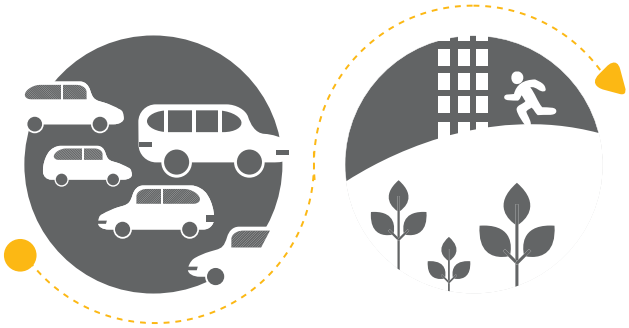
PROJECT REPORT

# RETHINKING OFF-STREET PARKING REGULATIONS AROUND STATION AREAS IN MUMBAI

Inputs into the Mumbai Development Plan 2014-34



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## EXECUTIVE SUMMARY

# INVESTIGATING PARKING REFORMS WITHIN TOD ZONES IN MUMBAI

Cities across the world are using parking as a tool to positively impact pedestrian and NMT accessibility, enhance public life, and reduce the reliance on cars within TOD zones.

The Development Plan (DP) for Greater Mumbai is currently under revision. It will provide direction towards the growth and development of the city for the next 20 years (2014-2034) (MCGM 2013). The Municipal Corporation of Greater Mumbai (MCGM) has adopted a two-tiered planning process for Mumbai. The first tier looks at city level planning strategies and Land Use and Development Control Regulations (DCR). The second tier of planning looks at the neighbourhood scale by creating a process for Local Area Plans (LAP).

At the city level, Mumbai is adopting a comprehensive Transit Oriented Development (TOD) strategy (MCGM 2013). "Transit Oriented Development (TOD) refers to residential and Commercial Centers designed to maximize access by transit and non-motorized transportation, with other features to encourage transit ridership. A typical TOD has a rail or bus station at its center, surrounded by relatively high-density development, with progressively lower-density spreading outwards one-quarter to one-half mile, which represents pedestrian scale distances" (VTPI 2014). However, the TOD discourse in India is focused on the intensification of density around station areas, without addressing the need for better access to transit and amenities (Rangwala, Mathews et al. 2014).

To promote safe and secure walking environments, cities are drafting building bye laws that ensure porous or no compound walls, active street fronts with ground retail spaces and adequate walking and cycling infrastructure (UTTIPEC 2012), (ITDP 2013). However, as TOD areas develop they give rise to an increase in property values, invariably replacing existing communities. Hence one of the biggest challenges faced by planners today is to orient existing and proposed developments towards transit—thereby, impacting better physical environments, improving connectivity to transit using feeder networks, and reducing congestion around station areas—while ensuring TOD areas are affordable to transit users.

A comprehensive TOD strategy includes various elements,to—build compact developments around stations, promote transit supportive land uses, build complete streets, build more public spaces, treat cultural landscapes sensitively, build integrated transport systems, and promote Travel Demand Management (TDM) in TOD areas (EMBARQ India 2013). Several cities across the world are introducing stringent parking management regulations (to impact TDM), with intelligent pricing

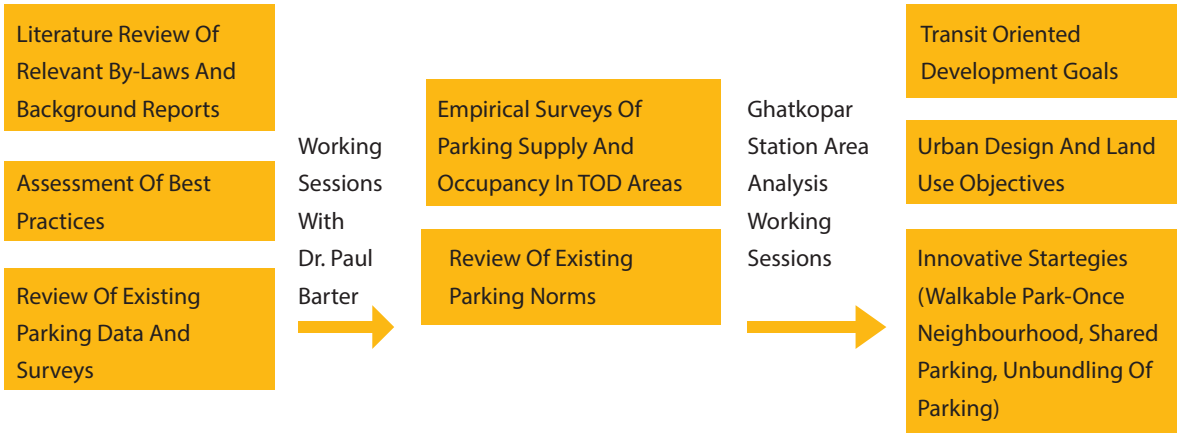


Figure 1: Framework for the TOD study report at Ghatkopar Station; Source: EMBARQ India

models within TOD areas to arrest reliance on car use and ownership (Barter 2013). Additionally, Cities are also using reduced parking norms as a means to impact affordability within TOD areas (Barter 2013). An oversupply of parking not only increases congestion around station areas, thereby inhibiting pedestrian and feeder system integration with MRT stations, but also, creates an inaccessible housing market in the city. This is because; lower parking supply within TOD areas, in turn increases housing supply, thereby decreasing property values.

In Mumbai, public transit ridership is extremely high (up to 52 percent train users and 26 percent bus users), while car users are negligible (up to 6 percent), considering all motorized trips. Car ownership in Mumbai is fairly low (32 cars per 1000 persons) as compared to other Asian cities with similar densities (LEA Associates 2008); however, parking provision is extremely high (2.17 parking spaces per 100 cars) (MCGM n.d.). At the same time, data reveals that 51 percent of all work-trips in Mumbai (including non-motorized modes) are conducted on foot (LEA Associates 2008). Assessing existing parking norms to restrict over provision of off-street parking spaces, is one of the pressing planning issues in the city today.

EMBARQ India is undertaking an independent study at the Ghatkopar Railway station area, as a pilot study to re-think existing parking norms and develop options for parking reduction within TOD areas in Mumbai. The study has evolved over-time with continuous engagement with MCGM officials and the Consultants producing the Mumbai Development Plan 2014-34. The study aims at positively influencing the Development Plan, Mumbai, pushing for a drastic reduction in off-street parking norms close to transit nodes. Regulatory tools developed in the report are based on a detailed data collection and analysis process, with continuous engagement with parking expert, Dr. Paul Barter. Regulatory tools are also tested by key stakeholders such as City officials, Developers, and architects through the process. Finally, the regulatory tools are envisioned as "living" regulations that will evolve as required, to meet the challenges of diverse city contexts, changing conditions, and evolving urban aspirations.

A framework for the study is developed as illustrated in Figure 1. Inferences from the study can be scaled-up across all suburban railway stations and upcoming MRT stations across the Mono and Metro Rail. The aim of the study is to achieve a desired urban form, which is compact yet porous with active street edges and decongested station areas, using parking as a tool. Based on this framework the report is structured into seven sections, summarized as follows:

## I. INTRODUCTION

The introduction gives a detailed understanding of what a Transit Oriented Development is, and why it is relevant in the Indian Context. The TOD discourse in India is in its formative stages, where several paradigms are directly adopted from Western cities. Mumbai, among other cities has adopted a TOD strategy in its statutory Master Plan review, scheduled to come into effect by end of year 2014. Using Ghatkopar station as a pilot demonstration study area, the report therefore, presents analyses and evidence of how the TOD discourse can be shaped for the city of Mumbai.

## II. EXISTING SITUATION ANALYSIS

An Existing Situations Analysis is executed at the Ghatkopar Railway and Metro station area. Ghatkopar station will serve as the end terminal for the Metro line 1. This section presents the data collection methodology and analysis, forecasting what may be the impact at the neighbourhood level once Ghatkopar station becomes a major transit interchange hub. The study is using Parking as a tool to change prevalent TOD trends by shifting the discourse around TOD in India from a means of intensification of density, to providing—both physical and socio-economic—access.

## III. REVIEW OF EXISTING PARKING DCRs

Existing parking norms in Mumbai are extremely high as compared to other Asian cities with comparable people densities, and much higher car density ratios. This section presents a critical review of the existing parking norms, (DP 1991 and modifications till 2008), which currently follow a "conventional approach" of overprovision based on projected demand. The parking policy in Mumbai is a blanket policy that mandates extremely high 'minimum parking norms' across the city. This is primarily done to reduce on-street congestion due to parking; however, in effect it is encouraging car dependency and discouraging the use of alternate, sustainable modes of transit.

## IV. APPROACH TO PARKING POLICY

To develop a sustainable and realistic parking policy, it is important to realize the "right" approach to parking provision. This section elaborates key learnings from several capacity building sessions facilitated by EMBARQ India and Dr. Paul Barter, an expert in parking policy around the world; as well as relevant case examples and best practices nationally and internationally.

## V. PROPOSED PARKING REGULATIONS

There are three parking policy options developed through this section. These are based on data collection, analyses at Ghatkopar station, and reduced parking norms explored in other cities. Inputs from Dr. Paul Barter, MCGM's DP team, as well as stakeholder workshops are integrated to further refine these options. The three options are based on three different parking approaches that are explored keeping in mind the city context and growth patterns.

## VI. TESTING THE PARKING REGULATIONS

This section informs the decisive market response on the new approach to parking regulations. Inputs from personal phone interviews with developers and architects, as well as a round-table workshop are integrated in this section. Further, inputs from engagements with city officials either as training sessions, or working modules are also included here. The section also elaborates key discussion points, suggestions and recommendations from the developers' workshop (including a web link to an abridged video of the workshop proceedings).

## VII. CONCLUSIONS

This section is a summary of the Ghatkopar Study report, highlighting key learnings. After a yearlong engagement with the site, MCGM officials and the consultants, there are frequent concerns and questions that are registered. This section also provides a list of concerns and questions with explanations from the report, Dr. Paul Barter's inputs, and from stakeholder inputs.

The Ghatkopar Station area study and report intends to inform and engage with various authorities, local governments, developers, and citizens in a critical dialogue around the feasibility of parking norms close to transit. It seeks to inform a broader rationalization of parking solutions at the city level, that enhance the attractiveness and quality of life around station areas, making them convenient for commuters, residents, and business owners.

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INTRODUCTION

# EMPHASIZING PARKING MANAGEMENT WITHIN THE TOD DISCOURSE IN INDIA

The TOD discourse in India is in its formative stages, presenting opportunity for cities to rethink and formulate context specific TOD policies addressing key challenges in the Indian context.

## WHAT IS TOD?

"Transit Oriented Development (TOD) refers to residential and Commercial Centers designed to maximize access by transit and non-motorized transportation, and with other features to encourage transit ridership. A typical TOD has a rail or bus station at its center, surrounded by relatively high-density development, with progressively lower-density spreading outwards one-quarter to one-half mile, which represents pedestrian scale distances" (VTPI 2014). EMBARQ India has evolved a TOD framework for Indian Cities based on the following elements: compact development, transit supportive land uses, complete streets, public spaces, cultural landscapes, integrated transport, and Travel Demand Management (TDM). (EMBARQ India 2013).

Here, compact development refers to housing types that are minimal, with medium to high built densities, with sufficient open spaces that are shared across developments. Mixed land uses catering to a high commuter crowd would constitute as transit supportive land uses. Complete streets with safe and secure pedestrian infrastructure to facilitate more walk and non-motorized transit trips. Cultural landscapes, including heritage structures, old markets, structures of religious or cultural significance, can be retained and assimilated in TOD planning and design processes. The integration of multiple modes of transit across Metro rails, suburban rails, light rails, feeder bus services, intermediate para-transit services and NMT parking can be prioritized. Lastly, emphasizing on a travel demand management approach that introduces reduced parking norms within TOD areas, while developing other smaller measures to shift travel patterns towards sustainable modes.

A TOD strategy within a Master Plan can be applied in one of three ways:

### 1. Overlay Zone

In city master plans, overlay zones are delineated around MRT station catchment areas. An overlay zone is a zoning tool that requires specific development and design regulations within the delineated area. The overlay zone is used to either protect the existing assets and character of the area or to envision an enhanced urban character within

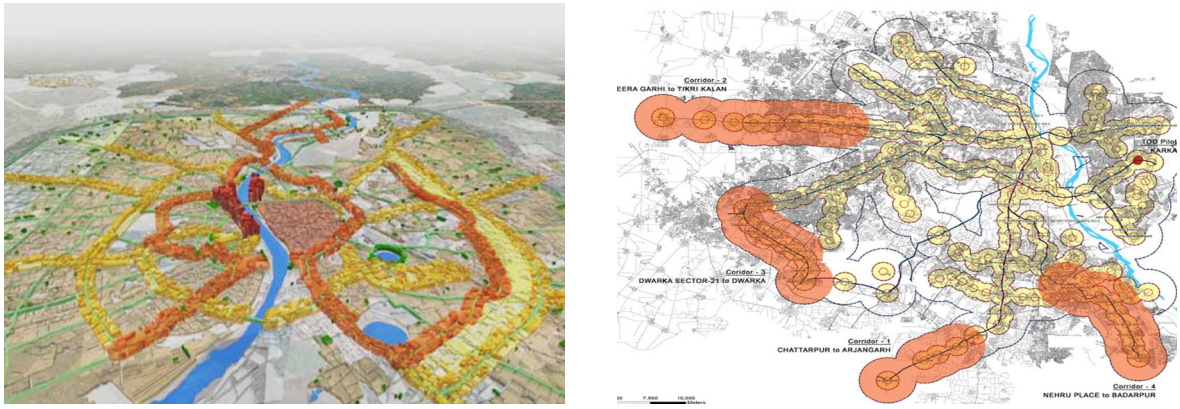



Figure 2: Difference between the TOD strategy and the resultant urban form in the Ahmedabad Master Plan (left) and the Delhi Master Plan (right); Source: (AUDA 2006-2012) (DDA n.d.)

the delineated zone. The Ahmedabad Master Plan is a good example of this (AUDA 2006-2012).

## 2. Special Land Uses

City master plans can create a provision for a special land-use category, applied within the MRTS influence zone. Special urban design codes are applicable within the TOD influence zone under the special land use category. These may include reduced block sizes, building typologies, building interfaces, permissible and non-permissible uses and so on. This was done in the Delhi Master
Plan (DDA n.d.).

## 3. Local Area Plans

A detailed second-tier planning process is mandated within City Master Plans to create Local Area Plans (LAP) at neighbourhood level. Cities are delineating special topics or planning strategies to be prioritized in the LAP process, TOD is one of them. Cities like Delhi are already in the process of plan preparation, and Mumbai will follow soon after the DP review process is completed.

TODs are planned within a delineated transit "Influence Zone", of a MRT system. The 'influence zone' is defined based on distance to the transit station by walk or non-motorized transit (NMT) modes. The extent of the zone is defined using a planning tool called 'ped-shed analysis', which correlates the distance walked/ cycled to transit from a destination, with the time taken to reach it. Hence the extent of the influence defines a TOD catchment area. These may vary based on the kind of mode, the structure of the network, and therefore its reach at regional, city, or ward level. For example, TODs along BRT Systems are often planned as corridors like in the Ahmedabad Master Plan; while, for a Metro system network, TODs are radial in nature, as the distance between stations is quite far apart, like in the Delhi Master Plan. The extent of a TOD zone may also vary based on peoples' willingness to walk-to-transit in different cities. All these factors combine, and help define a clear methodology for TOD strategies for different cities.

# TODs IN INDIA

Ahmedabad and Delhi master plans in Figure 2 show two different methods of realizing TODs in the city. The Ahmedabad plan delineates a zone of 200m from the BRTS corridor on either side along the entire stretch of the system. This is an overlay zone, thereby mandating special regulations and norms applicable within the extents of zone. In the Delhi Master Plan, TOD zones are defined for 500m from each transit node. This presents a radial plan, with overlaps between adjacent TOD zones. A special land use is applied within the zone, called a 'white land use' that mandates special standards and density allowances within the zone.

While both Master Plans, especially the Delhi TOD strategy, prescribe detailed norms, allowances and urban form guidelines that adhere to TOD principles, the question of affordability seems unanswered. The Delhi Master Plan defines a TOD as, "essentially any development, macro or

micro that is focused around a transit node, and facilitates complete ease of access to the transit facility, thereby inducing people to prefer to walk and use public transportation over personal modes of transport". However, the discourse around TODs in India is more of an urban design and densification approach, which is necessary, but yet an incomplete conversation for the Indian context.

Most Indian cities are already very dense; people tend to live as close to transit as far as possible. Most cities show a large percentage of users of public transit especially within the low income to economically weak sections. When a TOD strategy is primarily focused on densification along the corridor, increase in building height due to extra FSI causes a corresponding increase in property value. This in turn attracts high to middle income home owners, and high-end retail and office enterprises, who are most likely car owners. Hence a TOD strategy must be coupled with a stringent parking policy to arrest the use of private vehicles either for work or non-work trips. A stringent parking policy also ensures a decrease in property values as the supply of housing increases.

The Ahmedabad Master plan continues to mandate "parking minimums" (concept explained in Section III: Review of Existing DCRs) and looks at a meagre 10% reduction in parking for commercial uses along the TOD corridor (AUDA 2006-2012). Additionally, a special tax called "betterment charge" is levied upon all property owners living within the BRTS influence zone of 200m (TOI 2013). These surcharges that may seem as positive externalities of development for the City, adversely affect the economically weaker sections, most often forcing them to move away from the corridor. The Delhi Master Plan mandates a detailed parking policy for TOD zones, however it considers parking minimums and not parking maximums (refer Section III for definitions) (DDA n.d.).

The Mumbai DP addresses inclusivity as an important planning concept for the city (MCGM 2013). Using parking reforms as a tool, MCGM can impact an increase in housing supply thereby seeing a reduction in property values. Due to reduced parking norms, the demand for high-end residential apartments (essentially, 3 or 4 Bedroom-Hall-Kitchen (BHK) flats) by car owning families would reduce within TOD areas. This in turn creates an opportunity for different typologies of affordable housing, like studio apartments, 1 and 2 BHK flats, as well as rental housing, giving rise to compact, high density housing close to transit. Moreover, parking reforms can also enable retaining existing communities with low car ownership in TOD areas, by facilitating access to affordable housing.

## TOD AND TAD : SIMILAR CONCEPTS, VERY DIFFERENT CITIES

Most Indian cites translate TOD as a means of intensifying densities (and therefore increasing FSI, or Floor Space Index) along the transit corridor or within the TOD influence zone. This may result in what is commonly known as 'Transit Adjacent Development' (TAD). TAD signifies development that is in close proximity to transit stations but promotes auto-oriented planning such as sparse people densities, luxurious living environments, single or segregated land uses, and ample provision of parking (Newton 2010). Hence, a TAD is similar to TOD as both paradigms prioritize and propagate development close to transit; however TAD as an approach is just limited to that, often promoting auto-oriented planning concepts (refer Figure 3).

Adjacency to transit does not ensure a livable, walkable and healthy neighborhood with increased quality of life; it merely ensures proximity to transit by capitalizing on high land values. This form of planning is not people-oriented, but rather "auto"-oriented (i.e. planning that facilitates car use). For example, current parking norms in Mumbai promote higher parking allowances with FSI incentives for public parking lots within the first 500m of a transit node (MCGM 1995). This approach results in an increase in vehicular traffic around station areas that are already heavily congested.

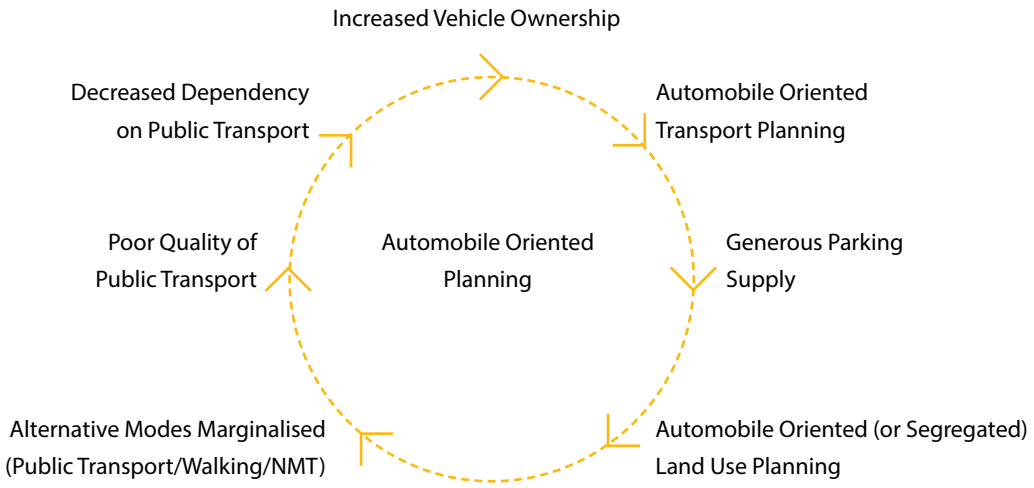



Figure 3: Diagram representing the vicious automobile oriented planning circle; Source: EMBARQ India, adapted from VTPI (Litman 2013).

## A TOD STRATEGY FOR MUMBAI: OPPORTUNITIES AND CHALLENGES

The Mumbai Master Plan is in the review process, for the next 20 years (2014-2034). It is scheduled to come into effect by the end of 2014 where MCGM is the implementing agency. External consultants are hired to enable the process of plan preparation under the directives of MCGM's DP department. To enable a "second-tier" planning process, the city is divided into smaller 'planning sectors'. These sectors cover an area of 2-4 sq. kms. They are envisioned as self-sufficient sectors that meet the need for amenities, housing and employment for the given population. Sector level plans will be prepared for some of the planning sectors to demonstrate the process of planning, where TOD is adopted as one of the major planning strategies (MCGM 2013).

Mumbai city is one of the most transit rich cities in India. In the Metropolitan Region, a population of 10 million people makes 28.5 million one-way trips every day, as stated in the 2008 CTS report (LEA Associates 2008). 53% of these trips are made on foot, and out of the remaining 47% motorized trips, 78% are made on public transit. This goes to show that Mumbai is extremely transit dependent. Mumbai's suburban railway system is one of the oldest in Asia. Historically, the city developed along the railway line, with compact neighbourhoods

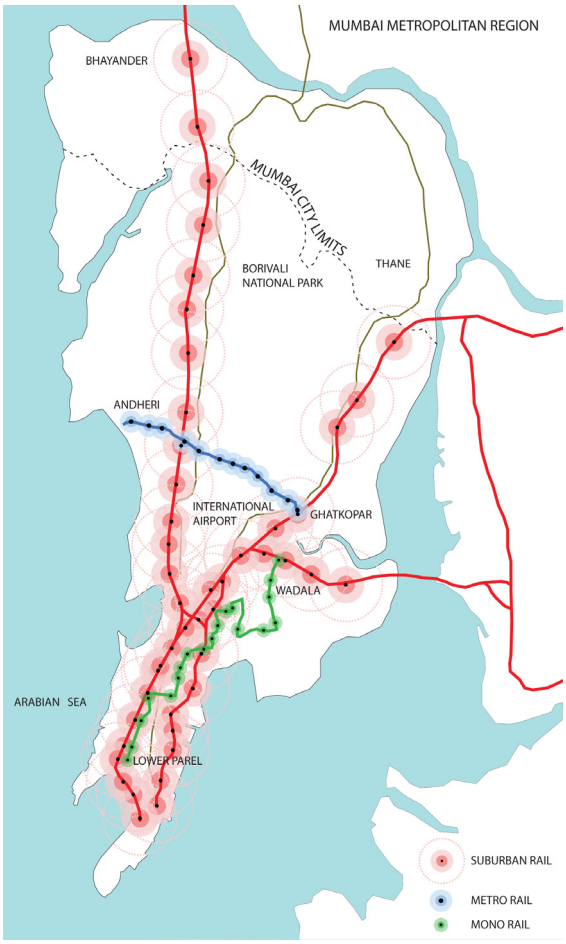



Figure 4: Transit Map of Mumbai showing existing and proposed MRT systems; source: EMBARQ India

| | CITY | POPULATION DENSITY | CAR DENSITY | PARKING SUPPLY |
|---|---|---|---|---|
| 1. | Honk Kong | 7.1 million | 55 | 0.24 |
| 2. | Singapore | 4.6 million | 112 | 1.30 |
| 3. | Seoul | 19.9 million | 227 | 1.44 |
| 4. | Beijing | 14 million | 103 | 0.52 |
| 5. | Guangzhou | 13.2 million | 84 | 0.74 |
| 6. | Ahmedabad | 5.4 million | 55 | 0.24 |
| 7. | Mumbai | 12 million | 48 | 2.17 |

Figure 5: Comparative table showing population densities, car ownership (per 1000 people) and corresponding parking supply (Equivalent Car Spaces per 100 sq.m of built-up area); Source: Barter 2011, LEA Associates 2008.

| OPPORTUNITIES | CHALLENGES |
|---|---|
| Mumbai DP is including a TOD strategy in their Master Plan review for 2014-34 | The TOD strategy in the public domain, has a strong density focus, not access (MCGM 2013) |
| Mumbai shows high reliance on public transit and walking | Transit users are mostly captive users as the transit experience is challenging and unsafe |
| Mumbai is looking at a two-tiered planning process, thereby ensuring neighbourhood context can be integrated into the planning process | Stakeholders at the local level include developers, business owners as well as residents; getting all key stakeholders on a common ground is a key planning challenge at the local level |
| Mumbai is positively influenced, towards reducing parking norms within station areas (Barter 2013). | Market trends and acceptance of reduced parking norms will further drive the political debate around parking in Mumbai. |

and villages that came up along the railways as it extended to the eastern and western suburbs. The 2008 CTS report records a ridership of 7.24 million commuters daily.

Suburban railway commuters in Mumbai battle huge footfalls of people during the morning and evening peak periods. Additionally, due to poor 'last mile connectivity' to their final destinations, everyday travel is often conducted in grueling and unsafe conditions. Intermodal connectivity at railway stations in Mumbai is a big challenge; drop-off or pick-up points from rail to intermediate public transit (IPT) like auto-rickshaws and taxis, and feeder bus services, is poorly planned. Moreover, station areas are a characteristic of vibrant markets,

active streets and high land values that induce high densities when redeveloped. High footfalls of commuters, businesses and residents within TOD influence zones lead to congested station areas with low service provision.

Like most Indian cities, Mumbai has witnessed rapid motorization over the last decade and more. The Comprehensive Transportation Study (CTS) conducted by the Mumbai Metropolitan Regional Development Authority (MMRDA) records an increase of private vehicle ownership over a period between 1996 to 2005 for cars and two-wheelers per 1000 persons, as 52 to 82 and 50 to 97, respectively (LEA Associates 2008). However, when compared to other Asian cities (like Honk Kong,

Singapore and Delhi) with similar densities, Mumbai shows very low car ownership ratios but very high off-street parking norms (as in Figure 5). Most middle and high income housing comes with parking spaces based on unit sizes (2, 3 or 4 Bedroom etc.). High parking norms, are drastically transforming pedestrian oriented neighborhoods in the city, into unsafe walking environments with inactive built edges dominated by vehicles and parking.

In Mumbai, parking norms over the last decade bundled with housing sales influenced an increase in car ownership, thereby increasing parking demand (Barter 2013). For each new car, there are typically two parking spots required—at origin (residential) and destination (office/ mall/ theater); invariably, increasing parking provisions for all associated uses, to cater to an increase in demand. For a city like Mumbai, where about 50% of its population lives in informal housing with very low infrastructure provision, using spaces for cars is simply irresponsible (Rangwala, Mathews et. al. 2014).

The MMRDA has proposed two new modes of mass transit—the Mono and the Metro Rail (refer Figure 4). This will further add to the city's public transit mode share. While new modes are proposed in the city, regulations to direct development around MRT stations are not addressed significantly. Development within these TOD zones along new MRT systems, may address the need for adequate open spaces, housing, and amenity provisions, with mixed uses that promote more walking trips. Integrating these objectives into the DP vision document, may enable planning and building a city that is more transit and people-oriented.

Using Ghatkopar Station as a case study, EMBARQ India is conducting an independent study to influence the Mumbai DP 2014-34. The study makes a case for rethinking existing off-street parking norms within the first 500 meters of station areas, to reduce vehicular congestion, improve safe and secure access, and influence affordable and compact housing developments.

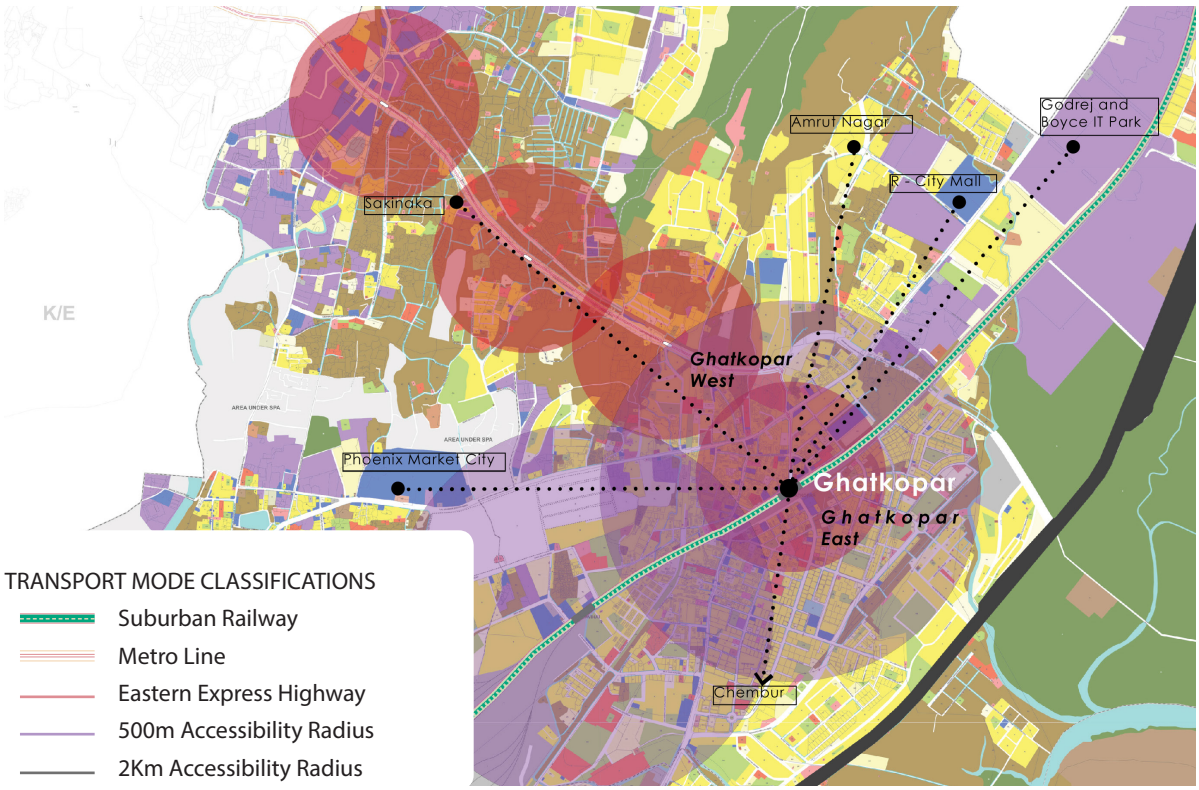



Figure 6: Ghatkopar Station Terminal with Suburban and Metro Rail showing Intermodal connectivity; Source: EMBARQ India.

## GHATKOPAR STATION AREA CHARACTERISTICS

Ghatkopar station is located along the central suburban railway line connecting South Mumbai to the Eastern suburbs. It is an important transit point on the central railway line as all trains stop at Ghatkopar, including some outstation trains. Additionally, Ghatkopar is planned as the end terminal for the Mumbai Metro Line 1, as in Figure 6, making it a multi-modal interchange terminal. People traveling on the north-south corridor by the suburban railway, can transfer to the east-west corridor to use the Metro. Over the next decade the Metro is expected to carry 30,550 people per hour (DMRCL 2012).

EMBARQ India conducted a preliminary survey to understand travel behavior and mode shares within a 1km radius around Ghatkopar station. Most commuters use either non-motorized (NMT) modes (walking or cycling) or feeder services such as BEST buses, autos or taxis to access the station area. Only 3% of the commuters use private modes like cars or two-wheelers to access the station area (refer Figure 14 for more details). These figures are representative of most station areas in Mumbai.

Ghatkopar station is used for work and non-work trips by people living, or working within a 3-6km radius around the station. There are five bus stops and four auto-rickshaw stands within a 250m radius around the station, on both east and west side.

There are two major arterial roads, the Lal Bahadur Shashtri Marg (LBS Road) on the west and the 90 feet Road on the east. They serve as both arterial roads and collectors, carrying up to 50% of the through traffic crossing Ghatkopar. This includes a large proportion of heavy motor vehicles (HMVs).

West Ghatkopar is very different from its eastern counterpart, which is well planned with a clear hierarchy of road networks and accessible walking environments. The major neighborhoods in the area are Pantnagar on the east and Nityanand Nagar on the west. Jhunjhunwala College and Sarvodaya hospital are two large institutions within the study area, located on the west side of the station. Although, Ghatkopar east has no prominent city level institutions, it is well provided with neighborhood and ward level schools, monuments of social and religious importance, open public spaces and parks and community centers.

Since Ghatkopar east provides a well-planned and legible street network pedestrians find it safer and more accessible than the west, which is a traditionally hilly terrain with urban village clusters, organic street networks. However, these village streets serve as NMT connectors to the station area and therefore see a large commuter footfall of working class professionals walking to the station. Informal surveys conducted by EMBARQ staff in the villages reveal that most households walk to the station to board trains to their final place of work.

Figure 7: Images showing Ghatkopar's neighbourhood character (from left)—urban village street (in the west), neighbourhood market junction (in the east), 90 ft. road section (east); Source: EMBARQ India

Hence living in close proximity to an MRT system significantly reduces their travel costs.

The overall TOD area has a diverse range of affordable housing types; these include old MHADA colonies, police quarters, old four-storied walk-up apartment buildings, urban villages and newer slum clusters. New developments that are coming up within the first 500 meters of the station bring a new urban form of higher built-up densities, large plot sizes with significant on-plot parking provisions. These fail to retain some of the traditional NMT streets that are used to access the station area, making walking distances long and cumbersome. Hence, a change in urban form due to redevelopment is a significant concern for the precinct at least within the first 500 meters.

Due to redevelopment, even though car dependency that is, car ownership and ridership in the study area are low, parking provision is significantly high. The existing situation analysis for the Ghatkopar station area further substantiates this hypothesis. Additionally, the report presents commuter patterns, people densities, and corresponding land use, built-form and parking provisions compared to basic TOD principles for the area.

## EXISTING SITUATION ANALYSIS

# A STUDY OF THE IMMEDIATE GHATKOPAR STATION AREA CONTEXT

Ghatkopar station is a multi-modal transit hub, with high density, low-rise built forms, and a predominantly residential land use with significant buildings with mixed land uses. The station is used for work and non-work trips by people living, or working within a 3-6km radius around the station.

Ghatkopar station is projected as one of the major transit hubs in Mumbai after the completion of Metro line 1. Parking is used as a tool to inform a sustainable planning framework around transit station of this capacity in the city of Mumbai. The existing situation analysis (ESA) at Ghatkopar station investigates existing conditions (and attributes) of the built environment, in cognizance with travel behavior and resident/ employee and commuter profiles. Given the current DCRs with regards to redevelopment and on-plot parking provision, introducing parking reforms to inform a sustainable development of transit areas is an implicit way forward. The Ghatkopar station area study serves as a case example to explore different options of parking reforms within TOD zones, which can be further applied at city level.

## METHODOLOGY

The study is conducted at three different levels based on the kind of data required. There are two main parts to the ESA—data collection and data analysis—that help extrapolate existing patterns. Figure 8 shows the structure of the data collection process and the types of data collected. To initiate the study the TOD "influence zone" is delineated.

There are three zones identified within the study area of 1km as shown in Figure 9. Four blocks are delineated for the neighbourhood level study, of which all blocks are either directly or indirectly accessed by the Mahatma Gandhi Road, which is the main east-west connector, for vehicular modes. MG Road is primarily commercial in nature, with several old retail markets along the street edge.

Two of four blocks are delineated within the first 500 m from the transit node. Once the Metro Line 1 is fully functional, these areas will witness a massive increase in commuter footfall and subsequent developmental pressures. The remaining two blocks are delineated in the next 500 m (i.e. within the 500-1000 m of the transit node). Urban characteristics in the east and west are very different, as explained in the level 2 analysis.

Data collection was performed at each plot in the four blocks for one weekday and one weekend day during the day time (non-peak hour) and night time (peak hour). The weekday data was collected at 3:30 p.m. and 7:30 p.m.to capture non-peak and peak parking occupancy counts. While, weekend data was collected at 12:30 p.m. and 8:30 p.m. to capture weekend non-peak and peak hour

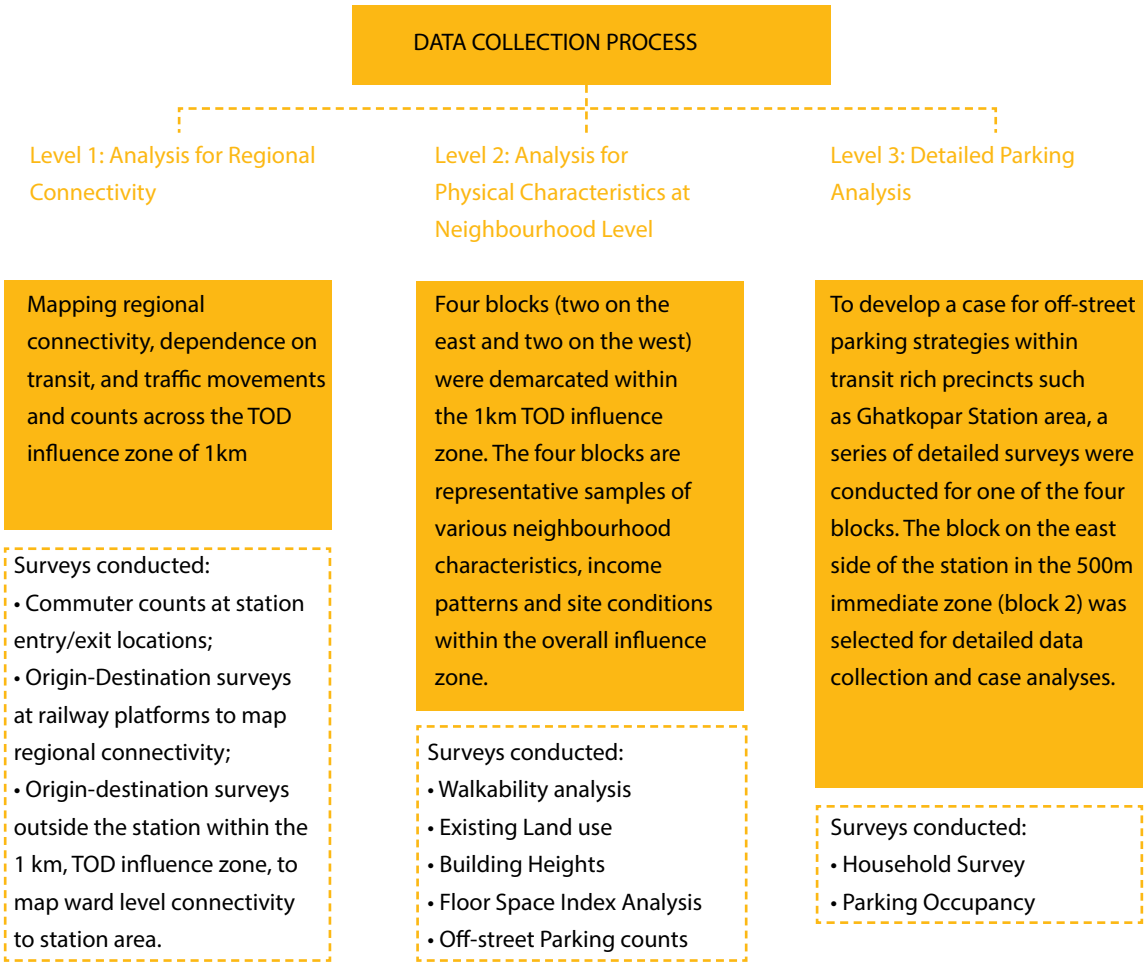



Figure 8: Data collection process chart

TOD INFLUENCE ZONE

TODs are planned within a delineated transit "Influence Zone", of a MRT system. The 'influence zone' is defined based on distance to the transit station by walk or non-motorized transit (NMT) modes. Based on modes used to access a MRT station, the influence zone may vary. Since most public transit trips start and end as walk-trips, walking is used as a means to define the influence zone. In Mumbai, people are willing to walk up to 0.91km (Rastogi 2011); therefore, the TOD influence zone is delineated as 1km around the station. For the purpose of the study the influence zone is further divided into three sub-zones; the Gateway zone—from 0 to 250m—the Intermediate zone—from 250 to 500m—and the Outer zone—from 500 to 1000m. A 'ped-shed analyses' (explained further in the report) is used to delineate the influence zone based on distance and time.

occupancy patterns. To map patterns of off-street parking within the station area, a parking inventory and parking occupancy survey was carried out. Further, the household survey was done using an interview schedule to map demographic data, along with travel mode choices, vehicle ownership and resident/ employee perception surveys.

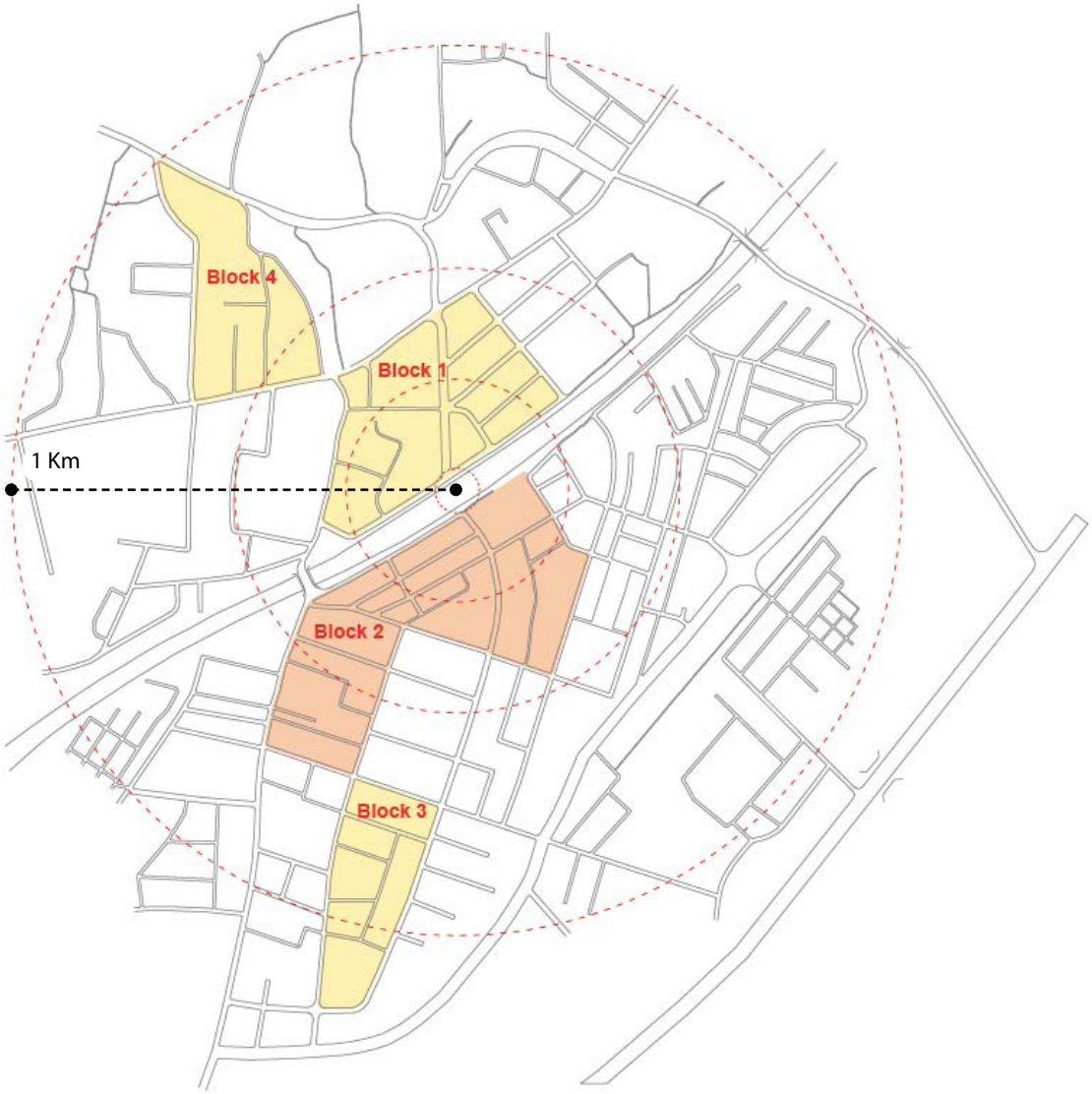
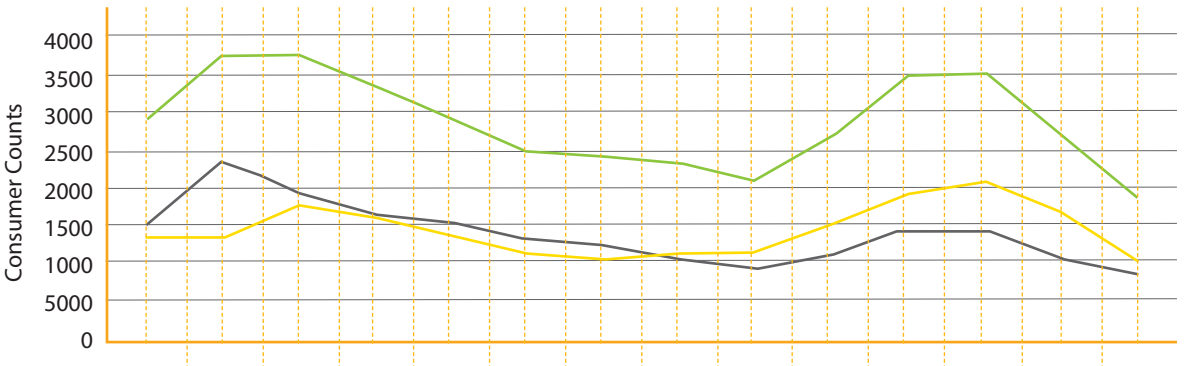



Figure 9: Diagram showing zone delineation at three levels of data collection and analysis;
Source: EMBARQ India

## LEVEL 1: REGIONAL CONNECTIVITY

To map regional connectivity passenger counts and profiles were assessed at all the 18 entry/exit locations at the Ghatkopar railway station. Passenger counts were collected over a 16 hour time period on a week day. Additionally, origin-destination surveys were conducted at railway platforms as well as in the 1km TOD influence zone to study regional networks and modes used to access the station.

Figure 10: Image of Ghatkopar Station, Mumbai; Source: EMBARQ India




| | 08.00 - 09.00 | 09.00 - 10.00 | 10.00 - 11.00 | 11.00 - 12.00 | 12.00 - 13.00 | 13.00 - 14.00 | 14.00 - 15.00 | 15.00 - 16.00 | 16.00 - 17.00 | 17.00 - 18.00 | 18.00 - 19.00 | 19.00 - 20.00 | 20.00 - 21.00 | 21.00 - 22.00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Entry | 14381 | 21953 | 18584 | 15720 | 14554 | 12527 | 12007 | 10806 | 9426 | 10644 | 13749 | 13880 | 10573 | 8174 |
| Exit | 13000 | 13000 | 16952 | 15640 | 13199 | 11065 | 10499 | 10926 | 10953 | 14554 | 18451 | 19612 | 15969 | 9990 |
| Total | 27381 | 34953 | 35536 | 31360 | 27753 | 23592 | 22506 | 21732 | 20379 | 25198 | 32200 | 33492 | 26542 | 18164 |

Figure 11: Graph showing the passenger counts at Ghatkopar station; Source: EMBARQ India

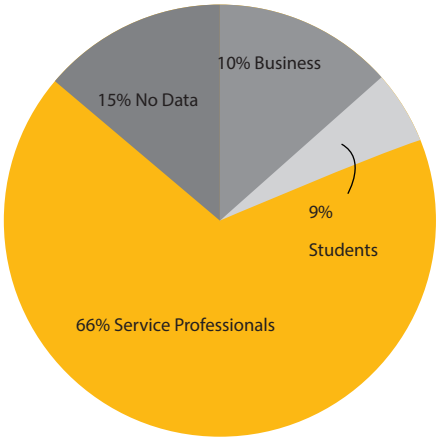


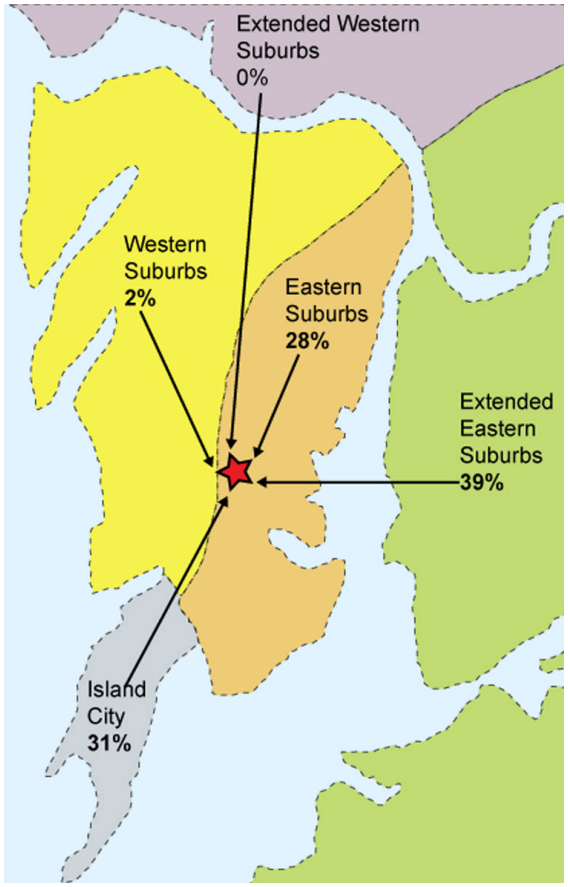

Figure 12: Graph showing occupation profiles of commuters conducting work-trips at Ghatkopar Station; Source: EMBARQ India

During the morning peak the average commuter count goes up to 36,500 people/ per hour and during the evening peak it goes up to 34,000 people per hour. Hence during the peak hours of the day this amounts to approximately 4000-6000 commuters entering or exiting the station every 15mins, Figure 11. Over the 16hr survey period, approximately 381,190 commuters are recorded entering or exiting the station on a week day. It is noteworthy that passengers commuting from the east are proportionately fewer than those commuting from the west. With the onset of the new Metro line these numbers are projected to increase thereby increasing congestion levels at entry/ exit locations on the west these numbers are projected to increase thereby increasing congestion levels at entry/ exit locations on the west.

## Passenger Counts

On an average Ghatkopar station receives up to 27,000 commuters per hour per weekday.

a. Trips Originating at Ghatkopar Station




b. Trips Terminating at Ghatkopar Station

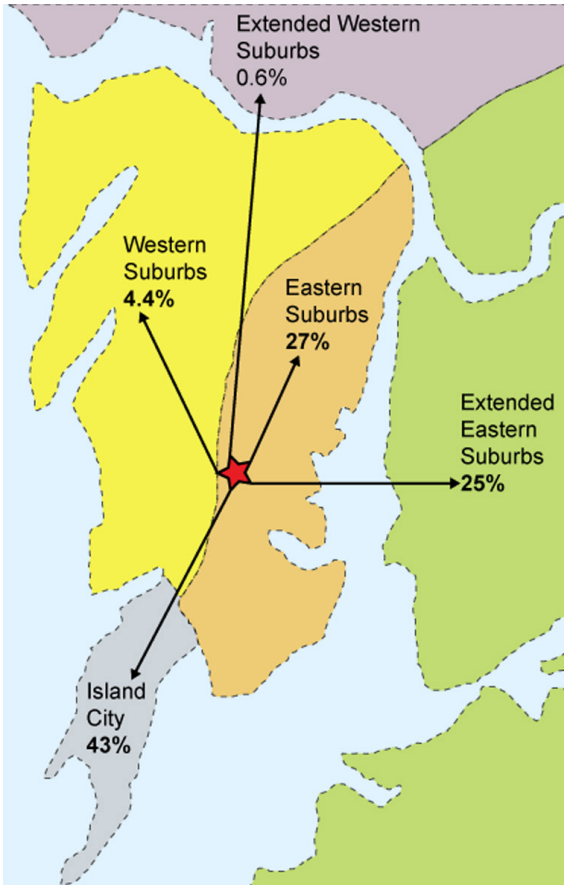



Figure 13: Origin (a)-Destination (b) maps showing regional connectivity to and from Ghatkopar Station; Source: EMBARQ India

## Passenger Profile

The average passenger travelling at Ghatkopar station falls in the age bracket of 25-30 years, within the income bracket of 400,000-500,000 INR per year, conducting a work-based trip. Figure 12 shows that 66% of the commuters conducting work-trips at Ghatkopar station are service professionals. (Here work trips include education trips made by students). service professionals. (Here work trips include education trips made by students).

## Origin – Destination Survey

The origin-destination (OD) survey helps map accessibility, connectivity and the importance of Ghatkopar station at precinct, city and regional \level. The survey is carried out at two locations. The first is on station platforms to map commuters' place of origin and destination while coming in or going out of Ghatkopar station respectively. The second is within the 1km TOD zone (but outside the station) to map ease of access and modes used to reach the station, or the final place of destination from the station. Based on the OD survey 73% of the trips originate at Ghatkopar, while 27% of the trips terminate there. Figure 13a, shows that 43% of the trips originating at Ghatkopar, terminate in the Island city. While 27% terminate in the eastern suburbs and 25% terminate in the extended eastern suburbs. Only 4.4% trips are carried out to the western suburbs from Ghatkopar station. Figure 13b, shows that 31% of the trips terminating at Ghatkopar, originate in the Island city. While 28% originate in the eastern suburbs and 39% originate in the extended eastern suburbs. Only 2% of the trips that originate in the western suburbs terminate at Ghatkopar station.

The OD survey executed outside the station within the TOD influence zone show that 49% of the commuters access the station by walk. 1% use cycles and other NMT modes. 34% of the commuters reach the station using BEST feeder bus services and 13% use IPT (either auto-rickshaws or taxis). Private vehicles either cars or two-wheelers are used by only 3% of the commuters. This is fairly indicative of a good public transport system where private modes are least preferred. Hence, park-and-ride facilities seem highly irrelevant in this context.

A comparison of modes used to access the station on the east and west, as in Figure 14, show that close to 50% commuters either walk or use NMT modes to reach the st ation on either side. However, BEST bus connectivity is better on the east, while more commuters prefer using IPT modes to access the station on west. While private modes are completely absent on the west, 5% of the commuters are seen using private vehicles to access the station on the east. This could be attributed to parking facilities for private vehicles right outside the station on the east side.

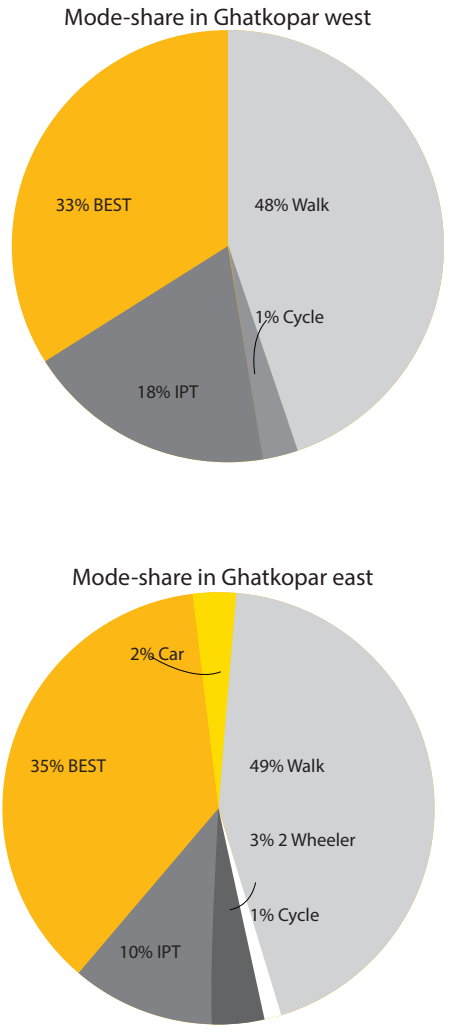



Figure 14: Mode shares at Ghatkopar east and west respectively; Source: EMBARQ India

## LEVEL 2: NEIGHBOURHOOD CHARACTERISTICS

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### Walkability Analysis

An initial survey of the TOD influence zone revealed that there is a high pedestrian footfall for a 10-12 min walking distance from the station. A 'ped-shed' analysis conducted within the TOD influence area (shown in figure 15) reveals that only 45% of the area in the immediate zone can be covered in 3-6 minutes on foot. This indicates that the neighborhood is fairly walkable but could definitely be made more accessible by providing shorter pedestrian and NMT connectors.

A good target for a walkable catchment is to have 60% of the area within a five-minute walking distance, or within ten minutes in the case of major transit stops. This takes into consideration the ability of pedestrians to get to and from all major destinations in the TOD influence, which helps determine the influence zone of a transit station based on accessibility and not just distance.

To execute a ped-shed analysis, four EMBARQ staff walked in four different directions from different station entry exit points, first on the east and then on the west, for distances covered in 3, 6 and 12 minutes each, on foot. Areas that were accessible based on the time taken to walk there were highlighted for each distance-time bracket. Figure 15 (left) shows a visual representation of a ped-shed model. LBS road on the west impairs accessibility for commuters walking towards destinations that are west of the major collector road. On the east due to a high vehicular movement outside the station, accessibility is impaired.

WHAT IS A PED-SHED MODEL?

Ped-shed also known as a walkable catchment can be defined as a given area (or distance walked) either to or from a neighborhood or destination within the time frame of 5mins. For the purpose of the study at Ghatkopar station it was assumed that a distance of 500m can be covered within 5mins of walking time. However, in Mumbai, average walking and bicycling trip lengths are much higher than those recorded for most other cities. The average acceptable walking trip length has been recorded as 0.91 km and average cycling trip length is recorded as 2.7 km (Rastogi 2011).

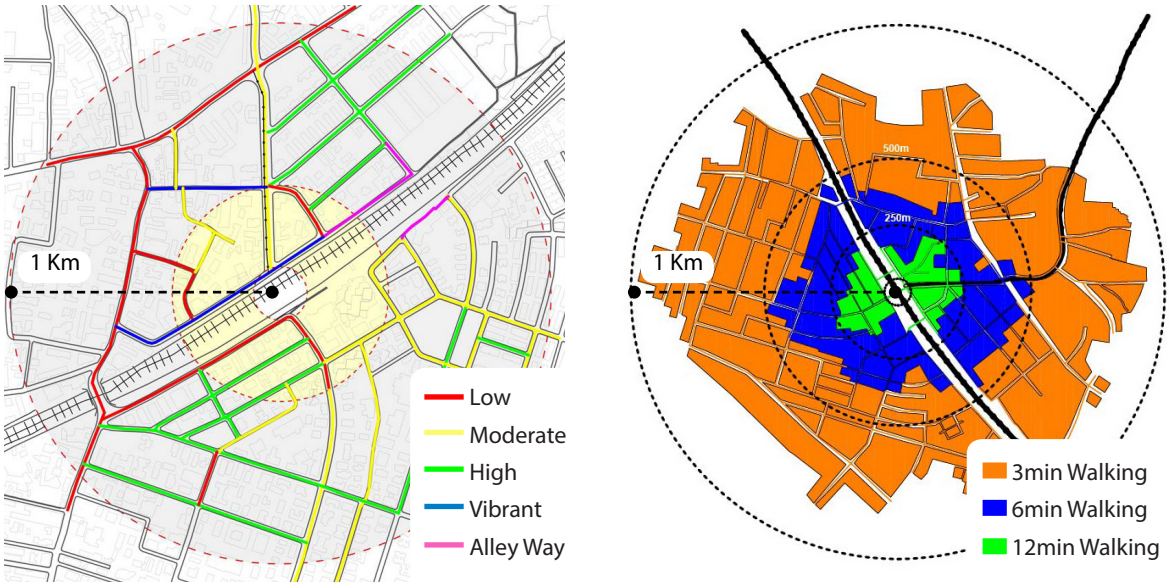



Figure 15: (left) Map representing a ped-shed analysis of Ghatkopar Station area; Source: EMBARQ India; (right) Map representing the ease and safety of walking within the TOD influence area. Ease measured from low to high, and safety measured as vibrant or alleyway; Source: EMBARQ India

Figure 15 (right) shows a perception analysis based on qualitative assessments as well as perception surveys. Neighbourhood characteristics such as a good tree coverage, ground floor retail establishments, building edges that shade the street, and access to good quality open spaces encourage walking. A perception survey of a sample size of 20 people revealed that most pedestrians were fairly satisfied with the walking experience within the Ghatkopar station influence zone. A mean rating of '3.6' (out of 5) was given by those surveyed.

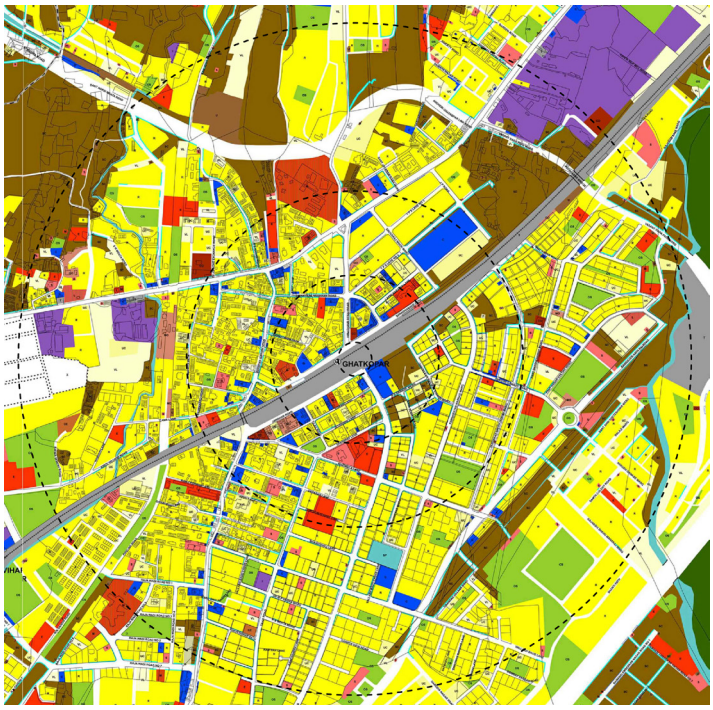
The street grid of a neighborhood is representative of the level of walkability in the area. Survey results show that people on the east side of the station walk a lot more than those on the west. The OD survey by mode Figure 14 reveals that walking is a preferred mode of access to the station. However, off-peak surveys conducted within the TOD zone reveal that people on the east use walk as a preferred mode even for non-work trips, while accessing amenities like schools, hospitals religious and cultural places, open spaces, and for daily shopping. However, walking is inhibited on all major collector streets due to high vehicular movements and on-street parking, making walking a laborious activity.

## Existing Land Use

The TOD zone is mainly residential in character, with a fair share of retail, commercial and mixed land uses. Figure 16 reveals that 46% of the area has a residential land use, 29% has a mixed land use, while 12% has commercial and 6% has other office land uses. There is a fair distribution of amenities such as schools, colleges and hospitals. Open spaces and places of religious and cultural significance are well distributed on the east, but lack on the west. Additionally, the land survey of the area reveals that 7% of all buildings in the TOD zone are undergoing redevelopment; of which, 5% are located in Ghatkopar east.

In the immediate zone, within the first 500 meters from the station, 16% of the buildings have a residential land use, 16% have a mixed land use and 9% are commercial. However, the outer zone is primarily residential in nature with large land parcels occupied by MHADA colonies (on the east) and urban village clusters (on the west). Even then, the outer zone shows 13% of the buildings with mixed land uses that are mainly located along all major streets.

The existing land use (ELU) survey is done based on ELU maps available in the public domain (MCGM n.d.). Based on TOD principles of mixed-



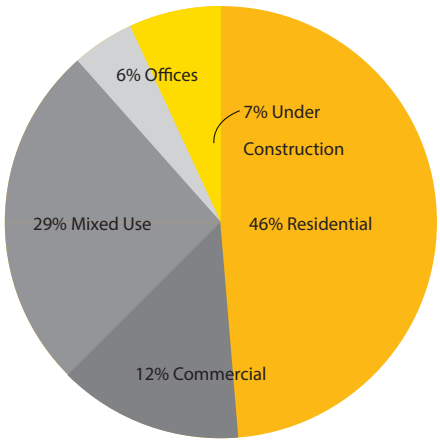




Figure 16: (top) Existing Land Use Map; Source: MCGM website; (Left) Graph showing land use distribution in the 4 study blocks across the TOD area; Source: EMBARQ India

use, compact, high density developments, Ghatkopar station has naturally developed with vibrant mixed-use neighbourhoods. The rate of redevelopment in the area is significantly high, especially on the east. Hence, the Mumbai DP 2014-34 can consider harnessing these characteristics within TOD zones along mass transit lines to retain and encourage mixed-use precincts even after redevelopment.

## Building Heights

The Ghatkopar TOD area is fairly low-rise, where 65% of all buildings within the TOD zone are ground+4 structures or lower. Only 5% of all buildings are ground+9 storeys and above. These are predominantly new developments, where the average height is ground+9 storeys. Figure 17 shows the distribution of building heights in the TOD zone. This distribution of building heights remains fairly consistent across the intermediate and outer zones. However, since Ghatkopar east has a higher rate of redevelopment, block 2 on the east close to the station, has the highest number of buildings (13 in number) with ground+9 storeys and above; this accounts for 72% of the high rises within the overall TOD zone.

A typical TOD model projects high-rise high density built form close to the transit station. Therefore, it can be said that Ghatkopar east is representative of that trend. However, Ghatkopar west has fairly low to medium rise buildings across the precinct. With an increase in redevelopment catalyzed by the upcoming Metro line, a similar trend may be seen in the west. It is noteworthy, that all new high rise developments in the east adhere to current parking norms, and therefore have extremely high parking provisions close to the railway station. Hence, high rise developments at one end bring more density


Figure 17: (left) Map showing existing building heights of the study area; (top right) Graph showing building height distribution across four blocks; Source: EMBARQ India

close to transit, but at the same time bring more cars within the TOD intermediate zone. This trend is counterintuitive to a TOD model, and can be considered for revision in the future master plan.

The data for building heights was collected for four representative blocks as explained in the methodology. The method used was a visual count of number of floors correlated with the building name and footprint on the base plan.

## Bulk Floor Space Index (FSI) Consumption

Figure 17 shows that the building heights in the TOD zone are fairly low, ranging between ground structures to ground+4 storey buildings. The average 'bulk FSI' consumption in the area, as seen in Figure 19, is 1.39 complying with current DCRs of a permissible FSI of 1 in the suburbs. The Mumbai DP, DCR 1991, define FSI as the quotient of the ratio of the combined gross floor area of all floors, except areas specifically exempted under these regulations, to the area of the plot (as seen in Figure 18). However, for ease of this study the 'bulk FSI consumed on a given plot is used for

FLOOR SPACE INDEX = TOTAL COVERED AREA ON ALL FLOORS / PLOT AREA

| PERMISSIBLE FSI IN THE SUBURBS | EXISTING FSI IN THE TOD ZONE | FSI OF NEW DEVELOPMENTS |
|---|---|---|
| 1 | Average FSI 1.64<br>Residential buildings: FSI 2.73<br>Commercial buildings: FSI 2.35 | Average FSI 3.64 |

Figure 18: Table showing the bulk FSI consumption ratio as well as a comparison of FSI trends by regulation, land use and for redevelopments; Source: EMBARQ India

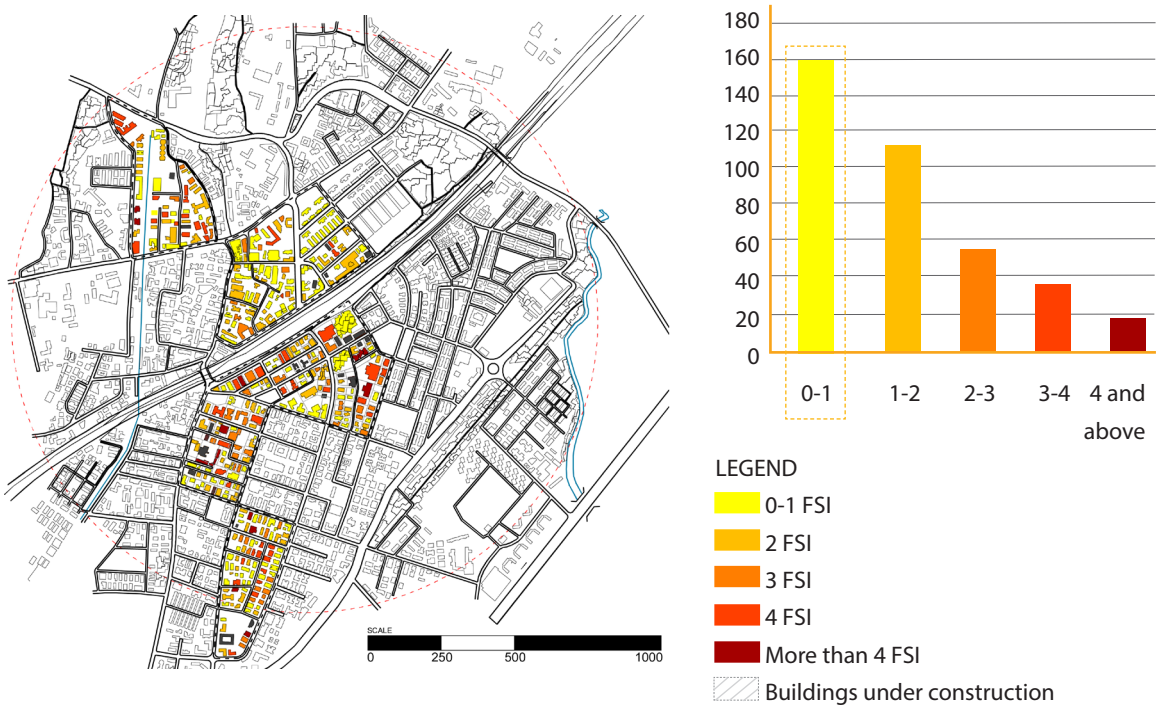



Figure 19: Map showing FSI consumption in the study area; (top right) Graph of average FSI consumption across the 4 blocks; Source: EMBARQ India

analysis. This means that areas that are specifically exempted under special regulations, such parking provisions, circulation and service shafts etc. are calculated as part of FSI. The bulk FSI consumed in each plot is calculated for all four blocks in the TOD zone, to derive the average bulk FSI consumption. The bulk FSI consumed within the influence zone shows a varied range from FSI 0.5 to FSI 7. It is noteworthy, that only 6% of the plots consume an FSI of 4 and above, as seen in the graph in Figure 19, whereas 62% of the plots have an FSI of 2 or less.

FSI consumption by use shows that the average FSI for a residential building is 1.46 and that for a commercial building is 1.67. New developments consume a much higher average bulk FSI of 3.64, which is 2.5 times higher than that of TOD zone. The average FSI consumed in the intermediate zone is 1.3 and in the outer zone is 1.48. This suggests that the bulk FSI consumption increases with distance from the station. A corollary to this can be seen if each block is analyzed separately, revealing that block 2 on the east in the intermediate zone has the highest average bulk FSI consumption of 1.63.

This can be attributed to a large number of new developments that are spurring close to the station.

Since the permissible FSI in the suburbs is 1, a high bulk FSI suggests that a significant portion of new developments have provisions for areas that may be exempted from FSI. On-plot parking provision is one such parameter. Buildings with high parking provision close to station areas have high bulk FSI consumptions with a significant portion of the building occupied by dead parking spaces. This not only increases the amount of car density in a given area, but also gives rise to buildings with dead facades up to the 5th or 6th floors. Hence, including parking provisions within FSI may help evaluate

## Off-Street Parking Analysis

To study off-street parking provisions and trends in the TOD zone, a survey of parking provision was executed across the four blocks. The survey reveals that 72% of the buildings in the TOD zone have some form of off-street parking. There are approximately 4206 car parking spaces (equivalent car spaces ECS) for a population of 13,943 people over an area of 57.5 hectares across four blocks.


| | INNER 500m | OUTER 500m |
|---|---|---|
| Residential | 0.62 | 0.71 |
| Commercial | 0.38 | 1.3 |
| Mixed Use | 0.41 | 0.67 |

LEGEND

Buildings with Parking

Buildings with No Parking

Buildings under construction

Figure 20: (left) Map showing buildings with and without parking; (top right) Table showing number of parking spaces per 100 sq.m across the four blocks by land use and distance to transit station; Source: EMBARQ India

ECS numbers have been collated based on visual counts and surveying security personals. The parking ratio in the TOD zone overall is 1.16 car spaces/ 100 square meters of built up area as compared to current parking norms in Mumbai of 2.17. As compared to other Asian cities (refer Figure 5) even 1.16 is extremely high.

In the intermediate zone, the parking ratio is 0.83 car spaces/ 100 square meters and that for the outer zone is 1.51 car spaces/ 100 square meters. This is a good existing model establishing that parking provision increases with increase in distance. 66% of the buildings in the intermediate zone have some form of parking provision; while in the outer zone 82% buildings have parking. Since Ghatkopar east is better planned and has a higher

proportion of formal housing and commercial establishments. This has led to a significantly higher percentage of buildings with parking, 63% (or 3010 ECS for two blocks), while the west has only 28% buildings with parking (1196 ECS for two blocks).

However, from all the buildings with parking in the overall TOD zone, 59% lie in the intermediate zone and 41% lie in the outer zone. This counter trend points to new developments in the intermediate zone that are built based on current parking norms. Since block 2 on the east close to the station has a significant number of new developments its corresponding parking ratios are very high. For buildings with no parking provision, 77% lie in the intermediate zone and 23% lie in the outer zone, indicating that there are more buildings with no parking closer to the station. Again, this can be attributed to old developments close to the station.

Figure 20 shows parking provision (ECS) by use based on distance from transit per 100 sq.m of the built up space. It can be seen that parking provision by use increases with increase in distance from transit station. It is noteworthy, that buildings with mixed land uses have a lower parking provision than single use buildings.


Figure 21: Survey locations at three levels within the TOD zone; Source: EMBARQ India

## Traffic Analysis

The Traffic analysis is conducted at (i) the two major junctions within the TOD zone, (ii) along major streets in the four blocks. Traffic volumes at the two main junctions, and pedestrian counts and modal splits are collected at mid-block for main streets in the four blocks. Survey results have helped determine travel behavior, mode shares, pedestrian activities and transit ridership patterns. The map below shows the location of data collection points for processing a traffic analysis in the area.

### Pedestrian Counts

Based on survey results across all the mid-block locations, it can be said that Ghatkopar TOD area shows a constant pedestrian movement across the TOD zone. At the two junctions pedestrians are observed walking the last mile to the station, even though they may have used other modes to the get to the station area. At the mid blocks the pedestrian share is up to 35%. Modal share by direction at the two junctions reveals that 80% of the trips are recorded as trips to and from the station. During the day more than 51,000 pedestrians are recorded across 10 mid-block locations in the overall TOD zone. Out of the total pedestrian count recorded across the 10 locations, 67% of the pedestrian share is in the intermediate zone.

### Traffic Volume

The traffic volume survey was conducted at two major intersections along M.G. Road; where M.G. road meets the LBS Road and the 90 feet road respectively (as in Figure 21). The survey was conducted over 12 hours, from 8 am to 8 pm, where the morning peak is from 9am to 10am and the evening peak is from 6:30pm to 7:30 pm. Traffic peak counts at junctions are preceded by train peaks suggesting that the suburban rail is the primary mode of travel. The east has more traffic volumes than the

west. However, the west has more Heavy Motor Vehicle (HMV) traffic throughout the day along LBS road. Due to heavy construction activity in the west along the Metro corridor, traffic volumes on the west are comparatively lower than before. Both these junctions are heavily used and are the important points of intersection for the trips towards or from the Ghatkopar station. The internal streets show comparatively less volumes of heavy vehicles.

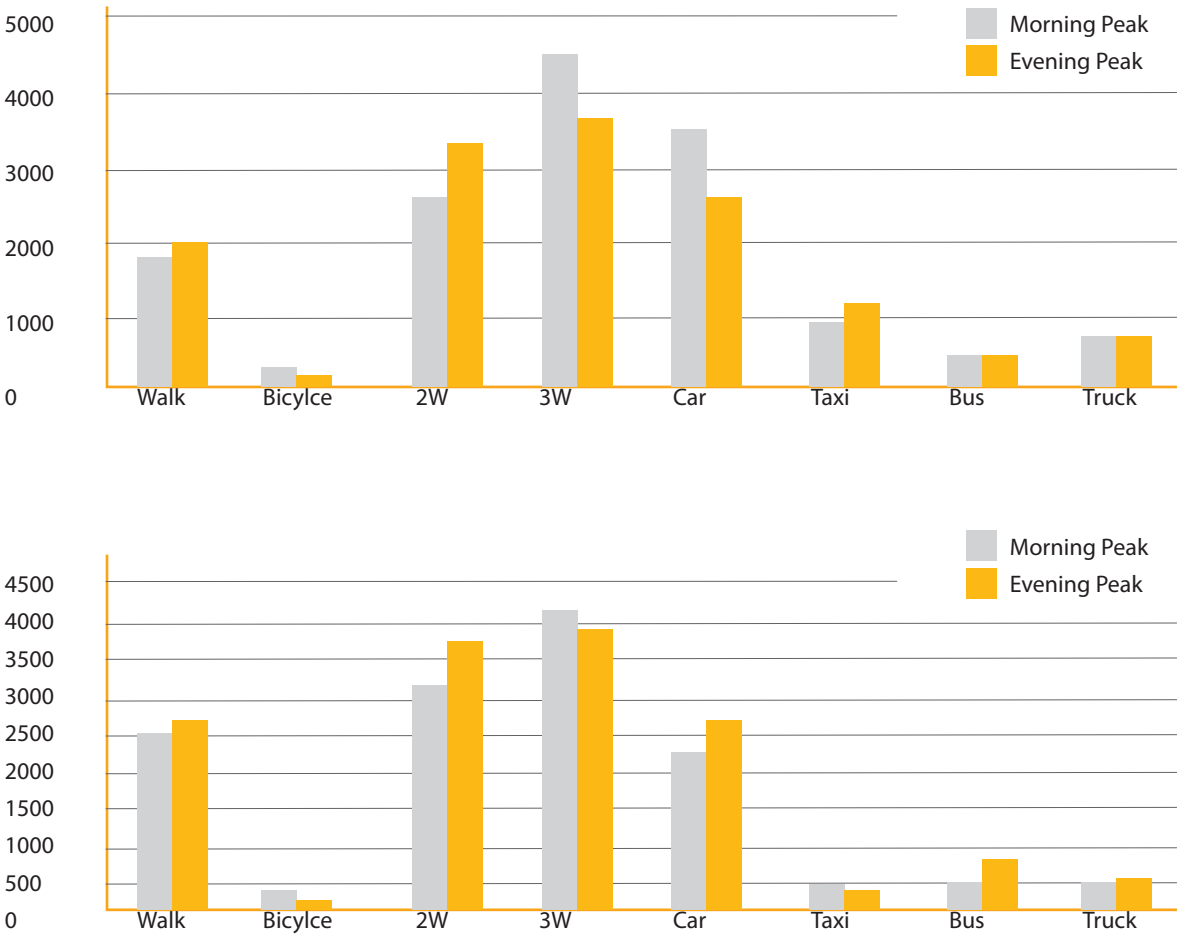



Figure 22: (Top) Average traffic volumes and modal splits at the two junctions; (Bottom) Average traffic volumes across all internal streets at mid-block; Source: EMBARQ India

## Modal Splits Across All Mid-Block Locations

A modal split within the TOD zone reveals that 29% people walk, and including NMT, 31% use NMT modes. 29% use IPT services, while only 3% use BEST services. However, due to close proximity to two arterial roads (the Eastern Express Highway and the LBS Road) private vehicular use (including two-wheelers, cars and HMV) is high up to 37%. This is mainly through traffic, while a detailed analysis of block 2 will reveal traffic volumes in the immediate station area.

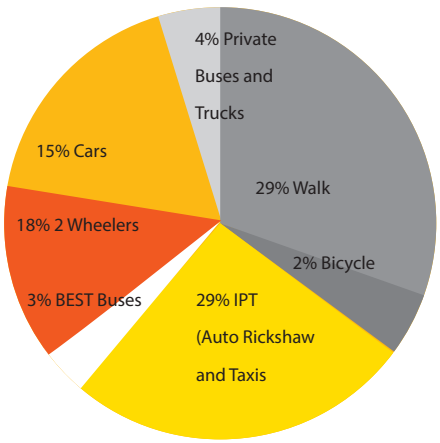



Figure 23: Modal split across all four blocks in the TOD zone; Source: EMBARQ India

# LEVEL 3: BLOCK-LEVEL TRAVEL BEHAVIOUR AND PARKING ANALYSIS

Based on the analysis presented in levels 1 and 2, the Ghatkopar station area is highly dominated by commuters walking to their final destinations, or the next modes. This presents a clear case for exercises stringent parking reforms to ensure that existing conditions of a TOD precinct are retained, and further enhanced, even after redevelopment. A detailed analysis of Block 2 on the east within the first 500 meters from the station is taken up. Finally, based on the block level analysis parking reform strategies are demonstrated in order to recommend policy reforms.

Block 2 on the east has one of the higher rates of redevelopment, it shows higher car ownership patterns and parking provision is fairly high as compared to other areas in the overall TOD zone. This helps us build stringent parking reforms, while considering a 'well-provided' study area. This is to ensure that all policy reforms are flexible and meet existing demand as well as future projected growth in the area.

## Existing Land Use Analysis

Block 2 has a high rate of mixed land uses with commercial and retail establishments in most residential buildings. Figure 24 shows that 42% of the buildings in block 2 are purely residential, while 16% have either commercial or retail uses. 28% of the buildings in block 2 have mixed land uses; out of which, each mixed use building, on an average has a 23% commercial component incorporating ground retail, offices, dispensaries, and coaching classes, up to the first 3 storeys of the building.

Most buildings typically have ground level retail or commercial uses, contained within the plot boundary and in some cases spilling out onto the sidewalks. About 1/3rd commercial uses are within the first 250m from the station, with most of them located right outside the station along Ratital Mehta Marg. Hence, one could make a qualitative assessment that most streets in block 2 have active edges with a vibrant and pedestrian friendly walking experience.

10% of the buildings in this block are undergoing redevelopment, and are therefore either under construction or newly developed with few inhabitants. Further analysis of building heights,

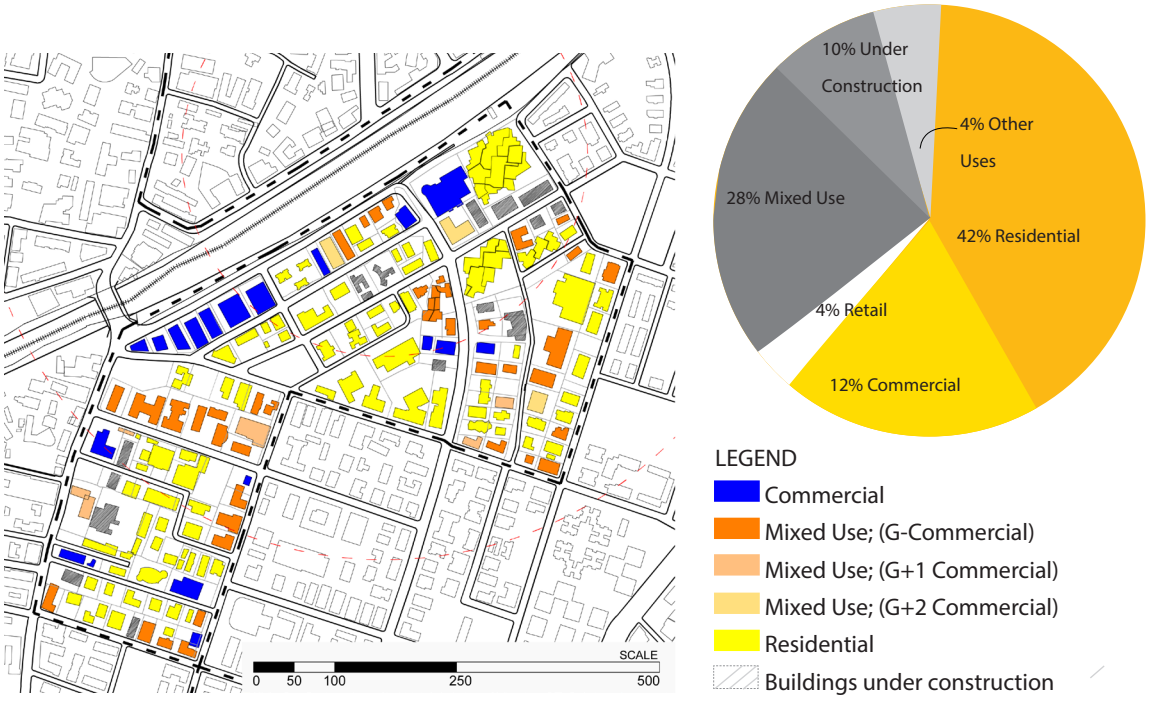



Figure 24: (left) Map showing land use distribution in Block 2; (right) Graph showing the land use distribution in Block 2; Source: EMBARQ India

FSI consumptions and parking provisions will present a clear picture of the implications of redevelopment to the area. It would be important to survey the land uses derived after redevelopment to assess whether these land use characteristics have been enhanced or arrested. A set of guiding principles can be incorporated in the revised DP 2014-34 to enhance these characteristics.

## Building Heights

The average height of all buildings in block 2 is ground+5 storeys. 55% of the buildings are

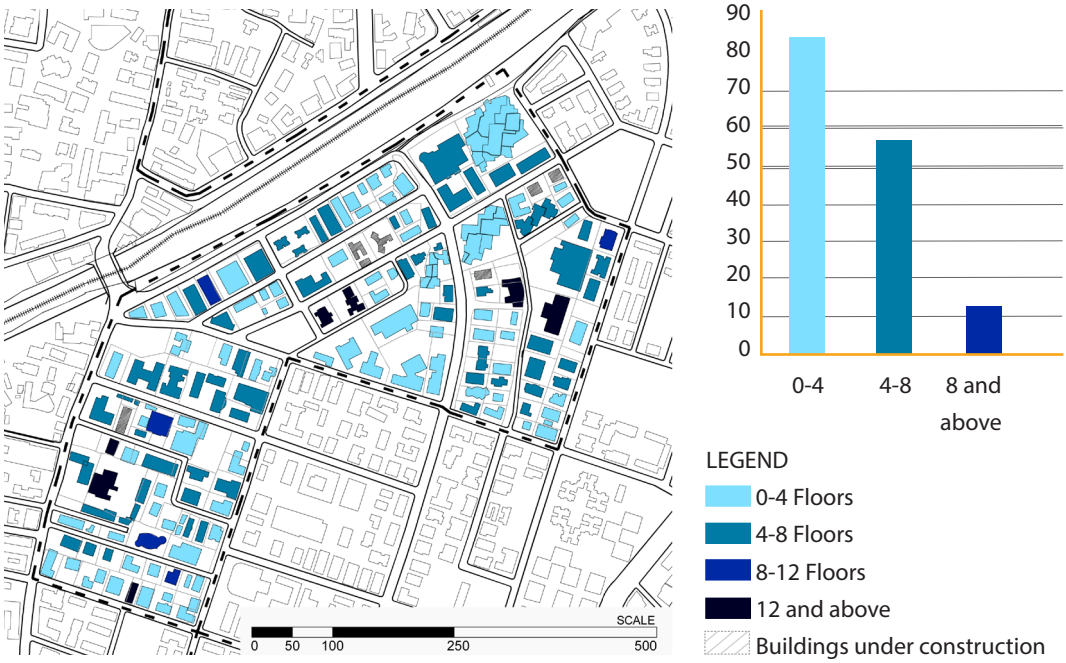



Figure 25: (left) Map showing the building height distributions in Block 2; (top) Graph of building height distribution in Block 2; Source: EMBARQ India

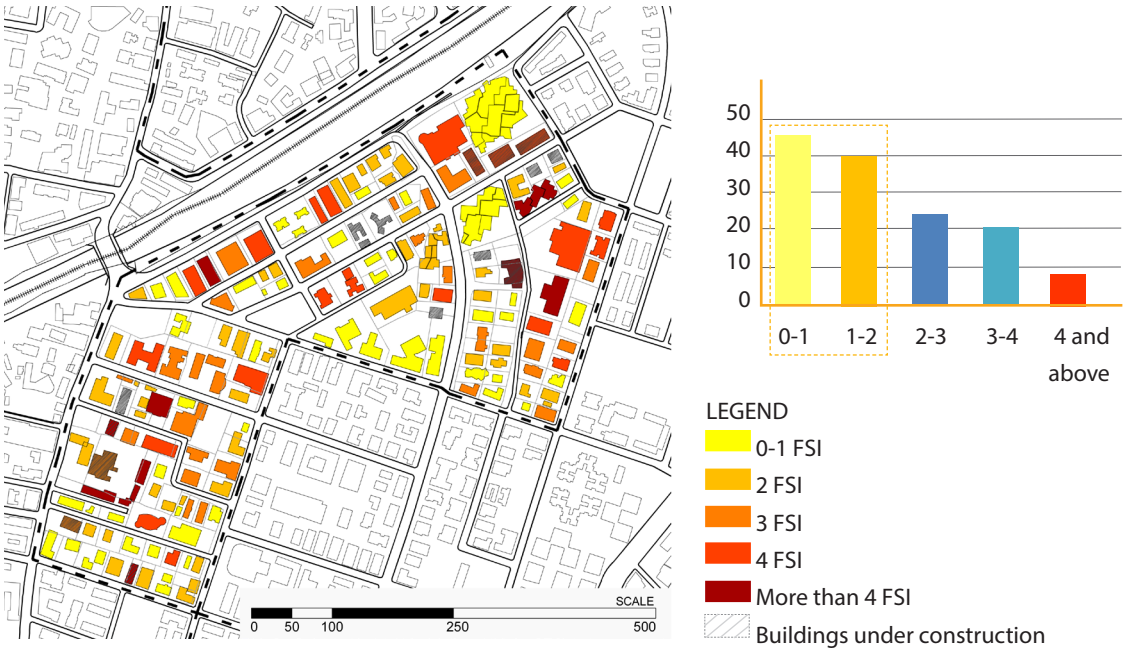



Figure 26: (top left) Graph and Map (right) showing existing FSI consumption in Block 2;
Source: EMBARQ India

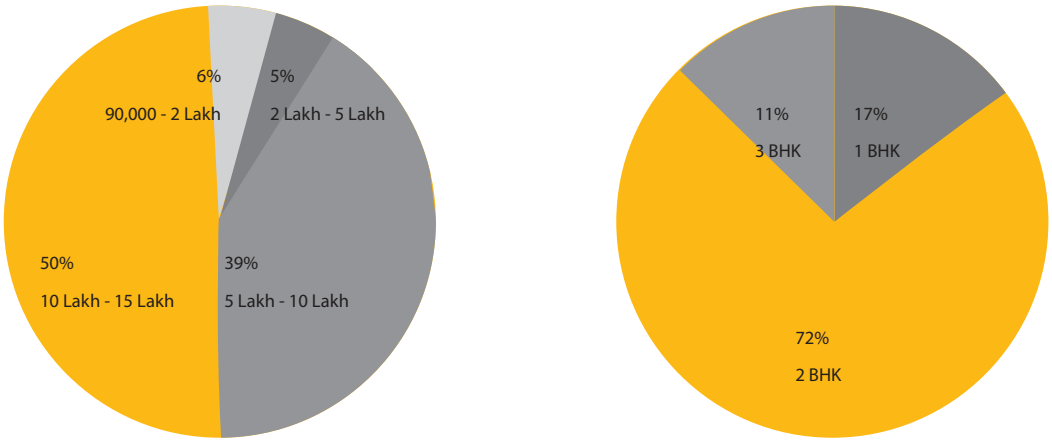



Figure 27: (left) Graph showing household income within Block 2; (right) Graph showing the proportion of household unit sizes; Source: EMBARQ India

ground+4 storeys or lesser, 36% buildings range between ground+5 to 8 storeys and 8% are more than ground +8 storeys. These are located along the station road on the Ratilal Mehta Marg. Figure 25 shows plot-wise building heights in block 2. The highest buildings go up to ground+14 storeys, which are very recent constructions with multi-level car parking facilities. Redevelopment trends in the area show that new developments have a minimum height of ground+8 floors. A survey of the 'dwelling unit density' of new constructions may reveal it is almost similar to that of other buildings with lesser building heights, as the first 2 to 5 storeys are parking.

## Bulk FSI Consumption

Block 2 has higher bulk FSI consumption than the overall study area, with an average of 1.63 bulk FSI. Only 6% of the plots consume more than 4 FSI. These are mostly new developments with an average of 4.2 FSI. Along the station road, residential buildings consume up to 2 FSI but commercial developments (most of which are very new) consume as high as 7.5 FSI. The permissible FSI for the suburbs is 1, as shown in Figure 18. Buildings under construction are consuming up to 3.64 bulk FSI, which is twice the existing average and four times the permissible FSI. However, the increase in FSI in new constructions can be attributed to high parking requirements. Figure 26 shows the FSI distribution in block 2, where the average FSI for residential buildings is 2.73 FSI and for commercial buildings is 2.35 FSI.

## Household Survey

A 3% sample household survey was conducted in block 2. 50% of the residents fall in the income bracket of 1,000,000 to 1,500,000 INR annually, and have a basic graduate level education. 72% of the residents live in a 2 BHK (Bedroom-Hall-Kitchen) apartment type, with an average household size of 4.2 persons per household, within an average age bracket of 25-50 years.

These patterns reveal that the resident population in this block is an educated, professional class, living in mostly nuclear families, from a middle-income group with sufficiently large household sizes.
The population density (based on household size

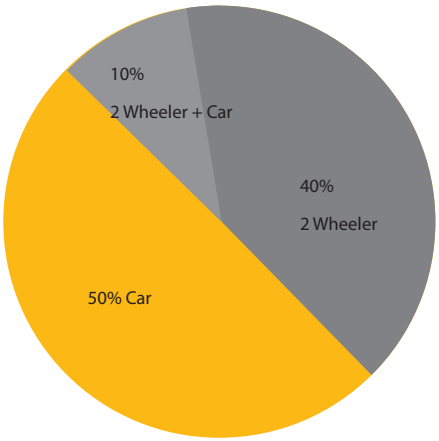



Figure 28: Vehicle ownership chart showing 50% car ownership; Source: EMBARQ India

and dwelling unit density) is calculated as 25,760 people per sq.km., while that at ward level is (for the N-ward) is 11,853 people per sq.km.

This shows that the population density in this block is 2.5 times higher than that of the N-ward, indicating that the area around the station is densely populated. The household survey reveals that public transport and non-motorized modes are the preferred mode of travel for all work trips. While 67% people use public transport, 28% people walk to work. The suburban rail is the most preferred mode, followed by BEST buses.

## Vehicle Ownership

Out of a 3% sample size, 50 residents in number, 10 households own cars. Proportionately, 24% of the residents own cars, but car usage is very low, up to 5%, which is mostly limited to non-work or weekend trips. Since the population density is very high, this amounts to a high absolute figure of car users. The survey reveals that the average car ownership in the area is high, up to 79 cars per 1000 people, which is almost double that of the city's average of 41 cars per 1000 people. While 64% of the residents in the area don't own a vehicle and rely primarily on other modes of travel, 10% of the population in the area own 2 cars. Households owning cars fall within the annual household income bracket of 1,000,000-1,500,000 INR.

## Opinion Survey

An opinion survey was conducted for residents, employees and visitors of this area with an objective to understand people's perception about the area. 56% of individuals surveyed are averagely satisfied with the neighbourhood, due to a good amenity distribution of schools, hospitals, with a pleasant walking environment. 90% individuals want more redevelopment as long as they can continue to live there. Proximity to a mass transit system with access to efficient bus and IPT options is highly appreciated. However, there was dissatisfaction with the quality and distribution of recreational open spaces, and a lack of parking in the area.

## Parking Analysis

Block 2 shows a significantly high parking provision for both off-street and on-street parking. Two internal streets Khokhani Lane and Jethabhai Lane (refer Figure 29) serve as on-street parking lanes for two-wheelers and marginally for four-wheelers. However, due to a shear lack of enforcement, on-street parking is a fairly random phenomenon where a large portion of parking occurs informally. Off-street parking supply in block 2 is fairly high due to redevelopment where new developments follow current parking norms. There are a total of 162 buildings in block 2, out of which 64% have some form of parking provision, in building set-back spaces, stilt areas, basements, or at podium level. Compared to a 70% parking provision across all buildings in the overall TOD zone.

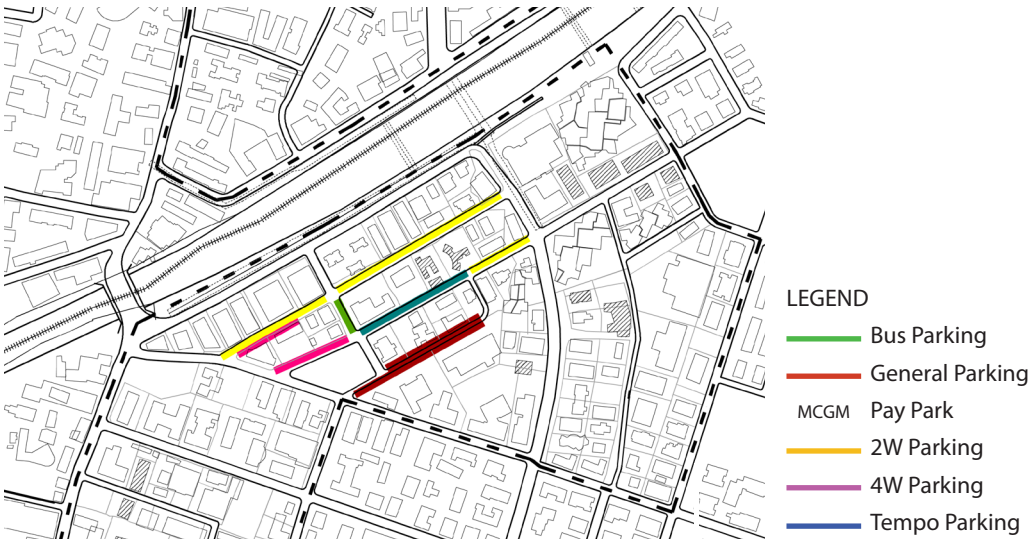


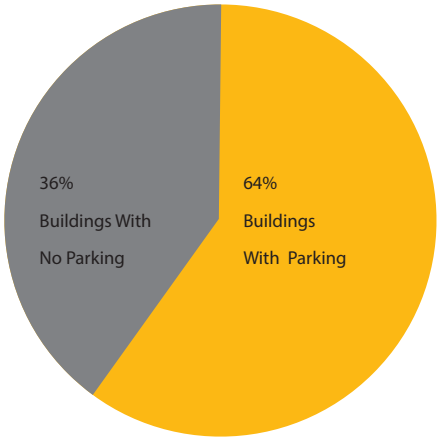

Figure 29: Paid on-street parking facilities in Block 2

| Parking Provision Inventory for Block 2 | | | |
|---|---|---|---|
| Total Parking Spaces (ECS) in Block 2 | | | 1899 |
| Total Built up Area (sq.m) in Block 2 | | | 324950 |
| Average Parking Supply/100sq.m of Built up Area in Block 2 | | | 0.5843976 |
| Parking Provision in Block 2 | | | 1.52 |
| | | Overall Block 2 | Buildings With Parking |
| ECS/100 sq.m Based On Land Use | Residential | 1.53 | 1.93 |
| | Commercial | 0.2 | 0.25 |
| | Mixed Use | 0.48 | 0.61 |
| ECS/100 sq.m Based On Distance | Less than 250m | 0.79 | 1.16 |
| | 250m - 500m | 0.56 | 0.91 |
| | More than 500m | 1.48 | 2.29 |
| | | Provision % | Provison Type % |
| Type Of Parking Provision Percentages | Stilt or Set Back Parking | 74% | 91% |
| | Basement/Multi Level Parking | 26% | 9% |

Figure 30: Parking inventory for block 2; Source: EMBARQ India

## On-Street Parking Provision and Occupancy Analysis

The on-street parking occupancy analysis was conducted along all streets adjacent to the station in block 2 from 8am to 8pm on a weekday. Figure 29 depicts an overall picture of on-street parking in

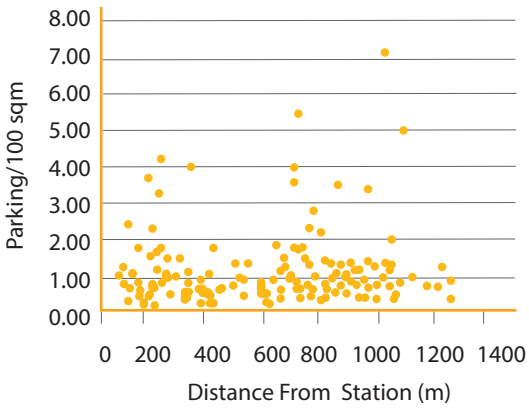




Figure 31: Map (left) and graph (right) showing parking supply, and (bottom right) graph showing parking supply by distance from transit in Block 2; Source: EMBARQ India


Figure 32: (left) Map showing parking occupancy percentages in Block 2 and (top right) graph showing parking occupancy percentages for block 2; Source: EMBARQ India

the vicinity of the station. The northern sides of both Khokhani Lane and Jethabhai Lane are regulated by MCGM as pay and park.

The MCGM pay and park is operated by a private contractor and handles the ticketing and collection of parking fee. The two streets witness heavy two wheeler parking and to some extent four-wheeler parking as well. Data analysis reveals that the average duration of vehicles parked on the streets for the entire block 2 is about 8 hours and is about the same for the streets adjacent to the station. Field observations indicate the occupancy levels at 100% during AM and PM peak hours along Khokhani Lane and Jethabhai Lane. This implies that the two streets adjacent to the station serve as park and ride for most of the two-wheelers and four-wheelers that park and use the suburban rail for their forward journey. It can be further argued that these are clearly work based trips.

## Off-street Parking Provision and Occupancy Analysis

Across block 2 there are 1899 car parking spaces provided off-street within buildings in set-back areas, stilts, basements or on multiple floors. Out of a total of 162 buildings (including buildings under construction), 104 (64%) have some form of parking provision, while 58 (36%) have no parking (refer figure 31a). The average parking provision across block 2 is 0.58 cars/ 100 sq.m of total built-up area, which is fairly low and optimum for a TOD precinct. However, the average parking provision increases three times to 1.52 cars/ 100sq.m, when calculated for buildings that have parking. This shows that the Ghatkopar station area has a good mix of buildings with and without parking, reducing the overall
parking supply. New norms for redevelopment in TOD areas can therefore arrest parking supply by reducing existing parking norms. Based on the building typology parking provision in the area varies. It ranges from 2 ECS for a stand-alone bungalow type, to 70 ECS for a high-rise, HIG (high-income group) residential building with mixed-use retail and office uses on the first 3 levels. Based on the household survey it is noteworthy that only 26% of the population of block 2 have cars, but the parking provision at block level 1.52 car spaces/ 100sq.m. An inventory of the parking provision for block 2 is provided in figure 30, to understand critical patterns based on land use, distance from transit and parking provision type.

Out of the total parking stock, 26% of the parking

provision is provided in basements or multi-level parking floors; while the remaining is provided at surface level or in building set-back areas. However, only 9% of the buildings have basements, remaining buildings with some form of parking provide it at ground level. Constructing basements and multi-level parking spaces may be cost-inefficient; however, they are more space-efficient. They allow for common parking places thereby freeing ground space for circulation, recreational spaces or street facing retail and commercial enterprises. Ground level parking can be restricted and basement/ multi-level parking encouraged.

Clear guidelines to restrict use of ground plot area for parking purposes can be introduced into the revised DP. Additionally, stringent guidelines that ensure car parking entries and exits are from internal streets, freeing main streets off car
congestion due to bunching. Additionally, multi-level car parking can be restricted on ground and first two storeys. This is to ensure that buildings have active land uses like retail, commercial or residential spaces, closer to the ground level.

A parking occupancy analysis for the block 2 was done at two times of the day—peak time and off-peak time—to map travel behavior and reliance on cars as the main mode of travel. For residential buildings the day time was considered as off-peak and night time was considered as peak time. For commercial the assumption was vice versa, as employees would come in during the day and return in the evening, leaving behind empty parking lots. Figure 31 shows a map of parking occupancy levels in block 2. The average occupancy level in the area is 50%, i.e. on an average 50% of the parking spaces in the block are occupied.

Along the station road the average occupancy percentage is 67% as these buildings are mainly commercial, and therefore have a significant provision for visitor parking spaces. Within residential buildings it is noted that there is 40-60% occupancy as most residents in the neighborhood use public transport or walking as their preferred mode choice. This has been established through the origin-destination surveys, household surveys as well as parking occupancy surveys. Moreover, residential buildings have low occupancy levels than mixed use developments, as mixed- use buildings present an opportunity for shared parking. Figure

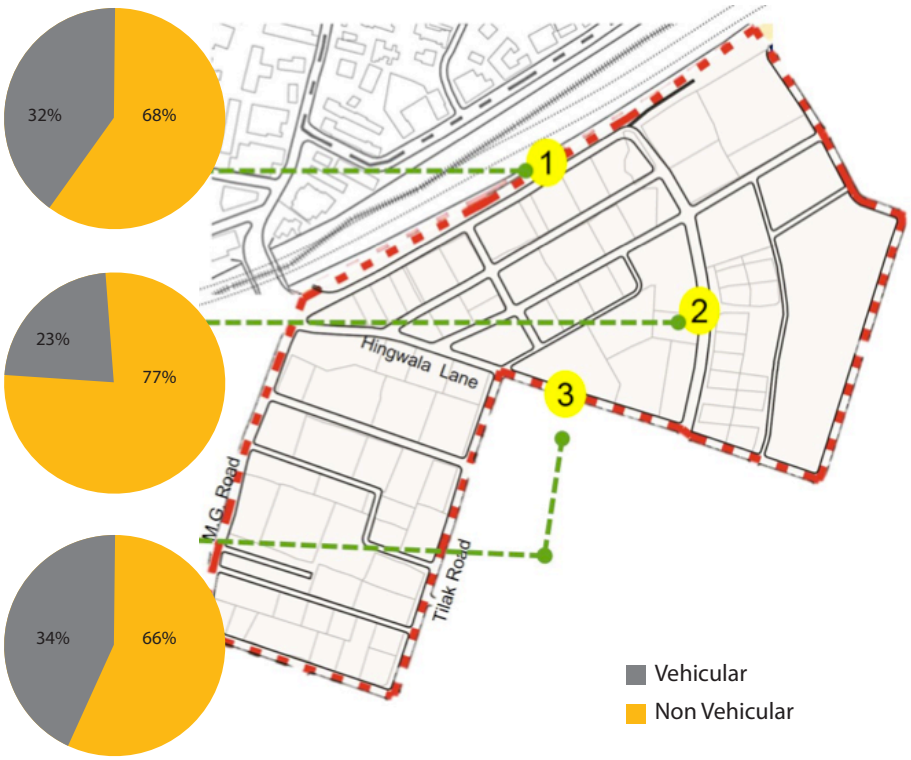



Figure 33: Modal splits at mid-block locations in Block 2; Source: EMBARQ India

32 suggests that parking occupancy levels are fairly low, compared to the permissible threshold occupancy of 85%, while parking provision is fairly high. (Also refer figure 30 for detailed parking provision numbers). Only 12% of the plots occupy a threshold limit of 85% parking spaces. Parking provision by distance from the station as represented in the parking inventory in figure 30 establishes that there is no clear increase in parking with distance from the MRT station. In fact parking provision across block 2 is fairly constant irrespective of distance. This further establishes a need for reassessing parking supply close to an MRT station.
The maps and graphs shown in the parking analysis section suggest that parking supply across block 2 is significantly high. 64% of the buildings across the block have some form of parking provision in addition to a large regulated and unregulated on-street parking availability. Based on the household survey for block 2 we know that car ownership percentages are significant, but car usage is very low. The occupancy analysis for the area shows that there are many vacant car parking spots, even during peak-times in the day, showing an imbalance between demand and supply. Comparing this to city level car ownership and growth patterns—an increase in parking provision facilitates car ownership rates.

On-street parking availability in block 2 is already quite congested as explained in the analysis. There is little scope to expand these for the future needs of the area. This information along with the off-street parking data only implies that parking supply and demand levels are already in excess around the station areas. The existing parking regulations have resulted in streets being taken over by private vehicles while in reality it should be pedestrian and NMT friendly to providing safe access. Therefore it becomes very critical to ensure that special regulations need to be framed within the first 250 meters from the station for parking.

## Traffic Analysis

The traffic analysis for block 2 illustrates modal splits as well as volume to capacity ratios. The volume to capacity ratio is calculated to understand the current level of service for streets within block 2. This helps present the congestion scenario for the area.

### Modal Splits in Block 2

Figure 33 reveals that the percentage of NMT use to vehicular modes varies based on proximity to station. Just outside the station at mid-block location 1, only 32% people use NMT modes. However, the overall analysis shows that 35% use IPT and BEST services across the study area, as feeder services, which contributes to vehicular modes. Location 2 is the main sub-collector street, with high vehicular movement (77% motor vehicle count) connecting the station to the 90 feet road and the Eastern Express Highway. Hingwala lane (location 3) is a quiet residential street with vibrant markets and street vending activities and therefore sees a high NMT movement of 66%.

An average across all three locations shows that 40% of all trips are made using NMT modes. While bicycle shares in the area are only 3%, the opinion survey suggests that people are happy to cycle if streets were safer and had more infrastructures for NMT users.

## Flow Capacity Ratio (V/C)

The flow capacity ratio, also known as the Volume-to-Capacity ratio (V/C), is a measure that reflects mobility and quality of travel of a facility or a section of a facility. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity).

***v/c = (rate of flow) / capacity***

Figure 34 shows the V/C ratio for the road segment where mid-block counts were collected. Data reveals that the evening peak volumes are higher than those for the morning peak; hence the flow capacity ratio is collected for the evening peak time. It can be seen that a number of streets in block 2 are one-way streets forming a loop of movement near the station. The major collector in this block is Ratilal Mehta Street that is a two-way street with the highest V/C ratio value of 1.4. This indicates that it is utilized more than its capacity, due to congestion and therefore is unable to release vehicles smoothly through the road segment.

An increase in vehicular use can worsen levels of congestion on the street. Congestion levels just outside the station are medium to high, as during evening peak hours a significant pedestrian movement of commuters is observed, balancing

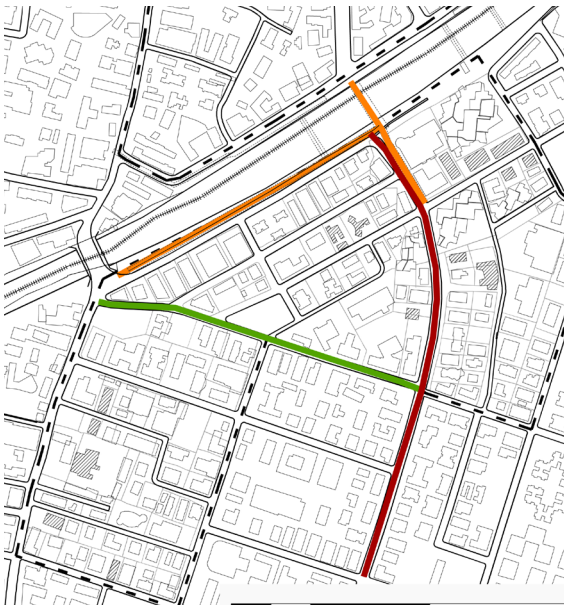


Figure 34: Map representing the Flow-Capacity ratio for different street types in Block 2; Source: EMBARQ India

vehicular traffic. Inner streets like the Hingwala lane show relatively low V/C values, indicating more pedestrian and NMT activities than vehicular traffic. Hingwala lane has the lowest V/C value as it is a one-way neighborhood street with the highest pedestrian movement.

The traffic analysis conversely shows a very extreme case of congestion outside the station due to private vehicle movement. However, based on the traffic analysis at mid-blocks and junctions it is clear that most of the traffic is through movement of vehicles. The O-D survey (refer Figure 14) shows that about 50% of the commuters walk to the station. Hence, most traffic around the station is not induced by transit users and can therefore be diverted or restricted to improve pedestrian access.

## Key Findings

Ghatkopar station is a good case to demonstrate a TOD strategy that can be scaled up for the rest of the city. The station serves as an important transit hub with more than 300,000 commuters using the station every day. After the completion of the Metro Line 1 it will serve as an interchange terminal for commuters transferring between the Metro and the suburban railway. Most commuters access the station by walk or using feeder services like BEST buses or auto-rickshaws. Private vehicle usage to access the station is almost negligible. There are two major concerns that may affect TOD areas in Mumbai due to high parking provisions: increase in traffic congestion therefore decreasing safe access to transit, and a pedestrian unfriendly built environment.

The overall TOD zone is representative of a good mix of land uses, with high population densities, relatively low built densities and low FSI consumption. Older housing typologies like urban village clusters, informal settlements, and older walk-up apartment types have smaller dwelling units and low parking provisions, thereby housing more people close to transit. Due to redevelopment, new housing typologies in the area have larger dwelling unit sizes catering to higher income groups with high parking provisions, thereby housing fewer people and more cars closer to transit. Figure 35 shows a comparative graph of car parking spaces provided in block 2 to the FSI consumed.

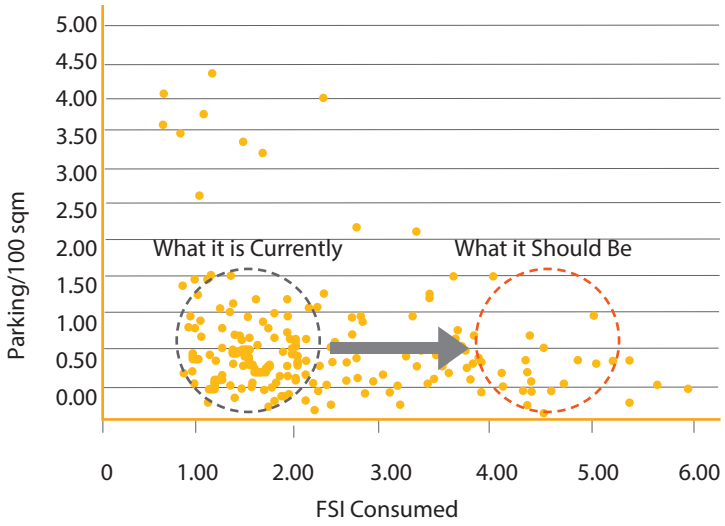



Figure 35: Graph of parking supply in residential buildings to FSI consumed in residential buildings; Source: EMBARQ India

At present the overall parking provision in the block as well as the FSI consumed is low. However, an optimum model for a TOD precinct would show extremely low parking provision in the area with high FSI consumed.

The analysis shows that vehicle ownership in the area is quite high compared to that at city level, but use of private modes for work trips is fairly low. Simultaneously, parking provision in the area is high such that it over provides for parking based on projected growth in income and aspirations. This can be said based on the parking occupancy analysis that reveals peak period parking occupancy is between 40-60%, which means that approximately 680 parking spaces across block 2 remain vacant. Overprovision of parking not only, incentivizes car use, thereby reversing the dependency on public transit, but also increases traffic congestion within the TOD zone. Opinion surveys within the TOD zone reveal that most people are fairly satisfied with the walking environment in the area, but find it cumbersome to walk in the area due to traffic congestion.

Ghatkopar station area is a fairly old precinct with

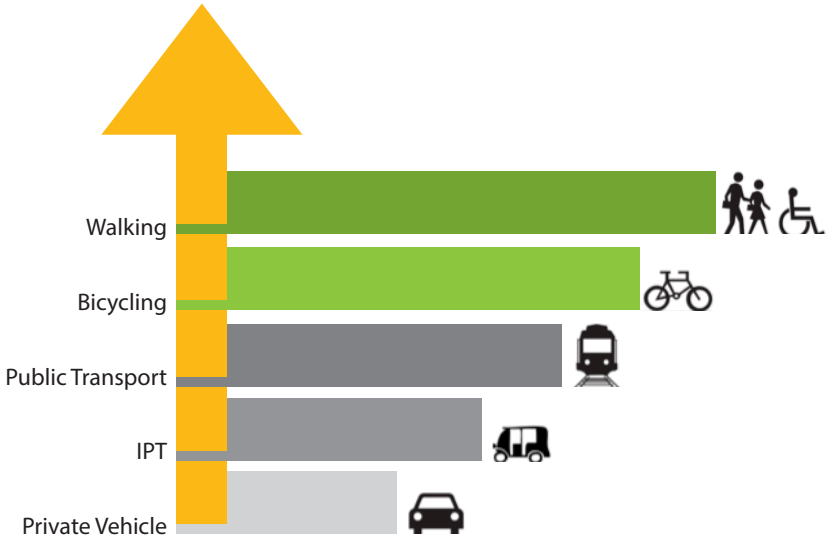



Figure 36: Mode priority within Transit Oriented Development precincts; Source: EMBARQ India

some buildings that date back to 100 years ago. Older DCRs required much lower parking supply and therefore several old buildings in the area have little to no parking. However, new developments in the area consume up to 4 FSI and have extremely high parking provisions. As shown in Figure 35, current FSI consumption is low and only going to increase due to redevelopment around the station area. Based on current parking regulations this will only increase parking supply by almost three-folds, subsequently increasing congestion levels. If parking norms are unbundled from dwelling units, parking supply can be capped at a certain maximum limit, while the number of dwelling units can be increased. This will ensure that the increase in FSI will bring in more people densities closer to transit and not as many cars.

Presently, constructing parking facilities increases costs for developers and proves inefficient for the municipality when a large proportion is unused. Reduced parking requirements can make land available for community purposes, as well as make housing more affordable by selling dwelling units without parking spaces. Moreover, based on the Existing Situation Analysis for the TOD zone it is clear that cars are the least preferred mode of travel. Therefore, the hierarchy of priority given to different modes used to access the station area should be as represented in Figure 36. However, current planning paradigms that lead to extreme traffic congestion around station areas follow an inverse hierarchy.

Therefore, reducing parking requirements as well as improving accessibility in the region will increase transit ridership. A review of the existing development control regulations in the next section, calls for a radical rethinking of the current approach to parking in Mumbai. While it is unfeasible to eliminate all parking within a TOD zone, the revised Mumbai DP 2014-34 can mandate parking reforms by shifting its 'parking approach' to one that is responsive to the city's prevalent travel behaviour.

## REVIEW OF CURRENT DEVELOPMENT CONTROL REGULATIONS

# ESTABLISHING A NEW FOR PARKING REFORMS IN MUMBAI

High mandatory parking provisions favour automobile oriented cities, where a large portion of the available road space, is consumed by private vehicles leaving little space for public transport and pedestrians.

The current DCRs for parking in Mumbai follow a conventional approach of meeting the projected demand by increasing parking supply. Over the last decade due to income growth, decentralization of employment, and public transport supply not keeping pace with demand, car ownership has increased manifolds. This has caused a subsequent increase in traffic congestion levels in the city, impacting the overall quality of life. Existing parking regulations are described in the following sections of the Development Plan 1991.

- Section 36 (table 15): States parking requirements based on building use
- Sections 33 (5, 6, 7, 9, 10 & 14): State parking requirements for buildings going for redevelopment under DCR 33 (5, 6, 7, 9, 10 & 14) respectively.
- Section 38 (9); part (iv)—[b,c,d &e]: State guidelines and requirements for basement parking;

Important aspects of the existing DCRs are reviewed here, establishing the need to rethink parking norms for Mumbai. Appendix 1 includes an exhaustive table of parking requirements based on specific regulations from Sections, 36, 33, and 39.

This is not the cause for increased car ownership in the last decade. Income growth, decentralization of employment, and public transport supply not keeping pace with demand are the key reasons.

### DP 1991 Review

### High Parking Requirements

The table below shows a comparison of parking requirements for Asian cities. It can be clearly seen that Mumbai has the highest parking requirements of 2.17 car parking spaces/ 100 sq.m of built up area, even though the car ownership rate is very low, only 48 cars per 1000 people population, and high modal shares of transit users (refer Figure 5). Existing parking requirements are like a magnet for increasing car ownership, aiming to continuously meet demand, entering into a vicious cycle of auto-oriented planning (refer Figure 3 as part of the introduction).

### Parking Minimums

The current parking norms are based on 'minimum' requirements that are free of FSI, proving an incentive for developers to build more off-street parking. High minimum norms, in turn force construction costs on developers for providing more parking. Developers are then forced to sell

parking along with housing, forcing residents to buy the number of parking spaces prescribed in the norms. This happens even if residents do not need as much parking at the time of property sales. Additionally, for middle to low income housing, these kinds of forced norms increase property values and make housing less affordable.

## Blanket Regulation

A blanket parking policy applies across the city, irrespective of local city contexts. The city follows a generic "one size fits all approach" giving no importance to the availability of alternative forms of sustainable transport, heritage precincts, business districts or shopping/ retail areas.

## Quantity over Quality of Parking Provision

Current norms for off-street parking, promote quantity over quality to meet parking demand by supplying in numbers. There is a lack of urban design guidelines to restrict the ways in which parking is provided within buildings, thereby creating active street edges with retail or housing on the street face. Current regulations leave design choices, like building underground or over ground parking, on developers resulting in undesirable consequences for the built environment.

Buildings undergoing redevelopment, under the cess policy (DCR 33(7)) or slum rehabilitation policy (DCR 33(10)), are required to follow a different set of parking norms. These include a provision for minimum one parking space per dwelling unit for the sale component. This adds to the parking provision and FSI consumed on every redeveloped plot. Additionally, developers can also pay a premium and buy additional parking provision, which is free of FSI. Each plot is mandated to accommodate these high parking provisions with additional 25% parking for visitors, resulting in large Buildings undergoing redevelopment, under the cess policy (DCR 33(7)) or slum rehabilitation policy (DCR 33(10)), are required to follow a different set of parking norms. These include a provision for minimum one parking space per dwelling unit for the sale component. This adds to the parking provision and FSI consumed on every redeveloped plot. Additionally, developers can also pay a premium and buy additional parking provision, which is free of FSI. Each plot is mandated to accommodate these high parking provisions with additional 25% parking for visitors, resulting in large parking lots on the first 10 (to 15) stories in new buildings with low occupancy levels. Figure 37 shows one such development in Lalbaugh, Mumbai, just 300m from Curry Road railway station.

## Public Parking

The existing DCRs mandate a 'public parking component' within private buildings, but do not support it with adequate incentives to encourage public parking. Public parking lots thus built over time, were not viable and had to be modified with time. Present standards fail to support these with design guidelines and a system to monitor how many parking lots are being built in an area.

## Two-Wheeler Parking

Current DCRs only focuses on four-wheeler parking. They fail to specify any standards or norms for the parking or two-wheelers, bicycles or IPT modes.

Figure 37: Development near Curry Road Station with 10 floors of parking; Source: EMBARQ India

## On-street Parking

On-street parking remains outside the purview of the DP. The lack of a comprehensive approach to parking management has caused a condition of oversupply, where large public parking lots remain vacant and underutilized and streets remain clogged with parked cars. Paid on-street parking facilities are regulated by the Transport Department at MCGM; however any form of on-street parking enforcement falls under the mandate of the Traffic Police. This creates a condition of multiple agencies making it difficult to manage parking supply in a comprehensive manner.

## Need for Parking Reforms

High mandatory parking provisions favor automobile oriented cities, where a large portion of the available road space, is consumed by private vehicles leaving little space for public transport and pedestrians. While MCGM has recently taken vital steps in managing on-street parking, similar reforms need to be addressed for off-street parking spaces. It is imperative to rethink the current parking policy towards a more sustainable and inclusive city vision. For this the correct approach towards parking must be developed, to draft new parking norms and guidelines.

## APPROACH TO PARKING

# DEFINE THE RIGHT PARKING APPROACH

Parking policies are not transferable, but local to a city context. Based on the right parking approach, strategies and recommendations can be applied to introduce parking reforms.

In order to develop parking strategies that are optimally designed for a neighborhood, it is important to define a clear approach. There are no standard thumb-rules or formulae that enable universal and transferable parking policies; however, if a city defines an "approach" towards parking, then strategies can be made transferable in theory. Based on inputs from global parking expert, Dr. Paul Barter, three parking approaches applied internationally are discussed below and a corresponding list of strategies and recommendations follow.

## Three Parking Approaches

### 1. "Right-Sizing Parking"

Is a conventional but slightly reformist approach that helps develop accurate systems to gauge 'actual parking demand'. This involves determining exactly how much parking demand exists, to match it to the supply to avoid overprovision. This is a fairly conservative approach, as it doesn't try to bring reforms to change the extent of parking demand. This approach is common in the US and Europe.

### 2. "Parking Management"

This is a Travel Demand Management approach that forces lower parking demand by setting parking standards lower than the expected demand. This is done by inducing a mode split, thereby encouraging the use of public transport, and introducing congestion pricing at parking locations, to reduce overall demand. London, Sydney and Seoul among other cities around the world are using a parking management approach.

### 3. "Responsive" Approach

This is a more cautious approach towards parking minimums, by reducing parking minimums to zero in all major locations within the city. It is important to understand that this does not mean zero parking in all new buildings. It means leaving the choice to the developers to make their own assessments of how much parking the market needs in such places. Developers do their own market research and meet the estimated demand. This approach is more radical than the conventional approach as it treats parking as a priced commodity, but is less radical than the parking management approach, as it doesn't enforce a change in demand. Portland, Seattle, Paris, and Berlin have abolished parking minimums and have taken up the responsive approach in varying forms.

## Strategies and Recommendations

Based on the three approaches discussed above the following strategies and recommendations can be applied to introduce parking reforms within local contexts. (A detailed description of each strategy/ recommendation is elaborated in appendix 2 for reference).

## Approach to Parking Reforms in Greater Mumbai

The former part of this section establishes a need for localized approaches to parking reforms. To develop new parking standards for TOD areas in Mumbai, a parking approach local to the city is discussed here. Strategies discussed here are based on research of best practices globally and

inputs from Dr. Barter.

## Reduction of Parking in TOD Areas Could Help Better Access to Mass Transit Stations

• Prevalent mode shares at station areas reveal that cars and private vehicles are used by a marginal share of commuters. Car users around station areas use cars as a weekend mode or for non-work trips on weekdays;

• High parking norms in TOD areas incentivizes car ownership (since parking is made readily available) and therefore results in an increase in car density around stations. This results in increased traffic congestion thereby restricting safe access to MRT stations;

• Reduced parking norms within TOD areas can reduce traffic congestion levels, create demand for people oriented uses—within buildings and in the public realm—and thereby improve access to MRT stations.

## Reducing Cars in TOD Areas Will Not Burden Public Transport

• Cars have limited role in actual transportation of people in Greater Mumbai. Therefore reduction of presence of cars will not significantly increase the burden on public transport;

• Rather reduction of space for cars would increase space available for public transport and enhance space for interchange between Rail-Bus-IPT and safe NMT access.

| | |
|---|---|
| Right-sizing Parking | 1. Regulate parking supply based on parking demand<br>2. Revert to parking maximums rather than parking minimums<br>3. Change the current parking norms to be on "per square meter" basis not "per housing unit" basis |
| Parking Management Approach | 4. 'Walkable Park-Once neighborhoods' with shared parking<br>5. "Proof of parking";<br>6. Introducing Parking congestion pricing |
| Responsive Approach | 7. Introduce zero parking maximums in TOD areas<br>8. Involve local stakeholders in the process of parking management;<br>9. Different parking norms for Transit Oriented Development (TOD) zones and non TOD zones;<br>10. Unbundle Parking;<br>11. Parking norm flexibility with Deficiency Charges<br>12. Lower parking norms for small sites/ developments; |

In addition to these, overall standards of regulating parking through long-term actions can be taken in the following ways:

1. Introduce good Urban Form guidelines for quality off-Street parking facilities;
2. Introduce a Parking Management cell as part of the City municipality to develop a comprehensive approach to off-street and on-street parking management;
3. Mandate a parking management plan into the Local Area Planning process for the area. The plan could include time sensitive congestion pricing models for on-street and off-street parking within TOD areas. Revenues from priced street parking can be used to improve the pedestrian/NMT infrastructure in the neighborhood so that residents in the TOD zone get a service—sort of a betterment levy, but implemented through parking pricing.

## Parking Reduction in TOD Areas Can Be Drastic

• Drastic reduction of parking will not be effective immediately. While the new parking norms will be applicable for any new development/ redevelopment, the existing parking supply will continue until a building goes into redevelopment. Hence, these reductions will be seen gradually over a period of time;

• For new MRT corridors like the Metro and Mono rail the reductions must be mandated immediately to avoid long-term damage.

## Parking Reduction Will Not Cause Cartelization

• Reduction of parking will be common to all properties;

• Excess of parking spaces in existing buildings can be converted to other uses if feasible and permissible subject to other regulations;

• To enhance efficient use of space, parking in TOD areas can public; private buildings could consider pricing vacant parking spaces by leasing them out to neighbouring uses.

## Maximum Limit of Parking Rather than Minimum Requirement Will Not Affect Attractiveness for Development in TOD

•All properties follow the same maximum limits;

•Residential on-street parking permits can be issued to control spillover of parking on streets;

• Organized and priced on-street parking is essential along with maximum limit of parking;

• Maximum parking freezes could control the number of cars in an area even when the FSI is very high.

## Manner in Which Parking Spaces are Provided Could Favor Public Life in the Street

• Avoid dead parking floors facing the street to allow for active streets edges;

• Control the number of parking spaces on ground to ensure activities that support public life and minimize impact of vehicles;

• Podium level parking not to be allowed along public street edges;

• Number of vehicle access points to plots that cut across the footpaths of the streets required to be minimized.

## Including Parking in FSI Could be Effective

• Parking requirements hide cost of parking by bundling it into higher housing prices and higher consumer prices, everyone including non-motorist pay for parking;

• Including parking in FSI and increasing FSI proportionately would ensure TODs are not rendered less attractive for developers;

• Including parking in FSI would allow developers to decide the extent of parking supply based on different circumstances;

• Existing parking floor spaces in existing buildings excess to that of the new regulation can be allowed (partly wherever feasible) to be converted in to other uses.

## Branding of TOD Areas

• Reducing parking needs to be enforced along with branding of transit oriented development as areas of noted difference in better pedestrian infrastructure and public transport.

## FRAMING NEW REGULATIONS FOR TOD AREAS IN MUMBAI

# REDUCED PARKING NORMS TO IMPROVE QUALITY OF LIFE

Parking norms prioritize accessibility to mass transit, requiring reduced norms in the first 250 meters from transit and slightly relaxed norms in the next 250 meters away from transit.

This section proposes new parking standards for TOD areas regulating the supply and design of private, off-street parking. Using the Ghatkopar TOD zone as a demonstration area, the study adopts a broad approach towards off-street parking reforms to enable:
1. Better access to mass transit stations;
2. An improved built-environment that facilitates pedestrian and active street activities.
Regulations are drafted for two parking zones, around the station. A methodology for zone delineation is detailed to enable clear and transparent enforcement. Finally, three parking options of varying degree are provided to address parking policy reforms.

### Zone Delineation for Parking Regulations

Parking regulations for TOD zones are based on the distance from the transit node. In order to arrive at specific strategies based on accessibility to mass transit, parking zones are delineated based on distances to entrances of mass transit stations:

### TOD Parking Zone 1

includes plots falling within, or having more than 50% of the plot area within a 200m radius from the entrance of the station.

### TOD Parking Zone 2

includes plots falling within, or having more than 50% of plot area within a 200 to 500m radius from the entrance of the station. Parking requirements proposed are based on the distance from transit node; thus parking zone 1 has lesser parking requirements than parking zone 2. Hence specific regulations could be framed for the two zones to achieve a gradation of importance for access to mass transit than the rest of the area.

The approach intends ambitious efforts for reduced parking in transit oriented areas. The regulations does not imply that the entire area would be totally car free; parking would be available in public priced parking lots, in buildings located in surrounding areas outside TOD and in buildings in TOD parking Zone 2. Therefore parking shall be available in the area for lease/ license/own as per market rates. Minimum parking requirements are to be abolished and maximum measure of on-plot parking to be allowed in TOD areas.

## Parking Regulation in TOD Areas: OPTION 1

The approach intends ambitious efforts for reduced parking in transit oriented areas. The regulations does not imply that the entire area would be totally car free; parking would be available in public priced parking lots, in buildings located in surrounding areas outside TOD and in buildings in TOD parking Zone 2. Therefore parking shall be available in the area for lease/ license/own as per market rates. Minimum parking requirements are to be abolished and maximum measure of on-plot parking to be allowed in TOD areas.

## Conditions

### FSI Appropriation

Parking provision in TOD Parking Zone-2 would be counted as part of maximum floor space allowed as per FSI. This would allow developers to choose the provision of parking as per market requirement and location. In order to support the option, FSI needs to be increased proportionately (to accommodate parking) more than the otherwise proposed.

### Transport Systems Improvement

Enhancement of bus based public transport system and organized intermediate public transport system are also essential along with discouragement of private vehicles in TOD areas to reduce congestion in TOD areas.

Conversion of excess of existing parking to other uses
Existing buildings having parking provision excess to that of the maximum parking allowed as prescribed by the new regulations could be allowed to use their parking space for other uses, provided the parking floors satisfy regulations and standards applicable for usable floor spaces.


Figure 38: Delineation of parking zones based on distance from transit node; Source: EMBARQ India

| Parking Regulation in TOD areas: OPTION 1 | | | | |
|---|---|---|---|---|
| | TOD Parking Zone 1: Maximum number of ECS per 100sq.m floor space of buildings | | TOD Parking Zone 2: Maximum number of ECS per 100sq.m floor space of buildings | |
| | Residential | Commercial | Residential | Commercial |
| Option 1: Parking Management – stringent approach | 0 | 0 | 0.5 | 0.65 |
| Parking space and FSI calculation | Parking space provision is included in calculation of FSI for the plot. | | | |
| Overall parking at plot level control | The maximum overall number of parking allowed per 100 sq m of plot area for zone -2 as 1.0 car space | | | |
| Parking for physically handicapped to be provided additional to the mentioned above | | | | |

Figure 39: Table showing proposed parking regulation Option 1; Source: EMBARQ India

## Advantages

The option envisages ambitious approach to reduce vehicular congestion along mass transit nodes and thereby favor public transport. Zero parkingwould favor people who rely on public transport to live near mass transit stations. Attractiveness of TOD areas is ensured by reducing the expenses on building parking spaces. Additionally, using parking fees to improve the public NMT realm further enhances the attractiveness of TOD areas. Regulations to allow existing buildings to convert their existing parking spaces in to other uses could be explored.

Note: ECS translates as Equivalent Car Space as per DCR Section 36

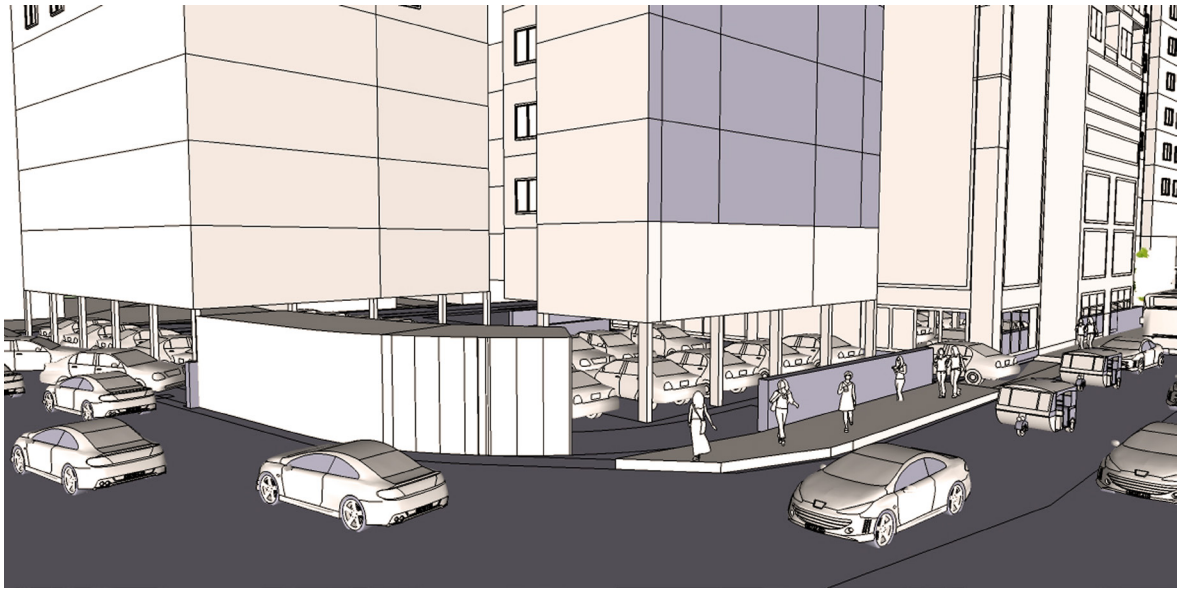


Figure 40: Representation of the Ghatkopar station area after redevelopment based on current parking norms; Source: EMBARQ India

Figure 41: Representation of the Ghatkopar station area after redevelopment with parking reforms applied; Source: EMBARQ India

| Parking Regulation in TOD areas: OPTION 2 | | | | |
|---|---|---|---|---|
| | TOD Parking Zone 1: Maximum number of ECS per 100 sq m floor space of buildings | | TOD Parking Zone 2: Maximum number of ECS per 100 sq m floor space of buildings | |
| | Residential | Commercial | Residential | Commercial |
| Option 2: Parking Management – restrained approach | 0.35 | 0.45 | 0.70 | 0.90 |
| Parking space and FSI calculation | Floor spaces provided for parking spaces are included as part of FSI calculations for the plot. | | | |
| Parking for physically handicapped to be provided additional to the mentioned above | | | | |

Figure 42: Table showing proposed parking regulations Option 2; Source: EMBARQ India

## Parking Regulation in TOD Areas: OPTION 2

This option adopts a more restrained approach than OPTION 1 and allows more possible variations due to different conditions along various mass transit stations and also across types of uses. However the conditions in which the regulation is to be implemented predominantly remains same for both the options 1 and 2. Minimum parking requirements are abolished and maximum measure of on-plot parking to be allowed in TOD areas.

## Conditions

### FSI Appropriation

On-plot parking provision would be counted as part of maximum floor space allowed as per FSI of the plot in both TOD Parking Zone-1 and Zone-2. This would allow developers to choose the provision of parking as per market segment and location. In order to support the option, FSI needs to be increased by 0.15 more than the otherwise proposed. The points on transport systems improvement and special parking in OPTION 1 are also applicable.

### Advantages

This option provides more flexibility to the developers to provide parking spaces based on the market segment and differences between TOD areas in various parts of Greater Mumbai.

| Parking Regulation in TOD areas: OPTION 3 | | | | |
|---|---|---|---|---|
| | TOD Parking Zone 1: number of car parking spaces per 100 sq m floor space of buildings | | TOD Parking Zone 2: number of car parking spaces per 100 sq m floor space of buildings | |
| | Minimum number of ECS to be provided | Maximum number of ECS allowed | Minimum number of ECS to be provided | Maximum number of ECS allowed |
| Option 3: Responsive approach | 0.35 | 0.5 | 0.7 | 0.9 |
| Parking space and FSI calculation | Floor space provided for parking as per minimum requirement is free of FSI calculations. Parking space provided beyond the minimum requirement up to maximum requirement shall be counted in FSI calculations. | | | |
| Common shared parking | In cases where multiple plots having mixed uses share a common parking lot then the minimum requirement of number of parking spaces shall be reduced by 40% of the total requirement as per the regulations. | | | |
| Parking for physically handicapped to be provided additional to the mentioned above | | | | |

Figure 42: Table showing proposed parking regulations Option 2; Source: EMBARQ India

## Parking Regulation in TOD Areas: OPTION 3

The approach promotes round the clock usage of a parking space by multiple vehicles in alternate timings. This could be achieved by shared common pool of parking in mixed uses (example commercial and residential) and common parking across multiple properties and thereby effective usage of parking space and reduced requirement of parking provision in TOD areas.

## Conditions

### Shared Parking

Unbundling of parking from the corresponding floor space and allowing it to be accessible to public as a common pool of parking spaces. Pedestrian accessibility to the common parking lots within the group of plots shall be provided by removal/openings of compound walls of plots to support movement between them. The existing excess stock of parking space beyond the requirements as per new regulation in other existing buildings, located within 200m distance could also be shared/ used to account the number of ECS to be provided by a new building/ redevelopment.

### Shared Amenities

Setback spaces and open spaces around buildings are normally divided by compound walls and often underutilized. If the open spaces are connected by providing access across compound walls then they could be shared and utilized better similar to the concept of shared parking. Common amenities and open spaces of plots along with shared parking could be encouraged to create innumerable possibilities of better access and effective usage of space.

### Advantages

Common parking pool not only reduces the requirement but also reduces entry and exits from parking on to roads, which reduces kerb-cut on footpaths and enhances pedestrian convenience. Common parking could catalyze a network of access between plots, with system of common public/ semipublic spaces by amalgamating otherwise dead spaces around buildings. By providing incentives the regulation favors natural reduction of parking rather than imposing drastic reduction.

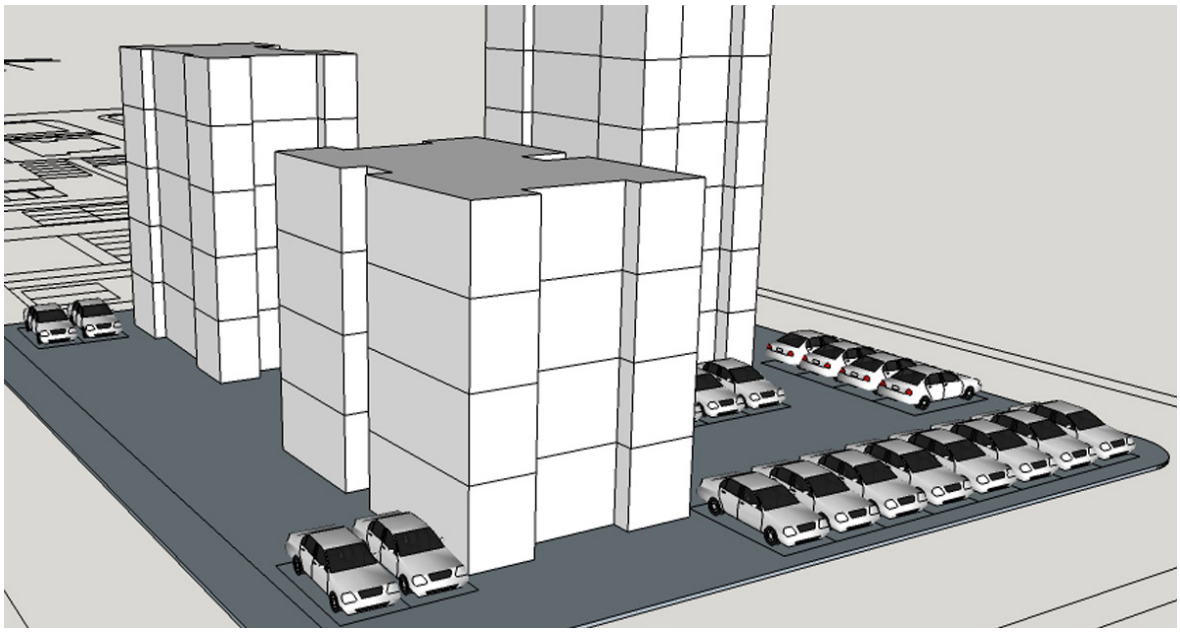
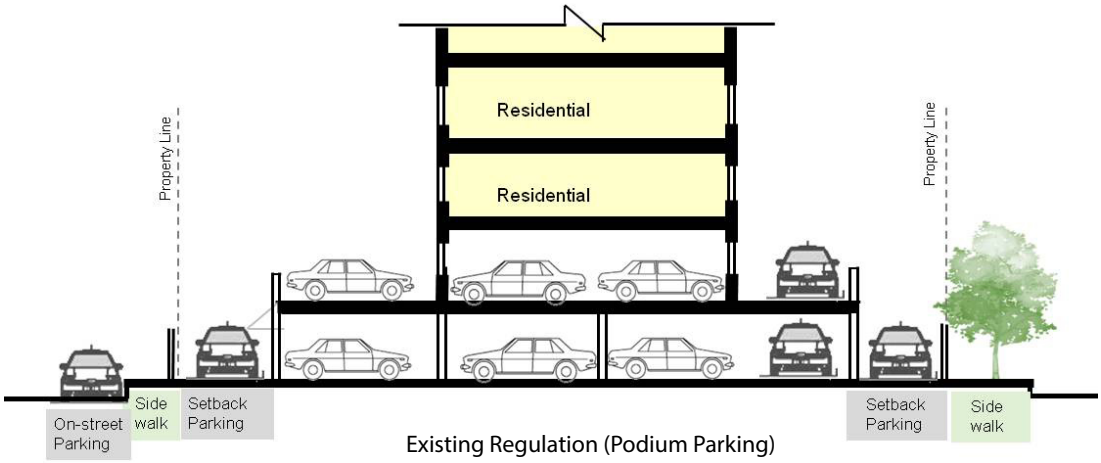
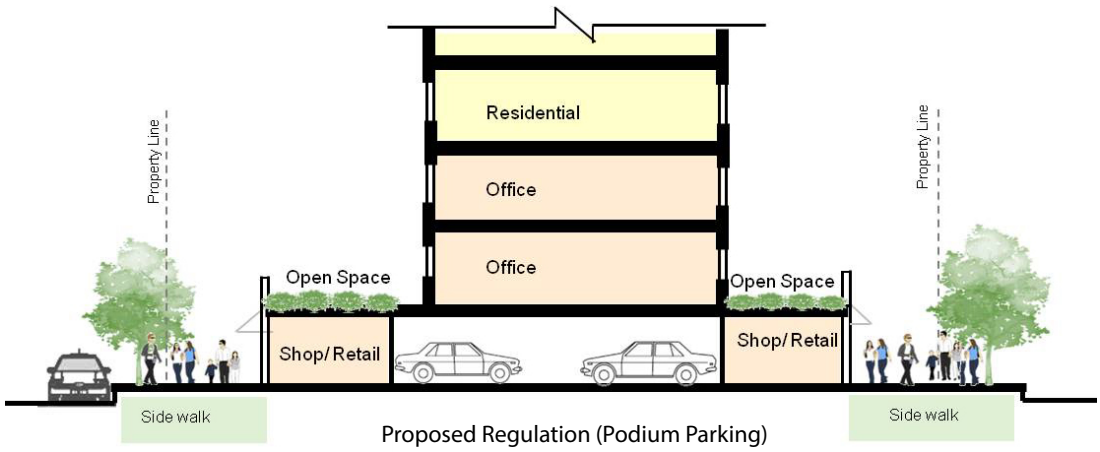


Figure 44: Existing building at Ghatkopar station. Ground plot area and building set back spaces used for on-plot parking; Source: EMBARQ India




Existing Regulation (Podium Parking)

Lower levels of buildings occupied by parking supply up to the podium level




Proposed Regulation (Podium Parking)

lower levels of buildings occupied by retail and commercial uses with ground level recreational areas

## Other Regulations

Manner in which on-plot parking is to be provided:

### On-Plot Parking Control on the Ground

In order to avoid parking and presence of vehicles taking away public life at ground floor of plots it is essential to control parking at the level and ensure sufficient public space is available. Hence not more than 30% of Ground floor plot area can be used for providing parking.

TOD areas are likely to have active streets because of huge number of pedestrians accessing mass transit stations through them. Whereas parking in front setbacks and in front part of buildings create dead edges to the street and do not support public ness of the street. Therefore in order to ensure active street frontage of buildings along public streets, parking cannot be allowed along the public street frontage of plots. Parking could be provided at sides, rear or in courtyards but not along the streets front setback.

### Active Adge Along Street Edge

Whenever parking floors of buildings adjoin public streets they need to have at least 10m depth of other uses such as commercial or residential uses along the street on the stilt level and first two levels.

### No Parking on Podium

Whenever podium levels are provided along public streets, parking provision cannot be provided on the podium level along public streets, instead they need to be as public spaces for the building

### Augmentation of Walkways

Many of the streets in TOD areas lack segregated walkways; this could be solved by including front setbacks as part of footpaths. No compound walls would be allowed in setback space of buildings adjoining
public streets in the TOD areas. The setback space would be considered as public walkway added to the street space.

### Basement Parking

In TOD areas parking provided in basements are also included in total maximum number of parking that can be provided for the plot.

### Visitors Parking

The parking provision norm includes requirements for visitors parking. No extra parking for visitors is allowed in TOD areas.

### Parking for Physically Handicapped People

Provision of parking and access requirements as per DCR Section 41 on Special Regulation for physically handicapped persons, is mandated additionally to the parking regulations.

### Parking Provisions in Redevelopment Under Sections 33(5), 33(6), 33(7), 33(9), 33(10) & 33(14)

Parking requirements as per the sections are also required to follow the maximum control on number of parking and manner in which parking can be provided.

### Other Vehicles Regulations

Lay-by for IPTs: Dedicated lay-by spaces for IPTs needs to be mandated in large plots, preferably located near their entrances from connecting streets.

### Bicycle Parking

5% of parking space needs to be dedicated for bicycle parking in public buildings including commercial, educational, hospitals and Government buildings in TOD areas.

## Regulations of Other Sections

Underground parking under DCR Section 68: considering the nature of Provision of underground parking below Recreational Ground / Playground / Gardens / Parks and Open Spaces and roads, shall not be allowed in TOD areas.

### Multilevel Storied/Parking Lots

Parking lots under regulations Section 33(24) shall not be allowed in TOD Parking zone 1 and 2.

## Complete Street Design and Integrated Parking Management

### On-Street Parking Management

Management of on-street parking with pricing in all the streets in TOD areas needs to be implemented. A complete framework of parking management includes – no parking streets/stretches, parking control as per timing and parking pricing. Revenues of parking management can be used to improve and maintain sidewalks, create pedestrian/NMT infrastructure and amenities. Less parking and better walking environments (paid for by parking fees) will lead to increased reliance on transit, which will further reduce parking demand and increase transit ridership as time goes by.

### Augmentation for Bus Feeder Public Transport

Dedicated areas for infrastructure for feeder public transport such as bus bays needs to be ensured near entrances to mass transit stations. Detailed area level plans need to be prepared to identify space for dedicated bus bays. Incentives/financial mechanism could be explored to make land available for inter-modal interchange near mass transit stations.

### Augmentation of IPT

Dedicated areas for infrastructure for intermediate public transport such as bays needs to be ensured near entrances to mass transit stations to support last mile connectivity. Incentives/financial mechanism could be explored to make land available for inter-modal interchange near mass transit stations.

### Summary

Parking options and related regulations explained in the section indicate vital policy directions towards achieving effective transit oriented development. TOD areas require special parking policy to achieve effective usage of street space and land area and support its overall objectives of a sustainable built form. Parking provision attracts car movement, when it is provided near mass transit stations; they disproportionately occupy the street space meant

for people accessing mass transit and cause congestion. Therefore in order to provide priority for public transport, parking supply needs to be reduced near mass transit stations.

Parking requirements can be deregulated to some extent to allow developers to assess parking demand, provide market-priced parking to meet average demand, and use shared parking to accommodate peak demand. Reduction of parking and parking pricing would also discourage people who rely on private mode of transport and would encourage people relying on public transport to live near stations. Branding of TOD areas with superior public domain of pedestrians' zones, active streets, active building edges, uninterrupted walking zones, shared semipublic spaces and smooth interchange to public transport, etc. are core characteristics to achieve effective TOD.

Ensuring space for multi modal interchange favoring public transport as the focus of development and management of spaces along the immediate surroundings of mass transit stations is essential. Off-street policy changes needs to be integrated with on-street parking management in the entire area in order to achieve desired impact.

Major generators of private traffic such as location of multi storied parking lots in private plots could be allowed to be located outside TOD areas. To develop parking policies, cities need parking databases to understand supply and demand and to develop programs that allow the city to track the impacts of adjustments.

## TESTING AND ENGAGEMENTS

# FEASIBILITY TESTING THROUGH STAKEHOLDER ENGAGEMENTS

An overwhelming number of stakeholders agreed that the existing norms were very high and could be reduced significantly.

To test the feasibility of the regulations presented here EMBARQ India conducted a workshop with real estate professionals, developers and architects. Developers working within the corporation were also present for the discussion. Various dimensions of parking and its relation to housing affordability, redevelopment attractiveness, congestion and crowding were discussed at the onset of the session. Further, three hypothetical parking scenarios were presented to the stakeholders, in the broader context of TODs and the important principles that are essential to TOD areas. Stakeholders were asked to adopt these scenarios and present a costs and benefits argument regarding the three cases.

An overwhelming number of stakeholders agreed that the existing norms were very high and could be reduced significantly. Scenario based responses discussed at the workshop were as follows:

### Zero Parking in Immediate Surroundings of Mass Transit Stations

1. If zero parking is considered then bicycle and IPT parking provisions need to be made mandatory for all public buildings; private buildings could include bicycle parking for visitors;
2. It was agreed upon that large parking spaces cause congestion within station areas. To facilitate better access to transit, parking norms around stations should be curbed down;
3. To support a zero parking mandate, we could consider building public parking lots within 10min walking distance from stations;

### Minimum Parking Requirements are Abolished and Maximum Parking Provisions are Introduced in Areas Surrounding Mass Transit Stations

1. To shift to maximum parking norms, parking should be sold independent of housing; if developers can sell parking in the open market, it would provide a "win-win" situation for all.
2. There was a unanimous fear of cartelization, where some areas have reduced norms and others can continue to over supply; this maybe a negative externality of parking zones.
3. Parking needs vary across localities. While it is impossible to create an extremely dynamic policy, customized for every station, station areas can be broadly categorized based on a threshold commuter count. Norms can be differential based on how busy the station is, to ensure we are not creating a new set of blanket norms.

## Parking is Included as Part of FSI

1. If parking is included in FSI it would become a privileged commodity; however, this could work only if FSI is increased. If not the strategy would make redevelopment in TOD areas unattractive to developers, arresting the rate of growth in these areas.
2. Proper monitoring of parking spaces would be required to ensure parking is not converted to other habitable uses; this would be yet another negative externality if it is allowed to proliferate;
3. Unless strict maximums are applied, including parking in FSI will not arrest the overprovision of parking, as the car ownership is also aspirational and not just need based.

## Other Key Inputs

1. Process of approvals can be simplified and time can be minimized;
2. Parking norms can be simplified to purge all the many sub-clauses for easier interpretation;
3. Ensuring consistency in parking reforms at regional and national level; changes in parking norms in the city should be reflected in the National Building Code.

## Summary

Concerns towards sustainable ways of reimagining the city were felt across the board. While, maximum parking provisions and reduced norms are a requirement, zero parking was a point of much contention. Some developers thought it were a necessary evil to endure, at least within station areas, others felt it was amateur and did not fully address the complexity of the problem. Including parking within FSI was seen as a fairly harmless strategy considering station areas may be pumped in with increased FSI incentives to catalyze a trend of urban renewal. This may not necessarily reduce the overall parking provision unless strict maximums are applied. As the session came to a close there was a unanimous agreement that more such discussions must be carried out towards developing creative strategies that not only revert the trend of auto-oriented planning but also enable an active real estate market.

## CONCLUDING NOTES

# KEY RECOMMENDATIONS TO THE MUMBAI DP 2014-34

Parking can be used as an essential tool to shift planning in Mumbai from an automobile-oriented approach to a people-oriented sustainable planning approach.

Parking for private vehicles is the main cause for automobile dependency in cities today. Without places to park, driving remains the most inconvenient form of travel. It forms a self-perpetuating cycle, where increasing supply leads to increased demand, while destroying the character of a neighbourhood. In order to capture the benefits of a TOD area, travel demand management approaches need to be integral to the planning process.

Ghatkopar station provides a great case to understand commuter densities around busy station areas in Mumbai, address issues of access, aspirations and congestion mitigation. Based on physical data, opinion surveys, and an extensive parking analysis, key assumptions could be evaluated. Using Ghatkopar as a case study, regulations and parking models could be easily tested and simulated. Mumbai has high parking norms but very low car ownership; even though the specific block surveyed and used for as a demonstration sector, modal shares at block level and for the over TOD zone are reflective of city level trends.

Based on the parking approaches and strategies discussed in the report, key points to remember are:

1. Prioritize principles of Reduction, Design, Location, Management and Pricing (RDLMP) (Barter n.d.);
2. Proposed regulations include parking to promote intermodal integration of public transport, IPT, and bicycles;
3. Promote efficient management strategies to induce common and shared parking spaces with adequate pricing models.
4. Introduce parking pricing management to utilize parking revenues to improve public streets, public spaces, NMT infrastructure and amenities, and create a self-reinforcing cycle for better access to transit.

In conclusion it is clear that parking can be seen as an essential tool to shift planning in Mumbai from an automobile-oriented approach to a people-oriented sustainable planning approach. That said these are a set of key recommendations that must be integrated into the Mumbai Development Plan 2014-34, to support a complete TOD strategy for the city.

1. Incorporate parking reductions around stations, as well as for the city;
2. Adopt parking maximums, and abolish parking minimums;
3. Introduce differential parking regulations for TOD/Station areas;
4. Introduce parking as part of FSI;
5. Simplify parking regulations;
6. Exempt small plots from minimum parking requirements;
7. Introduce guidelines for Multi-level car parking lots, and ensure they are located outside the 500m TOD zone;
8. Introduce Urban Design Guidelines as norms for parking;
9. Additional parking should not be allowed in TOD areas (either by paying a paying premium or by the discretion exercised by the Municipal Commissioner).

# APPENDIX

## Appendix 1: Development Control Regulations 1991 Review

The table above shows the parking requirements in 1991 and later modified in 2009. It can be observed that the residential, educational and shopping areas have doubled the parking requirements. Currently the recent redevelopments have these high parking requirements. The parking requirements in the table below do not include visitor's parking or other allowances availed off to increase parking, as per the DCRs

| Main Categories | Sub Categories | ECS requirement per 100 sqm as per 1991 | ECS requirement per 100 sqm as per 2009 |
|---|---|---|---|
| Residential | SRA/ CESSED/ Fire redevelopment/ MHADA/ Transit housing | 0.35<br>0.71<br>1.09<br>1.41 | 0.35<br>0.71<br>1.09<br>1.41 |
| | Other residential | 0.71<br>1.09<br><br>1.41 | 0.71<br>1.39<br>2.17<br>2.82 |
| | (3,4,5) star category hotels<br>Lodging establishments<br>General requirement for I, II, III hotels<br>For grade -I hotels and eating houses | 1.66<br>0.83 | 1.66<br>0.83<br>1.66 |
| | including hall, dining room, pantry<br>For grade -II and III hotels and<br>eating houses including hall, | 4 | 8 |
| | dining room | 1.25 | 2.5 |
| Educational | | 1.43 | 2.85 |
| Assembly and Assembly halls or auditoriums (including those of educational uses or hostels) | | 3.3 | 6.6 |
| Government, Semi public or Private offices and Business buildings | Markets, department stores, shops, other commercial uses and IT parks | 1.33 | 2.66 |
| Mercantile | | 1.25 | 2.5 |
| Industrial | Government hospitals and Municipal | 0.33 | 0.67 |
| Storage | hospitals and institutions | 0.33 | 0.66 |
| Hospital and Medical institutions | Ambulance parking space for hospitals and medical institutions of 100 bed strength or more | 0.16 | 0.16 |
| Shopping (not included under mercantile) | | | 1.0 |
| | | 1.0 | 2.0 |

# Appendix 2: Rethinking Parking Paradigms for Mumbai—Capacity Building Session with Dr. Paul Barter

Venue: MCGM Ward Office, Sion, Mumbai.
Agenda of the Meeting:
Drawing parallels from different cities across the world, to rethink parking policies and norms for Mumbai's Development Plan revision 2013-2034.

Attendants: Dr. Paul Barter, EMBARQ India, MCGM staff, Consultants

## Introduction

The Mumbai Development Plan (DP) is scheduled for review for the next 20 years from 2014-2034. Mumbai is one of the most transit rich cities in India, with more than 50% of its population that conducts all trips on foot, and more than 75% of its population that uses Public Transit for daily work-trips involving at least one motorized trip . The Municipal Corporation of Greater Mumbai (MCGM) is considering a Transit Oriented Development (TOD) Strategy for the City's Development Plan. EMBARQ India has been in conversation with MCGM's DP team engaging with various officials over the past nine months.

Parking strategies within TOD zones in the city was seen as an area of interest for MCGM. EMBARQ India first presented key parking paradigms to the Municipal Commissioner and members of the DP team on June 21st, 2013. Over the last four months EMBARQ India has been in close conversation with parking expert and academic, Dr. Paul Barter,

adjunct professor at Lee Kew Yuan Yew School of Public Policy, Singapore.

Dr. Barter has more than 18 years of experience in urban transport and parking policy reform.
He has a PhD in Science and Technology Policy from Murdoch University, a Graduate Degree in Environmental Sciences from University of Adelaide and an Undergraduate Degree in physics. He has authored "Parking Policy in Asian Cities" 2011 and is a regular blogger at http://www.reinventingtransport.org/.

A parking policy for Mumbai has been identified as one of the key issues not only to address the upward trend of increasing vehicle ownership in a transit rich city, but also increasing levels of traffic and congestion on city streets. EMBARQ India has undertaken an independent study exploring the concept of Transit Oriented Development in Mumbai, focuses on issues of parking provision in close proximity to Transit Stations. Through issues of parking affiliated areas of amenity provision, affordability and redevelopment can be addressed, in order to disincentivize private vehicle ownership and improve quality of life.

## Exploring Off-Street Parking Paradigms

Overprovision of parking results in an automobile oriented living environment, with large single-use plots, with low standards of walkability. Policies incentivizing auto-oriented planning have resulted in even worse results in inner city precincts where street widths are minimal and plot sizes are small. Cities like inner city Houston have more parking lots than buildings resulting in unsafe and blighted neighbourhood environments. There are two approaches one can define:

1. A "Conventional" approach using (i) an auto-centric approach or (ii) a demand- realistic approach, that focus on ensuring adequate supply by using parking "minimums"; The conventional approach is problematic and poorly suited to a dense urban environment like that in most old, inner city areas. Parking spaces are exempted from the maximum permissible Floor Space Index (FSI) and therefore become a strong incentive for developers to over provide parking within new buildings.

2. Or a "Parking management" approach that could be developed as a (i) multi-objective approach or a (ii) a constrained-focus, in which complex and localized parking management tools are used to achieve larger policy goals.
A parking management approach is a comprehensive approach to parking provision that limits on-street parking to an optimal amount, and coordinates with off-street provisions. Here, parking minimums are set very low and almost exempt for small buildings; residential permits, or a proof-of-parking rule can be institutionalized to ensure one has access to night-time parking before registering a vehicle.

The parking management approach can be explored through various strategies, some of which are discussed here:

## Concept 1: 'Walkable Park-Once TOD Neighbourhoods' could be identified,

especially within TOD zones, but also otherwise. Here, parking is considered for a particular area or neighbourhood, and not for individual plots. Parking spots are commonly shared across the neighbourhood irrespective of where they are located, and can be regulated by providing residential permits or congestion pricing for different uses. These are essentially dense, walkable, mixed-use precincts where parking is either privately or is public.
• Bundling of parking and housing often causes home buyers to not be able to buy housing. Can we explore unbundling parking from housing in TOD precincts; thereby looking at lower minimums?
• Controlled Parking Zones (CPZ) where effective parking management can be carried out;
• Varying parking norms for TOD zones and non-TOD zones to disincentivize private vehicle ownership and use within TOD precincts;
• "Abolish" parking around Metro stations, to ensure effective decongestion of the neighbourhood;

## Concept 2: Urban Form Guidelines for Quality Off-Street Parking can be

enforced by development control regulations. Regulate how much parking a building can provide maximum based on plot size instead of tenement density, in order to relate the urban form to parking provision. Small plot sizes should simply abolish parking norms, and large buildings (plot sizes) can require stringent parking provisions. Instead of making all allowed parking free of FSI, only a percentage, say 25%, of parking above ground can be considered free of FSI while anything above and beyond that is counted in FSI. If public parking is provided within a new building, every square feet of parking until the maximum is counted within FSI.

## Concept 3: Don't Fear Parking Spill-Over in TOD Zone (Street Management will be Improved).

First thing is to get the on-street parking managed efficiently. But still in some cities even with well managed on-street parking the off-street parking was left vacant and not used at the fullest of its capacity. If on-street parking management is not efficiently carried out, off-street parking demand drops and fails to be a lucrative and efficiently used model.
• Have parking norms but reserve the capacity to say that a particular street or area can abolish or refuse more parking based on parking maximums;
• Price on-street parking high to disincentivize long durations of parking on the street;

## Concept 4: Revert to Parking Maximums within TOD zone! (or At Least Much Lower Minimums).

• Abolish the parking minimum norms and if the on-street parking is well managed then developers would make a judgement on how much parking do they provide.
• For residential areas bundling / unbundling of parking with housing depends on shortage or over supply of parking. Bundling of parking is a tax on those who don't own a car to subsidise the parking for the ones who owns car.
• Different parking norms for TOD zones and non TOD zones, enforcing zero minimums within TOD zones as private vehicle ridership is low in Mumbai and public transit ridership is the highest.
• Design a system that is impact based, assess the impact and then provide accordingly. this may reduce the risk of over-provision;
• Formulae based approach can be taken up, this formula should be publically published and a transparent system can be set up;

## Concept 5: Residential Parking Norms on "Per Square Metre" Basis not "Per Housing Unit"

basis. Most cities have a tendency of developing unfeasible regulations and then running them into fiscal tools, which can be very harmful in the long run. Relating parking maximums to plot areas and FSI consumption rather than number of tenements and tenement sizes, helps regulate the amount of provision.

• The DP is looking at reverting parking norms for "square meters" rather than units;

• Exempt small units or areas of plots to retain plot sizes;

## Concept 6: Parking Norm Flexibility with Deficiency Charges ("Parking-In-Lieu Fee").

• Heritage areas could apply deficiency charges;

• Involve local stakeholders such as Chamber of Commerce, Industrial associations, residential associations and so on, who have some local authority to manage the local parking, example a Parking Benefit District.

• In these districts the local stakeholders have a say in the pricing of the spaces along with the use of the proportion of the revenue thus collected. In this process the benefits of the effective on-street parking management are dispersed across the society.

• Encourage more and more public parking by having different set of norms for building which provide public parking and other for providing only private parking. The incentive could be more FSI free parking if the parking is made public.

## Concept 7: Allow Several Other Kinds of Flexibility in Meeting Parking Norms

• Allowing a developer to meet parking norms within a 100-200 meter purchased parking space;

• Like the Assam model, allowing long-term lease of parking spaces to limit car ownership;

## Concept 8: Lower Parking Norms for Small Sites/ Developments (and Exempt Smallest Altogether)

• Small plots, for example plots smaller than 500 sq. mt exempt from parking, and encouraging large plot buildings to accommodate for more parking;

• "Proof of parking": parking businesses can be stimulated by available parking spaces like in Japanese neighbourhoods, for example, to manage and operate available public parking spaces.

## Concept 9: Standard TIA Process is Not Appropriate in a TOD Zone.

How much road space should a developer be able to provide? Asking the question in this manner drives an excess of provision, not only of road space but also of parking and other requirements.

• A modified TIA process for denser areas must be developed that doesn't in effect curbs auto-dependence in the context of TOD zones;

## Main Take-Aways from the Session

### Concluding notes:

• Roads are for public goods, and not for cars. As often quoted by the Mayor of Bogota, Enrique Penalosa, "parking is not a human right"

• The central theme guiding the discussions for the day can be summarized under the concept of a "park-once neighbourhoods".

### Challenges to be addressed in the DP:

• IPT parking, drop-off and pick-up points and organizing routes around station areas;

• Require small parking norms for loading/ unloading drop-off points, disable parking, and parking for service vehicles etc.

• Dedicating curb space for buildings in dense pedestrian neighbourhoods may not really work, hence locating the above services strategically is essential;

## Way Forward From Fere

EMBARQ India has undertaken an independent study to explore off-street parking regulations and related urban form guidelines at the Ghatkopar Station area within the TOD influence zone of 1km around the station. Ghatkopar station is a heavily used Suburban railway station within the Eastern Suburbs and is proposed as an inter-modal connection via the new Metro line connecting Ghatkopar to the Western Suburbs at Versova. Initial data collection and site analyses have revealed that approximately 4000-6000 people are seen entering or leaving Ghatkopar station (across all exits) during the peak morning and evening

hours. After the Metro is fully functional these numbers are expected to increase significantly.

Previous engagements with MCGM's DP team have revealed parking as a major concern especially within TOD zones. Current regulations prescribe high incentives for building public parking lots in close proximity to station areas (within 500 meter of station areas). These regulations continue to increase congestion around station areas that have always been dominated by people. Using parking norms strategically car use and ownership can not only be disincentivized, but also more affordable and accessible neighbourhoods can be designed.

Some key aspects to look into going forward would be:

• Rather than having a blanket parking policy across the city, it should be on a district basis or based on zones;

• On-street parking provision and management must be controlled in order to increase off-street parking efficiency;

• Off-street parking regulations must be linked with size and use and must be unbundled from housing;

• A Tool-Kit for off-street parking strategies exploring affordability, and efficiency around station areas can be developed to provide a formulaic methodology to calculate parking requirements at city and neighbourhood levels.

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