stops, public amenities, etc need to be prepared. This can help to reduce conflict between different uses and help to organise parking better. Public parking facilities should not be treated or provided as isolated projects for any one spot without addressing the larger area.

Area level parking management plans should be part of the overall area improvement plan

This is needed for effective utilisation of the capacity of roads and improved network. For instance, the UTTIPEC design guidelines in Delhi state that an area management approach provides more net available parking space in an area by increasing parking turnover through good design, management and pricing strategies. A portion of the revenue generated from parking should be used for local improvement of footpaths, cycle-tracks, and maintenance of facilities with involvement of the local communities.

Multi-level parking projects should not be implemented as stand-alone and isolated projects; only as comprehensive area management plans

These expensive projects can become viable only if they are integrated with common area management plans with strict enforcement and higher on-street parking charges. On-street and off-street parking (including multi-level) should be managed and enforced by a single agency. The area plan needs to inventorise surface and structured parking in all commercial, residential and industrial centres. Development of multi-level parking facilities, if required by the area plan, may be taken up in a public-private partnership framework, with private sector investments and responsibility of common area management of both multi-level and surface area parking in the designated area. The area plan can help to identify major corridors with mixed land use for redevelopment with areas for parking, green development and pedestrianisation.

It may be noted that both conventional as well as high-end automated facilities against conventional ramp-based parking facilities are very expensive. Conventional parking that requires 32 sq m of land for one slot costs around Rs 4–6 lakh/ECS. Stack parking that requires about 16 sq m of land per slot costs Rs 1.5 lakh/ECS, and fully automated parking requires 16 sq m per slot and costs Rs 8–10 lakh per slot. Local agencies are increasingly opting for the

Global experience has demonstrated that if on-street parking is used judiciously and strategically, it can actually help lower demand for scarce land for expensive off-site parking

fully automated technology option. This has high operational costs, which makes recovery all the more difficult. This means parking rates will have to be rationalised to recover these costs based on user pays principle.

There is global consensus that no policy for parking will work unless there is adequate, stringent and effective enforcement against illegal and wrong parking

Often these structures are built keeping in view the estimated parking demand in the area. In fact, these structures are designed to supply more than the current demand on surface. But after creating that capacity, the parking in the surrounding surface area continues as business-as-usual. Thus, both surface parking and structured parking together create more parking than needed and become magnets for even larger number of vehicles. This worsens congestion. This has been noticed in several cases in Delhi.

Define separate strategies for short-term and long-term parkers

As evident from the parking surveys carried out in Indian cities, those who park for a shorter time (2–3 hours) dominate on-street parking spaces as they prefer to come closest to their destination. These places can be earmarked properly on ground and priced in a way that people move out quickly. This will increase the turnover rate and maximise use—more people can use the available slots. But those who park for long period (7-8 hours), like office goers and the shop owners, should not be allowed to park on-street. They should be given space in more off-site and remote parking areas away from roads. This management of short-term and long-term parking spots should be supervised by a single public private agency. The agency can frame a common management framework for on-street and off-street parking and rationalise management and pricing for optimal use of both. All encroachments on land earmarked for public parking should be removed.



VIKAS CHOUDHARY / CSE

Need optimal mix of on-street and off-street parking management

There is a general notion in India that on-street parking causes congestion and should be removed entirely. It is assumed that if off-street parking facilities are expanded they will automatically suck away on-street parking and free up road spaces. Based on these assumptions, several orders and directives have been issued in Delhi demanding complete removal of on-street parking. However, global experience has demonstrated that if on-street parking is used judiciously and strategically, it can actually help lower demand for scarce land for expensive off-site parking. Off-street parking also affects walkways and open areas adversely. Entry and exit from high-capacity structured parking adds to local traffic circulation and congestion. International experience shows that efficient management and proper utilisation of legal parking lots can increase parking capacity by at least 20–40 per cent.

Parking facilities should be public, shared and priced to maximise efficient use of space. Conventionally, parking standards are applied in such a way that each premise and building is required to provide individual parking spaces that are often designated for exclusive use. But individually owned parking spaces block usage by other users in the neighbourhood and leads to sub-optimal use of the facilities and spill over. Instead parking facilities should be created in a manner that is shared between different neighbouring uses with varied peak hours of parking demand. For example, in commercial areas or mixed land use areas, parking facilities that are used by the office-goers during the day time can be used in the evening by cinemas, restaurants or neighbouring residences. This will enable efficient and optimal use of the scarce land, resources and finances. This is also important for old city areas where premises do not have individual parking spaces, and narrow streets constrict on-street parking that leads to enormous congestion. These areas will require off-site parking facilities that are common, public and shared to enable freeing up of inner roads, allow more pedestrian circulation and lower traffic volume.

St. Petersburg, Russia stipulates parking provisions for shared parking lots. A parking facility shared between residential and commercial areas doubles the efficiency of a particular parking lot by using the same parking space at staggered time periods. Availability of accurate parking demand studies for the concerned region is essential for the success of shared parking. Shared parking policies should be made available to all users as well as the management staff. This would surely make shared parking a good management tool. Parking must be constructed based on the average of peak and non-peak demands.¹

Integrated management of dedicated and shared parking

It is also important to promote integrated management of structured parking and surface area parking for most efficient use. This will promote efficient management and also allow rationalisation of parking charges in a given district. Enforcement of the whole parking management district by a single agency can ensure smooth movement between on-street and off-street parking facilities.

Parking enforcement

There is global consensus that no policy for parking will work unless there is adequate, stringent and effective enforcement against illegal and wrong parking. Once an area is planned with all infrastructure facilities, signages and rules focusing on efficient operation, its management has to be supported strongly

Stringent provisions by way of fines and other penal action need to be provided for violation of parking rules. There should be a zero-tolerance policy for parking on footpaths, walkways and cycle tracks

by efficient enforcement. This includes services that formulate a keen system solving parking problems. The key features of effective parking enforcement are attitude, consistency and fairness.

The important elements that require special attention for enforcement include:

- Development of a parking area management code that will codify all aspects of parking area management including demarcation, signages, metering, valet training and uniforms etc. This should be the basis of licensing the parking contractors. the quality of a parking facility should be considered as important as quantity, including aesthetics, security, accessibility and user information.
- Enforcement of parking and driving rules.
- Set up public information system. Motorists should have advance information on parking availability and travel options.
- Constant surveillance of parked vehicles, users and other facilities associated with parking areas.
- Enforcement of penal actions against violators.
- Training for correct driving and parking behaviour.
- Special efforts should be made to deal with peak-demand. The most desirable spaces should be managed to favour high-priority uses.

It is now becoming an established global practice to adopt universal codes to govern the management of parking areas that will uplift the overall quality and efficiency of the management of the parking areas

Benefits of stringent parking enforcement

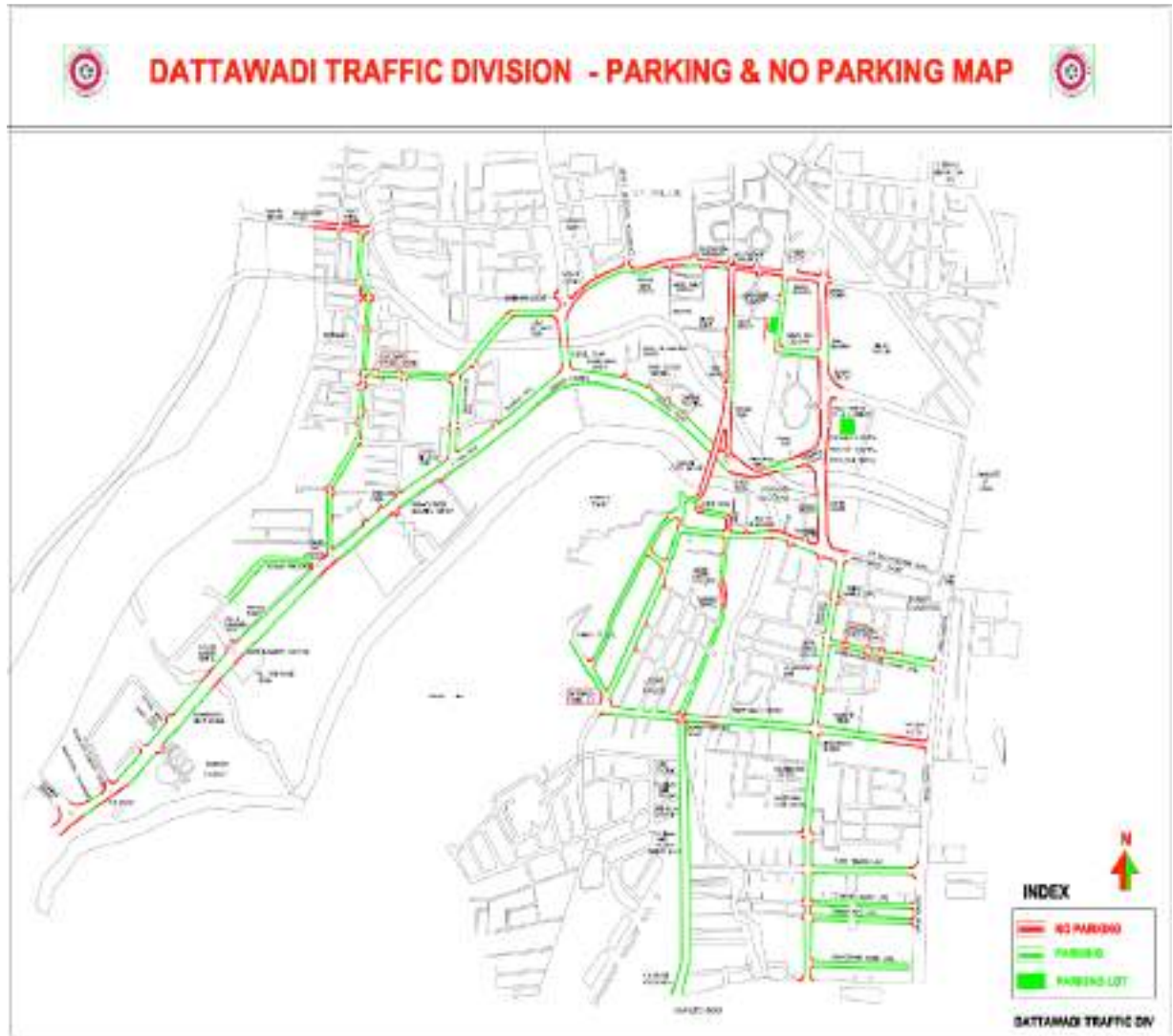
Proper vigilance and management will have to ensure that people cannot park illegally. This helps to lessen congestion, save time and fuel by reducing cruising time, reduce green house gases emission and lessens air pollution. Road safety and mobility is also improved. In fact, when parking is proper, pedestrians and cyclists can have barrier free sidewalks and footpaths. This reduces chances of accidents. Display boards and advanced information on availability of parking lots can curb this problem. This improves availability of parking spaces for shoppers and improves access for emergency services.²

Design guidelines for legal parking spaces

Urban local bodies should put out the list of legal parking sites and contractors on the website. The contract with the parking contractors must include the terms of service and conditions of improvement in parking management, including on-ground demarcation, signages and information systems for the parkers, metering system for parking charges, well-planned circulation systems etc. It must introduce metering and impose penalty for illegal parking. In a few cities in India, steps have been taken to reorganise on-street parking and create a map of legal parking areas and area with parking ban. (see box: *Pune–Pimprichinchwad map showing legal and prohibited parking areas*).

Different design approaches are emerging to demarcate on-street parking for efficient circulation. These are usually done in the form of parallel or angular parking to ensure that on-street parking does not block the carriage way, and parking access and exit do not disrupt traffic flow. This is also needed to ensure that parking does not interfere with other services on the road, like access to footpaths, spots for loading and unloading commercial merchandise, halting space for para-transit stands near bus stops etc. In Delhi and a few other cities, attempts are being made to come up with design guidelines as well as

Pune–Pimpri–Chinchwad map showing legal and prohibited parking areas



Design options of on street parking

Parallel parking

Angular parking



Source: CSE

implementation strategies. UTTIPEC, for instance, has adopted street design guidelines that include all aspects of street use and design. Design of parking is also being developed for specific areas in Delhi that indicates the nature of this intervention (Box: *Proposed design for demarcating parking spaces on ground in Delhi*)

Proposed design for demarcating parking spaces on ground in Delhi

Delhi-based group I Trans has proposed the following design for on-street parking on Asaf Ali Road, New Delhi. This shows off-street car and auto-rickshaw parking areas along the road



Source: ITrans, New Delhi

On-street parking of para-transit, like auto-rickshaws



Source: Oasis Designs Inc.

Enforcement techniques

Parking enforcement can be made efficient through varied means—use of technology and design and better policing. With the advancement of technology, there are many new ways which make supervision easier, thus generating higher revenues. Various techniques are available. For instance, License Plate Recognition technique (LPR) is a useful enforcement tool. It captures images of number plates to identify vehicles. When the registered vehicle comes in front of the security gate, the LPR camera identifies the number and opens the gate. If drivers are caught exceeding the time-limit, a fine is imposed. Galveston, Texas started using automated LPR technique from 2013.³ Wagga Wagga, Australia uses this technique to monitor the compliance of parking rules.⁴

Introduce stringent penalty for illegal parking

Stringent provisions by way of fines and other penal action need to be provided for violation of parking rules. There should be a zero-tolerance policy for parking on footpaths, walkways and cycle tracks. Parking enforcement is critical to the success of PMDs. Strong enforcement can decongest areas by ensuring parking is designated, make the area accessible by reducing unauthorised encroachment by cars and encourage use of off-street parking lots for long-term parking while restricting on-street parking for short-term occupancy only. It can also ensure adequate collection of parking revenue. By use of technology and automation, fare collection, parking management and dealing with violators can become hassle free for the enforcement agency and the end user.

In India, the Motor Vehicles Act, 1988, in its section for control, enforcement and violation of parking, lists all the possible reasons why vehicles should be fined for obstruction and wrongful parking. But it provides a meagre fine of Rs 100 for violations. Unless penalty is a deterrent, law is not followed. For instance, Delhi police has had success in bringing down drunken driving simply because the penalty is severe (imprisonment). The Motor Vehicles (Amendment) Bill, 2007 introduced in Rajya Sabha increases the penalty (Section 177) for violation of parking rules to Rs 500 for the first offence and to Rs 1,000–1,500 for the second and subsequent offences. This upward revision of the parking penalty will have to be made stringent to provide a better deterrent. State governments should have the right to fix the penalty as needed.

Enforcement violations

When parking norms are violated, penalties are paid in the form of fines, vehicle confiscation and driving license confiscation. These are done to create awareness as well as promote judicious use of parking lots.

In Delhi (and most Indian cities), traffic police has the responsibility of enforcement. But there track record leaves a lot to be desired. According to Delhi traffic police information, there are some 100 cranes for towing away illegally parked vehicles in the city. These cranes (35 owned by government and the rest private) operate across the 43 police circles in Delhi and are expected to handle huge volume of vehicles. Some 400–500 vehicles are towed away on a daily basis. The system has limitations. Currently, the penalty for unauthorised parking is a mere Rs 100 and, in addition, Rs 200 is charged for towing away vehicles. But private vehicle owners can get their cars released immediately by paying the charges and if this is not done then they need to get the vehicle released from the nearest police station. This system is sub-optimal and does

Inner city streets need to be pedestrianised as much as possible. Intermediate public transport system needs to be allowed with improved traffic circulation schemes for different modes

not lead to stringent enforcement and adds to the chaos in parking. Clearly, both the penalty and enforcement need to be upgraded for compliance.

The Delhi traffic police is working on introducing a system of electronic fines so that enforcement can be improved and compounded offences can be introduced. The introduction of this system needs to be expedited.

Globally, penal action has been made very stringent. In Toronto, for example, to reduce congestion, Toronto police service has taken up new initiatives to improve traffic flow. They have increased fines for parking on rush-hour routes. They have also implemented fixed fine rate of \$150 for any parking offences, in case of expired license plate validation stickers with a fixed fine of \$40.⁵

In New York, if one exceeds the allowed parking time or parks in a no parking area and fails to show a parking receipt in the windshield, a massive fine of \$65 is charged.⁶ A two-tier penalty parking scheme operates in London where penalty charge notice is issued if parking norms are violated. For less serious contraventions such as over-staying a parking meter, the full penalty charge is £80, and the discounted charge, if the payments are received within 14 days, is £40. But for more serious contraventions like parking on pedestrian crossings, bus stops and yellow lines, the rates are higher, the full charge and discounted rates being £130 and £65 respectively.⁷

Adopt parking area management code and revise parking contractor agreements for improved management of parking lots

Globally, it is now becoming an established practice to adopt universal codes to govern the management of parking areas that will uplift the overall quality and efficiency of the management of the parking areas. The terms of contracts for parking contractors are being worked out accordingly. The current conditions, as in force in Delhi, are minimal and are not oriented towards efficient management. It is important to reform the terms of contracts to include certification and verification, providing clear conditions to put onus for display, demarcation, contact details and rates on contractors, ensure all contractors introduce metering system, provide strict penalties against misuse, encroachment of public land or pedestrian space, parking for other purpose, uniform and identity cards.

Improve the vehicle information and ownership database

Currently, the system is deficient, so much so, that only 20 per cent notices for penalties, which are sent by post, reach the owners of vehicles. Under this system, it will not be possible to introduce improvements in governance. From January 2012, under directions from the High Court, high security registration plates (HSRP) have been made mandatory for all vehicles plying in the national capital. All vehicles have to get HSRP, an embossed and tamper-proof plate, by April 2014. In the process of getting this plate, the vehicle owner has to get their information validated by Road Transport Organisation which will improve the database of vehicle ownership and must be expedited.

Park-and-walk and park-and-ride system

This should be specially introduced in the old city, major commercial areas and new developments to decongest roads. “Park and walk” and “park and ride” facilities can be planned alongwith street improvement. This will

enable commuters, shoppers and office-goers to conveniently park and access destination within 10–15 minutes walking catchment of the parking facilities, reducing the traffic volume in congested areas. Park and ride should be encouraged in key public transport terminals and remote areas.

Parking in old city areas

This is a common challenge in most cities of India and will require more locally appropriate strategies. Off-street and remote parking areas around the old city area need to be identified so that on-street parking can be minimised in the narrow lanes. Inner city streets need to be pedestrianised as much as possible. Intermediate public transport system needs to be allowed with improved traffic circulation schemes for different modes. Encroachments from footpaths need to be removed to facilitate smooth pedestrian movement and enable ‘park-and-walk’ and ‘park-and-ride’ strategies. The movement of heavy vehicles needs to be banned in old city areas. Light commercial goods vehicles can be allowed restricted entry during the night and early morning at designated hours for loading and unloading. Appropriate sites for this may be identified.

Old Pasadena, California faced the problem of unauthorised and unorganised parking in the early 1990s. As a consequence, the quality of urban life declined, leading to loss of investment opportunities in the city. With a declining economy, the residents were apprehensive about installation of car parking meters fearing reduced inflow of customers. Old Pasadena parking meter zone was created and parking meters were installed. Revenue collected was invested in urban regeneration and renewal initiatives. Streetscape, parking, maintenance, beautification and safety projects were taken up with the funds from the parking meters. This reversed the urban decline and Old Pasadena became a sought-after destination for investment.

Strategies to curb spill-over parking

Even after creating parking facilities, there can be spillover from legal parking areas for various reasons. For instance, if parking charges are high in one place this may shift and spillover parking to inner streets with cheap and free parking. Spillovers can also happen from shopping malls if enforcement is lacking. Also, during special events, massive spillovers can happen. All these will require proper planning and pricing strategy.

There are several ways to curb spillover parking impact:

- Provide sufficient information indicating where vehicles may be parked.
- Use of regulations such as time limits and permit programs.
- In residential streets, the affected zones must be identified and demarcated, and parking pricing based on opportunity cost of land should be applied.
- Use of price control—charging from non-residents for using the residential streets and businesses’ to charge non-employees for using their parking facilities.
- Areas that experience spillover effects can be turned into PMDs and parking benefits districts (PBDs).
- Establishing a proper monitoring system and pricing, management and enforcement guidelines with the help of local authorities.
- In tow away, no parking and no halting zones, proper enforcement is needed
- Parking spaces must also be made available for buses, autos and other intermediate public transport modes. Currently, no parking management

and enforcement strategy includes providing parking spaces for such types of transport modes.

In London, the demand for parking spaces in burroughs are determined through transport assessment. Any development cannot exceed the parking supply beyond the estimate, unless there is a very good justification for doing so. Public transport accessibility levels (PTALs) have been adopted by the transport department.

Enforce public information system on availability of parking

A lot of time and fuel is lost by car users while looking for a parking spot. This leads to fuel wastage, additional pollution and also increases congestion. To avoid this, as part of the organised parking system, public information systems regarding parking supply availability in different zones should be provided through websites, on-ground display and digital media, to guide people in making travel mode choices. Public information systems for PMDs have to address the following:

Parking bundled with building purchases and rents, or as a flat annual or monthly fee, provides little incentive to use an alternative mode occasionally

- Location and capacities of various parking facilities in the concerned district need to be readily available at all times. Preferably, the same should be accessible either online or designated places.
- Information about parking rates, durations and penalties can also be displayed at various locations and can be available on mobile phones or through the internet.
- The information about other facilities near the parking lots should be available. This includes information regarding nearest public transport stations, interchange hubs, cycle stands, nearby landmarks, emergency services and public utilities.
- The information about penalties, legal action and other necessary action needs to be accessible.

Parking strategy for old city areas and busy commercial areas

In India, lanes and streets in historic towns were planned and developed at the time when vehicles were not part of lifestyles. Due to limited availability of space, drastic physical transformation cannot be expected in these areas. Chandni Chowk in Delhi is one such busy shopping place experiencing huge turnout of people. It is one of the oldest central business districts of Delhi. Due to large number of wholesale establishments, it experiences immense loading and off-loading activities on a daily basis makes it very difficult to access the markets and shops. Buses, autos, private cars and two-wheelers through the place, worsening the situation. In these areas, providing parking spaces is a concern, since it is not possible to build new parking due to paucity of land.

The ways by which parking woes can be healed are:

- No vehicles should be allowed close to the main shopping area. Walking within the inner core of the main market should be encouraged and only pedestrians should be allowed to enter. This would lead to easy movement. Private vehicle usage should be discouraged to lower the demand for parking spaces.
- The place is well connected with public transit system as well. In order to encourage people to use public modes of transportation, parking rates in

areas close to the market should be kept higher than spaces at a walking distance from the market. The rates should be progressive in nature, so that drivers pay higher for parking for longer durations, discouraging longer use of parking space by a single user.

- Use of remote parking to shift vehicles from the inner core is another essential step. This works as follows. People park their cars in parking lots situated towards or outside the periphery of the main area. They can then make use of the various riding facilities available like para-transit modes and other modes of public transport or walk to the inner core. Such measures assist in easing the congestion in the main areas, making the shops and small lanes more accessible to the pedestrians and also lowering the risk injuries to them. Recently, some parking lots have been proposed towards the periphery of the Chowk, encouraging park and ride and park and walk.

Parking strategy for high footfall areas

High footfall areas like exhibition grounds or shopping malls attract higher private vehicle trips. Pragati Maidan in Delhi and shopping malls are good example. Very often, one witnesses a spillover of parking to the main streets around the malls. Such a spillover takes the shape of unauthorised parking that leads to massive congestion. Such cases need special attention. Not only should excellent connectivity be provided to such areas by all modes of transport, but park and ride and park and walk principles along with discouraging parking around such places must be given priority too. Strict enforcement regulations also must be prioritised.

Parking management and transit oriented development

Transit oriented development (TOD) is now on policy agenda and this has implications for parking. UTTIPEC/DDA has proposed TOD policy for Delhi. TOD aims to promote mixed use development adjacent to public transit stations. It encourages live work settlements with a mix of residential, office, shopping, civic and entertainment land uses within walking distance from the centrally-located transit station.⁸ TOD is designed to reduce the need for parking. Transit accessibility, ridership, enhancing liveability, broadening housing choices, improving safety and reducing parking requirements are the key features of TOD.

Globally, TOD approach has emerged largely in cities that have traditionally seen low-density growth. This instrument has been effectively used to redistribute density in cities in such ways that more people come and live close to the transit line to maximise its use. There are several examples in the US— bay area rapid transit (BART) and Santa Clara county valley authority (VTA), San Francisco; Dallas area rapid transit (DART), Dallas, Texas; Massachusetts bay transportation authority (MBTA), Boston; Baltimore metro, Washington metropolitan area transit authority (WMATA), Washington D.C.⁹

Indian cities, where density distribution is already quite good, may require more infilling on a case-to-case basis. But the bigger opportunity of the TOD approach in Indian cities is the design interventions that are possible and are currently missing close to transit lines. Within this framework, parking plays a very important role. Within the TOD zone parking supply is limited, prices, car parking gets less priority in the building and urban space design and so on. This helps to restrain car ownership and usage. This strategy is critical as by

Research has shown how advance IT-based information on availability of parking can cut down unnecessary cruising and search traffic that intensify local traffic and add enormously to fuel guzzling, pollution and climate impact

Transit oriented development (TOD) is now on policy agenda and this has implications for parking. TOD encourages live work settlements with a mix of residential, office, shopping, civic and entertainment land uses within walking distance from the centrally-located transit station

2021, nearly 80 per cent of Delhi's population will live within 400 sq m from some metro station. If Delhi has to achieve 80 per cent modal share¹⁰ in favour of public transportation, this opportunity cannot be wasted.¹¹ (See box: *Draft regulations for parking in the transit oriented development policy for Delhi*)

Intelligent transport system in parking management

To cope with current problems in parking management, ITS is being used expansively in many parts of the world. Also known as advanced parking management system, it is mainly a combination of use of computers, communication and sensing devices in transport systems. It can help with efficient management of parking areas in terms of collection of parking fee and penalty, provide advance public information on availability of parking slots and so on.

In fact work of Donald Shoup has shown how advance IT-based information on availability of parking can cut down unnecessary cruising and search traffic that intensify local traffic and add enormously to fuel guzzling, pollution and climate impacts.

Draft regulations for parking in the transit oriented development policy for Delhi

The proposed draft regulations of TOD policy for Delhi of UTTIPEC says that 'No free or unpaid' on-street parking for private vehicles is permitted in the TOD zone. A fully subsidised parking facilities for intermediate public transport (IPT) and non-motorised transport (NMT) modes will be provided at all the terminals, stations and bus stops and on all roads with a right of way (ROW) 18 m and above and near all major public building and destinations. Parking facility for them is also permissible in the roads having vehicular movement. In areas where provision of adequate IPT and NMT parking is not possible within ROW, setbacks surrendered as public roads may be used for providing them the parking. It also proposes for parking for differently-able.

Each on-street parking space should be marked physically on ground and notified before commissioning, so as to facilitate enforcement by the law enforcement agencies.

No boundary: At grade parking, no boundary wall will be permitted around parking lots though permission may be given for fencing or cordoning off with low growing landscape, so that the visual connection between a parking lot and adjacent footpaths is maintained. Only permeable materials to be used for surface parking.

No parking on green space: Just like the Master Plan for Delhi 2021, TOD policy also emphasises prohibition of the conversion of any green or recreational space into parking and says that no parking will be permitted on, within or under any designated 'green public open space'.

Parking facilities: Parking may be in the form of stack parking, demarcated on-street parking (on the new roads or existing roads that are part of the TOD scheme), surface parking, podium parking, basement parking, stilt parking on surface or within basements or podiums, or any other innovative methods, and it shall be counted towards ECS requirement. Floor area which is counted in the FAR should be counted for parking ECS calculations.

Cycle parking: Secured cycle parking facilities (which are mandatory as part of the ECS requirement) shall be provided at least every 50-100 m.

Bangalore—on-street parking management with parking meters

Brigade Road is considered to be a shopper's paradise in Bangalore. The heavy traffic on this road causes frequent traffic jams. Bangalore Municipal Corporation (BMC) decided to remove parking on Brigade Road. But the shop owners on felt that such a move would adversely affect their businesses. A novel solution was implemented that has since been replicated in other shopping centers of the city. Under the earlier system, the BMC used to auction the rights to collect parking fees to private individuals. This was manually handled, hence there was no record of the number of vehicles or the money collected. Further, there was no time limit on parking.

Implementation strategies: Shopkeepers of Brigade Road formed the association Brigade Shops Establishments Association (BSEA), undertook surveillance to determine parking patterns in view of the location of offices, cinemas and restaurants and to assess the nature of parking users. The BMC entered into a memorandum of understanding with BSEA for the pay and park scheme on Brigade Road. A standard MoU with a "build operate transfer" partner was drawn up along with an amortisation schedule for the period of the MoU. The BSEA came forward to import eight parking meters from "Schlumberger Sema" in France and the contract for installation and maintenance was given to "Smart Parking International Pvt. Ltd." The machine functions on solar energy.

How the parking meter works? Park the car in the bay, insert money into the meter depending on the time limit of the shopper and obtain a parking ticket. Punch in the license number, data, starting time and ending time. Leave the ticket inside the car on the windscreen. If the parking time exceeds two hours or if the ticket is not placed in the car, traffic police will tow away the vehicle and a fine will be imposed. The meters installed were re-configured to accept Indian coins and instructions in English. Initially guards were employed at each parking meter to assist customers. The system can be monitored from a control room.

Resource mobilisation: The overall project cost amounted to Rs 38 lakh. The required fund was raised by BSEA through innovative ways of conducting various entertainment shows. There is also a contribution from each member of the association in the form of an enrolment fee of Rs 1,000 and a yearly membership fee of Rs 1,200. The overall project cost amounted to Rs 38 lakh.

Results and Impact: There are a total of nearly 85 parking bays, accommodating approximately 1,623 cars in a day on rotation. The revenue generated is three times that of the old system. Fifty percent of the revenue generated goes to BMC as its share (approximately Rs 1.5 lakh per month) and the balance is used by the BSEA for maintenance of parking meters and pavements and for the salary of the guards etc.

Sustainability: The automated parking system is technically sustainable as the system is mechanised thus preventing corruption. It maintains data on the number of vehicles versus the amount collected and the duration of time for which the vehicle was parked. The initiative is financially sustainable, even though the capital investment is high. The daily collection, which is done based on the parking rates, has proven to be profitable. For its long term sustainability, regular maintenance (at least once in 3 months) is required. The parking meter machine solar operated, thus saving electricity.

Lessons learnt: Introduction of technological tools in governance enables urban local bodies to keep pace with changing times and helps provide quick solutions to various civic problems. A similar initiative can also be extended to two wheeler parking. A key learning that emerges is that public-private partnerships can be forged if there is a realisation that there is much to be gained from such partnership. While proposing a parking system, there is a need for adequate survey for traffic inflow and outflow.

Cashless parking pricing in Nairobi

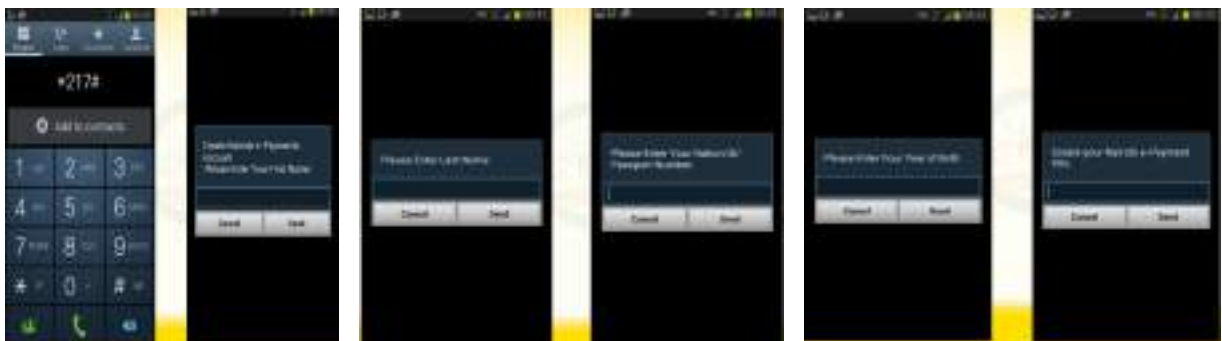
The Nairobi city county is responsible for regulating on-street and off-street parking, parking enforcement, imposing fines, revenue collection and developing parking standards for new development.

The city has variable pricing. In 2014, the county initiated a pilot project of cashless parking pricing system. This was aimed to increase the parking revenue as well as overcome the challenges of inadequate parking facilities, poor enforcement and manual records of revenue collection being practiced in the County. There was a growing demand for improved service delivery, monitoring and evaluation of revenue collection by zone and performance of parking attendants and a culture of non-payment. The other challenges include lack of adequate revenue collection and enforcement personnel.

How does it work?

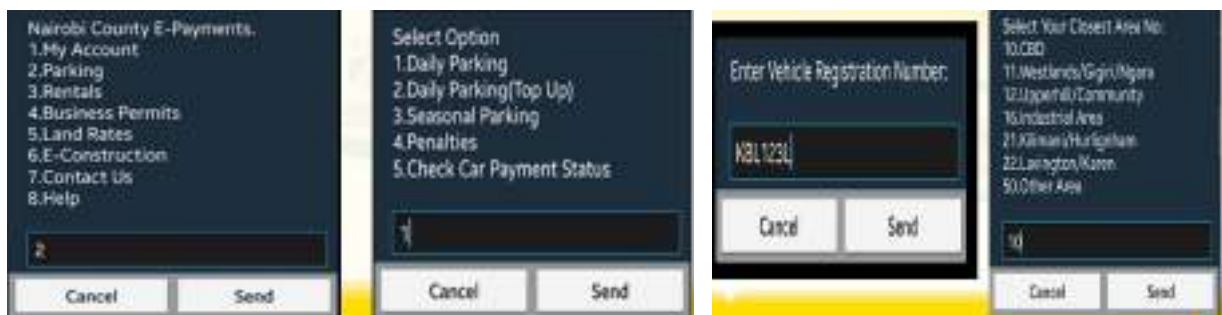
The cashless parking payment system does not involve paper parking tickets, rather payment is done through a phone. It allows the motorist to create an electronic wallet for the county from where services can be paid. Electronic wallet can be created as shown in the illustration. The next step is to load wallet with money. Money to transact is loaded from other channels e.g. Visa Card, Master Card, MPESA, available registered agents (banks) etc. As the county has many services to pay for the wallet, it provides a menu for each available service. To top-up from MPESA, one has to go to MPESA menu, enter the paybill number, the mobile number of the user is to be entered as the account number and indicate the amount and click ok.

Illustration: Wallet creation



MPESA transfers money to the wallet and a notification from the county is received about receipt of money in the wallet. The wallet is now ready for the payment. The wallet can be accessed through the mobile phone by dialling *217# which gives a USSD menu below.

Illustration: Wallet transaction



Once payment is done, an enforcement application is used where the enforcement officer keys in the vehicle registration number and confirms about the payment. In case of non-payment, the registration number is forwarded to the clamping team with the location of the vehicle to be clamped manually. The vehicle is also clamped on the system to ensure the penalty is charged to the customer. People who do not pay for parking have their cars clamped and a penalty of KSh 2,000 is charged which is to be paid within 2 hours of the clamping of the vehicle. Thereafter, the car is towed and impounded, for which the car owner has to shell out KSh 2,500 for towing and KSh 3,500 for impounding.

This system in the initial stage was not favoured by the cars owners or drivers. They were skeptical about its use and convenience. According to the county, this system has many benefits. The customer saves time as they do not need to look for attendants to pay for parking. The transaction process is easy and convenient as one can pay the parking fee remotely. The system is also secure as there is no involvement of cash in the payment process. In addition, the management gets to know about the revenue collection in real-time. The county officials are of the view that it is not difficult to come up with innovations and use technology, the challenge is to get user acceptance and behavioral change.

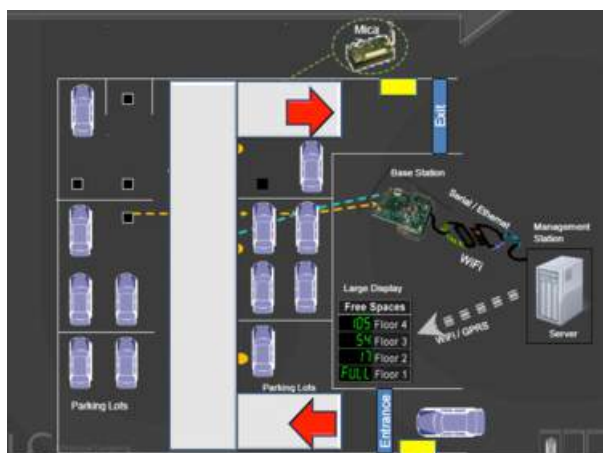
Parking management in Connaught Place—central business district, by Delhi integrated multi-modal transport system (DIMTS)

Issues with the earlier system: Exceeding parking (upto 3 times) without any circulation space. The vehicles were damaged. The user had to wait for long hours to find the parking space. There were also other issues like overcharging by the operator, haphazard parking management, theft and security issues and no data regarding parking collection.

Management structure: Municipal Corporation is the owner of project. The project was conceptualised, designed and implemented by DIMTS on behalf of NDMC. DIMTS is a project management company which is managing the overall parking. It has deployed its software system, manpower and supervisory team including control centre and data analytics. Systems are purchased based on competitive bidding basis with a five-year contract with vendor with monthly payment.

Parking management system technology: DIMTS off-street parking management system has different components: Informational display on occupancy, boom barrier, PC, CCTV, sensors at entry and exit, printers with bar code printing and hand held (cash and card payment). The comprehensive ITS used for parking management. Boom Barriers for the entry and exit of the cars.

Parking vacancy display: Communication of ETM through GPRS. Booth PC to Control Centre via Internet Dongle system. Information through mobile apps.



Sign post

- Adopt area-wide management plans for comprehensive and integrated parking planning.
- Design enforcement strategies for organised parking, prevent illegal parking and promote park and walk and park ride approaches.
- Adopt intelligent transport systems for management.
- Define and adopt national codes to govern the management of parking areas that will uplift the overall quality and efficiency of the management of parking areas across cities.

How to price parking?

Review of global good practices shows that governments are increasingly making an explicit link between parking policy and clean air objectives. For instance, Boston froze its parking requirements at a level that is only 10 per cent higher than the 1973 level to meet the federal clean air standards. In New York, very high parking fees and limited parking supply have lowered car ownership far below the average rates in other US cities. In Amsterdam parking fees have been expanded to meet EU directives regarding NO₂ and PM₁₀ emissions. Car plate numbers are registered with emissions information. Trucks are allowed to unload for a maximum of 15 minutes in spots where parking is not allowed. Zurich takes into consideration total NO₂ emissions in determining the amount of parking to be allowed.

Deepening policy and public understanding of this connection between parking pricing and strategies with clean air and environmental objectives in Indian cities is critical. Often resistance builds up as this connection is not clear to many. It may be recalled that when New Delhi Municipal Council introduced priced parking in Khan Market, a prominent commercial place in Delhi, there was strong resistance from the shopkeepers who could not see how this was connected with air pollution control.

The current pricing approaches are extremely flawed in Indian cities and such explicit link with environmental gains has not been established. In most part of urban India daily parking is free or very nominally charged in some targeted areas. Vehicles are also allowed to pay a one-time miniscule amount at the time of registration for parking for lifetime. This is an extremely perverse policy and contradicts the principles of National Urban Transport Policy (NUTP).

Cities need area-based parking management strategies linked to a comprehensive mobility management plans. This should incentivises public transport and non-motorised transport and disincentivise personal motor vehicle use.

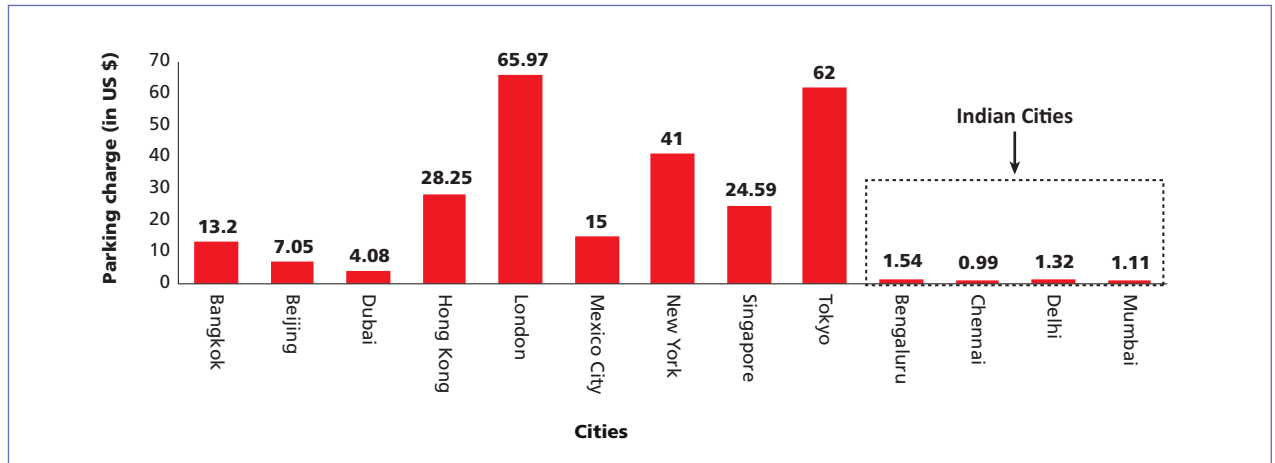
If parking is priced based on the local availability and demand it may change the travel behavior and commuting choices of people. A dynamic parking pricing system, with time-based variable pricing based on user characteristics analysis, parking accumulation system and parking duration studies for an area may be very useful for keeping a balance between the supply and demand of parking.

Currently, most parking is inefficiently priced, it is provided free, significantly subsidised, or bundled (automatically included) with building purchases and rents, forcing consumers to pay for parking facilities. When motorists do pay directly for parking, it is often a flat annual or monthly fee, providing little incentive to use an alternative mode occasionally. This will have to change.

Principles that govern parking pricing

It is now well accepted that parking facility for private vehicles must not be considered a matter of public service. It is not a basic necessity or a constitutional right. Parking prices need to keep in mind the following:

Eliminate free parking and introduce effective parking charges: Car users pay nothing or a small amount for using valuable public space to park their personal

Graph 1: Global parking charges

Source: Handbook of Urban Statistics, 2016, Ministry of Urban Development

vehicles. International studies show that Delhi and other Indian cities have the lowest parking charges in the world (see Graph1: *Global parking charges*).

Parking prices for private vehicles must include cost of land, capital cost, and operation and maintenance costs. Higher the parking fee, more attractive will public transport be.

Parking charges should be market driven: Construction of parking facilities for private vehicles should not be dependent on subsidies. End users should pay for such a facility at market rates. Currently, governments set a minimal parking charge. If parking contractors are seen charging more than that in peak time and peak areas it is seen as an illegal activity of the parking ‘mafia’. But such charges are the result of peak demand and what the market is capable of paying. If government is not regulating rent of property for private use why should it regulate use of public space for private use?

Introduce variable parking rates to influence behaviour: Several factors guide parking pricing. Location and land use is a critical factor. Generally, for parking charges in central business districts or commercial areas should be high. This is mainly because these areas have good public transport connectivity and high parking charge will help make a transition to alternate public transport modes, ultimately reducing traffic congestion.

Time and day is a critical determinant. Demand for parking is generally high during the peak hours of the day. Variable pricing is needed to enable quick turnover of parkers. Parking charges should be higher for personal vehicles.

Parking pricing principles are as follow:

- Experts take a view that the market will find the right equilibrium. Parking charges should be optimal and not be so high as to reduce occupancy drastically or too low that it induces more demand. The broad guidance should be that optimal pricing ensures that at least 85 per cent of the available parking spaces are occupied during peak time.
- Parking rates in commercial areas should factor in peak hours, duration of stay, commercial importance of areas.

- Parking rates must be rationalised for on-street and off-street parking. A difference should be maintained between on-street and off-street parking rates to incentivise use of off-street facilities.
- Charge convenient parking spaces higher than inconvenient places to reduce congestion in targeted areas and to influence commuting choices.
- Free parking should be allowed only for cycles, cycle rickshaws, battery operated vehicles and public transport vehicles.
- Higher rates should be set for bigger cars and SUVs.
- Do not allow annual or monthly lump-sum payment for parking in commercial areas. Annual passes allow unlimited use and do not reduce demand.
- The revenue from efficient parking management plans can be used to improve conditions for walking, cycling and public transport.

Most cities around the world put their parking revenue into the city's general fund. The critical question is how to return part of the revenue from parking to the local area without undermining the general fund

Local revenue return and parking increment finance for local area development: Revenue generation is not the primary objective of parking pricing. But if city authorities return a part of their revenue to pay for public transport infrastructure or local area development, people are more likely to support performance prices.

Most cities around the world put their parking revenue into the city's general fund. The critical question is how to return part of the revenue from parking to the local area without undermining the general fund. Experts suggest this can be done if the city returns only the subsequent increment in parking revenue that comes after the city begins to charge performance prices. This arrangement is called as parking increment finance.

Parking increment finance is like the tax increment finance, a way to pay for public investment in districts. Local redevelopment agencies receive the increment in property tax revenue that results from the increased property values in the redevelopment districts. Similarly business districts can receive increment parking revenue that results from performance parking prices.

On principle the parking rates should be rationalised and revised periodically to augment the revenue for urban local bodies. A part of this revenue should be spent on local area improvement and public transport augmentation. For example Montreal has implemented a new policy in 2010 which levies a special tax on parking spaces. The parking lots under residential areas are taxed at a lower rate as compared to central business districts, whereas the surface parking is taxed higher than structured parking. The revenue collected is expected to be used in improving public transit. In fact, the municipal administration and urban development of Hyderabad is planning to impose marginal property tax on private parking lots in residential areas to end the parking woes in the city.¹

Public, priced and shared parking: Parking should be shared jointly by different buildings taking into consideration the differences in the peak parking demand timings in the given parking district. (Table 1: *Peak parking demand for different land use types*). Consider the case of a locality where on-street spaces are allotted for use by local offices and restaurants. Since the peak hours of parking demand for the offices is during the day and that of the restaurant is

during the evenings, shared parking management can easily reduce the parking spaces as parking can be pooled efficiently by land uses with different peaks. So, 60–70 parking spaces can be shared between nearly 100 vehicles.²

Shared parking should be implemented through local zoning ordinances or through agreements between individual property owners.

Table 1: Peak parking demand for different land use types

WEEKDAY PEAKS	EVENING PEAKS	WEEK END PEAKS
Banks Schools Factories Medical clinics Offices Professional services	Auditoriums Bars and dance halls Meeting halls Restaurants Theatres	Religious institutions Parks Shops and malls

Remove employer’s subsidy for parking: Employees chose alternative to cars if parking becomes expensive at the work place. The most dramatic example comes from the World Bank. As part of a broader cost-cutting initiative, the World Bank management has done away with their standard policy of subsidising parking for its employees. Elimination of employee parking subsidy resulted in single occupancy vehicle commute share to fall from 69 per cent to 48 per cent in Los Angeles.

Varying approaches to estimating parking charges: There is no established formal practice of setting parking charges in Indian cities. However, globally, experts have worked out several approaches to estimate the cost of parking by including the larger societal and environmental costs, using techniques of evaluating parking and linking it to recover all costs. These techniques are now widely known but there has to be a policy approach to adopt such techniques for implementation (see box: *Methods to determine parking charges*).

Parking charges can make enormous difference: Globally, it has been established that amongst all restraint measures parking charges and enforcement work out to be the most effective restraint. This is illustrated in the experience of Singapore and Hong Kong. Singapore-based global expert on parking, Paul Barter, explains that both Singapore and Hong Kong have stringent approaches towards restraining car ownership and usage. Yet Hong Kong has been more effective in restraining car ownership—about 60 cars per 1,000 people which is much lower than 110 cars per 1,000 people in Singapore. Singapore has three times more private car kilometres of travel per person than Hong Kong. This is explained by the Hong Kong’s more expensive parking.

Parking pricing in residential areas: Residential areas will also require parking pricing strategy. Parking must be unbundled from property so that price of parking is not automatically included in the property price.

The Supreme Court has ruled that developers cannot sell parking lots separately as independent real estate units but this has not outlawed pricing of common parking and permits. Residential parking permits can be introduced for use of public spaces for parking in residential areas. Developers must hand the parking areas over to a management organisation like housing societies. They can find that charging and unbundling are useful ways to manage conflict.

Several benefits for the residents: All residents have assured parking spaces in

As part of a broader cost-cutting initiative, the World Bank management has done away with their standard policy of subsidising parking for its employees. Elimination of employee parking subsidy resulted in single occupancy vehicle commute share to fall from 69 per cent to 48 per cent in Los Angeles

Methods to determine parking charges

Currently, no authority in Delhi or any other city in India follows a proper methodology of determining parking pricing. Mostly, it is determined by two simple factors—one being a minor source of revenue while the other being driven by political motives. A quick review of the global literature on parking pricing brings out the following key elements and principles that determine and govern parking charges.

Estimate of external costs of parking: Parking charging is a method of levying charges on the motorists using a particular parking space with the main objective of reducing parking and traffic congestion. It is a market-based instrument which equates the price of using parking spaces with the cost (externality) of it. It is used to charge the users of a parking space an equilibrium price for negative externality such as time delays that they generate when the demand of using the parking space exceeds the supply. If the tax is set equal to an amount the marginal external costs in the optimum, parking traffic is reduced to a socially optimum level, thereby lessening congestion and associated externalities.

With the aim of making consumers of parking spaces conscious of the external costs that they impose on each other and subsequently making them pay for it, the goal of redistribution of the demand of using the parking area in time or in space, or shifting the demand to the use of alternatives, say, the public means of transport can be achieved. It would be impractical to measure and allocate to each road user his or her congestion cost and this is the reason why the problem of parking congestion should be looked through the lens of 'good mispricing'—where the 'good' refers to the parking area at a specified time and place and 'mispricing' refers to the paucity of supply in comparison to the demand for its use. The demand for a free good tends to be more.

Willingness to pay: Parking charging is premised on a fundamental concept in economics: levy a price so as to allocate a scarce resource to its most valuable use, as substantiated by the user's willingness to pay (WTP) for the resource.³ Doing so will correct the parking problem by influencing the decision making process of the resource users.

Ways to know the willingness to pay of individuals: It becomes imperative to introduce one of the many ways in which parking pricing can be determined in different Indian cities. This will be beneficial in internalising the external costs of parking in addition to reflecting a better, truer value of the land used for providing parking spaces. One such technique involves the use of contingent valuation research methodology.

Contingent valuation techniques are based on surveys for the assessment of non-market resources. While these resources do give people utility, certain aspects of them do not have a market price as they are not directly sold in the market. People receiving benefits from a beautiful view of a mountain would be a perfect example for such studies which would be tough to value using price-based models. Contingent valuation surveys are one technique used to measure these aspects. Contingent valuation is often referred to as a stated preference model, in contrast to a price-based revealed preference model. Both models are utility-based. Typically, the survey asks how much money people would be willing to pay (or willing to accept) to maintain the existence of (or be compensated for the loss of) an environmental feature, such as biodiversity.

The same concept of contingent valuation can be extrapolated to semi-market goods i.e. goods that are not explicitly commodities sold in the market yet form an example of goods that are priced in many regions. Parking is one such good. The amount a person is willing to pay for parking one's vehicle in a commercial business district, for instance, would

the neighbourhood. Pricing allows equitable sharing of local parking spaces.

Parking pricing in Indian cities

The current pricing approaches in Indian cities are extremely flawed. While daily parking is free or cheap, there is also a practice of a small one-time payment for registration for parking for a lifetime. This is an extremely perverse policy and contradicts the principles of National Urban Transport Policy (NUTP).

Parking pricing in Delhi

Urban local bodies decide the parking rates in Delhi and publish them. Parking areas in various zones are managed by private contractors appointed by the concerned authorities. The revenue is divided between the contractors and the concerned authority.

Till recently, the parking price applicable for various designated parking areas were somewhere between Rs 10 and Rs 20 for several hours. This was very low as compared to the opportunity cost of land where the parking facility was located.

On the other hand, a few multi-level automated parking complexes were planned and constructed by civic agencies with public money. These complexes had comparatively higher parking rate than surface parking lots. This could be around Rs 10–30 per hour. In such situations, these parking complexes were under-utilised as the cheaper rates in surface parking or free illegal parking undercut these facilities.

Civic agencies and contractors were not incurring huge losses in revenue. Yet they continued to put in additional public money or draw private investment to construct multi-level parking lots in the hope that on-street encroachment due to parking would reduce. The private developers who have put money in the multilevel car parks have been allowed to recover most of their investments by putting about 25 per cent of the facility under the commercial component.

Revised parking pricing in Delhi

Parking rates in Delhi have been revised based on the recommendations of the special task force (STF) set up by the Supreme Court asking for the adoption of the principle of travel demand management (see Table 2: *Revised rates in Delhi*).

Table 2: Revised rates in Delhi

South Delhi parking charges (in Rs)	Surface		Multi-level	
	Cars	2-wheelers	Cars	2-wheelers
1 hour	20	10	10	7
Every subsequent hour	20	10	10	7
Upto 12 hours	100	50	60	35
Upto 24 hours	200	100	60	35
Monthly–day pass	1,200	600		
Monthly–day and night pass	2,000	1,000		

(Rates mentioned were notified by South and East Delhi Municipal Corporations and are in effect since 1 November 2014)

North Delhi parking charges (in Rs)	Surface		Multi-level	
	Cars	2-wheeler	Cars	2-wheeler
1 hr	20	10	10	7
Every Subsequent Hr	20	10	10	7
Upto 12 hrs	100	50	60	35
Upto 24 Hr	200	100	60	35
Monthly- day pass	1500	500		

(Rates mentioned were notified by North Delhi Municipal Corporations and are in effect since 1 November 2014)

Global practices in parking pricing

Worldwide, parking pricing strategies have been deployed to control pollution and congestion. **Victoria, British Columbia**, is a commercial center for the region which has a population of 0.33 million. Victoria itself has a population of 80 thousand. The city's downtown has paid parking spaces for about 11,000 vehicles. This includes 1,900 on-street parking spaces and the rest in the form of parking lots and garages. On-street parking for first hour is available at a charge of \$1 and for every subsequent hour it increases by \$2. The charges for off-street parking lots and garages are \$1 per hour. In 2009, the city earned \$15.4 million in annual gross revenues from parking spaces.

City Development Corporation of San Diego conducted a pilot program in targeted sections of the city's downtown and identified on-street parking spaces in the area and categorised them into differential parking based on the levels of congestion in the area. In high demand areas, the parking fees were established at \$1.25 per hour and kept as low as \$0.50 in peripheral areas. The differential parking charges reduced the demand of parking spaces in congested areas quite drastically.

Strong penalty and enforcement in cases of violation of parking rules improves traffic situation considerably

City of San Francisco had introduced parking meters in 1947. This controlled the demand for parking spaces. The administration charged for parking during the working hours on weekdays and made on-street parking facilities free on the weekends. With the passage of time, the working hours of the city kept on transforming. By 2009, most of the work centres stayed open till late on weekdays and worked even on weekends. This induced higher demand of parking spaces on weekends as compared to weekdays. After analysing the whole situation, the city administration recommended increasing the hours for priced parking to match with the prevailing working hours and also made the weekend parking heavily priced. This made the off-street public parking lots more attractive thereby reducing load on the on-street parking spaces (see Box: *SFPark, performance parking pricing*).

New York has enforced very high parking fees while limiting parking supply. This has lowered car ownership far below the US average. **Bogota** has removed limit on the fees charged by private parking companies. The revenue goes to road maintenance and public transit improvement. **Shenzhen** has hiked parking fees during peak hours. This has led to 30 per cent drop in the parking demand. **Bremen** does not allow free parking in the city centre. Parking charges are much higher than public transport cost. **Barcelona** takes part of the parking revenue to a special fund for mobility purposes. **London** channels parking income to transportation projects.

Strong enforcement and penalty

Tokyo enforces very high penalty for violations of parking rules. Private firms are allowed to issue tickets for parking violations. If the cost of penalty is taken into account this makes on-street parking much more expensive. **Antwerp** invests parking fines into mobility projects. **Redwood City, California** set meter rates to achieve an 85 per cent occupancy rate for on-street parking downtown, the rates both by location and time of day, depending on demand. The city returns the revenue to the metered districts to pay for public parking structures, police protection and cleaner sidewalks. Property owners all supported the new policy of parking when they learned the meter revenue would pay for added public services in the downtown business district and the city council

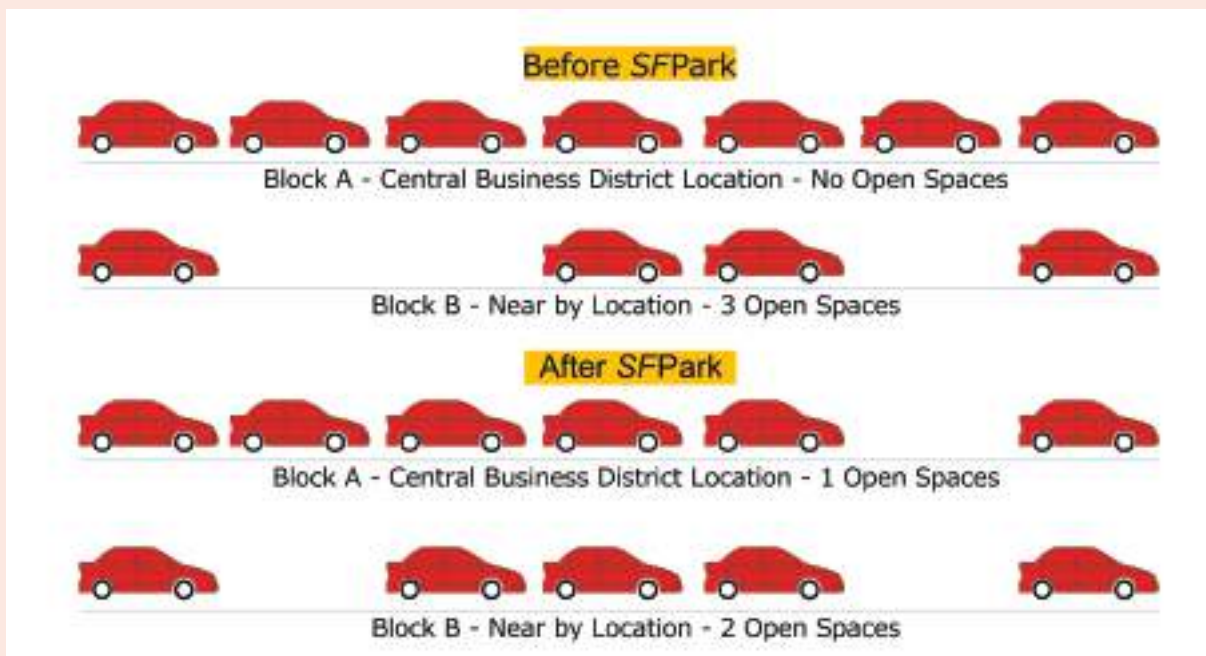
SFPark, performance parking pricing

San Francisco has embarked on an ambitious program, called SF park, to get the prices of on-street parking right. If too many curb spaces are vacant, the price will go down, and if no curb spaces are vacant, the price will go up. Wanting more revenue will no longer justify raising prices. The city has installed meters that charge variable prices and sensors that report the occupancy of each space in real time. The city has information on “on street” occupancy rates and the ability to adjust prices in response to the occupancy rates. The city intends to adjust prices once a month, never by more than 50¢ an hour. In this strategy one cannot set the right price for curb parking without observing the occupancy. By nudging prices up or down in a trial-and-error process, the city seeks a structure of prices that vary by time and location throughout the city, yielding one or two open spaces on every block.

Figure 1 shows that nudging up the price on crowded Block A by enough to shift only one car to less crowded Block B can significantly improve the performance of the transportation system. This shift will eliminate cruising on Block A and take advantage of the empty spaces on Block B. Even if all the parking spaces are occupied on all the nearby blocks, shifting only one car per block from on-street parking space to nearby off-street parking can also eliminate cruising.

Beyond managing the curb parking supply, SFPark can help depoliticise parking by stating a clear principle for setting the prices for curb spaces. The demand for parking will set the prices. After shifting from a revenue goal to an outcome goal for the parking system and choosing the occupancy rate for the desired outcome, the city council will no longer have to vote on parking prices.

Figure: Performance Prices create open spaces on every block



adopted it unanimously. Performance parking creates a few on-street parking vacancies so visitors can easily find a space, the added meter revenue pays to improve public services, creating political support for performance prices.

Other cities have also begun to adjust their parking meter rates to ensure the availability of parking space. The US department of transportation have awarded grants to Chicago, Los Angeles and San Francisco to test performance prices for on-street parking and Washington D.C. has already started them. Pasadena and San Diego return meter revenues to enhance public services in the metered districts.

Benefits of parking pricing

Well-managed and organised parking with transparent pricing system builds public confidence and acceptability. Also, parking revenue can be used partly for city public transport improvement and walking and cycling facilities, car free public spaces, encourage people to walk and use transit system. People understand the benefit in terms of quality of public life, vibrant public spaces, reduced congestion, improved air quality and increased road safety.

Experts point out that the reduction in traffic will come not from fewer vehicle trips but from shorter vehicle trips

The basic idea is effective pricing trigger many commuting decisions. People can combine trips, avoid peak time, share cars with family members and colleagues, look for cheaper parking areas off-street, take an auto or a taxi, walk or cycle, take metro or a bus—especially if they are a long-term parker, and reduce parking durations.

Experts point out that with reliable information on parking, drivers will no longer have to arrive at their destinations 5 to 10 minutes early to search for a curb space. Vehicle trips will be 5 to 10 minutes shorter. Experts point out that the reduction in traffic will come not from fewer vehicle trips but from shorter vehicle trips.

It is explained that performance prices promotes faster turnover because drivers pay for as long as they park. If a parking space turns over twice during the evening, each space can deliver two groups of diners to a restaurant. For both reasons—higher-occupancy vehicles and faster turnover—performance prices for curb parking will attract more customers to a business district.

Residential neighbourhoods and local commercial area parking plots need to have only neighbourhood level commercial shops in the parking so as to not attract unintended or induced car traffic from distant areas and should serve the neighbourhood within a walking distance.

Overall car users benefit: It is important to deepen public understanding of the benefits of organised and priced parking. All car users must get reliable and predictable information about parking availability and reduce cruising time, fuel cost and pollution. They must enjoy efficient billing, making payment more transparent and accurate. Finding a parking space quickly will decrease traffic chaos due to indiscriminate on-street parking.

Non-car users also benefit: Good parking management also benefits non-car users. These measures protect footpaths and allow barrier-free walking. This frees up public spaces for cycle tracks, rickshaw parking, autorickshaw-parking, play grounds etc. These measures also improve access to bus-stops, metro stations, safety of children, women and elderly people. Shops become

more visible and the shopping experience is enhanced. It also makes it easier for emergency vehicles like ambulances, fire trucks, police, etc. to negotiate. Overall, reduced dependence on cars reduces air pollution, GHG emissions, congestion, noise and fuel loss.

Cities across the world are campaigning to win public transport for parking measures.

- **Downtown Pasadena, California Redevelopment:** Parking Meter Zone (PMZ)—Each parking meter has a sticker saying, “Your Meter Money Will Make A Difference: Signage, Lighting, Benches, Paving.” Dedicated revenue from parking is invested in area improvements, including new street furniture and landscaping, police patrols, street lighting, street cleaning, pedestrian facility improvements and marketing.
- **Ventura, California** municipality, has introduced a bye-law that states, “All moneys collected from parking pay stations, and meters shall be placed in a special fund—devoted to purposes within the parking district. This increases residents’ support.
- **Aspen, Colorado: Downtown parking pricing** has a marketing campaign to let motorists know about the meters and parking violations. This reduces parking problems and was supported in a municipal election by a 3-to-1 margin.

One time parking charges in Delhi: Wrong practice

In Delhi, private cars are allowed to pay a one-time charge that is collected at the time of registration. One time parking charges are against the key demand management principles of parking pricing. This insulates parkers and fails to make pricing demand responsive. This cannot influence commuting behaviour and choices.

These are fixed as follows:

- Personal four-wheeler vehicles costing up to Rs 4 lakh pay Rs 2,000 for life time and those costing more than Rs 4 lakh pay Rs 4,000.
- Commercial vehicles are charged annually at the time of fitness check. Buses pay Rs 4,000, RTV: Rs 2,500, goods vehicles (tempo): Rs 2,500, goods vehicles (trucks): Rs 4,000.
- These charges are collected by the transport department and passed to Municipal Corporation of Delhi (MCD). These charges are called MCD tax. The corporation has the authority to determine the rate of fees from time to time.
- During 2011–12, the MCD collected over Rs 120 crore from these charges.

Bengaluru: Differential parking pricing

Bengaluru has a differential parking system which entails higher fees in central business districts. The quantum of the parking fees is fixed by the 198 corporators. A plan approved by the state government mentions zoning localities into A, B and C categories based on the traffic flow as reflected in passenger car units and mass transportation facilities. Category A will comprise areas like commercial street and MG Road, where traffic flow is high and public transport connectivity is good. Such roads will have the highest parking fee. Areas with moderate public transport accessibility will fall under Zone B. Zone C will comprise areas with low public transport connectivity and vehicle flow. Parking fees here will be lowest.

Box: Application of parking pricing principles in Delhi: Snapshots of a study by School of Planning and Architecture

A team of researchers in School of Planning and Architecture, New Delhi, led by Prof Sewa Ram, has conducted a study on parking pricing in Delhi and generated insightful data that can provide critical policy input. Some of the key highlights of the study are as follows:

Differential parking pricing: Parking pricing policy needs non-uniform parking pricing slabs based on surrounding land use, duration, purpose, mode and priority or preference to public transport. This needs accurate monitoring of parking duration by parking monitoring systems and heavy parking fee for not adhering to the parking duration. Creating intermediate parking lots and connecting them with feeder system and varying parking fee in favor of high occupancy vehicles like passenger buses rather than single occupant vehicle like a car.

Distance from public transport nodes is a critical factor in determining this variable parking rate. As we move away from the public transport station, the parking charge decreases. The charges near the public transport station should be kept high so as to shift the personal vehicle user to public transport (see Graph 1).

Demand responsive parking pricing: Parking pricing should vary

according to the demand during peak and non-peak hours. The rate has to increase if the demand increases but at the same time ensure that at least 85 per cent of the parking lot is full. Parking rentals are inversely proportionally to available parking lots and dynamic pricing is applicable to already parked vehicles also. A vehicle which is parked in lean hours but remained in the lot during peak hours shall be incrementally charged and overall parking rental shall include higher prices of peak hour. This mechanism will increase the parking turnover as users would try to minimise parking duration during peak hours (see Graph 2).

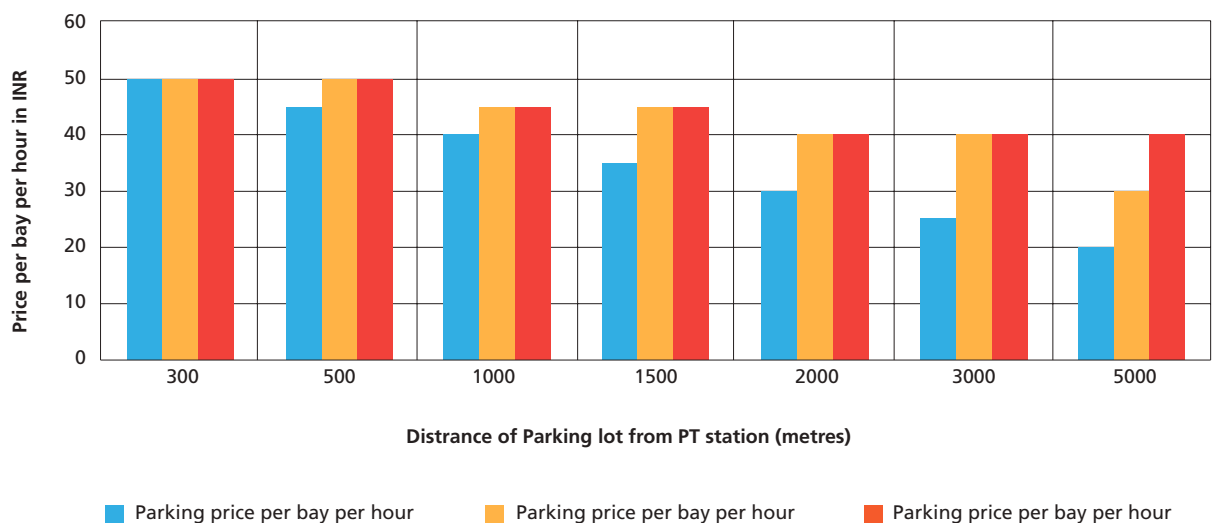
Users get motivated to stagger parking into lean hours and short duration during peak hours. This leads to higher parking turnover indicating better efficiency (see Graph 3).

To generate similar revenue as from dynamic pricing, a flat rate of Rs 60 per hour is levied. Further, the traditional approach of flat rate has no motivation for staggering the demand or short-term parking.

Parking charge analysis of some off-street parking in Delhi: Sher Shah Suri Marg, Opposite Delhi High Court:

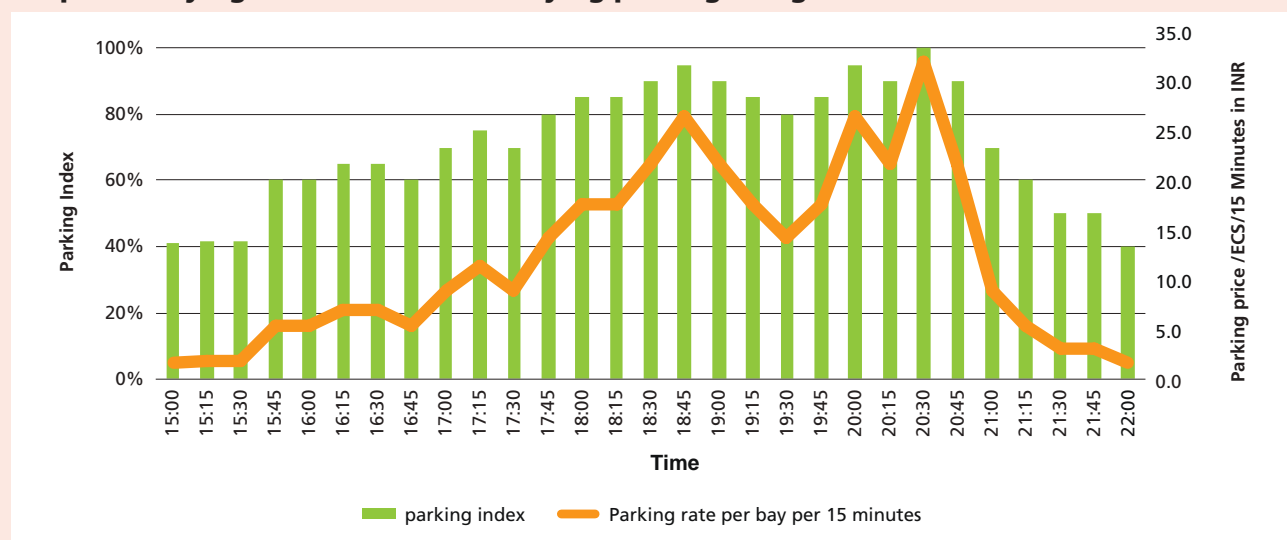
The multi-level parking was initiated in 2008 and was open to public in 2012, built by DMRC. On surface it can accommodate 300 cars, after the multi-level car parking was constructed, it can accommodate 1,467 cars at six different basement levels and an additional 51 cars for emergency purposes (see Table 1).

Graph 1: Differential parking pricing with respect to parking location distance from public transport station

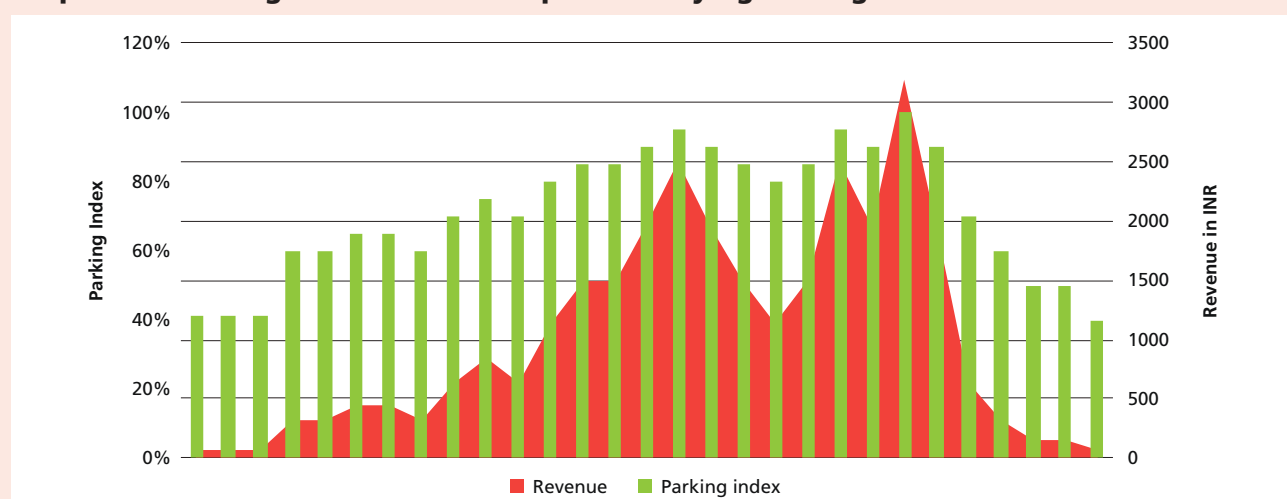


Source: Sewa Ram 2015, Parking pricing system, collection, mechanism, and external cost of parking, School of Planning and Architecture, in CSE Parking Management Workshop, November, 2015

Graph 2: Varying Demand leads to varying parking charges



Graph 3: Revenue generation with respect to varying Parking Index



Source: Sewa Ram 2015, *Parking pricing system, collection, mechanism, and external cost of parking*, School of Planning and Architecture, in *CSE Parking Management Workshop*, November, 2015

Table 1:

Plot area	9,864 sq m
Land cost*	Rs. 110 crore
Construction cost	Rs. 182.71 crore
Total accumulation	21,995
Peak accumulation	2,292
Supply ECS	1,467
Gap between supply and demand	825
Parking index	1.43
Parking turnover	13.76
Short-term parking (%)	58.6
Long-term parking (%)	41.4

Capitol Point, Connaught Place

Capitol Point enjoys prime location on Baba Kharak Singh Marg, Connaught Place. It was open to public in 2012 and was built on built operate transfer model of PPP (public-private partnership). It works on advanced pallet technology which moves on conveyor beds and includes the jig-saw puzzle system. Parking fee structure: Rs 10 for the first hour and part thereof, Rs 10 per additional hour (see Table 2).

South Square, Sarojini Nagar

DLF, under the public-private-partnership module with New Delhi Municipal Council (NDMC), has developed an automated multi-level car parking facility on a built operate and transfer basis in Sarojini Nagar. The ground and first floor would have a total of 105 commercial units while the 2nd-8th floors are

Table 2: Cost and turnover of multilevel car park

Plot area	7,555 sq m
Land cost*	Rs. 1.06 crore
Construction cost	Rs. 220 crore
Total accumulation	33,792
Peak accumulation	2,273
Supply ECS	1,408
Gap between supply and demand	865
Parking index	1.08
Parking turnover	9.36
Short-term parking (%)	21.9
Long-term parking (%)	78.1

Table 3: Economics of multi level car parking

Plot area	3,789 sq m
Land cost*	Rs 2.77 crore
Construction cost	Rs 157.95 crore
Total accumulation	28,648
Peak accumulation	1,598
Supply ECS	824
Gap between supply and demand	774
Parking index	1.51
Parking turnover	11.48
Short-term parking (%)	64.3
Long-term parking (%)	35.7

Source: Sewa Ram 2015, Parking pricing system, collection, mechanism, and external cost of parking, School of Planning and Architecture, in CSE Parking Management Workshop, November, 2015

dedicated to the car park for 824 vehicles. Parking fee structure: hour (see Table 3).
Rs 10 for the first hour and part thereof, Rs 10 per additional

Table 4: Account for internal Cost of Parking

S. no.	Structure Name (Site)	Space in the structure	Pollutant	Emission per Space (gm/day)	Emission per Space (lb/day)	Emission Cost (\$/lb)	Emission Cost (₹/lb)	Emission Cost (₹/day)	Total Emission Cost (₹/day)	Total Emission Cost (₹/hour)
	1	2	3	4	5	6	7	8	9	10 = (9/24)
1	Shersha Suri MLCP, Opp. High Court	1518	CO	64.11	0.14	2.22	359.86	50.86	60.84	2.54
			NOx	4.73	0.01	5.88	953.15	9.93		
			PM10	0.03	0.00	4.87	789.43	0.05		
2	Capitol Court, Connaught Place	1408	CO	64.11	0.14	2.22	359.86	50.86	60.84	2.54
			NOx	4.73	0.01	5.88	953.15	9.93		
			PM10	0.03	0.00	4.87	789.43	0.05		
3	South Square, Sarojini Nagar Market	824	CO	64.11	0.14	2.22	359.86	50.86	60.84	2.54
			NOx	4.73	0.01	5.88	953.15	9.93		
			PM10	0.03	0.00	4.87	789.43	0.05		

Table 5: External Cost Parking

S. no.	Structure Name (Site)	Total Cost per Space (₹)		Amortization Cost/Space (₹)*	O&M Cost for parking (₹)**	O & M Cost (₹)#	O & M Cost (₹)	Internal Cost (₹)	Internal Cost (₹)\$	Internal Cost (₹)\$
		Year Built	2015			Per Month	Per Month			
		1	2	3	4	5	6 = (5/(30*12))	7	8 = (4 + 7)	9 = (8/days)
1	Shersha Suri MLCP, Opp. High Court	1,536,771.24	3,470,319.08	35,696.00	164,754,500.20	457,651.39	301.48	35,997.48	1,199.92	50.00
2	Capitol Court, Connaught Place	2,339,656.61	4,799,822.23	49,372.00	180,763,032.40	502,119.53	356.62	49,728.62	1,657.62	69.07
3	South Square, Sarojini Nagar Market	2,507,190.70	4,750,753.76	48,867.00	118,873,439.92	330,204.00	400.73	49,267.73	1,642.26	68.43

Note: *R = 12%, Period = 30 years; **4% of capital cost; #period = 30 years; \$Days = 30; \$\$Hour = 24

Sources: Sewa Ram 2015, Parking pricing system, collection, mechanism, and external cost of parking, School of Planning and Architecture, in CSE Parking Management Workshop, November, 2015

Table 6: Total Cost of providing multi level parking structure

Multi-level parking structures	Internal cost (per space/ hr)	External cost (per space/ hr)	Total cost (approx. Rs)
	Capital + O&M		
Shershah Suri Marg MLCP, Opposite High Court	40 + 10	2.5	55
Capitol Point, Connaught Place	57 + 12	2.5	75
South Square, Sarojini Nagar Market	55 + 13	2.5	75

Source: Sewa Ram 2015, *Parking pricing system, collection, mechanism, and external cost of parking*, School of Planning and Architecture, in *CSE Parking Management Workshop*, November, 2015

Analysis of parking structures requires high parking cost to recover the huge investment

It should be noted that the total parking charge is almost four times the present charges, i.e., Rs 20 per hour.

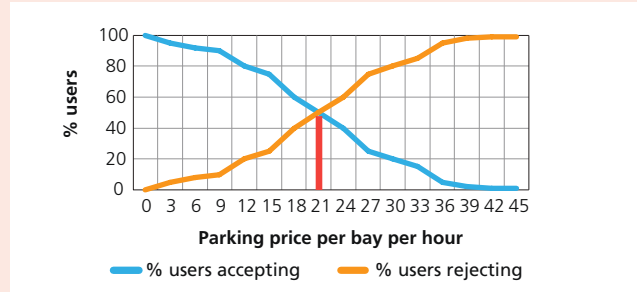
Willingness to pay for parking: The research team has carried out surveys in Delhi to understand the maximum charge that a user can pay with respect to different locations.

Maximum parking charge that almost 55 per cent of the users can pay is Rs 21 an hour in the central business districts. It is also seen from Graph 4 no one is willing to pay a parking fee when parking charge is increased to Rs 45 per hour.

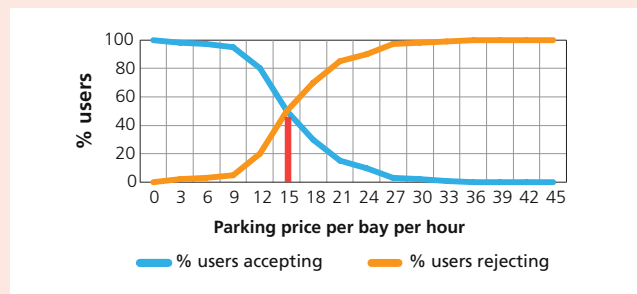
The maximum parking charge that almost 50 per cent of users can pay is Rs 15 an hour at a public transport terminal like a metro station. It can also be seen from Graph 5 that no one is willing to pay a parking fee when parking charge is increased to Rs 45 per hour.

The maximum parking charge that almost 55 per cent of the users can pay is Rs 13 for an hour in a typical neighbourhood. No one is willing to pay a parking fee when parking charge is increased to Rs 45 per hour (Graph 6).

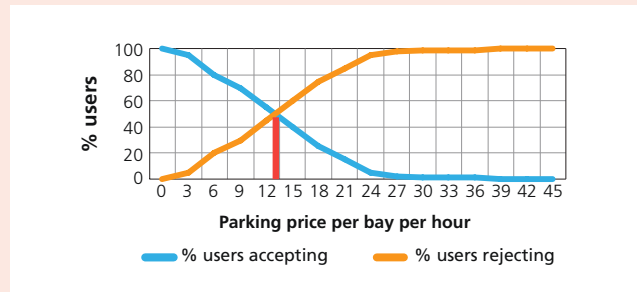
Graph 4: Maximum parking charge a user can pay at CBD



Graph 5: Maximum parking charge a user can pay at Public Transport Terminal



Graph 6: Maximum parking charge a user can pay at Neighborhood Level



Sources: Sewa Ram 2015, *Parking pricing system, collection, mechanism, and external cost of parking*, School of Planning and Architecture, in *CSE Parking Management Workshop*, November, 2015

Parking should be strategically located. The site or plot located on major roads—collector and above—should have easy dispersal facilities for motor vehicles. The site or plot should be within 300 metre distance from the residential or commercial development.

- **City of Regina, Canada, has a parking awareness campaign** to help residents avoid getting parking tickets. They have linked parking management to public safety—e.g., violation if parking too close to a fire hydrant or parking too close to an intersection blocking sight lines. This helped garner public support.

Sign post

- Introduce demand responsive performance parking rates to influence commuting choices and reduce use of cars.
- Spend part of the incremental revenue in local area improvement and public transport improvement.
- Make explicit links between parking pricing strategy and clean air benefits.
- Initiate public awareness campaigns to build public support for effective parking pricing.

Parking strategy for residential and mixed-use areas

Residential and mixed-use areas are coming under severe parking pressure which is aggravating neighbourhood tension and conflict. Car ownership is increasing exponentially much beyond the holding capacity of existing parking spaces. This also creates serious blockages to the access of emergency vehicles. Most of the parking happens on the roads as the premises, especially in the core and old city area do not have adequate parking space. This significantly reduces the carriageway width and adds to congestion. Therefore, the city requires a well thought out parking strategy for the residential areas as well.

While parking restraint and high parking charges in commercial areas are expected to influence commuting choices by encouraging commuters to cut down on car trips, restraint and priced parking strategies in residential areas are expected to curb car ownership especially multiple car ownership. This matter came up very sharply in Delhi recently after the implementation of odd and even number scheme to reduce car numbers by half as an emergency pollution measure. There are fears that such action may encourage limitless car ownership as people would want to dodge the scheme by buying more cars with different number plates. Such rampant and multiple car ownership can be controlled only if legal parking areas in residential areas are limited and priced effectively.

Currently, there is no established practice of charging residential parking. At the time of car purchase the car owners pay a miniscule and a life-time amount for parking and then continue to enjoy free usage for the lifetime of the car. This is a very wrong practice. Free parking will have to be stopped in residential areas. Therefore, it has become necessary to identify key strategies for introducing parking charges in residential areas and also rules for regulating residential parking in public spaces.

All new residential buildings and group housing need to provide parking within the plot area or building as shared parking area. They should not be allowed to park outside the plot area. Local resident welfare associations should be responsible for enforcement. The norms for parking in residential areas need to be strictly assessed and controlled through pricing and strict enforcement of on-street parking.

Unbundling parking from property: As per the present planning bye-laws, group housing societies, commercial complexes, public institutions, etc. have to provide large quantum of parking space. The sheer size of these facilities makes them function as stand-alone infrastructure. The unbundling of these huge facilities allows them to be shared between multiple complexes and uses. In new projects, shared parking provisions would require that parking spaces are provided and leased or sold separately from the rent or sale price of a property. This can help to incentivise individuals to reduce private vehicle ownership and use alternative modes.

Unbundling of residential parking garages is yet another wise outcome to reduce private car ownership and at the same time rent the empty spaces to the non-residents. An unbundled parking lot is a parking facility which is planned and managed in a manner that it can be used as a public facility, though constructed as a part of a private or a public institution or a residential complex. When

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parking facilities are bundled with the property purchase or lease this means parking costs are absorbed with the tenant leases, hiding the true cost of parking. ‘Unbundling’ means that parking is rented or sold separately, rather than being included with the building space. For example, rather than renting an apartment with two parking spaces for \$1,000 per month, the apartment is rented for \$800 per month, plus \$100 per month for each parking space. This makes the parking cost transparent and the occupants pay for the parking only if they own a vehicle. This tends to reduce the average number of cars owned per housing unit and also reduces driving. This kind of unbundling is already prevalent in commercial complexes, however now it should be applicable across all kinds of projects.

Unbundling to function efficiently, the building owners must be able to lease or sell away excess parking spaces. The burden of on-street parking decreases a bit due to unbundling. It will also work better if greater safety of vehicles is ensured than on-street parking and parking charges are lower than those for on-street parking. Otherwise, the owners would not use the residential parking lots and instead find it lucrative to park on-street.¹ It’s the duty of the local officials to regulate the nearby on-street parking. Unbundling parking in residential areas can directly influence travel behaviour of the residents and reduce the quantum of vehicular trips significantly.²

There are a variety of ways in which unbundling can be done. Facility managers can unbundle parking when renting building space. Developers can make some or all parking optional when selling buildings. Parking costs can be itemised in lease agreements

There are several examples globally. In Boulder, Colorado, authorities sell few parking permits to non-residents on the block that have a vacancy rate greater than 25 per cent. Non-residents pay market prices for the parking permits. Each permit is valid for a specific block and the city sells no more than four non-resident permits on any block. In Arlington, Virginia, the residents in 300 apartments do not have assigned parking spaces, instead the spaces are on rent. The monthly charge the residents pay for the single spot is \$25 and for the second the value ranges from \$75–\$100 depending on the area of the location. The parking structure is shared with the retail outlets and restaurants. In fact, shoppers can also access the garage after buying short-term permits. Hence, it is evident that unbundling surely meets the needs of all without much chaos.

There are a variety of ways in which unbundling can be done. Facility managers can unbundle parking when renting building space. Developers can make some or all parking optional when selling buildings. Parking costs can be itemised in lease agreements to help renters understand the parking costs they bear and that would help them to negotiate reductions. Informal unbundling can be encouraged by helping to create a secondary market for available spaces. For example, office and apartments can maintain a list of residents who have excess parking spaces that are available for rent. Any project with a commercially viable quantum of parking space, either in the form of multi-level parking lots or standalone mechanical parking lots, can be treated as a standalone parking facility not just for the end-users of the project itself but for anyone who pays for the facility.

The UK car park management has recommended three easy solutions in residential areas. According to them, the problem of unauthorised parking can be solved easily and effectively using the permit scheme. In order to prevent parking in unallocated parking bays the parking bays are allocated and numbered and the bay number is printed on the face of the permit of the concerned vehicle. Supervision becomes easy and each resident has an exclusive access to a parking bay.

In a recent development,³ the Supreme Court of India ruled that developers cannot sell parking spaces as independent real estate units. The court ruled that parking areas are ‘common areas and facilities’. However, this ruling has not forbidden unbundling of parking or charging for off-street parking. Managing parking as ‘common areas’ is compatible with having a system of parking permits for tenants. These can be priced of course. Managing parking as ‘common area’ is also compatible with deciding to charge visitors for parking which would be most relevant for commercial complexes.

The bottom line of the Supreme Court ruling is that developers of residential apartments or commercial buildings must hand the parking areas over to the management organisation (such as the ‘housing society’). Building management committees (but not the developers) can still unbundle parking and charge for it if they choose to. Such committees will eventually find that charging and unbundling is a useful way to manage conflict over their on-site parking.

In some developer apartment blocks in Delhi residents opting for a garage have to pay a lump sum amount at the time of the allotment of a flat. This can be roughly 1–3 per cent of the cost of the apartment. In Scottish Garden Apartments in Indirapuram in Ghaziabad, one parking costs Rs 25,000 and covered parking Rs 30,000; in Green Valley by Omaxe in Faridabad, open parking costs Rs 50,000 and covered parking Rs 80,000, in the Nile complex in Gurgaon by Omaxe open parking costs Rs 75,000 and covered parking Rs 200,000.

Residential parking permits: Introduce residential parking permits and payment for on-street parking in residential areas. Also, in narrow streets with two lanes on-street parking should not be permitted. For instance, Kolkata does not allow on-street parking on narrow streets. This has led to informal off-street priced parking in neighbourhoods where car owners rent space to park cars. This also keeps a check on car ownership. In several apartment complexes in Delhi, resident welfare associations have set criteria to make residents pay based on the number of cars owned.

Under this program, permits are given to local residents who must display the permit in their cars or affix them to their two-wheelers. The streets are clearly marked, indicating the zone and specifying the time when the zonal restrictions are in force. The restricted time is generally at night since during the day local residents do not require on-street parking and outsiders can use it. In order to avail this facility, residential parking permits have to be issued to vehicle owners residing in the area. They must also provide proof of their residency to the authority in-charge. US and Canada were the pioneers in using this program, following its success many cities across the world has opted for it. This arrangement includes permits that displays specified registration number and visitor permit for those visiting the residents.⁴

There are several benefits of residential permits for the residents. They have assured parking spaces in the neighbourhood. As parking now comes with a cost it leads to equitable sharing of local parking spaces. People with more cars cannot use space with own convenience because there is cap on the number of permits issued. Individuals not owning vehicles have no claims in the parking space and save money. This acts as an incentive not to own a personal vehicle.⁵

Brihan Mumbai Municipal Corporation (BMC) is chalking a new parking policy for Mumbai under which it will give parking permits to the residents to park their cars on one side of the road. The slot for parking is allowed is from 8

There are several benefits of residential permits for the residents. Assured parking and equitable sharing. Individuals not owning vehicles save money. This acts as an incentive not to own a personal vehicle

am–8 pm. The policy will have area-based rates depending on the demand of the concerned area. The proposed monthly rates are Rs 3,960, Rs 26,490 and Rs 1,320 for the island city, the western suburbs and the eastern suburbs respectively.⁶ This policy has been approved in first week of January 2015 on public parking and parking on roads by residents at night. The civic body introduced hefty charges (Rs 30 per night, amounting to Rs 1,800 a month) for night parking on roads by housing society residents. The new policy, with revised rates will be implemented only after a three-month pilot project for both kinds of parking in a ward, most likely in South Mumbai, proves to be successful.

Hyderabad has also drafted a parking policy for Hyderabad Metropolitan Authority (HMA) which suggests the formation of residential parking permit zones. Under this, it plans to entitle one parking space per residence.

Therefore, it is critical that a carefully designed policy for residential areas is adopted. This will require that parking areas on streets should be priced and that a system of monthly permits should be adopted for each vehicle. Currently, many resident welfare associations in Delhi issue parking tickets for entry into colonies. These should be priced and the money collected should be shared between the municipal corporation and RWA. The permits for second or third cars should be proportionately higher in price. Monthly parking rates applicable in the city for different areas should apply to residential colonies as well.

F O R M - 8 0

CERTIFICATE OF HAVING GARAGE, ETC.

I _____ (Designation) DTO/MVI,
 Transport Department do hereby certify that as a result of my verification of
 Shri/Smt _____ S/o, D/o _____
 residing at _____ village/town/city for issue of this
 certificate, the verification of which was carried out on the spot on _____
 found to my satisfaction that the applicant.

OR

1. He has lawfully constructed a garage in his own compound
 for this vehicle he intends to get registered.

OR

2. He has lawfully constructed a garage in the land of the other
 person, namely Shri/Smt _____
 of _____ (locality) for the vehicle
 which he intends to get registered.

OR

3. Has hired a garage / a lawful belonging to other person to
 park the vehicle which he intends to, in the land of
 _____ (locality).

This certificate is issued only on the condition that the applicant has certificate
 that he has all the necessary garages for the other vehicles including two-wheelers
 which he had purchased prior to the implimentation of the provisions of these Rules,
 and that this certificate is meant only for the purpose of Rule 54 of the Mizoram
 Motor Vehicle Rules, 1995 as amended from time to time. This shall not be pledge as
 a document ownership, title or possession on any land or building for any other
 purpose.

Dt _____

Signature of Issuing Authority
 Seal with designation.

Source: Department of Transport, Mizoram, Private Motor Vehicle registration document, Form-80

Proof-of-parking strategies: This is a very important strategy to contain uncontrolled car ownership. People will not be allowed to buy a car if they do not have proof of legal parking. This can help reduce demand for cars, multiple ownership and demand for parking. Proof-of-parking strategies ensure that every car bought or owned by residents of a city have a designated parking space either owned or rented by the car owner.

Mizoram has made it mandatory to provide a declaration of ownership of a garage or car parking space at the time of registration of a vehicle.⁷ These efforts are laudable but come with their own set of enforcement problems. All existing and proposed private and public on-street and off-street car parking spaces need to be identified and used for the purpose of sanctioning.

The Sikkim transport department has issued a notification making it mandatory for buyers to produce an availability of parking space certificate before they can get their vehicle registered. The superintendent of police is empowered to issue the certificates after physical verification of the parking space. Outside the city, the responsibility has been given to panchayats. Motor vehicle inspectors are responsible for submitting details to the authorities along with a map of the site. Traffic police has framed guidelines for implementation of this rule. It does not encourage on-road parking. The state government also keeps vigil on the car dealers to stop them from selling cars with proof of parking.

Jodhpur High Court has issued directives to the state government to implement a proof-of-parking policy to reduce congestion in cities. All the regional transport authorities have to implement this and strict action will be taken for violation of this rule.

Proof-of-parking is a global best practice in which Japan took the lead. Japan introduced the policy in the 1950s and it worked wonders. In Kanagawa, a vehicle owner needs to procure a “garage certificate” from the police department on provision of relevant proof of parking spaces. Accordingly, the department issues a certificate and a sticker to the vehicle owner mentioning the various details of the car, its owner, parking space, etc. The certificate is essential for getting a vehicle registered. The owner of the car needs to put up the sticker on the car at a visible, designated spot. The same need to be re-issued in case of change of ownership of the vehicle or change of address of the owner.

The police has also devised an innovative and effective solution for easy enforcement of the rule and to identify defaulter. The administration has issued a notice banning night-time parking of all private vehicles on public on-street parking lots and public spaces, except in case of emergencies. At mid-night, the parking meters are shut and the same are restarted at 3 a.m. The enforcement department penalises any car parked at on-street parking lots and public spaces during this time.

Parking provisions in areas within transit-oriented development zones served well by public transport, walking and cycling must be limited: The new draft policy of a transit-oriented development zone in Delhi has recommended limiting parking provisions within 500 meter radius around transit nodes like metro stations and making those areas more accessible through walking and cycling. In Central London, for instance, buildings are not allowed to have their own parking areas. In areas around London, parking garages are at a distance from residential areas and also placed farther away from bus and train stations. Greater degree of difficulty is introduced in accessing parking garages that can

Proof-of-parking strategies ensure that every car bought or owned by residents of a city have a designated parking space either owned or rented by the car owner. People will not be allowed to buy a car if they do not have proof of legal parking. This can help reduce demand for cars, multiple ownership and demand for parking

also influence parking behaviour.

Prohibit parking in green areas and in neighbourhood parks: No green areas shall be converted and used for parking. Use of green areas and neighbourhood parks for parking can have serious adverse impact on environment and public health especially that of children. Increasingly, childhood obesity and metabolic diseases among children are being reported from Indian cities. Delhi Master Plan has been amended to state that parks and playgrounds would not be permitted to be utilised for parking purpose as it would destroy breathing space and playgrounds for children.

The Delhi Master Plan 2021 originally allowed “creation of underground parking below parks and open spaces will have to be considered.” This anomaly was fixed after the Environment Pollution Control Authority intervened to direct that there should be no parking below parks, which takes away playgrounds and community spaces. In the limited cases where work had already started, it has directed that 90 per cent of the land use of the existing park area will have to be restored as a flat green area, so that it can serve as a playground. It has also stopped any further diversion of green areas for parking. The Master Plan has been revised accordingly.

Sign post

- Introduce priced parking in public spaces in residential areas. Introduce resident parking permit schemes for parking on public land.
- Earmark no-parking zones including footpaths in residential areas. Ban night parking on narrow streets. Develop residential parking areas as shared, common and priced parking.
- Limit parking provisions in areas that fall within transit-oriented development zones, i.e., within 500 meters from transit nodes. This is needed to reduce use of personal vehicles in areas that are well served by public transport, walking and cycling.
- Unbundle parking provision from property prices. Let people pay separately for parking.

Parking for other modes

Parking policy and planning should not be dominated only by the needs of private vehicles. The city Master Plan needs to designate, plan and design parking provisions for other modes including public transport buses, intermediate public transport like autos, taxis and non-motorised transport including cycle rickshaws and bicycles.

Public transport buses: Cities are in the process of expanding their bus transport to scale-up public transport services. Adequate bus depot space with terminal facilities must be planned in advance to accommodate new buses and also to avoid dead mileage that increases with increased distances to depots. Delhi is facing a serious crunch for depot space for buses which is holding up bus purchase and expansion. It has been estimated that the additional land requirement will be 202 acres and 409 acres for the fleet of 11,000 and 16,000 buses respectively. But so far, Delhi Development Authority has been able to earmark only about 47 acres, most of which is encroached.

Increasingly, therefore, the focus is shifting towards design solutions to maximise available land—including multi-functional depot complexes with multi-level parking facilities. This will not only help to generate revenue that can be ploughed back in the bus transport but also maximise use of space for parking more buses. Additional strategies of earmarking areas for night parking like parking spaces in stadiums or other institutions; delinking parking and garages for inspection and maintenance etc. are being considered for bus transport.

Commercial vehicles: Similarly, there is no clear strategy for earmarking areas for parking of commercial vehicles including para-transit. Areas for parking of other commercial vehicles during off-peak and night hours must be earmarked. Appropriate rates may be charged for such parking. Industrial areas will require well-planned truck and trailer parking facilities that also keeps polluting fleets away from city centres. Truck terminals must be provided.

Parking of non-motorised transport and intermediate transport: All parking facilities and lots need to have space earmarked for non-motorised transport and it should be free. Adequate parking and halting spaces need to be created for autos and taxis, especially near bus stops, railway station and other public transport modes and major commercial areas. This can also help the city in developing a zero emissions bike sharing scheme.

Evaluation has become important at a time when municipal bodies and development agencies in Delhi and other cities are committed to building numerous multi-level car parks. Before more urban spaces are surrendered to this mindless and expensive construction for cars, it is important to draw lessons from the structures that have already been built and get the terms right

Case studies: Evaluation of ground reality

Centre for Science and Environment (CSE) has carried out specific evaluation of two representative cases in Delhi. i) Assessment of the multi-level car parking constructed in Sarojini Nagar in 2012; and ii) Assessment of area planning and parking pricing approach in the Alaknanda market area to establish the importance of taking a more composite planning approach to address the parking crisis.

Assessment of multi-level parking in Sarojini Nagar Market

The assessment of the Sarojini Nagar multi-level car park was carried out in 2012 immediately after the opening of the new structure constructed by the DLF under the public-private partnership mode (see box: *Assessment of multi-level parking in Sarojini Nagar market*). It is important to deepen policy understanding of this issue as most urban local bodies are drawing up plans of constructing such structures randomly across cities without paying attention to crucial detail.

The state-of-the-art parking facility was constructed at a humungous cost of Rs 80 crore. The concessionaire, DLF, was given the project on a build-operate-transfer basis by NDMC. Under the terms of the agreement, the concessionaire had to build the parking facility and operate it for 35 years. The structure is completely electronic. There are no ramps or staircases as fallback in case of power failure or any other emergency. DLF was allowed to commercialise 25 per cent of the space.



Multi-level car park created without area planning

The study found that the newly established, fully automated and highly expensive parking structure in South Delhi's Sarojini Nagar market operated—shockingly—at a mere 20 to 40 per cent of its capacity after it became operational. This, when the surrounding area remains gridlocked with cars. The Rs 80-crore structure has effectively been reduced to being a shopping mall on free land, thus perpetrating huge subsidy to car owners. Car drivers still preferred to park their vehicles on already chock-a-block roads, adding to the parking chaos.

This evaluation became important at a time when all municipal bodies and development agencies in Delhi and other cities are committed to building numerous multi-level car parks. Before more urban spaces are surrendered to this mindless and expensive construction for cars, it is important to draw lessons from the structures that have already been built and get the terms right.

What has the CSE assessment found?

Inbuilt subsidy: The cost of the new parking facility works out to Rs 10 lakh per car. To keep the system operational, it will require an additional Rs 3 crore a year. If it tries to recover the full cost from parking charges, the parking rate will have to be an astounding Rs 77 per hour. Car users are enjoying an enormous subsidy as they pay a miniscule proportion of this rate.

Parking charges can recover little: Currently, the structure is able to recover only 1.6 per cent of the operational costs from parking. Even in a best case utilisation scenario, the full revenue from the current parking rates can recover only one-fifth of the operational costs.

Real estate dominates, parking is relegated to a secondary role: 98 per cent of the earnings for the developer will come from shops in the ground and first floors of the building. As earnings from parking are very small, developers have little interest in ensuring full utilisation of the parking space. Developers are also resisting common management of the surface parking area.

People are willing to consider shifting to other modes of transport if minimum parking rates are three times the rate in multi-level parking: CSE survey of visitors in Sarojini Nagar has shown that people are willing to consider a shift to public transport only if the minimum rates for parking cross Rs 30 per hour. This is three times the rate of Rs 10 in multi-level parking and double the proposed rate of Rs 15 per hour in the surface parking. The municipal agency will have to fix parking charges at a rate that will influence commuters' choices.

Getting the parking price right immediately and city-wide is important: Aggressive decisions are needed now to have effective, high parking rates on a city-wide basis – in both commercial as well as residential areas. Small incremental changes will only fuel the growing dependence on cars.

Parking revenue needs larger objective: Cities are mandated under JNNURM to create a dedicated urban transport fund. Parking revenue is earmarked as one of the potential sources. The fees and revenues from parking can be used for public transport enhancement and local area development. But such plans have not been drawn up yet.

Improve connectivity of the area to give people more choices for travel: No

strategic planning has been done to enhance bus service and metro feeders to the area. Such planning is needed to give people an option in all key commercial areas to curtail parking demand.

No strategic planning to use the new structure for ‘pedestrianising’ the market for improved shopping experience and business: Though plans are afoot to curtail surface area parking and improve usage of multi-level parking, the huge spillover and illegal parking on the surface undermine such measures. Cars are still allowed very close to the shops—this impedes walkability in the area. While cars have the freedom to come into the market, three-wheelers—the local para-transit—are not allowed in. The design of the parking has encouraged only car access to the market.

Cars of local shopkeepers use up a substantial part of the legal parking area and lower the revenue potential. Shop owners take away most of the legal parking space and nearly for free. Parking contractors, therefore, rely more on illegal parking to make money. There is no provision of remote parking and feeder connection.

Poor and narrow access to the structure and automated technology discouraging parkers: The time taken to park or retrieve a vehicle increases the waiting time for parkers, sometimes, cars may have to wait for as long as 20–25 minutes. This discourages parkers and builds up congestion on the approach road. Also, there is no manual ramp back-up in the design in the eventuality of a technical snag in the system. Cars have to queue up to get inside. Location and appropriate technologies will require attention.

Before embarking on massive investments in parking facilities, cities need to adopt policy goals for parking. The National Urban Transport Policy, as also the Supreme Court of India, have made it clear that a parking policy—while meeting some parking needs—will also have to lower personal vehicle travel and urban-peak traffic with the aim of reducing congestion, accidents and pollution.”

The current provision of multi-level parking with 25 per cent commercial component needs to be reviewed and revised: The commercial component is creating a perverse incentive to not check the cost of the parking facility infrastructure for reduced operational cost, it is adding to the numbers of vehicles that need parking and creating conditions in which there is scope for misuse of these facilities. Under this circumstances, the allowance for commercial component should be revised to 10–15 per cent and offices, not shopping areas, should be promoted. This will allow use of parking space on weekends when shops have higher footfalls.

This calls for an end to parking subsidies, immediate parking pricing reforms, effectively high parking charges, stringent enforcement and high penalties for violations. When combined with priced parking, limits on parking space and improved access through other modes of transport, parking strategies can help a switch to alternative modes of travel and restrain car usage.

Alaknanda parking challenge

Alaknanda residential complex is a prominent residential neighbourhood in South Delhi. It has a collector road passing through it, connecting two important arterial roads—Outer Ring Road in the north and Guru Ravidas Marg in the

When combined with priced parking, limits on parking space and improved access through other modes of transport, parking strategies can help a switch to alternative modes of travel and restrain car usage

Figure 1: Alaknanda market and the surrounding influence area



Source: CSE

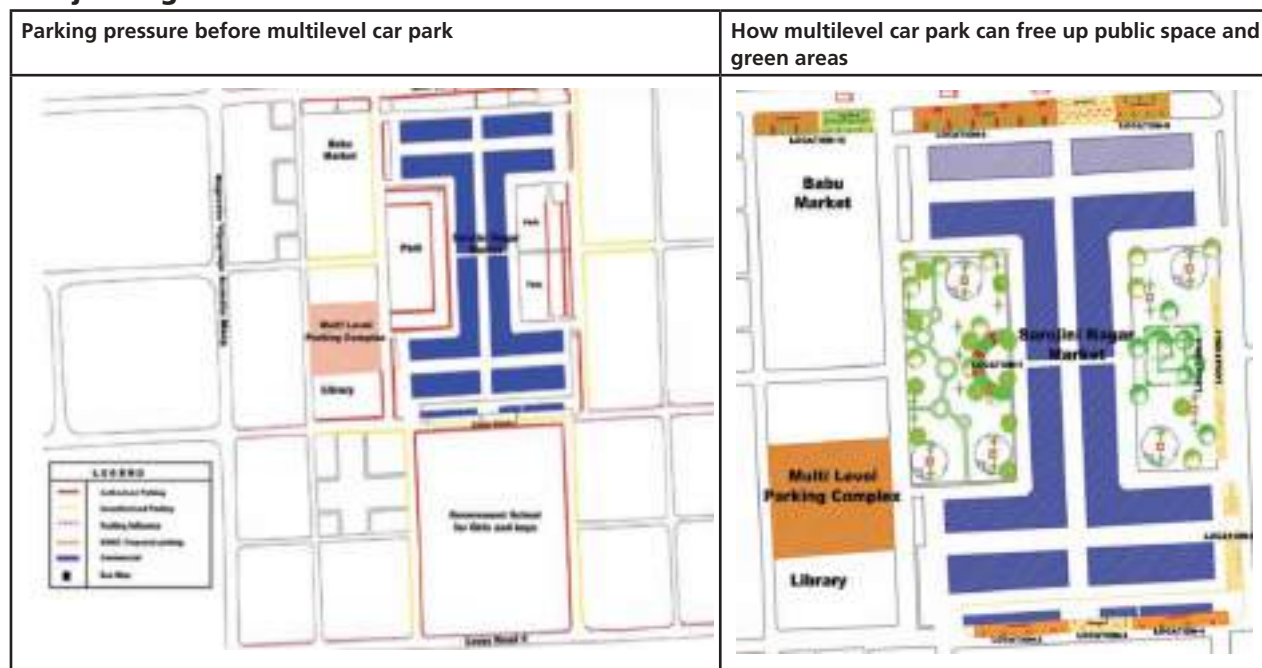
south. It is flanked by residential colonies, market and schools, mostly with access from this road. Alaknanda road is the only connector between the two arterial roads for long distance through-traffic. It is also the only major access road to the colonies, market and schools of the area. The area itself generates a large volume of vehicular trips.

A stretch of about 800 m, from the Tara Apartment junction to St. George School crossing, has been considered. This stretch is flanked by five residential societies including Nilgiri Apartments, Yamuna Apartments, Godavari Apartment, Gangotri Apartment and Tara Apartment. Altogether, there are about 1,125 residential flats along the stretch. In addition to this, there are three schools—New Greenfield, St. George and Kalka Public. There is also a prominent market. However, the number of residential apartments and units in the entire influence area is much higher.

Parking Challenge: Factors like multiple car ownership in the residential complex, visitors parking near schools and the market etc. contribute enormously to the pressure on the road. Most societies in the residential complexes provide one parking space for each flat inside the complex. It has been reported that in a couple of colonies the available parking space is less than the number of apartments. This leads to spillover. The existing DDA flats behind the market have been provided only with scooter parking as they were designed in the

1980s. New demand occupies road space for parking personal vehicles. A majority of the flat owners have multiple cars that cannot be contained within the complex. There is also a problem of residents from other neighbourhoods with space constraints parking on this road. The local parking contractors have pointed out that residents from nearby Tughlakabad, that has serious space crunch, largely park on Guru Ravidas Marg, but there is some spillover on the Alaknanda road around Tara Apartment. Free parking encourages this trend.

Figure: Need integrated management of multi level and surface area parking in Sarojini nagar



Parking availability: The Alaknanda market parking area is under Municipal Corporation of South Delhi (South MCD). The capacity of legal/notified surface parking area in and around the market is around 200 cars limited to on-street parking on roads adjacent to the market and the parking space within the market (see Figure 3: *Legal parking provided along the Alaknanda market by South MCD*). The surface parking timings are 14 hours from 8 a.m. to 10 p.m. every day. The map shows the existing parking space along the market designated by South MCD. There are two offstreet parking areas along the stretch located inside the Alaknanda market.

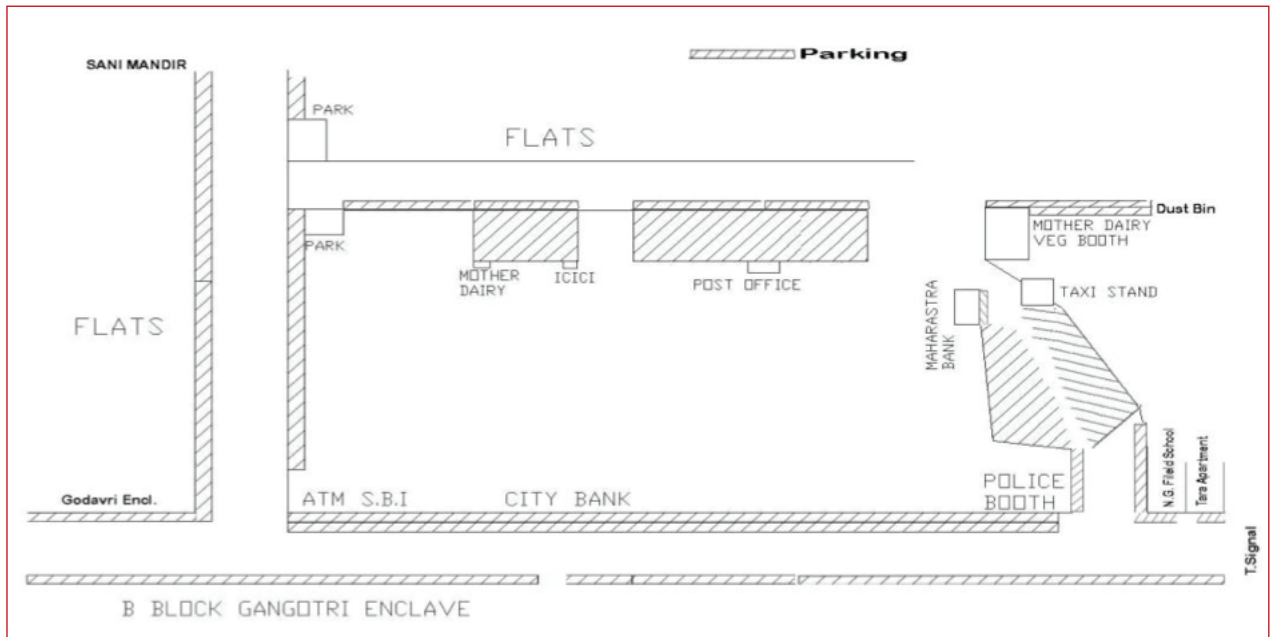
Table 1: Approximate number of residential flats along the road in the study area

Apartment	No. of Flats
Nilgiri	448
Yamuna	195
Godavari	114
Gangotri (Pocket B)	208
Tara	160
Total	1125

Source: CSE survey

However, the parking goes much beyond the notified space and stretches up to a kilometre on the main Alaknanda road. In fact, the entire stretch from Tara crossing to St. George School has been found to be occupied with parked cars on both sides. During the activity survey in August 2014, a maximum of 630 parked cars were noted at one time in the study area. About 40 per cent of them were around the market place. This number can vary from time to time during the day. This means the area allows 3.15 times higher parking than what is legally provided. Parking demand around the

Figure 2: Legal Parking provided along the Alaknanda market by South MCD



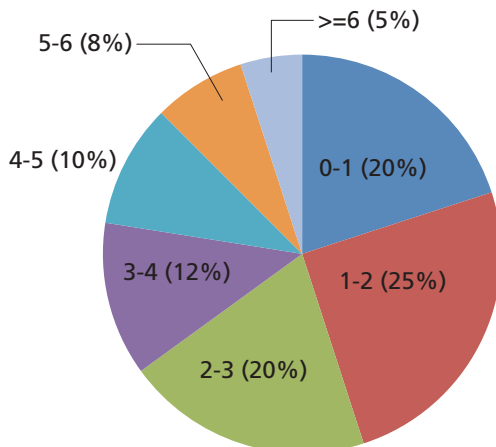
Source: Town Planning Department, SDMC

market place comes from shoppers, shopkeepers, DDA flats behind the market and spillover parking from apartment complexes.

Parking pressure on Guru Ravidas Marg

Where do people come from? : It is necessary to know the origin and destination of the trips to the Alaknanda market. Origin is defined as the place where the trip begins and destination is defined as the place where the trip ends. An origin destination survey was carried out in the market to know the influence zone or the catchment area of the market.

Figure 3: Percentage share of trip length (km) of visitors to the Alaknanda market



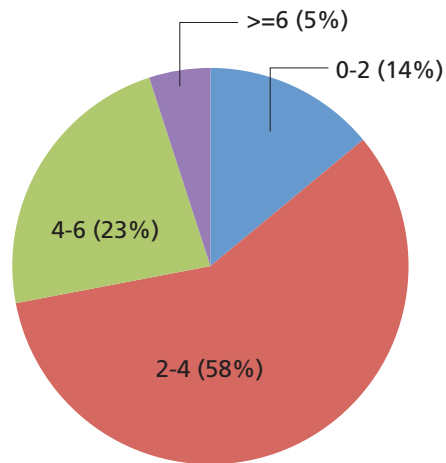
Source: CSE survey



The survey indicates that a quarter of the visitors are from within 1-2 km and another 20 per cent from within 2-3 km. Overall, around 77 per cent of the total shoppers come from within a radius of 4 kms from the market. Therefore, the catchment area largely includes the nearby residential colonies. Shoppers are dominantly coming from nearby residential societies and from areas like Govindpuri, Greater Kailash, Tughlakabad etc (see Figure 4: *Percentage share of trip length of visitors to the Alaknanda market*).

Parking demand from shopkeepers and shoppers: The majority of the visitors—about 48 per cent—come by car, 23 per cent by two-wheelers, 6 per cent by public transport/autos, and the rest walk. If we consider only shopkeepers then as many as 51 per cent come by cars and 38 per cent by two-wheelers. This only shows the enormous potential of converting most of these short distance motorised trips to walking and non-motorised trips. This, combined with an effective pricing strategy, can reduce parking pressure significantly.

There are a total of 84 shops in the Alaknanda Market. If we consider only the shopkeepers about 14 per cent of the total shopkeepers are from within the Alaknanda area. A large numbers of shopkeepers—as many as 58 per cent, come from within a radius of 2-4 km from the market. According to the shopkeepers association, a majority of shopkeepers are from areas adjacent to Alaknanda that include Sangam Vihar, Tughlakabad, Okhla, Govindpuri, Kalkaji depot etc. (see Figure 5: *How far the shopkeepers come from*). This only points towards the fact that improved walking and cycling access and better intermediate public transport connectivity can reduce parking pressure from car and two-wheeler users. Parking has spread from inside and adjacent to the market to quite far from the market. The spillover effect is quite substantial.

Figure 4: How far the shopkeepers come from

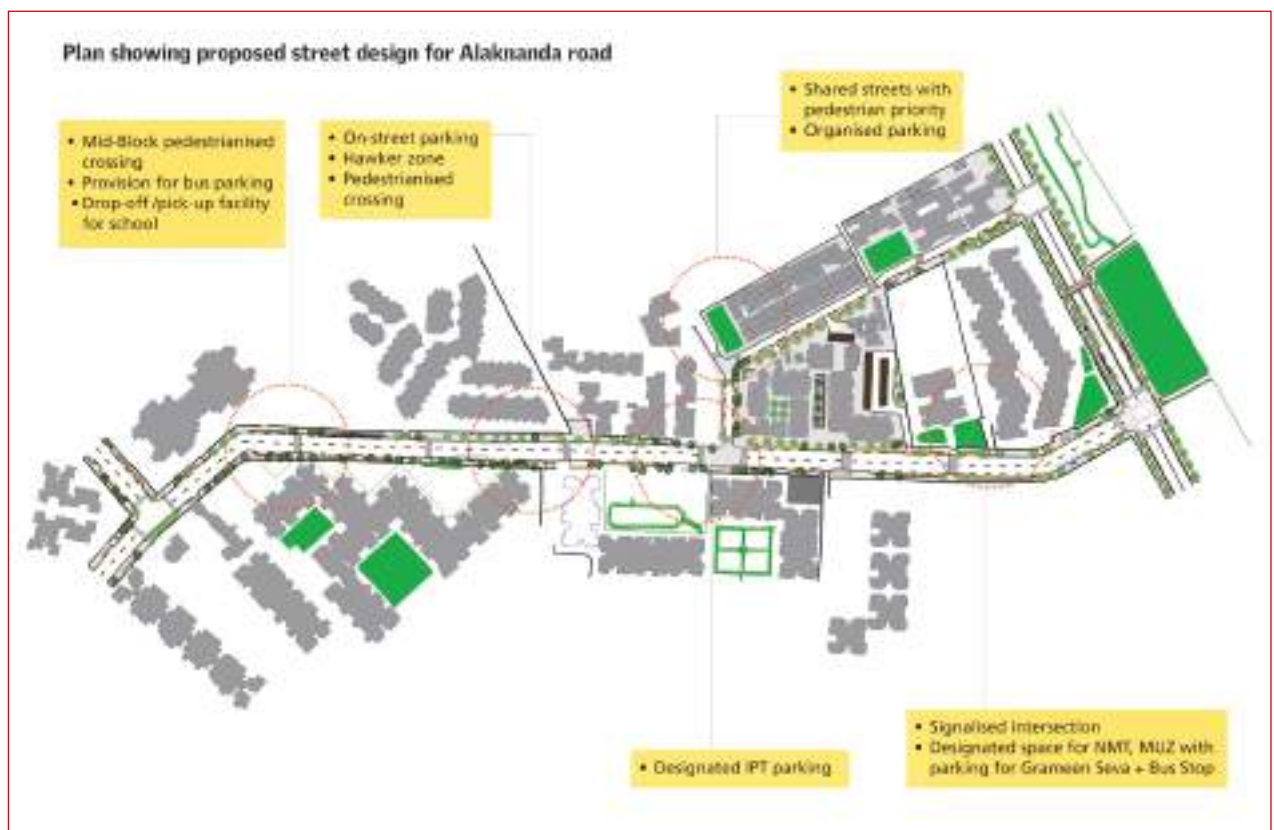
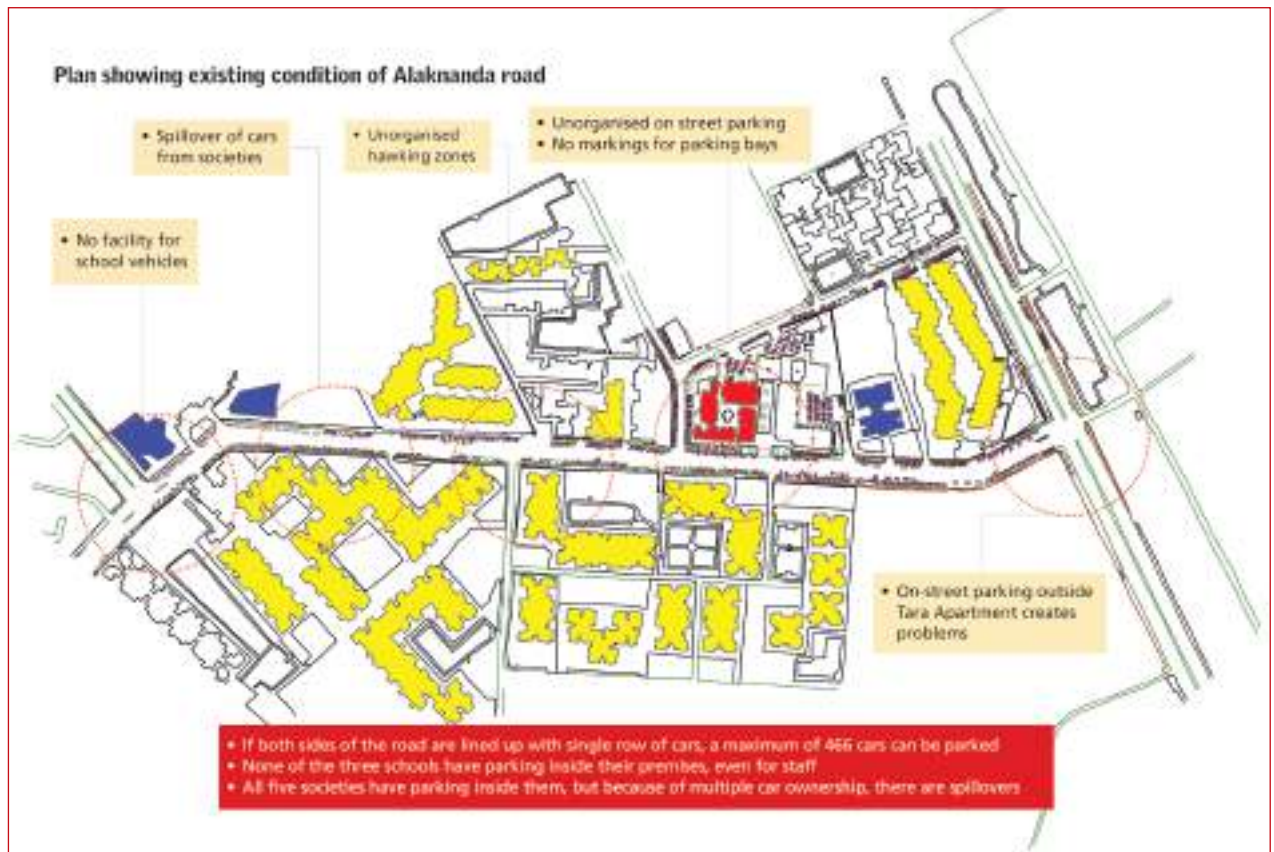
Source: CSE survey

The challenge of night parking: CSE surveyed night parking end-to-end on the stretch and found that between 11.30 and 1.00 a.m. 535 cars were parked on the Alaknanda road and 166 cars in the parking lot around the market. Further, 173 cars were parked on the road near the temple. Density was higher near the temple and near entry gates of the apartment blocks. Tara Apartment had double parking. Several cars with covers on them were found near the market. These seem to be long-term parkers. Parking attendants informed CSE that there are several cars that have remained parked for years and months. The nature of night-time parking shows the visible impact of rising car ownership and mainly multiple car ownership in the area.

Parking pricing: Even though MCD has notified a legal parking area around the market with an approximate provision of 200 parking spaces, there is no parking fee. It is reported that at some point MCD contractors used to collect parking fee but this practice has been discontinued. The recently introduced rate of Rs 20 per hour by MCD South has inexplicably not been implemented here. However, in practice there are informal parking operators who are collecting Rs 10 per parking in front of the market. Free parking is inciting unlimited car ownership and parking in the area. Nearly the entire available road and public space around the market have been saturated by parking. Without restraints it will be impossible to implement solutions and control the pollution and congestion mayhem in the area.

Informal market in parking spaces: An interesting phenomenon has been observed in this area. There is a serious space crunch behind the market and there is clamour for space among the residents of Janata Flats to find space for parking. These flats do not have car park areas within the complex. As a result, a thriving informal market in residential car parking has emerged behind the market and near the temple. Residents can park their cars for the whole day for a fee of Rs 1,500/ month for 24-hour parking and Rs 1,000/month for only night-time parking. The place is barricaded and there is a security guard. During the CSE survey, about 50 such cars were parked at night. This only proves how limiting and organising parking supply can help create a market that can earn revenue not only for the contractors but also for the government. Use of public spaces for both residential and commercial parking should not be free. Suppose

Redesigning Alaknanda street to provide for all street activities



all the 870 cars that were seen parked in the public space during night pay a minimum of Rs 1,500 a month, more than Rs 13 lakh per month and Rs 1.5 crore annually can be generated only from this small stretch. The earning potential of the entire road is much higher. This only brings out the revenue and earning potential of priced parking that is needed not only to control infinite increase in parking demand but also use of this revenue for local area development for the larger benefits of the residents.

Parking inconvenience reported by both motorised and non-motorised users:

Chaotic and mismanaged parking also adds to the hassle of parking. About 60 per cent of the respondents park their vehicles inside and adjacent to the market, about 34 per cent near the market and about 6 per cent at a distance from the market. As many as 75 per cent of the respondents said they are not satisfied with the parking situation and 80 per cent said the parking facility should improve. Traffic chaos and choked parking spaces have increased the cruising time for the drivers to find parking spaces. This also translates into additional fuel loss.

Chaotic parking and traffic affect non-motorised transport the most. There is no dedicated space for cycle parking. As many as 64 per cent of cycle users are dissatisfied with the parking situation. This is a serious barrier to improving non-motorised and walking access to the market to reduce the parking pressure. About 75 per cent of the respondents are not satisfied with the present parking as well as the traffic scenario prevailing in the area. But the non-motorised transport respondents believe that for them the situation is better than the vehicular parking condition.

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Centre for Science and Environment

41, Tughlakabad Institutional Area, New Delhi 110 062

Phones: 91-11-40616000 **Fax:** 91-11-29955879

E-mail: cse@cseindia.org

Website: www.cseindia.org