

ANAROCK

VALUES OVER VALUE

Mumbai Redefined

November 2017

in association with



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A Note from the Chairman



Anuj Puri
Chairman
ANAROCK Property Consultants

Dear All,

India's future development is heavily dependent on the quality of living in major cities. Cities are the growth drivers of any nation and more so in India with around 32% of 121 Crore population presently residing in urban areas, and an increasing influx of migrant population every year.

Infrastructure is one of the most critical elements that influence the liveability quotient of cities. A city with well-developed infrastructure has a positive impact on the nation's economy and overall development. However, with tremendous growth in the urban population in major cities, particularly in a mega city such as Mumbai, there is an increasing burden on the existing infrastructure and other urban services.

Mumbai, being the most densely populated city in the country and growing by leaps & bounds, is being tested on a daily basis. The urban sprawl and inadequate infrastructure are creating an imbalance in equitable and inclusive development. There is a huge scarcity of land in the core areas to accommodate the rising population. Whilst the living space per person is 34 square meters in Shanghai, it is a mere 4.5 square meters in Mumbai. This raises the need for sustainable and efficient urban planning to prevent haphazard and illegal developments.

Anarock Property Consultants presents the white paper, "Mumbai Redefined", which deep-dives into the city's current status and highlights key issues that need attention. We have also tried to articulate actionable insights that may make the city liveable and sustainable, by uplifting the quality of life. This whitepaper serves as a guide to the policymakers, city administrators, urban planners, technology providers and others to work on the challenges unleashed by the rapid urbanization.

We hope you find it an insightful read!

Yours sincerely,
Anuj Puri



Blue hour shot of a busy traffic intersection in South Mumbai.

Executive Summary

Mumbai, the financial capital of India and one of the most densely populated cities, has transformed significantly over the last few decades. The city, originally a habitat of the fishermen community, was spread across a group of seven islands. In 1853, the first Indian railway line began operations between Bombay (now Mumbai) and neighboring Thane, over a distance of 21 miles. The commencement of Mumbai's rail network was a turning point for the city's connectivity; to date, railways are the lifeline of most Mumbaikars.

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Post-independence with the emergence of financial services, discovery of offshore oil fields and establishment of public sector

4,355 sq.km.

Mumbai Metropolitan Region

22.8 mn.

MMR Population

94%

population in urban areas

units, the city's growth was pushed even further. With the island city becoming highly commercialized and congested, the suburbs emerged and developed as major residential destinations. As Mumbai became an employment magnet and attracted people from various parts of the country, the city's population grew significantly. Consequently, Mumbai extended further Northwards towards the far suburbs and peripheral regions, including the Navi Mumbai region which was set up by CIDCO in 1970.

In 1975, the Mumbai Metropolitan Regional Development Authority (MMRDA) was established. MMRDA has successfully completed large-scale development programmes in the city, and continues to be the key agency which plans and prepares Mumbai for a better tomorrow.

MMR, spread across more than 4,355 sq.km., had a population of 22.8 mn as per census 2011, of which around 94% was in the urban areas. The Greater Mumbai municipal corporation, comprising of the island city and suburbs, had a population of 12.44 mn, which was 54% of the entire MMR's population. This major skew towards the Greater Mumbai region has necessitated large-scale development, and MMRDA has actively undertaken several projects to improve the quality of life of Mumbaikars. Major projects/transportation options that have shaped up Mumbai include the suburban railway network (Around 2,300 train services carrying an average 7.5 mn people daily), bus transportation (BEST, NMMT and TMT), metro rail system, monorail and key arterial roads (Eastern Express Highway, Western Express Highway, Bandra-Worli sea link, SCLR, Mumbai Eastern Freeway, Sion-Panvel Highway, etc.)

However, given the sheer pace and scale of city's development, MMR expanded rapidly and in an unplanned manner, with the pace of developments unable to match the burgeoning population. As a result, the quality of living in certain parts of the city still seems underdeveloped. There are issues such as traffic congestion, water logging, power-cuts, water supply shortage, unhygienic living conditions, sewerage and waste treatment problems, etc. Around 1.39 mn households (27% of total) in MMR reside in slums and with 1.10 million slum households, Greater Mumbai has the highest share of these. Expensive property prices force people to live in slums, chawls, cramped tenements, etc., thus also endangering their lives and property to natural calamities.

MMRDA recognizes the fact that to live up to the expectations of the residents to make Mumbai a more global city, massive infrastructure upgrades will be required in the next few years. Ongoing major infrastructure projects include completion of all phases of metro rail and monorail. These two modes of transport aim to ease the commute of Mumbaikars and also decongest the roads and suburban railways. Once fully operational, the metro and monorail will transform the face of Mumbai and the way people live, work and recreate there. Additionally, several other infrastructure upgrades such as a multimodal corridor from Virar to Alibag, Mumbai Trans Harbour Link (along with a metro link), Mumbai Urban Transport Project II, Inter State Bus Terminus (ISBT), coastal road project and the new international airport at Navi Mumbai are planned to significantly upgrade Mumbai's infrastructure and improve intra-city connectivity and accessibility. Also, Bandra-Kurla Complex (BKC) was developed to decentralize the business districts, and major developments in Navi Mumbai are attracting IT-ITeS companies to locations along the Thane-Belapur road.

With the Government's focus on affordable housing, the Smart Cities and AMRUT missions and PMAY, Mumbai is likely to be revamped in the next few years. However, to keep pace with the likely population growth, it is imperative that new developments are rapid and sustainable. As per our assessment of the current situation in MMR, we recommend the following:

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Fast-track redevelopment & slum rehabilitation.

Mumbai can easily replicate the success story of Singapore's Housing and Development Board (HDB) which remained laser-focused on eradicating slums. With effective PPP models, higher incentives to the stakeholders and good financial structuring, the slums in Mumbai can be eradicated faster than envisaged.

Land unlocking & change in development norms.

For sustainable development, it is imperative that the Government systematically unlocks land controlled by public sector undertakings or other companies. Only when land is unlocked in the core areas will new developments thrive and the city's demand-supply equilibrium be maintained. In addition, there is a dire need to change the FSI norms as the island city still possesses an FSI of 1.33 while cities in the U.S. and China have FSIs as high as of 12-15. These aspects should be considered while drafting the new Development Plan (DP) for MMR.

Implementing sustainable living.

The general division of sustainability includes three dimensions or 3 E's - environment, economy, and equity. If MMR is developed on these pivotal pillars while factoring in conservation of the natural resources, cost optimization and focus on social progress, the city can emerge as a true World City in the years to come. The Government's ambitious Smart Cities mission, if implemented properly, can surely meet Mumbai's requirement for sustainable growth.

Focus on affordable housing.

Affordable housing is a much-debated topic in the context of liveability and the city's development. The Maharashtra Government has initiated several initiatives to plug the affordable housing gap in MMR, such as the special townships policy, development/redevelopment of MHADA land, the slum rehabilitation scheme (SRA), etc. To boost affordable housing development, the Chief Minister of Maharashtra has also announced that by 2019 the

Government will build 12 lakh and 10 lakh affordable houses in rural and urban areas respectively. However, the on-ground action is lacklustre at best - the Government could take cues from The Hong Kong Housing Authority, which fast-tracked rental and public housing schemes, as a result of which half of the population now resides in some form of public housing.

Embrace Cutting-Edge Technology.

With changing times, cutting-edge technology must be adopted to expedite the construction process. Contemporary technologies such as self-climbing formwork, aluminium shuttering (Mivan) and pre-cast concrete are reshaping the way industry operates, and Mumbai should rely more heavily on these to fast-track construction.

Accelerate private sector participation.

While private sector participation is not a new concept in India, the key reason why the PPP model has not yielded better results so far is delayed approvals and project completions. The Government has announced a new PPP Policy for affordable housing that allows extending central assistance of up to INR 2.5 lakh per house to be built by private builders even on private land, besides opening up the immense potential for private investments in affordable housing projects on Government lands in urban areas. This policy gives several lucrative options for the private sector to invest in the affordable housing segment.

.....

As already mentioned, the Government's focus on revamping Mumbai is tremendous. However, considering the outdated processes, bureaucratic red tape and largely non-conducive market conditions that still prevail, the city is still buckling under its growing population. With stronger political will, policy reforms and laser focus on bridging the infrastructure gap, MMR can surely evolve as the most promising city for the current and future generations to live, work and play.

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Mumbai: The Financial Capital of India

Evolution Story

This section highlights Mumbai's evolution and further expansion to constitute the Mumbai Metropolitan Region. It also includes MMR's demographic profile along with the trends pertaining to population, density and growth rate over the past few decades. Details on existing land use, quality of living and infrastructure projects are also included here.



Formal transformation of seven island of Bombay to today's Mumbai.

Mumbai, the financial capital of India and one of the most densely populated cities, was originally a habitat of the fishermen community known as 'Koli'. The city was previously spread across a group of seven islands which were under the control of indigenous empires for many centuries until the Portuguese arrived in A.D. 1542.¹ In 1661, the Portuguese gifted these islands to King Charles II of England, who in turn leased it to the East India Company in 1668. The company later established Mumbai as a major trading port and its headquarters.

In the second half of 17th century, Governor Hornby Vellard started the first civil engineering project to transform the seven islands into a single mass. The project, completed in two years, connected Mumbai

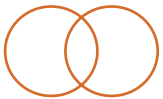
¹The-maharajas.com. Maharajas' Express Official Website| Luxury Train Tour in India by IRCTC. [online] Available at: http://www.the-maharajas.com/luxury-train/CityWise_Pdf/Mumbai.pdf [Accessed 23 Oct. 2017].

with other regions of the states by blocking the Worli creek and preventing low-lying areas from being flooded during the high tide.²

Under the British rule, Mumbai's development was initiated methodically, with a focus on better infrastructure and connectivity. The hinterland of cotton growing areas was connected with Mumbai by rail to facilitate the supply of raw cotton to factories in England. The city became a prominent port and started growing in leaps and bounds. By 1864, the city's population had grown significantly and with the emergence of many cotton textile units, Mumbai soon became one of the largest commercial hubs in India.³ In 1888, a municipal corporation was created through special provincial legislation in Mumbai, making it the first city to have a municipal corporation in India.⁴ Over the time, the city's manufacturing sector also expanded into chemicals, basic metals, engineering products, etc. and this fast-paced industrialization attracted large-scale working population to the city.

Post-independence, the emergence of financial services, along with the discovery of offshore oil fields and the establishment of public sector units, pushed the city's growth further. Mumbai gradually became one of the busiest ports and trade centers, which helped its transformation into one of the prominent financial centers in the world. Subsequently, the city's island area became highly commercialized and congested, which slowly pushed residential developments outward. This expansion led to the emergence of the suburbs and as of now, the island city along with the suburbs form Greater Mumbai.

Growth factors



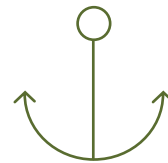
Combining Islands



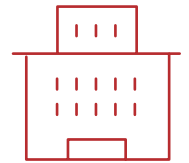
Manufacturing



Oil Field



Port



Real Estate

Establishment of Mumbai Metropolitan Region (MMR)

With massive economic developments and increasing employment opportunities, Mumbai and its surrounding regions have witnessed rampant population growth in the last few decades. With the increase in population and development of new areas, the length and breadth of the city expanded tremendously. As Mumbai is flanked by the Arabian Sea on the South, the natural expansion was towards the North - and that is where today's suburbs and peripheral areas are located. With the incessant inflow of migrant population and lack of affordable housing options, the city expanded further and the peripheral areas developed beyond the Central as well as the Western suburbs.

To relieve the burden on the core city and decentralize the growth centers, the concept of a twin city was proposed. City Industrial Development Corporation (CIDCO) was formed as a key authority in

²Theory.tifr.res.in. The Hornby Vellard: Architecture: Mumbai/Bombay pages. [online] Available at: <http://theory.tifr.res.in/bombay/architecture/civil/hornby-vellard.html> [Accessed 23 Oct. 2017].

³"VI The Later British Period". The Origins of Bombay. Retrieved 23 October 2017

⁴Bombay Act 1888. [ebook] Mumbai: Law and Judiciary Department, Government of Maharashtra. Available at: <http://bombayhighcourt.nic.in/libweb/acts/1888.03.pdf> [Accessed 23 Oct. 2017].

The sheer magnitude of the city's expansion was not supported by existing systems, and this led to inadequate social and physical infrastructure.

1970, culminating in the development of Navi Mumbai.

While the city's expansion benefited the working population and new areas were developed, it also led to a certain amount of unplanned growth. The sheer magnitude of the city's expansion was not supported by existing systems, and this led to inadequate social and physical infrastructure - including water, housing, health and education facilities, transportation, etc. As a result, even today, there is a vast difference between the quality of life in the core city, the suburbs and the peripheral regions. Nonetheless, its rapid expansion has helped Mumbai feature among the top cities of the world, and it definitely continues to be one of the most promising destinations.

Once MMR was established, it was inevitable that an authority which can plan, coordinate, execute and monitor various programmes to ensure sustainable development of the region be formed. In 1975, the Mumbai Metropolitan Regional Development Authority (MMRDA) was established under the MMRDA Act, 1974 of the Government of Maharashtra. MMRDA has successfully completed large-scale development programmes in the city, and continues to be the key agency which plans and coordinates a better tomorrow for Mumbai.

Geographical Area & Administrative Setup

Located on the Western coast of India in the state of Maharashtra, MMR is spread across more than 4,355 sq.km.⁵ It consists of 8 municipal corporations, 9 municipal councils, 35 census towns and around 1,000 villages.⁶ There are about 40 planning authorities responsible for the micro-level planning of different areas. The sheer magnitude of the city is clearly visible in this large administrative setup. Listed below are the key municipal corporations and municipal councils that plan and develop MMR:



⁵MMRDA.maharashtra.gov.in. Mumbai Metropolitan Region Development Authority. [online] Available at: <https://mmrda.maharashtra.gov.in/> [Accessed 23 Oct. 2017].

⁶Censusindia.gov.in. Census of India Website: Office of the Registrar General & Census Commissioner, India. [online] Available at: <http://censusindia.gov.in/> [Accessed 23 Oct. 2017].

Municipal Corporations

1. Greater Mumbai
2. Thane
3. Ulhasnagar
4. Kalyan-Dombivli
5. Mira-Bhayander
6. Bhiwandi-Nizampur
7. Navi Mumbai
8. Vasai-Virar

Municipal Councils

1. Ambarnath
2. Kulgaon-Badlapur
3. Alibag
4. Karjat
5. Khopoli
6. Matheran
7. Panvel
8. Pen
9. Uran

Population Trends

As per 2011 census, MMR's population was 22.8 mn, of which around 94% was in the urban areas.

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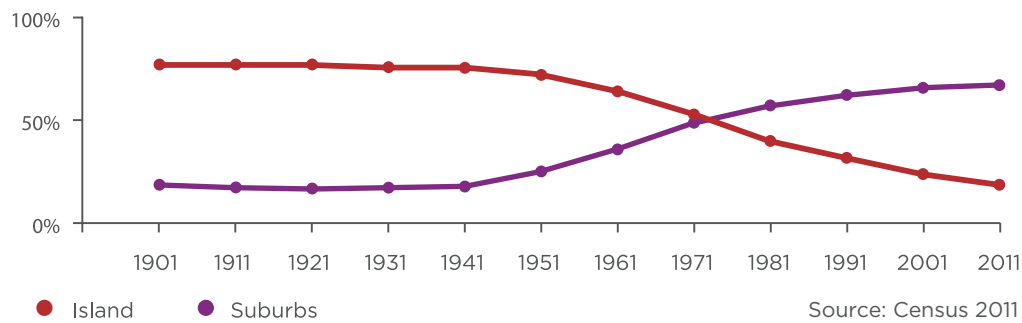
Population Trends

Region	1971	1981	1991	2001	2011
Greater Mumbai	5.97	8.24	9.93	11.98	12.44
Cumulative Growth	NA	38%	66%	101%	108%
Rest of MMR	1.79	2.83	4.63	7.39	10.36
Cumulative Growth	NA	58%	158%	312%	478%
Total MMR	7.76	11.08	14.55	19.37	22.80
Cumulative Growth	NA	43%	87%	149%	194%

Population (in mn), Source: Census 2011)

MMR's population has been continuously growing at a fast pace. However, the rate seems to have slowed down post-1991. The CAGR has come down from 3.62% during 1971-81 to 1.95% during 1991-2011. In addition, there has been a significant change in population distribution within Greater Mumbai (island city and suburbs). While in 1901, the island had a share of 83% and suburbs only 17%, the island now has only a 25% share and suburbs constitute the major share of 75%.

Population Share Trends - Greater Mumbai



Area Spread and Population Density

Rapid population growth has transformed Mumbai into one of the densely-populated cities in the world. While Greater Mumbai has only around 10% of the total MMR land area, it encompasses more than 54% of the total population⁷, depicting an imbalance of distribution. The gross population density for Greater Mumbai has doubled since 1971, increasing from 13,640 persons/sq.km. to 28,426 persons/sq.km. in 2011. In fact, a few of wards in Greater Mumbai have the highest density in the country.

MMR's gross population density tripled from 1,825 persons/sq.km. in 1971 to 5,361 persons/sq.km. in 2011, exerting massive pressure on the support infrastructure.⁸ The gross population density in the peripheral regions is significantly higher than the city average - indicating that without proper planning and infrastructural developments, these regions will buckle in the next few years.

Region	1971	1981	1991	2001	2011
Municipal Corporation	6,000	8,602	11,266	14,777	17,024
Greater Mumbai	13,640	18,833	22,677	27,366	28,426
Thane	1,981	3,700	6,265	9,846	14,361
Ulhasnagar	13,304	21,671	28,391	36,441	38,931
Kalyan-Dombivali	4,383	7,843	14,902	19,172	22,218
Mira-Bhayander	401	846	2,212	6,554	10,194
Bhiwandi-Nizampur	4,006	7,978	14,353	22,671	26,871
Navi Mumbai	369	828	2,833	6,146	10,315
Vasai-Virar	601	775	1,164	2,178	3,827
Municipal Councils	1,216	1,773	2,499	3,917	5,529
Census Towns	4,809	6,903	9,085	12,050	14,116
Rural (MMR)	181	235	300	421	537
MMR Total	1,825	2,604	3,421	4,553	5,361

Density (persons/sq.km.) (Source: Census 2011)

Quality of Living

Housing

Nearly 1.39 mn households live in slums which is around one-third of total urban households in MMR.

As per census 2011, the number of total households in MMR was approximately 5.1 million. It has witnessed an increase of around 25% between 2001 to 2011, and the majority of these have come up in the urban areas.

	1991	2001	2011
Households Number - Total MMR	30,38,139	41,37,921	51,94,614
Households Number - Urban	29,31,739	40,56,038	50,85,014
Household Size - MMR	4.79	4.68	4.39
Household Size - MMR Urban	4.84	4.67	4.39
Number of Urban Slum Households	-	15,17,361	13,91,685
% Urban slums wrt total Urban Households	-	37.41%	27.37%

MMR (Source: Census 2011)

Although the number of urban slum households has decreased to approximately 27% from 37% over the last decade (2001-2011), approximately 1.39 mn households still live in slums - which account for around one-third of total urban household numbers⁹. This underscores the massive requirement for affordable housing, specifically in the urban areas, without which people tend to opt for informal housing - leading to slums mushrooming in the city. Concurrently, rising property prices cause people to locate further away from the core city. Ironically, more than 60% of formal jobs are in the core city, so population migration towards the suburbs and peripheral regions results in a gruelling daily commute for residents, pressure on the suburban rail and massive traffic congestion in the main areas.

⁹Draft Mumbai Metropolitan Regional Plan Report, 2016-2036. [ebook] Mumbai Metropolitan Region Development Authority. Available at: <https://mmrda.maharashtra.gov.in> [Accessed 23 Oct. 2017].

Modern highrise rich buildings and poor slums in Mumbai city



Dwelling Unit Sizes

Per capita living space

4 – 6 sq.m.

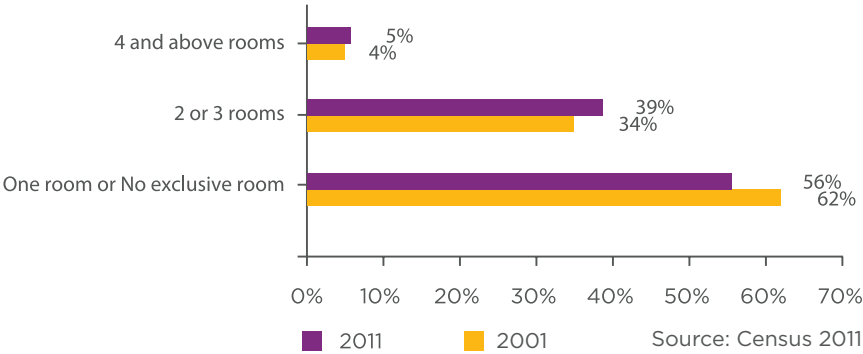
MMR

30 sq.m.

China

The per capita living space in MMR is between 4 to 6 sq.m. This is significantly lower than in other Asian countries such as China, where the average per capita living space in urban areas is around 30 sq.m. As per census 2011, approximately 57% households in MMR live in one room tenements or in constrained conditions where multiple families share accommodation with no exclusive rooms. Bhiwandi has the maximum number of such households (70%) followed by Greater Mumbai (65%) and Vasai-Virar, Thane, Navi Mumbai and Kalyan-Dombivali at 55%, 50%, 48% and 45%, respectively. However, the overall situation seems to have improved in 2011 with only 56% households living in such conditions as compared to 62% in 2001.

Households vs Dwelling Units Size - 2001 Vs 2011

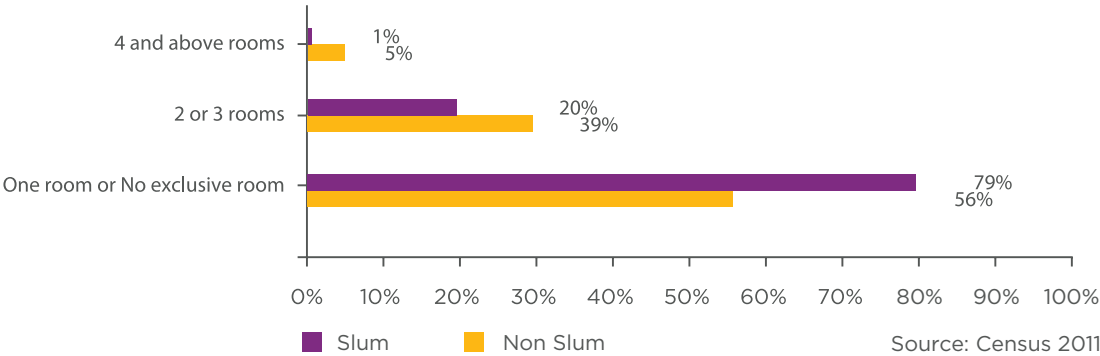


Slum Population

Approximately 1.39 mn households (27% of the total) in MMR live in slums - and with 1.10 mn slum households, Greater Mumbai has the highest share of them. Around 79% of the total households in Greater Mumbai live in slums.

An approximate 79% of the total slum households in MMR live in tenements with one room or no exclusive room, 20% in tenements of 2 to 3 rooms and only 1% in tenements of 4 or more rooms.

Slum Vs Non Slum Households



Water Supply & Sewerage Systems

Mumbai's water distribution system is more than 100 years old, and water supply in MMR depends primarily on the surface water of four major rivers - namely Vaitarna, Ulhas, Patalganga and Amba. The basins of these rivers fall under the Mumbai Hydrometric area (MHA), covering a catchment area of 5,756 sq.km. At present, most of the water for the MMR is being drawn from the Vaitarna river basin (66.5%) followed by Ulhas (20%), Patalganga (11.5%) and the remaining 2% from the Amba river basin. Groundwater accounts for a very small portion and as per an estimate, around 293 million litres per day (MLD) water are extracted through dug wells, tube wells and hand pumps.

As per 2016 MMRDA report, the current demand for water supply in Greater Mumbai itself is close to 4,770 MLD. However, the total supply from current resources stands at only 3,980 MLD. Therefore, there is a gross deficit of 790 MLD in the water supply, of which 697 MLD deficit is for domestic use.¹⁰

Sewerage Systems

Although most of the municipal corporations in MMR have a sewerage system, a major share of households that reside in slums and low-cost houses are still not connected to the sewer system. The absence of sewer system leads to the predominant use of septic tanks for disposal. Sewage is collected through both open or underground drainage systems and discharged in adjoining rivers, or directly into the Arabian sea.

While the coverage of the sewerage network in the major municipal corporation ranges between 85% to 50% (Greater Mumbai - 84%), there are several municipal councils where sewerage treatment system is not available. As per census 2011 data estimation, there is an approximate gap of 50% between the total sewage generation and sewage treatment in MMR. Out of the total 4,587 MLD of generated sewage, only 2,275 MLD get treated before disposal.¹¹ Also, the massive flood-like situation witnessed during the last few years indicate that the obsolete sewerage systems need a significant revamp to keep the city going.

¹⁰MCGM Data Book, Water Resources Handbook 2008, MIDC website & Chitale Committee Report

¹¹Draft Mumbai Metropolitan Regional Plan Report, 2016-2036. [ebook] Mumbai Metropolitan Region Development Authority. Available at: <https://mmrda.maharashtra.gov.in> [Accessed 23 Oct. 2017].

Flooded terminal after heavy rainfall in Mumbai



Geological Aspects

Rapid population growth and fast-paced urbanization have impacted the land use pattern in MMR over the last few decades. Over time, with the gradual saturation of land in the island city followed by the suburbs, other parts of MMR have experienced fast expansion with the dispersed growth of residential and commercial developments. On the other hand, forest and vegetation land coverage has decreased significantly since 1971. The current land use distribution (as per Existing Land Use survey ELU-2016) is shown below.

Category	Area (sq. km)	% Share
Agriculture & Other Primary Activities	1,307.38	30.32
Built-up	697.01	16.17
Airport	6.15	0.14
Industry	88.02	2.04
Port/Jetty	6.12	0.14
Coastal Features / Wetlands	304.07	7.05
Forest	833.08	19.32
Scrubland/Grassland/Wasteland	889.62	20.63
Water Bodies	180.3	4.18
Total Area	4,311.75	100

Sprawl of Built-Up Area of MMR

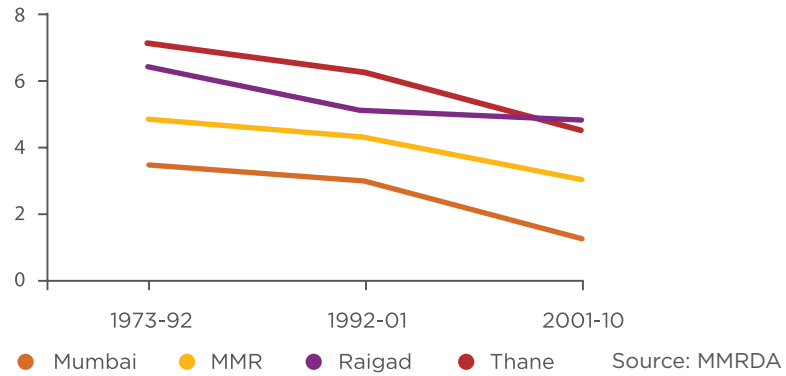
The total built-up area in MMR has grown at a rapid pace. From 1973 when the total built-up area in the constituent areas of MMR was 114 sq.km., it had grown to 504 sq.km. in 2010, registering a around five-fold increase.¹²

Growth in Built-Up Area (sq.km.) during 1973-2010

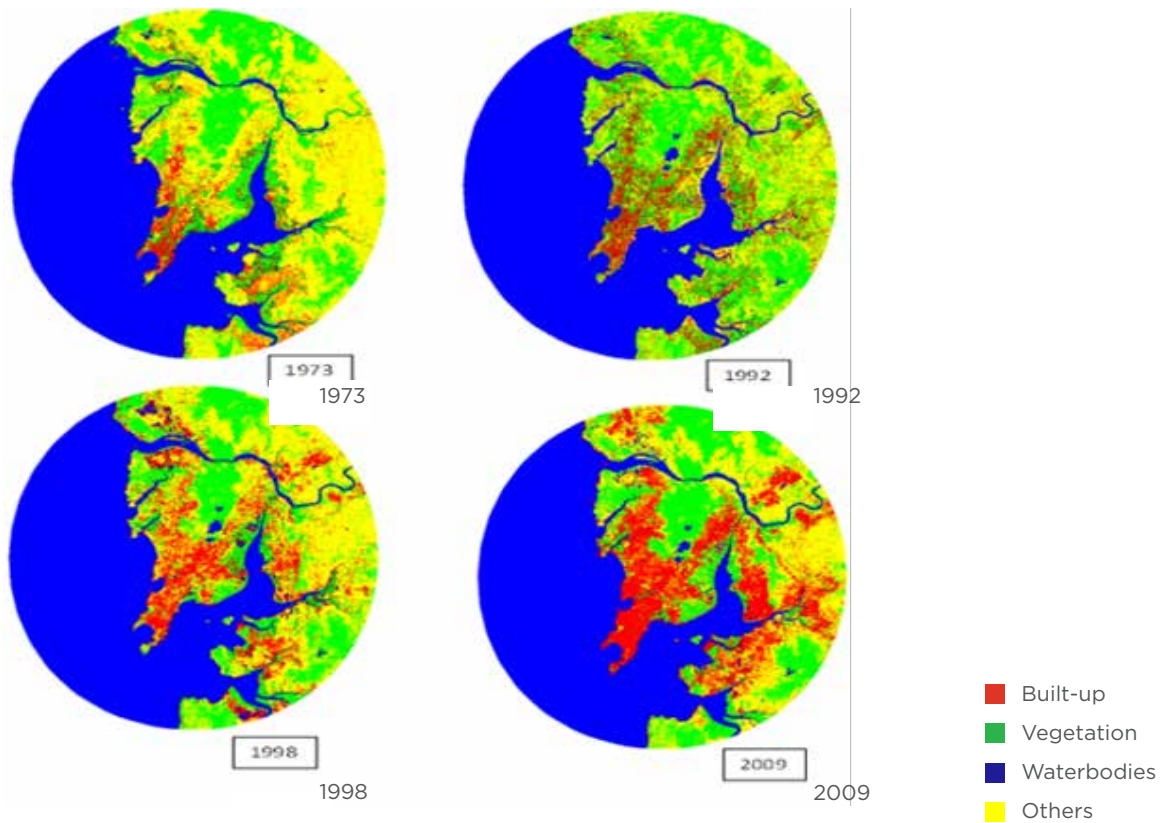
Area	Year				CAGR		
	1973	1992	2001	2010	1973-92	1992-01	2001-10
Mumbai	78.56	153.77	199.21	210.46	3.6	2.92	0.61
Thane	25.35	93.16	155.17	212.35	7.09	5.83	3.55
Raigad	10.88	36.37	55.12	81.3	6.56	4.73	4.41
MMR	114.78	283.3	409.57	504.12	4.87	4.18	2.33

¹²Existing Land Use survey (ELU)-2016

Growth Rate in Built-up Area (CAGR %)



Spatial Land Usage Pattern (1973 to 2009) -MMR



Source: Journal of Urban and Regional Analysis

The table and chart above show that the overall built-up area in MMR grew a rapid rate (4.8% to 4.18% CAGR) from 1973 till 2001, which slowed down during 2001-2010 and grew at a CAGR of 2.33%. The maximum decrease was seen in Mumbai (from 2.92% to .61% annually) while the suburbs and peripheral regions continued to grow.

Physical Infrastructure

The entire MMR relies heavily on the public transportation system to commute from workplaces to far-off residential destinations. The suburban railway network and the public bus systems play a vital role in the current transportation systems, and are considered to be the lifeline of Mumbai. As per Economic Census 2014 data, around 4 million jobs are created in MMR, of which 68% are in Greater Mumbai itself. This results in a gruelling commute time for the residents - as per 2005 Comprehensive Transportation Study (CTS), around 10 million people make about 28.5 million daily trips across the MMR. Among motorized trips, 78% are made through public transport, 9.5% through para-transit modes (taxis and rickshaws) and the remaining 12.5% are done by private transport (cars and two-wheelers).

Mode of transportation - MMR

Traveling Mode	Trips per day (in mn)	% Share (including walk)	% Share (Excluding walk)
Walk (entirely on foot)	14.85	52.43%	-
Train	6.98	24.62%	51.76%
Bus	3.55	12.53%	26.35%
Rickshaw	1.05	3.71%	7.79%
Taxi	0.23	0.79%	1.67%
Two-Wheeler	1.05	3.71%	7.79%
Car	0.63	2.21%	4.64%
Total Trips - Including walk	28.33		
Total Trips - Excluding walk	13.48		

(Source: Comprehensive Transportation Study of MMR)

After excluding exclusively pedestrian trips, more than half of the trips are made through the suburban rail network. CTS-2005 data depicts a grave situation of daily frequency of road transportation, with more than 55,000 vehicles entering and exiting MMR through three arterial roads, viz. Western Express Highway, Eastern Express Highway and Sion-Panvel Highway. This constitutes more than 60% of the total external traffic. In addition, nearly 6,700 buses enter and exit MMR daily.



The Suburban Railway

An offshoot of the first passenger railway established in the British era, Mumbai's suburban railway system is spread over 465 km, with more than 2,300 train services carrying an average 7.5 mn people daily. Mumbai's suburban railway is divided into two operational zones i.e. the Western and Central lines. While Western Railway operates the entire western line, Central Railway operates the central line, harbour line, and the Vasai Road-Diva-Panvel line.

The average commuter density in Mumbai's suburban railway is one of the highest in the world, at 12 persons/sq.m., compared to the internationally accepted standard of 6 to 8 persons/sq.m.



Bus Transportation

After suburban railways, buses are the second predominant mode of transport in MMR. The city's bus transport system extends over 5,700 routes and caters to about 26% of the total motorized trips in MMR. Brihanmumbai Electricity Supply & Transport (BEST) is the largest public bus transport service provider with a fleet of more than 4,700 buses plying on more than 500 routes within Greater Mumbai. Navi Mumbai Municipal Transport (NMMT) and Thane Municipal Transport (TMT) buses have also eased commuting in the city.¹³



Mumbai Metro Rail System

To ease the extreme pressure on existing public transport systems, MMRDA had approved a master plan for the Mumbai metro. The master plan is divided into three phases and consists of 9 corridors which will cover a length of 172 km. Out of 9 corridors, the first metro line i.e. Versova-Andheri-Ghatkopar was completed and opened for public in June 2014. It has an average daily ridership of 3 lakh commuters. Other corridors are either under construction or in the planning stages.

Development plans for a Metro rail in Navi Mumbai have also been initiated, and the first foundation stone was laid in May 2011. Navi Mumbai Metro has planned to build 5 lines covering a length of 106 km.



Monorail

MMRDA is planning to build a monorail network in many parts of the city which are either not connected by the suburban rail system or cannot be connected through Metro rail. This network has to be developed in two phases, and Line 1 - one of the first phases of the monorail (the 8.9 km stretch between Chembur to Wadala) - has been operational since 2014. An extension for Line 1 consisting of 11 stations from Wadala to Jacob Circle is also expected to become operational by mid-2018. It is estimated that once the entire monorail network is complete, it could be the fifth-largest monorail system in the world.¹⁴



Airports

Currently, MMR is served by Chhatrapati Shivaji International Airport. It is one of the most prominent airports in India, and is the second-busiest airport in the country in terms of total passenger traffic after Delhi. Currently, it handles around 44 mn passengers annually, and it is estimated that by 2034 it will have a traffic of 100 mn passengers.¹⁵ Considering the different constraints, handling the fast-rising number of passengers with the existing airport will become increasingly difficult. Ever-increasing passengers and the challenges of traveling to and from far-flung areas has pushed the development for a new international airport in Navi Mumbai. This new international airport is being developed at Kopar-Panvel in Navi Mumbai, and is expected to be operational in the next few years.



Key Arterial Roads

MMR is well-connected by key arterial roads which effectively link the island city to the suburbs and the peripheral regions. A few major roads are listed below:

- **Eastern Express Highway:** This highway connects all the Central suburbs of Mumbai to South Mumbai. Starting from Chhatrapati Shivaji Terminus, it extends until Thane, covering a stretch of 23 km.
- **Western Express Highway:** A 25 km stretch starting from Mahim and extending up to Dahisar, this highway connects the Western suburbs to the core areas of the city.
- **Bandra-Worli Sea Link (BWSL):** This is a 5.6 km, 8-lane, cable-stayed bridge which connects Bandra to Worli over the sea.
- **Santacruz Chembur Link Road (SCLR):** With a total stretch of 6.5 km, it links the Western Express Highway at Santacruz to the Eastern Express Highway at Chembur. SCLR has tremendously improved connectivity and accessibility to BKC, the key commercial office destination of MMR.
- **Mumbai Eastern Freeway:** This is a toll-free highway that helps in connecting South Mumbai, the Central suburbs and Navi Mumbai.
- **Sion-Panvel Highway:** This starts from Bhabha Atomic Research Centre (BARC) and extends up to Kalamboli.

Population Growth Vs Transportation Growth: A shift from Public to Private Transport Modes

The excessive density in suburban trains and more time to cover the routes by buses, pushed residents to opt for para transit modes or own vehicles.

As per the CTS-2005 report, the public transport systems in MMR have been unable to keep pace with the population growth. This is leading to a gradual decrease in the share of public transport modes in overall transportation. During the period between 1991-2005, the share of travel made through private modes has increased significantly, as depicted below:

Indicators	% Growth (1991-2005)
Population Growth	43
Suburban Train Daily Trips	35
Bus Daily Trips (Main Mode + Feeder Trips)	9
Registered Cars	137
Registered Two Wheelers	306
Registered Auto Rickshaws	420
Registered Taxis	125
Registered Commercial Vehicles	200
Airport Passengers	94

¹³Draft Mumbai Metropolitan Regional Plan Report, 2016-2036. [ebook] Mumbai Metropolitan Region Development Authority. Available at: <https://mmrda.maharashtra.gov.in> [Accessed 23 Oct. 2017].

¹⁴mmrda.maharashtra.gov.in. Mumbai Metropolitan Region Development Authority. [online] Available at: <https://mmrda.maharashtra.gov.in/> [Accessed 23 Oct. 2017].

¹⁵[Airportsindia.org.in](http://www.airportsindia.org.in/traffic_news/jan2k16_trafficnews.jsp). (2016). Traffic News. [online] Available at: http://www.airportsindia.org.in/traffic_news/jan2k16_trafficnews.jsp [Accessed 23 Oct. 2017].

The above table shows that while MMR's population increased by 43% during 1991-2005, daily train trips increased by only 35%. Growth in daily bus trips was much slower, increasing by only 9% during the same time period. On the other hand, the number of private vehicles and para-transit modes (taxis, auto rickshaws) has increased significantly. The rapid increase in private and para-transit vehicles has led to increased traffic congestion on roads across the region. The excessive density in suburban trains and increased time buses take to cover the routes has pushed residents to opt for para-transit modes or their own vehicles.¹⁶

¹⁶MMRDA.maharashtra.gov.in. (2005). Comprehensive Transportation Study. [online] Available at: <https://mmrda.maharashtra.gov.in> [Accessed 23 Oct. 2017].



Traffic in India's largest city

Initiatives to Enhance the City's Liveability Quotient

This section highlights the continuous efforts by the Maharashtra Government and the MMRDA to implement several initiatives and schemes for improving the quality of living in Mumbai. The city's liveability quotient depends heavily on its infrastructure, so the ongoing and proposed infrastructure upgrades will have a positive impact. To ease traffic congestion in the core areas of the city, the decentralization of the business districts which is under progress is also covered in this section.

Mumbai has been expanding rapidly towards the suburbs and peripheral areas over the last few years, thereby raising challenges in keeping the city liveable. Consequently, the Maharashtra Government and MMRDA have been undertaking and fast-tracking urban development projects backed by holistic planning.

The State Government has been constantly investing in infrastructure upgrades to keep the city going and transform the way its residents live, work and recreate. MMR is currently witnessing massive investments in infrastructure revamps targeting rapid mass transport, a new airport and development of real estate and roads. Over the next couple of years, the city will witness several new areas of sectoral as well as geographical growth aimed at making Mumbai less cluttered and more resilient. This will require an equivalent investment in enabling infrastructure, covering various constituent sectors of the economy.¹⁷

State budget 2017-18 allocated around INR 7,000 crore to MMRDA for completing mega-infrastructure projects in and around Mumbai, of which the seven proposed metro rail projects will get around INR 3,200 crore. Apart from the metro rail projects, funds have also been allocated for the monorail Phase-II, construction of several flyovers, and expansion of Mumbai's road network. MMRDA has also earmarked around INR 1,200 crore for the Mumbai Trans-Harbour Link.¹⁸ MMRDA intends to invest significantly in various other infrastructure projects in its quest of bridging Mumbai's infrastructure deficit.

Ongoing Major Infrastructure Projects

Mumbai Metro Rail

The existing suburban rail system of Mumbai is under extreme pressure as it carries more than 7.5 million commuters daily, and the existing role of bus services is limited to acting as a 'feeder service' to the suburban railways. To free up the railways and improve urban commuting, MMRDA had initiated the metro rail project. Upon completion of the metro rail, connectivity to pockets in the island city and suburbs which are currently not served by the suburban rail network will be enhanced. The table below provides a snapshot of the metro rail transit routes.¹⁹

¹⁷Chandorkar, A. (2017). Maharashtra Day: Eight Big Infrastructure Ideas That Can Smarten Up The State. Swarajyamag.com. Retrieved 17 October 2017, from <https://swarajyamag.com/infrastructure/maharashtra-day-eight-big-infrastructure-ideas-that-can-smarten-up-the-state>

¹⁸Breakdown: How MMRDA will spend Rs 7000 crore on improving Mumbai's infrastructure in 2017-18 - Local Press Co. (2017). Local Press Co. Retrieved 16 October 2017, from <http://localpress.co.in/2017/03/breakdown-mmrda-will-spend-rs-7000-crore-improving-mumbais-infrastructure-2017-18/>

¹⁹Mumbai Metropolitan Region Development Authority (2017). Mmrda.maharashtra.gov.in. Retrieved 16 October 2017, from <https://mmrda.maharashtra.gov.in/>

Line	Name of Corridor	Length (in km)	Estimated cost (in INR)	Current status	Expected Commissioning
1	Versova-Andheri-Ghatkopar	11.40	4,321 Crore	Operational since June 2014	-
2	Dahisar-Mankhurd	42.1	17,329 Crore	Bidding (Dahisar-DN Nagar is Under Construction)	2020
3	Colaba-Bandra-SEEPZ	33.5	24,430 Crore	Under Construction	2020
4	Wadala-Ghatkopar-Mulund-Teen Hath Naka-Kasarvadavali	32	14,549 Crore	Post-bidding	Post 2020
5	Thane-Bhiwandi-Kalyan	24	8,416 Crore	Approved	2022
6	Lokhandwala-Jogeshwari-Kanjurmarg	14.5	6,672 Crore	Approved	2022
7	Dahisar East-Andheri (East)	16.5	6,208 Crore	Under Construction	2019

Mumbai Monorail

²⁰Rawal, S. (2017). Smoother commute in Mumbai: 2nd phase of monorail, Wadala to Jacob Circle, may start in Oct. <http://www.hindustantimes.com/>. Retrieved 17 October 2017, from <http://www.hindustantimes.com/mumbai-news/smooth-commute-in-mumbai-2nd-phase-of-monorail-wadala-to-jacob-circle-may-start-in-oct/story-20wUnwgsbl5bB4YDBLJpXN.html>

The monorail project proposes to reduce the traffic congestion in the regions where Metro or BRT cannot be implemented. The monorail is considered to be an efficient feeder transit to the metro and suburban rail systems, as it offers efficient, safe, air-conditioned, comfortable and affordable public transport. The Mumbai monorail master plan proposed the construction of 8 lines at a cost of around INR 20,000 crore.

Phase & Timing	Line	Corridor	Length (in km)	Estimated cost (in INR)	Current status	Expected Commissioning
Phase I February 2014²⁰	1	Chembur-Wadala Depot-Jacob Circle	19.54	2,716 Crore	Operational between Chembur & Wadala Depot.	Next phase (Wadala-Jacob Circle) to be operational by mid-2018
	2	Mulund-Goregaon-Borivali	30	4,170 Crore	NA	NA
	4	Lokhandwala-SEEPZ-Kanjurmarg	13.14	1,827 Crore	Under construction	NA
	5	Thane - Mira-Bhayander - Dahisar	24.25	3,370 Crore	Construction yet to begin	NA
Phase II mid-2018 expected	6	Kalyan-Ulhasnagar-Dombivli	26.40	3,670 Crore		
	7	Chembur-Ghatkopar-Koparkhairane	16.72	3,686 Crore	Construction yet to begin	Post 2020
	8	Mahape-Shil Phata-Kalyan	21.10	2,933 Crore		

Proposed Upgrades

Multimodal Corridor from Virar to Alibag

The 126 km long Virar-Alibag Multimodal Corridor will connect NH-8, Bhiwandi bypass, NH-3, NH-4 and NH-4B, Mumbai-Pune Expressway, NH-17, etc. The Multimodal Corridor will play a vital role in development and the creation of job opportunities in the seven growth centers of Virar, Bhiwandi, Kalyan, Dombivli, Panvel, Taloja and Uran. It will also help in the development of Navi Mumbai International Airport, JNPT Port, Mumbai Trans Harbour Link (MTHL) and the Dedicated Freight Corridor.

Mumbai Trans Harbour Link

Also known as the Sewri-Nhava Sheva Trans Harbour Link, MTHL is a 21.8 km 6-lane freeway proposed to facilitate decongestion of the island city by improving connectivity between South Mumbai and Navi Mumbai. The coastal road intersects the proposed 4.25 km Sewri-Worli road on the Worli Sea Face, providing additional connectivity.²¹ Estimated to cost around INR 18,000 crore, the project is planned to kick off in 2018.

Mumbai Trans Harbor Link (MTHL) – Metro Link

The Mumbai Trans Harbor Link is a 22-km metro corridor from Prabhadevi to Sewri and further to Navi Mumbai and a suitable location on the Panvel-Pen section. It will provide direct access to the proposed Navi Mumbai International Airport from the Mumbai mainland, and also provide easy access to the Mumbai-Pune Expressway. The estimated cost of the project is INR 18,000 crore²² and is expected to be commissioned in 2022.

Mumbai Urban Transport Project II

Mumbai Urban Transport Project (MUTP) Phase I commenced in 2002 and was completed in 2011. Under this project, the State Government, Indian Railways, and MMRDA, with financial assistance from the World Bank, completed several initiatives on the road as well as rail routes to improve the physical infrastructure of the city. The projects undertaken include widening of the Jogeshwari-Vikhroli Link Road (JVLR), setting up the Santacruz-Chembur Link Road (SCLR) and many other rail-linked initiatives.

The Government of Maharashtra and Ministry of Railways has proposed MUTP II to improve the suburban service network and operations. The project cost is INR 5,300 crore, of which the World Bank has sanctioned funds of INR 1,910 crore. MUTP II includes the following projects: extension of the harbour line to Goregaon, EMU procurement and manufacture, maintenance facilities for EMUs, technical assistance, institutional strengthening, station improvement and trespass control.

Inter-State Bus Terminal (ISBT)

The Comprehensive Transport Study conducted by MMRDA proposed a INR 150 crore Greenfield Inter-State Bus Terminal to

²¹Lewis, C. (2017). Freeway, MTHL & Coastal Road to meet in grand cross-city link - Times of India. The Times of India. Retrieved 17 October 2017, from <https://timesofindia.indiatimes.com/city/mumbai/freeway-mthl-coastal-road-to-meet-in-grand-cross-city-link/articleshow/58271530.cms>

²²Sharma, R. (2017). Mumbai Trans Harbour Link: Larsen & Toubro emerges as lowest bidder for final 22-km part of project. The Financial Express. Retrieved 17 October 2017, from <http://www.financialexpress.com/industry/mumbai-trans-harbour-link-larsen-toubro-emerges-as-lowest-bidder-for-final-22-km-part-of-project/857015/>

decongest Mumbai's roads from heavy vehicles.

The proposed ISBT in Panvel is expected to be completed in the next few years, and will serve as the main boarding and alighting point in the city for all passengers traveling outside the city and the state. The terminus will help control and regulate informal drop-off or pick-up points on the Sion-Panvel highway by private operators, and also provide inter-modal and intra-modal transfer facilities at the new terminal. The terminus will be a concentration of bus transport activities in a hub model - improve services and safety for commuters and provide shuttle services from all parts of the city to ISBT.²³

Coastal Road

The coastal road - an ambitious INR 15,000 crore project - is a 29 km freeway that would run along Mumbai's western coastline connecting Marine Lines in the South to Kandivali in the North. The project has been divided into the Northern and Southern phases. While the South phase will run from the Princess Street flyover till the south end of the Bandra-Worli Sea Link, the North phase will cover the stretch from the north end of the Bandra Worli Sea Link till Kandivali.²⁴

Navi Mumbai International Airport

Navi Mumbai International Airport is a greenfield airport planned at Mumbai's Kopra-Panvel area. It will be Mumbai's second airport, and function alongside the existing Chhatrapati Shivaji International Airport (CSIA). Upon its completion, Mumbai will be the first city in India to have more than one airport. Navi Mumbai International Airport is expected to be commissioned by 2019 (originally 2014) but many legal challenges continue to appear along the way, especially pertaining to land acquisition.²⁵ The INR 16,000 crore project will be executed by Mumbai International Airport Limited (MIAL), which is a joint venture between the Airports Authority of India (AAI) and the GVK Industries Ltd.

Decentralization of Business Centers

With Mumbai getting over-burdened due to increasing population, the State Government aims to create commercial avenues in the outer regions to absorb the surging population influx. The development concept is to not only reduce the pressure on the island city but also to provide more employment opportunities and promote a walk-to-work culture. These centers will be a combination of commercial and residential spaces, and will reduce the travel time from residential areas to workplaces.²⁶

In line with the declining interest in the traditional central business district (CBD) of Mumbai, several corporations have established their front-office functions in the secondary business districts (SBDs) and moved their back-office activities to the suburban markets. From Fort (the historic CBD of Mumbai) to Bandra-Kurla Complex (BKC) and Thane-Belapur road, the commercial sector is undergoing a lot of development, spurred by the upgrading of the suburbs and peripheral areas.

²³By 2018, city may get swanky depot for inter-state buses - Times of India. (2017). The Times of India. Retrieved 17 October 2017, from <https://timesofindia.indiatimes.com/city/navi-mumbai/By-2018-city-may-get-swanky-depot-for-inter-state-buses/articleshow/51229048.cms>

²⁴Coastal Road project: Work likely to begin from January. (2017). The Indian Express. Retrieved 16 October 2017, from <http://indianexpress.com/article/cities/mumbai/coastal-road-project-work-likely-to-begin-from-january-4809321/>

²⁵Navi Mumbai International Airport New Airport Profile | CAPA. (2017). Centreforaviation.com. Retrieved 17 October 2017, from <https://centreforaviation.com/data/profiles/newairports/navi-mumbai-international-airport>

²⁶Badauria, S. (2017). New business districts emerging in suburban Mumbai

Bandra-Kurla Complex (BKC)

BKC has emerged as the trending commercial hotspot of Mumbai with most leading banks and financial institutions headquartered here. Besides, this area houses five-star hotels and consulates as well. To cater to the booming walk-to-work concept, residential complexes are also being developed here along with hospitality and retail facilities. BKC has grown in terms of popularity on the back of its central location as well as excellent infrastructure in terms of parking, multi-modal connectivity, power supply etc. Consequently, it has witnessed a tremendous rise in demand and supply of real estate.

Thane-Belapur Road

Thane-Belapur road in Navi Mumbai is one of the most recently expanded locality and has developed into a flourishing business hub. Equipped with ample space, sound connectivity, and upcoming social infrastructure, the area has recorded significant growth of IT-ITeS companies. Navi Mumbai has emerged as a hub for IT-ITeS and manufacturing industries, marked by mixed-use developments for commercial, hospitality, retail, and education sectors.

Kharghar

An emerging commercial destination, Kharghar is attracting businesses from Panvel, New Panvel, and the nearby areas. Excellent planning by CIDCO and availability of surplus land in the surrounding region indicates that Kharghar can also become a key competitor in the affordable commercial space.

Other Business Districts in MMR

In an endeavor to develop Mumbai as an international financial hub, Maharashtra government has proposed to develop five Central Business Districts (CBDs) in Vasai-Virar, Greater Panvel, Kalyan, Oshiwara and Bhiwandi on the lines of Bandra-Kurla Complex (BKC), which will be developed by the MMRDA.

Public-Private Partnership (PPP)

Developing India's infrastructure as per global standards and bridging the massive infrastructure deficit calls for massive investments which the public sector cannot meet by itself. There is a clear need for private sector participation in coordination with the public sector to develop public infrastructure facilities. To this end, the economic reforms initiated in the country provide a policy environment conducive for PPP in infrastructure development. Sector-specific policies to enhance PPP in infrastructure building have also been initiated from time to time.²⁷

In most cases, PPPs combine the best of both worlds, i.e. the private sector has the resources, management skills and technology while the public sector contributes in terms of regulatory actions and protection of public interest.²⁸ The broad sectors encouraged under the PPP framework are Highways, Railways, Ports, Airports, Power and Urban Infrastructure, etc. There has been a gradual rise

²⁷Reserve Bank of India - Database. (2017). Rbi.org.in. Retrieved 18 October 2017, from https://www.rbi.org.in/scripts/BS_VIEWContent.aspx?ID=1912

²⁸Public Private Partnerships (PPP) in Infrastructure Projects. (2017). Retrieved 18 October 2017, from http://www.cag.gov.in/sites/default/files/cag_pdf/ppp-project.pdf

PPPs combine the best of both worlds i.e. the private sector has the resources, management skills and technology while public sector has the regulatory actions and protection of the public interest.

in the extent of private sector participation in the establishment of infrastructure, especially through PPP, in the past few years.

Below are some of the projects falling in the PPP models which are either in the 'Pre-construction Stage', 'Under Construction' or 'Operation and Maintenance Stage'.

AMRUT and Smart Cities Mission

Even though the Cabinet allocated the Smart Cities Mission and the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) of 500 cities with an outlay of INR 48,000 crore and INR 50,000 crore respectively, the funds allocated for these missions are inadequate for actual implementation. Hence, project costs are being met through substantial private investments which will be mobilized by states and urban local bodies through the PPP mode.²⁹

Modernization of Mumbai Airport

Mumbai International Airport Pvt. Ltd. (MIAL) (a joint venture between the GVK led consortium and Airports Authority of India) was awarded the mandate of modernizing and upgrading Mumbai's Chhatrapati Shivaji International Airport (CSIA) in February 2006. CSIA's transformation is a one-of-its-kind infrastructural project, unlike any other airport development project in the world. It has been recognized as the 'Best Brown Field Airport in Public-Private Partnership' by the Air Passengers Association of India (APAI) and Consumers Association of India survey in 2009.³⁰

Navi Mumbai International Airport

CIDCO is the nodal Government agency for the greenfield airport project which will be built through PPP on a 'design, build, finance, operate and transfer' (DBFOT) basis. The airport project will be developed on 1,160 hectares at an estimated cost of INR 145 billion.³¹ The GVK-led consortium MIAL will be offering a 12.6% share of the annual revenue to CIDCO.³²

Public-Private Partnerships for Affordable Housing

A new PPP Policy for Affordable Housing was introduced in September 2017 that allows extending Central assistance of up to INR 2.50 lakh per house to be built by private builders even on private lands, besides providing immense potential for private investments in affordable housing projects on Government lands in urban areas.

Out of the eight PPP investment options available to the private sector, six are for promoting affordable housing with private investments using Government lands. The remaining two PPP models are for private investments, along with Central assistance, in affordable housing on private lands.³³

²⁹Union Cabinet approves Atal Mission for Rejuvenation and Urban Transformation and Smart Cities Mission to drive economic growth and foster inclusive urban development. (2017). Pib.nic.in. Retrieved 18 October 2017, from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=119925>

³⁰GVK Airports. Enhancing Experiences. (2017). www.gvk.com. Retrieved 18 October 2017, from http://www.gvk.com/media/pdf/4GVK_Airports_Brochure_kala.pdf

³¹Megaproject 868: GVK wins Navi Mumbai airport PPP | Infrastructure Finance & Investment - PPP. (2017). [Infrappworld.com](http://www.infrappworld.com). Retrieved 18 October 2017, from <http://www.infrappworld.com/news/megaproject-868-gvk-wins-navi-mumbai-airport-ppp>

³²Navi Mumbai Greenfield airport: CIDCO to get just 12.6 per cent of the revenue share. (2017). The Indian Express. Retrieved 18 October 2017, from <http://indianexpress.com/article/business/business-others/navi-mumbai-greenfield-airport-cidco-to-get-just-12-6-of-the-revenue-share-4525529/>

³³Centre announces new PPP Policy to promote private investments in affordable housing. (2017). Pib.nic.in. Retrieved 18 October 2017, from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=170988>

Major Initiatives for MMR's Transformation



Pradhan Mantri Awas Yojana (PMAY) – Housing for All

The Pradhan Mantri Awas Yojana (PMAY) launched by the Government of India aims to provide cost-effective housing solutions for the Economically Weaker Section (EWS) of Indian society. The primary objective of the PMAY scheme is to construct 2 crore houses in urban areas across the country by 2022.³⁴ To this end, Union Budget 2017 allocated a fund of INR 23,000 crore for the fiscal year 2017-18. The scheme comprises of the following four categories.

- Building and/ or enhancing the houses led by legatees
- Reasonable housing via credit linked grant
- In-situ slum redevelopment with private sector participation using land as resource
- Affordable housing in association with private and Government funding

Out of the shortlisted 373 cities in Maharashtra, the following cities are some of those included in the PMAY: Alibag, Ambernath, Badlapur, Bhiwandi-Nizampur, Greater Mumbai, Kalyan-Dombivli, Mira-Bhayander, Navi Mumbai, Panvel, Thane, Ulhasnagar, Vasai-Virar city, Igatpuri, Karjat, Khopoli, Lonavala, and Palghar.

Smart Cities

The Smart Cities Mission is a programme by the Government of India for urban renewal and retrofitting of 100 cities across the country with a view to making them citizen-friendly and sustainable. The Union Ministry of Urban Development is implementing this mission in collaboration with the State Governments.

The Smart Cities mission aims is to drive economic growth and enhance the quality of living of the people by enabling local area development and harnessing technology.³⁵ A total of 10 cities are shortlisted in Maharashtra, and the cities from MMR include Navi Mumbai, Greater Mumbai, Kalyan-Dombivli, and Thane. The State Government raised over INR 25,000 crore to fund the development of eight of the ten Smart Cities.³⁶

³⁴Pradhan Mantri Awas Yojana - Housing for All by 2022 Scheme. (2017). Bankbazaar.com. Retrieved 18 October 2017, from <https://www.bankbazaar.com/home-loan/pradhan-mantri-awas-yojana.html>

³⁵Smart City Mission Statement and Guidelines in Smart Cities Mission Guidelines. (2017). Retrieved 18 October 2017, from <http://www.smartcities.gov.in/upload/uploadfiles/files/SmartCityGuidelines.pdf>

³⁶Maharashtra to raise its own funds for eight smart cities. (2017). The Hindu. Retrieved 18 October 2017, from <http://www.thehindu.com/news/cities/mumbai/news/Maharashtra-to-raise-its-own-funds-for-eight-smart-cities/article14429773.ece>



AMRUT Mission

Launched along with Housing for All by 2022 scheme by Prime Minister Narendra Modi in June 2015, the AMRUT Mission focuses on the establishment of an infrastructure that could ensure adequate and robust sewage networks and water supplies for urban transformation. The urbanization programme will be undertaken over a 5-year period. The objective of the mission is to provide every household with basic amenities such as water supply, sewerage, infrastructure, rainwater harvesting, open spaces, transport, etc. to enhance the standard of living.³⁷

The Maharashtra Government has initiated the AMRUT Mission in 43 cities in Maharashtra, out of which Ambarnath, Badlapur, Bhiwandi, Greater Mumbai, Kalyan-Dombivli, Mira-Bhayander, Navi Mumbai, Panvel, Thane, Ulhasnagar and Vasai-Virar city have been identified in MMR.³⁸ The Central Government has allocated funds of around INR 1,000 crore for its implementation in Maharashtra.

Affordable Housing Scheme

The Government of Maharashtra has set a target to construct 20 lakh houses in a span of 5 years for Project Affected People (PAP) in Mumbai's Vidyavihar, Bhandup, and Mahul under its Affordable Housing Scheme 2017. More than 23,000 houses have been allotted to the Brihanmumbai Municipal Corporation (BMC), and around 25,000 units to the Mumbai Metropolitan Region Development Authority (MMRDA). These homes will be provided to candidates willing and eligible to buy affordable housing units under Affordable Housing Scheme 2017, Maharashtra.³⁹

³⁷Maharashtra govt proposes 43 cities for AMRUT project. (2017). The Indian Express. Retrieved 18 October 2017, from <http://indianexpress.com/article/cities/mumbai/maharashtra-govt-proposes-43-cities-for-amrut-project/>

³⁸Kakodkar, P. (2017). Maharashtra to begin AMRUT scheme in 43 cities - Times of India. The Times of India. Retrieved 18 October 2017, from <https://timesofindia.indiatimes.com/city/mumbai/Maharashtra-to-begin-AMRUT-scheme-in-43-cities/articleshow/49199417.cms>

³⁹Affordable Housing Scheme 2017 Maharashtra - Government to Launch 50,000 Houses. (2017). Awas Yojana. Retrieved 18 October 2017, from <http://www.awasyojana.in/affordable-housing-scheme-2017-maharashtra-government-launch-50000-houses/>

Revamping Mumbai: Recommendations & Case Studies

This section covers the issues that need to be addressed in Mumbai and its metropolitan region, a case study of cities across the world which had similar problems in the past, and the solutions that can be adopted by the MMRDA. Certain challenges that might arise are also discussed.

The major recommendations include fast-tracking redevelopment and slum rehabilitation, land unlocking and change in development norms, implementing sustainable living norms, focusing on affordable housing projects, embracing contemporary technologies to expedite construction, and accelerating private participation.

**US\$400
billion**

MMR Economy in 2017

Mumbai, the financial capital of India and a major economic powerhouse, is one of the most dynamic cities in the world. The city accounts for 6% of India's economy, 30% of income tax collections, 40% of foreign trade, and contributes INR 40,000 crore (US\$10 billion) in corporate taxes. It is also one of the world's top 10 centers of commerce in terms of global financial flow⁴⁰ and the world's 37th largest city by GDP.⁴¹

The city is the fashion, entertainment and commercial hub of the country, with the MMR's economy being more than US\$400 billion as of 2017. The city hosts headquarters of several financial institutions such as the Reserve Bank of India, Bombay Stock Exchange and National Stock Exchange, as well as big corporate houses such as the Tata Group, Reliance Industries and Aditya Birla Group. In addition, MMR is home to some of the country's largest packaged goods companies such as Hindustan Unilever, Colgate-Palmolive, Godrej Consumer Products, Procter & Gamble and many more.

The region has a presence of all the essential elements to make it one of the sought-after destinations. A World Bank report has pointed out that MMR has a potential of \$40-50 billion income in this financial hub.⁴² The MMR is on the threshold of becoming an economic power, with constantly improving infrastructure and attracting FDI for mega infrastructure projects. Out of the total FDI inflows into India, Maharashtra bagged 50%, worth around INR 1.20 lakh crore.⁴³ In addition to this, the Mumbai-Ahmedabad High-Speed Rail (MAHSR) is also funded by the Japan International Co-operative Agency (JICA). The MAHSR debt structuring is also very attractive - an INR 88,000-crore loan at a notional rate of interest of 0.1 percent to be repaid over 50 years, with a principal payment moratorium of 15 years.⁴⁴ The project will boost economic activities in the region and open up tremendous employment opportunities. The construction of the high-speed rail network will boost allied industries such as steel, cement and infrastructure. This will translate into additional logistics and warehousing demand.

However, with constant development and a massive influx of migrants, the entire region has recorded an exponential rise in population. As per estimates based on the 1999-2000 NSS survey, migrants constitute about 37% of Mumbai's population.⁴⁵ The

⁴⁰Nakaskar R. (2017). Mumbai, a land of opportunities - Times of India. The Times of India. Retrieved 23 October 2017, from <https://timesofindia.indiatimes.com/city/mumbai/Mumbai-a-land-of-opportunities/articleshow/9292526.cms?referral=PM>

⁴¹City Mayors reviews the richest cities in the world in 2005. (2017). Citymayors.com. Retrieved 23 October 2017, from <http://www.citymayors.com/statistics/richest-cities-2005.html>

⁴²No need to turn Mumbai into Shanghai: CM Devendra Fadnavis | Latest News & Updates at Daily News & Analysis. (2017). DNA India. Retrieved 23 October 2017, from <http://www.dnaindia.com/mumbai/report-no-need-to-turn-mumbai-into-shanghai-cm-devendra-fadnavis-2056932>

⁴³Maharashtra govt taps FDI to push infra projects. (2017). The Indian Express. Retrieved 23 October 2017, from <http://indianexpress.com/article/cities/mumbai/maharashtra-govt-taps-fdi-to-push-infra-projects-4861277/>

⁴⁴Chandorkar, A. (2017). Mumbai to Ahmedabad on the bullet train. The Hindu Business Line. Retrieved 23 October 2017, from <http://www.thehindubusinessline.com/opinion/mumbai-to-ahmedabad-on-the-bullet-train/article9856326.ece>

⁴⁵D.P.Singh. Migration and Occupation In Mumbai Issues and Implications. (2017). Retrieved from http://www.demoscope.ru/weekly/knigi/tours_2005/papers/iussp2005s50938.pdf

population of MMR has grown almost 3-fold in the last four decades. Also, the rapid increase in population and continuous urbanization have led to an increasing demand for land in urban settlements, resulting in an acute housing shortage and tremendous load on the existing infrastructure.

The Government of Maharashtra has initiated several infrastructure initiatives (such as metro rail, monorail, coastal road and MTHL) and housing policies (Housing for All by 2022) to enhance the quality of life of Mumbaikars and improve the economic and social fabric of the city. In addition, the Government has tied up with 'Mumbai First' – a non-profit organization which focuses on PPP to enhance Mumbaikars' lifestyle - to make MMR a global financial, commercial and entertainment hub. This organization was incorporated in 1995, when a group of businessmen got together to establish a think-tank for Mumbai City and foster partnerships between major stakeholders such as industrialist, big business houses and financial institutions.

The core focus areas of the 'Mumbai First' committee are specified below:⁴⁶



Environment: Promoting initiatives that allow development and urban planning without environmental degradation. It focuses on effective waste management and prevention of pollution.



Healthcare: Improving health services in public hospitals and controlling diseases through improved sanitation and public awareness programmes.



Education: Enhancing the grade and standard of municipal teachers and improving the quality of education in public schools.



Governance: Examining concrete problems in the existing governance architecture and suggesting ways and means to restructure local government to be more effective, efficient and responsive to public needs.



Infrastructure: Improving the city's infrastructure to keep pace with the burgeoning population.



Housing: Increasing land supply and promoting affordable housing through the redevelopment of mill lands and slums.



Security: Ensuring basic security of the citizens and countering terrorist attack threats.

The Government has already taken up several initiatives to transform MMR into a world-class city, and one of the best places to live and work. However, without proper planning and plugging the loopholes of existing policies and infrastructure, making Mumbai more liveable is a daunting task. The region is experiencing massive problems in terms of upkeep of current infrastructure. The condition of the city's highways and arterial roads is degrading, its railway stations are far from adequately maintained, traffic congestion is a serious problem and lack of sanitation is a major concern. The city needs to revamp

⁴⁶ Our Focus. (2017). Welcome to Mumbai First. Retrieved 23 October 2017, from <http://mumbaifirst.org/our-focus/>

not only in terms of infrastructure but also healthcare facilities, mass transportation, education and safety facilities to make it more vibrant and liveable.

This section will focus on Government initiatives that can potentially transform the life of Mumbaikars. In some cases, a brief comparison with other developing/developed economies will be made. The agenda will remain - how to make Mumbai more liveable within the context of the city's current socio-political and geographical dynamics.

Recommendation

Fast-track Redevelopment & Slum Rehabilitation

Dharavi, often described as the largest slum in Asia



Slums have formed an integral part of Mumbai's cityscape for several decades. Being the economic hub of India and cynosure of commercial activity, the city attracts large numbers of migrants from different parts of the country. Due to unaffordable property options, many of them are forced to stay in slums for lack of better alternatives. These slums often have unhygienic conditions, with the residents having no access to healthcare facilities, and lack good quality houses. It is estimated that more than 55% of Mumbai's population resides in slums. Nearly 60% of household in the Greater Mumbai region and around 20% of households in the rest of MMR reside in slums.⁴⁷ The constant inward migration from villages and small towns to MMR has led to degradation of urban environmental quality and lack of sustainable development.

Problem

Dharavi is now a veritable black mark on Mumbai's report card, given the high incidence of crime, unhygienic lifestyle, poverty and highly dense population.

It is estimated that over 1.39 million households live in slums in MMR. The scale of economic activity in the financial capital has induced rapid but unplanned and distinctly unsustainable growth. Mumbai hosts one of the world's largest slum - Dharavi, home to nearly 1 million people, spread across 2.1 sq.km. and with a population density of over 2.75 lakh/sq.km. The Dharavi slum cropped up in 1882 during the British colonial era, and is one of the oldest slum settlements in the country. It has a thriving informal economy in which numerous household enterprises employ many of the slum residents.⁴⁸

In its evolution from the colonial era settlement to an industrial populated slum, Dharavi is now a veritable black mark on Mumbai's report card, given the high incidence of crime, unhygienic lifestyle, poverty and highly dense population there. Since 1997, several plans were floated to redevelop Dharavi in a systematic manner, on the lines of the former slums of Hong Kong (Tai Hang) or Singapore; nevertheless, nothing has been done on the ground. The latest redevelopment plan proposed for the Dharavi area involves the construction of 30 lakh sq. ft. of dwelling units, schools, parks and roads to serve the families residing there, along with 40 lakh sq. ft. of residential and commercial spaces. The proposed Dharavi redevelopment plan has been divided into 10 sectors, to be developed by different developers. However, there is still significant local opposition to this plan. Residents maintain that the proposed size (350 sq. ft.) of the redeveloped housing units is not adequate, and that small businesses there would be adversely impacted.

Case Study - Transforming City's landscape

In the 1950's, Singapore had one of Southeast Asia's largest urban slums and squatter populations. The island was over-crowded with slums, with deplorable living conditions and very inadequate infrastructure. During the 1950's, a quarter of a million people lived in deteriorated slums while another one-third of a million lived in squatter settlements. Slum dwellers constituted 37% of the then population of 1.58 million.

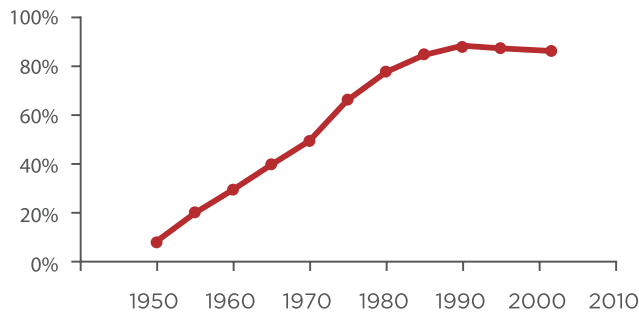
To solve the crisis of housing shortage and to improve quality of living for its citizens, the Housing and Development Board (HDB) was established in 1960. In its initial first 5-year programme from 1960 to 1965, the priority was to construct small-sized housing units with basic toilets and kitchen facilities, focusing on quantity. During

⁴⁷ 2001 slum census adjusted on trend line to 2008; press search and MMRDA commissioned reports

⁴⁸ BBC NEWS | Business | Indian slum hit by New York woes. (2017). News.bbc.co.uk. Retrieved 23 October 2017, from <http://news.bbc.co.uk/2/hi/business/7676337.stm>

1970-80, the authority constructed self-sufficient developments which included commercial, recreational and institutional facilities. During this period, about one-third of the population received HDB flats. During 1980-90, greater emphasis was laid on creating a better quality and more picturesque environment, with larger-sizes housing units. Special attention was also given to the preservation of the natural landscape. Subsequently, in four decades, the HDB has built more than 8 lakh units to house about 85% of Singapore's population. The chart below shows the percentage of population in HDB housing estates over the past four decades:

Percentage of Population Housed in HDB Flats



Source: HDB Annual Report 2001/2002

To provide sufficient financial support to the HDB, Singapore's Government also provided financial aid in the form of grants and loans such as housing development loans that covered development programmes and operations. Also, legislative support was provided with the passing of the Land Acquisition Act in 1967, which permitted the authorities to compulsorily acquire private land for housing and other developments.

How Can Mumbai Replicate Singapore's Success Story?

With proper rehabilitation of slum dwellers and redevelopment of community living backed by a sustainable living concept, Singapore has achieved one of the most successful public housing programmes in the world. MHADA and SRA can replicate the success story of HDB, with respect to overcoming the housing shortage in MMR. However, to accomplish this task, the Government must intervene and involve itself at every level of the redevelopment plan. Below are the salient points to consider:

- Effective PPP models for self-sustainable development
- Focus on a community living concept factoring in the multi-ethnic population in slums
- Massive incentives to developers for slum redevelopment
- Attractive home loans with nominal interest rates for slum dwellers

Challenges for Mumbai's Redevelopment Plan and Rehabilitation of Slums

Slums remain the major area of concern in terms of population, transportation, hazardous diseases, health and safety. Dharavi has

one of the largest slums in the world, and an enormous population of migrants working in and around the MMR. The Slum Rehabilitation Authority (SRA) has undertaken the redevelopment plan of Dharavi, and laid down the plan to redevelop the entire slum by dividing Dharavi into 10 sectors, each to be developed by different developers considering the self-sustained development plan. Sector 5 (close to BKC) will be developed by the Maharashtra Housing and Area Development Authority (MHADA).

The slum is not only struggling with unhygienic and sanitation issues but also struck between authorities and developers over its redevelopment plan. Developers are demanding higher Floor Space Index (FSI) and Transfer of Development Rights (TDR), as the current FSI for Dharavi redevelopment is only 4. Despite the higher incentives given to developers, only 15% of Dharavi's slums have been redeveloped in the last 12 years. Only determined political will, massive incentives and quick conversion of words into action will help in redeveloping this large piece of land - and unlocking a massive and invaluable real estate catchment in the heart of the city.

Recommendation

Land Unlocking & Change in Development Norms

Problem

Mumbai, being the third-densest city in the world, is considerably space starved. On an average, 28,000 people live on every square kilometres of land area in Greater Mumbai. Due to this space constraint and unaffordable costs for land and built-up areas, a large share of the population stays in slums or similar housing settlement, which in turn results in lack of quality of living with regards to affordable housing and adequate civic amenities.

Case Study - Meeting Mumbai's Affordable Housing Requirements

In a city like Mumbai - especially in the old settlement areas such as South Mumbai, immediate areas of CBD and some prominent suburbs - the quality of living can only be upgraded by the addition of open spaces, social amenities and affordably-priced housing. This, in turn, will only become possible when land is made available at cheap rates - a tough proposition in space-starved Mumbai, where land prices have skyrocketed.

The only viable option is to unlock land parcels held by various Government bodies and public-sector undertakings (PSUs). Typically, the cost of land constitutes around 40-60% of a project's total cost, especially in developed urban areas. It is therefore imperative that significant measures are taken to make land cheaper for development of affordable housing. Six mechanisms that have been used around the world to unlock urban land for affordable housing are detailed below, and Mumbai should consider using them:⁴⁹

⁴⁹Tackling the world's affordable housing challenge. (2017). McKinsey & Company. Retrieved 23 October 2017, from <https://www.mckinsey.com/global-themes/urbanization/tackling-the-worlds-affordable-housing-challenge>

Hong Kong has added 1.4 million homes in the New Territories, across the harbour from Hong Kong Island, most of them oriented to transportation infrastructure: 43% of residents and 56% of jobs are within 500 meters of rail and metro stations.

1. Developing land around transport infrastructure

Access to rapid transit that can get residents to work within short spans of time is an important aspect. For instance, Hong Kong has added 1.4 million homes in the New Territories across the harbor from Hong Kong Island, most of them oriented to transportation infrastructure: 43% of residents and 56% of jobs are within 500 meters of rail and metro stations. In cities where new transit facilities have been built, land values in the surrounding areas tend to have risen by 30-60%. By capturing a share of that increase (through land sales or 'betterment' assessments), the Government can deploy infrastructure investments and meet the cost of affordable housing.

2. Releasing Government-owned land for development

The Government often owns a significant share of undeveloped land in cities, and this land is frequently valued below market prices. In Turkey, the TOKİ housing agency has assembled 4,120 sq.km. or 4% of the urban land, largely by acquiring land from other Government entities. This land is developed in partnership with private developers under a revenue-sharing scheme that allows TOKİ to split development costs and fund further land acquisition and development of affordable housing. The Chinese Government also releases public land to the market every year by selling development rights and 70-year ground leases to developers. This helps in the development of infrastructure and housing in the core areas of its cities.

3. Using regulatory measures to unlock private land

In many cities around the world, a significant amount of serviced residential land (with access to utilities and infrastructure) within urban areas lies unused or is under-developed. An analysis of a sample of parcels in Riyadh, Saudi Arabia indicates that around 40 sq.km. that are zoned as residential and have access to suitable infrastructure have remained idle for two decades. Tax and regulatory policies can unlock idle land through incentives (such as property tax exemptions for new development) or penalties (such as idle-land taxes so that required developments mandatorily kick in).

4. Assembling or re-adjusting land to allow development

Land assembly and readjustment (also known as land pooling) has been used successfully in Japan and South Korea. Under these schemes, owners pool their land in exchange for higher density and infrastructure investment. The re-adjusted land (typically a comparable or smaller plot with similar improvements) is then returned to the owners. The resulting increase in value creates a strong incentive for owners to contribute land for development.

5. Formalizing ownership of informal land and modernizing land-registration systems

Informal land can be formalized through legal structures that facilitate individual or collective ownership. Simply establishing who actually owns the land can make it accessible to the market. Often, in developing economies, land registration systems are not evolved and more than 70% of the land is unregistered (as per a report by UN-Habitat). An efficient land registration system establishes clear ownership rights that enable transactions to move ahead without the risk of other parties later asserting ownership rights.

6. Improving urban land-use rules and using inclusionary planning

By changing land-use rules, cities can significantly lower the amount

of land used per housing unit, usually by adjusting the permitted floor-area ratio (FAR). This can be done on a block-by-block basis to take into account the impact of higher density on infrastructure capacity. Developers can then construct more square meters of space for each square meter of land and thereby cater to the increasing housing demand, particularly in areas close to transit stations where the infrastructure can support it.

How Can Mumbai Resolve Its Space Constraint Issues with Its Limited Land Availability?

One means available is the use of land parcels previously demarcated as no-development zones (NDZs), salt pan lands and tourism development areas for development of affordable housing and civic amenities, along with a change in FSI norms. Only the Government can unlock surplus land and make it available for the development of affordable housing or social amenities. A substantial portion of land under the jurisdiction of these authorities is in a surplus of their requirement, or is not efficiently utilized.

FSI across prominent global cities

Country	City	Maximum FSI
Bahrain	Bahrain	17
USA	New York Downtown	15
	Los Angeles CBD	13
	Chicago CBD	12
	San Francisco	9
China	Hong Kong	12
Thailand	Bangkok	8

FSI across prominent Indian cities

Indian city	Area	Maximum FSI
Kolkata	City	3.00
	Salt Lake	5.95
	Rajarhat	2.50
Bengaluru	City	4.00
Mumbai	Island city	1.33
	Suburbs	2.70
NCR	BKC	4.00
	Delhi	3.50
	Gurgaon	1.75
Noida		3.50
		3.50
Chennai	City	3.50

The authorities can sell this surplus land and prioritize the development of affordable housing and social amenities. As per a recent update in the Development Plan (DP 2014-2034), the civic body has proposed unlocking some of the salt pan lands for affordable housing. According to the data with the BMC, of the 2,177 hectares of salt pan land in Mumbai - owned in part by Mumbai Port Trust and the Salt Commissioner - around 430 hectares are not being used for their defined purpose, and can instead be put up for development⁵⁰. Consequently, in the revised DP, the civic body has marked reservation of 260 hectares of salt pan land for affordable housing - which, if unlocked, may improve the affordable housing situation substantially.

⁵⁰BMC may use smaller parcel of salt pan land for affordable homes - Times of India. (2017). The Times of India. Retrieved 17 October 2017, from <https://timesofindia.indiatimes.com/city/mumbai/BMC-may-use-smaller-parcel-of-salt-pan-land-for-affordable-homes/articleshow/52260178.cms>

Recommendation

Implementing Sustainable Living

MMR Region's Problems with Safeguarding the Environment

Urbanisation is taking place at a rapid pace in India. As per the 1901 census, the population residing in urban areas in India was 11.4%, which increased to 28.53% in 2001, 31.6% in 2011 and is likely to reach 40% by 2030.

Mumbai has also witnessed tremendous rural-urban migration in the 20th century, and is now one of the most populated cities in the world.

Environment Status of Mumbai Metropolitan Region

With an aim to integrate the concepts and strategies of sustainable development into the MMR's 3rd Regional Plan 2014-34 (RP) developed by the Planning Department of MMRDA, TERI (The Energy and Resource Institute) and MMRDA signed a Memorandum of Understanding in 2010 to work in collaboration on green buildings, transport and environment. Under this initiative, it was mutually decided to document the baseline status of various environmental resources and parameters. This included the quantitative as well as qualitative status of water resources, land use-land cover analysis, quality of air and its monitoring infrastructure, climate variability, issues pertaining to solid waste management, and so on.

According to the status report submitted by TERI, a reduction of 7% and 5% has been observed in the share of agricultural and forests land respectively. The forest area covers of MMR which originally accounted for almost 1,142 sq.km. have been reduced by around 225 sq.km. The second-highest change in land use has been recorded in the agricultural land under paddy cultivation in the highly urbanized areas of Thane, Vasai, Ambernath and Kalyan. The report indicates that this is primarily due to the lack of planning in the land-use pattern by the authorities, which in turn resulted in the following issues:

1. Conversion of land use - Landowners usually sell or abandon the cultivable land for the high economic value offered by real estate developers, which has led to the conversion of agricultural land into non-agricultural plots.

2. Quarrying - Quarrying activities have damaged the mountains significantly. Stone quarrying has also resulted in increased air pollution, which has led to health hazards.

Improving Mumbai's Sustainability and Liveability for a Better Future

The current situation in MMR calls for an enormous amount of infrastructural and civic developments, and housing improvements. All Government bodies should necessarily have well-researched development plans which can safeguard the sustainability of the city

and its people. An ideal scenario of sustainable living would meet current needs without sacrificing the ability of future generations to meet their own needs.

The general division of sustainability includes three dimensions, i.e. the 3 E's - **environment, economy, and equity**.⁵¹



The environment dimension concerns itself with conserving natural resources, so they can be utilized by the future generation.



The economy dimension concerns itself with economic growth involving economic processes and their impact on the natural environment.



The equity dimension may be defined as the social progress or social dimension, factoring in a fair share of benefits to every individual.

Smart Growth and Smart cities

Managing its urban sprawl is the biggest challenge for MMR today. To address the issue of urban sprawl, the concept of smart growth - defined as development that opposes sprawled growth - came into existence. It is the direction of a portion of growth to the inner metropolitan area, combined with a more controlled outward movement. Also, this is termed as a strategy based on land-use and transportation planning, keeping in mind the impact of development on the natural environment.

Smart Cities are unique solutions for the balanced and eco-friendly growth of sustainable living. The concept of smart cities came into existence from 1997 with the purpose to limit carbon dioxide emissions of ongoing urban developments, and consequently to safeguard the environment all over the world. As far as the complete MMR region is concerned, a total revamp as per the Smart Growth or Smart City” concept seems tough. That said, a few initiatives can be taken by providing infrastructure services and utilities to urban settlements with the integration of the modern technology (ICT), which can eventually improve the quality of living.

Recommendation

Focus on Affordable Housing Projects

Affordable housing is a much-discussed topic in the context of Mumbai's liveability and overall development. When it comes to any city's growth dynamics or evolution, one of the most important aspects to consider is the quality of living of lower income group people and the initiatives undertaken by the Government towards the betterment of this segment.

The Maharashtra Government has initiated several initiatives to address MMR's affordable housing shortage. Primarily, three agencies are responsible for the planning, building and implementation of affordable housing schemes for the EWS/LIG - MHADA, the Slum Rehabilitation Authority (SRA) and MMRDA. Below are the initiatives

⁵¹Randhawa, A., & Kumar, A. (2017). Exploring sustainability of smart development initiatives in India. International Journal of Sustainable Built Environment. <http://dx.doi.org/10.1016/j.ijjsbe.2017.08.002>

undertaken by the Maharashtra Government to plug the housing shortage in MMR:

- 1. Special Township Policy:** 33.3% of tenements or 20% of the total built-up area should be used for EWS/LIG houses.
- 2. Development/Redevelopment on MHADA land:** 60% of tenements to be reserved for EWS/LIG/MIG housing.
- 3. Inclusive housing in layouts:** Development of a layout exceeding an area of 4,000 sq. m. will require reservation of 20% of the built-up area for EWS and LIG households.
- 4. Slum Rehabilitation Scheme:** Rehabilitation of slum dwellers undertaken by SRA, MHADA, and MMRDA.
- 5. Affordable Housing:** MMRDA's rental housing scheme (2008) has been modified into an affordable housing scheme in November 2013.

To boost affordable housing development, the Chief Minister of Maharashtra has also announced that by 2019 the Government will build 12 lakh houses in rural and 10 lakh houses in urban areas under the affordable housing project.

Problem

MMR is witnessing an enormous shortage of affordable housing. In 2008, an approximate 2.3 mn households in Greater Mumbai and close to a million households in the Rest of MMR could not afford a basic housing unit.⁵² Affordable housing has been the most critical issue for Mumbaikars, and to provide housing solution to citizens is one of the complex problems for the Government and authority to address.

A significant share of the MMR population lives in slums, with inappropriate living conditions and lack of basic amenities. Slum dwellers with no permanent source of income cannot afford homes in the city. Also, the majority of the city's working middle class cannot afford homes within the city center due to high property prices, and thus lives in peripheral areas of the city.

Case Study – Achieving Housing for All vision via Efficient Housing Policies and Frameworks

The Hong Kong Housing Authority was established in 1973 with the core agenda to plan, build and manage public housing estates throughout the city as well as clear land for development. In addition, this authority also advises the Government on all housing matters, including land acquisition.

Public Housing is a major component of residential developments in Hong Kong, with nearly half the population now residing in some form of public housing.⁵³ The Hong Kong Housing Authority and the Hong Kong Society have built most of the city's public housing societies. Also, to attract lower group income people, the authority has set lower rentals as compared to private housing. It has so far rented 6.6 lakh public flats and over 2 lakh home ownership flats. The Hong Kong Housing Authority mainly focuses on providing assistance to low-income families who cannot afford private rental accommodation. Interestingly, to provide homes to the economically weaker section, rentals in public housing are determined on the basis

⁵²Housing in the Mumbai Metropolitan Region. (2017). Mumbai First. Retrieved 23 October 2017, from <http://mumbaifirst.org/wp-content/uploads/2016/06/Bombay-First-Housing-Paper.pdf>

⁵³Population Estimates - Publications | Census and Statistics Department. (2017). Censtatd.gov.hk. Retrieved 23 October 2017, from <https://www.censtatd.gov.hk/hkstat/sub/sp150.jsp>

of tenants' ability to pay, which has encouraged lower income group people to opt for this scheme. Additionally, through the Tenants Purchase Scheme existing tenants in public housing estates were allowed to purchase their rented flats at discounted prices. Moreover, in 2013 the housing authority introduced a pilot rental scheme for elderly householders by providing a cash subsidy in lieu of public rental housing. Since its inception, more than 1,800 households have applied for this scheme.

Since 1978, under the various subsidized home ownership schemes, the authority has sold around 4.5 lakh houses to the lower and middle-income groups at discounted prices. Subsequently, with increasing demand for public housing, the private housing sector witnessed a downturn in prices and demand. To maintain the equilibrium, the Housing Authority decided in 2002 to withdraw from its role as a provider of subsidized sale flats and refrain from competing in the private residential market. In 2003, the new Home Assistance Loan Scheme was introduced to provide home purchase assistance towards down payment and related expenses, in the form of interest-free loan on monthly mortgage subsidy.

New town of Hongkong, Tseung Kwan O



The Hong Kong Housing Authority has designed an effective mechanism which addresses the housing requirement of all buyer segments and over time, the focus shifted to high-end housing. It changed from quantitative emergency relief to a more quality-oriented housing system. Nearly 31% of the total population lived in public housing estates in 2013.

How Can Mumbai Replicate Hong Kong's Housing for All Success Story?

To replicate Hong Kong's success story in the context to the affordable housing shortage in the MMR, the authority should consider the below mentioned:

1. Identify PSU land banks (defence land, salt pan land, Airport Authority land) within the city center for affordable housing development, and speed up the process of land acquisition and clearance.
2. Further support the economic weaker section group by providing financial aid for home purchase, and home loans at nominal interest rates. The interest subsidy provided to EWS and LIG is a step towards providing this assistance.
3. Reintroduce the Rental Housing Scheme (RHS) to attract people who cannot afford homes and have no access to home finance schemes. Good, liveable rental housing options should be provided within the city center.
4. Encourage private developers to undertake the development of affordable housing projects by providing land at discounted rates as well as ensuring swift approvals.
5. Ensure that basic physical and social infrastructure is provided to make affordable houses liveable and viable for residents.

Mumbai's Challenges with the Housing for All Mission

Unlike in other metro cities, land prices in Mumbai are skyrocketing and houses are unaffordable for the economically weaker sections. In addition, being an island city, Mumbai has an acute shortage of land parcels within the city center. Thus, EWS and LIG housing schemes naturally mushroom only in the suburbs and the peripheral areas. Also, considering the lack of support infrastructure, developing affordable housing in the peripheral areas does not serve the purpose of affordability, as residents have to commute significantly from their homes to their workplaces.

Also, there is minimal participation of private sector players in the development of affordable housing units, as there is no additional benefit to them. This exacerbated the housing shortage.

Recommendation

Embrace Cutting-Edge Technology

Technological advancements have been helping the nation by speeding up the construction process, delivering a higher quality of output in the defined time, and with lower resource consumption and costs.

Traditionally, the engineering and construction (E&C) industries have been seen as a labor-intensive sector which does not utilize cutting-edge technology. However, this is changing rapidly. A wide array of disruptive, breakthrough technologies are transforming the way such companies build and operate, reshaping the way these industries have operated over the time.

Both the industries are on the brink of a new era wherein technology start-ups are creating new applications and tools that change how companies design, plan, and execute projects. By providing advanced software, construction-focused hardware and analytics capabilities, these innovative start-ups are eliminating many problems that have dogged the E&C sector for decades, including difficulties in compiling and sharing project information. Such improvements could not come at a better time, since construction projects are becoming increasingly complex and expensive, putting managers under greater pressure to improve costs, timelines, and efficiency⁵⁴.

In line with the Government's vision for building a New India, the National Building Construction Corporation (NBCC) has collaborated with many foreign companies to import 3D printing technology for speedy and sustainable construction of projects. NBCC has collaborated with renowned companies of the U.S. for importing 3D printing technology, and with Gremound (Hungary) and ETICS-BOLIX (Poland) to import energy-efficient solutions and non-tectonic technology systems. 3D technology enables fast construction and also reduces the cost of housing. Adoption of such technologies will not only reduce the turn-around time but also improve the quality and durability of construction.

The major technologies which are changing the real estate industry include:

- 1. Self-climbing formwork:** This system is driven by hydraulic and mechanical systems and enables large sets of formwork to be lifted simultaneously, without the requirement of a crane.
- 2. Aluminium shuttering⁵⁵:** Also known as Mivan shuttering, this is a fast-paced construction technique that offers strength and durability to a building by use of aluminium formwork cast around a steel mesh which can be directly erected on the construction site.
- 3. Pre-cast concrete:** Pre-cast concrete is made by casting concrete on a steel pallet and curing it in a regulated chamber before shipping it to the construction site.

These technologies are not only cost-effective but also offer advantages such as low labor requirement, high earthquake resistance, higher durability than conventional building techniques, increased carpet area, smoother finishing and lower maintenance. Embracing these technologies on a mass scale will surely speed up the construction process and make housing more affordable.

⁵⁴The new age of engineering and construction technology. (2017). McKinsey & Company. Retrieved 18 October 2017, from <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-new-age-of-engineering-and-construction-technology>

⁵⁵Goyal, S. (2017). Mivan Shuttering: Latest technology in construction

Recommendation

Accelerate Private Participation

Infrastructure is a fundamental aspect that every country needs to develop in order to achieve overall progress. However, there is no denying that developing countries tend to have limited resources. This has certainly been the case with India due to the sluggish pace of its economic growth and rapid rise in its population. To overcome this challenge, the Government of India has been striving to mobilize investments for infrastructure developments.

Given the Government's limitations with regards to raising such finances on its own, it has resorted to the innovative PPP model in various sectors. PPP refers to a form of a contract between the public and the private sectors for a specific duration in order to facilitate projects that require a huge capital outlays.

Private participation is not a new concept in India. The Great Indian Peninsular Railway Company operating between Bombay (now Mumbai) and Thana (now Thane) was one of the first private ventures. The Bombay Tramway Company running tramway services in Bombay (1874), The Great Indian Peninsular Railway Company and the Power Generation and Distribution companies in Bombay and Calcutta (now Kolkata) in the early 20th century are also among the earliest examples of PPP in India.

Today, we have many infrastructure projects which are operating under private participation, some of them being Bangalore International Airport (INR 12,690 crore), GIPCL Vadodara & Surat (INR 2,000 crore), GPEG Paguthan in Gujarat (INR 2,000 crore), and Tirupur Water Supply in Tamil Nadu (INR 1,023 crore)⁵⁶.

The key reason why India has benefited much from the PPP model is delays in project approvals and completions. Both these factors result in cost overruns and revenue losses to private owners. Among the numerous recommendations on revisiting and revitalizing the Union Ministry of Finance's PPP model was a consistent and transparent legislative and institutional framework. This would lower the risk of adverse changes that reduce market confidence and deter investor participation.

In many countries, PPP-specific laws are not strictly required to make PPPs legal, but have nevertheless been introduced to encourage them as a model for delivering public infrastructure. In South Korea, for example, the PPP Act and the Enforcement Decree regulate the procurement of PPP projects, including a 'Basic Plan for PPP' which provides a detailed implementation process and defines the roles of associated parties. In Europe, France and Greece have laws that accelerate the implementation of PPPs. In the developing world, there are PPP facilitation laws in place Angola, Benin, Mauritius, Fiji and Honduras.

Initiatives by the Central Government to Promote PPP and Develop Affordable Housing

The Government has announced a new PPP Policy for affordable housing that allows extending Central assistance of up to INR 2.5 lakh per house to be built by private builders even on private land, besides opening up the immense potential for private investments in affordable housing projects on Government lands in urban areas.⁵⁷

⁵⁶Gujarat-The Growth Engine of India. (2017). www.ibef.org. Retrieved 23 October 2017, from <https://www.ibef.org/download/Gujarat-March-2017.pdf>

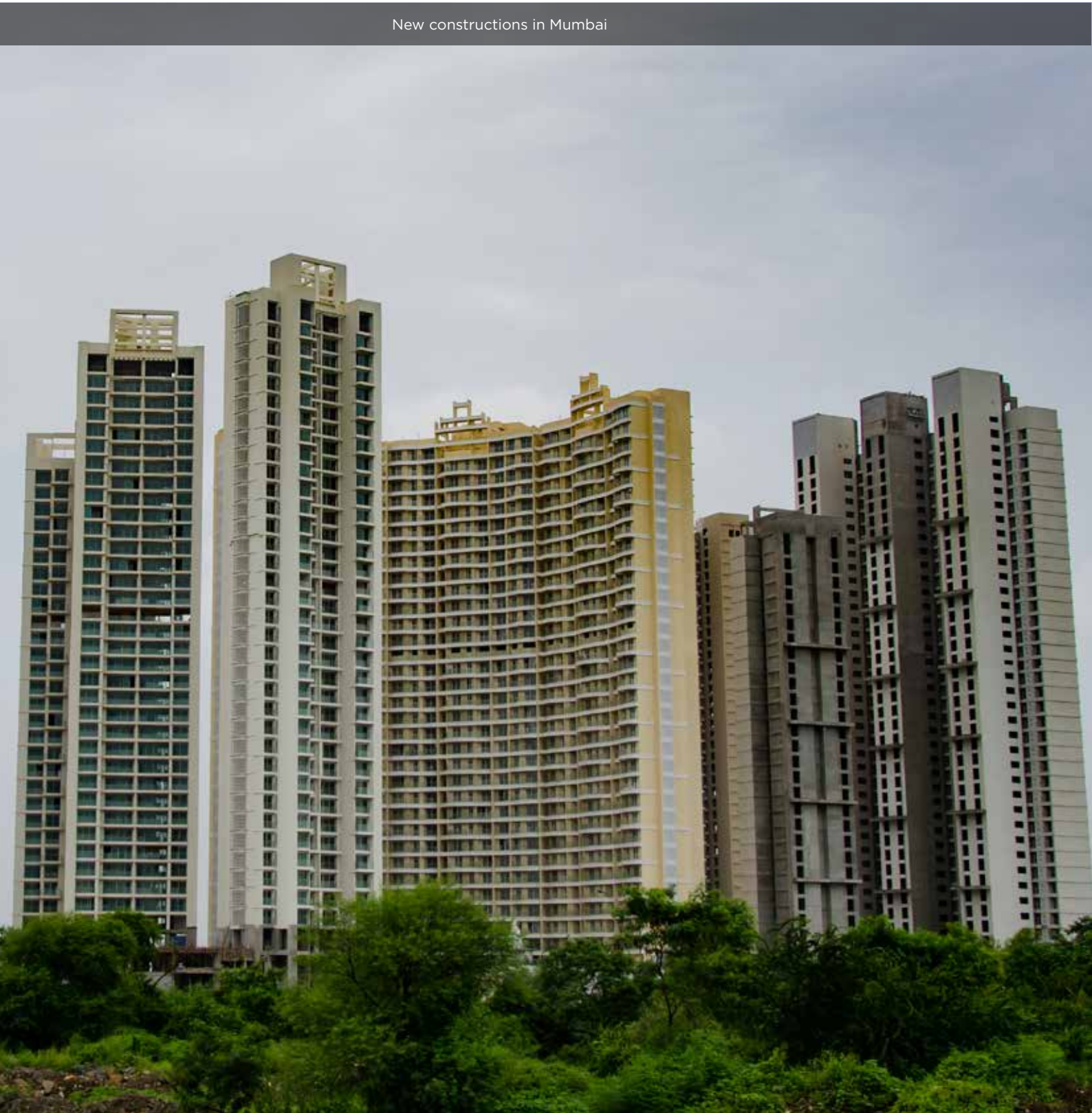
⁵⁷Centre announces new PPP Policy to promote private investments in affordable housing. (2017). [Pib.nic.in](http://pib.nic.in). Retrieved 23 October 2017, from <http://pib.nic.in/newsite/PrintRelease.aspx?relid=170988>

This policy gives 8 options for the private sector to invest in the affordable housing segment. Of these, two options are for private investments for affordable housing on private land:

- Central assistance of about INR 2.50 lakh per house as interest subsidy on bank loans for an upfront payment under the Credit-Linked Subsidy Component (CLSS) component of PMAY (Urban)
- Central assistance of INR 1.50 lakh per house to be built on private lands to be provided in case the beneficiaries do not intend to take bank loans.

The remaining 6 options are for promoting affordable housing with

New constructions in Mumbai



private investments using: Government Lands

1. DBT Model: Under this option, private builders can Design, Build and Transfer houses developed on Government lands to public authorities. Government land is to be allocated based on the lowest cost of construction. Payments to builders will be made by the public authority based on the progress of the project as per agreed-upon milestones, and buyers will pay directly to the Government.

2. Mixed Development Cross-Subsidized Housing: Government land to be allotted based on the number of affordable houses to be built on the plot offered to private builders, cross-subsidizing this segment from revenues from high-end houses or commercial developments.

3. Annuity-based Subsidized Housing: Builders to invest against deferred annuity payments by the Government. Land allocation to builders is based on the unit cost of construction.

4. Annuity-cum-Capital Grant Based Affordable Housing: Besides annuity payments, builders could be paid a share of the project cost as an upfront payment.

5. Direct Relationship Ownership Housing: In contrast to Government-mediated payments to builders and transfer of houses to beneficiaries in the above four models, under this option, promoters will directly deal with buyers and recover costs. Allocation of public land is based on the unit cost of construction.

6. Direct Relationship Rental Housing: Recovery of the costs by builders is through rental incomes from the houses built on Government lands.

As mentioned above, the Government’s focus on revamping Mumbai is tremendous. However, the city is still straddled with outdated operational processes, bureaucratic working styles and lack of conducive market conditions – all to the backdrop of an ever-growing population. Political will and a sharper focus on bridging the infrastructure gap will be key elements in MMR’s journey towards evolving as a City of the Future for its coming generations.

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Abbreviations

AAI	Airports Authority of India
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
APAI	Air Passengers Association of India
BARC	Bhabha Atomic Research Centre
BEST	Brihanmumbai Electricity Supply & Transport
BKC	Bandra-Kurla Complex
BRT	Bus Rapid Transit
BWSL	Bandra-Worli Sea Link
CAGR	Compound Annual Growth Rate
CBD	Central Business District
CIDCO	City and Industrial Development Corporation
CLSS	Credit Linked Subsidy Component
CSIA	Chhatrapati Shivaji International Airport
DBFOT	Design, Build, Finance, Operate and Transfer
DBT	Design, Build, Transfer
DP	Development Plan
E&C	Engineering & Construction
ELU	Existing Land Use
EMU	Electric Multiple Unit
EWS	Economic Weaker Section
FAR	Floor-Area Ratio
FSI	Floor Space Index
GDP	Gross Domestic Product
HDB	Housing and Development Board
ICT	Information and Communication Technology
INR	India Rupee
ISBT	Inter-State Bus Terminal
JICA	Japan International Co-operative Agency
JVLR	Jogeshwari-Vikhroli Link Road
LIG	Low Income Group
MAHSR	Mumbai-Ahmedabad High-Speed Rail
MHA	Mumbai Hydrometric Area
MHADA	Maharashtra Housing and Area Development Authority

MIAL	Mumbai International Airport Limited
MLD	Million Litres Per Day
MMR	Mumbai Metropolitan Region
MMRDA	Mumbai Metropolitan Regional Development Authority
mn	Million
MTHL	Mumbai Trans Harbour Link
MUTP	Mumbai Urban Transport Project
NBCC	National Building Construction Corporation
NH	National Highway
NMMT	Navi Mumbai Municipal Transport
PAP	Project Affected People
PMAY	Pradhan Mantri Awas Yojana
PPP	Public-Private Partnership
PSU	Public-Sector Undertakings
RHS	Rental Housing Scheme
RP	Regional Plan
SBD	Secondary Business Districts
SCLR	Santacruz-Chembur Link Road
Sq. ft.	Square Feet
sq. km.	Square Kilometer
sq.m	Square Meter
SRA	Slum Rehabilitation Authority
TDR	Transfer of Development Rights
TERI	The Energy and Resource Institute
TMT	Thane Municipal Transport
TOKI	Housing Development Administration of Turkey

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