

# Urban Sprawl and Comparison of Travel Indicators

Rahil M. Avadia<sup>1</sup>, Prof. Ashok C. Patel<sup>2</sup>

<sup>1</sup>M.E Student, Dept. of (Civil Infrastructure) Engineering, L.D.R.P Institute of Technology Research, Gujarat, India

<sup>2</sup>Asst. Professor, Dept. of Civil Engineering, L.D.R.P Institute of Technology Research, Gujarat, India

**Abstract-** Urban sprawl is growing along with the growth of the city to fulfil its need. Urban sprawl is the expansion which is happening on the peripheral limit of an urbanized area. Such growth results into low density settlements and decentralized pattern of suburban growth. Such urban sprawl attract or produces trip to fulfil their needs that indirectly increases travel distance, use of more private vehicle, increase in congestion, pollution, quality of life decreases and no safety for commuter as well as pedestrian and non motorized vehicle (NMV). The Sustainable Transport Area should be such that it can efficiently use the existing resources as well as create resources that could sustain for a longer period. It should be the combination of all the three factors Socially, Convenient and easy and environment friendly. Urban sprawl is one of the major points of discussion for rapidly growing cities. This kind of development leads to various other issues like congestion, pollution, increased travel time and trip length, unsafe for pedestrian. To define Sustainable Transportation system, its overall goals and objectives. To examine factors that support sustainable transportation at neighbourhood level.

**Index Terms-** Urban Sprawl, Decentralized, Neighbourhood, Congestion, Sustainable Transportation system.

## I. INTRODUCTION

Through most of history the human population has lived a rural lifestyle. However, in the first decade of the 20th century this trend started to change and the world is still becoming urbanized as thousands of people migrate to cities. Urbanization is now seen all over the world, especially in an alarming rate in developing countries. Because of the different activities and processes that take place in the urban ecosystem every day, the subject of urban sprawl has drawn attention from ecologists, urban planners, civil engineers, sociologists, policy makers, and finally to

common urban or rural resident. In most cases, urban sprawl is regarded as one of the major effects of urbanization. It mainly consist of excessive land, low density at peripheral limit, lack of transportation ways and modes, wside open space, scattered appearance, lack of choice in housing type and prices, saperation of uses into distinct areas, repetitive one story development. Sprawl takes place in the peripheral boundry of the city area. Low residential density with leapfrog development and no centralized ownership of land or no planning of development takes place at sprawl.

### 1.1 Need of Study

- This review paper will outline possible conditions and impacts of urban sprawl area.
- It will help in explaining urban sprawl and its causes, it ultimately has always been a population and land-use issue.
- To invent inter-connected social, physical, political factors and their effect on sprawls.
- To examine the indicators of present condition of study area to understand whether (study areas) facilitate an efficient accessibility to land use and travel activity.
- To make conclusion and recommendations regarding the topic of problems arising due to urban sprawl.
- To discuss the urban sprawl for selected city.

### 1.2 Objective

The objective of this study is to give a better understanding of the term 'sprawl'. The aim here is to compare the two study areas in accordance with the Level Of Service ranks which is calculated according to the equations given in the journal of MoUD – Service Level Benchmarking for Indian cities. To discuss the link between population and

growth pressure and its effect in urban land-use change in developing countries.

- Study different causes and patterns of land use that lead to urban sprawl.
- Describe interconnected social, physical and political factors and their effect on sprawl.

## 2. STUDY AREA

The city of Ahmedabad is located in the state of Gujarat, which is located in the western part of India. The city of Ahmedabad is the seventh largest metropolis in India and the largest in the state. The city is known as the commercial capital of the state and known as the textile capital of India. The city of Ahmedabad is governed by Ahmedabad Municipal Corporation (AMC), the area of approximately 466.35 km<sup>2</sup> and Greater Ahmedabad is under the jurisdiction of the Ahmedabad Urban Development Authority (AUDA) with an area of approximately 4200 sq km. The latitude of ahmedabad city is 23.0225° N and the longitude is 72.5714° E.



Figure 1: Location map of Ahmedabad

In addition the study of this research is limited to selecting only two neighborhood area. These two neighborhoods are compared and verified with the indicators of the sustainable transportation system. These two neighborhoods are Chandkheda and Kathwada, which are located at the edge of the city of Ahmedabad.



Figure 2: Location map of Chandkheda

Both the areas have similar characteristics, in terms of socio-economic characteristics. Both the areas are of similar size and well-developed neighborhoods. As one is old developed and other is newly developed area. Also one is located near the city center and the other is located far from the city center.



Fig 3: Location map of Kathwada

The population of Chandkheda is 1 lakh and contains the area of 11 sq. km. The density of Chandkheda area is 9100/km sq. It contains the household of 10,989.

The population of Kathwada is 23,300 and contains the area of 7.25 sq. km. The density of Kathwada area is 3,217/km sq. It contains the household of 4,940.



Figure 4: location map of neighbourhood

As shown in above map, Chandkheda area and Kathwada area are located at the peripheral boundary of Ahmedabad city and are growing on large extent.

Both the area contains residential, non-residential, industrial and recreational zones. It also contains different transportation indicators.

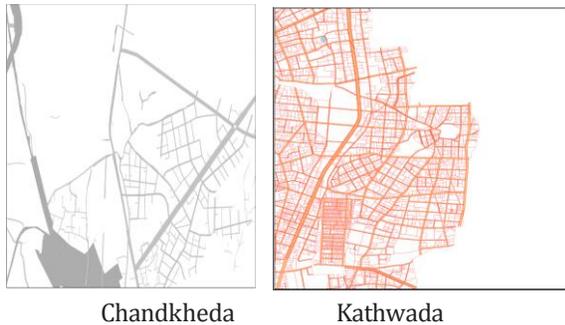
## 3. DATA COLLECTION & ANALYSIS

Measuring performance of different transport facilities is necessary to identify gaps and problems

in service levels. Performance levels can be evaluated using various indicators that can help in establishing baselines, identifying trends, predicting problems, assessing options and setting performance targets. Benchmarking - comparing performance levels against set targets or best practice cases - has now been recognised as integral to ensuring accountability in service delivery with the Ministry of Urban Development (MoUD), Government of India announcing “Service Level Benchmarking” for Urban Transport.

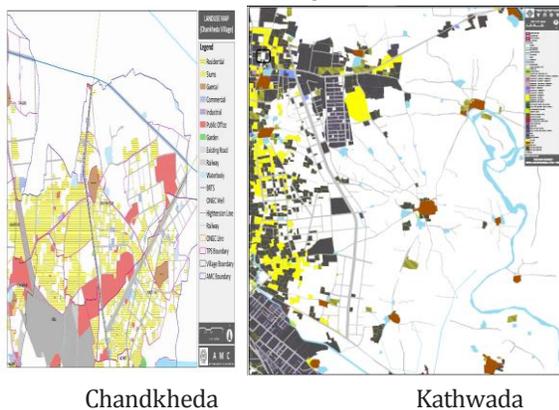
3.1 Comparing the Indicators for both the study areas

3.1.1 Road network pattern



Chandkheda	Kathwada
Complete network but not clear and complete pattern	Complete network but not clear and complete pattern
LOS 2	LOS 2

3.1.2 Mixed Land Use Zoning

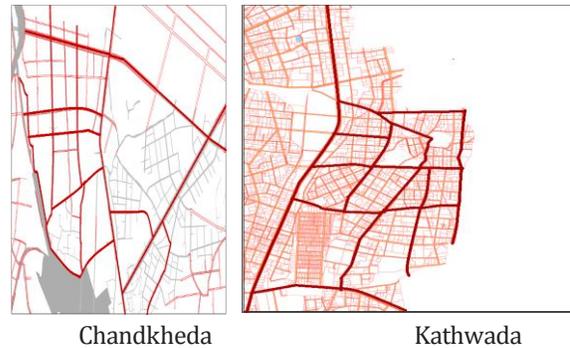


This indicator evaluates the percentage of mixed land use located along transit corridor. Mixed land use here it is considered the non-residential property that includes commercial, offices, institute, parks, markets, and also residential property.

Chandkheda	Kathwada
A) Total undeveloped area (sq km) - 5	A) Total undeveloped area (sq km) - 3.25
B) Total Transit Network (km) - 23	B) Total Transit Network (km) - 18
A/B = 21.7%	A/B = 18.05%
LOS 2	LOS 2

3.1.3 Service coverage of public transportation:

This indicator are used to examine available public transport services in the respective study area. If the service is accessible and covers the main demand corridors in the study area. This helps to know the density of the public transport network; the more the result, it means very good public transport service is available and decreases the result, it means less the service is provided by the public transport service.



Service Coverage of Public Transportation	
Chandkheda	Kathwada
A) Total PT length(km) - 23	A) Total PT length(km) - 18
B) Total Area (sq km) - 6	B) Total Area (sq km) - 4
LOS 1	LOS 1

3.1.4 Bus Stop Location

Availability and accessibility at the bus stop are important for a sustainable transportation district. Commuters should be encouraged to use public transport services by providing comfortable public transport service with appropriate access to this service on walking distance.



	Kathwada	
Chandkheda	Chandkheda	Kathwada
Bus stop location	34	17
Total no. of bus-stop	3.09	2.34
Density (total no. of bus stops/total area)		

First of all to check the availability of the bus stop in the area, it is important that the total number of bus stop requirements must be calculated by calculating the bus stop density. To know the density of the bus stop, the calculation is made for the total number of bus stops/sq km.

### 3.1.5 Street Connectivity

This is an important indicator that shows the connectivity of street in the study area. It helps identify missing links and helps to plan alternative route option for pedestrian, non motorized vehicle (NMV) and motorized vehicle. Links are pieces of road that connect nodes. Nodes exist at the intersection of the street and dead ends.



Street Connectivity	
Chandkheda	Kathwada
A)Total No. of Links – 341	A)Total No. of Links– 280
B)Total No. of Nodes– 280	B)Total No. of Nodes–268
A/B = 1.21	A/B = 1.04
LOS 3	LOS 4

These indicators are examined to support the studies and to know existing scenario of the study areas. To simplify this analysis the factors are filtered and

compared on the basis of Level of Service by the journal of MoUD-SLB for Indian city so that it is easy to evaluate those indicators and compare the two study areas for better results. Also the indicators here are selected from the journal of MoUD Service Level Benchmarking for Ahmedabad City. The calculations of the LOS shows the sustainability level of both the study areas and to reach the desired LOS recommendations and suggestion is provided.

## 4. CONCLUSION AND RECOMMENDATION

### 4.1 Conclusion

Urban sprawl is the uncontrolled and uncoordinated outgrowth of towns and cities. Sprawl generally refers to some type of development with impacts such as loss of agricultural land, open space, and ecologically sensitive habitats in and around the urban areas. These regions lack basic amenities due to the unplanned growth and lack of prior information and forecasts of such growth during policy, planning and decision-making.

The research has studied the indicators and methodology to differentiate the indicators into three categories that are Economic, Physical and Trip characteristics. The economic characteristic has impact on the individual’s ability to afford motorized vehicles and its use. Less average family income leads to more two wheeler ownership in Indian cities compared to other developed countries where two wheeler ownership is not as distinct. It has been observed that indicators of Physical characteristics and trip characteristics are interrelated with each other. Physical characteristics indicators like road network connectivity, land use and public transportation services are very essential to justify the sustainability of given areas. Appropriate physical planning at any area with proper accessibility to all amenities is essential. Amenities located within 250 to 400 m can be defined as accessible area. The area containing mixed land use having good accessibility to transit has an effect on individual’s decision to use public transportation service. Both the areas can sustain increase in residential density and commercial density by taking various steps to integrate transit into their area and participation in land use planning in their metropolitan area. The methods like meetings, planning activities and personal networks have taken place between the people and

government. The citizens are made aware of sprawl and transit facilities connected to it and how to use it.

#### 4.2 Recommendation

To provide Sustainable Transport Study Area following points are recommended:

- Complete road network pattern requisite with maintained hierarchy of street within the area so that it can filter pedestrian and motorized vehicle movement.
- Desired Street connectivity index should be 1.6 or minimum 1.4 for good network connectivity.
- The existence of dead ends should be eliminated.
- Higher FSI (about minimum 4 to 5) should be investigated along transit corridor with mixed land use to generate employment and population density within the area.
- Good and complete road network pattern with maintained hierarchy of street within
- Population density ratio should be higher to grow the city as compact.
- Public transportation services should be within walkable distance of 250 m to 400 m for it to be accessible.

#### REFERENCES

- [1] AUGUSTO de Lollo,(june 2012). Urban Sprawl and the Challenges for Urban Planning.
- [2] Darren Bilborough, Roman Trubka, (april-2010). THE COSTS OF URBAN SPRAWL INFRASTRUCTURE AND TRANSPORTATION.
- [3] DERMOT FOLEY and MORAG CARTER,(2003).Understanding Sprawl A CITIZEN'S GUIDE. The Chawkers Foundation.
- [4] W WASMER, (2005), Causes of Urban Sprawl (Decentralization) in the United States: Natural Evolution, Flight from Blight, and the Fiscalization of Land Use.
- [5] Nina Shir Khanloo, (2013), Analyzing the Effects of Urban Sprawl on the Physical Environment in the case of Kyrenia.
- [6] DEL PETERSEN, (oct-2009). TRANSIT AND SMALL URBAN SPRAWL .Small urban and Rural Transit center.
- [7] Matthew L. James, (1996), Towards Sustainable Cities:Urban Transport and Land Use Planning.

Science, Technology, Environment and Resources Group.

- [8] Richard Gilbert, Neal Irwin, Brian Hollingworth, (2002), Sustainable Transportation Performance Indicators (STPI).
- [9] AMC GIS SECTION
- [10] AUDA GIS SECTION