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GIS And Auto Desk Modeling For Satellite Cities around Bhubaneswar

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Abstract: ***The smart cities concept is modern and shall continue to mitigate the future demand of houses for the burgeoning flocking population from rural to urban. These complexes are prototypes of present smart cities, energy efficient green mansions nearer to large metropolis which is fulfilling prompt accesses to civic usages (like connectivity, Marketing, electricity, water, drainage and water supply) and maintains equilibrium between population, economy, resources, and environment. In contrary metropolis face mammoth challenges of space, health, quality of living,stress, pollution and hassles of city life and comforts.In this project we tried our best to plan a model of a satellite city in Jatni area. The GIS and the remote sensing method is used to conceptualize the places , commuters, dwellings etc. The 2D planning with AUTOCAD software, the 3D plan of the flats with REVIT software for Building Information Modelling architecture was used to conceptualize an ideal satellite city in and around 15 to 30km from centre of Bhubaneswar consisting of area 44300Ha accommodating 10500 inhabitants fortheir apartments, duplexes and supporting staffs.***

Keywords: AUTOCAD, GIS, BIM, Satellite cities, Metropolis, REVIT, Bhubaneswar, Urbanization

I. INTRODUCTION

The space race to have a roof for individuals with population explosion, economic rise and innovation is alluring urban expanse than rural at a very high rate. Satellite cities are small polycentric cities to provide a roof to likeminded people in the outskirt of metropolis. A city can have several satellite cities around it. Large cities of the world like New York, London, Sydney, Los Angeles, Mumbai, Shanghai, Beijing, and Rio de Janeiro have large populations and confined areas to accommodate more dwelling houses and originated many satellite cities adjacent to the metropolis in late 20th century. The paradigm of satellite cities in India commenced from 1980 onwards when the metropolis like Delhi, Kolkata, Bombay, Madras, Bengaluru, Bhubaneswar and Hyderabad etc. become overpopulated and congested. Odisha has 107 statutory and census towns out of which 76 are slum reported town. That indicates Odisha has bare necessity of satellite

Fig 1: Index map of Bhubaneswar, Source; BDA

housing complexes at the outskirt of the urban area. The 1.563 million people must be provided shelter at cheaper cost to accommodate growing population of Bhubaneswar, Khurdha and Jatni. Khurdha district has 6200Ha of forest, 10000Ha of grooves/ vegetation and 5000 Ha of Pasture with normal rainfall of 1408.4mm according to the Directorate of economics and statistics, GOO. The % of urban population of the important states of India are in Fig-2and the decadal rise in Fig-3.

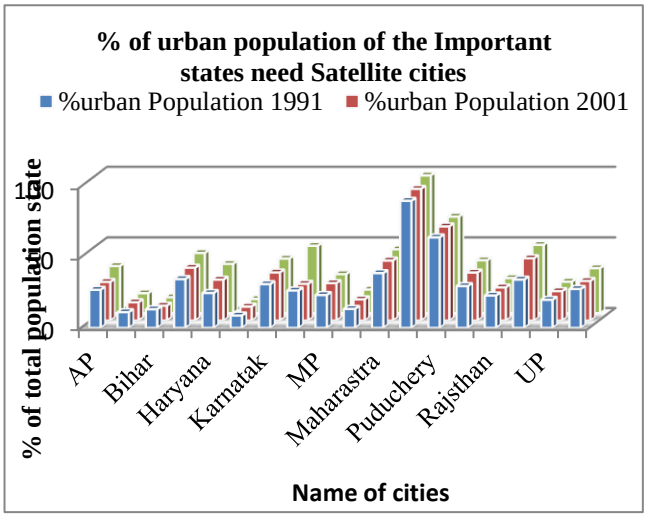

Fig 2: % of urban population of states in India need Satellite cities, MOHUA: GOI-2019[1]

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Urbanization is fast in India with growth rate of urban population is 2.76%/annum from 2001-2011 and level of urbanization @3 .3%/ annum. Numbers of statutory towns have increased from 3799(2001) to 4041 (2011 and census towns have grown from 1362 to 3892 in 1st decade of 21st century and UP being the highest. India had 648 statutory and 267census towns in 2011. 55.29% of Global population live in urban whereas 34.03% of Indians live in urban(World's urbanization prospect 2014). According to World economic forum report and HPEC the urban agglomeration report there were 8 class-I A cities, 45 class-I (B) cities, 412 class I(C) cities and other cites of all category are 7523 in numbers in India the 2011 census.

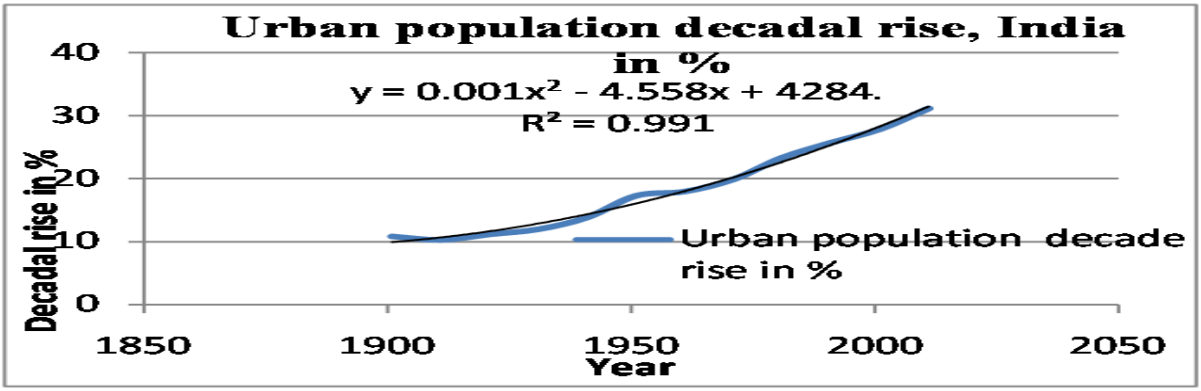
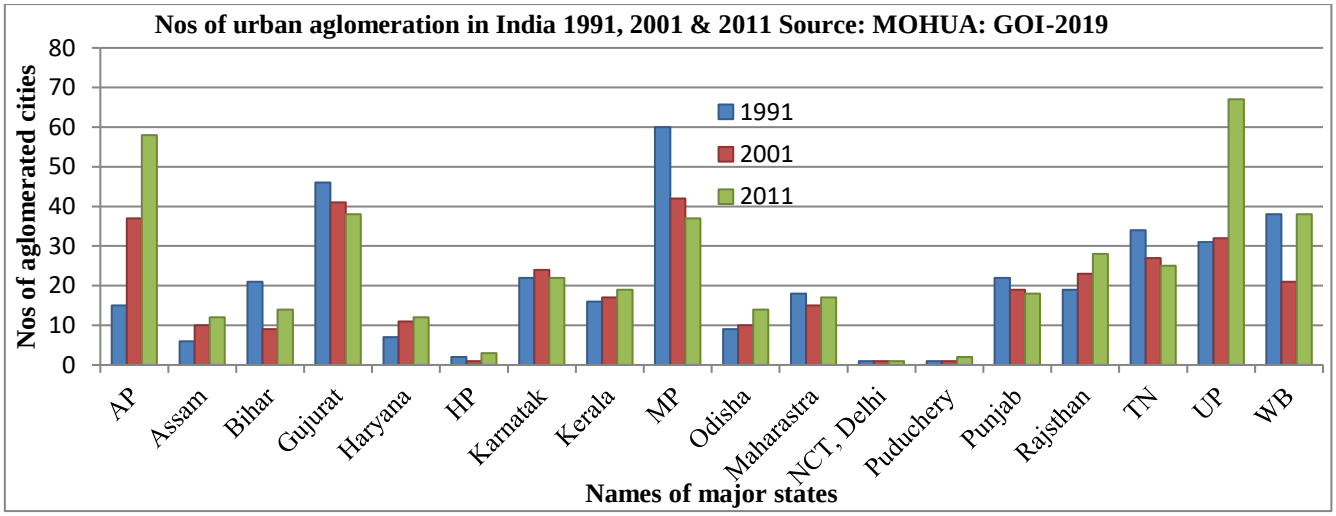


Fig 4: No's of urban agglomeration in India 1991, 2001 & 2011 Source: MOHUA: GOI-2019[1]



The World economic forum has projected that High Powered Expert Committee, HPEC Class I (A) and Class 1(B) cities shall increase to 87 instead of 53 and 377 million people today may increase to 600 million by 2031where the satellite city provision shall be required Ahluwalia I. J. 2011[3], Gregory H, 2015. The urbanization level was 97.50% of NCT Delhi and Chandigarh was97.25% being topping the list and has high agglomeration rate needs satellite cities for accommodating the rising urban population. According to 2011 census the numbers of urban agglomerations of Odisha state has increasing trend and were 9, 10, and 14 where as India had 374, 384, and 474 in the year 1991, 2001 and 2011 respectively Fig -4. Within economic energy configuration, satellites cities provide efficient, improve sustainable, economic and augmented quality of life for people living and working in the nearby cities. They are the future suburbs. Optimum infrastructural facility, integrated planning, dwellers security and huge capital investment are the concern for the satellite cities. The population total and urban growth in Odisha and the mother city Bhubaneswar and the proposed satellite city is in Table-1

Table 1: The decadal demography of the Odisha, Bhubaneswar, Jatni and Khurdha 1951-2011

Census Year	Odisha Total Population	Odisha Urban Population	Population BBSR	Population Jatni	Population Khurdha	Population Pipili
1951	14646100	594632	16512	9975		
1961	17549500	1109128	38211	16068	12497	
1971	21944625	1406650	105491	29894	15897	
1981	26370270	3109055	291211	41755	22386	8739

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1991	31659740	4236073	411512	50116	30591	11649
2001	36707900	5495173	648032	57597	39054	14263
2011	41947358	6996819	843402	63697	46205	

Source:http://www.rcueslucknow.org/states/Compendium

The birth and death rate of Odisha was 6.5 and 6.1 / 1000 people during 2011. Slums signify the sprawl of towns towards cities. Odisha has Statutory and slum reported towns are 107, 76, with population 1.56 million and Bhubaneswar being the largest. The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) in 2010 has reported that, 29.4% of urban population India live in slums 96% get improved water, and 59% had admittance to better sanitation facilities against global figure 96.1% and 79.4%.

II. REVIEW OF LITERATURE:

Sorensen A, 2001[4] studying the growth of Tokyo city, has reported development of polycentrism through sub-centers or satellite cities successful to provide benefits of the old rural fabric. Karjalainen L. E. et al., 2019[5], Transportation plays pivotal role in planning metropolis sustainability and management of urban GHG reductions. By use of shared transportation, cycling, and walking. Bauler T., 2012[6] indicated about environmental indicators like legitimacy, credibility and salience which are backbone concept behind the satellite cities. Chatterjee A. et al 2015[7], mentioned that old garden cities are the present satellite cities like Navy Bombay in Maharastra. The Institute of Town planners India, 2015[8]reported that mega cities have drawbacks of deficient infrastructure like Water& power supply, solid waste disposal and transportation infrastructural problems, housing, deficient informal settlements, environmental degradation can be ameliorated with construction of satellite townships adjacent to the Cosmo polis to avoid transit oriented developments (TOD's). Majeed P. A et al., 2015[9]mentioned that falling transport costs &rise in cost of living in the parent city, increased numbers of medium and high income group, elevated standard of living and population rise are the causes for urban sprawl and creation of satellite cities. Md. M. Hasnat et al., 2016[10]reported that sustainable urban development is possible by prioritizing public transport, accessibility to all, optimization of space and energy sources, sustainable drainage system and develop social integrity and personal safety through construction of satellite cities around Dhaka, Bangladesh. Shahneez et al, 2017 reported the satellite cities constructed in 20th century have flaws in planning so it is necessary the 21st century planning of satellite cities should stress upon sustainability and equity catering all amenities to its residents H&UD Dept. GOO, 2017[11] informed that the urban centre in India has increased from 3126 numbers in 1971 to 5161numbers by 2001 and ≈ 8000 in 2011 but a declining tendency in 21st century. Jena P. P., 2018[12], reported that the urbanization is mounting in the key areas from middle of 20th century and have an increasing trend which will continue up to 2050.Bogunovich D., 2016[13]reported that that development of cities should work on the norm of safe, sustainable, resilient, economical viable need rigorous policy decisions and investment credibility.

III. KEY FEATURES OF SATELLITE CITY

The goal of constructing satellite townships is to keep like skilled people together away from the town by provision of affordable accommodation and professional safety for them. There is an underlying need to develop satellite cities near smart cities. From LU/LC perspective, satellite townships and urban sprawl expanse are the best ways to accommodate population growth and optimize space and farmland. The substitute is the urban sprawl or satellite towns encircled by greenbelts and are well allied to the large smart city, BBSR by buses, cabs and rails. The aim is to create reasonably priced and comfortable housing for major section with efficient transportation, through satellite cities.

The Mother City Bhubaneswar:

Bhubaneswar (Long. 85044'to850 55' E and Lat. 20° 12' to 20° 25' N, 45 M. above MSL), the mother city born in 1959 has municipal area of 138.10 Km2and the city area under development 393.57 Km2 towards Cuttack (an old city of 1000 years old), Barang (developed after 1960 as an industrial set up), Khurdha (old fort of King of Utkal), Jatni (developed from 1880's as a railway junction) and Pipili (old hand crafts city), the future cluster city(Fig -5). The Bhubaneswar Municipal Corporation (BMC) has population of 844thousand as per 2011 census with decadal growth of 30.2%.The city has well access by NH 16, and grown up as medical and educational hub of Eastern India. In NURM and JICA are entrusted for drainage development; Solid waste management is done on PPP approach and the transportation by MRTS.

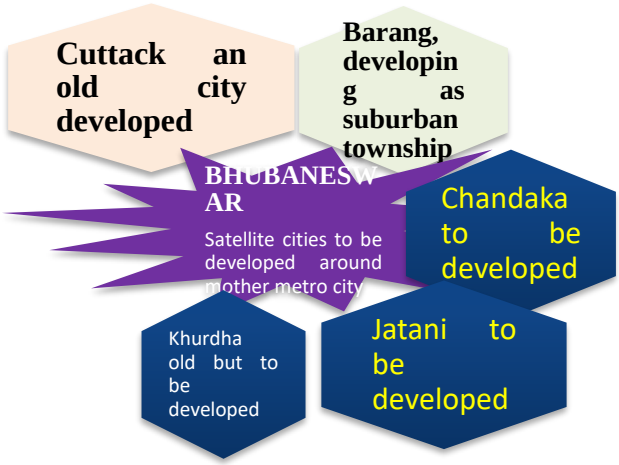


Fig 5: The satellite cities older than BBSR, already developed.

The Bhubaneswar development plan area lies in earth quake zone II and III as per present assessment. Above 1000 high-rise buildings are constructed in Bhubaneswar out of which 99% are not tremor proof. An earth quake of about Richer Scale VII can cause havoc to the buildings.

Before 2013 the maximum height was allowed by BDA was upto 33mtrs but there after apprehending increase in intensity of earth quake and urban flooding the height is limited to 27m. Micro zone seismic assessment is entrusted to conduct only in 2018 of the BBSR area by BDA, IIT BBSR. The climate is Tropical with maximum temperature of 43 °C and minimum temperature of 12 °C with av. annual rainfall of 1498 mm. The city according to M of UD, Goo, 2017 the projected population Bhubaneswar shall be 1033816 by 2021. The City was designed by the architect Otto H. Konigsberger as grid-iron pattern (Rajat Nainwal, in slide share), in 1950's and the final master plan was prepared in 1968 to developed in rectangular shape. The city stressed upon the functions as the capital of Odisha as well as a holy temple city where 320 temples were remaining out of 1000 of eighth century onwards. The main metropolis is being surrounded by villages of art and craft of stone cutting works, wood carving and applique works. The master plan had not considered the EIA studies, the high demographic growth and poor drainage system in the low lying areas around the rivers the Kuakhai and the Daya in eastern belt and hills range of the Bharatpur hills and its Reserve Forest in the NW.

The Townships around BBSR:

Bhubaneswar (BBSR) has the problems of space congestion, traffic overcrowding, industries and utility areas for the middle class and high middle class people. The Z1 constructions (Fig 1) have prepared large housing schemes in Patia area near Nandan Kanana. The growing Tata Housing scheme "Ariana", under construction towards west of Bhubaneswar in Paikerapur area which is in close vicinity of the future satellite city of BBSR. Ariana city constructed 12 blocks consisting of 1100 units over a land of 12Ac in Paikerapur is a complex having residential apartments and community motivated features like uninterrupted electricity, internet, security, community hall, clubs, swimming pools, library and gymnasium (Fig 6). It is widely claimed that the setup and structural costs of satellite cities are difficult to afford. But the extended urban sprawl is too high if loss of farmland, loss of ecosystem, traffic congestion, and pollution are considered, with the present growth rate the population of Bhubaneswar city (area 135 Km2, GPS Co-ordinates 20.272N, 85.834E) has surpassed 9 million by 2019(estimated), which was 411540 in 1991 census, and 16512 according to 1951 census. With high rise of population growth can never be house existing urban sprawl alone. A limited number of new medium-sized multi-storied buildings at Pipili, Jatni and Khurdha areas around BBSR can never adjust extreme housing shortages towards 2030.

Characteristics of Satellite cities;

A satellite city is small locally independent housing complex render part services delivered by adjacent metropolis. The satellite cities in urban planning are self-sufficient, limited size, built near parent city to render decongestion, space optimization, self-economy, skills and expertise, adaptation of labour to workforce, and up-gradation of ecology with proper waste disposal and water supply. Satellite cities are small boroughs that later increases to join the parent metropolis. less prominence and the conurbation and its apart, separated by natural villages and slums. self-influenced financially, culturally but have livelihood of their own. Satellite cities, expandable to equalize later with large numbers of end users. This occupancy has self-management body and self-economy but well interconnected with the metropolis but strongly. Satellite cities are at a few kilometers from main city. They have small expanse, fewer residents, These cities are lack of infrastructural and reliefs, securities than the metropolis. The inmates have to move often to the metropolis for their livelihood, food, modern utilities, education, medical facilities, recreation and other reasons. The megalopolis avails manpower from these satellite cities. The expansion of the city is limited and never matches or exceeds the size of the parent city but often historically self-evolved.

Global Satellite Cities:

Satellite cities are there in all subcontinents. Satellite Cities are good choice to live in near a major city as it is a smaller and easily affordable than the major city. Some of the major satellite cities in the U.S include Bell Air, Bridgeport, Fort Collins, Fort Lauderdale, New Haven, Rockford, Riverside, San Bernardino, Santa Cruz, Tacoma, Worcester and Brentwood among others. In Canada, some satellite cities include Hamilton, Kitchener, and Sorel-Tracy among others. The evolving satellite cities are at Chengdu, China SW, Tatu City in Kenya, Silicon Savannah in Nairobi, the Kenya's Konza Technology City,Texas, Oregon, Colorado, Utah, Washington, Florida, Delaware, Idaho, Arizona, North and South Carolina in USA.

The ghost towns:

Still, failure in conceptualizing satellite cities, those planned both built and ineffective or not built but turned into flicker towns. A Brazilian city, Fordlandia, Harlow within England, New Cairo of Egypt are the burning example. These satellite cities claim to their overpriced infrastructural growth, high costs and the elongated project timetable.

Satellite Cities in India:

The development in technology like communication, energy, drinking water, environment, governance, public safety, housing, education, healthcare amongst others has converted many large metropolises in India to smart cities and planned to be surrounded by satellite townships. A list of major satellite towns of prominent cosmopolites are in Table 2

Table 2: The developed satellite cities in the fringes of different metropolitan cities, India

Sl No	Metropolis	State	The satellite cities
1	Mumbai	Maharashtra	Thane, Dombivli, Kalyan, Vasai, Palghar and Navi Mumbai
2	Kolkata	West Bengal	The New town Calcutta, Salt Lake City
3	New Delhi	New Delhi	Dwaraka, Gurgaon, Sonipat, Ghaziabad, Noida and Faridabad
4	Chennai	Tamil Nadu	Mamallapuram, Kanchipuram, Tiruvallu. and Sriperumbudur
5	Bengaluru	Karnataka	Kengeri and Yelahanka
6	Others	Hi-Tech City; (Hyderabad), Dholera; (Ahamadabad), Amaravati; (Telengana), Pimpri-Chinchwad; (Pune), Vikram City (MP), Gift city (Gandhi Nagar), and Mohali (Chandigarh) and many others	

Satellite cities in Odisha:

3% of total populations of Odisha compared with 13.86% in India were living in urban according to 1941 Census. Latter urbanization in Odisha rampantly grew to 16.68% against 31.16% in India with urban population density 269 persons/Km(2011 census). The categorization of the cities are done based on demography such as class I (≥100,000), class II (50000 to 99999), class III (20000 to 49999), class IV (10000 to 19999), Class V (5000 to 9999) and class VI (≤ 4,999). The Odisha state has total numbers of cities were 223, out of which Class I (101), Class II (14),class III (43), Class IV (49) ,V (78) and VI (29) cities according to 2011 census H & UD Dept. GOVT. of Odisha, 2017[11]. The cities like Barang, Choudwar be developed as satellite cities around Cuttack. The Jatni, Pipili and Khurdha can be developed as the satellite cities of the Bhubaneswar metro, Burla and Hirakud that of Sambalpur, Gopalpur and Chhatrapur that of Berhampur city in future.

Upcoming Satellite cities of Bhubaneswar

Table 3: The areas of the villages in the out skirt of Bhubaneswar city can develop Sat. city

Village name	Area (Sq. m)	Block	Claiming to develop Satellite city
Badaraghunathpur	517076.8986	Jatni	No, Settled as housing/ educational hub
Bhagabanpur	277575.2975	BBSR	No, Settled as housing/ educational hub
Bidyadharpur	1053137.424	BBSR	Yes, can be developed as a satellite city
Bijipur	1109081.726	BBSR	No, developed as res buildings
Deulia_Patna	1216378.892	jatni	Yes, can be developed as a satellite city
Garajagasara	386290.6392	Jatni	No, Vilage existing, cultivated land
Ghatikia	129478.6083	BBSR	No, Developed in the out skirt of BBSR
Harapur	13482.51433	Jatni	No, a small patch
Jagasara	2419809.794	Jatni	Yes, can be developed as a satellite city
Jagasara_Patna	178772.4812	Jatni	No, Developed in the out skirt of BBSR
Janla (Partly)	4816.685425	jatni	No, Developed in the out skirt of BBSR
Kaimatia	857343.6904	jatni	No as agricultural land
Kaimatia_Patna	97806.16006	jatni	No, as agricultural land
Madanpur	2152480.922	jatni	No, developed, balance as crop land
Managobinapur	538678.363	BBSR	Yes, Mostly barren Land
Naragoda	687266.5211	BBSR	Cultivated area, low land and drains
Nuagaon	544310.0322	BBSR	NO, Cultivated area, low land and drains
Paikarapur	3654963.48	BBSR	Yes, Mostly barren and cultivated Land
Sahajpur	501400.9211	BBSR	Yes, crop land
Sankarpur	302389.443	BBSR	Barren land partly, yes suitable for sat. city
Sijuput	1081018.852	BBSR	No, The urban at out skirt of BBSR
Subudhipur	1389697.512	BBSR	Developed as Kalinga Nagar
Tamando	850837.7029	BBSR	Developed as a parent city to BBSR

The areas in the Jatni and Bhubaneswar block but away from the city.The satellite cities are the balance amongst the demography, assets and maintaining an eco-friendly setting. The city intends to generate reasonable dwelling houses for the major section. To reduce space stress and slum free in the 70years old, the Capital city of Odisha India, BDA, the Bhubaneswar Development Authority has projected to launch satellite cities, at its outskirts under the Comprehensive Development Plan (CDP). The future satellite city shall be constructed over ≈487Ha at 20-25Km away in the hinterland surrounding four hinterland villages of Jagamara (≈236Ha), Madanpur (≈83Ha),, Paikerapur (≈128.7Ha), and Kaimatia (≈39Ha), of Jatni and Khurdha municipalities. The cities shall be covering of ≈20000 apartments for all sections of high, medium and low income groups to accommodate 200000 people including slum dwellers, https://www.bda.gov.in/cdp -executive-summary and http://www. Orissalinks.com/orissa growth/ topics/real-estate/ satellite-towns. The city shall have many housing complexes and to be constructed scattered at different places in future Fig 6.

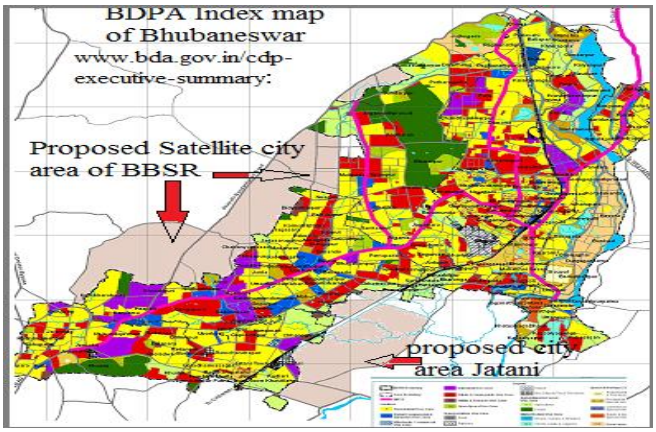


Fig 7: Bhubaneswar the mother city and the possible Satellite city extensions

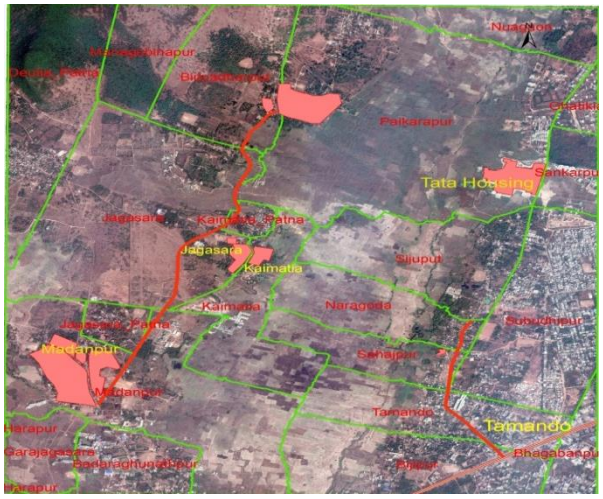


Fig 6: Bhubaneswar, the smart metro- city and the possibilities of growth satellite cites around it

History of Urban growth in India:

The building of cities in India was too old than Ramayana and Mahabharata era and even from 3000 to 4000 years BC, Indus Valley Civilization i.e. Mohenjo-Daro and Harappa civilization. Organized metropolis culture started nearly ≈1000years ago with different concepts and climatic adaptive design in layout and functioned at the junctions of religion, transportation and navigation routes. The pre Holocene heavy rain, sustained agriculture and scientific developments encouraged the urban revolution over nomadic Aryan culture in India. They made cities to live behind the fort walls to save them and their city from intruders and these cities became the administrative hubs, with military camps for protection.

Why Satellite cities:

Urban sprawl is a continuous process and ever posing problems of illegal involuntary slums adjacent to the large towns with unhealthy life style, indulged in unlawful acts. So satellite cites are thought with the objectives density optimization, Economic piling, and sustainable environment, https:// abhimanuias.com/state/Searchdetail. aspx?type=BL &id=7521

Density Optimization:

The major concern for metro jamming is due to more numbers of vehicles, lorries, cabs and buses for the heavy traffics and the pedestrians. Satellite cities like Dwaraka, Noida and Gurgaon could accommodate huge migration and could ameliorate the traffic congestion of Delhi metropolis.

Economic Sub centre:

Metros are centers for investors of both small and medium entrepreneurs who congregate at the heart of metro area. But the supplies of their products are from the skilled mob staying in the satellite towns which may turn out to be a sub centre of the metro city.

Space Optimization:

The optimal use of horizontal and vertical space over the land plays pivotal role for space management which is significant, valued with limited resource of land available. By developing satellite cities, the weightage is given to the bordering areas which can provides the best space optimization of the metropolis in long run.

Ecology and Environment sustenance:

The environment deterioration through urbanization is observed in common. The rate of growth of a city has degradation impact ambient air, soil and water due to damage to the green vegetation and prompting of anthropogenic concrete jungles. Satellite towns may perform as a result against the nature's degradation. The plantation, water conservation through watershed management, waste management in the outskirt and staple areas shall protect the ecology degradation.

Employment Conversion:

Identical opportunities must be rendered to both the agriculture labours and other workmen which is essential for expansion of a township. Unemployed, poor, marginal and migrants labourers, seasonal unemployed agriculture labourers can be converted as human resources in various manufacturing and construction industries. It is desired the creation of employment opportunities in small and medium enterprises of metropolis but to be housed in the developed satellite cities.

Economy:

Satellite towns in the outskirts of the major cities may opt for novel choices for the commercial outlay. The possible options of satellite towns are to boost regional progress with adequate easy and cheap resource utilization. The positive aspect of satellite cities is to offer cheap superior accommodations with better-quality water supply, waste disposal facilities, electricity, connectivity, drainage and important utilities.

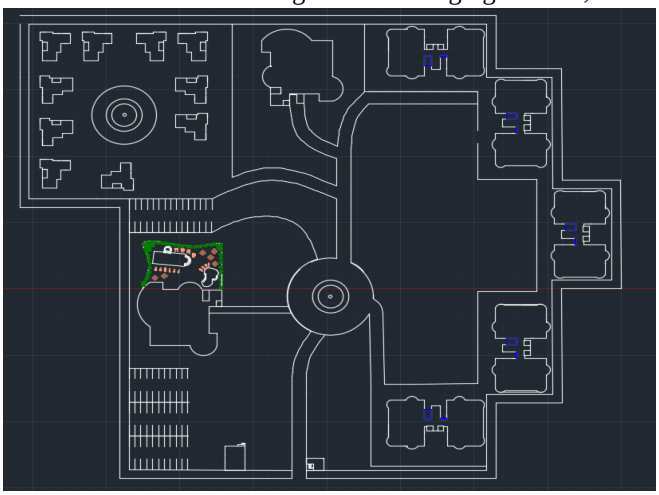
Methodology and data collection:

The data used to select suitable locations of satellite towns in this study are communication, Village sites and their mouza boundary, land use of the area. The main reason for choosing such criteria is due to the fact that they are the controlling factors for satellite city development. The methodology adopted to collect high resolution satellite imagery, collected village mouza boundary from BHULEKHA Odisha cites. Geo-refencing was done to the downloaded data and village boundaries are digitized to calculate the area suitable for the satellite city.

Analytical computations:

(BIM) Building information modeling, a process that reinforces different gears, technologies and tools to generate and manage digital images for physical and functional physiognomies of an area. AutoCAD (Auto computer-aided drafting or design), is a user friendly powerful handy software to design and have 2D drawing of different disciplines, Parvez M, 2005students.autodesk.com. For the 3D drawing (Kurland K S 2013[14] and estimation used 3D PDF Maker for Autodesk Revit software. The concept is borrowed from the Palava satellite city, currently home to 8,500 families in 4,500-acre Greenfield site in Bombay area .Building information modeling (BIM) is done here to have the architectural modeling of the proposed satellite city. The present model is constructed considering the satellite cites might save our urban future. The modern followers of satellite cities are stressing upon creating additional independent small suburbs. The satellite cities differ from traditional suburbs where the best of a city can be achieved through jobs-sufficiency and rich in culture in the central area of mother city. Short commute times provide less traffic congestion as the work place and commercial units are nearer to their residence.

The forth coming generation shall have fast transportation due to introduction of by developing package supplying drones, hyper loops, self-driving vehicles, electric auto rickshaws, shared vehicles, air taxis that shall reduce the physical distance and cost with increased connectivity. The satellite towns could augment in bridging federal, social,



political, cultural ethnic and economic issues.

Fig 8: plan of the proposed Satellite city

IV. OVER VIEW OF THE PLAN:

Total plan area = 44,308.9089 sq. m. Perimeter of the total area = 946.2105 meter. The plan is in fig 8. Five premiums high raise residential apartments, 10 duplex houses, and one big yoga garden. The area of the building complex shall 6354.8511 sq. m and of Perimeter 356m. The area should be added with modern facilities such as; a mini theatre, two restaurants, one Gymnasium, one indoor games complex, one banquet hall with bar, swimming pools for adults and kids, and sitting lounges near the pool.

2 Dimensional view of Apartment:

Fig 9(a) top view apartment

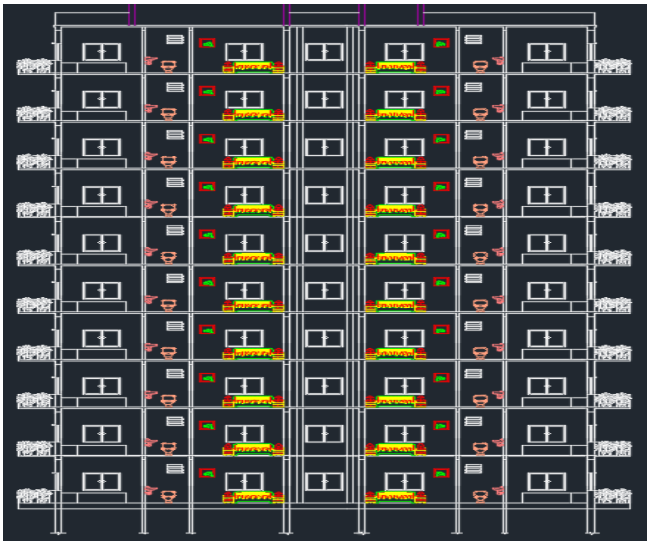


Fig 9(b): Front Elevation

One satellite complex shall have 5 apartments in which one single apartment contains 10 floors. Each floor is having 4 numbers of 3 BHK apartment accommodating minimum five people in 3BHK apartment. The total population in 50floors of 4 apartments each shall accommodate 50 floors x 4 apartments x 5people = 1000 persons. Similarly 10 Duplex shall accommodate 5 people X10 duplexes = 50 and in support staff quarters the numbers of persons shall be accommodated are 450 people. The total numbers of persons can be accommodated in each satellite city shall be 10000 + 50 + 450 = 10500 persons. Fig 9(a) and Fig 9(b) shows the top view and the front elevation of the proposed units.

Dimensions:

The different dimensions of the apartment are total area of the apartment is 786.325sqm. 4 numbers 3bhk flats in each floor and 2 lifts

Table 4.1 Dimensions of different rooms and different openings of doors and windows

Rooms	Dimensions(mm)	Doors & windows	Dimensions (in mm)
Drawing room	6310*5063	D	1200 mm
Dining room	4010*3281	D1	900 mm
Kitchen	3902*3589	D2	750 mm
Master bedroom	4573*3649	W	1500 mm
Bed room - 1	4363*3795	W1	1200 mm
Bed room - 2	4023*3649	V	600 mm
Toilet- 1	3045*1808		
Toilet- 2	4023*1800		

Elevation

An elevation is an orthographic projection that exhibits the finished look of single side of a building shown in the vertical projection. Four elevation views are shown in Fig 10.

Drawing the Elevation Plan:

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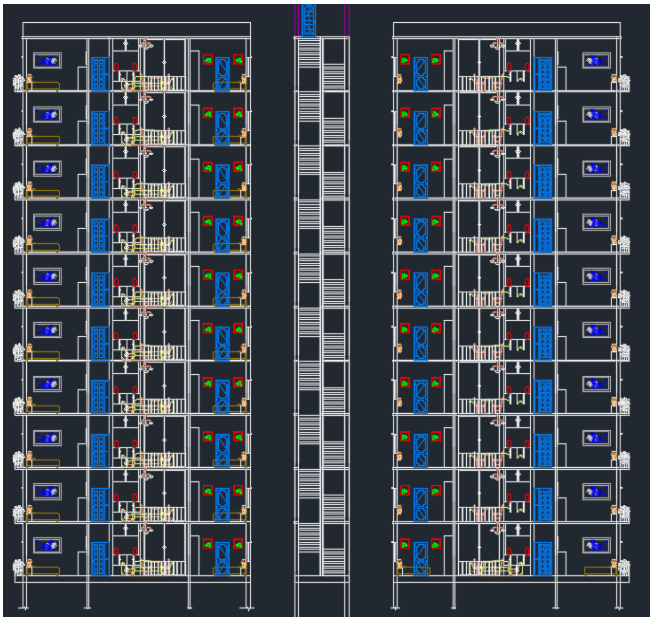

Fig 10(a): Side Elevation of the proposed buildings

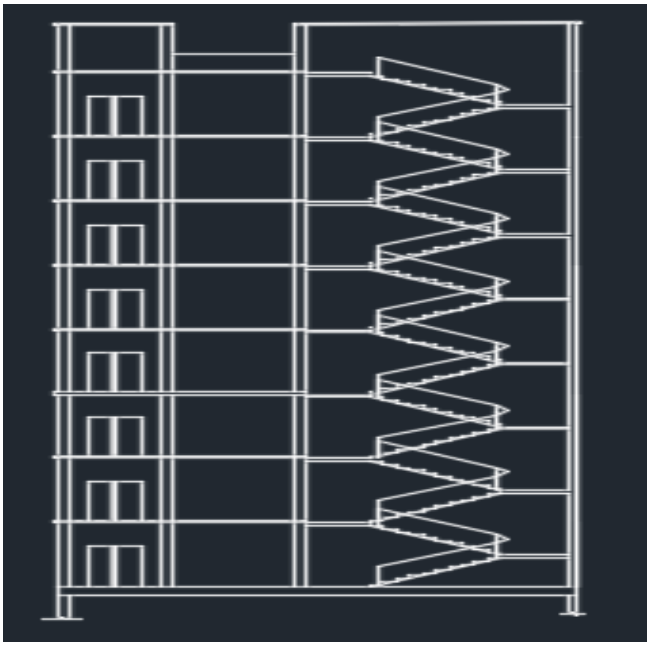

Fig 10(b) Staircase Elevation

The floor plan is positioned exactly below the elevation. The exterior walls should represent the elevation facing underneath the elevation. The points are projected down towards free space. The lowermost part of the footer should be drawn with a horizontal line the mentioned reference point. The drawings should not show the lines of construction and the changes made and must be erased. The openings, fittings and fixtures such as window, staircase components, railings, trim, and block outs and projections are to be drawn latter mentioning all dimensions, foot notes and symbols. The first print of the drawings should be well checked and corrected before finalization. Proposed elevation and staircase: The proposed elevation and stair case views are given in fig 10 (a) and fig 10 (b).

Duplex:

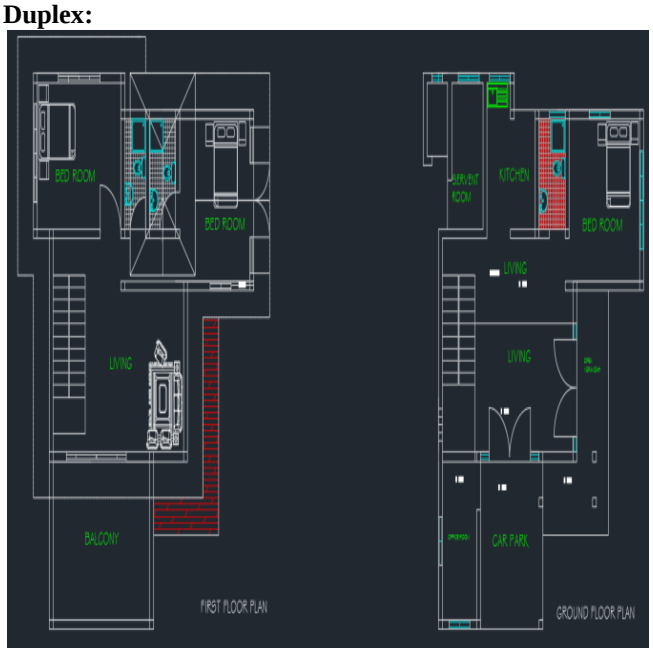

Fig 11(a) The plan of the proposed Duplex

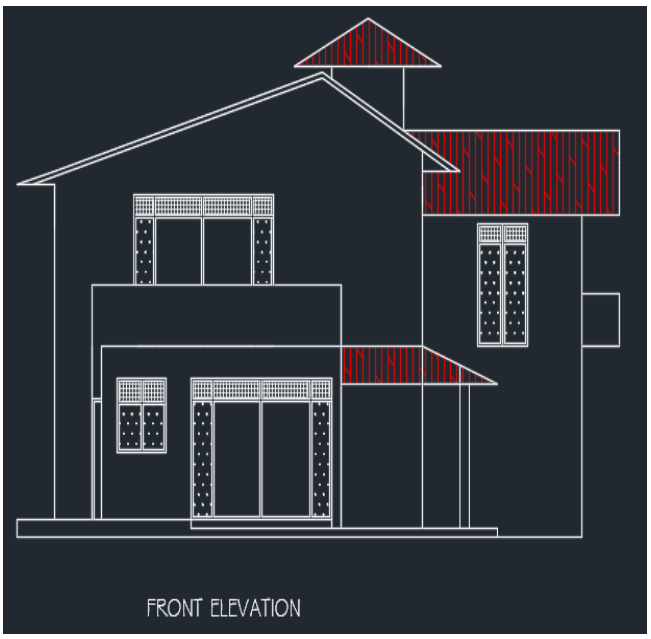

Fig 11(b): The front elevation of the duplex

In Indian context, duplex is a villa look apartment for dwelling of a single family having only single space for dining and kitchen. A dining hall with kitchen and bedrooms are the utilities of the ground floor. The 1st floor comprises of only bedrooms and wash rooms and other amenities except kitchen and dining. Also the duplex includes two-story houses having a complete apartment on each floor which is not provided in the present design. The plan and the front elevation of the duplex units are given in Fig 11(a) and Fig 11(b). In the present apportionment, the duplexes have area of the first floor is 145.56sqm and Area of the ground floor is 129.66sqm.

Other Structures:

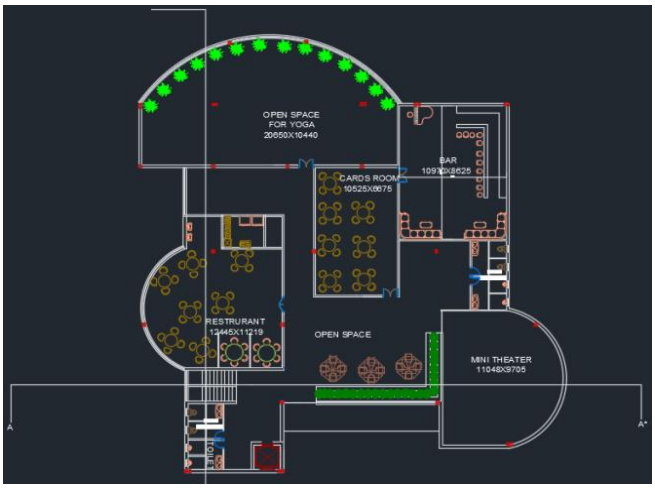

Fig 12(a) other structures

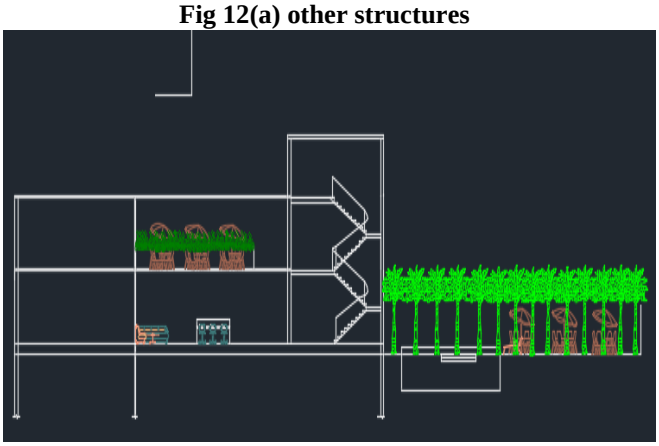

Fig 12(b) Elevation of theatre compound

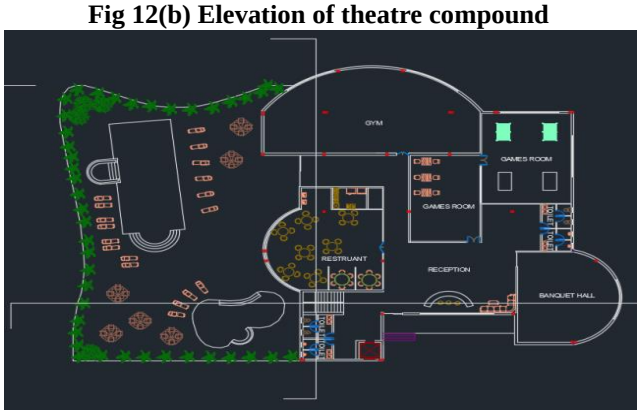

Fig 12 (C) Swimming pool compound

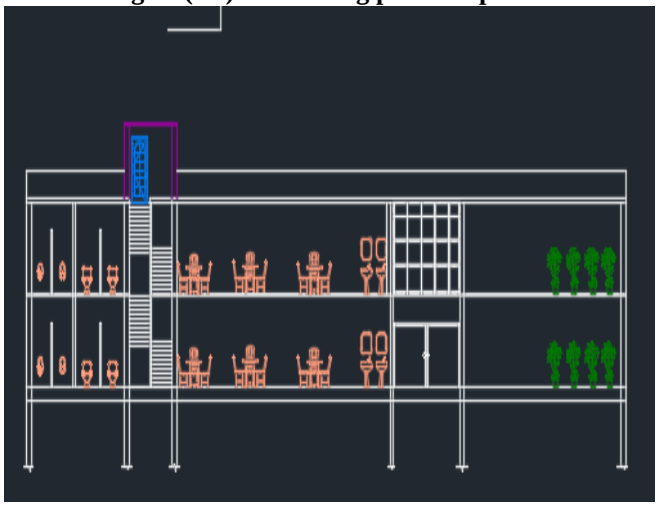

Fig12 (d) Elevation of Swimming Pool Compound

Dimensional plan of the apartment

The front view, side view, back view and the top view of the building is given in Fig 13, 14 (a) and (b) and Fig 15 All new or old cities should be safeguarded from the environmental squalor. The satellite city developer must safeguard equilibrium between ecology, environment, aesthetic, and humanity. The non-renewable energy sources like solar operated auto rickshaws, battery-cars for communication, PV cells and windmills shall be used in the cities to be developed which is not discussed in the present paper.

Fig 13: Front view of apartment

The photovoltaic solar cells, thermal collectors, wind generators, geothermal and biofuel use for power have reduced the GHG and aerosol atrocities. Emergency mass vehicles system, walking bus concept for school goers, waste recycling for creation of zero debris zones should be main function of these newly formed satellite towns.

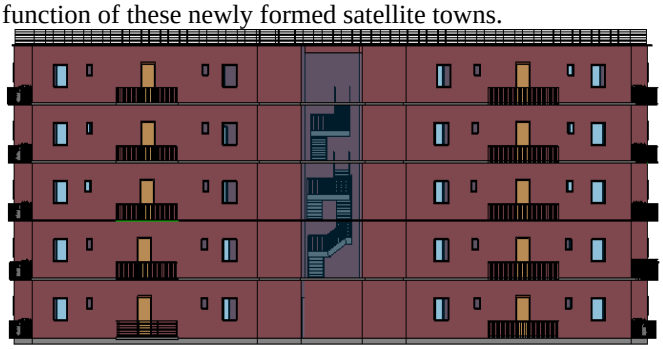

Fig 14 (a) Back view of apartment

Fig 14 (b) Side view of apartment

The terrace, Portico and the land development is not shown which need to be designed as per developers and users choice.

Discussion:

India's mega cities are provoking the mammoth task of rapid population growth and numbers of urban and industries. Plenty of job prospects and better living standards have encouraged shift, migration from other rural and urban corner. The excess population is occupying the available space in the metropolis in last 4 decades and the urban is super saturated/congested space wise. For better space management, the developers and builders initially attempted construction of high rise buildings but became partly successful. Later they thought of developing satellite cities in the adjacent open land and construct buildings added with all facilities and amenities.

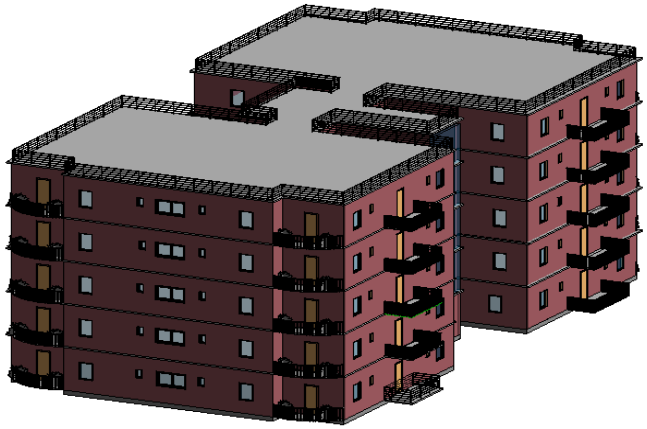

Fig 15 Side view of apartment

The architects and developers established solutions where they compromised between infrastructural development and legalization of suburb fallow and farm lands as residential areas. Satellite cities are established providing the dwellers at hand access to all comforts and infrastructural facilities.The satellite cities should keep a sustainable balance of horizontal Vs vertical growth, well organized amenities Vs. green organic growth, short-term lacunae Vs long term concerns and finally economic development against resilience strategies, The emphasis to be imposed upon Water Supply, Sewerage disposal, Solid Waste Management, Storm Water clearance, Pavements and Roads, Transport and connectivity, illumination and Street Lighting, Traffic Support and Infrastructure. Hasanat et al., 2016[10] reported about crowding of satellite cites lacks the requirements of modern, futuristic services and slips the sustainability of a city life. However it is advocated that the residents of the satellite cities have availability of enjoying stress less, pollution free environment avoiding the irritations of metro life, easy accessibility, and affordable accommodation under decongested traffic that they would avail in the adjacent metropolis. Residents shall get quality of life in form of connectivity, electricity, water, drainage and other utilities. It also enables the dwellers to propel the augmentation of local economy. The satellite cities not only offer employment probabilities within the satellite towns in medium and minor industrial units, IT parks, and focused practices but also provide proper connectivity of satellite town with the parent city through fast commuter transport (Rail, Metro, town busses BRTS, etc) for faster development. Holistic regional planning approach is essential for vibrant fast growth of satellite towns by safeguarding the development of intermittent urban and rural areas by active deployment of manpower, available material and natural resources and other technologies. Satellite cities latter put forth borough pressure on the existing green belt converting gradually to brown field contradicting concept of green satellite township. Planners should emphasize on premeditated location for rural culture and ecology, existing social infrastructure and low impact on ecology and develop a model of satellite township unit. Integrated spatial strategic planning is required before development of the satellite city projects. However the architects and developers must follow the guide lines laid by federal authorities.

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