Note on Ahmedabad

April 17, 2012

From Alain Bertaud

A housing policy focusing on the need of the poor for affordable housing would include two components:

1) Upgrading of all viable existing slums to improve services and allow housing investments by the dwellers themselves in a time frame not longer than 3 years
2) Reforming the way land and housing markets are regulated so that the private sector can provide low cost housing solutions more efficiently and at a higher standards than in the past. Direct government housing assistance should be directed only to the very poor, typically not more than about 10% of the urban population.

This note is focused on the second component.

In Ahmedabad the private sector has been and still is the largest supplier of housing for the great majority of households poor and rich. For instance, between 2001 and 2011 about 6,800 low income households a year have found shelters in the slums of Ahmedabad. While about 18,000 dwelling units per year were built outside slums, in legally developed settlements and in settlements that are legal but whose standards would not be authorized under the land use present regulations.

The contribution of the government in building affordable housing for the poor is not known. By contrast, slum upgrading has been a more effective government contribution to the environmental improvement in the neighborhoods where the poorest households are living. About 60,000. households are now living in slum upgraded during the last 10 years.

The issues to be addressed are therefore as follow:

1) What has been the private sector contribution in building the current low cost housing stock – including units in slums, illegal subdivision, densification of older neighborhood and formal subdivisions – what land use standards have been used, what are the resulting prices?
2) Could the private sector be able to develop legally new housing types that would be affordable to households currently living in slums? And could these housing units be built in locations that meet the requirements of low income households for transport costs and distance to employment?

3) What are the constraints that increase the transaction costs of developers without providing obvious benefits to end users?
4) How has the Ahmedabad spatial development evolved in the last 10 years? What are the development trends likely in the future? Will the new emerging urban shape be compatible with the use of mass transit, or will individual means of transport (mopeds, scooters, motorcycles, motor-rickshaws and individual cars) become the major mode of transport?

A. The evolution of the population and built-up areas of Ahmedabad between 2001 and 2011

1. Change in population

The population of Ahmedabad has increased by 23% ,by an average of 2.1% a year, between 2001 and 2011. By contrast the population in slums has grown by only 1.6% a year (*Figure 1*). This implies that some slum households have been able to "graduate" over the years to a dwelling units located outside slum areas. Slum populations have normally a higher natural growth rate and absorb the bulk of the migration rate from smaller towns and rural areas.

Ahmedabad - Growth of slum and chalis population and areas between 2001 and 2011

	2001	*2011*	*Absolute increase*	*% increase*	*Yearly increase*
Ahmedabad Population (AMC area) [1]	**4,520,255**	**5,570,585**	**1,050,330**	**23%**	**2.1%**
Built-up area (Km2) [2]	185	212	27	14%	1.4%
Built-up density (p/ha)	244	262	19	8%	0.7%
Slum and chalis area (Km2) [3]	14.9	15.3	0.4	2%	0.2%
Density in slums (p/ha) [4]	1070	1230	160	15%	1.4%
population in slums and chalis	1,596,800	1,880,300	283,500	18%	1.6%
% of slum and chalis population over total AMC population	35.3%	33.8%	-1.6%	-4%	-0.5%
Population living in formal areas (outside slums and chalis)	2,923,455	3,690,285	766,830	26%	2.4%
Areas of formal development	170	197	26	16%	1.5%
Densities in formal areas	171	187	15.9	9%	0.9%

[1] 2001 and 2011 census data corresponding to current AMC boundaries
[2] built up area as measured on Google Earth imagery dated Oct 2000 and jan 2001 for the year 2001 and May and Nov 2010 for 2011
[3] Slum areas measured on Google Erath imagery dated as above. Were included slums that have no apparent planned street structures and settlements with streets narrower than about 3 meters
[4] Average densities in slums extrapolated from a detailed topographical and social survey in 15 slums done by SEWA-MHT in 2001 and 2011

Figure 1: Evolution of population and built-up areas in the AMC between 2001 and 2011

The area of land developed between 2001 and 2011 has increased at a slower rate than the population, resulting in higher densities in the built-up areas in 2011 than in 2001. This increase in average built-up density is exceptional for a city of the size of Ahmedabad (Angel 2011). Given that between 2001 and 2010 the nominal

median household's income has increased on average by 170% and that as a consequence households should have been able to afford larger houses, this countertrend in land development shows a serious land supply constraint. This land supply constraint, however, is not caused by a lack of transport infrastructure – as it is often the case in other parts of India – Ahmedabad has developed a large number of arterial roads during the last 10 years – but by severe regulatory constraints that are discussed in a section below.

The areas occupied by slums have barely increased by 2% over 10 years, while the slum population has increased by 18%. This implies that a densification of existing slums occurred during this period. As shown below, the morphology of slums allows densification through the occupation of existing open space or the subdivision of existing dwellings.

2. Change in slum population between 2001 and 2011

Evaluation of the number of dwelling units produced per year between 2001 and 2011 per type of land use

	year 2001				year 2011						
Type of use	*built-up area (km2)*	*density (p/ha)*	*population*	*Households or housing units*	*built-up area (km2)*	*density (p/ha)*	*population*	*Households or housing units*	*Additional number of units created*	*Average number of units created per year*	*Total addition to the built up area (ha)*
Mix Built-up	121.14	138	1,669,096	370,904	142.51	148	2,104,960	473,038	102,134	10,213	2,137
Old City	5.60	665	372,633	82,806	5.60	750	420,020	94,389	11,583	1,158	-
Slums and chalis	14.92	1,070	1,596,839	354,847	15.29	1,230	1,880,300	422,551	67,704	6,770	36
Gamtal	10.73	700	751,161	166,922	11.69	850	993,485	223,261	56,340	5,634	96
Industry	15.77	50	78,853	17,523	16.69	60	100,161	22,509	4,986	499	92
Villas in large estates	17.25	30	51,753	11,500	20.47	35	71,660	16,104	4,603	460	322
Total	185.41	244	4,520,335	1,004,501	212.25	262	**5,570,585**	1,251,852	247,351	24,735	2,684

Sources: aggregate population :census data; area per land use type: Google earth image measurements; population per land use type: density measurement
File: AB_pop and land use 2000_2011.xlsx

Figure 2: evaluation of the number of dwelling units produced between 2001 and 2011

By measuring the changes in the different types of land use within the built-up area and the increase in the total population it is possible to extrapolate the number of dwelling units built in each type of area between 2001 and 2011 (*Figure 2*). About 25,000 dwelling units were created on average each year between 2001 and 2011. Of these, about 5,600 units were created in slums. So while the areas occupied by slums have not increased much, about 23% of the new housing stock has been built in slums.

The maps of *Figure 3 and 4* show the spatial distribution of slums within the metropolitan area in 2001 and 2011. Heavy concentrations of slums are found in the East and North of the city. On the positive side, most slums are relatively small and close to existing primary infrastructure.

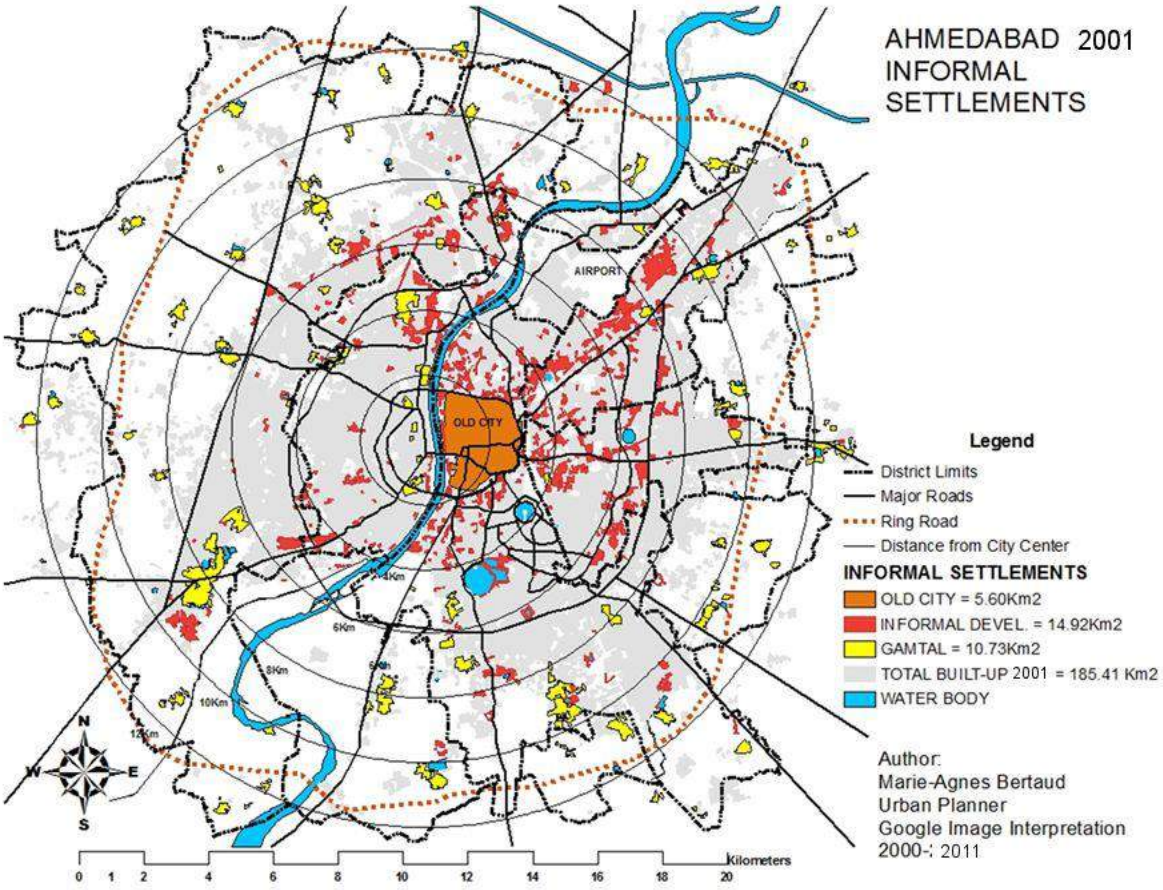


Figure 3: Built-up area and areas occupied by slums in 2001

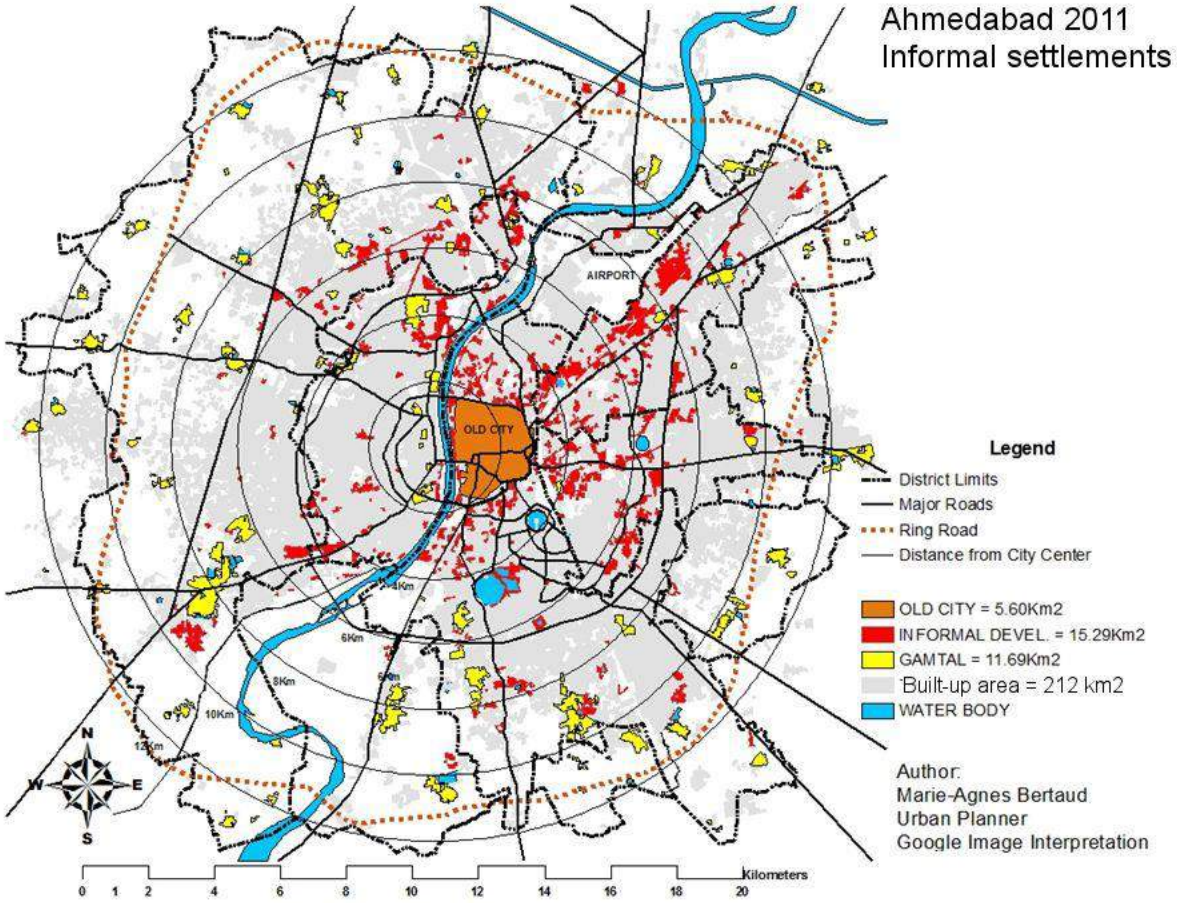


Figure 4: Built-up area and areas occupied by slums in 2011

The map of *figure 5* shows the extension of the areas built between 2001 and 2011. The fragmentation of the urbanization in the Western part of the city contrasts with the relative compactness in the East. One of the reasons might be the difference in income between West and East. The higher income households in the West can better afford the transport costs linked to the dispersion. The large number of TP schemes in the West may also account for this dispersion as we will see below.

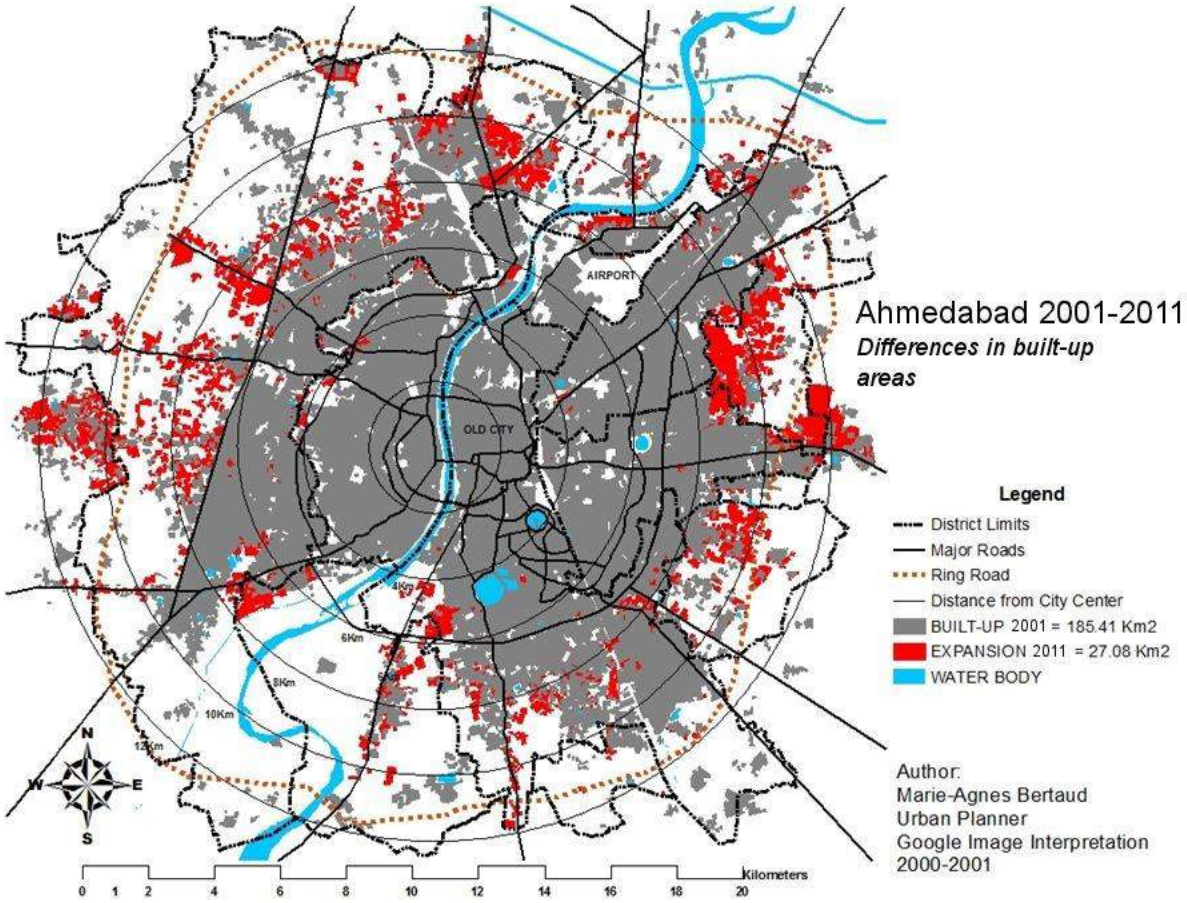


Figure 5: Location of newly developed areas between 2001 and 2011

B. Is a private sector solution to low income housing possible in Ahmedabad?

In Ahmedabad about 35% of the population lives in slums[1] or "chalis". However, about another 45% live in settlements that have been privately built but do not meet the current planning standards established by the GDCR (General Development Control Regulations). These "not to standards" settlements include gamtals, the old city, and private subdivisions. We will call "illegal subdivisions" the settlements that have been built without permit and that have standards below

[1] Based on: a) a measurement of areas occupied by slums made on Google Earth imagery for 2001 and 2010 for the entire area of the AMC (2005 boundaries), and b) on density measurements on detailed topographical and biometric surveys conducted by SEWA-MHT in…

the GDCR. Land use surveys have shown that the great majority of the population of Ahmedabad (about 80%) is currently living in settlements that use land in way that differs significantly from the minimum standards established by law. Infrastructure and urban services are usually deficient to different degree in both the slums, chalis and illegal subdivisions. However, it is clear that the land use standards used in illegal subdivisions, while not meeting the GDCR standards, are quite acceptable or are even desirable for a large part of the population. The market price of pucca housing found in illegal subdivision ranges from Rs 2 lacks to 12 lacks and above. This is to be compared to the Rs 8 lacks and above found in legal subdivisions. The land development standards used by illegal developers vary from scheme to scheme. Whatever their shortcomings in the allocation of space, these standards have the great merit to be affordable to a large number of households under current market land price and allow the construction of a pucca house by the buyer of the plot in a location that is acceptable in terms of transport costs to employment centers. The standards of some illegal subdivisions are barely distinguishable from those of slums at the low end of the market; however in some subdivisions the allocation of land between public and private space is both efficient and socially desirable.

To solve the affordability problem of the majority of lower income households in Ahmedabad it would make sense to study the land use standards that have been used by various developers in the past and select and adapt the types of layout that are more attractive from environmental and economic criteria. Obviously, the type of layout to be recommended for legalization in a central location would differ from layouts adapted to suburban locations. The current legal land use standards discussed in a section below are arbitrary, rigid and are ill adapted to high land prices. By contrasts, many subdivisions built at a time when land development was submitted to more benign legal constraints have been submitted with time to a Darwinian process. By surveying the land use of these older subdivisions and the environmental satisfaction of its inhabitants it might be possible to develop standards that are more anchored in the urban culture of Ahmedabad and less prisoner of an arbitrary and abstract geometry. In any cases, it doesn't make sense to persist in enforcing land use regulations that results in costs that are unaffordable to about 40% of the population of Ahmedabad.

1. The land use standards in slums and chalis

The plot size – equivalent to the dwelling size – varies a lot within slums and between slums. The graph of *figure 6* shows the variations of plot sizes in a sample of slums which were the object of a detailed topographical survey. It shows that about 58% of dwellings have an area of less than 25m2 (269 sq feet) , the legal minimum for a dwelling in GDCR is 250 sqr feet (23,23 m2). However, it is

important to note that plot sizes vary enormously within a slum, from 4m2 to 100 m2. By adjusting the quantity of floor and land they consumed poor households are able to afford to live in relatively central location.

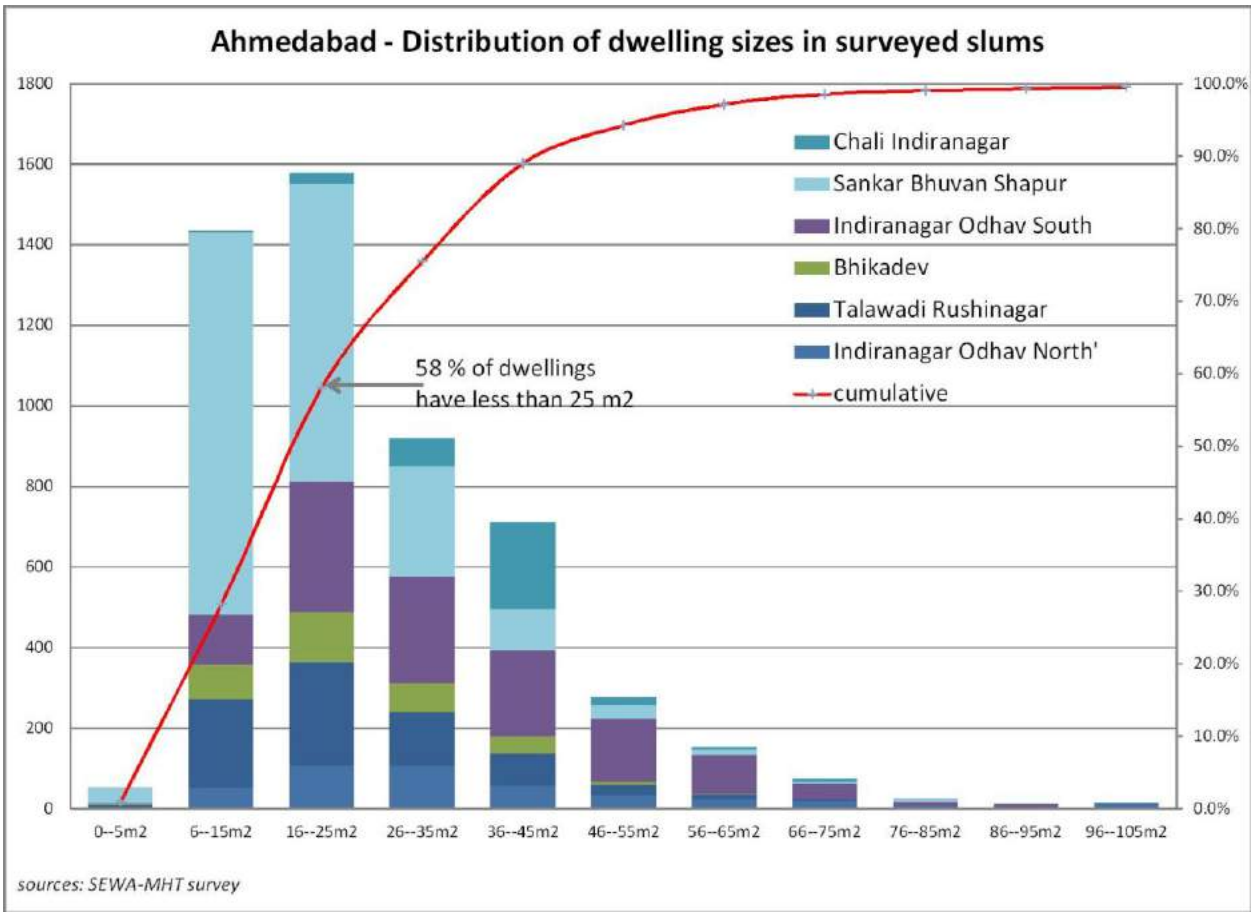


Figure 6: distribution of plot sizes in a sample of slums and chalis in Ahmedabad

The land used for road and open space – 37% – is surprisingly high in slums (*figure 7*). Roads and passages are narrows, often below 3 meters (much below the permissible width of streets in GDCR). However, plot sizes are small and there is often a small passage between dwellings to allow roof drainage. As a consequence the total amount of land lost by the multiplicity of small passages is significant. In addition, the growth by successive aggregations contributes also to a significant loss of space as compared to a planned lay-out as seen in illegal subdivisions.

Land use summary of 6 slums surveyed

Total land area	m^2	216,164
Total floor area	m^2	137,157
Average gross FAR	m^2	0.63
Street area	m^2	79,007
Percentage of street area		37%
Number of dwellings		5,279
Average household size		4.8
Number of people		25,339
Population density	p/ha	1,172
Average dwelling size	m^2	26
Floor area per person	m^2	5.4

Sources: SEWA-MHT survey

Figure 7: land use in slums surveyed

The loss of space due to the inefficiencies of spontaneous lay-out has to be compensated by smaller plot sizes as illustrated by the typical slum land use as shown on *Figure 8.* The amount of open space explains the absorption capacity of some existing slums. It is much less in chalis. The high density reached in the slum shown on *Figure 8* (1,544 p/ha) is made possible by the exiguity of many individual plots.

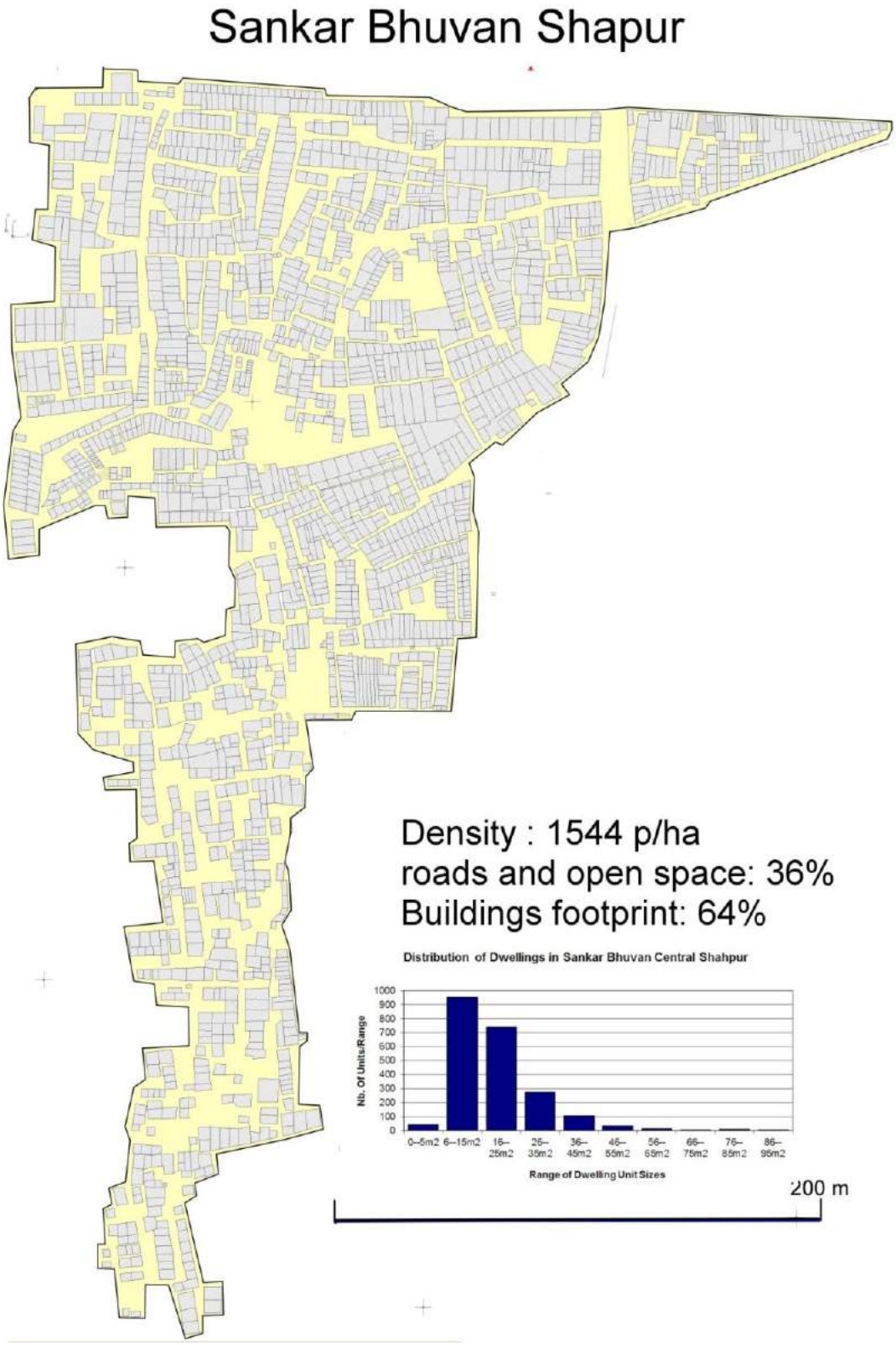


Figure 8: Map of a typical slum

2. The land use standards in formal but illegal subdivisions

Illegal subdivisions were often built in the past at a time where authorities had a more benign attitude toward land use standards. Because these subdivisions were privately built, their standards had to clear the market in terms of price and consumers preferences. The typical built-up foot print of these settlements is around 75% compared to the maximum footprint of 45% required by the GDCR in new subdivisions. The higher built-up footprint allows lower, cheaper buildings and more flexibility in space allocation between households. *Figure 9* shows typical layouts and land use in 2 different subdivisions located respectively at 11 and 8 km from the CBD.

Figure 9: layout and land use in two typical illegal subdivisions

The land development plan of an existing community built in the north-West suburb of Ahmedabad (called site H in the typology) could be used as a model for new land use standards for low income subdivisions. The design is simple: a main street 6.5 meter wide that constitutes a commercial spine connecting pedestrian alleys 2.5 meter wide, themselves not longer than about 60 meters. Town houses with common walls are built on lots typically 3 to 4 meters by 12. A private narrow staircase, often common to 2 adjacent plots, gives access to the upper floors that can

be used as independent dwellings or part of the lower floor dwelling. The subdivision represented on *Figure 10* achieves an FSI of 2.11 with only about 50% of the plots having 3 floors. Under the GDCR rule of 1.8 maximum FSI 45% footprint and 25% of lots provided with a parking, to achieve the same number of dwellings the same plot of land would have to be developed with 5 floors requiring the use of an elevator and incurring the loss of usable floor space due to wide staircases and corridors.

The standards of site H suggested as models are applicable to only small projects between 1 and 3 hectares and with less than 2,000 dwelling units. These standards would not apply for large subdivisions. Anyway it is not advisable to develop large homogenous low income estate. Infilling small lots in already built area usually respond better to locational demand for low income households. A mix of income groups on the same site can be achieved when addtitional floors can be consolidated into one dwelling.

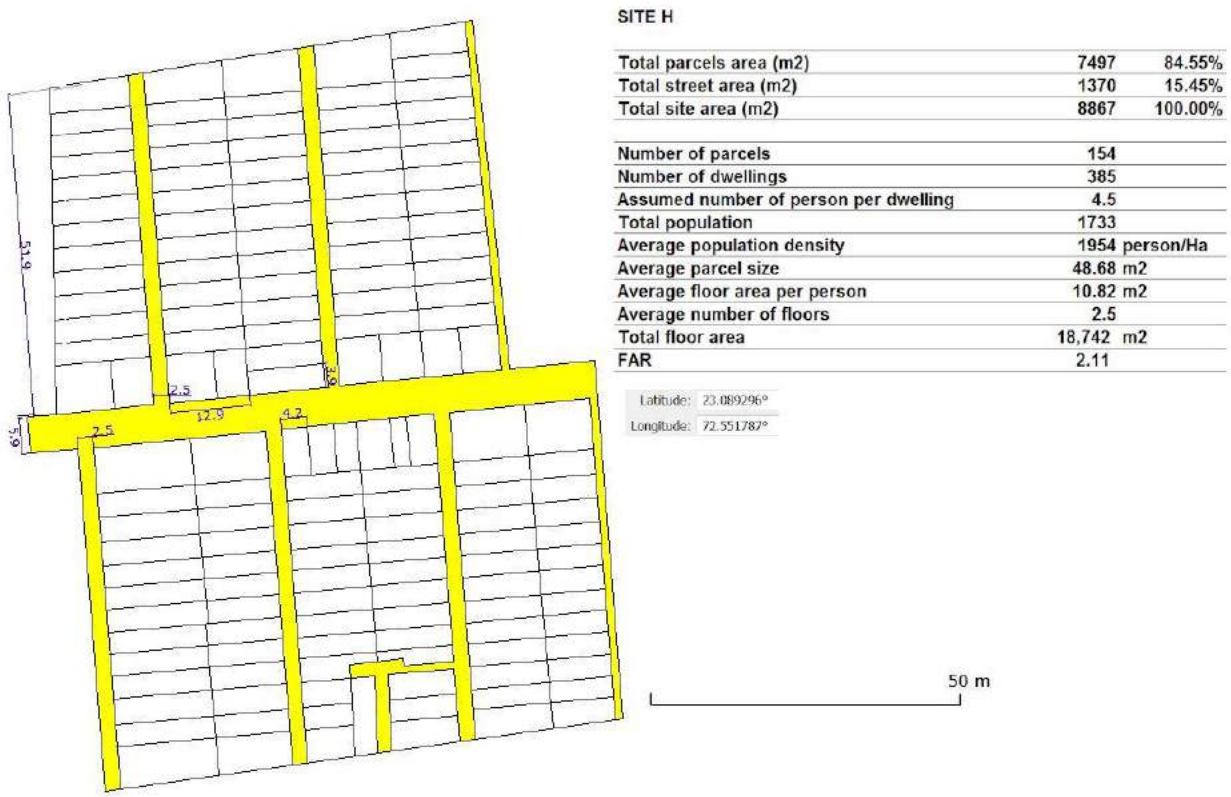


Figure 10: typical layout that could be used to set new standards

Land use standards should not be based on abstract numbers but should be the result of an allocation of space between private and public use that has to be acceptable to the community they serve. The standards proposed here are already in use in many communities and it is easy to test their acceptability and the quality of the environment they provide in relation to the location and to the income of the community that inhabit them. *Figure 11* shows some typical townhouses built in the

settlement of *Figure 9*. There are many variations on the typical layout shown on *Figure 9* and their relative merits should be tested by surveying the communities that inhabit them.

Figure 11: Typical row houses in Site H

A number of sites layouts and housing types were surveyed to form a typology on which to base future reform of the land use regulatory framework. The graph shown on *Figure 12* shows horizontally the floor size of the dwellings and vertically the land consumed by each dwelling. The land consumed is calculated by using the FSI of the settlement, it includes therefore the land used for streets and open space and not only the footprint of the building. The graph shows the wide array of solutions and different combination of floor space and land area used. However, the bottom right part of the graph (large floor area, low land consumption) does not contain any housing types. Normally this space will be occupied by high income high rise apartment buildings. The current regulations prevent these types of buildings from being built. If there is demand for such buildings in Ahmedabad it would be to the benefit of the entire community to build them as it will reduce the demand for land and as a consequence prevent land price inflation in the future.

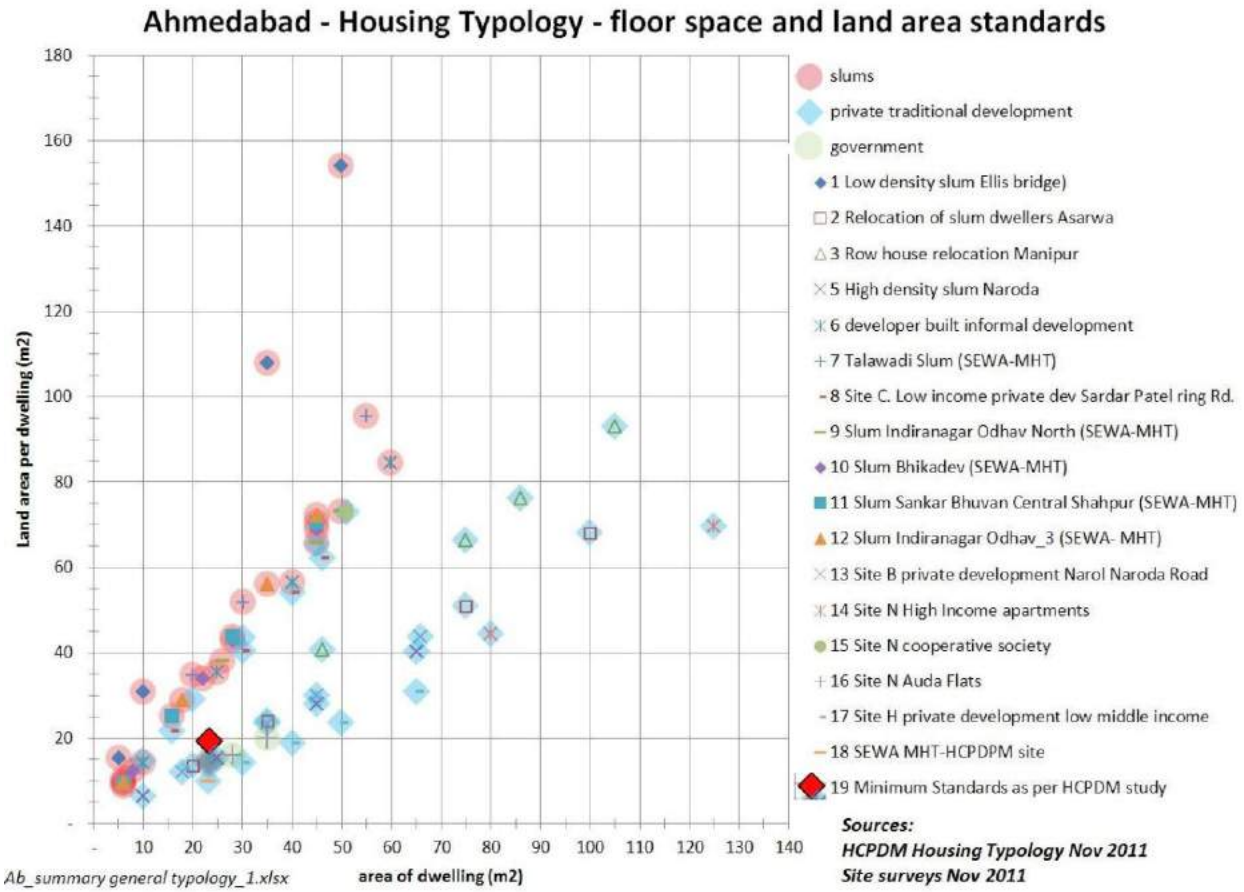


Figure 12: Land use and floor space consumption of housing typology

C. Housing supply and demand: the state of the current equilibrium

By definition, every household living in a city can afford the type of housing it is living in. Therefore, if we can match the number of households ranked by their income with the dwelling they live in we would have a snapshot of the current equilibrium between housing supply and demand in a given year. If we can repeat the exercise in subsequent years we would be able to see how elastic is the supply when income change and how a new equilibrium is reached by a combination of supply response and price increase.

The income distribution of households within the AMC current boundaries is shown for 2001 and 2011 on the two graphs of *Figure 13*. The incomes are compared in nominal terms and inflation is not taken into account. The population living in slums is shown as yellow bars while the population living outside slums is shown as blue bars. Predictably, the slum population is mostly clustered at the left part of the graph for the 2 years measured. However, we can see an overlap between the income

of the more affluent households living in slums and the income of the less affluent living in formal housing.

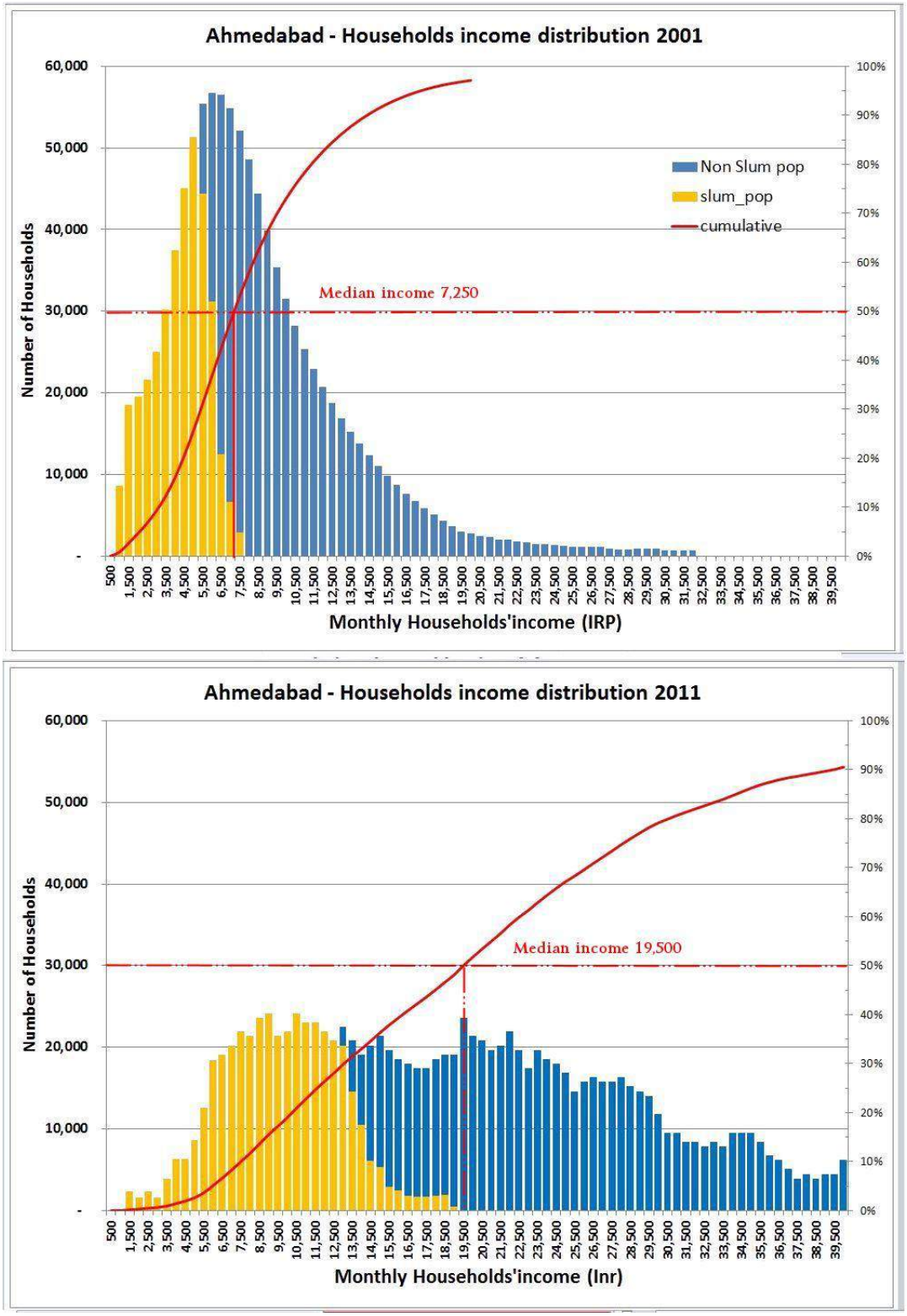


Figure 13: Evolution of income distribution between 2001 and 2011

If the supply of housing were perfectly elastic any increase in income for the higher income slum dwellers would allow them to move into formal housing. If the supply of housing were completely inelastic then higher incomes would result in higher prices and a general increase in income would results in households living in the same type of housing in spite of their increased income.

The graph of *Figure 13* shows that most households who were living in slums in 2001 are liklely to be still living in slums in 2011 in spite of a large increase in nominal income. However, if we take into account the demographic conditions in slums (higher natural growth rate, higher rate of in-migration) it is clear that quite a number of slum dwellers must have "escaped" from their slum by affording housing in the formal sector. If it was not the case the proportion of slum dweller in the total population would have increased (as it appears to be the case in Mumbai). For the slum households whose increase income allowed them to move out of a slum, it is likely that they have moved to the older part of the formal housing stock, which is cheaper and often more centrally located than the newer part of the housing stock.

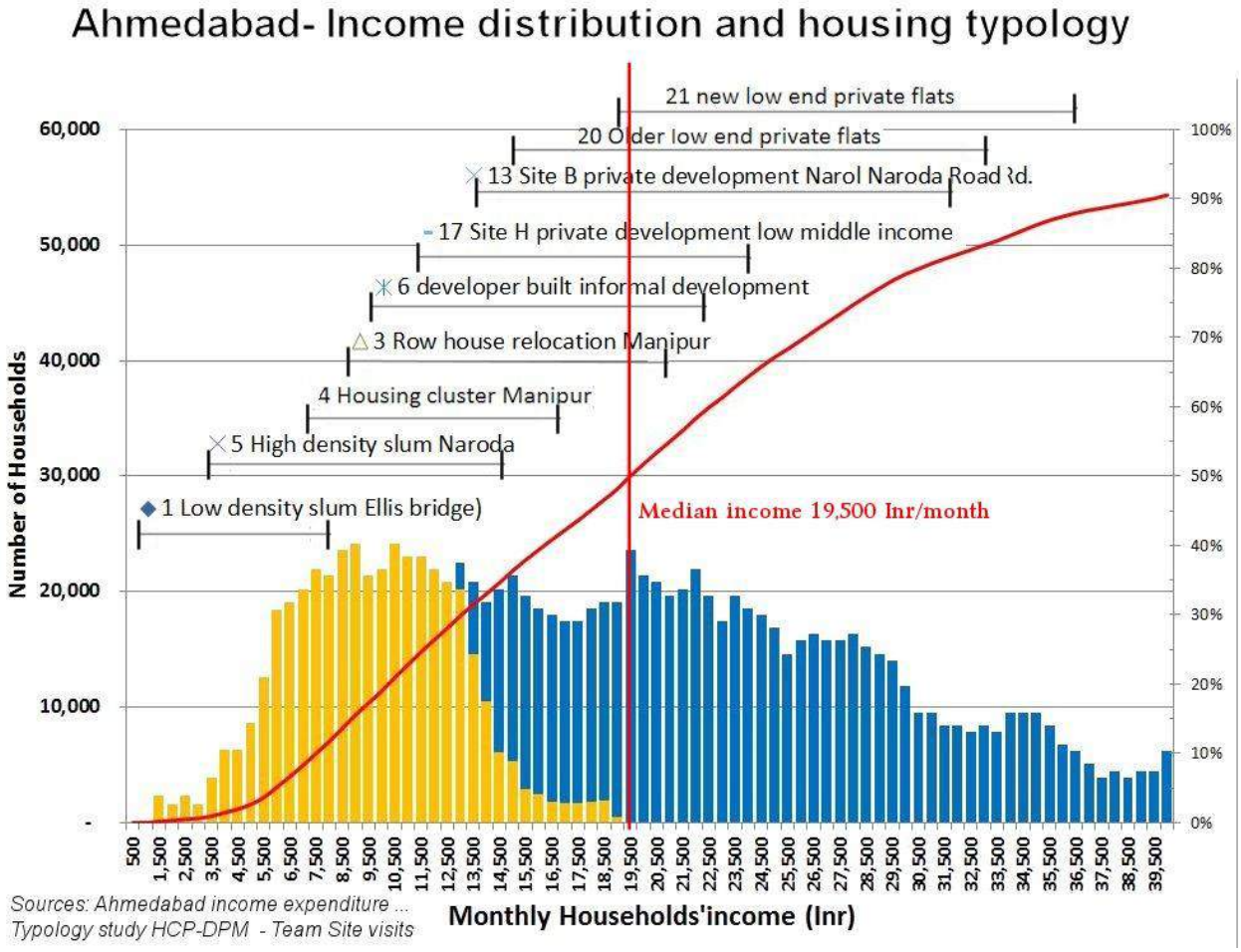


Figure 14: Households' income distribution and current typology

Theoretically, it should be possible to match each household income with a housing type. We have tried to superimpose the housing typology to the Ahmedabad households' income distribution for 2011. This should show the type of formal housing that should be affordable to slum households at the limit of the income threshold that keep them in slums. Ideally, an increase in supply for this type of housing should allow slum dwellers with increasing income to leave their slums for better formal housing. Upgraded slums may also often offer the same environmental quality than the low end of the formal housing market.

If we take the current income distribution of slum dwellers we should be able to define what housing price each income group could afford. Based on some of the data collected during the typology study, we have tried to define affordability by a range of price / income ratio (PI ratio). At the very low end of the income distribution, less than INR 7,000 per month, households can hardly afford any expenditure on housing except for a very low rent for a small hut in an existing slum. The 2011 households' income distribution shows that about 8% of Ahmedabad population has a monthly income below INR 7,000 or about 24% of the total slum population in 2011. For the other 76% slum dwelling households, there should be a free market housing solution once the GDCR constraints are removed.

We have used a PI ratio between 2 and 3.5 for monthly income above INR 7,000 to calculate the range of price that slum dwellers could afford on a free market (*Figure 15*). Individual households vary in their capacity to save and borrow from banks or relative, hence the range of PI ratio for the same income groups.

For instance, for a land cost of INR 16,000 /m2 and a construction cost of INR 8,000/m2 a dwelling of 12 m2 would cost INR 1.7 lacks if the same land use standards shown on the plan of *Figure 11* were used (84% coverage, 3 floors) while the same 12 m2 dwelling on 3 floors would cost 2.4 lacks or 38% more if GDCR standards were used. In fact the GDCR standards penalize low buildings as it force to use a large amount of land on the ground for large streets, open space and parking.

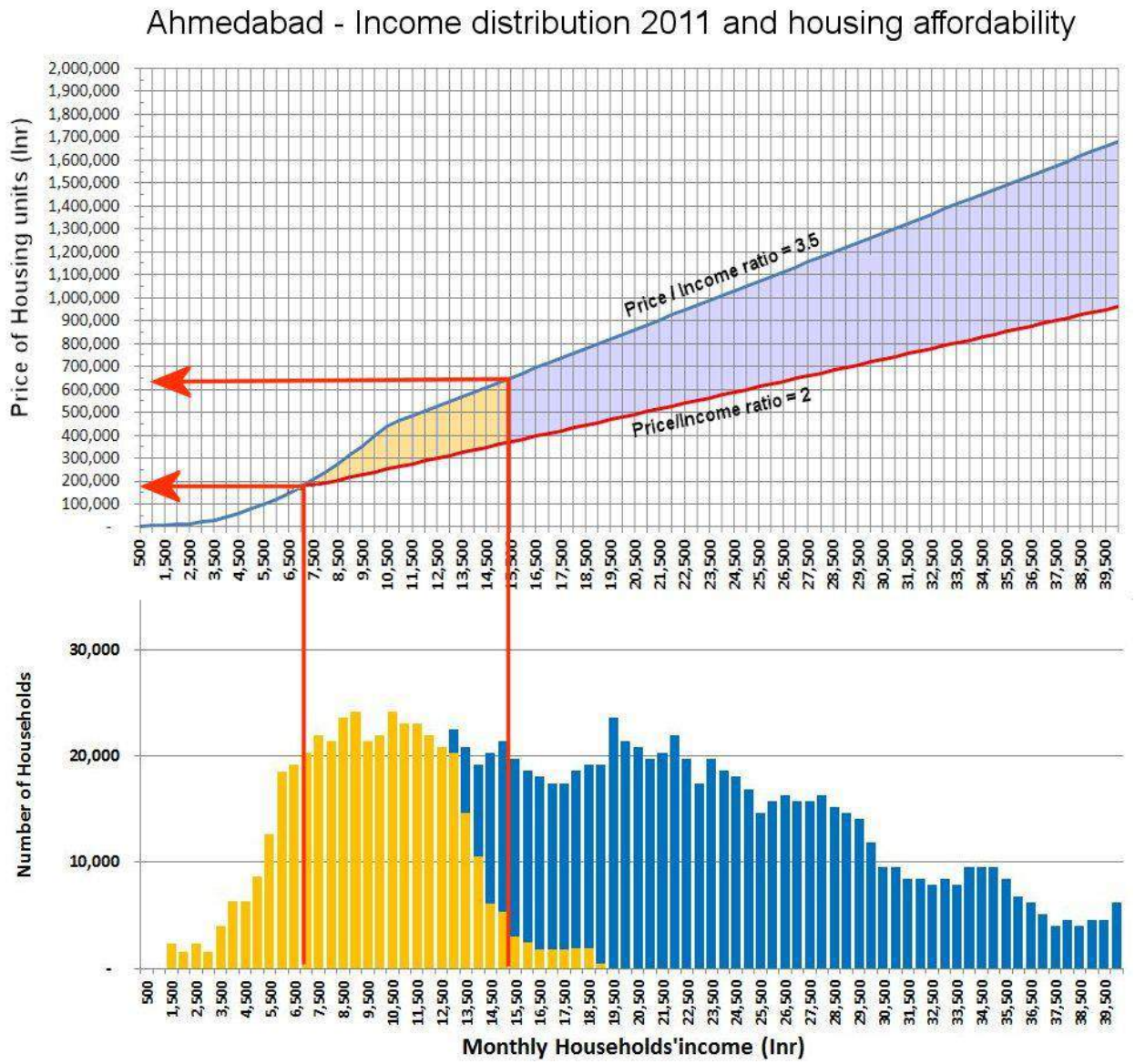
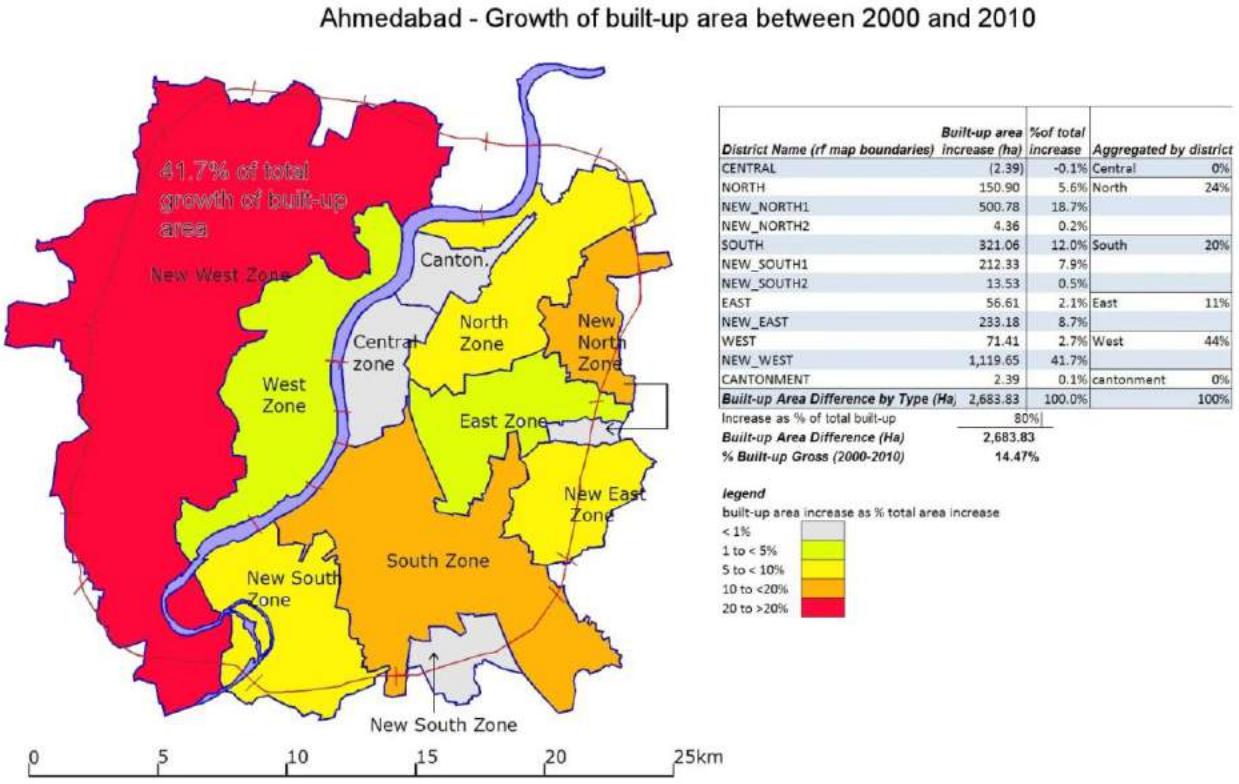


Figure 15: Households' income distribution and affordable housing prices

The range of affordable price for households with a monthly income between INR 7,000 and INR 15,000 (which includes the majority of the population currently living in slums) is shown in yellow shaded area in the upper part of the graph of *Figure 15*. For a PI ratio of 2 the price of housing should be between 1.8 lacks to 4 Lacks. If small formal projects were allowed to be built in order to meet these target costs with varying standards depending on land prices and location, households currently living in slums would be able to move to formal housing when their monthly income increase above 7,000 rupees. The rigidity of the current standards freeze the supply of low cost housing and condemn current slum dwellers to stay in slums when their income increase, paying always more for the same low quality dwelling.

D. Evolution of the city spatial structure between 2001 and 2011

The various regulatory constraints described above were tested for their impact on the poor. However, land use regulations like maximum FSI and maximum land coverage have also unforeseen side effects on the structure of cities. We will now consider the effects of current regulations like maximum FSI but also of TP schemes administrative constraints on the spatial structure of Ahmedabad. The viability of the dominant mode of transport – transit or individual means of transport (motorcycle or private cars) depends largely on the nature of urban spatial structures. The mobility of workers and consumers depends largely on the efficiency of urban transport, which in turn depends on the spatial structure of cities which are often irreversible in the short and medium term. We will then study the pattern of spatial development of Ahmedabad metropolitan region and try to anticipate structural problems that could be corrected become they become irreversible.



District Name (rf map boundaries)	Built-up area increase (ha)	%of total increase	Aggregated by district	
CENTRAL	(2.39)	-0.1%	Central	0%
NORTH	150.90	5.6%	North	24%
NEW_NORTH1	500.78	18.7%		
NEW_NORTH2	4.36	0.2%		
SOUTH	321.06	12.0%	South	20%
NEW_SOUTH1	212.33	7.9%		
NEW_SOUTH2	13.53	0.5%		
EAST	56.61	2.1%	East	11%
NEW_EAST	233.18	8.7%		
WEST	71.41	2.7%	West	44%
NEW_WEST	1,119.65	41.7%		
CANTONMENT	2.39	0.1%	cantonment	0%
Built-up Area Difference by Type (Ha	2,683.83	100.0%		100%

Increase as % of total built-up	80%
Built-up Area Difference (Ha)	2,683.83
% Built-up Gross (2000-2010)	14.47%

legend
built-up area increase as % total area increase
< 1%
1 to < 5%
5 to < 10%
10 to <20%
20 to >20%

Figure 16: Map of new land development by district

Forty two percent of the land developed in Ahmedabad between 2001 and 2011 has been located within the "new West Zone" corresponding to the 2004 territorial addition to the AMC boundaries. The map and table of Figure 16 shows the pattern of developed land increase in the AMC. It is important to note that this map and data concern only the land developed it does not necessarily correspond to

the increase in population, which often has occurred through densification of areas already developed before 2001.

The table of *Figure 17* shows the change in land use between the various zones shown on the map of *Figure 16*. We can see that the bulk of the increase of the land occupied by slums has been relatively even geographically. Practically no growth occurred in the cantonment area, although it is one of the lowest developed area of the city while being the best located in term of infrastructure and access to the city center.

District Name (rf map boundaries)	Mix Built-up	Old City	Inform.Devel.	Gamtal	Industry	Large Estate	Built-up area increase (ha)	%of total increase	Aggregated by district	
CENTRAL	(2.36)	-	0.01	-	(0.04)	0.00	(2.39)	-0.1%	Central	0%
NORTH	111.85	-	8.08	2.99	(9.83)	37.81	150.90	5.6%	North	24%
NEW_NORTH1	502.61	-	2.97	(2.57)	-	(2.23)	500.78	18.7%		
NEW_NORTH2	4.37	-	(0.01)	-	-	-	4.36	0.2%		
SOUTH	279.15	-	10.06	33.54	(1.97)	0.27	321.06	12.0%	South	20%
NEW_SOUTH1	99.33	-	5.40	14.41	92.92	0.27	212.33	7.9%		
NEW_SOUTH2	10.67	-	-	2.86	-	-	13.53	0.5%		
EAST	102.85	-	(0.74)	(3.23)	(41.51)	(0.75)	56.61	2.1%	East	11%
NEW_EAST	203.12	-	(0.00)	9.85	2.75	17.47	233.18	8.7%		
WEST	56.30	-	2.61	(0.02)	5.77	6.74	71.41	2.7%	West	44%
NEW_WEST	769.31	-	7.91	37.88	42.11	262.45	1,119.65	41.7%		
CANTONMENT	0.01	-	-	-	2.09	0.30	2.39	0.1%	cantonment	0%
Built-up Area Difference by Type (Ha)	2,137.20	-	36.30	95.72	92.29	322.32	2,683.83	100.0%		100%
Increase as % of total built-up	80%	0%	1%	4%	3%	12%	100%			
Built-up Area Difference (Ha)	2,683.83									
% Built-up Gross (2000-2010)	14.47%									

Figure 17: Differences in land use between 2001 and 2011

The spatial distribution of densities in a city has an important impact on labor mobility and transport efficiency. The map of *Fig 18* shows the distribution of population densities in built-up areas per ward. The distribution of densities present 2 anomalies: 1) the high densities areas are nearly exclusively to the East of the Sabarmati river and 2) the high density areas expand at more than 14 km from the center on the East side while the areas within 5 km from the CBD on the West side have relatively low densities. The east side has a lot of industrial and informal employment but most of the modern sector is expanding on the West side. This spatial pattern of densities reflects of course a form of income segregation between East and West. The effect of on the efficiency of transport might large in the future, as a mass of workers and consumers would want to commute from East to West across the few bridges on the Sabarmati River.

Unfortunately we could not have access to the ward level population from the 2011 census to know if the trend shown in 2001 had continued or reversed in 2011.

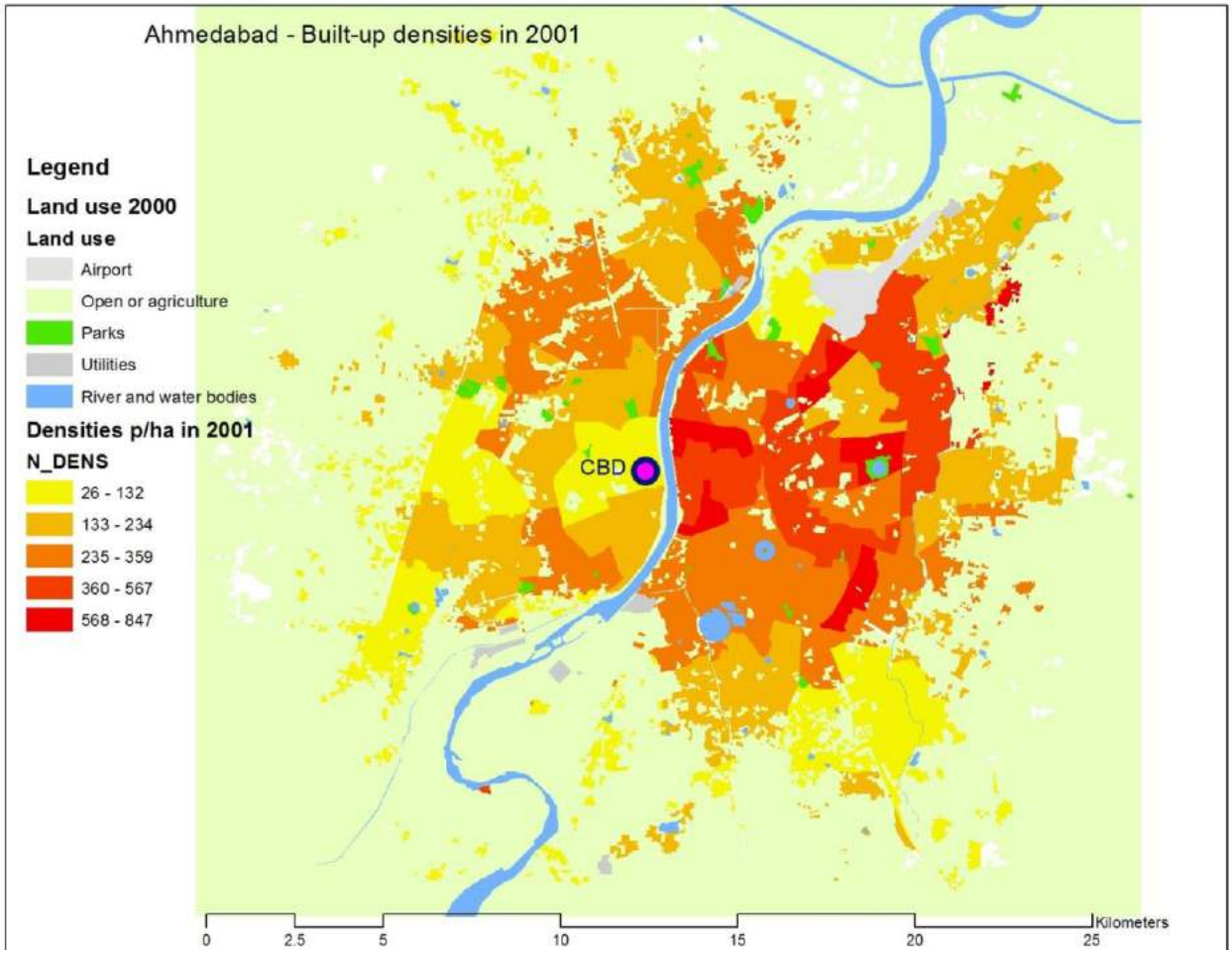


Figure 18: Ahmedabad population densities in 2001

The profile of population density in 2001 shows the traditional decrease in density from the center to the periphery although the profile would be very different if one was drawing a separate profile for the west bank and east bank of the Sabarmati river. The average built-up density in 2001 244 people/hectare and reached 262 p/ha in 2011. This increase in density with time is exceptional for large cities. In itself it may not be a cause of concern if the density pattern was more homogeneous between the 2 banks of the river.

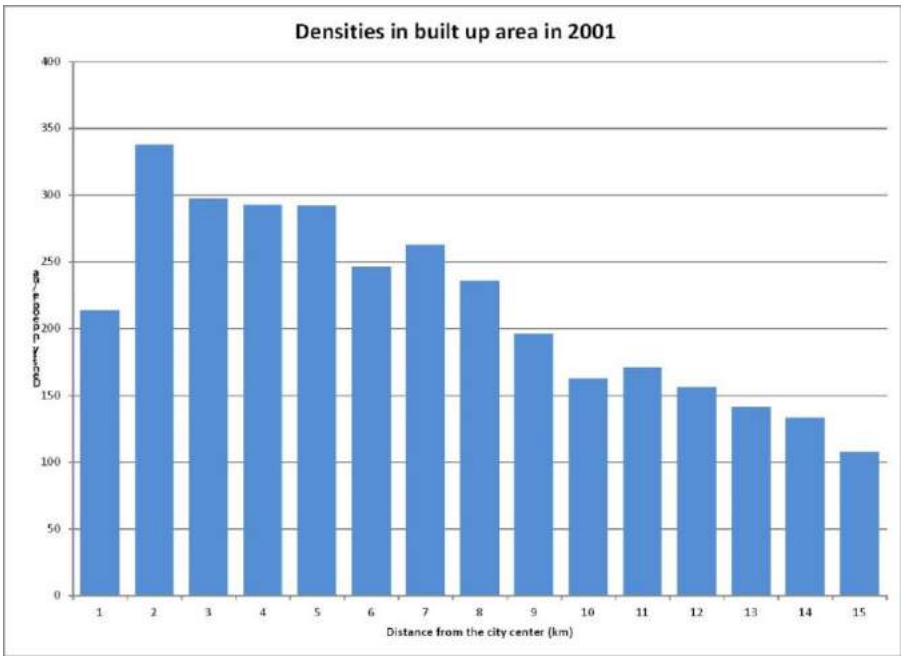


Figure 19: profile of population densities in 2001

The comparison between the profile of densities between 1991 and 2001 shows the large structural changes that have occurred between these dates. There has been a large increase in the density close to the center. Mostly this densification has occurred in the old city, which densely built but not densely inhabited in 1991. The densification of the periphery has also been spectacular.

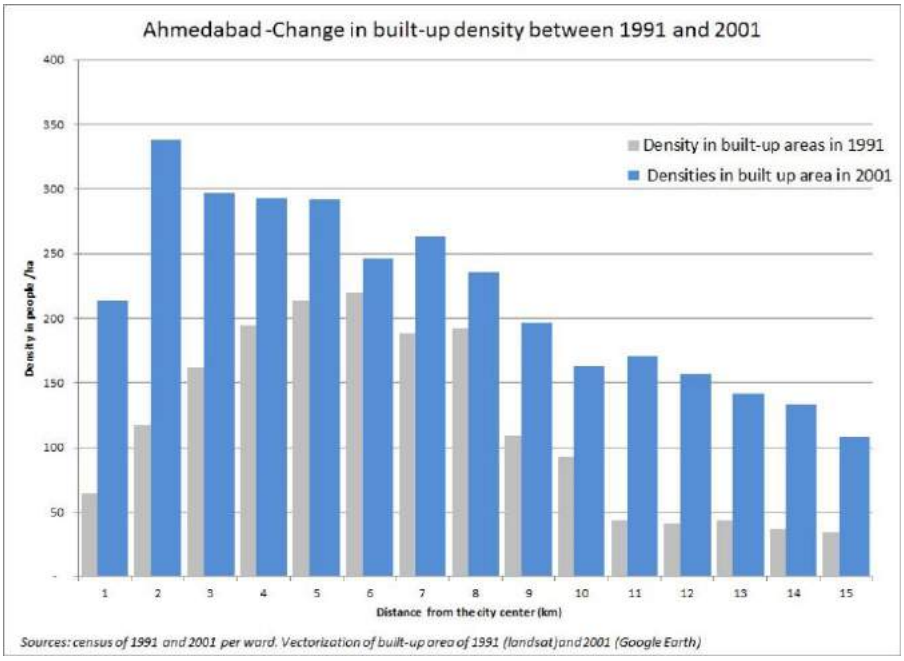


Figure 20: Profile of population densities in 1991 and 2001

E. Regulatory constraints on housing supply

1. Regulatory constraints on land supply

a) Land conversion from agricultural use

The constraint on land conversion from agricultural to urban use increases the supply constraint on land and therefore contributes to the high price of urban land. The time required and the legal cost incurred to convert land greatly decrease supply elasticity and increase transactions costs. There is no benefit possible in requiring a permission to convert agricultural land to urban use within the AMC boundary or even AUDA boundary. The land within these boundaries has already been declared urban by competent authorities. The preservation of green recreational areas within these boundaries should be the responsibility of urban planning authorities and has very little to do with agriculture.

b) Impact of TP schemes

The creation and implementation of TP schemes in Ahmedabad resolve the problem common to many fast developing cities: how to reserve the right of ways of primary and secondary roads in advance of development. The TP schemes implementation process has been continuously improved over the years so that the delimitation between private and public land (streets, parks and government land reserves) are now made in a timely and transparent manner. The inability however to complete the legal process to allow land owners whose land has been shifted to build in a timely manner creates a major problem resulting in scattered development and in an artificial land shortage. The revenue department has become that is supposed to register properties one by one and to collect stamp duty has become a major bottleneck in Ahmedabad land supply.

However, the current administrative bottleneck doesn't freeze all land under the TP schemes from formal development. What proportion of land under TP schemes is frozen by the inability to complete the entire administrative process is not known. Here is an attempt at a rough calculation.

A land owner receives typically a developable lot whose area is about 54 % of his original undeveloped land. Some part of this developable land usually coincides with the original boundary of its original property. The land owner can build on the portion of its original plot that is allocated to him/her after final plot boundary attribution, but he/she cannot build on the part of the land that might has been shifted from its original boundary. For some land owners the final plot will be entirely contained within its original property boundary, while others might have to shift entirely to a new plot. The ability to build before the administrative process is completed depends therefore on the proportion of the area of final plot that coincide

with the original property of each land owner. This proportion for individual land owner might vary from 100% to 0%. Usually, town planning officers who design TP schemes try to keep the boundaries of original plot as identical to the original as possible, but this is not always possible.

Because of the current administrative bottleneck, the ability of TP schemes to increase the supply of developable land depends entirely on an unknown and eminently idiosyncratic parameter: how much land is retained by land owner that lay within its original boundaries!

A quick calculation on a portion of a specific TP scheme in the North of Ahmedabad suggests that this figure is around 73 %. However this figure might not be representative of all TP schemes. If we take 73% as plausible, it means that under the current conditions for every square km of land under implemented TP scheme only about 39% (73% of 54%) is actually on the market for developable. If one takes into account that many developers may not want to build on parcels in areas where there are no schools and amenities nearby this further reduces the area of developable land effectively on the market.

The administrative bottleneck affecting TP schemes has therefore two main effects:

1. It reduces the supply of land and therefore increases its price, making land unaffordable to low and middle income households
2. It contribute to the dispersion and fragmentation of the built-up area in the suburbs as adjacent piece of land for which there is equal demand cannot be developed for administrative reason.

c) Impact of low and uniform FSI on land supply

The practice, common in India, to impose a uniform FSI to an entire city has many negative impacts. This practice increases the consumption of land in suburban areas where there will be little demand and it decreases the area of floor space built in areas where there is a high demand.

By failing to distinguish between commercial and residential land the current 1.8 FSI imposed on Ahmedabad contributes to disperse commercial activities into distant suburbs. The modern service sector CBD that emerged in the 80s along Ashram road around Nehru Bridge is now anemic because the low FSI doesn't allow the construction of a modern CBD. Instead, small office and commercial centers are being built in suburban areas along ring roads and radial roads. This dispersion of business and commercial activities will have consequences for the transport system of Ahmedabad. The dispersion of jobs along suburban roads will destroy the

viability of a mass transit system.

The current density of Ahmedabad (262 p/ha) is quite high per international standards. This density is not compatible with a dominant mode of transport based on individual transportation. The minimum necessary road space required for parking and moving a car at 30 km/h would simply not be available when, say, 30% of trips will use an automobile. However, transit to operate efficiently requires not only high densities but also concentration of trip destination, i.e. CBDs that are dense in jobs and commercial activities. The uniform FSI prevent the formation of CBDs that could be the focal points of a modern mass transit network.

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