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Harvard University
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A

RESEARCH REPORT

of the Harvard University
Graduate School of Design

ACKNOWLEDGEMENTS

This publication came about when Christopher Lee, a colleague at Harvard, generously approached me with some funding to perform an overview study of Palava City in the contemporary context of Mumbai in India. His faith in the project and support are truly appreciated. More fundamentally still, the Lodha Group, who sponsored this effort and those that will follow, must be thanked for financing our efforts through their gracious gift to the Graduate School of design at Harvard University and for so generously giving us their time and sharing information about Palava City. In particular Abhishek Lodha, Shaishav Dharia and Raunika Malhotra were instrumental in helping and guiding us. Then too a group of public officials under Uma Adusumilli, the Chief of the Planning Division of the Mumbai Metropolitan Regional Planning Authority generously shared their plans with us. In addition, Vidyadhar Pathak and Advait Aundkar offered insightful commentary and field operations. All along the way, Aditya Sawant and Kapil Gupta accompanied us, offering useful opinion and explanation about the machinations of development within Mumbai and its metropolitan region. Finally, little of this would have come to fruition without the presence and work of my friend and colleague Rahul Mehrotra who took valuable time out of his sabbatical leave to make sure that we saw as much as we could and had all the access that we needed. Any misconstruals of circumstances and mistakes are of our own making.

LIST OF FIGURES AND TABLES

1

INTRODUCTION

The following report is an account and brief evaluation of the Lodha Group's Palava City project in the broader context of the Mumbai Metropolitan Region. Presentation proceeds from some background about the region, its scale, earlier and existing plans, administrative boundaries and population dynamics, as well as relative types and densities of development together with geographic conditions. Patterns of road and rail infrastructure are also described, along with plans for subsequent improvements and assessment of relative accessibility within the region. A brief summary of salient issues confronting future planning follows, together with several proposals concerning the location of growth centers, new region-wide facilities and various forms of environmental protection. This discussion is then rounded off with brief comparisons of Mumbai in the context of other urban regions in the world.

Plans for Palava City, which began development as recently as 2009, are then outlined, beginning with its location within the broader Mumbai Metropolitan Region and followed by some details of the proposed three phases of development, of which the first is largely completed. This discussion will also address progress and potential further progress towards goals and metrics for development dealing with population, employment, self-sufficiency and environmental amenity, along with related issues of affordability, governance, social capitalization, typological diversity and environmental suitability. Along the way, recommendations will be made in the spirit of offering useful guidance. In particular other opportunities for

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on-site or nearby job creation will be identified, along with some urban-architectural strategies for more mixed and diversified levels of housing-related development and landscape opportunities. In these last regards, significantly further development is anticipated from design studio exercises within Harvard's Graduate School of Design. Finally, as this report is based on relatively cursory observation and analysis from a field trip and related data gathering, recommendations for further study will be made.

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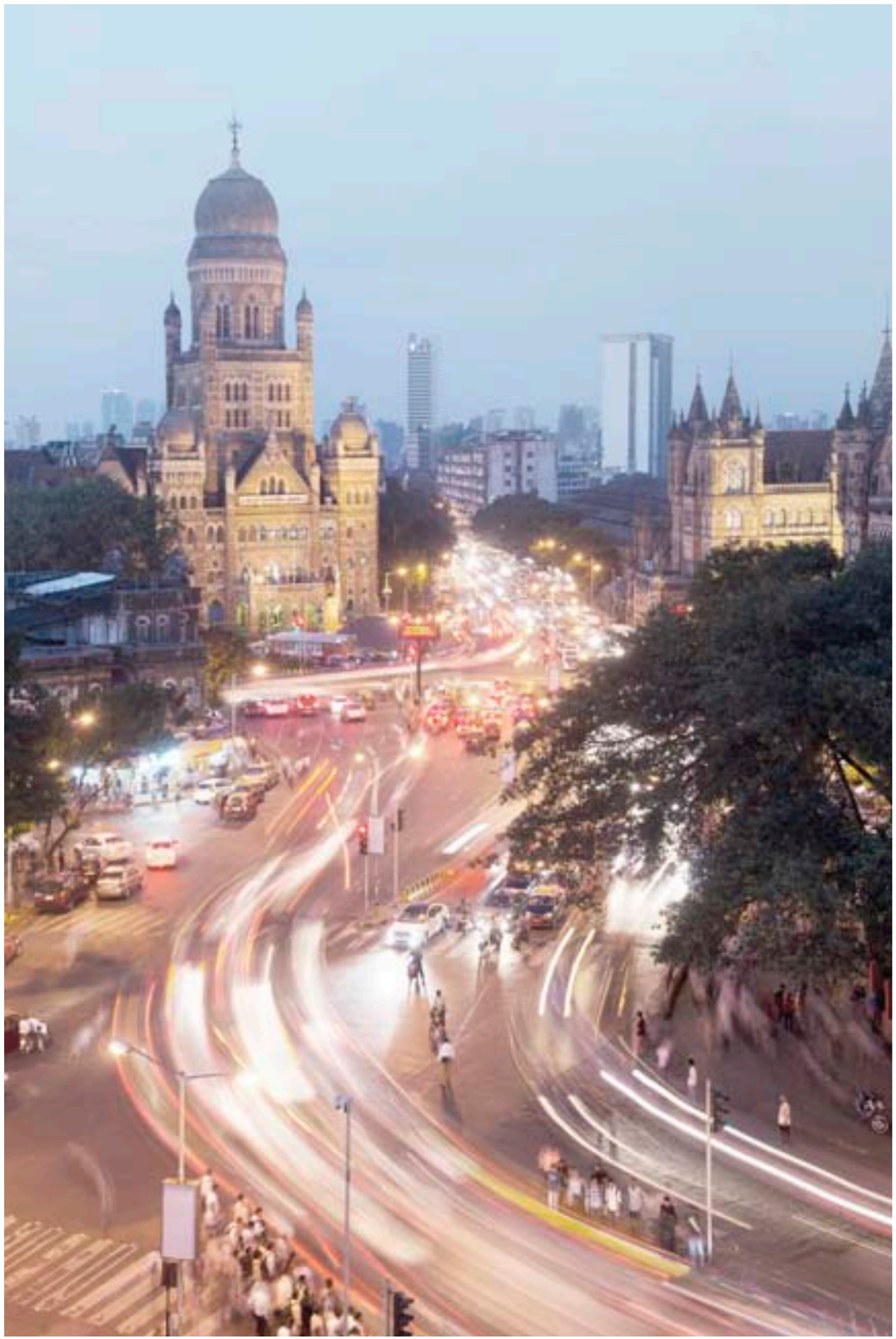

2

A BRIEF BACKGROUND OF THE MUMBAI METROPOLITAN REGION

The Mumbai Metropolitan Region emerged during the 1960s, particularly when the need for a broader perspective became apparent to support more local municipal planning exercises and to extend beyond the limitations of lateral growth of wedge-shaped Mumbai. Delineation of the Region took place in 1967 and essentially covered surrounding areas within daily commuting distance and exhibition of similar urbanizing trends[1]. The first plan followed quickly in 1973, primarily extending its attention to the east in the vicinity of Navi Mumbai and across the water from the wedge-shaped peninsula of the older area of the city and Mumbai Harbor *(figure 1)*. The second plan was promulgated in 1996, extending urbanization in an arc further on the eastern side of the region, as well as generally in a northerly direction *(figure 2)*. Both plans also more or less encapsulated large natural conservation areas, with urbanization driven, as much as anything, along major transportation corridors leading away from the city into the host state of Maharashtra. A third plan is currently under review, scheduled for release in late 2016 or in 2017 (*figure 3*). More pronounced are the industrial areas and further projected urbanization of agricultural lands and village areas.

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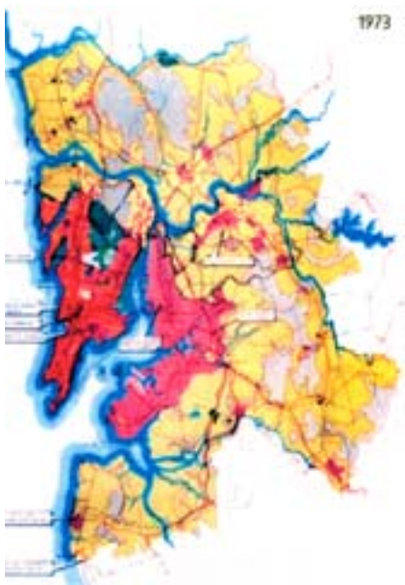

1 / *The 1973 Regional Plan.*

2 / *The 1996 Metropolitan Plan.*

3 / *Proposed Land Use, 2016-2036.*

4 / *Existing Land Use, 2016.*

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Today the Mumbai Metropolitan Region embraces 4,312 square kilometers of area, along with 22.8 million inhabitants as of 2011, 94 percent of which are seen as urban population *(figure 4)*. Some 16 percent of the region is built up and fully 25 percent is under forest designation. Within the region there are 17 municipalities covering 30 percent of the area and containing 90 percent of the population; 35 census towns covering 5 percent of the area and 3 percent of the population; together with 994 villages covering 65 percent of the area and inhabited by 6 percent of the population[2]. As elsewhere in India, the mixture of city, town and villages adds to the complexity and often vagueness of urban definition. When it was finally designated in 1975, after being founded in 1974 through the Mumbai Metropolitan Development Region Authority (MMRDA) Act., it was the third of its kind in India, preceded by Kolkata in 1970 and by Chennai in 1972[3]. From a juridical point of view, the Regional Authority's functions extend to planning, projects, development finance but not control, and co-ordination. Absent also is jurisdiction over health care employment, present for example in Kolkata, and across other sections like housing. By contrast, the MMRDA enjoys considerable authority over transportation.

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3

REGIONAL ADMINISTRATIVE BOUNDARIES AND POPULATION DYNAMICS

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6 / 7 •
A / 7 •

The spatial distribution of administrative boundaries within the metropolitan region takes various forms. The Cities are shown in *figure 5*, while the Cities and Special Planning Areas are depicted in *figure 6*. In both images the prominently shaded areas represent those that are strongly urbanized. More precise boundaries of cities, towns and districts in combination are shown in *figure 6 and 7*. Some 18 areas are demarcated, varying in size from larger ones, like Bhiwandi-Nizampor in the north, to the hill town of Matheran towards the south. Mumbai itself is further divided among Mumbai City, Suburban Mumbai and Navi Mumbai on the east. The ensemble of areas spans some 100 kilometers from north to south and some 70 kilometers from east to west. An abundant presence of water bodies also punctuates the metropolitan spread. The region is also encompassed within 5 districts *(table A and figure 7)*.

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5 / *Administrative Boundaries, Cities.*

6 / *Administrative Boundaries, Cities and Special Planning Area.*

	1991	% Ch	2001	% Ch	2011	District
Alibag	16,289	19.7	19,496	6.4	20,743	Raigad
Amdarnath	--	--	203,804	24.4	253,475	Thane
Bhiwandi-Nizampur	379,070	57.9	598,741	18.5	709,665	Thane
Kalyan-Dombivali	1,014,537	17.6	1,192,883	4.5	1,247,327	Thane
Karjat	--	--	9,891	17.9	11,659	Ahmadnagar
Khopoli	45,039	30.3	58,664	21.3	71,141	Raigad
Kulgaon-Badlapur	--	--	--	--	174,226	Thane
Matheran	4,709	9.2	5,139	-14.5	4,393	Raigad
Mira-Bhayandar	175,605	96.3	520,388	55.5	809,378	Thane
Mumbai City	3,194,889	5.1	3,338,031	-7.6	3,085,411	Mumbai
Mumbai Suburban	6,751,002	28.0	8,640,419	8.3	9,359,962	Mumbai
Navi-Mumbai	304,724	131.3	704,002	59.2	1,120,547	Thane
Panvel	59,986	73.4	104,058	73	180,020	Raigad
Pen	21,588	39.9	30,210	25.3	37,852	Raigad
Thane (City)	803,369	57.2	1,262,551	45.9	1,841,488	Thane
Ulhasnagar	369,077	28.4	473,731	6.8	506,098	Thane
Uran	17,775	30.8	23,251	30.9	30,439	Raigad
Visai-Virar	--	--	--	--	1,222,390	Palghar
--------	--------	--------	--------	--------	--------	
Totals	**13,137,658**	**30.8**	**17,185,879**	**20.4**	**20,686,244**	

A / *Population of Cities, Towns and Districts in the MMR.*

7 / *Administrative Cities, Towns and Districts of MMR.*

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8 / 9 / 10 • 11 / 12 • 12 •

Within this depiction of 18 areas, recent population dynamics are shown via *figures 8, 9, and 10*, with increments between censuses by *figures 11 and 12* [4]. The most significant change between 1991 and 2001 occurred with the construction and development of Navi Mumbai, which grew 131.3 percent from 304,724 to 704,002 inhabitants. It was also one of the strongest growing communities between 2001 and 2011 with a further 59.2 percent increase to 1,190,547 inhabitants *(figure 12)*. Also expanding rapidly between 1991 and 2001 and between 2001 and 2010 was Mira-Bhayandar, to the immediate north of Suburban Mumbai. In addition, Panvel in the south, adjacent to Navi Mumbai and in line with major infrastructure corridors also expanded substantially across the same time periods at 73.4 and 73.0 percent respectively. Outlying areas, like Alibag in the south and on the coast and Matheran in the hills, expanded little. Of note was the decline in the population of Mumbai City between 2001 and 2011, with relatively small gains of 5.1 percent between 1991 and 2001, even though the population was well over 3 million inhabitants across all periods. In addition, Suburban Mumbai, the most populace area, began to slow down from 28.0 percent gains between 1991 and 2001 to 8.3 percent gains between 2001 and 2011, arriving at a massive 9,359,962 inhabitants. Kalyan-Dombivali, another area of significant population at over one million persons,

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also slowed down in growth from 17.6 percent in the first period to 4.5 percent in the second. All told within these areas, the total population expanded from 13,137,658 to 20,686,244 at a brisk expansion rate of 30.8 percent between 1991 and 2001 and 20.4 percent between 2001 and 2011. In other words, it was the outer belt of areas, so to speak, that tended to gain mostly, although Thane, both old and new, also expanded significantly in both periods at 57.2 and 45.9 percent respectively. Moreover, the current map of population densities, especially with the upward thrust in population density among the areas along major corridors leading east such as Kaylan-Dombivali, Uhasnagar, Ambarnath and Badlapur, are a part

13 • of the eastern arc of urbanization mentioned earlier *(figure 13)*.

In addition, population densities also vary from area to area, although they are rather high, by and large, even in some otherwise rural areas at around 5,000 people per square kilometer. This also further illustrates the dilemma of accurately accounting for

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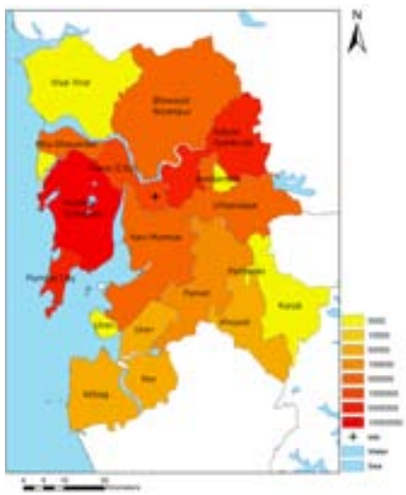
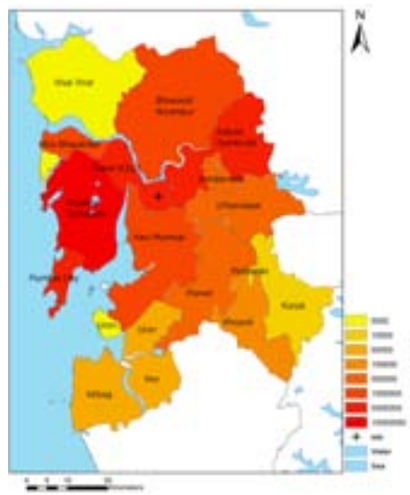
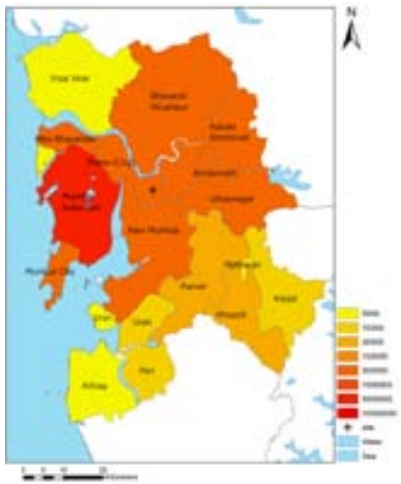


8 / *Population Distribution, 1991. MMR 1991 (unit=population)*



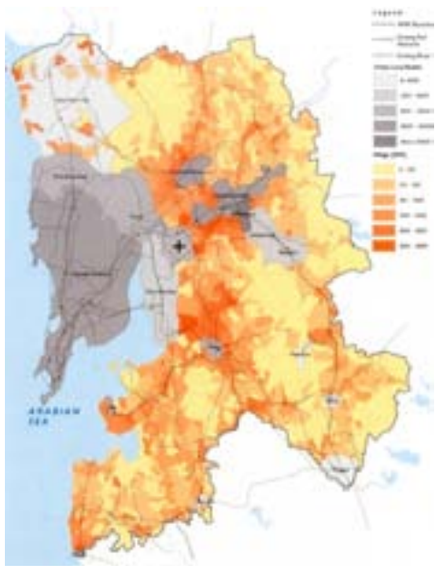
9 / *Population Distribution, 2001.MMR 2001 (unit=population)*

10 / *Population Distribution, 2011.*
MMR 2011 (unit=population)



11 / *Population Change, 1991-2001.*
MMR 1991-2001 (unit= Δ population)

12 / *Population Change, 2001-2011.*
MMR 2001-2011 (unit= Δ population)



13 / *Population Density.*

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'urbanization' in such areas. Current gross densities across the metropolitan region as a whole are from 4,000 to 40,000 persons per square kilometer, with current net densities even higher at from 7,000 to 45,000 persons per square kilometer. Spot densities in places like the City of Mumbai can be significantly higher. On international scales of comparison population density is, in fact, high. Most Chinese cities, for instance, have overall densities of 10,000 to 12,000 people per square kilometer, and Tokyo, for instance, is much less at around 6,000 to 7,000 persons per square kilometer overall. Given a projected population in the metropolitan region of around 30.4 million inhabitants by 2034, densities in places like Suburban Mumbai and the City of Mumbai my not rise further, but those in other areas seem likely to do so. Indeed, some reports predict a density of all cities in the region to be around 40,000 persons per square kilometer by 2034 [5].

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REGIONAL GEOGRAPHIC CONDITIONS

Apart from the coastal area and the land filling between the seven islands that originally comprised Mumbai, the other major geographic feature is the Western Ghats and the manner in which the north-south directionality of these mountain ranges striate the riverine landscape of the region in an east-west direction. In a number of instances these thickly vegetated areas and forested outcrops also form substantial natural conservation areas within the metropolitan landscape. They also lend relatively consistent form to smaller tributaries that flow down from them into adjacent coastal areas. This is particularly so in Suburban and Navi Mumbai *(figure 14)*, Further eastward the larger river system of the Ulhas, moving through Kaylan-Dombivali, for instance, tends to dominate the landscape, hosting significant agricultural production and numerous village settlements. There the relatively flat topography also encourages agricultural production. Indeed, the so-called '27 Villages' in proximity of Kaylan appear to be holding out from becoming designated towns at least partially because of the prosperity to be derived from these conditions. More generally, the Ulhas River drains a vast area of 4,637 square kilometers flowing westward through Maharashtra and the Thane, Raigad and Pune Districts within the Mumbai Metropolitan region. At the nexus of Thane Creek and Vasai Creek it also flows either due west or to the south depending on tidal influences. Geologically, much of the substrate in the region is rocky, another aspect of the Western Ghats migrating north, as it were. In Mumbai itself this is very evident in the famous tanks, such as the Banganga Tank, located next to Malabar Hill and the Arabian Gulf.

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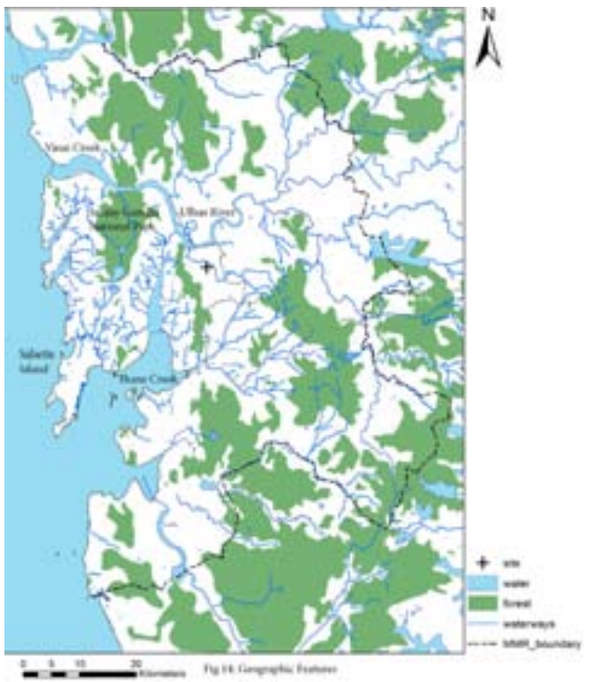

14 / *Geographic Features.*

Seasonally, the Mumbai Metropolitan Region experiences four relatively distinct seasons. They are the summer season from March to May, the monsoon season from June to September, the post-monsoon season from October to November, and the winter season from December to February. Rainfall during the monsoon season is substantially higher than at other times of the year, averaging from 312 to 800 mm in rainfall. In effect, some 2,248 mm of rainfall out of a yearly total of 2,258 mm on average, or 96 percent, occurs across a brief four-month period. This has several immediate impacts. First, potential flooding is a hazard during those periods. Second, the water quality of streams and rivers during less rainy periods is apt to be poorer due at least in part to diminished flushing. Third, without significant rainfall detention, Mumbai is often bereft of available water supply and, ironically, prone to be drought stricken. Based on available water quality monitoring, during much of the year quality is medium to good, if not excellent at times[6]. However, during the period roughly from 2011 to 2015 water quality where monitoring stations are located, including Thane Creek, has been low at various intervals *(figure 15 and 16)*. This is probably due to increased urban uses. Likewise air quality, based again on official monitoring station data, indicates deterioration around industrial development in Navi Mumbai and towards Panvel, for example, and generally below standard across much of the region[7]. More specifically this is based on average value data, again recently, from 2015 to 2016 *(figure 17)*.

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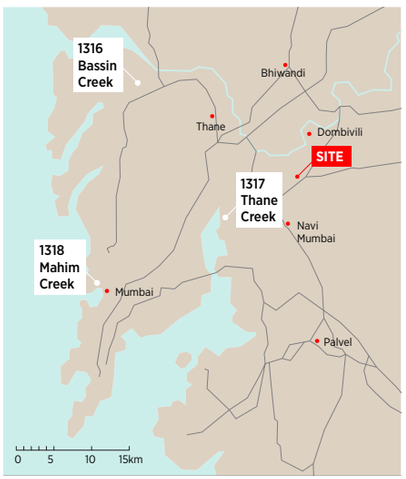
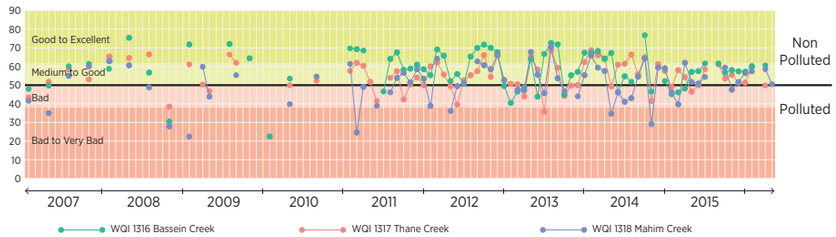


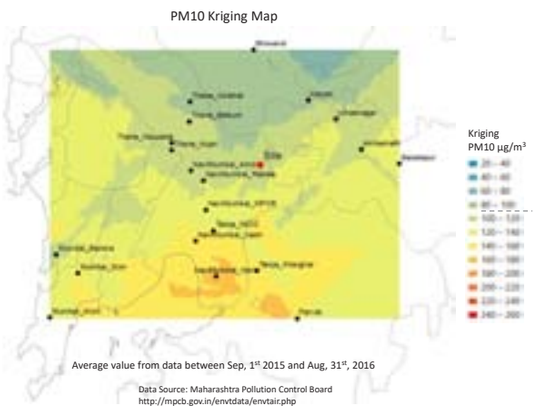
15 / *Location of Water Quality Monitoring Stations.*



Climate Data for Mumbai (Chhatrapati Shivaji International Airport)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average Rainfall (mm)	0.6	1.3	0.2	0.7	12.5	523.1	799.7	529.7	312.3	55.8	16.8	5.3	2.258
Average Rainy Days	0.1	0.1	0.0	0.1	0.7	14.5	23.3	21.4	14.4	3.0	1.0	0.4	78.9

16 / *Water Quality Trends.*
Water Quality Index 2007-2016 from Bassein, Thane and Mahim Creek.



17 / *Air Quality Kriging Distribution.*

5

REGIONAL INFRASTRUCTURE

18 • The main rail and road infrastructure is illustrated in *figure 18*, including the planned Multi-Modal Corridor (MMC)stretching from Visai-Vivar in the north to Alibag in the south. The basic configuration of the overall network is radial, moving out from the center of Mumbai, with the exception of the MMC which proposes to form links some 20 to 25 kilometers from the center as a circumferential system of movement. To date it has undergone some planning but no construction. Generally the road network is relatively sparse for a metropolitan region of Mumbai's size and population. Traffic congestion, especially during peak hours, is the rule rather than the exception. Within the more central areas, such as the City of Mumbai and Suburban Mumbai, the network is also relatively coarse grained, with extensive megaplots of development, often constructed on old textile mill sites. The entire eastern seaboard side is dedicated to the dwindling port functions and remains underused and relatively remote while being controlled by authorities well above those of the regional municipalities. A useful illustration of the poor roadway access is the time-cost associated with movement from the Palava City site in Thane on the eastern side of the region to other areas. For instance, the time-cost to Mumbai City is on the order of 105 minutes or more in peak times and

19 • around 45 minutes, or so, from Suburban Mumbai *(figure 19)*. The primary impact on this scheme of accessibility of the MMC will be to generally reduce time-costs on the eastern side of the region, although without appreciable reduction of time-costs to the City of Mumbai

20 • *(figure 20)*. This, however, makes a certain sense, given the population and urbanization dynamics discussed earlier, which are strongly oriented towards expected growth on the eastern side of the region.

Commuter rail service also extends well out into the metropolitan region, with station stops at reasonably regular intervals. Although the carrying capacity of this service is comparatively high, it also suffers from severe overcrowding, again particularly during peak

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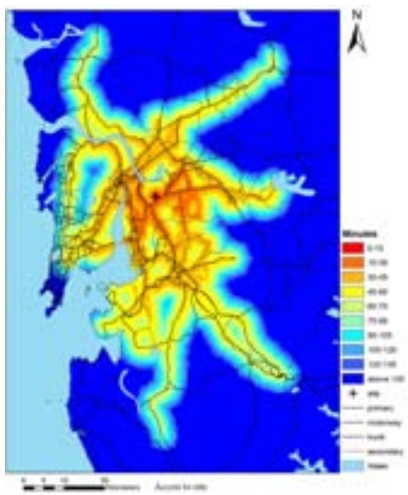
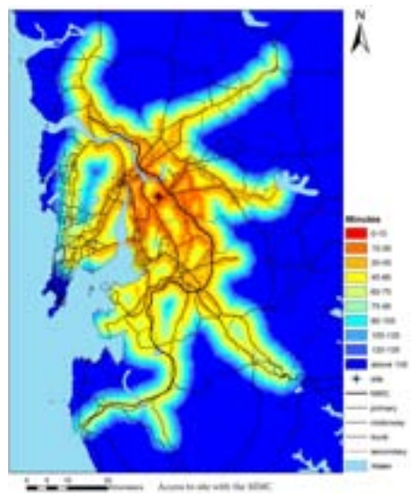
18 / *Main Rail Road, and MMC Infrastructure.*



19 / *Accessibility to the Palava City site.*



20 / *Accessibility to the Palava City cite with the MMC.*

hours of operation. This also underlines the need for more service. In addition, under India's Eleventh Five-year Plan (2007-2012) the Ministry of Railways began constructing its Dedicated Freight Corridor (DFC), the western portion of which will travel from Dadir in Uttar Pradesh in northern India to the Jawaharial Nehru
21 • Port Terminal(JNPT) located south of Navi Mumbai *(figure 21)*. At present this is the largest Indian port facility by some margin and a main port of entry and egress into the country as a whole, supplanting the moribund facilities on the eastern side of City and Suburban Mumbai noted earlier. Further road access across the sea inlet between Mumbai City and Navi Mumbai is proposed and will
22 • also improve general access to the JNPT *(figure 22)*. Indeed, as a part of the 2016 master plan some 10 growth centers have been proposed, principally along the MMC and DFC, sweeping in a broad arc from Visai-Virai on the coast in the north, out through the eastern side of the region and then around towards Alibag again on the coast in
22 • the south *(figure 22)*. Those in the southern reaches of the region are also designated for industrial expansions, a topic to be taken up later with regard to employment opportunities. The net effects of
23 • the growth centers, plus the MMC are illustrated in *figure 23*, where four are proposed urban growth centers and the fifth is the City of Mumbai itself. As shown, time-cost access is substantially evened out, although remaining relatively long from one center to other parts of the metropolitan region.

In addition, a new airport has been proposed (NAINA-New Airport Influenced Notified Zone) in the area of Panvel in the south-eastern
18 • portion of the region *(figure 18)*. It has been very slow to come to fruition and appears to be primarily in the service of freight and commercial movement into nearby heavily industrialized areas and the new industrial growth centers. The existing airport is located in the middle part of Suburban Mumbai and will remain as it is
17 • *(figure 17)*. In fact, it was recently expanded and modernized. At this juncture it is fair to say that India and the Mumbai Metropolitan Region is 'infrastructure following', rather than 'infrastructure led' as in China, the other emergent Asian economic power. Moreover, under present conditions and regimes of land tenure and control the difficulty of introducing new infrastructure improvements and transportation corridors into the broader scheme of things is high and costly. It also appears to be a distinct impediment to rapid economic expansion.

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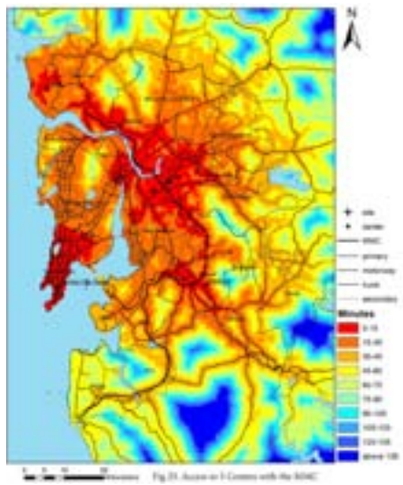
21 / *The DFC Rail Corridor.*

22 / *The MMC and Growth Centers.*



23 / *Access to 5 Centers with the MMC.*

6

REGIONAL DEVELOPMENT ISSUES AND PROPOSALS

As with most if not all metropolitan regions, Mumbai faces a range of developmental issues, along with some proposals for relief, especially under the 2016 master plan. Basically, the range of issues is comprised of uncertain economic development moving forward, property development over-speculation and loss of affordability, uneven and a lack of local governance, difficulty in making necessary infrastructural improvements, and rising challenges to environmental sustainability. Proposals for relief range from spatial planning exercises, like the growth centers mentioned earlier, to more layered and complex forms of implementation involving different levels of government and private sector actors.

The economy of Mumbai in general was in decline from around 1970 into the 1990s due to limited effectiveness of the larger elements of the manufacturing sector and the lack of a strong presence in the tertiary or service sector[8]. After national and state government stimuli to the service sector (FIRE) from 1991 onwards, economic circumstances began to improve. Today the service sector accounts for some 60 percent of the Gross Domestic Product (GDP) with retail trade accounting for another 10 percent and manufacturing making up the remainder. Indeed, the reduction of secondary sector industrial contributions to GDP, coupled with most of this being supplied through the informal sector, presents a worsening employment perspective. In fact, there continues to be very slow growth in employment and increasing informalization of what remains. While vital, the 'ancillaries' aspect of the informal sector, often building up to combinations of various kinds of piecework and on into more fully-fledged industrial components, has been under threat from elsewhere.

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In addition, information technology based work (IT) though present in the region, has not competed well with Bangalore or Hyderabad in other parts of India, with losses in market share. Also, call centers are losing out as well to the Philippines outside of India. Consequently the economic future of the Mumbai Metropolitan Region is uncertain at best. Certainly the emphasis on trade-related industrial processing around the JNPT and DFC nodal developments seems to be promising as it draws on a clear comparative advantage of the region. More focused IT development might also fair better when paired with other knowledge-based institutions and enterprises.

One recent major economic engine of economic development has been property development. The real estate industry has boomed on the promissory of continued regional growth and speculative profit. Job creation in real estate has also followed suit. One problematic aspect of this trend, though, has been the cap on allowable FAR at around 1.33 to 1.00, effectively creating scarcities which the private sector is looked to by the government to solve. The market is also hampered by the need to provide units for displaced households – not necessarily an unreasonable demand – alongside of high borrowing costs and high transition costs. Consequently, property development often proceeds to the maximum allowable circumstances and profit as protection against marginal risks[9]. One outcome is relative abundance of luxury housing, typically sold off as a speculative asset, and disincentives for development of lower middle-income housing. Large plots of redeveloped property invariably consist of three parts: a high-rise project, meager accommodations for displaced households, and squatter settlements (*figure 24*). In addition, under much the same

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24 / *Three-Part Division of Property.*

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logic, housing ownership is much preferred, limiting the availability of rental units and also entry into the formal housing sector. Some estimates of the cost of housing in central Mumbai are around 0.7 lakh rupees per square meter, which, on an average technician and managerial salary of 7 to 12 lakh per year is equivalent to an exorbitant rate of some 50 to 100 salaries[10]. Economic circumstances elsewhere in the region are certainly better, probably on the order of

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15 or so salaries, but still very high by many international standards. Even in China, with its purported overly inflated housing market, the average is around 7 to 8 salaries and approaches 15 salaries and above only in very large cities like Beijing and Shanghai. In the United States on average the rate is 3 to 5 salaries. One other obvious shortcoming is the need for simply more affordable housing. The 2016 master plan calls for some 2,280,000 units to be provided per year against a projected housing need in 2034 of 46 lakh or 4,600,000 units – a very big ask indeed! This is seen to be provided via: easing in the renting of apartments, vacant tenant taxing, creation of apartments, public-private partnership provided housing, and redevelopment of slums, alongside of promotion of 'work-live' inhabitation in the proscribed growth centers in the region[11].

Regional governance in India and Mumbai continues to be problematic. Constituencies are still highly centralized. Within the current Mumbai Metropolitan Region there are 9 municipal corporations and 8 municipal governments, alongside of numerous villages. Among the corporations and municipalities there are little to no legislative powers. Villages, however, are agricultural with strong central government support and municipal services provided for by elected officials and semi-autonomous taxing schemes. They often resort to municipal mergers because of the lack of authority, power and higher tax rates, without any real improvement in service. Hence there is the case of the '27 Villages', mentioned earlier, and in close proximity to Palava City, now leaving municipal authority and going it alone. In addition, the MMRDA itself lacks formal powers, also as noted earlier. It cannot review local plans, for instance, and has access to a paucity of funds or revenue streams. The state, Maharashtra in this case, controls land and building as well as, therefore, urban policies. Within this climate, inimical to subsidiarity, local settlements either make their own way without much support in order to accomplish their objectives, or effectuate collaborative schemes among the overlapping agencies and controls.

As mentioned the relative density of infrastructure network serving the Mumbai Metropolitan Region is sparse. Furthermore, the use of eminent domain powers is very limited and difficult, often impeding improvements that might otherwise be envisaged. Forward planning within the region appears to be concentrated on improvements to the

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suburban rail system with some extension. Another key component is simply improvement and making more east-west road and rail connections, as well as those in the north-south direction. In other words, thickening, so to speak, the scope of the present system. If and when these connections materialize the probable effect will be to distribute transportation accessibility more evenly, particularly on the developing eastern side of the region. Other major road and rail improvements have already been discussed. The Multi-modal Corridor (MMC), as its name suggests, will be comprised of an expressway style of roadway in both directions, flanking a rail corridor with stations along the way. The DFC or freight rail facility uses existing rights-of-way, but with better rail bed and other improvements.

Environmental proposals include articulation of a 'blue-green' network through the metropolitan region, drawing on greenways alongside the MMC and other roadway alignments. Reforestation of certain areas will also be undertaken, alongside of the restoration of quarry sites. Attention will be paid to villages in efforts to boost tourism, together with extension of environmental conservation[12]. Nevertheless, as indicated by a comparison of the existing land-use plan and that proposed in the new master plan, large areas of agricultural land in the eastern side of the region are to be urbanized. This may also have the effect of placing parts of this new urbanization within a proverbial archipelago of villages, a somewhat awkward arrangement. Development controls are also envisaged to protect slopes of the hilly ranges and other topographic features. Also, development alongside rivers and beside heritage sites will be regulated and controlled through use of buffer zones. Pressing problems with round-the-year water supply will also need to be addressed through protection and regulation of aquifers, as well as providing large-scale and distributed water storage and reservoir facilities. Stricter and more efficient forms of water harvesting and

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recycling also seem to be required in order for water self-sufficiency to be reached, in addition to improvements in water quality.

One model worth mentioning in these regards is the Singapore experience with its blue-green planning. Very early on in the formation of the Republic in 1965, high priority was placed on environmental quality[13]. Water sustainability as one component was of strategic importance in order to wean the city-state away from dependence on neighboring Malaysia. In addition, achieving and maintaining a clean and green environment through pristine public spaces together with constant innovative and practical approaches, was viewed as necessary for Singapore to be attractive for improved financial investment and economic development. Indeed, from the days of night soil buckets, polluted rivers, water rationing, unhygienic street hawking and smoke emitting and effluent discharging industry in the 1960s and 70s, Singapore mounted concerted campaigns to become a green city of tropical excellence. Between 1970 and 2005, something on the order of S$8.8 billion was spent on water conservation, sewage treatment, river cleanup, reverse osmosis with the Marina Bay barrage, incinerator plants, and so on. Particularly during the early days this high investment was also made against competing claims for other needed investments, underling the priority given to environmental cleanup and maintenance. Broad citizen engagement was also sought through such events as: the Keep Singapore Clean Campaign of 1968, Tree Planting Day inaugurated in 1971, Clean and Green Week in 1990, and Clean and Green Singapore in 2007. Other government-sponsored efforts, such as the ABC Water Plan (Active Beautiful and Clean Plan) was enacted in 2007, alongside of competitions to become the island's cleanest residential estate during the same year. Most profoundly throughout, though, was public equating of 'green and blue' with 'clean' and 'self-sustenance' as foundation qualities of a progressive society.

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7

THE MUMBAI REGION IN THE WORLD

Nowadays one fashionable way of rating the quality of cities and metropolitan regions is by way of so-called 'benchmarking indices'. Typically, they rank order cities based upon comparisons across various indicators of quality incorporating measures of social, environmental, economic and cultural performance. Depending upon the purpose behind the particular index, factors vary, as does the efficacy of their measurement. One such index is Arcadis, produced by the Design and Consultancy of Natural and Built Assets. This Index covers 100 cities worldwide and is comprised of 3 pillars or dimensions They are: 'people', 'planet' and 'profit', standing essentially for social, environmental, and economic sustainability. Overall, Singapore ranked number one with a 74.1 percent score, whereas Mumbai was ranked number 91 with a 39.9 percent score. Under 'profit' Singapore was also ranked first with a 87.9 percent score whereas Mumbai was even further behind with a 18.1 percent score at number 93. Under 'environment' Mumbai faired better with a 50.0 percent score at number 75 with Singapore doing less well at number 12 and a 75.8 percent score. A second index, the Mercer Quality of Living Survey, ranks 221 cities across 39 factors and places them on a base where New York is 100. Topped by Vienna at 106, among Asian cities Singapore again comes in best at number 26 with 103.5, whereas Mumbai is ranked at number 152 at 56.0 (*figure 25*). In a third ranking, the Siemens Green City Index, researched and formatted by the Economist Intelligence Unit, qualitative judgments are rendered by region. Singapore is ranked as 'well above average' whereas Mumbai is 'below average'. Essentially, eight key dimensions go into this index. They are: environmental governance, carbon emissions, energy, buildings, transport, waste and land use, water and air quality. Clearly across these three benchmarks Mumbai performs poorly, although also indicating the need for further development, a stronger economy, more infrastructure and better governance. These are also factors that emerged strongly in the foregoing narrative and brief analysis of the region.

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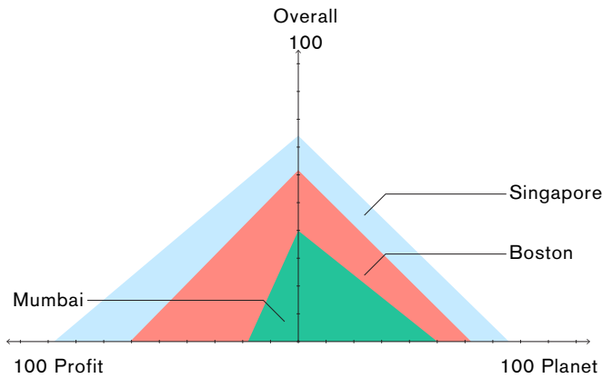
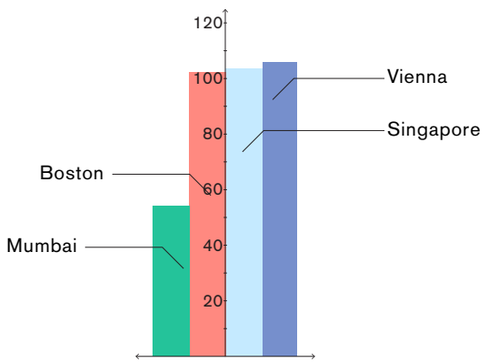


Arcadis Sustainable Cities Index



Mercer Quality of Life Survey

25 / *Relative City Benchmarks Regarding Quality.*

8

PALAVA CITY WITHIN THE METROPOLITAN REGION

Looking now at Palava City in the geographic context of the Mumbai Metropolitan Region and in the light of earlier discussion, it appears to be well placed. In fact, it could well be regarded as one of the 'growth poles' imagined and proposed by the MMRDA and as a 'city' or new town within the broader region. As indicated in figures 19 and 20 the site enjoys good transportation access to the eastern side and, indeed, the bulk of the metropolitan region. Prolonged trips, in excess of commuting times of 45 minutes to 1 hour are experienced, however, to Mumbai City and parts of the densely populated Suburban Mumbai. Positioning Palava City as a 'work-live' environment will help this commuting situation provided that adequate levels of employment can be provided on site or nearby. The presence of something of an IT corridor in Thane as one approaches along Kalyan Road from the west, appears to be a reasonably close work destination, as will be other anticipated development in the Eastern Suburbs. More strategically, the MMC's proposed alignment goes through phase 2 and phase 3 of Palava City, also with designated station stops for the rail component at Shirdhon and Usatane in phase 3 (*figure 26*). In addition, the DFC rail freight corridor will utilize the right-of-way of the existing rail line beside phase 1 and next to phase 3 on its way south to the terminals at YNPT.

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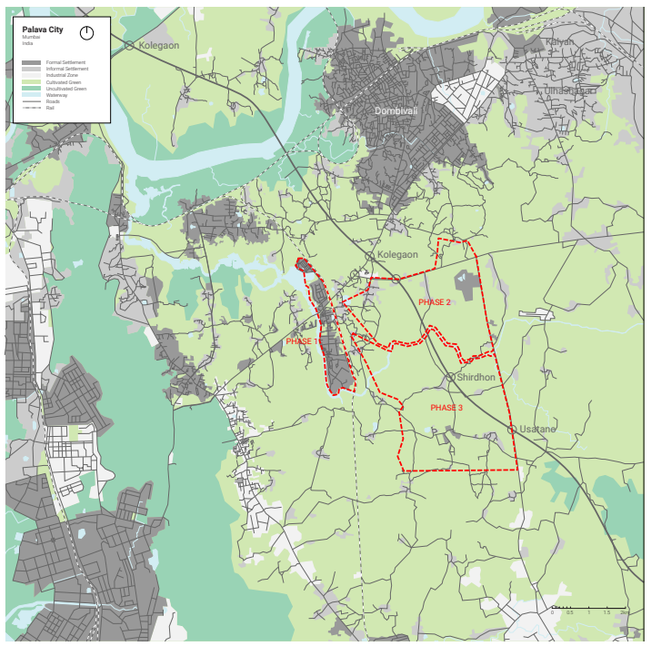

26 / *Palava City in its Immediate Context.*

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26 • The geography of the three phases of Palava City is presently largely agricultural. In fact, as shown in *figure 26*, there are numerous villages dotting the landscape nearby. Dombivali is the largest urban center, which combined with Kalyan, forms a broad urban and industrial swath to the north of the Palava City site. The agricultural land is relatively low lying and water prone. There is also a tributary of the large Ulhas River forming the western boundary of phase 1 of the development. Views to the west are framed and terminated by the hilly outcrops of the Western Ghats as they move northward, offering a prominent forested skyline. Although scheduled in the metropolitan plan for further urbanization and industrialization, the open agricultural areas and background hills adjacent to Palava City

27 • form an attractive landscape (*figure 27*). Phase 1 comprised of Casa Bella on the far north and Casa Rio and Casa Rio Gold on the south

28 • is not contiguous (*figure 28*). Unfortunately, the area in between has been developed to a lesser quality by the local municipality, although it does offer some community services.

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27 / *The Western Skyline from the Palava City.*

28 / *Residential Development in Phase 1.*

9

PALAVA CITY MASTER PLANS AND PHASES

Located about 40 kilometers north of central Mumbai on the road out to Dombivali and Kalyan, Palava City has a site area of around 18.21 square kilometers, 1,821 hectares or 4,500 acres[14]. It is to be developed in three relatively discrete phases, of which phase1 is largely complete as mentioned earlier. The entire development will house on the order of 1 million inhabitants when completed in around 250,000 to 300,000 dwelling units. The ambition is for it to become something of a 'City within a City', incorporating high degrees of self-sufficiency, balanced development between dwellings and workplaces, as well as superior community facilities and life-style amenities. At build out some 300,000 jobs are to be provided in business and commerce, at a high rate of 1.0 to 1.4 jobs per family. Effectively, this would position Palava City as a major hub of tertiary sector employment and, as noted earlier, the equivalent of one of the growth centers envisaged by the MMRDA and others on the eastern side of the region. Also as noted, the geographic location of Palava City lends itself to this kind of outcome. Dwelling density is also projected to be high, at about 55,000 people per square kilometer and in excess of central Mumbai. The planned compact nature of development also reflects a desire for 'work-live' circumstances for many, within walking distance of origins and destinations. Started in 2009, with phase 1 essentially completed by 2015, the eventual build out is scheduled to occur in about 25 years, ending around 2035. Proposed non-residential facilities and amenities range across a broad spectrum including commercial and retail activities, malls and markets, performing arts venues, schools, a university campus, a hospital and several clinics, alongside of numerous sports arenas catering to cricket, tennis, golf and football, among other pursuits. Throughout, Palava City is to be equipped with a 'smart city' infrastructure providing access to services and providing opportunities for citizen participation, together with surveillance and security.

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As mentioned, phase 1 of the project is comprised of three relatively distinct parcels of development covering an area around 10.28 hectares or 1.28 square kilometers (*figure 29*). First came Casa Bella in the north, followed by Casa Gold further south and then both Casa Rio and Casa Rio Gold still further south and contiguous with an adjacent municipal project of mixed though lower quality. The number of apartments in phase 1 is 18,733 in the form of high-rise towers, predominantly, and villas located along river front perimeters. The total population is expected to be on the order of 75,000 inhabitants[15]. To date the number of apartments that have been handed over accounts for 67 percent of the total, with 37 percent being occupied, although with more to come at the break in school terms. This disparity of owned versus occupied units is indicative to some extent of the speculative aspect of real-estate investment in Mumbai, noted earlier, although less so towards the region's perimeter, including Palava City. Unit prices vary, but at around 45 to 65 lakh per unit in middle ranges they are within the scope of technical personnel and managerial staff in the IT

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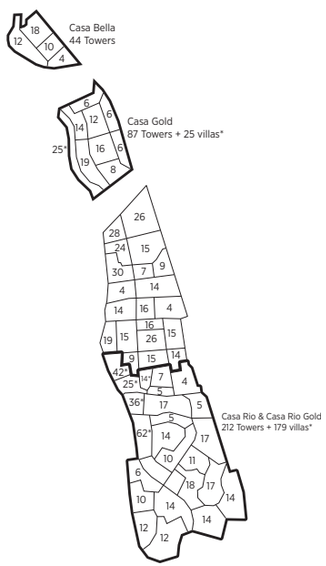

29 / *Numbers of Residential Buildings in Phase 1.*

industry, at about 5 to 6 salaries, and expensive though to entirely unaffordable for those of more average income, at around 11 to 12 salaries. Principally, accommodation is in the form of 1,2,3 and 4 BHK apartment types, ranging in area from 58.5 square meters all the way up to 211.5 square meter villas (*figures 28 and 29*). Needless to say, perhaps, the smaller units are among those most sought after and occupied[16]. Broadly the site amenity of phase 1 is high and from a critical perspective improvements have been made in the quality of development from the early Casa Bella stage up to and through the later Casa Rio and Casa Rio Gold stages. Dwelling heights have diminished along with overall densities, landscape elements and community facilities are of a higher standard, and walking distances are mild and more inviting. The more varied unit orientations in the latter stages of phase 1 also relieve some of the monotony of earlier stages to the north. Basically, the aspirational notion often ascribed to higher-rise dwelling in Mumbai may certainly be in play even on the regional outskirts. However, with the greater scope for higher site amenity and service it probably becomes asymptotic at around 12 to 15 stories (*figure 30*).

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Phase 2 of Palava City is under construction, with sector 3 partially completed (*figure 31*). This sector is planned straightforwardly with a central north-south aligned main road traveling the length of the phase 2 site and lined along much of the length through sector 3 by retail commercial activities and other non-residential uses. Rectangular courtyards with 20 plus story high-rise housing along their perimeters comprise the residential developments. Following from the earlier observation about building height, these towers are probably too tall and tend to overshadow the otherwise reasonably spacious courts containing recreational and community facilities. The eastern perimeter of Phase 2 is lined by Taloja Road, running in a north-south direction. Sectors 1 and 2 adjacent to Ambernath Badlapur Road running in an east-west direction, have been set aside for commercial development. The remaining 7 sectors, to date, are earmarked for residential and some mixed-use development with the exception of sector 10 across on the eastern side of Taloja Road, which has been set aside to accommodate people displaced during the development. As mentioned earlier in the regional metropolitan discussion, this is a common practice in Mumbai aimed at avoiding undue dislocation and displacement of populations from gentrification (*figure 24*). A centrally landscaped portion of phase 2 has been set aside for recreation facilities and for the proposed university campus. Adjacent to this is the proposed site for performing arts venues, including potentially an opera house by Renzo Piano, serving as a regional venue at some time in the future.

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30 / *Views of Phase 1.*

31 / *Sectors of Development in Phase 2.*

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Taken together, phases 1 and 2 of the proposed Palava City development cover some 4.5 square kilometers or 455 hectares. They accommodate 73,908 apartments of various sizes, comprising 5,912,640 square meters of housing, or thereabouts. The expected total population is on the order of 295,000 persons, with non-residential facilities comprising an additional 1,371,523 square meters (*table B*). In particular, these facilities will include a 150-bed multi-specialty hospital plus several clinics, and a 20,000-student university campus with around 1,200 faculty members. To date the type or name of the university is unknown, although it will likely emphasize information technology and related disciplines. The schools, including the World School already operating, are to be of an international quality, as are the sports facilities. At present the ratio of residential to non-residential development is about 80 to 20 percent. This is certainly in line with the present real-estate market favoring residential construction, although probably lopsided in relation to eventual balanced development of in situ employment in relationship to dwelling. As shown in table B an estimate of total employment in phases 1 and 2 is around 70,000 jobs, far short of the eventual 300,000 jobs aspired to in the overall conception of Palava City. Phase 3 is under compilation and will extend further south along Taloja Road (*figure 26*). It will also be larger in area and offer further scope for job creation. As noted earlier, the MMC, for instance, is planned to pass through this part of the overall site development, with at least two station stops. Furthermore, phase 3 is also proximal to the DFC alignment for heavy freight running south towards the JNPT facilities.

B

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	Facility Area (m^2)	Potential Employment (jobs)
Commercial	980,159	30,000
Retail Mall	76,477	1,550 - 2,550
Market	8,103	250
Incubator Hub	15,000	1,000
Performing Arts	41,944	500
Hospital + Clinics	21,905	1,335 - 1,500
Schools (2)	67,528	650 - 1,000
University Campus	123,600	7,000 - 10,000
Sports Facilities	varied	1,000
Public Utilities	36,807	200
	--------	--------
	1,371,523	**63,485 - 68,000**

Sources: Lohda Group, Palava: 'City of Opportunity' (various); Retail 30-70 sqm/empl; Commercial 15-20 sqm/empl; Restaurant, etc 30 sqm/empl; Hospitals 9 empl/bed; other 50-100 sqm/empl.

B / *Phase 1 and 2 Non-Residential Facilities and Estimated Employment*

10

ISSUES CONFRONTING DEVELOPMENT OF PALAVA CITY

As with many developments of the scale and ambition of Palava City, there are a number of issues that will require further consideration. At this juncture at least five broad areas stand out. They are: continued housing affordability, job creation, building type diversity, governance and 'smart city' applications, and environmental suitability and landscape opportunities. Also at this juncture, Palava City seems likely to mark a high standard for satellite city or growth center development within the Mumbai Metropolitan Region, but with aspects warranting improvement under broader international comparisons. As noted earlier, the region as a whole or Mumbai as a city does not fair well in this regard at the moment. At least one knowledgeable observer described it as a place "where a high price purchases a relatively low standard of living", or words to that effect[17].

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a. Housing Affordability

As discussed, new formal housing in Mumbai has become expensive. Within the Palava City development as it now stands, sales have been brisk, even if occupancy has lagged, indicating that dwelling units have been desirable and affordable. Advertised rates of appreciation no doubt contribute to this desirability[18]. Delving deeper though, continued affordability seems likely to require some effort and consideration, particularly in relationship to average and typical salaries. Forbes, for example, placed the average salary in 2014 at 3.54 lakh rupees per year for Mumbai. Payscale, another source, placed medium hourly wage-earning employees at 2.5 lakh per year, rising to 7 to 10 lakh per year for people in managerial and technical

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lines of work. India Commercial, yet another source, placed middle-class employees at 15 lakh per year and higher. Yahoo Overseas cited similar ranges. Rounding up from average to a higher side, salaries in the range from 3.54 to 7.0 or 12.0 and above would seem to comprise an appropriate market. On the supply or price side, comparables on the eastern side of the region ranged from some in Dombivali for as low as 39 lakh for 60 or so square meter units up to around 63 lakh for 100 square meter units. Elsewhere, prices started at 42.5 lakh up to 66 lakh. Central Mumbai prices seem to run on the order of 0.7 to 0.9 lakh per square meter, as noted earlier, or the equivalent of 70 to 90 lakh for a 100 square meter unit. Certainly much higher-priced units were and are on sale. However, for this exercise ranges from 39 lakh through, say, 55, 63 and 70 and on up to 90 lakh per unit seem appropriate. With those ranges of salaries and dwelling unit prices, affordable units would seem to lie in the shaded area of *table C*. Unit sizes would range from as low as 60 square meters to around 100 square meters. Other units of significantly larger size would fall outside of this presentation, Villas, for instance, on offer in phase 1 are both larger and more expensive.

C

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	3.54	7.0	12.0
39	11.0	5.6	3.3
55	15.5	7.9	4.6
63	17.8	9.0	5.3
70	19.8	10.0	5.8
90	25.4	12.9	7.5

Sources: Forbes Mumbai, Yahoo Overseas, Indian Commercial, Lodha Palava City Field Trip Information, September 27, 2017.

C / *Ratios of Salaries to Dwelling Prices.*

b. Job Creation

The opportunities for additional job creation are broadly of three kinds. They are: science parks and incubators, warehousing and logistics, and television production and post-production. This is in addition to the 70,000 or so jobs likely to be generated within phases 1 and 2 of the development as it now stands. Phase 3 remains unspecified at this writing, although the likely site for warehousing and related Special Economic Zone (SEZ) activity will probably be placed there. Indeed, location and development of warehousing facilities could precede other uses in phase 3 in order to take full advantage of improved freight connections from elsewhere in India to the JNPT facility.

The aim of a science park and incubator space would be to capitalize on the presence of the proposed university within the central part of phase 2 (*figure32*). This would potentially concentrate on IT kinds of activities and also use the 'smart city' infrastructure of Palava City as a test-bed for further application development. Generally, 'smart city' applications are in their infancy and broad system-wide networks have yet to be fully implemented. It is well known that the basic requirements for such activities are: close proximity to university settings involved in compatible research, dedication of facilities and incubator spaces, and attractive nearby living environments for those engaged in innovative IT pursuits. In the context of Palava City all three conditions can be met, especially if extra area is set aside for these functions immediately adjacent to the university. Several university-based innovation and research facilities are described in some detail in Appendix A of this report. It commences with an overview of science and research parks in general, which began to emerge in the United States and around MIT in particular. This is followed by a brief account of MIT's facilities base in these regards and plans to add an additional 500,000 or so square meters of space in the coming years. Then three examples of innovation and research facilities in an Asian context are described, as they are probably more

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32 / *The University Campus in Phase 2.*

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applicable to the Palava City situation. One is the Tsinghua University Science Park (TUS Park) in Beijing, established in 1994. Another is the Tongji Science Park established around 2003 and, finally, the third example is the Innovation Center set up at Nanyang Technological University in Singapore in 2005 to 2006. Of these the TUS Park is the largest, housing some 800 companies on a 15-hectare site and employing about 35,000 people. It is located immediately adjacent to Tsinghua University in the north-western part of Beijing, close to the university's East Gate. In fact, it shares ancillary hotel and other related service functions with the university. The Tongji facility is smaller, involving about 130 enterprises and employing on the order

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of 10,000 people, while the Nanyang Technological University center is smaller still, employing about 500 or so people (*table D*). Prorating against student populations, establishment of universities and stages in knowledge industry development, the university campus at Palava City might be expected to employ upwards of 5,000 people in closely associated science park and incubator spaces of on the order of 100,000 square meters and around 2.5 hectares in land area.

D

Warehousing and logistics operations are a little more difficult to pin down. However, guidelines for establishing warehousing, SEZs and other specialized parks have been promulgated for Maharashtra and are contained in Appendix B of this report. Moreover they are made in response to the DFC freight corridor improvement described earlier. It is anticipated that a number of locations in the Pune area, south of Palava City, will be developed for these purposes, outside of the TNPT facility. Reasonably logical candidates for Palava City would seem to be cold storage, food processing and dry goods, taking advantage of the food production going on in Maharashtra Location in phase 3 could also take advantage of road connections

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	Util. Rate	Blt. Area	Empl.	Students
TUSPark	20m2/p	690,000m2	35,000p	45,000s
Tonji SPK	20m2/p	200,000m2	10,000p	75,000s
Nanyang I. Center	20m2/p	10,500m2	500p	33,000s

Sources: See Appendix A, University Projects.

D / *Employment Estimates for Selected Science Parks.*

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to the east, alongside the north-south freight corridor. Scales and sizes of warehousing facilities vary and are relatively mutable, along with primary employment. Unlike innovation and research facilities, employment is also less likely to be highly skilled. Nevertheless, as an employment opportunity for those in the general area, outside of Palava City, such a complex could be attractive and make the broader community more balanced and self-sustaining. With regard to sizes of facilities and likely trends of employment, there can be considerable variation. Taking food processing as the main proxy, nationwide the U.S. Department of Agriculture estimates that about 1.8 million jobs are spread among 31,000 food-processing plants. For large companies like General Mills and U.S. Foods, single plant employment tends to be about 280 to 300 jobs and upwards. A recent survey of new food-processing plants coming on line in 2005 suggests smaller plants are on the order of 3,000 square meters in size and larger plants 18,000 square meters in floor area (*table E*). With these metrics in mind, a warehousing and food-processing complex in phase 3 of Palava City could be about 10,000 square meters of floor area on a 18 plus hectare site, employing as many as 1,500 to 2,000 people. Much here, of course, also depends on relative degrees of automation.

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	Plant Size	Util. Rate	Empl.	Site
Small	3,000m2	60m2/p	50p	0.3ha
Medium	10,000m2	60m2/p	160p	3ha
Large	18,000m2	60m2/p	300p	5.5ha

Sources: US Dept. of Agriculture, 2015; The Natural Processor, 2005; Kansas Wheat and sundry other plants.

E / *Food Processing Plant Sizes and Employment Estimates.*

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Another possibility for job creation sympathetic to the Palava City setting could be television production and post-production. Again, Appendix C to this report details some aspects of this activity and some case study examples. Of course, Mumbai is famous for its Bollywood cinematic productions. However, many of these are produced outdoors these days and tend to occur in well-established venues in northern Mumbai proper. Television production, by contrast, appears to be growing and is less specifically located. A marriage of media with the university might also be possible, as well as provision of service to the eastern side of the metropolitan region. Some synergy with IT incubator enterprises might also be anticipated. Sectors 1 and 2 of phase 2 would also seem to be ideal sites for this kind of activity. They are close to the university and proposed science park, as well as favorably positioned to the major roadway network. Looking across the industry, typically individual studio and stage spaces range in size dramatically, from about 300 square meters to 5,000 square meters of floor area. Specific studio enterprises and building complexes also range in size from around 1,400 to 6,000 square meters, such as at Baird T.V. in London, to 12,000 plus square meters, like at M3 Studio in Miami, up to 35,000 square meters in the case of BBC Scotland. Several governments, like New York State and California, offer economic incentives in the form of tax credits to establish production facilities. In addition to production space per se, ancillary post-production and office space can range as high as 8,000 square meters additional space. Specific studio settings tend to be small or big, although some of an intermediate scale do

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F • exist (*table F*). Apart from OMA and the massive CCTV complex in Beijing, star architects have also been involved in other complexes, such as David Chipperfield at the BBC Studio in Scotland of 2007 and Richard Rogers at the 124 Studio in London of 1997. Location of a facility in the medium range with some post-production facilities would probably net Palava City an additional 1,000, or so, primary employees. All told it might be possible from these three kinds of businesses to generate up to 8,000, or so, primary jobs that with a multiplier of an apportionment of service employment could rise to about 20,000 jobs. Together with the roughly 70,000 jobs already anticipated, this would mean close to 100,000 jobs and a higher likelihood of balanced development in and around Palava City. Media spaces would also be attractive by way of skill and knowledge levels for potential inhabitants of the development as well.

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	Fl. Space	Util. Rate	Empl.
Small	1,400 - 6000m2	15m2/empl	97 - 400
Medium	10,000 - 12,000m2	15m2/empl	666 - 800
Large	25,000 - 35,000m2	20m2/empl	1,250 - 1,750

Sources: York Studios, NYC; CMPP, Vancouver; M3 Studios, Miami; BBC Scotland; Levy Production Group, Las Vegas; Baird TV, London; 124 Studios, London; Eagle Rock Studio, Atlanta, and amongst others.

F / *Television Studio Sizes and Estimated Employment.*

c. Building Type Diversity

A noticeable aspect of the phase1 and sector 3 of phase 2 development at Palava City is the relative plainness of the building. The typological range is very limited, buildings tend to be of uniform heights and program, and there is little mixing of uses, except perhaps at ground level. In the interests of an active street life more profound senses of community and simply better accommodation, more hybrid manners of construction should be considered. The attached Appendix D outlines some case study examples in these regards, ranging across scales and types of building that might be anticipated at Palava City. In each case, there is a mix of housing and some other uses and projects vary formally from quotidian to unusual. Needless to say there are many more cases that could be cited in the cause of improved expressive vitality and liveliness.. Indeed, the design studio exercises that will follow are aimed in large part to propose alternatives, especially in the realm of high quality living spaces.

Among the cases cited here, the Skyville at Dawson is an exercise in developing a spatial sense of communities within a high-rise, high-density complex. It has been well received by the Housing and Development Board in Singapore as a potential way to move forward with public and affordable housing. The Interlace, also in Singapore, poses as an alternative to tower block construction and incorporates a close interlinking of dwelling and socializing spaces. Jian Wai SoHo in Beijing presents a novel way of 'grounding' high-rise buildings into a shared and programmatically inclined base condition of multiple levels that also activates and articulates normally flat courtyard spaces. Market Hall at Rotterdam integrates private housing into the need for a large covered space in the form of a market. The result is somewhat fantastic and certainly out of the ordinary. The Duolan Commercial Complex in Hangzhou, China, rises to the occasion of the megaplot and does so more or less as a contiguous building mass, wrapping around itself and the perimeter of the site. Again housing is combined with other related functions also on a neighborhood

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level. Finally, the Ypenburg Center is a well-composed essay in the combination of mid-rise perimeter-block building, high-rise construction and internal courtyard development.

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d. Governance and 'Smart City' Applications

Another conspicuous aspect of Palava City is the deployment of so-called 'smart city' ideas and applications. Primarily they are in the service of planning, interconnectivity, governance, operations and engaging citizens in the affairs of the community. In these regards they are to provide more efficient and enhanced services within the development. They also aim to monitor progress towards policy outcomes by facilitating citizen activity in these kinds of discussions. They are also used to manage aspects of the infrastructure associated with transport, traffic management, water supply and energy distribution. In addition, they operate for the security of the community and in necessary forms of surveillance. Much of this is to be provided from a central command center and through '311 New York' type line services. Aspects of the 'smart city' will include city-wide fiber and Wi-Fi networks, alarm systems and sensor systems, digital library services and swipe identification cards, GIS-based location grids and smart water meters, energy controls and the like.

One potential issue in these kinds of applications is perception of control versus enhancement of personal freedoms. Another is exclusivity and exclusion versus accessibility and openness. For the most part management of infrastructure and some services will go largely unnoticed. However, security, surveillance and citizen engagement can be far more visible and present. Striking the appropriate balance especially among those within the community and those from without will be key. In its present context Palava City runs a certain risk of being perceived negatively as a place of privilege within a proverbial sea of poorer settlements. Experiences elsewhere, such as at Songdo in South Korea, warn against the possibilities of over-regimentation and sameness in service. Ironically, there can also be introduction of unwelcome biases in community engagement

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through open yet narrowly directed communication. Debate in India itself these days, particularly in light of national government 'smart city' initiatives, has also heightened awareness and a certain wariness about these and related issues[19].

One age-old problem in governance revolves around the trust placed in the property management company associated with a development, including timely payment of management fees. Vanke, the largest residential developer in China if not elsewhere guards its brand with its own management company. The Vanke Property Management Company is a subsidiary of the China Vanke Company and manages over 210 million square meters of built area as of 2015. Langrun Gardens is one of these properties in western Shanghai hosting more than 1,000 households and over 120,000 square meters of built space. The composition of residents includes people of different ages and occupations[20]. Among retirees are a number who formerly assumed management positions in companies and government enterprises. They have time to contribute and actively volunteer to assist the management company in its tasks. They have also formed a resident committee that helps Vanke's professional management team and essentially becomes part of that team. The advantages are several-fold. First, the needs of residents are more readily identified. Second, peer supervision of non-conforming activities associated with community health and welfare can be undertaken. Third, this coalition enhances the feeling of representation rather than regulation among residents. It helps to resolve trust problems, especially during early stages of development. Such peer pressure can go a long way to ensuring timely payment of management fees. Another strategy in play at Langrun Gardens is continued management of retail commercial establishments, instead of selling them off outright. This is done in order to address immediate retail needs of residents and to capitalize on the increasing market rate of rental incomes. A portion of the annual cash flow is allocated to subsidize resident-run businesses. The strategy effectively makes daily life more convenient and generates on-site job opportunities.

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e. Environmental Suitability and Landscape Opportunities

As noted earlier, the Palava City site area is generally in a green field condition, somewhat prone to flooding and with water quality issues in rivers during times of low rainfall. Air quality is usually close to standards, although sometimes lower due to industrial sites to the north of the site. Cursory tests along with some associated with noise levels, however, have not indicated any significant impairment of acceptable standards of performance. Infrastructure within Palava City has been geared to internal rain-water harvesting and the use of high levels of treatment. All flushing and landscape watering needs, for instance, are and will continue to come from recycled water. Roof-top and cistern storage is being incorporated extensively within the development, particularly in phase 2. Flood-water management is handled via adequate site drainage and by raising levels of development. No storm-water detention, however, has been overtly incorporated into site works and would necessitate a thorough hydrological analysis of site conditions to affirm its efficacy. Nevertheless, it seems like a promising strategy. Potable water is furnished as an externally-treated supply using proven techniques. On-site potable water treatment, though able to be imagined in a development of this scale and amenity does not seem to have been addressed. Generally, the landscape quality around Palava City is highly vegetated and rural in character. Views of the not so distant ranges are clearly visible and the river system of small streams and drainage canals is evident.

Upon reflection about what has been put in place so far and the rocky terrain underlying much of the development, more probably could and should be made of the broad landscape character of it. Indeed, rather than being constructed in an ad hoc and piece-meal fashion, it could become one of the iconic aspects of Palava City. At work would also be the opportunity to create a Mumbaiesque landscape across the entire development. This would necessarily entail creating active water body edges, especially along the adjacent river. It would also entail both literally and metaphorically creating tanks, but as contemporary versions of those in old Mumbai. It would also entail using rock and vegetated outcrops to lend a more immediate sense of topography and three- dimensionality to site development. In

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addition, where possible, the naturally occurring green elements should be preserved and, indeed, amplified and opportunities for bio-remediation of water quality should also be incorporated into the landscape (*figure 33*). As suggested earlier, Singapore's efforts to become green, might be emulated. This would involve a prodigious amount of tree planting and tending to roadside verges, parks and playgrounds. Also like contemporary Singapore through its ABC program, the constructed landscape can be put to work for storm-water management, water harvesting, water quality improvement, provision of recreational amenity and horticultural conservation. In fact, in addition to the usual plans and construction documents prepared for the building components of Palava City, the corollary for the open landscape realm should also be undertaken. In large measure Singapore, among other places, has come to connect the condition and realization of being 'green and clean' through concerted effort in water self-sufficiency, catchment area conservation, the greening of buildings and other structures, horticultural curation, multiple and joint use of parks, remaking of drainage ditches and creation of more abundant ecotopes. As also note, this did not come without cost and forward investment.

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33 / *Tanks, Water Bodies, and Bio-Remediation Schemes.*

11

SOME RECOMMENDATIONS AND FUTURE WORK

Further development of a community-based model of governance within specific segments of Palava City should be undertaken, including initial experiments within phase 1 of the overall development. It should draw upon resident expertise based on a canvas of resident interest, capability and standing within the community. Those involved should work closely with the professional project management company and lend both authority and moral suasion to management functions, including collection of user fees and similar levies.

Further due diligence should be pursued with regard to favorable job creation alternatives. This should involve screening of potential primary tenants and site visits to employment centers of interest. One clear incentive for participation would be construction of turn-key accommodations for prospective major tenants and to their specifications. With regard to science park and incubator functions the choice of a research university will be highly determining of successful outcomes. The initial attraction will undoubtedly revolve around the relative prestige of the institution involved. Partnering programs, along the lines of those already in places elsewhere, will need to be specified and implemented, as well as facility spaces developed accordingly. Overall governance structures should also be envisaged to provide appropriate guidance to and promotion of science park and incubator operations. With regard to warehousing, food processing, and storage, due diligence should focus on what is already in play within the Palava City area of the region, including towards Navi Mumbai. Several overseas enterprises, such as General Mills appear to have subsidiaries opening in the region. Site selection and development should also seek to leverage location with regard to both rail freight and road access. The more precise type of warehousing, food processing and storage should be specified according to local trends, needs and hinterland resources within Maharashtra. As with science park and incubator job

creation, television production and post-production might begin with canvassing of potential primary tenants both from within the Mumbai region and from without. Either medium sized to larger networks or production providers in the manner, say, of Indigo Production in New York, would seem to be the best candidates.

A truly broad and on-going landscape condition for Palava City should be investigated, conceptualized, designed and developed. To do otherwise in the setting available would seem to be a missed opportunity. This exercise should actively seek occasions for maximizing joint use of landscape and infrastructural resources, including water and other ecosystem cycles. A specific physical and aesthetic character should be instantiated particular to the place and to Mumbai in general – a so-called 'Mumbaiesque landscape'.

The variety and quality of building, beyond what is already in place should be widened and raised, particularly with regard to the mixing of uses, typological variation and styles of living, as well as integration into evolving landscape conditions. Given the overall size of the development a higher degree of mixed income might well be pursued even with the potential to engage in cross-subsidization with regard to the nagging issue of on-going affordability. The Massachusetts Housing Authority, among others including some private providers, have followed this kind of strategy successfully.

Finally, in order for Palava City to become a truly successful city-building project rather than just another big property development, will involve co-operative participation with other communities within the region on a variety of levels. These include with local governments, village communities and district authorities. Leadership offered in these regards should also be forthcoming and oriented towards setting the right example in everyone's interests. In particular, common cause and interest in areas such as infrastructure building,

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pollution mitigation, and community service provision should be actively pursued. Over time, for instance, it will be particularly important to create more and stronger links into Maharashtra State, rather than continue the north-south bias in transportation into Gujarat State. In addition, at an eventual projected population of around one million people, Palava City is considerably larger than most, if not all, existing new towns and similar satellite arrangements. In Hong Kong, for instance, the range is from around 300,000 to upwards of 600,000 inhabitants, and in South Korea around Seoul somewhat less at about 170,000 to 390,000 inhabitants. This would seem to place further emphasis on Palava City being an integral part of a broader regional metropolitan community and the leadership that would appropriately go with the sheer scale of its operation.

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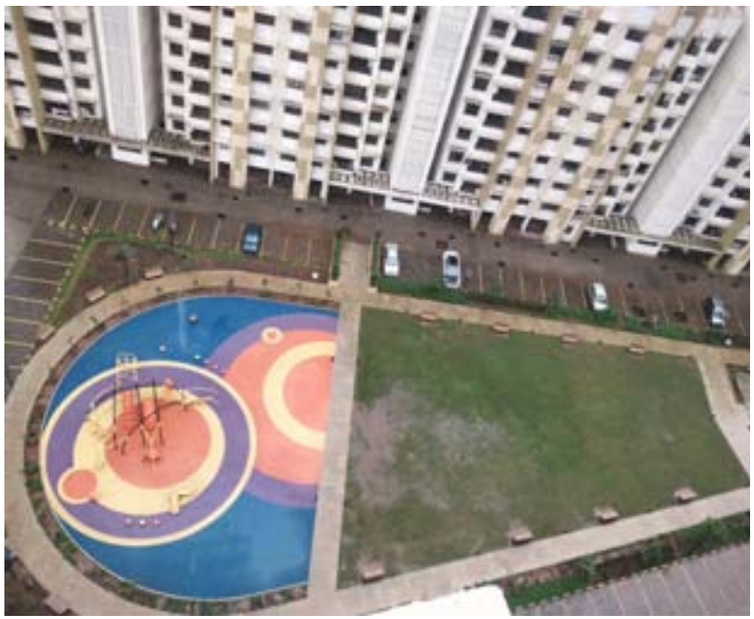

NOTES

1. Much of the following narrative is based upon presentations and discussion with staff of the Mumbai Metropolitan Regional Planning Authority on September 27, 2016, as well as on conversation with Vidyadhar Pathak on September 25, 2016.

2. Based on data from INDIA STATS, National Information Center, 2011.

3. Data furnished by MMRDA on metropolitan development activities in India, 2016.

4. Based on INDIA STATS, 2011.

5. Mumbai Metropolitan Planning Authority on September 27, 2016.

6. The Maharashtra Water Resources Regulatory Authority, 2015.

7. The Maharashtra Pollution Control Board, 2015.

8. Conversation with Vidyadhar Pathak on September 25, 2016 and on INDIA STATS, various years.

9. Op Cit., 2016.

10. Various sources although primarily India Commercial, Payscale, Yahoo Overseas and Forbes.

11. Briefing by the Mumbai Metropolitan Regional Planning Authority on September 27, 2016.

12. Op Cit. 2016.

13. See Tan, Lee and Tan, 2008.

14. Most of the statistical and other factual claims made here are drawn from Lodha Dwellers Pvt, Ltd, 2013, as well as from Lodha Group, 2016a, b, c.

15. As specified in Lodha Group, 2016a.

16. Palava City Plans – http://www.lodhapalavacity.ind.in/

17. Conversation with Vidyadhar Pathak on September 25, 2016.

18. Returns on investment for Palava City – http://lodhapalavacity.org.in/investment-potential/

19. See Assink, S., 2015. “Who Is The Smart City For?” Common Place, May and Bundhun, R. 2015. “Hope Springs in India’s Smart Cities”. The Nation, July.

20. Observations based on interviews at Langrun Gardens in July, 2014.

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APPENDIX

INTRODUCTION

University science parks or research parks, innovation clusters and so on, have become an essential ingredient of the innovation system of various countries around the world.

The history of the science park can be dated back to 1951, when the Stanford Research Park was established as the first science park in the world.

In the late 1970s and the early 1980s, the number of science parks grew explosively in the US, due to the decrease in spending in industrial research and development (R&D) and the increase in demand for university-industry collaboration. University science parks have played an important role as a mechanism for the transfer of academic research findings, as a source of knowledge spillovers, and as a catalyst for national and regional economic growth.

This kind of facilities, combining multiple resources as a platform of support and services, is the cradle for scientific and technological achievements, development of high-tech businesses, innovation and entrepreneurship training.
Practices around the world have proved that the development of high-tech enterprises is inseparable from both the creation and improvement of innovation capability.

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Innovation Neighbourhood:
MIT - Cambridge, MA, US

HISTORICAL DEVELOPMENT

Overview: Tech, Biotech, Pharmaceutical and IT research headquarters (ultimate innovation cluster for its high concentration of high-tech leaders).

- 19th century up to 1960s: Kendall Square as an industrial landscape: Major industrial center in 19th century, was home to distilleries, electric power plants, soap and hosiery factories, and the Kendall Boiler and Tank Company. The square was named after the company. Railroad and the 1912 opening of the first subway line made the area attractive for manufacturing. In 1916, the Massachusetts Institute of Technology moved to its current location in Cambridge

Kendall Square site had been empty for most of the last 40 years, unoccupied post-industrial wasteland.

- 1960s-2000s: Kendall Square as an office park district: postwar urban renewal movement, grand scheme to locate NASA's Electronics Research Center in Kendall Square, later cancelled. The vacant land was later partially occupied by the National Transportation System Center.
- 1960s-2000s: Kendall Square as an office park district: postwar urban renewal movement, grand scheme to locate NASA's Electronics Research Center in Kendall Square, later cancelled. The vacant land was later partially occupied by the National Transportation System Center.
- (1983) In 1983, the company opened its first U.S. facility, dedicated to research and development and some manufacturing, in the heart of Kendall Square — where it still stands. Philip Sharp saw it as an advantageous location: It was near top molecular biologists at MIT and Harvard University, and close to a business-savvy community in Boston.
- Many companies have been founded or co-founded by MIT professors. Notable offspring of this MIT-Kendall synergy include global biotech giant Biogen Idec, co-founded by Institute Professor Phillip Sharp in 1978; leading Internet content-delivery network Akamai, co-founded in 1998 by former professor of applied mathematics Tom Leighton and Daniel Lewin '98; and HubSpot, a fast-growing marketing-software company co-founded in 2006 by Brian Halligan MBA '05 and Dharmesh Shah SM '06.
- 2000s-2012: Kendall Square evolving into a livelier, more mixed-use district: mixed-use real estate developments, such as Cambridge Research Park (1999) and 303 Third Street (2003), have started to activate the pedestrian realm of Kendall Square. Moreover, new buildings are designed for Pfizer and Novartis.

Today: Amazon just revealed plans to rent 100,000 square feet here; Google is expanding its footprint by 40,000 square feet; and Microsoft, I.B.M. and Nokia are nearby.

MIT area in the 1960s

MIT area in the 1980s

MIT area in the 2000s

KENDALL SQUARE

- Kendall Square has the highest number of biotech and information technology firms per square mile in the world." (Boston Consulting Group (BCG))
- The innovation spirit of entrepreneurs is an essential component of the identity of Kendall Square.
- The current and growing array of innovation industries (clean tech, high tech and biotechnology) in the Square help strengthen Cambridge's economy and fosters for job creation and growth. These companies grew into large businesses — in some cases, even industry leaders — in a setting that cultivated an influx of intellectual capital and a culture of innovation.
- Retain and expand incubator spaces for entrepreneurs. The start-up companies spun off by MIT laid the groundwork for the current "innovation neighbourhood". Due to its worldwide recognition, Kendall Square has become increasingly attractive to multi-national corporations. As a result, start-ups and small businesses have to compete for space with larger, established companies.

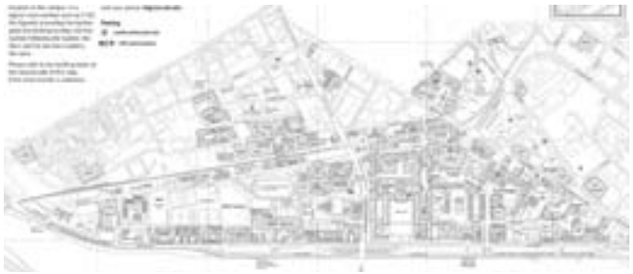
- As the area gets built out, low-rent warehouses are getting redeveloped into modern buildings that are too expensive for start-ups. As a result, such companies are often priced out, and may move to other parts of the region. MIT recognized the importance of this phenomenon several years ago by making space available in the "Badger Building" at 1 Broadway that had been built in the 1960s for traditional office space.

Biotech + Its per square mile, comparison.

MIT: URBAN EXPANSION

- **MIT Land Owner:** Since its arrival in Cambridge, the MIT campus has more than tripled in size to 160 acres, and the university owns an additional 94 acres of commercial property that it's continuing to develop. The investment property, which MIT leases or develops to generate income for its $8.3 billion endowment, has made the university the largest taxpayer in Cambridge. MIT pays nearly $33 million in taxes a year, more than six times that of neighbouring Harvard. MIT's contribution represents more than 12 percent of the city's tax revenue stream.
- **Expansion and Attraction:** Over the last decade, MIT's academic footprint has increased by more than 2.7 million square feet. MIT was created by the state Legislature as one of the first land-grant institutions in the nation. In addition to its academic expansion, MIT has spurred the growth of industry, spawning hundreds of companies around the perimeters of campus and attracting others to relocate to Cambridge on university-owned land.
- **Reconversion of Old Fabrics, Warehouses, Parking Lots:** MIT is also renovating half of the historic Ford assembly plant on Memorial Drive for the oncology headquarters of French pharmaceutical firm Sanofi-Aventis. In the past decade, the university has converted old warehouses on the west side of campus into laboratories. It has developed University Park, a 27-acre complex for research, housing, and retail, on the site of a shuttered wire and cable company. And it's fixing up the edges of Central Square.

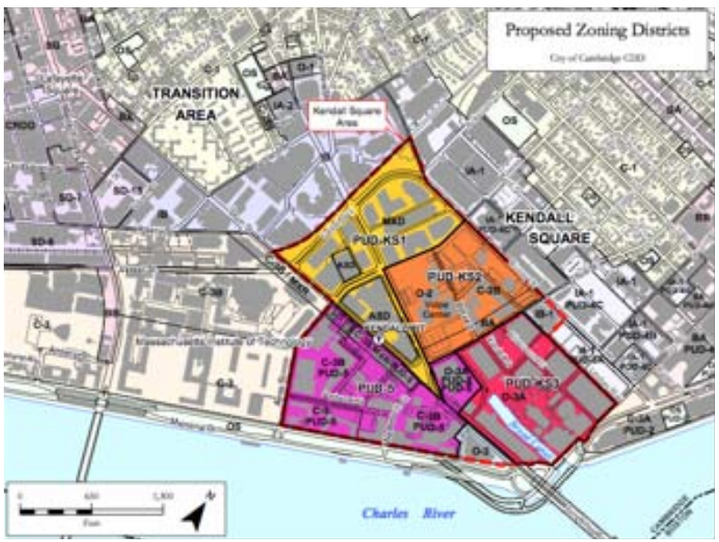
MIT Academic Projects have made positive additions to the urban environment: the Stata Center (2000) was created by replacing an unattractive parking garage.



MIT area in the 2000s

KENDALL SQUARE SUB-DISTRICTS

- PUD KS1: currently zoned as Mixed-Use District (MXD), under the control of the Cambridge Redevelopment Authority with its designated developer, Boston Properties.
- PUD KS2: the area largely controlled by the US DOT, with the separate 303 Third Street housing project
- PUD KS3: mostly built-out, includes the Cambridge Research Park (Lyme) PUD with Watermark housing, Genzyme HQ, etc.
- PUD-4: Alexandria area recently rezoned in 2009, not suggested to be changed.
- PUD-5: MIT campus area, recently rezoned in 2013 based on the K2 zoning recommendations.



Proposed Zoning Districts

Potentials for MIT Properties in Kendall Square

MIT began its "Kendall Square Initiative" planning before the K2 Committee was formed, and fully participated in the Committee. MIT owns several surface parking lots near the heart of the Square that could support much more positive development, including space for high tech and innovation companies, retail, and housing. In buildings owned by MIT, there is now a limited amount of retail, but given the proximity of MIT holdings to Kendall Station, there is a strong potential to make a much more active urban place that is centered on the presence of the station.

MIT: REDEVELOPMENT OF KENDALL SQUARE

New Projects

The university's plans add 5 million square feet of lab and office space underway or under consideration. The construction plan calls for about 1.1 million square feet of new space at eight locations in Kendall Square, including two large office, lab, and retail buildings along Main Street. Other facilities would be built on parking lots just south of Main Street and near MIT's One Broadway office building by Memorial Drive.

Revitalization of the Neighbourhood

- Kendall Square Association: the official business and civic development organization for Kendall Square, formed by approximately 80 organizations in February 2009.
- Kendall Square Initiative: is part of a much-larger 20-year capital plan by MIT to make major building and infrastructure improvements across the university's sprawling campus. The goal of the larger Kendall-Central squares initiative by the city is to establish long-term commercial, retail, and housing priorities on both MIT and other privately owned properties in those areas.
- Kendall Square development is located one block north of Kendall Square, and includes a mixed-use "live, work, play" community that weaves parks, an ice rink, a farmers market, and a recreational boating basin through a series of office, lab, residential and retail buildings.

MIT new developments in MIT website: news

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Science Park:
Tsinghua University - Beijing, China

OVERVIEW OF THE CHINESE CASE

Difference with the West

The growth trajectory of university science parks of China is different from that in Western Societies. The majority of Chinese universities are public universities, which are heavily funded by the government. In addition, Chinese universities are allowed to own university-affiliated enterprises. As a result, a university science park is a good place to explore the government-university-enterprise linkage in China.

- 1980s. China has undertaken substantial efforts to develop science parks to encourage innovation and technology transfer. Back then, China tried to build a national innovation system (government promoted) to satisfy the need of the market economy.

Promotion of Science Parks

- 1988. China launched the Torch Program to encourage local governments to establish high-tech parks. By 2012, China had established 105 state-level high-tech parks nationwide.

The government encouraged university faculty and staff to serve enterprises through technology contracts, patent licensing, consultation, or establishing joint research centers. Universities also encouraged faculty and staff to establish university-affiliated enterprises to commercialize academic research, transfer technology, and strengthen the collaboration with industry.

- 1990s. China recognized that the universities were the integrated part of the nation's innovation system, and initiated the University Science Park program. University science parks have become the universities' platforms for commercializing academic research, incubating innovative start-ups, and training innovative talents.

HISTORICAL DEVELOPMENT

China began to construct university science parks from 1990s, which is the background that Tsinghua University Science Park (TusPark) was established on. TusPark (Tsinghua University Science Park) was set up in 1994. The TusPark's founder and President is Mei Meng, the senior vice-president is Chen Hongbo, who is the vice-dean of the Tsinghua University.

Technology + Products Strategy Period

- 1980. Tsinghua University established the Tsinghua Technology Service Company, which focused on software development and data analyses for companies of developed countries. It has been one of the first university-affiliated enterprises since the open and reform era.
- 1988. Tsinghua established the Tsinghua Technology Development General Company (TTDGC) to manage its affiliated enterprises. By the early 1990s, Tsinghua owned more than 190 affiliated enterprises, more than any other Chinese university.
- 1993. The concept of TusPark is formally proposed and approved by the Beijing Government.
- 1994. Development of Center of TusPark is set up and it is formally started. Tsinghua University established TusPark with an initial mission of "promoting the commercialization of research results, zoning affiliated-enterprise area and university's education and research area, and improving the environment and landscape surrounding the campus" The mission focused on improving campus physical planning, rather than on promoting innovation and spurring regional economy.
- 1997-98. Tsinghua amalgamated some affiliated enterprises focusing on environment technology.
- 1999. Tsinghua Business Incubator under TusPark is set up for the preliminary function of facilitating enterprise incubation.
- 2000. The Development Center of Tsinghua University Science Park is transformed to be TusPark Construction Holdings Co. Ltd for the comprehensive construction of the main park. Tsinghua uses entrepreneurial leadership to facilitate TusPark building sustainable competitive advantages.

Capital + Equity strategy period

- 2004. TusPark Construction Holdings becomes TusHoldings Co. Ltd. to manage the university-affiliated enterprises (it controls 32 companies and shares 66.)
- 2005. Science Park Tower (landmark building of the Park) is completed. A service platform for high-tech enterprises is constructed in cooperation with

the Haidian District to further improve the innovation service system.

- 2006. Construction of the main park is finished. 15 companies selected to join the "diamond plan" and occupancy rate of main park exceeds 95% by 2007. Tsinghua Holding Company ranks 154th in China's top 500 enterprise list.
- 2009. Tsinghua University TusPark Research Institute for Innovation is jointly set up by Tsinghua University and TusHoldings.
- 2012. InnoSpring (1st Sino-US cross-border incubator) is jointly established by TusPark, Silicon Valley Bank, Shui On Group and Northern Kight Venture Capital.

TusPark, from TusPark website

LOCATION PROXIMITY

Proximity of the science park to the university, benefits:

- Obtaining extramural funding, optimizing curriculum, creating greater job opportunities for graduates.
- Firms within geographically proximity: higher level of innovation activities and knowledge spillover
- Proximity facilitates informal interpersonal ties, which can be transformed into formal inter-organization ties, and then promote cooperative innovation.
- TusPark is directly adjacent to Tsinghua University, both TusPark and Tsinghua can maximize the proximity advantage.
- TusPark is also in the proximity to China's most prestigious universities and research institutions, including Peking University (PKU) and China Academy of Sciences.
- TusPark is also located in the core region of Beijing's high-tech zone—its southern neighbour is ZGC and western neighbor is PKU Science Park.

- In the region there is a strong academic, business, and personal network along with a intense information exchange.
- TusPark also enjoys a skill labour pool and suppliers networks resulting from its location proximity.

Tsinghua and TusPark, Location Proximity: close to the best universities and surrounded by high Tech zone.

TUSPARK TODAY

- Hosts 800 companies and 35,000 employees.
- In total, the park covers an area of 159,600 square meters, while the planning construction area occupies 151,800 square meters. TusPark completed has 690,000 square meters floor areas building within a 15 hectare lot directly adjacent to Tsinghua campus.
- TusPark is a branch of the national A-level university science park in Guangdong, is recognized by Guangdong Province as a service center for high and new technology and is also one of the first few incubators of science and technology enterprises recognized by the government of Zhuhai municipality.
- Since 2005, major companies such as Google and Microsoft established in TusPark.
- There are well-developed supporting service facilities in the park, which provide a conducive incubating environment for high-tech enterprises' start-ups and growth.
- The park extends its work from high-tech enterprises incubation, venture capital investment, talents cultivation, new technology development and the promotion of the technological achievements.
- The park has effectively boosted local economic growth. Its achievements, talents, management structure, enterprise culture, innovation and results assist in the promotion of regional economic development.

Tsinghua University Campus Map

THE TUSPARK MODEL

"Incubator + Entrepreneurship Training + Angel Investment + Open Platform": it is committed to improving the entrepreneurship ecosystem and eco-industrial system.

- Funding: Tsinghua's university-affiliated enterprises' R&D funding can rely on the capital market rather than on the university. After overcoming the constraint of funding, affiliated enterprises can participate in larger scale innovative projects which the university lacked capital capacity to support previously.
- Multinationals: 1) act as models for developing Chinese companies, 2) facilitate exchange of ideas, interpersonal ties, and 3) act as a solid finical base for the commercial operated science parks

- Large Chinese Companies: 1) Act as models for Chinese developing companies and, 2) advantageous exchange between academic environment and commercial sector
- Incubation Systems: 1) with about 200 start-ups under incubation, in major sectors of Bio and Life Science / Software / IC Design / Digital TV / 3G Mobile Communication etc.

TUSHOLDINGS AND ITS SUB-PARKS

- TusPark has grown to become home to high-tech giants and spawned more than 30 branch operations around China.
- TusPark Holding Limited is formally considered as a high-tech company which owns and builds business parks. It has buildings in Zhongguancun of Beijing, in Kunshan, Suzhou, Jiangsu and in Nanjing. It has about 400 companies and 25,000 employees are working in Tuspark.
- The company is in charge of development, construction and management of the entire Tsinghua Science Park, which is itself at the core of the Zhongguancun national innovation model park in Haidian district.
- Collaboration with other science parks, such as that run by Peking University, is also crucial to success.
- TusPark provides its resident companies with professional services such as registration, capital investment and assistance in protecting intellectual property rights.

3

Creative Cluster *:*

Tongji University - Shanghai, China

HISTORICAL DEVELOPMENT

OVERVIEW: Tongji University, located in Shanghai, is one of the oldest and most prestigious universities in China. Among its various departments, it is especially highly ranked in engineering science (esp. civil engineering), architecture and urban planning. Tongji University plays an important role in the knowledge innovation and industry upgrading during the past years.

The Tongji Creative Cluster because it exemplifies a new model of a regional innovation system in contrast to the university-based science parks in China.

- 1907. German Medical School was founded by Erich Paulun, a German doctor in Shanghai, in 1908 it is renamed Tongji German Medical school.
- 1923. It was formally established as a university. It became National Tongji University in 1927, one of the seven earliest national universities of China.
- 1946. From that date on Tongji grew to be a “comprehensive university” which offered programs in science, engineering, medicine, arts and law.
- 1952. Following a nationwide campaign of restructuring universities, Tongji developed with top-notch strength in civil engineering and architecture – it consolidated the aim to develop a multi-disciplinary engineering university.
- 1995 - 1996. the university became one to be jointly built by the State Education Commission and the Shanghai Municipal Government. It later merged with Shanghai Institute of Urban Construction and Shanghai Institute of Building Materials. The merger was hailed by the State Council as Tongji Model in the system reform of higher institutions in China.
- 2000. the expanded Tongji merged again with Shanghai Railway University.
- 2003. Shanghai Tongji Science and Technology Incubator Ltd. was founded with a registered capital of 8 million CNY.
- 2009. Once the Tongji Knowledge Economy Cluster was integrated into the management system of Zhangjiang High-Tech Park a distinction between the two was considered necessary. The Shanghai Municipal Committee for Economy and Informatization highlighted the characteristics of the cluster: it provided products or services which contained a substantial element of artistic or creative endeavour, and named it the Tongji Creative Cluster. It was granted the status of the first Creative Cluster Exemplar in Shanghai.
- 2013. Set its vision of “a sustainability-oriented world-class university.”

Tongji University Campus Map

TONGJI CREATIVE CLUSTER AS REGIONAL INNOVATION SYSTEM

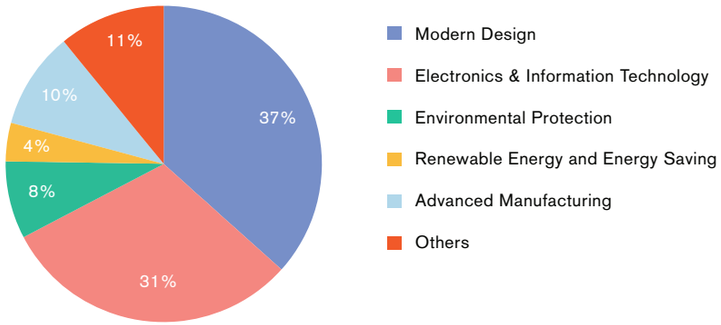
- It is the first and the only national-level cluster based on knowledge-intensive services in China. All the other clusters in the National Torch Plan are based on the high-tech manufacturing industry.
- Regional innovation system: focused on the field of knowledge-intensive services, especially architecture, engineering, consultancy, advertising and publishing activities.

University-based science parks: are in the field of high-tech manufacturing industries such as pharmaceuticals, computing and electronics, aviation and spacecraft, chemistry etc.

- With the support of the central government, Tongji Creative Cluster was able to establish collaboration with governments and enterprises in other regions beyond Shanghai municipality, and contributed to the formation of branch parks in Suzhou, Changshu and Cixi.

Long-term effects on regional economic development:

- The university can enhance the quality of local labour through training graduates.
- The existence of a university in the region acts as an incentive for local firms to expand their activities in order to take advantage of highly skilled graduates.
- A university’s highly skilled staff may provide expert advice to local development agencies as well as to local firms.
- The presence of a university in an area enhances the cultural as well as the economic attractiveness of an area for mobile firms and highly skilled workers.



Tonji University, tenant companies. Source: Tongji incubator

TONGJI SCIENCE PARK AND INCUBATOR

- TSP is located in the Chifeng Road South Campus of Tongji University, having more than 700 registered companies and around 20,000 m2 official area. Currently, there are 130 enterprises and 5 R&D companies with an annual output value of 1840 million RMB.
- It benefits from an excellent location: the downtown center of Shanghai and the neighbour of Tongji University.
- TSP provides full-fledged and whole-hearted services for all the enterprises in the park, in an attempt to advance in technology and provide an education for talented entrepreneurs.
- TSP boasts a host of benefits: easy transportation, fast communication, perfect facilities for residents, and multi-functional services.
- TSP now consists of 4 bases with different scales and functions: Chifeng Lu Base for High-Tech Incubation, Guokang LU Base for Invention Projects, Anting Base for Automobile Technology R&D, and Nanhui Base for High-tech Industry.
- Tongji incubator offers the start-up companies various supports: the rent for the office area is between 1-2 CNY/ m2/ day, which is less than half of the regular rent fee. The tenant companies can have 100% tax refund on the regional level + support for various financial issues.
- One third of the start-ups graduated from the incubator successfully according to the speaker of Tongji incubator. After leaving the incubator the companies can move to the accelerator in the Tongji Science and Technology Park, where more places are available and normal policies are applied.
- Tongji incubator is open to all industry sectors.
- 37% of the tenant companies have their focus on modern design. This can be traced back to the strength of Tongji University in architecture and design.
- Electronics and Information Technology represents the second largest group,

which is followed by advanced manufacturing, environmental protection, and renewable energy & energy saving.
- Polices to attract talent: Interns hired by the start-ups in Tongji incubator will be paid by the local government. High talents (e.g. returnees with own patents) who would like to start businesses in Tongji incubator can receive a compensation for private housing.
- A fund can be granted by the incubator to the college students and graduates from Tongji. This grant can be obtained in forms of debt with zero interest rate or as equity of the incubator limited for 2-3 years.

4

Innovation Center:
Nanyang Technological University - Singapore

HISTORICAL DEVELOPMENT

OVERVIEW: The Nanyang Technological University (Abbreviation: NTU) is a publicly-funded autonomous university in Singapore. NTU is comprehensive and research-intensive university, with over 33,000 undergraduate and postgraduate students.

The university has colleges of Engineering, Business, Science, Humanities, Arts, & Social Sciences, and an Interdisciplinary Graduate School.

NTU is one of the seven founding members of the Global Alliance of Technological Universities (GlobalTech), a network of top technological universities united in addressing global issues through leading-edge science and technology.

- 1956. Before Singapore's independence from the British - Nanyang University was established.
- 1980-82. Nanyang University merged with the National University of A new university—the Nanyang Technological Institute (NTI)—was formed to take over Nanyang University's campus. NTI was set up in 1981 with a charter to train three-quarters of Singapore's engineers. When NTI started in 1982, it had a total student population of 582 in three engineering disciplines – civil and structural, electrical and electronic, and mechanical and production engineering.
- 1991. The National Institute of Education (NIE) merged with the College of Physical Education and became part of the new NTU.
- 2006. NTU became autonomous and stands as one of the two largest public universities in Singapore today.

NTU Campus Map

CAMPUS-TOWN

- NTU has the largest on-campus residence infrastructure in Singapore
- Within the Campus Master Plan learning, living, research and recreational spaces are united to foster multidisciplinary pursuits and a collegiate culture. A large learning hub, the centerpiece of flipped classroom learning at NTU, and a lifestyle hub, the North Spine Plaza, are part of this transformed landscape. Another learning hub is being built.

RESEARCH-INNOVATION BODIES

Institute of Advanced Studies (IAS):

- Was established in July 2005 to provide NTU's science and technology initiatives with a "Nobel boost" and to establish the hallmarks of science at the highest level. IAS is advised and guided by a committee of world-renowned scientists, including 11 Nobel Laureates and a Fields Medalist.
- The Institute has helped to forge interdisciplinary research and close collaboration between NTU and major centers of research around the world. The multidisciplinary topics include physics, chemistry, engineering, biomedical imaging, materials science, maths, liberal arts, urban planning, etc.
- By establishing its close rapport with active scientists and distinguished scholars from all disciplines, IAS hopes to promote Singapore as a hub for international research and development.

Others:

- National Research Foundation (NRF): Organism through which NTU has made substantial contributions to Singapore's drive for research and innovation. Focus in the high-investment areas of biomedical sciences, environmental and water technologies, and interactive and digital media.
- The Innovation Centre comprised of 10,500 square meters is at the heart of NTU's innovation & entrepreneurship strategy and home to NTUitive: The Innovation Centre offers start-up space to companies founded by NTU faculty, undergraduate and postgraduate students who are licensees of university technology or mentees incubated by NTUitive under its business incubation and mentorship program. It is a mix of work and social space where individuals and companies can work, network, share synergies, and create alliances to enhance their value proposition.
- NTUitive (Innovation and Enterprise Company): if offers start-ups incubation, industry connectedness, commercialization, technology incubation, innovation cluster, licensing et al.

INTRODUCTION

Maharashtra has witnessed significant growth in Industrial activities: it has established strengths in many sectors including engineering, automobiles and auto components, chemicals, drugs and pharmaceuticals, textiles, information technology and biotechnology. A wide variety of horticultural crops are also grow in the State, making it a major producer of oilseeds, rice, cotton, sugarcane, etc. In addition, the heritage, trade, culture, history and growing economy of the State are the major tourism attractions.

In Maharashtra, the alignment of DFC passes through Dahanu Road, Virar, Vasai Road, Diva and terminates at the Jawaharlal Nehru Port in Navi Mumbai, with about 18% of area of the state within the influence area of DMIC. It includes:
2 Investment Regions
2 Industrial Areas
4 nodes (17-20): Node No.19: Pune-Khed Industrial Area

Node-19: Pune-Khed Industrial Area
Pune-Khed (along Pune-Nashik Road) Region located at a distance of 100-150km from the Dedicated Freight Corridor at Vasai Road. It also has direct access to JN Port and Mumbai Port via Karjat-Panvel and Karjat-Kalyan. Prominent industrial sectors in Pune include automobile, engineering goods, chemicals, consumer durables and IT/ITES. It also has high concentration of wine and grape processing industries.

SPECIAL ECONOMIC ZONES (SEZ)

Maharashtra has been a prominent promoter of special economic zones in India. Amongst the 204 SEZ projects, 166 SEZs are within the influence area of DMIC.

Special Economic Zones Policy
The Government of Maharashtra has adopted the SEZ Policy for developing Special Economic Zones in the state. Special Economic Zone (SEZ) is a specifically delineated duty free enclave with all required infrastructure provided under single administrative umbrella primarily meant for locating industries which manufacture and export goods and services. These enclaves shall be deemed to be foreign territory for the purposes of trade operations and duties and tariffs.

A Special Economic Zone in India can be established either by Central

Government, State Government or its agencies, private/public/joint sector or any person for manufacture of goods or rendering services or for both or as a free trade and warehousing zone. Foreign companies can also set up SEZs in India. The approved policy regime includes:

- Exemption of all state and local taxes and levies for transactions with the SEZ and for supply from domestic tariff areas to the SEZ Exemption from stamp duty and registration fees
- Grant of labour and environment related permits and approvals through a dedicated single window mechanism
- Permission to generate electricity for own consumption
- Expeditious process for land acquisition to set up SEZs
- The SEZ Policy aims at creating a simple and transparent system and procedures to attract large foreign and domestic investment in infrastructure for SEZ's in Maharashtra.

SEZ policy of Maharashtra provides attractive incentives as follows:

- Hundred per cent exemption from Stamp Duty and Registration Fees
- Permission for Captive Power Generation
- Micro, Small and Medium Enterprise Policy highlights
- Government is planning to initiate measures for availability of cheap and timely finance, technology up-gradation, up-gradation of skill sets of those employed in MSME enterprises and marketing.
- Setting up of a special institution for the SMEs
- New small scale industries are eligible for capital subsidy
- Special capital incentives (grants) are offered for setting up Small-scale industries in backward units Interest subsidy is also offered to new textile, hosiery and knitwear SSI units

SPECIALIZED PARKS

Existing Parks

- Specialized Industrial Parks. Eg. Floriculture Park - Pune
- Specialized Food Parks . They would provide infrastructural support for the promotion of food processing industry and cash in on Maharashtra's agricultural and farming resources.
- Specialized Silver Zone. Eg. Kolhapur area.
- Specialized Textile Parks. Eg. Nardhana and Butibori Parks
- Specialized Wine Parks

IT/ ITES Parks
Government of Maharashtra has developed the Mumbai-Pune Knowledge Corridor, a fast emerging IT hub of the country. A six lane, dual carriage expressway built to link the two cities of Mumbai and Pune, an internationally reputed center of culture and learning.
Six major IT parks setup in the two cities, 3 in Mumbai and 3 in Pune, providing good IT infrastructure, housing.

Information Technology (IT) Policy:
Aims to make Maharashtra the most favoured destination for investments in the IT and ITES industry. This is intended to be achieved by directing the State support at opening up large scale employment opportunities, facilitating growth of skilled and globally employable man-power, unprecedented spurt in exports, creating hassle-free and industry-friendly working environment, associating urban local Governments as responsive key stakeholders in promoting business and enterprise in the IT industry, and providing a legal framework for data protection and consumer privacy.

Biotechnology Parks (BT)
A BT Unit is a unit engaged in Research and Development and/or manufacture of products which use or are derived by using living systems, enzymes, Bio-catalysts derived therefrom.
The BT Park should have minimum land area of 2 acres or 20000 Sq.ft. of Built Up Area (BUA). Procedure for getting LOI /Registration as BT unit

Biotech Policy:
Biotechnology Policy has been framed to promote orderly growth of the biotechnology industry in the State to make it globally competitive. The policy aims at providing adequate infrastructure, especially in the form of biotechnology parks as well as developing research base to serve the needs of the sector.

Cluster Development Scheme
A cluster is a group of enterprises located within an identifiable and as far as practicable, contiguous area, producing same/similar product/services. Cluster projects are implemented by Special Purpose Vehicles (SPV) consisting of the actual/likely cluster beneficiaries/enterprises organised in any legally recognition, like co-operative society, registered society, trust, company etc.

LOGISTIC HUBS AND FREE TRADE WAREHOUSING ZONES

Logistic Parks/ Transshipment Zones As part of the development of Western Dedicated Freight Corridor (DFC), Indian Railways have proposed development of Freight Logistic Parks at six locations along the DFC to enhance rail based traffic along the DFC. These locations include Navi Mumbai.

These parks are proposed to be executed either as joint venture with Railways and respective state governments where Railways will offer land. Ministry of Railways has issued licenses to a number of private operators for running container trains on the same lines as CONCOR (Container Corporation of India). These private operators are allowed to set up logistic parks at different locations along the corridor, and also induct their own wagon fleets to carry the containers.

Custom Bonded Warehouses
The concept of Custom Bonded Warehousing has been promoted with a view to facilitate deferred payment of custom duty to encourage entrepreneurs and export oriented units to carry out their operations with least investment. These bonded Warehouses are located all over the country at places well - connected with the port towns for smooth movement of goods to and from the discharge points. The Central Warehousing Corporation of India (CWC) operates 95 Custom Bonded Warehouses with a total capacity of 0.7 Million Tonnes. It is important to note that DMIC States constitute 41 Custom Bonded Warehouses catering to a total capacity of 0.329 Million Tonnes. About 99% of capacities of custom bonded warehouses in DMIC States are located within the project influence area.

Rail side Warehousing Complexes
In order to augment the utilization of railway transportation system and facilitate cost-effective and efficient operation for freight distribution, the Central Warehousing Corporation of India (CWC) in association with Ministry of Railways have evolved the concept of Rail side warehousing facilities so as to ensure value added services viz. They provide total logistics solutions, avoiding of multiple handling of goods, curtailing of handling cost and offering hassle free efficient operation, to the users of rail transport system. Accordingly, the CWC and Railway Ministry have identified 22 strategic locations for development rail side warehousing complexes.

Within the Project Influence Area of DMIC, Rail side Warehousing Complexes are proposed in Mahrashtra as Road-Pune and Nashik Road in Central Railway

Region. It may be noted that Rail side Warehousing Complexes are the facilities similar to 'Logistic Parks' that are envisaged by the Ministry of Railways along the DFC, except that Logistic Parks would be developed at new locations along the DFC with rail terminals whereas rail side warehousing complexes would be developed at the existing railway station by upgrading the requisite infrastructure.

Free Trade Warehousing Zone
Government of India, through its Foreign Trade Policy 2004, had announced development of Free Trade Warehousing Zones (FTWZs) to increase the percentage share of global merchandise trade in India.

Services Offered in FTWZ
Warehousing space on lease: space for warehousing on lease basis and even space to construct the warehouses, to be leased out and ready to use facility customized as per the storage requirement of the specific products.
Freight Management support: the FTWZs are also expected to provide freight services to the FTWZ users in terms of transportation means to and from the Zone.

Common equipments sub-lease: the FTWZ would also make available general facilities for effective storage and movement of cargo through equipments such as counter balance fork-lifts, cranes and grabs, stackers, push carts, picking trolleys and bins, shelves and storage bins, strapping and electronic scales.
Activities that can be undertaken inside FTWZ: manufacturing facilities will not be allowed within the FTWZ. However, activities such as packing, de-stuffing, knitting, splitting and other activities required for storage purposes will be allowed within the FTWZ.

Support facilities and efficient management: support facilities such as banking, insurance etc. would be available for captive utilization within the FTWZ.
Single product storage facilities: FTWZ would provide users storage facilities that would meet the specific requirements of each product category, thereby ensuring a safer and more efficient environment for the storage of the products and others.

Benefits with FTWZ
Deferred Duty Benefits, hubbing Opportunities, Income & Service tax benefits, excise Duty Exemptions, benefit to Bulk Commodities such as fertilizers, dry chemicals, etc, benefit to Export Commodities, benefit to Trading Exchanges.

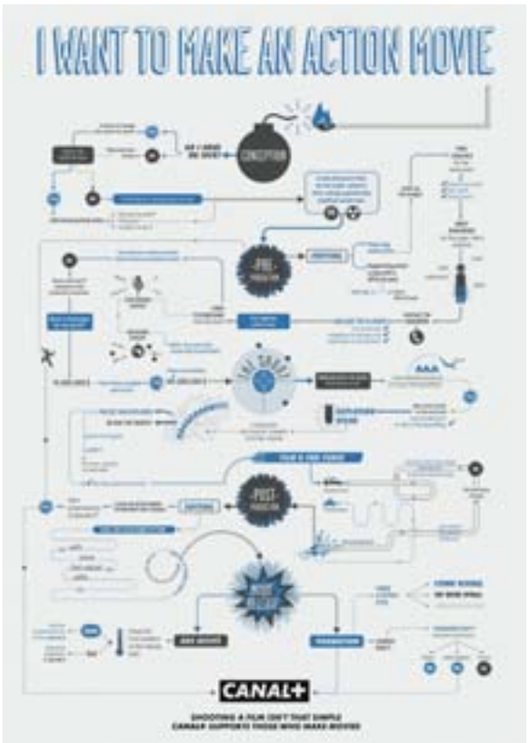
Locations of FTWZ
Free Trade Warehousing Zones are proposed to be located in six locations across India. These include, Greater NOIDA, Kandla, Mumbai, Cochin, Ennore, Haldia. It is important to note that amongst the locations selected for the FTWZs, except for Greater Noida, the remaining five are ports. This is expected to provide convenient and effective movement of goods through the sea, rail or road by offering the users of the FTWZ a superior infrastructure enabling efficiencies.

TV Production Diagrams

Television production is typically seen to consist of three parts: pre-production, production, and post-production.

Most elements of the television production industry, including the specialization of professions, division of tasks, and spatial arrangements, adapt to the tripartite structure of TV production.

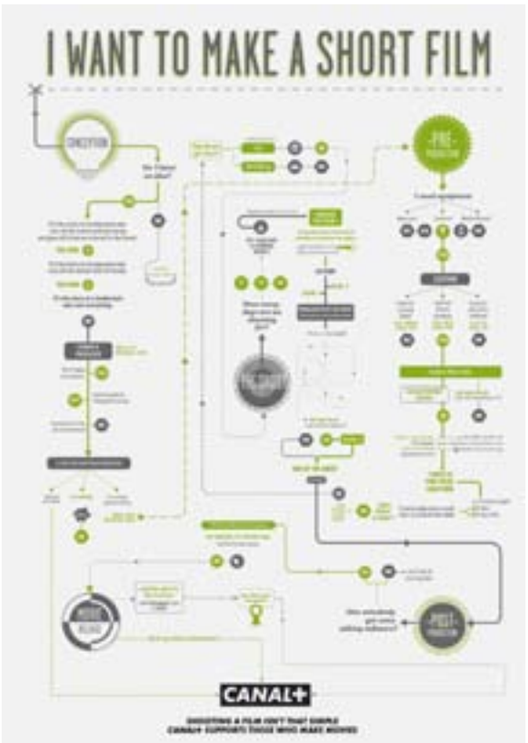
Illustrated are various diagrams of television production, focusing on different aspects of the process ranging from the division of tasks, specializations, and niches for business.



Stages

A TVC production goes through the following stages:

Development	Pre-production	Production	Post-production
Based on a brief, the creation agency comes up with a script, storyboard & treatment. Also shortlists prospective production houses	After selection of idea and production partner, detailed discussions take place on the execution of the script	The film is created on the shooting floor - actors, look, feel, style, direction, lighting, sets, locations are all aspects that dominate this phase	The images, sound and visual effects of the recorded film are edited, modified, enhanced, pieced together and a final film is ready for approval



TV Studio

A television studio describes the facility where television production takes place by recording live performances and/or by acquiring raw footage for post-production.

The configuration of the television studio is largely based on the movie studio, with a few features specific to television production.

Most distinctly, a television studio usually consists of a larger number of smaller spaces, separated acoustically but in close proximity. This configuration allows multiple tasks and filming sessions to progress concurrently in order to satisfy the shorter production cycle of television programs.

Pre-Production Spaces

Pre-production begins once the project has been given the go-ahead from the studio, and ends when principle photography begins. Tasks in pre-production include:

- Confirm financial arrangements.
- Refinement of the screenplay.
- Select key members of the cast.
- Select key members of the production team.
- The script is rendered into scene storyboards.
- Production of a detailed schedule; identifying the necessary locations, props, cast members, costumes, special effects and visual effects.
- Set construction.
- Hiring the crew.
- Read through of the script.

In terms of spatial requirements, most of the tasks can be conducted in a typical office space. Specific tasks, such as casting, set construction, and prototyping special effects, may require larger studio/workshop spaces and equipment.

Production Spaces

Compared to pre-production, television production entails a more specific set of spatial requirements. Typically, three types of spaces are required:

Studio Floor
The studio floor is where the action or performance is recorded. It consists of a set, video camera(s), microphones, stage lighting and associated controlling equipment, video monitors, public address system, and if possible, direct visual access to the production control room.

Production Control Room
The studio control room is where the incoming raw footage is composed into the outgoing program. Typical equipment includes a video monitor wall, video switcher, audio mixer, character generator, digital effects, camera control units, and store of images or videos.

Master Control Room
The master control room is where the on-air signal is controlled. Content from different Production Control Room is coordinated and transmitted directly or sent to broadcast providers.

Post-Production Spaces

The term post-production loosely covers a range of processes which occur ofter the shooting of individual program segments. Tasks include video editing, sound editing, animation, visual effects, and test viewing, and preparation for airing.

Post-production is often much longer than the actual shooting and can take several months to complete. Compared to movies, television post-production is often parallel with the shooting, giving it more scope to advise production in a cyclic feedback loop.

Traditional post-production using analog processes is often viewed as a dying industry, given the rapid advancements in video editing software, which, most significantly, facilitates non-linear editing processes.

The modern post-production space typically requires large computer stations and specialized equipments, but are relatively modest in scale, resembling a home theater.

Case Study - BBC Scotland

As the BBC's outpost in Scotland, the building houses television, radio, and internet production facilities, digital studios, technical support and office space.

The main design challenge was to integrate the studio spaces, which comes in a variety of sizes and are necessarily opaque and closed, with more open and transparent office spaces. The solution collects the studio spaces in a solid podium, forming a stepped promenade, with the office spaces above, defining a central atrium and meeting space.

LOCATION
Glasgow, Scotland

COMPLETED
2007

DESIGNERS
David Chipperfield Architects

Case Study - CCTV Complex

CCTV is the largest media company in the world, and it new headquarters was one of the feature projects conceived around the 2008 Beijing Olympics.

The visually striking form results from a detailed programmatic study of the process of television production. The loop configuration allows related functions to be located in close proximity, within a constrained urban site, allowing the efficient production of television programs.

LOCATION
Beijing, China

COMPLETED
2012

DESIGNERS
OMA

Skyville @ Dawson

Developed and operated by the Singapore Housing Development Board in 2015, Skyville @ Dawson is one of the several forward-looking projects experimenting with new housing types based on the basic idea of vertically stacked villages, each served by a set of community facilities in the forms of a naturally ventilated community terrace.

HUMAN SCALED VERTICAL VILLAGES
The 960 units are organized into 12 vertical villages of 80 dwellings units each, which share a naturally ventilated community terrace and garden. Each vertical village is limited to 8 floors high to facilitate easy visual and social connections.

ELEVATED COMMUNITY FACILITIES
The towers are connected at eight-floor intervals to create extended elevated communal gardens. In total, over 1.5ha of community gardens are provided. Together with vegetated facades, the project is able to achieve 100% green plot ratio.

ADAPTABLE UNIT PLANS
Units planes are designed to accommodate expanding and shrinking families, ranging from a couple to an extended family with children and grandparents.

LOCATION
Singapore

COMPLETED
2015

BUILDING VOLUME
Linked High-Rise Towers

ACCESS
Vertical Access and
Open-Air Terrace

APARTMENTS
960 units,
160 one bedroom
682 two bedrooms
118 three bedrooms

ADDITIONAL FEATURES
Supermarket, coffee shop, retail spaces, parking underground and in the adjacent podium, elevated sky terraces, community plazas at ground level.

DESIGNERS
WOHA Architects

The Interlace

Jointly developed by Capital Land and the Singapore Housing Development Board, The Interlace is one of the several forward-looking projects interested in challenging the typical isolated vertical towers for public housing in Singapore; looking instead for a closer integration of living and social spaces with the tropical environment.

HUMAN SCALED NEIGHBOURHOODS
The 1,040 units are divided into 31 apartment blocks, each 6 floors tall and identical in length. Units are arranged in vertical villages which share community amenities and outdoor spaces on multiple levels.

ELEVATED COMMUNITY FACILITIES
The 31 apartment blocks are stacked around eight open-air courtyards in a porous, hexagonal configuration; creating a fine-grain integration of units and terrace gardens. The project achieves a green plot ratio of 112%.

EFFICIENT VERTICAL CIRCULATION
Despite the project's visual complexity, the hexagonal arrangement of apartment blocks facilitates extremely efficient vertical circulation , with at least two cores serving each block, and each core serving three units per floor.

LOCATION
Singapore

COMPLETED
2013

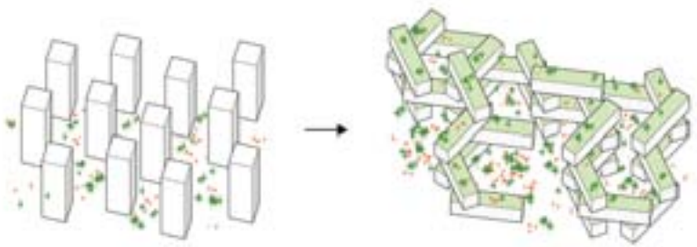
BUILDING VOLUME
Connected Slab Blocks

ACCESS
Vertical Access

APARTMENTS
1,040 units

ADDITIONAL FEATURES
Clubhouse, community amenities, retail, underground parking.

DESIGNERS
OMA / Buro Ole Scheeren



Jian Wai SOHO

Developed by SOHO China, well known locally for their patronage of star-architects and design conscious projects, Jian Wai SOHO was originally intended as an affordable housing and office component in the larger Beijing CBD development. In this case, SOHO is the acronym for Small Office Home Office, reflecting its mixed-use program.

THICKENED GROUND LEVEL
A persistent problem in mixed-use developments is the management of access and security between different programs. Jian Wai SOHO employs a thickened ground plane, extending two floors underground and five floors above, to regulate multiple systems of circulation for different groups of people while maintaining visual connections with large courtyards and bridges.

DESIGN FOR DESPECIALIZATION
Unit plans, both in the podium in and in the towers, are designed to facilitate a diversity of uses. Units in the podium may have direct street access, private courtyards, and/or rooftop terraces. In the towers, a diversity of unit sizes is available, in addition to a large atrium space provided every three levels; allowing occupants to expand vertically within the building.

LOCATION
Beijing, China

COMPLETED
2004

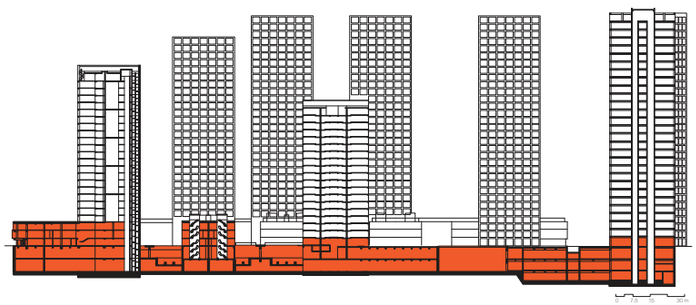
BUILDING VOLUME
High-Rise and Mid-Rise Towers on Podiums

ACCESS
Vertical Access

APARTMENTS
827 units,
37 duplex
140 one bedroom
428 two bedrooms
222 three bedrooms

ADDITIONAL FEATURES
Office, retail, school, sports club, parking underground, community space underground, throughout the building and on the roofs.

DESIGNERS
Riken Yamamoto



Market Hall

Responding to new laws in The Netherlands requiring traditional open air fish and meat markets to be covered due to hygiene considerations, MVRDV's Market Hall integrates private investment for housing and the public need for a covered public space in a mutually beneficial project.

COVERED PUBLIC SPACE
Two typical slab apartment blocks are arranged in an extruded arch configuration to provide a covered plaza within for the central market hall; providing a public good without significantly increasing the cost of the development.

JUXTAPOSITION OF PROGRAMS
Both the housing and market benefits from the mixed-use development. Residents enjoy the convenience of proximity the market and the novelty of living next to a bustling urban space. The market benefits from a stable consumer base and subsidized development cost. Close attention is paid to eliminate potential nuisances of the proximity, with noise and smell proof windows, and carefully separated circulation for the public and residents.

LOCATION
Rotterdam, The Netherlands

COMPLETED
2014

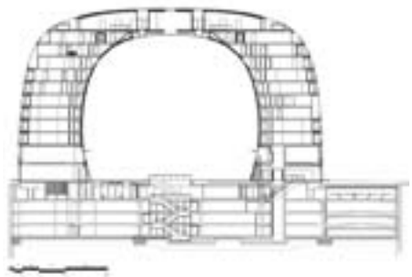
BUILDING VOLUME
Slab Blocks

ACCESS
Vertical Access

APARTMENTS
228 units,
24 penthouses

ADDITIONAL FEATURES
Central market hall, 100 fresh markets produce stalls, covered public space, food related retail units, underground parking.

DESIGNERS
MVRDV



Duolan Commercial Complex

Conceived as a pioneer project in a newly developed part of Hangzhou City, the Duolan Commercial Complex is notable for its architectural integration of multiple programs, and the generous community amenities accessible to both residents of the project and the surrounding high-density neighborhoods.

SELF SUFFICIENT MIXED USE
As one of the first major development in a relatively isolated site, the development was conceived with a high level of on-site amenities and self-sufficiency in terms of retail, employment, and recreation. A diversity of services were accommodated for in the lower levels and in the interior of the site, with work-live units above.

PUBLIC ACCESSIBILITY
The project is easily accessible for both residents of the project and the general public. Most notably, the hill-like roof terraces provide easy access to each level of the units and host a diversity of community facilities.

LOCATION
Hangzhou, China

COMPLETED
2012

BUILDING VOLUME
Perimeter Block

ACCESS
Vertical Access, Interior Hallways,
and Rooftop Terrace

APARTMENTS
200 units,

ADDITIONAL FEATURES
Supermarket, cinema, retail spaces, parking underground gymnasium, outdoor swimming pool, green rooftop with dining venues.

DESIGNERS
BAU Brearley Architects + Urbanists

Ypenburg Center

Located on the site of the former Ypenburg Airport, Ypenburg Center aims to develop a new neighborhood with a sense of urbanity and street life missing from the surrounding suburban neighborhoods. Inspired by medieval Tuscan towns, the scheme consists of mid-rise perimeter blocks which clearly define the streetscape, with towers demarcating points of access to the internal courtyards for community use.

A WELL DEFINED STREETSCAPE
In order to create a vibrant streetscape in a single-phase large scale development, the design has carefully defined the streetscape with mid-rise perimeter apartment blocks populated with retail and commercial programs at ground level. Streets become urban rooms for public and community activities.

ORIENTATION AND URBAN IDENTITY
The mid-rise perimeter blocks are punctuated by thirteen towers, each marking a point of access to the interior courtyards. In addition to increasing the FAR of the development in a controlled way, the towers serve as orientation devices in the immediate streetscape, and presents a distinctive skyline when viewed from afar.

LOCATION
Den Haag, The Netherlands

COMPLETED
2006

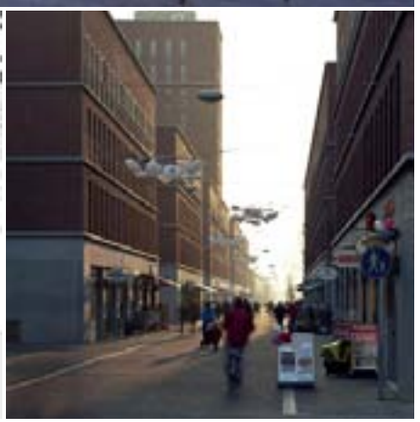
BUILDING VOLUME
Perimeter Block

ACCESS
Vertical Access, Interior Hallways, and Rooftop Terrace

APARTMENTS
586 units,

ADDITIONAL FEATURES
Commercial, retail, underground parking.

DESIGNERS
RAPP + RAPP



AUTHORS

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This book is a compilation of background research into the development of the Mumbai Metropolitan Region in India and a preliminary examination of the Palava City development within that context, including prospects for job creation, environmental management and governance. The work was sponsored through the generosity of the Lodha Group in Mumbai, India.