

## Analysing Urban fringes through the Conzenian approach: A case of Vadodara, Gujarat, India

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**Abstract** -The paper begins with defining the urban fringe in general and with respect to the Conzenian approach in the field of urban planning. It further describes the Fringe belt concept derived by German geographer M.R.G Conzen along with its origin and the evolution. It also studies the urban morphology not only with respect to the evolution of the Vadodara city, but also, through delineation of the Inner fringe, Middle fringe and outer fringe with respect to the Fringe belt model. The paper examines the inner fringe area that acts as a transition zone amidst the growth of the city that helps to understand the possible morphological transformation for the urban redevelopment. That justifies the fringe belt into four components that is fringe belt Consolidation, Alienation, Modification and Expansion taken as the major concern and evaluated in this study.

**Key Words:** Urban fringe, Fringe belt, Conzenian approach, Urban morphology

### 1. INTRODUCTION

Fringe is something which is developed in an agriculture hinterland that situated around or beyond the Major towns. It is an area that reflects the expected development of the city. Urban fringe is a growth driven area that situated an outside the Urban area or in between the urban and rural area that dynamically changes due to urbanization. Many efforts and studies have been carried out in an urban redevelopment to analyse urban morphology and there are many concepts related to urban morphology and one of them is fringe belt analysis derived by urban morphologists and geographers. The first comprehensive definition of the fringe belt is given by the German geographer M.R.G. Conzen. He has defined a fringe belt as "A belt like zone originating from the temporarily stationary or very slowly advancing fringe of a town and composed of a characteristic combination of land-use units initially seeking peripheral locations" (Conzen, 1960). In contrast to densely built up areas, fringe belts are potential green belts and common/public spaces. However, as a result of the rapid population increase especially in the metropolitan cities, fringe belts are often regarded as the new development plots. The relationship between urban morphology and planning is recently growing and the fringe belts are having little known recognition in urban planning and design practices (Gu, 2010; Whitehand and Morton, 2003, 2004) because there is not enough awareness to accept urban fringe belts as an urban entities with the exception of a planner, land developers and landlords.

### 2. Origin of Fringe belt

The research on a fringe belt development can be divided into three stages.

Stage-1: From 1936-Mid 1960s

The duration of the first stage of the fringe belt development was from 1936-mid 1960s. This was identified and articulated by the European geographers. The first fringe belt was recognised by Herbert Louis in his study of Berlin (Figure-1) which was further explored by M.R.G Conzen in 1960s in his studies of Alnwick and New castle upon Tyne (Conzen, 1960-62). His research became the foundation for the morphological theory of the urban growth and change. The inner and middle fringe belts were associated with city walls as fixation lines which acted as barriers to the physical growth of the city (Gu, 2010).

Stage-2: Between Mid-1960s to Late 1990s

The duration of the Second stage of the fringe belt development was from between mid-1960s to late 1990s. Whitehand (1967-1987) firm the relationship between fringe belts and building cycles, land values and innovations in transport and suggested the bid-rent model (1972) by these dynamics as per Figure 2.

The formation of the fringe belts was linked to slumps in housebuilding when land values were low; whereas the formation of high-density housing tended to rule during booms in housebuilding when land values were high. In this period, research on fringe belts mainly undertaken by geographers and largely concerned with the description and explanation of urban form rather than its relevance to planning (Openshaw, 1974; Slater, 1978; Carter and Wheatley, 1979; Whitehand, 1972; Conzen, 1978; Carter, 1983; Barke, 1976-1990).

Stage-3: From Late 1990s to Present day

The third stage of research is from the late 1990s to the present day as the larger attention has been given to exploring the connection between the idea of fringe belts and the practice of planning and urban morphology and urban management. The discussion of the fringe belt concept as an integrated planning approach (Whitehand & Morton 2003-2006), the place of fringe belts in urban management (Kropf 2001; Whitehand 2005) and their significance for urban ecology and sustainable development (Hopkins, 2004) is being systematically examined by urban morphologists, especially in the UK (Gu, 2010).



Fig -1: Berlin Fringe belt analysis, 1936

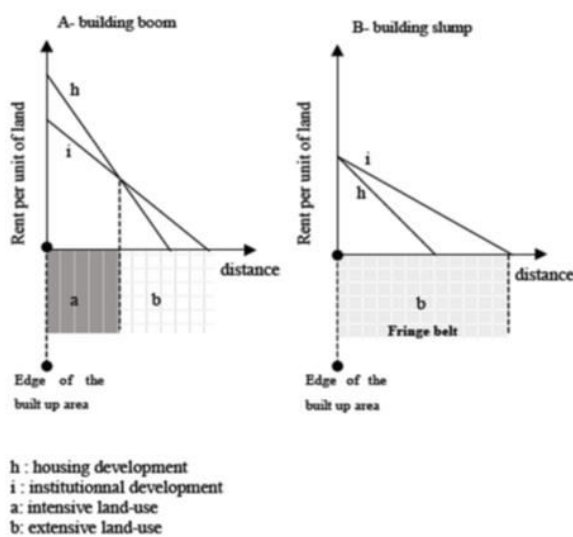


Fig -2: Bid rent model by Whitehand

### 3.Location

Vadodara is considered the 20th largest city of India located on the bank of the river Vishwamitri also called the cultural capital of Gujarat. It is the administrative headquarter of the Vadodara district. The nearest railway station is within the city itself. Climate of Vadodara city is hot and dry as the average maximum temperature reaches up to 44.2°C and minimum temperature reaches at 12°C. Yearly average rainfall of the Vadodara city is 950mm.

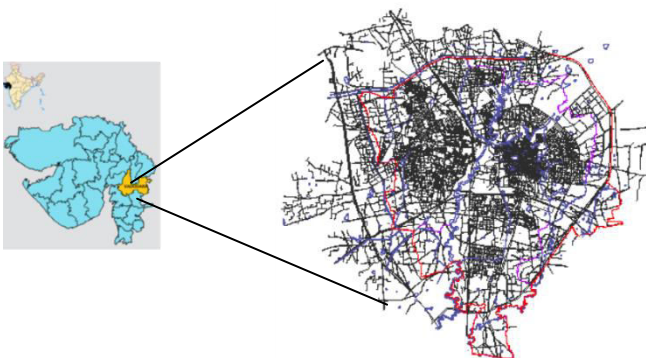


Fig -3: Map of Gujarat and Vadodara

Latitude: 22'30" N

Longitude: 73' 19" E

VMC: (Vadodara Municipal Corporation)

• Area: 270.21 Sq km

•Population: 1.7 Million (2011 census)

VUDA: (Vadodara Urban Development Authority)

• Villages: VMC and 106 villages

• Area: 714.56 Sq km

•Population: 2.1 Million (2011 census)

•Rivers: Mahi, Mini, Vishwamitri, Surya, Jambuva, Dhadhar

### 4. Development of Vadodara city:

Vadodara is a city with a long history. The first settlement in the region was developed near the bank of Vishwamitri somewhere around 1000B.C. In Cristian era a hamlet called Ankottaka was inhabited by nomadic tribes. In 600A.D, Massive flood in Vishwamitri washed away the Ankottaka which led the habitant to settled down at the Vadapadraka (Present Kothi area). During the 14<sup>th</sup> century Vadodara was ruled under Muslims rulers. By the end of the 15<sup>th</sup> centuryKhalikhan built a city on the eastern part of the Vadapadraka named Daulatabad and made a fort that became the new nucleus of the city which led the expansion of the fortified town towards east with extra mural growth. In 18<sup>th</sup> century within the fortified city Maratha Started ruling the Vadodara city. Finally, the British consolidated their position around 1818-19 by the virtue of their treaties with the Gaekwads in 1817-18 and with the Peshvas in 1819, and emerged as the supreme power. And this period was the evolution and growth of the City of Baroda and its development under the rule of the Late H.H. Sir Sayajirao Gaekwad, III (1875 to 1939).

### 5. Evolution & Growth of City

**Government:**The first civic body of Baroda City was constituted sometimes around 1830. The same year, the Municipality of Baroda began to work within the City walls. The municipal limits were extended beyond City walls in 1859 due to the rapid growth. In the princely state of "Gaekwads" (somewhere between 1875-1905) Baroda Municipality was in the form an administrative department. In 1905 the City was, brought under the 'A' Class according to the State 's classification of municipalities and its administration was transferred to the body of popular representatives.

**City development-major events:**

**a. Demographic growth trend:**

### b. Geographical expansion:

After independence industrial growth, development of service sector, educational facilities flourished in the city which resulted into population growth that made geographical expansion of the City imperative. In the sixth decade city, was spread over 22.68 sq. kms. In June 1964 the area of the City extended to include Nizampura, Nagarwada, Savad, Danteshwar, Manjalpur, Akota Jetalpur, Subhanpura and Cantonment area; with this the total area of the City increased to 72.44 Sq. Kms. Again, in December 1973 villages like Gotri, Wasana, Tandalaja, Ataladra, Vadasar, Maneja, etc. were included in the City limits. Due to the inclusion of these villages, the area of city increased by 25.28 Sq. Kms. making the total area of city 97.22 Sq. Kms. Later on in April, 1975 (dtd. 17/4/75) the area of city was further increased by 10.50 Sq. Kms. including Makarpura and Jambuva villages totalling an overall area limit at 108.22 sq. kms. And uptill 2011 the growth of the city further increased by 270sq. Kms. By including the outgrowth of Chhani and Nandersari..

### 6. Delineation of Inner, Middle and Outer fringe belt of Vadodara

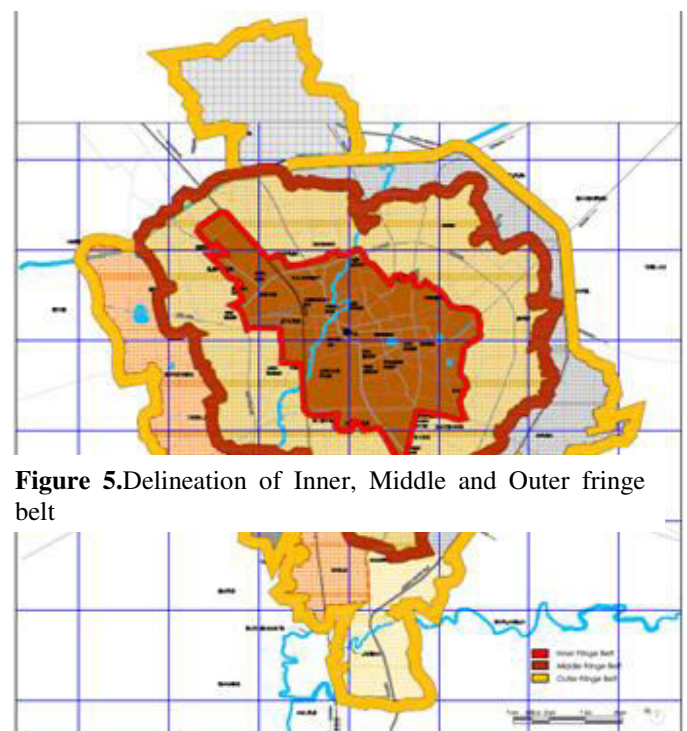
The map has been shown in the **figure 4** is the geographical expansion of the Vadodara city has faced

Year	Population	Growth rate
1901	103790	
1911	99345	-4.28 %
1921	94712	-4.6 %
1931	112860	19.16 %
1941	153860	35.8 %
1951	211407	37.9 %
1961	309719	39.6 %
1971	466696	58.3 %
1981	734144	59.3 %
1991	1,26,800	51.5 %
2001	1,491,045	32.2 %
2011	1,822,221	22.2 %

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raphical expansions has been shown through various legends. The geographical expansion up till 1964 denoted in dark brown boundary. Further, in light brown boundary it shows the geographical expansion of the city up till 1973. As it shows the gradual but very rapid growth due to the urbanisation process. Furthermore, from the year 1975 to the year 2000, the city limits extended gradually shown as orange and grey boundary. If we see this whole growth comprehensively, it can be seen that, the city majorly extended towards the northern, eastern and western side than the southern side. As the southern side of the city majorly occupied with the reserved government plot and the industrial estate

Through this organic growth as per the **figure no 4** the delineation of the inner fringe belt, middle fringe belt and outer fringe belt have been done. The decadal boundary naturally triggered the urban fringe of that particular time. Here, the Inner boundary of the city has been considered as the Inner fringe belt, similarly as per the geographical expansion Middle and outer fringe belt have been outlined shown in the **figure no. 5**.



**7. Inner fringe belt of Vadodara:** The first geographical expansion of the city has been taken as a study area. The urban periphery of the geographical growth is considered as an urban fringe and it was denoted in red boundary as the Inner fringe belt. The fixation line became the Vishwamitri river, railway station and further as the ring road, as it was assumed that the city will be develop inside the ring road.

The denoted inner fringe belt contains the institutional area, industrial area, low density housing area and many governments reserved area. **The figure 6** shows the inner fringe belt, considered as a study area with the major land marks of the city which used to be at the fringe of the city now embedded in the city. As we can see that from North east part many industrial setups like the Sarabhai chemicals, Alembic, Jyoti limited, Gorwa BIDC was located at then fringe. Towards the North the Vadodara Urban development authority was located. On the eastern side the Vadodara airport and the sardar estate was located at the urban fringe.

Likewise,

**Figure 4.** geographical expansion of Vadodara on the western side of the city the race course located on the fringe and



**Figure 6.** Inner fringe of Vadodara

towards the south the GIDC, Baroda dairy and Vishwamitri railway station located at the periphery of the city. These locations had been found at the periphery of the Vadodara city. If we see the current scenario these all

location accepts the southern side of the city merged and the city expanded beyond this former fringe.

## 8. Inner fringe development of Vadodara:

With the help of using the fringe belt analysis concept as a planning tool, it will help in the more in the formation of integrated planning and design policies. Here, the study of the fringe belt analysis of Vadodara city has been carried out through different techniques. Through Micro analysis technique the areas of the inner fringe belt have been analyzed. The land uses which have been considered the fringe belt component are the Industrial area, Institutional area, Government reserved areas, Green spaces, Vacant land and low-density housing. These all areas have been incorporated and analyzed through various maps.

In the micro analysis, the study majorly focused on four aspects which ultimately derives the existing situation of the fringe belt. The four aspects are:

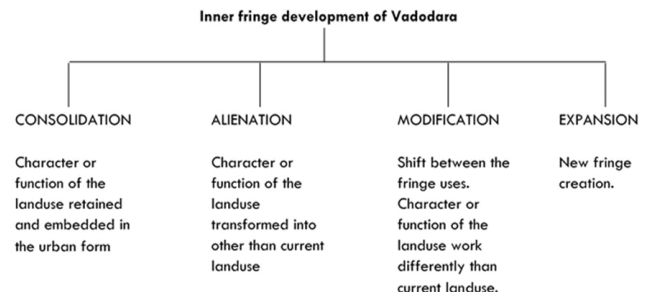
1. Fringe belt consolidation
2. Fringe belt Alienation
3. Fringe belt modification
4. Fringe belt expansion

Here the **fringe belt consolidation** defines the character or function of the land use retained and embedded in the urban form.

**Fringe belt Alienation** defines the character or the function of the land use transformed into other than the allotted land use.

**Fringe belt modification** defines the shift between the fringe uses. Character or function of the land use work utilized differently than allotted land use.

**Fringe belt expansion** defines the new fringe creation.



To investigate the fringe and transition and the morphological transformation, the land use plan of Vadodara city has been used as base plan for the study. The land use pan of Vadodara city of 1991 has been used as a base plan as shown in **figure 7**. Zoning of various land uses like Residential, commercial, industrial, institutional, agricultural and government reserved plot have been shown with their respective land use denotations. The zoning clearly defines the growth pattern of the city that was previously explained on the geographical growth of the city. The boundary which has been denoted as the inner fringe belt has been overlaid on the land use plan to delineate and identify the former fringe of the city which now became an integral part of the city and embedded totally. The identification of the fringe belt areas has been done and shown through different maps.

**Figure 8** shows the industrial areas of the fringe belt. It is denoted as a highlighted plot in the inner fringe belt. These industrial areas were deliberately planned to locate away from the city as per the demographic growth of 1966 but as per the current condition it was considerably merged in the city. The north-western side industrial areas were established very

beginning of the 20<sup>th</sup> century. As the areas which fall under were the Sarabhai chemicals, Alembic pharma, Jyoti limited Gorwa BIDD estate, Dinesh mill and Priyalaxmi mill. The area was considered as major industrial setup after the Makarpura GIDC. On the East, the sardar estate was located as a small industrial setup which was little farther from the former expansion of the city, now it is in the middle of the city as we can easily identify the basic distinguish between the residential area and industrial areas. On the south the major industrial setup of the Vadodara city had been established which serves the major industries that is Makarpura GIDC and towards the east the Pratap nagar industrial estate developed at the inner fringe of the city. Similarly, on the south-west the industrial area called Viswamitri township area has been developed near the palace compound. Served as an industrial area at the inner fringe of the city. So as per the industrial settlements we can get to know that there was a demand of an industries in the city back then and there is still a demand that some area which still serves as an industrial area with not as same extent as previously it served but it made an impact to the city and became the part of the city development. All these industrial areas have been analysed according to the current land use of the existing area and compared with the previous or allotted land use. And this analysis further classified into the four aspect which is Consolidation, Alienation, Modification and expansion.

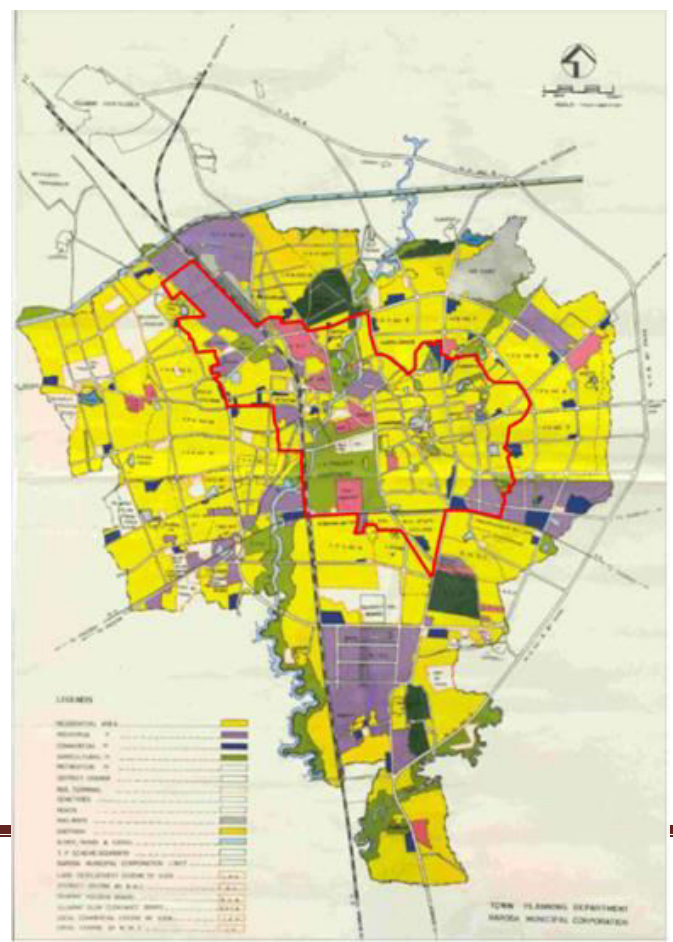
**Figure 9** shows the Institutional area of the city. In this inner fringe, few institutional areas have been found at the periphery. In the North-western side the agriculture university has been located near the Genda circle. The property has been divided in to two land parcels as the ring road is passing through them. Currently, this agricultural university serves between the city which was used to be at the periphery or on the fringe of the city. Similarly, on the North side, the M.S. University office campus and Polytechnic and B.B.A college located at the fringe which is now embedded in the city. On the Eastern side, the Land parcel was given to the institutional zone as at the time of the first fringe creation the growth of the city was not into that direction. It was allotted to the vaccine institute as currently it serves the Leprosy hospital and partially the land serves the recreational activities. And towards the south the Bhartiya Vidhya bhavan and the Tarsali I.T.I has been located as an institutional area. As this part of the area has not developed much over a period of time so it is still considered as a periphery of the city. These all institutional areas have been located and highlighted in the map along with the inner fringe belt and further analysed with the four aspect of the micro analysis of Consolidation, Alienation, Modification and expansion.

**Figure 10** shows the Low-density housing around the inner fringe belt. As the housing pattern were very inorganic and was rapid. The housing areas were not planned as the major settlement was developed before the land pooling system came into picture. The North-western areas that is area near and around the race course considers as a low-density housing area. On the North side called the fatehgunj area, the low-density houses developed near the E.M.E. campus. Which was converted into some of the institutions and commercial activities as now it is the part of the city. On the eastern side of the city There were two settlement established, one near the airport which was little far from the inner fringe and another at the fringe called the Warasiya area. On the south side there were only one low density settlement was found that is

Danteshwar as rest of the surrounding were industrial and the governments reserved plots which is still at the periphery. As the major residential development have been established towards the rest of the direction other than south.

**Figure 11** shows the Reserved plot by government. Highlighted plots are majorly owned by local government, Royal family and central government. As towards the north western side was only plot owned by government between the major industrial areas. Now it has been converted as a commercial area. Towards the north major reserved area have been developed as a cantonment area and regulated by the E.M.E. Also, towards the east it has been regulated by the airport authority and towards the south it majorly the reserved plot area owned and regulated by the Royal family, railway authority, S.R.P.F area and O.N.G.C. So, each component which serves as an inner fringe belt have been highlighted and further analysed.

The all the data has been combined together in to the one comprehensive base plan and further divided into three zones. The zone has been divided as per the 16square kilometre area as it was considered through observations of wards. Three zone have been divided named zone-1, zone-2, and zone-3 analysed individually in depth. Zone 1 represents the north-western area of the Vadodara city that is Sarabhai chemicals, Alembic, Gorwa BIDD estate, Racecourse etc. Zone -2 represents the eastern area of the Vadodara city that is area near E.M.E. cantonment, airport, Vuda, Warasiya etc. And zone-3 represents the south-eastern area of the Vadodara that is Pratap nagar industrial estate, Railway colony, O.N.G.C etc. Each zone individually analysed with four aspect kept in mind that is Fringe belt Consolidation, Fringe belt Alienation, Fringe belt Modification and Fringe belt expansion. The analysis has been done through photographs, current land use status, areas and Allotted land use status of all three zones. Comparative charts have been prepared after the analysis of each individual zones that represents the overall scenario or

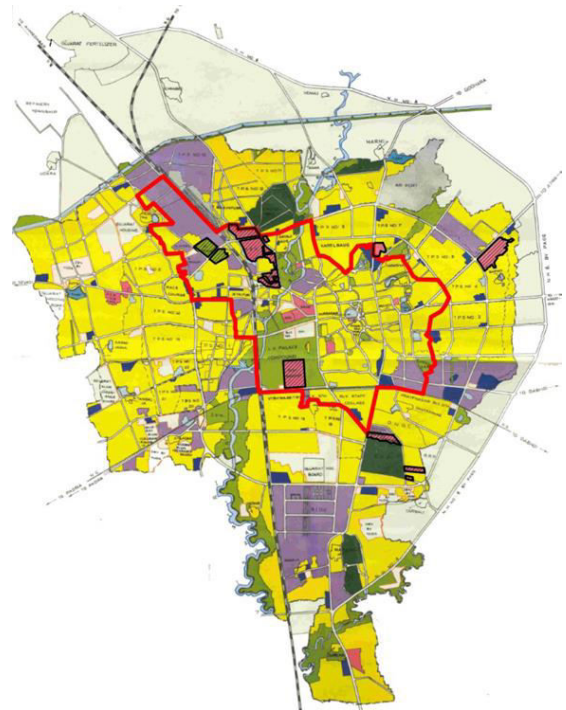


condition of the zones comprehensively, so that it would be easy to identify the gap and further findings. **Figure 12** represents the delineation of the zone.

**Figure 10.** Low density housing area



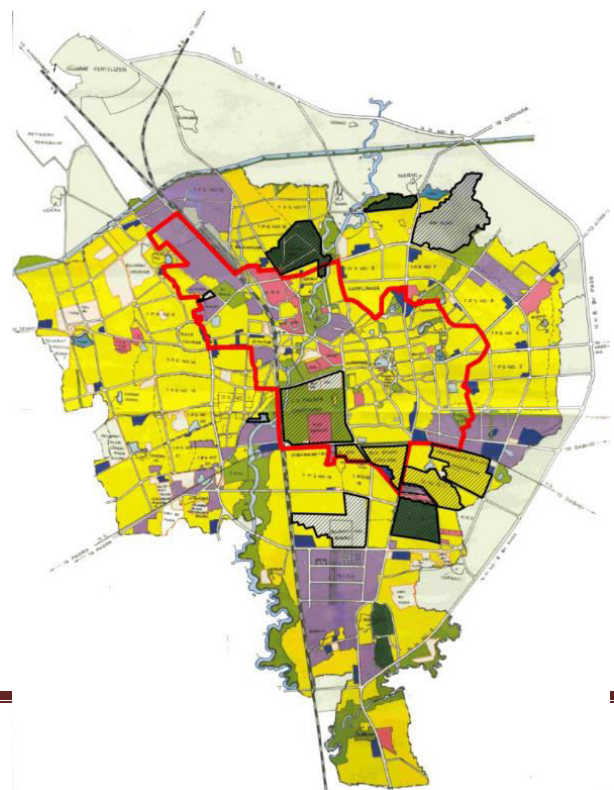
**Figure 8.**Industrial area



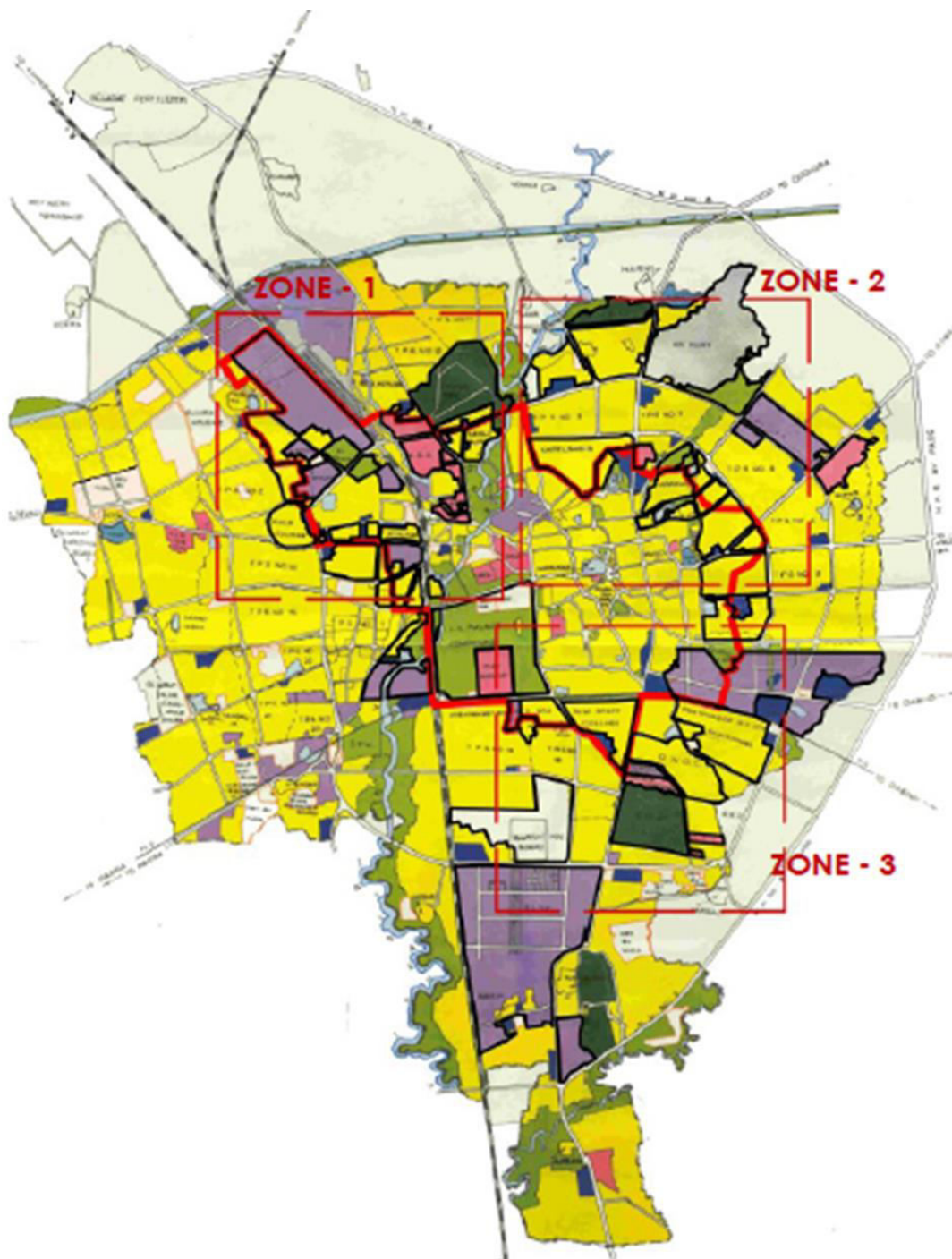
**Figure 9.**Institutional area



**Figure 7.** Land use plan of Vadodara,1991



**Figure 11.** Reserved plot by Government



**Figure 12** Zone delineation

have actually serving as per the allotted land use and which property has changed the land use on ground. Following are the properties have been analysed in zone-1.

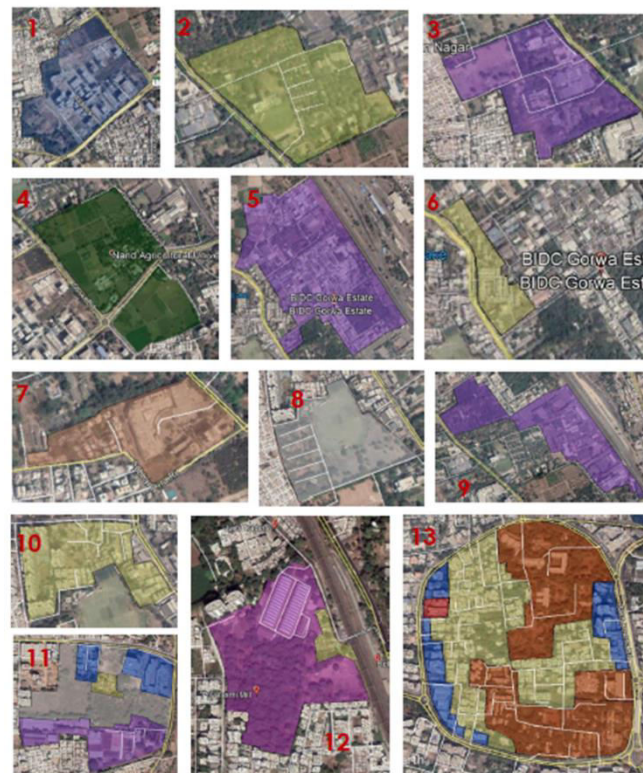
**Table 1** Zone-1 analysis

## 9. Analysis of Zone 1,2 and 3

### ANALYSIS OF ZONE-1:

Zone -1 is located at the north-western side of the Vadodara city. The zone is having an area of 16 square kilometre. The zone comprises of all the features of industrial area, Institutional area, Reserved area, and low-density housing. In the analysis each area has been surveyed as per the four components of the micro analysis that is fringe belt consolidation, fringe belt Alienation, fringe belt modification and fringe belt expansion.

In Zone 1, existing land use have been analysed and cross checked as per the ground reality. Plot sizes, Property name



**Fig. 13** Zone-1 analysis

As per table no-1 shows the analysis of Zone -1. It has been analysed that the Sarabhai campus having an area of 29.6 hectares having a big piece of land which was allotted as an industrial area. This area has been served as a Sarabhai chemical which was an industrial setup, was shut for a decade. As the area was at the fringe now embedded in the city having a developmental pressure and finally the land got converted into the commercial use and serving its best to the city because of its prime location and land value. This morphological transformation considered as a fringe belt alienation. Similarly, Alembic has a land area both as an industrial area and residential area. The Alembic residential having an area of 18.73 hectares the land use was allotted as a residential and it is still serving as a residential land use. This transformation is considered as a fringe belt consolidation. Similarly, Alembic research having a good amount of land which is having an area of 18 hectares. Previously the land had been served as an industrial area and currently it is serving the same as an Industrial land use.

Gorwa BIDs estate had been served as an industrial park, then embedded in the city. Gorwa BIDs having an area of 75 hectares in which 5 hectares has been converted to industrial to residential settlements. Here, the allotted land use has been an industrial area and currently it is still serving as an industrial area however some of the usage of land got modified. This transformation is considered as fringe belt modification. Now there was a reserved plot of government located between these industrial settlements, which was having an area of 60 hectares.

Sr . no	Name of Property	Area	Allotted Land use	Existing Land use
1	Sarabhai campus	29.60 ha	Industrial	Commercial
2	Alembic (Residential )	18.73 ha	Residential	Residential
3	Alembic (Research)	18.14 ha	Industrial	Industrial
4	Agriculture University	28.28 ha	Institutional	Institutional
5	BIDC	70 ha	Industrial	Industrial
6	BIDC (Residential )	5.61 ha	Industrial	Residential
7	Reserved plot	60 ha	Reserved plot	Commercial, Residential
8	Vacant plot (Alembic)	10 ha	Residential	Recreational
9	Jyoti Limited	34 ha	Industrial	Industrial, Recreational
10	Residential	6.09 ha	Residential	Residential
11	Dinesh mill	18.92 ha	Industrial	Commercial, Residential, Vacant
12	Priyalaxmi mill	10.25 ha	Industrial	Vacant, Commercial
13	Race-course	42.2 ha	Residential	Institutional, Residential, Commercial

and area of the land parcel have been analysed and compared between the allotted land usage and with the existing usage. Through this process it has been found that which property

The plot remains vacant for many decades but due to development pressure it had been converted and served as a commercial use. This transformation is also known as the fringe belt alienation. In addition, Jyoti limited has also been a part of the industrial area of 34 hectares having industrial land use but over a period time it can be seen some of the portion of the estate which is not in use and remain empty had converted into recreational area.

Also, the low-density housing has started to form around these industrial areas and still it has retained the character of residential. That defined the consolidation of the fringe belt. Similarly, the race course was once upon a time used as a recreational activity then over a period of time it started to convert and now it is all transformed into residential, commercial and institutional usages.

And towards the west, the fringe comprises a mill named the Dinesh mill and Priyalaxmi mills. Dinesh mill industrial area comprises of various other mills having an area of 42.2 hectares. Today only Dinesh mill has survived and rest was transformed into commercial usages however commercial set up is not as successful as the Sarabhai campus. This process is again called the fringe belt alienation. Similarly, the Priyalaxmi mills having an area of 10.25 hectares. There is no existence of the mill now, as most of the part of the land is vacant and some part is used as the godown. As the allotted land use of Priyalaxmi mills has not changed but it is not even serving as per the usage. This process is called the fringe belt consolidation.

As it has been found that the zone 1 has been through the major morphological changes and transformation as there has been major area alienated and transformed that resulted in a positive way and added the positive impact to the city. Also, some of the area from the analysis are on the verge to transform as the development will demand the transformation and that will change the morphology of the city.

### ANALYSIS OF ZONE-2:

Zone -2 is located at the north-Eastern side of the Vadodara city. The zone is having an area of 16 square kilometre same as the zone-1. The zone comprises of all the features of industrial area, Institutional area, Reserved area, and low-density housing. In the analysis each area has been surveyed as per the four components of the micro analysis that is fringe belt consolidation, fringe belt Alienation, fringe belt modification and fringe belt expansion.

In Zone 2, existing land use have been analysed and cross checked as per the ground reality like zone-1. The plot sizes, Property name and area of the land parcel have been analysed and compared between the allotted land usage and with the existing usage. Through this process it has been found that which property have actually serving as per the allotted land use and which property has changed the land use on ground. Following are the properties have been analysed in zone-2.

Zone-2 is majorly surrounded by the residential plots. There are many buildings which are found older than 60 years and some of even in deteriorated conditions. The Post and BSNL staff quarters are located in-front of the airport area. The buildings are more than 60 years old shown in figure no1. Some of the buildings are currently in use as people are residing but in the same campus there are some buildings which is not in use and in deteriorated condition. The total area in which the post and BSNL quarters are situated covers

up 12.71 ha. Similarly, in the near the Amit nagar circle, The Press quarters are situated. The people who are residing in the building are the employees of the Government Press. The buildings cover up an area of 1 hecter. The buildings are also older than 60 years and it can be taken in the consideration of redevelopment Shown in figure no.2.

There is a reserved plot of government opposite of the VUDA Bhavan, besides the Ratri Bazar shown in figure no 3. The plot is reserved and allotted as a Botanical garden land as per the given occupancy however there is presence of a Slum dwellings which has currently occupied by the slum dwellers over more than 40 years. The area of the reserved plot is 8.13 hectares and which is serves as slum dwelling and a vacant plot shown in figure no.3.

As above mentioned, there was reserved land used as a dumping ground is a Ratri Bazar opposite VUDA bhavan shown in figure no 4. The area of the land is 0.8 ha. It was a dumping ground for waste and an unused and vacant land till 2010. Now the land has total transformed with another land use as a commercial purpose and serves as a night market. This alienation of land changed the scenario of the city and has improved the night life of the city.

Sr. no	Name of Property	Area	Allotted Land use	Existing Land use
1	Post&BSNL quarters	12.71ha	Residential	Residential
2	Press quarters	1.09 ha	Residential	Residential
3	Botanical garden	8.13 ha	Reserved	Residential, Vacant
4	Ratri Bazar	0.8 ha	Reserved dumping site	Commercial
5	Agora	4.73ha	Residential	Commercial, residential
6	Vacant (Airport circle)	1 ha	Residential	Vacant
7	Old airport	1.64	Reserved plot	Recreational
8	Vacant plot (Warasiya)	7.87 ha	Reserved	Vacant
9	Vaccine Institution	37.24 ha	Institutional	Institutional Recreational
10	Sardar estate	76.8 ha	Industrial	Industrial, Commercial, Residential
11	Residential (B/H airport)	78.50 ha	Agricultural	Commercial, Residential, Vacant, Institutional

**Table 2** Zone-2 analysis

The intervention of Ratri bazar generated the opportunities to the surrounding neighbourhood and many commercial developments initiated the commercial development and one

of the major development is Agora Mall as shown in figure no.5. The land was having a slum dwelling previously which was ultimately relocated at the same site. The development was carried out on PPP mode. The land area is 4.73 hector and it is going to be one of the major commercial development of the city.



**Figure 14** Zone-2 analysis

Vadodara city has a domestic airport located in the North-East area. The airport was the one of the major commuting sources through air route in Vadodara city. It was opened for public in 1937 by H.H Sir Maharaja Sayajirao Gaekwad III. The city got its new airport in 2016 besides the old airport. As the new airport is serving the needs, the old airport is now used and carried out a commercial activity and generates revenue by the airport authority. The area outside of the old airport having an area of 1.64 hector used for commercial activity.

Sardar estate is the one of the small industrial estate which is situated in the Eastern part of the city. It was allotted of an area of 78.6 hector as an Industrial area however the area which is used as an industrial area is 41.5 hectors. The rest was modified and converted into residential and commercial areas as shown in figure no.10.

There is an Institutional plot allotted right after the Sardar estate. It was a reserved land of vaccine institute currently serving as a Leprosy hospital having an area of 37.24 hector. The hospital campus covered 16.9 hectors of land and rest has been used as a recreational space.

The area behind the airport was an agricultural land having an area of 78.50 hectors and now it has been transformed and alienated to the residential area.

### ANALYSIS OF ZONE-3:

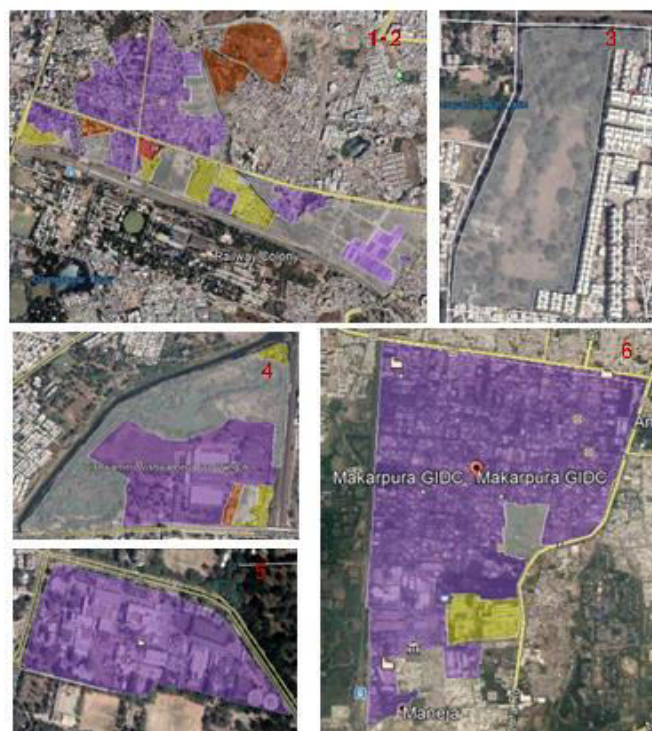
Zone -3 is located at the Southern side of the Vadodara city. The zone is also having an area of 16 square kilometre same as the zone-1and Zone-2. The zone comprises of all the features of industrial area, Institutional area, Reserved area, and low-density housing. In the analysis each area has been surveyed as per the four components of the micro analysis that

is fringe belt consolidation, fringe belt Alienation, fringe belt modification and fringe belt expansion.

In Zone 3, existing land use have been analysed and cross checked as per the ground reality like zone-1and Zone-2. The plot sizes, Property name and area of the land parcel have been analysed and compared between the allotted land usage and with the existing usage. Through this process it has been found that which property have actually serving as per the allotted land use and which property has changed the land use on ground. Following are the properties have been analysed in zone-3.

Sr. no	Name of Property	Area	Allotted Land use	Existing Land use
1	Pratap nagar Industrial area	92.11 ha	Industrial	Industrial, Residential, Commercial and vacant
2	Gajra vadi STP	12.12 ha	Reserved site	STP
3	Schlafhrost Engineering India	10.7 ha	Industrial	Vacant
4	Vishwamitri twonship	34.6 ha	Industrial	Industrial, Vacant, Institutional, Residential
5	Baroda dairy	10.1 ha	Industrial	Industrial, Commercial
6	Makarpura GIDC	437 ha	Industrial	Industrial, Residential

**Table 3** Zone-3 analysis



**Figure 15** Zone-3 analysis

Zone -3 is majorly occupied by the industrial area as Zone 3 consist of the major industrial setup like Gujarat Industrial Development Corporation, Pratap nagar estate, Vishwamitri township etc also Baroda dairy. G.I.D.C consist of all sort of industries from a small scale to the large scale. The city was not spread much on the southern side because of the industrial development and many governments reserved plots dominated the residential and commercial areas.

Pratap nagar estate was allotted as an industrial area in the development plan of 1991. As it was further developed and combined with the residential area. Figure no.1 shows the Pratap nagar industrial estate which is having an area of 92.11 hector. The land was allotted as an Industrial use however over a period of time it is modified as it used as an Industrial, residential, commercial and vacant spaces. The industrial areas are more occupied as compared to the residential areas. On the same side Gajrawadi STP also located as shown in figure no.1. The sewage treatment plant was having an area of 12.12 hector which is currently serving the south-eastern area and the STP site is reserved land by the Government.

On the contrary, there is a vacant land of 10.7 hector allotted as an industrial area located near the Vishwamitri railway crossing. The land is privately owned by the Schlafhorst engineering India as shown in figure no.3.

Vishwamitri Township located on the south-western side of the Vadodara city besides the Laxmi Villas Palace compound having an area 34.6 hector

The Baroda dairy is serving since 1957 near Makarpura road having an area of 10.1 hector. The land is allotted as an industrial setup for dairy plant having capacity of 50000 litre. Figure no. 5 shows the location of the Baroda dairy.

GIDC is one of the major industrial setup where in all types of industries are established from small, medium to large. It was the major industrial development area which is located at the southern part of the Vadodara city and established in the sixth decade having an area of 437 hector which is very huge chunk of land. It was strategically kept on the southern side of the city as the preliminary wind flows from the southwest, therefore the wind flows from these industrial area does not flow from the city.

From analysing the e all existing condition of Zone-1, Zone-2 and Zone-3 it has been analysed the condition of Alienation,

Consolidation, Modification and Expansion of the fringe belt as Micro level analysis.

Table 6 shows the segregated land zones according to the condition which has been analysed.

## 10 CONCLUSION

As a result of the fringe belt analysis, it is obvious that due to urbanisation, area which have fringe belt characteristics have been declined. This situation is called fringe belt alienation which is one of the four components which has been analysed in this study, causes the disappearance of these areas a result of rapid urbanization. Also the major concern of the study is to understand and analyse the fringe belt concept - which has not been introduced widely and practiced in urban planning-to incorporate in the panning literature.

The conclusion for this analysis is evaluated through forecasting 20years perspective plan and the proposals are given in the same line of direction.

Overall it has been observed that the green spaces are well maintained in the all three zones but many of them are fall under reserved plot, cantonment area and Privately owned properties. The public spaces are less in all three zones. So proper green space needs to be provided as per the URDPFI guidelines 10sqmt per persons or according to ward population whichever is suitable. That will ultimately create the breathing spaces and generate a buffer space which is surrounded by the more of residential and industrial area.

Public spaces are adequate and well served in zone-1 but it is inadequate in the rest of the zones. Though the city has good accessibility, it is lacking the public spaces which ultimately force people to travel with high proximity. To prevent the vacant and unsafe image of the area, active uses, cafes, museums, malls, art centres, connected pedestrian streets are suggested in zone 2 and Zone 3 to improve public integrations. Through decentralising the public spaces in each zone, it will shift the burden from one zone which used to solely serve the public and give access to public in their own nearby premises.

Several usages are suggested to be modified for more compatible according to the neighbourhood planning as the industrial area which is once was located as an extended fringe now embedded in the city creating the negative impact. In the analysis, it has been found that many industrial setups in the Zone-1 and Zone-2 utilising as different usage which is other than the industrial use. So it is suggested that the Industrial area and warehouses should be relocated and replaced by Cultural centres, Museums and several Institutional uses or Green areas, Public parks, Hawking or Vending zones etc. These kind of activities can be utilised in the respective zone ultimately benefits the people as in zone 1 and zone2 there are industrial activities on going which was previously on the edge of the city, now embedded in the core areas.

One more things which has been found in the micro analysis of Zone-1, Zone-2 and Zone-3 that the buildings which is in depleted or an unused condition or more than age of 60 years needs to be Redeveloped. In Zone-2, it has been found that the building age is taken into concern for two government townships. Considering the current building bylaws and the safety concern the building needs to be redeveloped and according to the current FSI it has to be utilised to its fullest

	ZONE-1	ZONE-2	ZONE-3
<b>CONSOLIDATION</b> Character or function of the landuse retained and embedded in the urban form	<ul style="list-style-type: none"> <li>BIDC gorwa estate</li> <li>Alambic</li> <li>Agriculture University</li> <li>Physioamr mill</li> <li>Race course</li> <li>Residential b/h Alambic</li> </ul>	<ul style="list-style-type: none"> <li>Port &amp; BSNL quarters</li> <li>Press quarters</li> <li>Vacant plot (Airport)</li> </ul>	<ul style="list-style-type: none"> <li>Schlafhorst Engineering India</li> <li>Gajrawadi STP</li> <li>Baroda dairy</li> </ul>
<b>ALIENATION</b> Character or function of the landuse transformed into other than current landuse	<ul style="list-style-type: none"> <li>Sarabhai Campus</li> <li>Dinesh mill</li> <li>Reserved plot nr. Alambic</li> <li>search</li> </ul>	<ul style="list-style-type: none"> <li>Rathi bazar</li> <li>Agrara city center</li> <li>Residential plot b/h airport</li> </ul>	<ul style="list-style-type: none"> <li>Pratap nagar Industrial estate</li> </ul>
<b>MODIFICATION</b> Shift between the fringe uses, Character or function of the landuse work differently than current landuse.	<ul style="list-style-type: none"> <li>Alambic Research</li> <li>BIDC residential</li> <li>Alambic Vacant plot</li> </ul>	<ul style="list-style-type: none"> <li>Reserved plot as botanical garden</li> <li>Old airport</li> </ul>	
<b>EXPANSION</b> New fringe creation.		<ul style="list-style-type: none"> <li>Airport</li> <li>Sardar Estate</li> <li>Vaccine Institute</li> </ul>	<ul style="list-style-type: none"> <li>Makarpura GIDC</li> <li>Vishwamitri township</li> </ul>

so that the maximum density meets the current need and this has to get supported by the Government.

The slum or any illegal settlements needs to be relocate. As in the Zone-2 it has been found that the slum which used to located at the site now developing as project which serves on PPP mode and the slum dwellers are relocated in the same place as per the government guidelines of PMAY housings. Also in the nearby context again on the reserved plot by the Government allotted as the botanical garden and currently served by the Slum dweller over more than 30 years which needs to relocate and the land must be utilised as per the given allotment for public use.

Also city's urban heritage is one of the historical value of the city needs to preserved as the Vadodara has its very own long history and the entitled to the cultural capital it is the responsibility of each individual to respect the heritage. So in this regards it is suggested that any historical building or Identity needs to be protected, also no other building ruins the silhouette needs to be taken care as primarily protecting the historical silhouette by storey restriction is necessary.

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