Editorial

This issue contains eight papers. The first one on "Smart Model for Urban Land Management" is written jointly by Pastagia Digant A., Patel Jignesh K. and Macwan Joel E. M., with a focus on urban land management in India, which is a state subject and each state has its own urban land supply policy. The aim of this research paper is to identify the best land management techniques in India based on performance indicators and to develop an innovative technique using a combination of various tools to enhance the quantum of supply of urban land. Accordingly, the town planning schemes being practiced in Gujarat specifically Surat TPS number 32 was examined in detail as a case study to find deficiencies in town planning schemes. The SMART (sustainable, marketable, aesthetical, rational and transit oriented) model was developed to improve the performance of land pooling as land management policy. The SMART model was implemented for TPS number 32 in which 12 per cent extra urban land was provided for infrastructural development in this scheme. While the second paper titled "What is the Name of a Place? A Toponymic Study in Historical Urban Settlements" jointly authored by Rebecca S. Jadon and Sanjay S. Jadon, explores place names, their origins and meanings in Indian cities. The paper discusses the concepts of place and placelessness in the current world scenario and the role of place names in the sense of identity. It argues how names themselves become a part of the place identity. A basic toponymic study of places in two Indian cities is used to explore the origins of names within the cultural, linguistic and socio-political context. The study seeks to understand linkages in social, historical and political narratives of cities through its toponyms.

The third paper on theme "A Road Map for District Planning in India" penned by Jacob Easow underlines the institutional architecture envisaged under the 74th Constitution Amendment Act, which mandates every district of the country to constitute a District Planning Committee (DPC) and to prepare a District Development Plan. The changed scenario after the establishment of the NITI Aayog, the district development plan envisaged in the amended constitution, assumes great relevance than ever before, therefore, a clear cut policy blueprint is needed. This paper outlines a methodological suggestion for district planning in the light of the constitutional provisions. Preparation of such a district plan will surely need decisions and commitments at various levels due to the multiplicity of agencies involved and the vast spectrum of aspects to be addressed. In this context, the paper traces a road map for each milestone for the preparation of district development plan,which can be replicated anywhere in India. The paper of Walid Al-Shaar on the on the topic "Design Models of Roadway Transportation Systems and their Integration with City Planning" lays emphasis that in Lebanon, cities are encountering many social and economic problems in terms of high population density and high unemployment rate. Besides, roadway transportation flow is not well distributed; frequent congestion on roads is a daily occurrence in Lebanese roads; and unbalanced infrastructure constitutes a significant problem. This paper presents design models, which represent a scientific tool and criteria to calculate and find the optimum road network area to be distributed all over the master plan. These results and findings of proportionality factors when used, it may lead to make the master plan optimistically feasible.

The next two papers focus on rejuvenation. The paper titled "Rejuvenation of Built Heritage of Porbandar City through Local Area Planning" written by Ravin M. Tailor,

Kandarp Rajyaguru and Akshay Kumar Sharma highlights that local area planning methodology is the new approach introduced in GTPUD Act of Gujarat in 2014. The city of Porbandar is an example of having organic growth without town planning schemes. LAP methodology could be applied to a city with these urban characteristics. In this study, public opinion was considered for identification of neighborhoods having side effects of urbanization. The proposal for LAP features maximum FSI of 3 and 4 based on the abutting road width, with an extra built-up of almost 2,00,000 sq m. The proposed road network covers an area of almost 24 per cent of the LAP boundary if compared to existing 26 per cent. The proposal also covers urban design projects like development of chowks and gardens. Improved circulation pattern, reconstituted plot boundaries and availability of additional built-up will lead to healthy urban development. The paper on "Rejuvenation of Urban Vacant Spaces in Perspective of Smart City" authored by Mohammad Laraib Ahmad, Muhammad Shahrukh and Pradeep Singh states that vacant land in a city can be used as green garden or park. Vertical farming concept can be implemented in smart city. This will improve air quality and will help to make such places socially interactive and functional that can act as recreational spaces. Urban areas are densely populated and have much hard scape. Density in urban areas is increasing vertically due to lack of urbanizable land, which results in lack of green spaces in urban areas. Need of the hour is to find out such issues and have better solution by introducing green strategies, which make urban environment clean and healthy. Aim of the paper is to find out the role of urban green space in smart city perspective, its impact on urban climate and importance of recreational areas.

H. S. Kumara in his paper on "CO2 Emissions from Urban Transport: Challenges and Opportunities for Non-Motorized Transport in Indian Cities" discusses CO2 emissions by transport sector in selected Indian cities, retrofitting challenges and opportunities for (NMT) non-motorized transport. It attempts to examine the modal share of NMT within the existing travel modes; to estimate CO2 emissions along with its growth rate; traffic index were analyzed in selected Indian cities. Regression analysis shows that shorter the trip, the greater the share of NMT. In nutshell, the study has analyzed the total vehicle registered, total registered passenger cars, and vehicle kilometers travelled (VKT), estimation of fuel consumption and CO2 emissions of passenger cars. In persistence, the study highlights the retrofitting issues, options and policy initiatives for NMT and concludes that, reduction of CO2 emissions is achieved by encouraging public transport and using NMT especially down town areas in the Indian cities.

The paper jointly authored by S. G. Sonar and Rajesh S. Phadke on the topic "GIFT City - A Unique Model of Urban Development" provides the inside on GIFT city model which is an important lesson for building a new city, and mentions that it is essential first to create the infrastructure and then only to start building offices and residences. It is observed that GIFT city offers a model by which city can be built with private investment by capitalizing land. Ministry of Urban Development, Government of India in its Mission Statement and Guidelines on Smart Cities published in June 2015 has rightly mentioned GIFT city as a good example of "Greenfield Smart City".

Ashok Kumar, Ph.D.
Editor

Content

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SMART Model for Urban Land Management

Pastagia Digant A., Ph.D.; Patel Jignesh K., Ph.D.; and Macwan Joel E. M., Ph.D.

Abstract

Urban land management in India is a state subject and each state has its own urban land supply policy. Accordingly, the aim of this research paper is to identify the best land management techniques in India based on performance indicators and to develop an innovative technique using a combination of various tools to enhance the quantum of supply of urban land. The Gujarat Town Planning Scheme is selected for the detailed study and Surat (Gujarat) TPS number 32 was used as a case study to find deficiencies in the Town Planning Scheme. The SMART (Sustainable, Marketable, Aesthetical, Rational and Transit Oriented) Model was developed to improve the performance of land pooling land management policy in India. The SMART model was implemented for TPS number 32 in which 12 per cent extra urban land was provided for infrastructural development.

1. INTRODUCTION

Being a state subject, land acquisition is adopted as an urban land supply policy in most of the states of India. It has become a time consuming process, sometimes it leads to unending litigation. On the other hand, land owners whose lands are acquired, feel that they have not been adequately compensated. Guided land development program is used in the north part of India for supply of urban land, but failure in commitment from private developers and colonizers, it is a failed concept. Town Planning Scheme mechanism has been followed as an alternative method to assemble land for urban development activities in a faster and financially affordable manner without taking recourse to compulsory acquisition of land. It is basically an area planning technique patterned on the concept of land re-adjustment. Disadvantages like time-consuming process, land revenue and title problem, and land speculation fail to attract other states developers. Statistical analytical approach to evaluate basic three policies like land acquisition, guided land development and land pooling and readjustment methods with performance indicators has same kind of interpretation. In this paper some of the innovative methods are discussed to make land pooling methodology more efficient. Land revenue and land development are like two sides of a coin which complement

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each other, and a new methodology is proposed to overcome the land revenue issue in urban land management.

2. LAND MANAGEMENT PRACTICES

Land assembly and development mechanism are undertaken for achieving the optimum social use of urban land and to ensure adequate availability of land to public authority and individuals. Public private participation is achieved in land development through various techniques. Some of the land assembly techniques also promote flexibility in land utilization in response to changes resulting from the growing city. The various mechanisms to assemble and develop land are discussed here.

2.1 Land Acquisition

Land acquisition means the acquisition of land for some public purpose of a government agency for individual landowners as authorized by the law after paying compensation fixed by government to cover losses incurred by land owners from surrender of their lands to a government agency. The land acquisition process can be undertaken by the state for itself or for the private sector.

2.2 Land Pooling and Redistribution

Land pooling and readjustment approach is found to be better as it involves public participation. In this method, the public planning agency or development authority temporarily brings together a group of land owners for the purposes of planning under the aegis of the state-level town or urban planning act. There is no acquisition or transfer of ownership involved, and there is no case for paying compensation.

2.3 Guided Land Development

Another alternative to compulsory land acquisition is negotiated land purchase as pursued by private colonizers. This was made possible for the first time in India under the Haryana Municipal and Regulation of Urban Area Act, 1975. The Act permits developers to negotiate direct purchase from farmers for large scale land assembly for urban development. This land is generally located on the fringes of existing towns and negotiated prices are three to six times higher than government rates. Land assembly is also completed relatively easily. All these methods have certain limitations.

Land acquisition is unfair for the original owners of land, mainly farmers, as they cannot enjoy the benefits of the development. Under this method, the majority of the farmers lose their cultivatable lands and they are forced to join the pool of urban labour because of their inability to invest wisely the money received in compensation. The increase in the pool of urban labour adds to

urban problems such as the growth of slums, increase in the crime rate and increased informal sector economic activity. Any person who needs land for urban use has to approach the urban development authority. Inefficiency in the human lead process results in a slow approval process. The development authority ends up becoming a bottleneck for development. Development agencies using the method of bulk land acquisition end up being powerful large-scale land developers, controlling vast urban resources and providing the space rent seeking and scope for encroachments.

Time lines proposed in the regulatory framework are too long. It takes approximately four years from conceptualization to the final sanctioning of the TPS. The state governments actually take much longer to approve the various stages. The TPS thus takes far too long to prepare and implement. In view of changes in technology, the time lines can be easily reduced.

The processes are far too centralized and too much power is vested in the state government to approve and sanction the DPs and TPS. The state government is responsible for undertaking both substantial reviews and procedural reviews of each and every DP. There are no limits on the time line, and there is a tremendous amount of rent seeking.

3. NEW ALTERNATIVES

This study tries to find out deficiencies in the current land pooling methodology and providing scientific solutions. The basic aspect of the solution is to have a higher ratio of urban land allocated towards infrastructural development. As per evaluation studies, land pooling is the best performance technique for supply of urban land. But at the same time it has failed to supply titled urban land to end users. Land acquisition is a good technique from planners' point of view, but at the same time it has failed due to the longer time frame and higher ratio of unsatisfied land owners due to lower compensation. A combination of both the tools may result in a new approach of land management. Some of the modifications in land pooling methodology and acts could lead to the development of new land policy.

Earlier land pooling and readjustment (LP and R) is now replaced with land acquisition and redistribution method. Few changes in acts and combination of techniques will give free hand to planners for more infrastructural space. Original land owners will be satisfied due to appropriate compensation. Three basic modifications in methodology are highlighted below.

Instead of temporarily pooling land, it should be acquired under the Land Acquisition Act 1894. As per the original act, land is redistributed to original land owners with same agriculture land title. It is very difficult and lengthy

process to convert land title into non-agriculture title. In this new policy, land was first acquired by local authority and then this land is returned back to land owners with single paper non-agriculture title with defined land use.

TRC (Transferable Rights Certificate) is issued to land owners having area less than 2,000 sq m, while others are facilitated with land readjustment approach. It was observed in critical review and analysis of town planning scheme that 10 per cent to 12 per cent of land having area less than 2,000 sq m and smaller plots fail to provide mass housing with better infrastructure facilities. In new policy, small plots are replaced with TDR and those lands are used for infrastructure facilities.

Where there is a shortage of land for infrastructure, more floor space index can be offered as compensation. For social and physical infrastructure facilities, more FSI is offered to adjacent land owners.

4. INNOVATIVE MODELS FOR LAND MANAGEMENT

4.1 Incentive Model

Incentive FSI Model has encouraged land owners and developers to come forward and redevelop old buildings, rehabilitate slum areas, construct cooperative housing societies, and cease buildings from tenants with small carpet area for better redevelopment, and more, implementation of incentive FSI in the TPS scheme is to create extra space for infrastructure. It can be done on a case to case basis, for example, where there is a need for a huge chunk of land for infrastructure development, it may be that five to six plots can be given incentive FSI and the state government can get extra land for widening roads in the area. In the TPS area, where width of a road is less causing traffic congestion, incentive FSI can be offered to land owners and land procured from them could be used to widen the road.

With the help of the Incentive Model, 12.00 meter road could be converted into 24 meter without the dissatisfaction of land owners as they could be compensated through incentive FSI. This model has the potential for retrofitting and redevelopment projects. This model can be introduced at the time of designing of draft TPS to get a higher ratio of land allotted for public purpose reservations.

4.2 Transfer of Development Rights Model

In the TDR Model, the potential of a plot of land identified as intensity of built space, guided by FSI, has been separated from land itself and made available to land owners in the form of TDR to be utilized by owners from the

inner zone (originating area) to an outer zone (receiving area) specified by regulations. TDR helps to make land more marketable, one of the important aspects of the SMART model. TDR is a market based technique that encourages transfer of growth from places where land owners would benefit less from the development to places land owners would benefit more after transferring the rights. In some cases, environmentally sensitive land such as open grounds, agriculture land, historic landmarks or other important lands where certain type of development is not possible, such lands can be used for new civic amenities development and land owners can use a TDR certificate for better development in the receiving area. TDR model facilitates removal of small plots from the layout, which could be used for public purpose like infrastructure development. TDR allotted to the owner of land against the acquisition of land creates a winning formula.

4.3 Revenue Model

Land revenue or land tax was the major source of revenue for Government of India from the time of the Mughals and British. In some of the states, the individual system was adopted under which the revenue settlement was made directly by the government with the individual or cultivator. In order to reduce the long term court proceedings and minimize the effort and the human resources required converting new tenure agriculture land into old tenure non-agricultural land, this research proposes a revenue model. This model has not been used previously since this has been a practical problem faced by developers in the last decade. This revenue model will provide some easement and help in reducing time duration for the new title of land. Under the deduction of land for TPS development, the government can decide to deduct those lands up to 60 per cent instead of 40 per cent under the Town Planning Act 1976. This extra land will be used for infrastructure development. In return, new land tenure holder gets old land tenure title for non-agricultural use.

Benefits to Government

- Availability of extra land without land acquisition; and
- Land at cheaper rate.

Benefits to Stakeholders

- Easy conversion of new tenure land to old tenure. Under the traditional method, it takes nearly two years for approval;
- Fast development without investment; and
- Avoids legal matters, where out of 100 revenue cases, 40 are fought due to new tenure land.

4.4 THE SMART MODEL

The SMART Model for TPS is the combination of all the above discussed tools, which can be used on a case to case basis, resulting in a higher ratio of urban land allocated towards infrastructural development. The SMART model will create an urban branding and it is required to follow global architectural styles, which can include the provision of nodes and landmarks, urban squares, urban streets, etc. In order to create urban branding in the state of Gujarat, it is necessary to do some modifications in TPS ideology and methodology. This new methodology of urban land management will increase the supply of urban land in a smarter way, hence it is called SMART.

The incentive model rejuvenates the old TPS area for sustainable development. The TDR model makes the city dynamically marketable. The revenue model increases transparency. Deleting smaller plots and encouraging bigger plots, creating extra urban space for amenities, wide roads and providing urban squares increases the aestheticism in the city. Rational distribution of the amenities makes the city look regular and uniform. With an incentive FSI model, the width of the road can be increased which will give space to accommodate a better transit system. Tall buildings on the side of the road will provide a better urban canyon effect and a skyline effect to the city.

The main vision of this SMART model is to help the planner to take a step towards a sustainable city without affecting stakeholders. Using the Incentive model, TDR model and Revenue model together in the SMART model for TPS, on a case to case basis, will help in planning a larger area (greater than 100 ha.) and will result in the development of sustainable cities in India. The SMART model increases land for infrastructure development by 15 per cent. All tools in the SMART model were tested in a court of law and found that it provides for less infrastructural costs with sustainable development. All to gather 1, 2 and 3 Model can be used for master planning in 300 ha, which is equal to approximate the area of 3 TPS. This will also result in a sustainable development in Indian cities. The SMART model has the capacity to supply nearly 20 per cent more land towards infrastructural development with the optimization of the cost of infrastructure.

6. CONCLUSIONS

Urban land management exercise is very crucial, complex and connected with many issues. Therefore, it needs careful consideration to arrive at amicable solutions. In the Indian context, it is more vital because land is a state subject. As per practicing professionals and policy makers are concerned, land pooling and readjustment known as TPS, Gujarat model is considered as the best

performing policies. It is difficult to evaluate the land value from compensation point of view alone in land acquisition method. Therefore, land pooling and readjustment method should be promoted to create extra land for infrastructure development. Incentive FSI model will be able to generate 5 per cent extra land towards infrastructure development. TDR model provides benefit of TDR, which should be given to landowners having a land area less than 2,000 sq m. As per assessment 7-12 per cent of the total area of TPS has plot areas less than 2,000 sq m. Generally, this land can be made free for infrastructure development. In revenue model, land having new tenure can be deducted as 60 per cent instead of 40 per cent. So that overall 3 -10 per cent land can be freed for infrastructure. SMART model is composed of all the above three techniques. By application of the same 11.16 per cent (10-15 per cent) land can be generated for infrastructure development.

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What is the Name of a Place? A Toponymic Study in Historical Urban Settlements

Rebecca S. Jadon; and Sanjay S. Jadon, Ph.D.

Abstract

This paper discusses the place names, their origins and meanings in Indian cities, so as to explores the concepts of place and placelessness in the current world scenario and the role of place names in the sense of identity. It argues how names themselves become a part of the place identity. A basic toponymic study of places in two Indian cities is used to explore the origins of names within the cultural, linguistic and socio-political context. The study seeks to understand linkages in social, historical and political narratives of the cities through its toponyms.

1. INTRODUCTION

Place, in general vocabulary means any portion of space regarded as measured off or distinct from all others. It is characterized or identified by a name. Places without names remain undifferentiated spaces. Sense of place and place identity are psychological constructs of a place. In a world of increasing placelessness and migrating populations, place identity is a component of self identity. A place may be said to have a personality as a composite of natural endowment and modifications wrought by successive generations of people (Tuan, 1979). But sense of place is a human attribute with respect to a place. Although sense of place may be personal, they are not the result of only an individual's feelings and meanings, but such feelings and meanings are shaped in larger part by the social, cultural and economic circumstances in which individuals find them. Rose in Massey (1995) and Massey (1993) have aptly stated that it is people themselves who make places. Places may be thought of as constantly shifting articulations of social relations through time. Senses of place are inevitably constructed through the process of interconnection and interdependence of social discourses and practice (Jianhui, 2006).

Relph (2009) puts place and placelessness in an arranged continuum existing in a state of tension with distinctiveness at one end and uniformity at the other. The urban world is fast moving towards placelessness with globalization not only of the economy but its products, its people and its places. Las Vegas was an exception at one time with facsimiles of world landmarks. Dubai has become the epitome of globalisation and markets, Spanish villas to spiralling towers in

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the desert with impunity. And urban India is a confused potpourri of all - isms in architecture. The borrowings of place identities to the extent of creating placelessness of a place can stifle the identities of the people themselves. It is argued in the new world that everyone is a global citizen, yet can identities of centuries be negated in a generation and doesn't even a global citizen need roots somewhere, need some place to call his own?

Place name can be said to be the first characteristic of place identity. Thus, is the power of a name that it itself conjures up an image of a place e.g. the word Disneyland conjures up an image of a place of fantasy brought alive. Place name defines a person's place identity. 'I am a Delhite', 'She is a Bangalorian' are common phrases of identity. As explained by Schultz (1980) human identity presupposes the identity of place. Human identity is to a high extent a function of place and things. Drastic speed of urban development can shake the place identity of its people. Place names are public symbols to which people attach meaning and from which they draw identity (Alderman and Inwood, 2013).

2. TOPONYMY

Place names or toponyms have cultural, political roots or simply generic elements. Toponymic research follows two approaches: intensive toponymy – which explores the etymological origins of the place name and analyses the biography of the place naming such that it includes its identification, documentation and interpretation; extensive toponymy follows a more broad based research with place names as independent variables to be tested against dependent variables such as region, toponym type, etc. Toponym types may be classified into descriptive, associative, occurent (commemorative of an event), evaluative, shift (use of a toponym in whole or part from elsewhere), indigenous, eponymous (commemorative of a person) types (Tent, 2015).

Migrations whether voluntary or forced (e.g. war refugees) often brings into perspective the role of place identity as a part of self identity. Toponyms are often an indicator of migrations of peoples or individual groups exemplified in shift type of toponyms. Chinatown is an intrinsic part of San Francisco as well as Kolkata. Chinatown in Kolkata originates as an 18th century settlement of Chinese immigrants; Chinatown in San Francisco settled by immigrants in mid 19th century. Thus the migrant population supplants its culture in its new location. Ironically may be towns in China have a more international outlook in its physical characteristics than Chinatown elsewhere. Curiously Calcutta is the name of more than one town in the US named after the Calcutta of British India.

In India, place names often derive from geographical features, physical characteristics, ownership indicators, local history of habitation, people or events, cultural identities or political assertions. The study of toponyms itself

is the opening chapter of the history and culture of a place and its people. Suffixes such as - patnam, - nad, - pura, - pur, - gaon - bari, are common to place names which according to regional languages meaning town, village, land, etc. The names of streets and places bring forth the essence of the city's places, its origins and its local history. Toponyms tell the story of the peoples' lives and livelihoods. They read out the history of social, political and spatial development of the city.

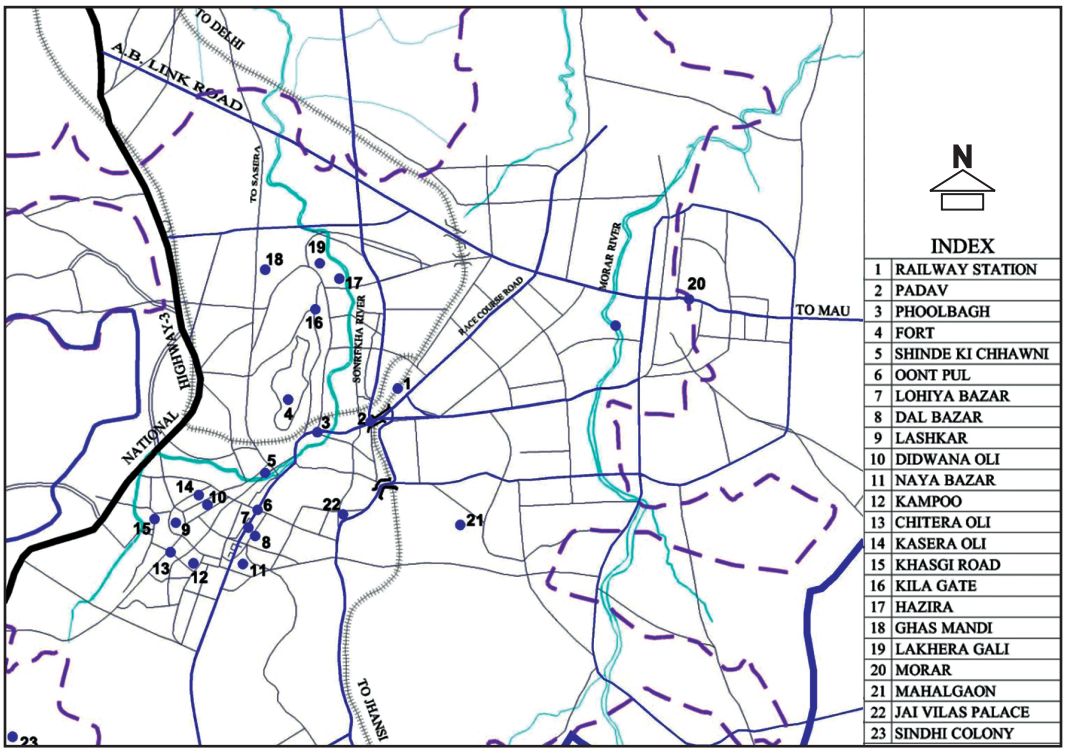
A qualitative research study of a sample of toponyms in two diverse cities of India is taken up herein to explore origins, developments and metamorphosis of places. While the cities have diverse origins, both cities came of age at the turn of the 20th century. The study is done through primary data survey, informal interviews and literature survey.

3. TOPONYMIC ORIGINS

3.1 Gwalior and its Name Derivatives

Gwalior is a city of about 12 lakh today in Central India. An erstwhile capital of the kingdom of the Scindias between 1811 and 1947, it also has an illustrative history as an important strategic stronghold for various ruling dynasties from the Gupta period(6th century), through the Pratihara and Tomar periods to

Fig 1: Map of Gwalior with Names of Localities



Source: Author

the Mughal period (16 -18 century). The city today amalgamates three distinct settlements developed in different periods: Old Gwalior, Lashkar (the Scindia settlement) and Morar (the British cantonment). Its names reflect its primarily strategic defense origins.

- *Lashkar* the settlement originated as the site of the army establishment. The Hindi word *lashkar* (army) derives from *al-askar*, the Arabic word for a guard or soldier.
- *Mahalgaon* – the 'village of the palace' is the toponym for the village settlement which arose attached to the palace premises
- *Ghauspura*– the village land allotted to the saint Mohamed Ghaus in the 16th century by the Mughal rulers (his magnificent tomb stands testimony within the city)
- *Padav* (meaning a temporary destination in a journey) –the erstwhile rest halt of horses and contingents before crossing the belt of hills at *Kati Ghati* (valley created by cutting hills)
- *Shinde-ki-chawni* – is the erstwhile location of the army camp during campaigns from the south to the north at the foothills of the fort hill bound by two rivulets. (*chawni* means army camp)

The locality *Kampoo* or Sikander Kampoo is the shortened Indian version of location of the erstwhile army commander Alexander's brigade (*kampu*) (*Sikander* is the Indian version of Alexander).

- *Khasgi* road – the name derives from the location of the elite royal bodyguard force (*khasgi)* behind the palace.

Many of the names are according to the business or the resident community of the locality.

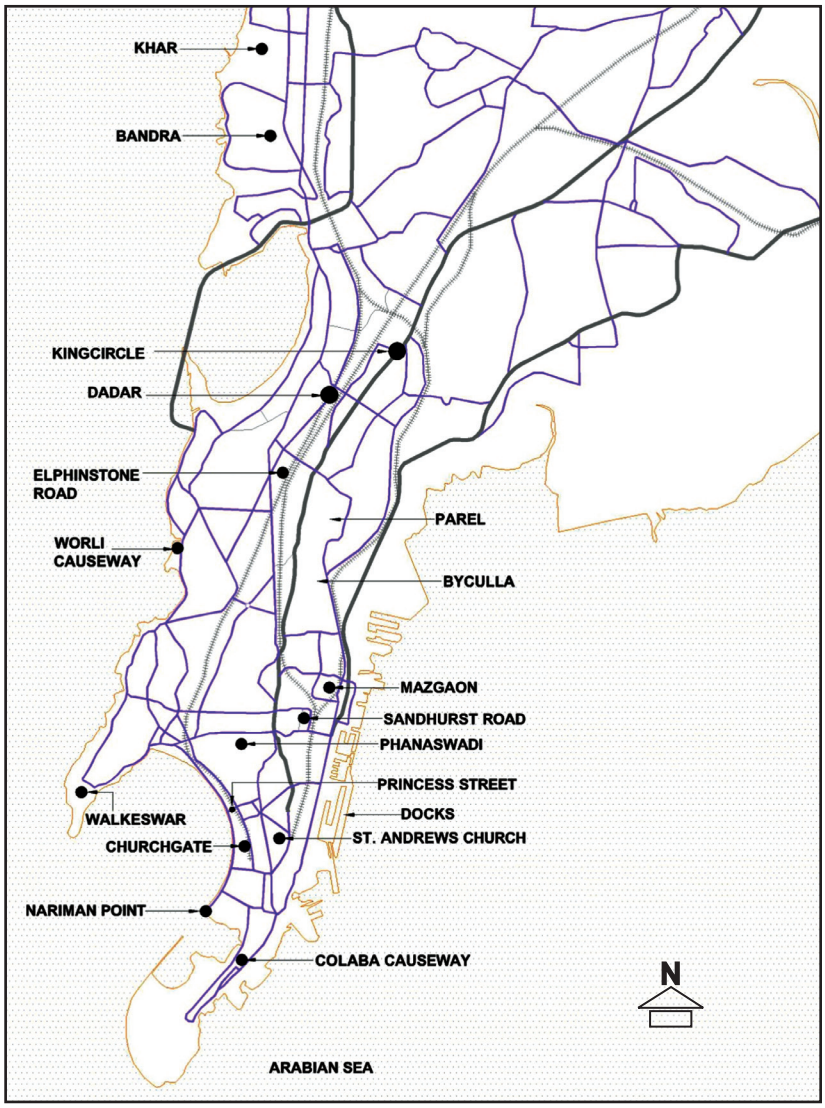
- *Lakhera gali*- the street of *lac* (shellac) workers
- *Ghas mandi* – the market place for fodder or grass for the animals - cattle, horses and elephants in medieval period
- *Didwana Oli* – the residential quarter of *Marwari* merchants from Didwana in Rajasthan (Gwalior state Gazetteer,1908)
- *Chitera oli* – the street where the mural painters (*chitera*) resided.
- *Kasera* oli - the street of metal utensil makers
- *Dal Bazaar* – the market of pulse (*dal*) taders
- *Lohiya Bazaar* – the market of steel traders
- *Naya bazaar* – (new market) denotes the later market developed in Lashkar around the 1860s-70s.

The place name *Sindhi* colony is witness to the refugee facilities offered (to people of Sindh) at the time of partition of India in 1947. Toponyms also derive from people's usage of names. A recent example within the city is adoption of the name of a new over bridge by people as *Oont - pul* (camel bridge) derived from its steep slope like a camel hump.

3.2 Mumbai and its Toponyms

Mumbai or Bombay, a city which came into being from the 1700s through a deliberate move to utilise its natural bay feature as a port by the British and its flowering into one of the most successful and populous cities is a lesson in planning history on its own. Study of names of its localities is a walk through its ethnic, colonial and political history. The naming of the city itself has a tortuous past. Mumbai is believed to be derived from the name *Mumba bai*, the local incarnation of the benign mother goddess. The Portuguese name of Bom Bahia (meaning good bay) became Bombay during its British period. The city was officially renamed with its local name Mumbai in 1995.

Fig 2: Map of Mumbai with Names



Source: Author

Although no remains of the Fort (Bombay Castle) are apparent now, the bustling commercial centre in South Mumbai is known as the Fort. Church Gate station is known by each Mumbaiite but that the name stems from the location of the erstwhile fort gate leading to the St Andrew's Church is known by few.

Mumbai has the interesting geography that a large extent of its land is reclaimed land, reclaimed in bits and pieces from the sea under various city development

schemes. From bunding of the Great Breach near Worli around 1750, building of the Colaba causeway in 1838 to the Link Road through Juhu-Malad in 1980s, the city has created its land and places have been born. Tiny island villages have become huge dense districts – be it Parel, Byculla, Mazgaon. Parel is believed to be derived from *Paral* – the trumpet flower tree (Dwivedi, 2001).

Some of the names have mythological origins (e.g. *Walkeshwar*) others are geographical descriptive toponyms. *Walkeshwar* in south Mumbai derives its name from the legendary *Valukeshwar* (Lord of the sands) temple which stood here since the Silhara period between the 9th and 13th century. (Dwivedi, 2001) The present Walkeshwar temple is a rebuilt temple in 1715. *Dongri* (hillock), *Phanaswadi* (jackfruit orchard), *Khar* (from *Khara*- salt swamps) are typical geographical derivatives; whereas still other names are eponymous named after the personalities or pioneers of their development (e.g. Curzon road, Nariman Point). The colonial legacy is apparent in the names of localities and stations as in Elphinstone Road, Sandhurst Road, King's Circle. An avenue road developed by the City Improvement Trust in 1901 was named the Princess Street as it was inaugurated by the Prince and Princess of Wales in 1905. The bay at Chowpatty in South Bombay was nicknamed the Queen's Necklace. Many of the street names have been renamed post Independence though some old names continue in public memory.

Station names in Mumbai are an integral part of its geography. Districts are identified from the station names, for example, Bandra, Khar, Andheri, etc. Naming of stations with the creation of new railway and metro lines is also a socio-political exercise. For example a station on the New Bombay line has two names Redwood-Darawe. Redwood is the name of the first major township in the locality and Darawe the name of the nearest village. One is a spatial marker while the other is assertion of the local origins. Naming of a new station on the western local railway line as *Ram Mandir* is again a spatial marker with socio-political considerations.

Toponyms sometimes can have quirky origins. The naming of a road as *Khadi* Machine (standing machine) Road is said to owe its origins to the fact that a road building machine was left standing for a long time after road building in a newly developed locality. In the current market driven society, names have a commercial value. Names of ambitious commercial building projects are named to be attractive or saleable addresses. They are often reminiscent of past glory, verdant spaces or commemorating brand names. Examples: Atlantis, Gulmohar Greens, Park Avenue, Raheja Towers, DLF Plaza; etc.

4. CONCLUSIONS

In a fast changing global world, place identity has its unique role in defining self-identities. Place names are more than innocent spatial references or passive

artefacts. They are embedded in social power relations and struggles over the identities of places and people (Berg and Vuolteenaho 2009; Kearns and Berg 2002 in Aldermann, 2015). Toponyms, like all place representations are expressive and constitutive of the politics of citizenship, conferring a greater degree of belonging to certain groups over others, while also serving as sites for battles to widen the 'distribution of citizenship' and the use of space (Dunn, 2003 in Aldermann, 2015). Renaming of places is often undertaken by rulers and political activists as a means of a political agenda. It is a natural political exercise. But changing of place names without a deliberate, objective and intensive study of its past and future probabilities plays with the identity of a place and its people. Thus, arbitrary renaming can have the same sociological repercussions of fabric damage as in case of undeliberated urban renewal. Toponymic studies of any city are a journey into the geographical, political, social, linguistic, cultural and economic history of the place through time. This toponymic study has explored roots of some place names in two cities of India. While it is not an exhaustive study of all place names of Indian cities, it has attempted to show how the life of a city over time gets embedded in its names even when its physical and economic functions may change. The study has brought into perspective the role of place names in the intrinsic character of the place, its identity and memories.

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A Road Map for District Planning in India

Jacob Easow

Abstract

The institutional architecture envisaged under the 74th Constitution Amendment Act mandates every district of the country to constitute a District Planning Committee (DPC) and to prepare a District Development Plan. The changed scenario after the establishment of the NITI Aayog, the district development plan envisaged in the amended constitution assumes great relevance than ever before, accordingly, a clear cut policy blueprint is needed. This paper outlines a methodological suggestion for district planning in the light of the constitutional provisions. Preparation of such a district plan will surely need decisions and commitments at various levels due to the multiplicity of agencies involved and the vast spectrum of aspects to be addressed. In this context, the paper traces a road map for each milestone for the preparation of district development plan,which can be replicated anywhere in India.

1. INTRODUCTION

In the First Five Year Plan (1951-56) itself, a District Development Council for coordinating the development activities of different agencies at the district level was suggested. It paved the search of sound district planning methodology in India. Despite several reports and studies, the science of district plan preparation and the art of its implementation remain an operational enigma and an unfinished task. Naturally, there is no unanimity concerning the methodology of district planning. Seventy-forth Constitution Amendment Act (CAA) mandates every district of the country to constitute a District Planning Committee (DPC) and to prepare a draft district development plan. It is a fact that though 27 years has elapsed since the enactment of the constitution amendment, the preparation of a district development plans still remains an unfulfilled reality.

Planning Commission that once played a dominant role in shaping the growth and development contours of the country is abolished. A market mediated development paradigm is well underway. The National Institution for Transforming India (NITI) Aayog was constituted replacing the Planning Commission through a cabinet resolution in January 2015. With the introduction of NITI Aayog, Government of India scrapped the economic planning system in India. There is no centralized fund allocation via five year plans under NITI Aayog. This a paradigmatic shift on the monetary control of various sectors right from national to states and

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subsequently to lower levels. In the new system, Finance Ministry of India will allocate funds based on respective ministry schemes without a central thread of integration. This will create disjointed projects and programs at the district and local level in the absence of a comprehensive five year plan. In addition, this will create regional disparities. However, it can be presumed that the NITI Aayog is also aware of this gap as it emphasis to develop a mechanism to formulate credible plans to the village level and aggregate these progressively at higher levels of government. This mechanism can be a comprehensive development plan for a district integrating the national and state level policies with local development aspirations. This makes the institutional architecture envisaged under the Seventy-forth Constitution Amendment Act (CAA) of India more relevant in the era of NITI Aayog. This paper outlines a methodological suggestion for district planning in the light of the constitutional provisions and set various milestones for achieving it.

Approaches at micro level (district or regional) planning in India vary with time and profession. There were mainly two streams in micro level planning, one originated from decentralized planning approaches and the other from regional planning approaches. Economists and administrators propagated the decentralized planning approaches while the regional planning approaches were developed by town planners and geographers. Both these approaches have grown with time to redress the problems of Five Year Plans, viz. lack of decision making process closer to the people and community participation in the first while regional disparities and backwardness in the second.

Under decentralization stream, efforts were made in successive five year plans to initiate decentralization at the district level and block level and to promote the establishment of three tier *panchayat raj* institutions namely *panchayats* at village, block and district levels. The Planning Commission, in its endeavor to strengthen the levels of administration below the state, had set up various committees and expert groups to review the issue regarding the planning process in India in order to suggest means and ways to accomplish the task of decentralized planning in order to ensure people's participation, etc. Balwant Rai Mehta Report, Dantwala Report on Block Level Planning, Ashok Mehta Committee Report on *Panchayat Raj* Institutions, etc.; are results of such attempts. In this context, district planning has become the most important link in the whole system of decentralized planning because this is the culminating point of decentralized planning process. Therefore, scope of district planning exercise in this stream was mainly consolidation of projects from lower tier of local governments. Some important planning attempts in this angle are Plan for Raichur District in Karnataka, Ananthpur district in AP, Pann Garhwal District in UP, Tirunelveli Kattabomman District in Tamil Nadu, Nasik District in Maharashtra, Shimila in HP, and Kannur District in Kerala.

On the other hand, under the regional planning stream, delineation of the operational area of planning i.e. the planning region for which all-regional studies could be undertaken and developments envisaged. It moved with the assumption that the linguistic or administrative boundaries like district, block or village (state as well) do not offer satisfactory regional units for planned development. Thus, it gives thrust for investable resources steered in space and time, balanced regional development, urban-rural relationships, etc.; and over and above, a spatial planning approach. Scope in this exercise was extended for settlements hierarchy and its structures and attempting for a perfect integration of the development. Therefore, this approach was very theoretical one. Worth mentioning under this stream are the plans for the National Capital Region, South East Resource Region, Western Ghats Region, General Development Plan for Savitri Watershed, etc.

Working Group on District Planning (1984) of the Planning Commission moved one-step ahead and found that the states are at different stages of progress towards decentralized planning. It has, therefore advocated a gradual, step-by-step, approach towards the final goal, i.e. district planning with the concept of integrated area planning or in other words comprehensive district planning. However, so called 'spatial planning dimensions' mentioned in the Working Group Report also emphasizes on locational choices of certain functions at the district level and fails to detail out the urban - rural integration and spatial impacts of investments. On the other hand, the National Commission on Urbanization (NCU) 1988 was successful in suggesting developmental spatial planning and recommended to introduce regional (district) spatial planning and identified district planning as an integral part of the multi-level planning system considering the politico-administrative viability. NCU classified district (spatial) planning into allocative, adaptive or developmental. The Commission termed the current district planning practice in our country as allocative planning. The system of developmental spatial planning for the district recommended by the NCU can be termed as district regional (spatial) planning. Constitution (Seventy-Fourth) Amendment Act, 1992 further brings in preparation of District Development Plans in all districts of India. Therefore, it is necessary to revisit the Constitution provisions in order to understand the scope and the directive principle of methodology of District Planning.

A close reading of the Constitutional provisions makes it abundantly clear as to what the functional role of the district plan is and what will guide the methodology to be adopted. Article 243 ZD(1) of the Constitution lays down that "There shall be constituted in every state at the district level a District Planning Committee to consolidate the plans prepared by the *Panchayats* and the Municipalities in the district and to prepare a draft development plan for the district as a whole". It means that there are two distinct roles for the District Planning Committee (DPC) namely (see West Bengal District Planning Committee Act, 1994): 'Consolidation

of plans prepared by the *Panchayats* and the Municipalities in the district and preparation of draft development plan for the district as a whole'. The contents of the draft district development plan, laid down in Article 243 ZD (3) (a) of the Constitution of India. According to the Article the district plan shall address "(i) matters of common interest between the *Panchayats* and the Municipalities including spatial planning, sharing of water and other physical and natural resources, the integrated development of infrastructure and environmental conservation (ii) the extent and type of available resources whether financial or otherwise".

Second Administrative Reforms Commission (ARC) interprets the above Article of the Constitution as follows. "A development plan for the whole district, for example, has to take into consideration both rural and urban areas. A district plan is something more than the two sets of separate plans - one consisting of micro-plans for rural areas and the other comprising plans for individual towns. As one moves from the micro-levels to the meso and macro levels, perspectives and priorities of plans change. The Constitution recognizes this and accordingly prescribes that the district plan, as distinguished from the individual *Panchayat* and Municipal plans, should have regard to 'matters of common interest between the *Panchayats* and the Municipalities'. This, in other words, means that the development needs of the rural and urban areas should be dealt with in an integrated manner and, therefore, the district plan, which is a plan for a large area consisting of villages and towns, should take into account such factors as 'spatial planning', sharing of 'physical and natural resources', integrated development of infrastructure' and 'environmental conservation' (Article 243ZD 3). All these are important because the relationship between villages and towns is complementary, one needs the other. Many functions that the towns perform as seats of industry, trade and business and as providers of various services, including higher education, specialized health care services, communications, etc. have an impact on the development and welfare of rural people. Similarly, the orderly growth of the urban centre is dependent on the kind of organic linkage it establishes with its rural hinterland".

Expert Committee on Leveraging *Panchayats* for Efficient Delivery of Public Goods and Services headed by Mani Shankar Aiyar's report on 'Towards Holistic *Panchayat Raj*' was published in April 2013. The report concluded on "the nature of a district planning methodology as envisaged in the Constitution is:

- The development needs of the rural and urban areas should be dealt with in an integrated manner;
- Assessment of physical and natural resources of the district and sharing proposals;
- Need of integrated approach in the development of infrastructure;

- Environmental conservation;
- Financial investment plans; and
- Planning in a spatial platform.

The first role of DPC mandated by the Constitution (consolidation of plans prepared by the *Panchayats* and the Municipalities) is the preparation of consolidated District Plan or in other words an exercise of district planning through consolidation of projects prepared by the *Panchayats* and the Municipalities in the district. The Manual for Integrated District Planning refers to this plan in para 1.2.1) as District Plan. Many of the decentralization groups argue for such an approach. But in para 1.2.3, the Manual also recognizes the second role of the DPC and refers as District Development Plan. Therefore; both roles of DPC can be done by independently or an integrated manner depending on the policies of government. Nevertheless, many of the decentralization groups stand for a joined up approach as the spirit of Constitution is for an integrated approach.

2. SEARCH OF METHODOLOGICAL PARADIGMS

2. Several Reports, Studies and Models are Available on District Planning

Report of the Working Group on District Planning (Planning Commission, 1984) popularly known as Hanumantha Rao Committee Report on District Planning may be considered by many as the bible for district planning. The Working Group Report recommended the following steps in sequence for the formulation of district plans.

- Formulation of major objectives of the district plan;
- Compilation of data for district planning;
- Bringing out the profile of the district in relation to the basic objectives;
- Formulating the main strategy and thrust area of district planning;
- Analysis of the existing programmes and projects with reference to the strategy outlined;
- Assessment of resources for allocation to various programmes and projects;
- Statements of physical and financial components of the district plan;
- Statement of spatial dimensions of the district plan; and
- Relationships and links between the district plan and regional and state development plans.

The Working Group claims that the concept of district planning adopted by them is akin to the concept of integrated area planning but it failed in recommending so. The suggested methodology will lead to a district plan which is not a plan for all development partners of the district. Chapter 7 of the Report does mention about ‘spatial planning’ as one of the three components, which may

be constructed as 'core' of 'district planning' and recognizes the role of spatial planning in the district planning process. But the Working Group fails to identify its relationship with the sectoral investments. In short, such a planning approach for the district can be termed as sectoral district planning.

The People's Planning Campaign ('*Janakeeyasoothranam'*), a mass movement to prepare plans of local governments for local development in a transparent and participatory manner, started in Kerala state during the Ninth Five Year Plan, and adopted a well-defined methodology for plan preparation (Local Plan), with an overall development perspective for each local body. As part of the campaign the respective District Planning Committee also prepared a District Plan for each district in the state of Kerala. The subject committees constituted for each development sector under the auspices of the District Planning Committee elaborated the various development sectors of the district as part of the District Plan preparation. The objective of the District Plan, so prepared, was the integration of the Development Reports (Local Plans) prepared by local governments in the lowest tier.

The District Plans prepared by District Planning Committees of Kerala during the Ninth Five Year Plan as a part of People's Planning Campaign was on the line of sectoral planning approach and majority of its proposals were of a general nature. There was lack of long-term perspective vision and systematic and scientific data analysis. The Plan resulted to be merely a compilation of the proposals submitted by sectoral departments, and therefore, lacked comprehensiveness, inter-sectoral relationships, objectivity and direction of development of the district. There were no efforts for integrating the plan on a spatial platform. Certainly, the attempt was bold and imparted the actual message of the constitutional obligation of the DPCs in India. It gave a good model for organizing a district plan through people's participation.

Guidelines for Preparation of District Plans in the Eleventh Five Year Plan issued by the Planning Commission stress that the district plan process should be an integral part of the process of preparation of state's Eleventh Five Year Plan and annual plan 2007-08. In continuation to the Guidelines, the Planning Commission issued a Manual for Integrated District Planning (2008) aimed at making district planning an intrinsic part of the Eleventh Plan itself. The guidelines envisage preparation of a vision document for the district by the District Planning Committee in consultation with the local government institutions. As admitted in the guidelines, it is an extension of Kerala model of decentralized planning in the national scene. The design of the guidelines itself is weak and it will lead only to creation of a shelf of *adhoc* projects which lack integration. Building a district vision, through perceptions and negotiations will reflect only half-truth of the planning area and finally degrade the quality of the plan. Again, the

process suggested mostly envisages a plan for the local government sector in the district through consolidation of programs or projects of the local government of the district and not a comprehensive district plan for all the development partners in the district. The Committee for Evaluation of Decentralized Planning and Development, constituted by Government of Kerala for the evaluation of decentralized planning and development in the state over the last ten years, however, disagrees with the Guidelines on "the sum total of outlay on district plans in a state may be around 40 percent of the gross State plan outlay". The Committee states "In our view a District Plan is a long range comprehensive development plan for the district. The district plan shall not be looked upon only as a short term financial investment plan for the district. The district plan should be much more than this and shall aim at the total development of the district. Therefore; there shall be only one comprehensive document serving as a district level development guideline and framework for all the LSGs and sectoral agencies".

Report of National Commission on Urbanization (NCU 1988) put forth probably the most useful and sound recommendations on district planning. The Commission observed "planning is limited to economic planning at the national and state levels and physical planning at urban settlement level. There is thus a wide gap between national and local planning. What is required is to introduce regional spatial planning to bridge this gap". NCU further added, "Although India has been engaged in far sighted economic planning since independence and despite the considerable achievements of the Five Year Plans, very little constructive attention has been paid to the spatial aspects of the social and economic change taking place in the country. Observing this the Commission notes that lack of spatial concern has resulted in regional spatial imbalances. The Commission further notes that each investment, whatever be the sector, has a definite physical manifestation and geographical location and generates as chain of developmental impulses affecting, in several cases, the activities of other sectors, resulting in a related spatial pattern. The Commission, therefore, recognizes the need for integration of economic and spatial planning with a view to achieving a rational spatio-economic development of the country and outlines the spatial planning objective, strategies, concepts, system and process to be adopted at different levels in the country". The system recommended by the NCU follows a multi-level planning approach and therefore functions at three levels viz. national, state and district. It involves disaggregation of development policies at national level into integrated inter-state and state spatial development strategies and inter-district and district plans, programs and projects. The Commission stresses that spatial planning will be most effective at state level and spatial development plans should be formulated and implemented at inter-district and district levels.

It is in this context that the pioneering efforts of District Planning Committee, Kollam district, Kerala commands attention. In Kollam district two level plans are prepared simultaneously: one at the lowest tier of local government (*panchayat* and municipalities) i.e. Local Development Plan (LDP) and the other for the District as a whole, an Integrated District Development Plan (IDDP). Here, the direct participation of people is ensured through village and ward *sabhas* and various working groups ensure the balanced involvement of elected representatives, government departments, NGOs, stakeholders, etc. Unlike other spatial plans prepared in the country, specialty of IDDP and LDP is that the sectoral polices of various development agencies of a planning area are translated to spatial plans. Clearly, the process starts with the collection of data and up to the analysis stage, the process moves almost in parallel for both the plans. The data and the results of the analysis for the preparation of each local self-government institution is an input for the preparation of Integrated District Development Plan. Later on, based on suggestions and proposals of the Sanctioned Integrated District Development Plan, the Local Development Plans are modified and finalized. Actually the concept of this process is based on a combination of top-down and grass-root approach whereby policies and strategies flow downwards, while plans, programs and projects are conceived and implemented at grass roots level which can be integrated to obtain the desired spatial pattern at higher levels at any given point of time (National Commission on Urbanization, 1988) and a good example for multi-level planning (Fig. 1 is a graphical abstract

Fig. 1: Steps in the Preparation of Integrated District Development Plan (IDDP) and Local Development Plan (LDP)

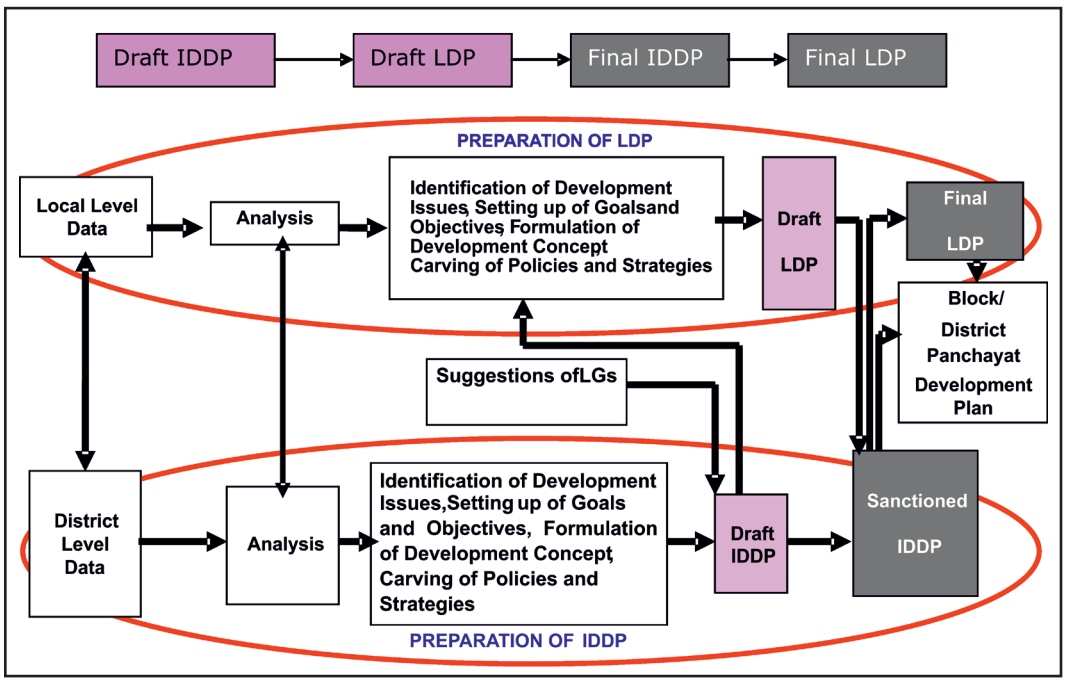
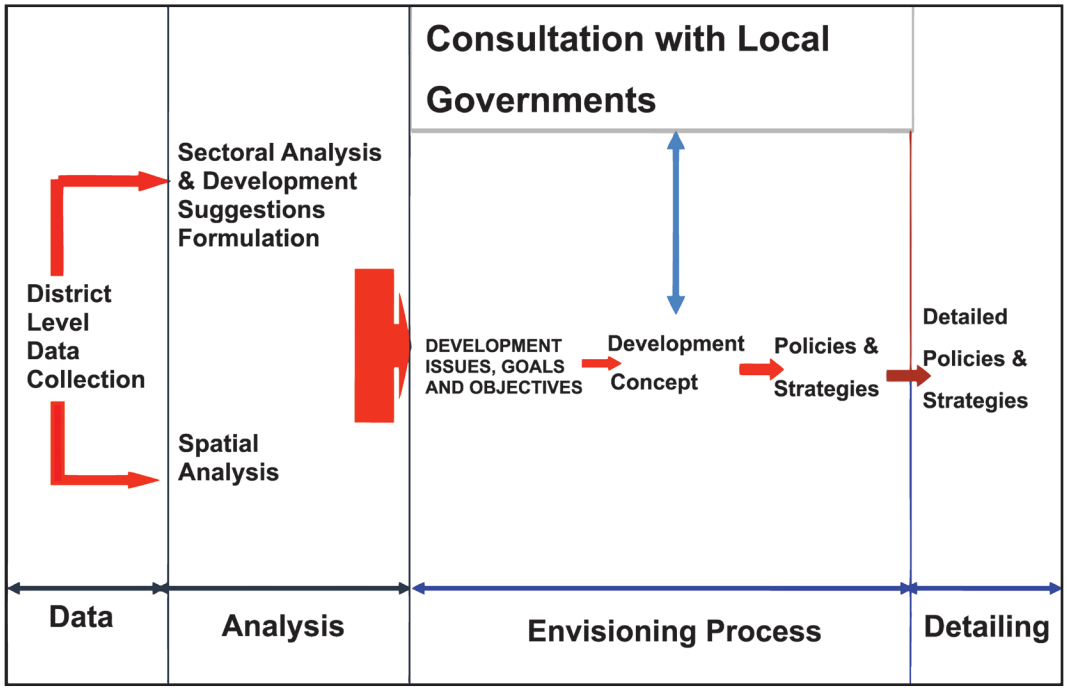


Fig. 2: Stages in Integrated Development Plan Vision



of the Kollam Model). In general both LDP and IDDP consist of a perspective plan for 15 to 20 years and an execution plan for 5 years. Basically five main stages involved in the preparation of an Integrated District Development Plan, which is illustrated in Fig 2.

Methodology for Kollam model was conceptualized through the synergic amalgamation of the methodology of under '*Janakeeyasoothranam*', the recommendations of the NCU and approaches in classic spatial planning. Expert Committee on Leveraging *Panchayats* for Efficient Delivery of Public Goods and Services (2013) which examined the Kollam model in an effort to stylize the process spelt out the following basic features:

- Harnessing of all available data;
- Creating a pool of experts for analysis and interpretation of data including the spatial dimensions on GIS platform;
- Widespread dissemination of the results of the data in simple terms for common understanding;
- Frequent interaction of local governments horizontally in a region and vertically across tiers up to the district level; and
- Congruence between the priorities drawn up by the analysis and the priorities felt by the people, achieved through a process of iterative negotiations and consensus.

Urban Development Plans Formulation and Implementation (UDPFI) Guidelines and Model Law on Town and Country Planning were created and issued by Government of India in August 1996 in line with the 73rd and 74th CAA for enabling amendments to the existing Town and Country Planning laws prevailed in various states. Further, the Planning Commission in Manual for Integrated District Planning (2008) recommended that: "The current legal framework that mandates planning for urban areas is usually the town and country planning acts enacted by the state governments. However, these laws pre-date the 74th constitution amendment and do not provide a formal role for the District Planning Committee. This legislation needs to be modified based on Model Urban and Regional Planning and Development Law (revised) prepared by the Ministry of Urban Development as part of Urban Development Plans Formulation and Implementation (UDPFI) Guidelines. The model law provides for constitution of District Planning Committees and Plans for District Planning Area Development". Town and Country Planning being a state subject, it is a state government to act upon the legislation on town and country planning. Unfortunately, no concrete steps were taken by any of the state governments towards this direction except the Kerala. The Kerala Legislature enacted the Kerala Town and Country Planning Act, 2016 in March 2016 completely embodying the spirit of the 73rd and 74th CAA and may be the first Town and Country Planning Act in India of this kind. In conformity with the 74th CAA, the Kerala Town and Country Planning Act, 2016 details the process of preparation and statutory processing of the draft Development Plan for the District as a whole, to be prepared by the District Planning Committee on a spatial planning platform. The District Development Plan envisaged in the Kerala Town and Country Planning Act comprises of a long term (20 years) Perspective Plan and mid term (five year) Execution Plans. The first role of DPC mandated by the Constitution i.e. District Plan through consolidation of plans prepared by the *Panchayats* and the Municipalities is not addressed in this Act. In short, preparation of consolidated district plan or in other words the exercise of district planning through cascading consolidation of projects prepared by the *panchayats* and the municipalities in the district is not in the purview of this Act. This was done purposefully so that the Act shall not make any bottleneck to the District Plan preparation in the decentralization system and made left to current government to decide.

3. CONSENSUS ON THE KOLLAM MODEL

There is no unanimity with regard to the methodology of district planning. However, there is a strong consensus on the methodology of IDDP, Kollam is considered a good attempt by many experts / commissions as well as legislature. The professional world including the 57th National Town and Country Planners Congress has recognized the significance of the 'Kollam Model' (see Government

of India (2008); Government of Kerala (2009; 2011); Government of India (2013); Oommen (2014) among others). As the Manual for Integrated District Planning prepared by Government of India in 2008 notes: "The project has given decision makers in local governments, the District Planning Committee and other stakeholders the opportunity to consider and take decisions in the emerging area of spatial planning and the Kollam experience, particularly the methodologies developed by it, can be up-scaled to other districts"(Government of India, 2008:111).

Equally relevant are the observations of the Mani Shankar Aiyar Committee report, which has gone into the Kollam project in details and depth: "It was in Kollam district of Kerala that a comprehensive district planning exercise was undertaken as an experiment to develop a realistic methodology which combines the participatory process, maintains the central role of local governments, and provides for rational and scientific analysis of data and preparation of a vision and perspective of its basis'. [A] district plan strictly adhering to the constitutional provisions" (Government of India, 2008:165).

Report of the Comptroller and Auditor General of India for the year ending 31 March 2011 (Civil), Government of Kerala (page 40 point 2.1.17) recommended that "the Government should prepare an Integrated District Development Plan for effective implementation of the schemes and Local Development Plan in consonance with the Integrated District Development Plan for effective implementation of the schemes"

IDDP, Kollam "realistic methodology"- says EPW: "In order to promote the democratization process, all executive and statutory measures should facilitate the process of democratization. Although preparation of the long-term district development plan (Article 234 ZD) could be an ideal platform for people, administration and technocrats to cooperate, Kerala has yet to make it an integral part of the state's development landscape. The multiplicity of guidelines that the central government and the Planning Commission have issued in the context of various CSSs has added confusion in the making of district planning. Kerala's Kollam District Plan is widely acknowledged as a "realistic methodology" with a participatory approach (GoI 2013: 487) and certainly needs to be given a fair trial in the state. How far it could be made an instrument for deepening democracy through local governance is a challenge not only for the state, but also for the nation" (Economic and Political Weekly of June 21, 2014, Vol. 49, No 25). Beside the Kerala Legislative Assembly enacted the Kerala Town and Country Planning Act 2016 in line with the methodology adopted from the Kollam Model IDDP. Approval of a legislature on the Kollam model methodology can be termed as a meeting point of the practical wisdom of the politician and the theoretical insight of the experts.

4. SOME SUGGESTIONS

Consolidation of plans prepared by the *Panchayats* and the Municipalities cannot be considered in isolation with respect to district planning and therefore; there is a need to adopt methodology that meet both the roles of DPC in an integrated manner. By making use of the Kollam Model, the new methodology can be outlined. Indeed, 'District Plan Components for Local Governments (LG)' is furtherance of this methodology. Following are the major concatenation recommended in the methodology of District Planning.

Part I - Perspective Plan

- Data collection and compilation
- Data analysis
  - Sectoral analysis
  - Spatial and aggregative analysis
- Envisioning process (Integrated Development Vision)
  - Identification of development issues and setting up of goals and objectives
  - Emerging of development concept
  - Framing general policies , strategies and major development directives
  - Formulation of Perspective Plan

Part II - Execution Plan

- Ensuring participation of Local Governments
  - Consultation of Integrated Development Vision
  - Consolidation of proposals
- Sectoral detailing
  - Projections
  - Framing of detailed policies, sectoral recommendations and proposals
  - Linking of proposals.
  - Formulation of Execution Plan.

Part III - Consolidated District Plan

- District Plan Components for Local Governments
  - Approach Paper for Plans for LGs and Financial Resource Mapping and Determination of Fund Envelopes
  - Draft Five Year Plans for LGs

- Consolidation of Plans of LGs
- Formulation of Consolidated District Plan

Certainly the district planning is a multi-phased process having three distinct plans viz., (i) Grounding of district development strategies for 15-20 years and therefore, one to three steps of above is the Perspective Plan of the District Development Plan ; (ii) Plan period of sectoral detailing is for five years and thus steps four and five are termed as Execution Plan of the District Development Plan; and (iii) Consolidation of plans prepared by the *Panchayats* and the Municipalities in the district can only be done when project are identified thus, final stage of the series is the District Plan Components for LGs or named as Consolidated District Plan.

Any scientific analysis needs to view the development parameters of the district - pertaining to a particular sector - are analyzed in slice. Nevertheless, a cross sectional and spatial analysis of development parameters for viewing in totality is also essential for a deep understanding of the development situation and potential. That is why two types of situation analysis viz. sectoral analysis and spatial and aggregative analysis is part of the methodology. From the analysis, development issues of district can be identified. Paramount quality of this approach is in envisioning process. Naturally, goals and development objectives will be synthesized from development issues. The development concept or the planning concept is the schematic spatial representation of the development determinants of the district derived inconformity with the development objectives using planning principles. On other hand, illustrating the development objectives and the determinants in a district map based on planning precept will emanate the development concept. This will lay down the foundation of spatial integration of the plan. Subsequently general policies, strategies and major development directives of the district will be framed. An integrated development vision in the spatial platform is the final output of the envisioning process. Thus, from the long-term development perspective of the district, detailing exercise of district planning will start for the five year Execution Plan. Functional integration will be achieved when this sectoral detailing is done. Once the midterm Execution Plan is finalized, approach paper can be issued and LGs can formulate their local plans. Finally, local plans will be buckled together through ‘cascading consolidation’ process. Thus, plan will congruent as one organic entity in terms of spatial, functional, sectoral, cross-sectoral, resources, agency wise as well as the time. Methodology of Local Plan (Plan of a LG) is not the scope of this paper but has to prepare in a participatory manner.

Kollam model can also be good signpost for designing the organizational set up. The District Planning Committee (DPC) shall be the apex body. To assist DPC in data collection, analysis and formulation of the District Planning, a Technical

Advisory Group (TAG) may be constituted with departmental officers (mandated and nominated for the purpose in addition to their duties) dealing with different sectors / retired officials from various departments, faculty from local academic institutions, members of civil society groups, etc. There shall be sub-groups for the Technical Advisory Group for various development sectors. The chairperson of each sub-group shall be a DPC member and the district head of the sectoral department concerned shall be the convener. These sub - groups will do the data collection, analysis and detailing of the proposals of respective sectors. The overall responsibility of preparation of the Plan shall be the vested with an Integration Committee chaired by DPC Chairperson.

Institutional supports through universities and research institutions, both at the district and state levels, could also be availed. Non-official (experts) members of TAG shall ideally be drawn locally, but if circumstances demand, they can be drawn even from outside the district. Care must be taken to ensure that participation is voluntary and above partisan politics. Members shall be able to respect different points of view. It is strongly recommended that a Resource Person (RP) shall be identified in each sub - group of TAG to monitor the works and to act as a link to the spatial planning sub - group.

In this respect necessary Guidelines, Hand Book, toolkits, customized software, etc., need to be designed to suit different geographical and developmental regions. Suitable mechanisms for data capture including satellite imagery and sharing of data need be made inbuilt component of the endeavor, so as to avoid duplication of efforts and to save time. It is also essential to create essential infrastructure and ensure availability of human resources including experts in the fields of Town and Country Planning.

4. CONCLUSIONS

Preparation of such a district plan will surely need decisions and commitments at various levels due to the multiplicity of agencies involved and the vast spectrum of aspects to be covered. In a vast country like India, having 640 districts in its different geographical, developmental and political regions, district planning will no doubt be a difficult task. However, delay in planning shall not affect development. Hence, a step-by-step approach may be adopted in planning. In this context, a road map have to be developed with examples and models along with templates for each milestone for the preparation of district plans, which can be replicated anywhere in India. It involves a brick-by-brick approach for district plan preparation.

“Orderly growth of the urban centre is dependent on the kind of organic linkage it establishes with its rural hinterland”. This indicates that planning of villages and towns are to be complementary. Therefore, a move of harmonizing urban

and rural centres of an area is considered as a move of planned urbanization of the area. This can be achieved through the preparation of a District Urbanization Report (DUR) for the district. It is the first milestone in the Road Map leading to the draft development plan for the district as laid down in the Constitution. The District Urbanization Report defines the future spatial structure of a district, which is formulated by integrating hierarchy and activity pattern of urban and rural settlements and the connectivity between them. The spatial structure of a district will act as a frame for the orderly development of urban centres and their rural hinterlands subsequently leading to a planned urbanization.

District Spatial Plan (DSP), the next milestone is designed as a synergistic form of the District Urbanization Report since as a plan it is congruent to a single unified physical design for the district through setting development goals and objectives and formulating the development concept of the district. DSP will frame the general policies and strategies and streamline directions of development of the district. The Development Directives of DSP is carved in the spatial platform through the synthesis of findings of the analysis over the spatial structure based on secondary sources of data. The District Spatial Plan will streamline the directions of development of the district by way of providing a framework for development as well as future planning of the district. However, the DSP lacks the sectoral studies as co-ordination of various line departments remain as an uphill task. IDDP of a District becomes the end product of a series of stages of actions with intermediate products at each stage. The formulation of spatial structure of the district is the first stage of preparation of an IDDP and the same can be considered as the first product. Development concept is the outcome of the second stage. Perspective plan is the third product. Sectoral proposals is the product of the fourth stage and breakup of the sectoral proposals - time wise, sector wise, and local body wise - is the product out of the final stage. The end product of each stage has its own standing and use in District Planning.

In short, the milestones in this road map for district planning in India are:

- District Urbanization Report (DUR);
- District Spatial Plan (DSP);
- Integrated District Development Plan(IDDP) - Perspective Plan;
- Integrated District Development Plan(IDDP) - Execution Plan; and
- Approach Paper for Five Year Plan of local governments and Consolidated District Plan

Supported with necessary toolkits and customized software, the DUR for a district can be completed in a period of 4-6 months and can also be up scaled from DUR to DSP in another 3 to 4 months. The IDDP – Perspective Plan will require another 4-6 months' time for its preparation. The preparation of IDDP – Execution Plan

will require a further period of 3-4 months and an Approach Paper for Five Year Plan (Consolidated District Plan) in another 3-4 months. The DURs and DSPs can be done elsewhere either departmentally or through engaging consultants and external experts. This road map will help to fill the gap of district or regional planning in the multi-level planning process of our country. Let us also hope district planning may emerge in India as an alternative solution to vacuum created by the National Planning Commission and the economic planning and build a mechanism for integrating projects at regional and local levels.

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Design Models of Roadway Transportation Systems and their Integration with City Planning

Walid Al-Shaar

Abstract

In Lebanon, cities are encountering many social and economic problems in terms of high population density and high unemployment rate. Besides, roadway transportation flow is not well distributed; frequent congestion on roads is a daily occurrence in Lebanese roads; and unbalanced infrastructure constitutes a significant problem. This paper presents design models, which represent a scientific tool and criteria to calculate and find the optimum road network area to be distributed all over the master plan. These results and findings of proportionality factors when used, it may lead to make the master plan optimistically feasible.

1. INTRODUCTION

During the phase of the preparation of new master plan, urban planners do not have any scientific tool or criteria to calculate and find the optimum road network area to be distributed all over the master plan land use areas. Generally, urban planners state clearly that the percentage of road network area to the total land area in any new master plan should not exceed 30 to 35 per cent as stated by many urban planners in Lebanese engineering consulting companies.

The absence of such design models may lead to making the master plan not optimally feasible and sometimes not feasible at all. Nowadays, the checking design process of roads system in any new master plan consists of using the following checkpoints as stated by transportation planners in different consulting engineering companies in Lebanon:

- Assessing the level of service in each road section independently; and
- Relating road sections to a fixed (present and future) population size and a fixed Land Use size.

This research identifies a calculation basis (design mathematical models) to calculate the optimum road network area to be used during the design of new master plan, and during the assessment of the road network in any city or town based on transportation demands (trip generation in the area).

Not taking into consideration any unexpected future urban development may present a big transportation planning issue in future.

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The aim of the research is threefold: First, to identify a calculation basis (design models) to be used during the design of new master plan or during the assessment of the road network in any city/town based on transportation demands (trip generation in the area). Second, to make new urban master plan much more feasible by calculating the optimized road network area based on the design and the selected V by C ratio. Third, to recommend the setup of new urban development legislation decrees, stating that the road network established for any new master plan (based on the design models), should present a reference for the capacity of the city / town in terms of the evolution and the growth of population, and in terms of urban expansion, where the concept here is to state that each resident, or any person entering the city (workers, employees, students, etc.), should have an allocated space share of the road.

In addition and based on establishing an optimum road network, it is also recommended to set an urban expansion standard in collaboration with local authorities, and using law enforcement in order to keep the roadway system in track with the city growth. Coordination with authorities (municipalities) should periodically be held in order to keep the population density, its uniformity, and the vertical and horizontal shape of the city in conformance with the master plan design. So, to identify the mathematical proportionality of road surfaces, population to the Land Use Areas, relating these 3 factors based on V/C required ratio depending on trip generation rates and land use types. Four hypotheses motivated this research plan are:

- Unplanned and unlimited urban expansions in the city, with non-respect to infrastructure road networks, may cause the over saturation in cities in terms of services (road queuing times and delays), infrastructures, natural resources, socio-economic conditions and environmental negative impacts;
- Not identifying the capacity of road network, and not setting a legislated plan for any urban expansion in term of population growth or any vertical and horizontal land use expansion, will lead to an uncontrollable urban evolution in the said city;
- An increase in the number of highways and motor ways users may cause uncontrollable road and traffic management; and
- City road network systems may be operated by similar principles as the Neocortex. Neurons are conduits for information-related signals on which brain computations rely, highways are conduits for physical materials and people. But from the perspective of the city as a whole, the materials and people that roads transport are crucial to the large scale function provided by the city, and are, in a sense, signals that one signal is electric and the other physical may not matter in regards to the fundamental principles governing

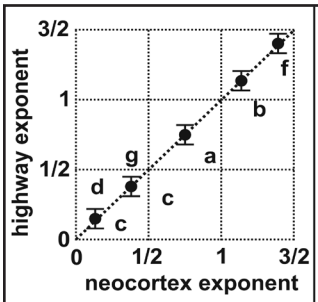
them. In addition to the prima facie analogy between city highway networks and the brain's neural connections, there are several other reasons we chose to examine city highway networks.

2. RESEARCH METHODOLOGY

Changizi and Destefano in 2009 stated that the total surface area of highways would appear to be of interest, and the neocortical analog of this is the cumulative surface area of white matter axons. Total white matter surface area is the product of the number of neurons, the length of white matter axons, and the axon diameter. Assuming axon length scales as the cube root of white matter volume, one may derive that the total surface area of white matter axons scales as the 1.375 power of total convoluted surface area. The total highway surface area may similarly be estimated, and assuming highway length scales as the square root of city land area, one may derive that total highway surface area scales as the 1.433 power of city land area, close to the 11/8 exponent for the analogous quantity in Neocortex.

Population scales as the 1.205 power of road (not highway) surface area for a set of 29 German cities (Changizi and Destefano, 2009). Figure 1 depicts a comparison of city highway system and neocortex exponents for quantities as a function of surface area.

Fig. 1. Comparison of City Highway System and Neocortex Exponents for Quantities as a Function of Surface Area



Generic Name	Variable for City Highways	City Highway System Exponent	Variable for Neocortex	Neocortex Exponent
Surface Area	Land area	1	Total convoluted surface area	1
(a) No. of conduits	No. of highways	0.759 (±0.083)	No. of pyramidal neurons	3/4 = 0.75
(b) Total no. of leaves	Total no. exits	1.138 (±0.072)	Total no. of synapses	9/8 = 1.125
(c) No. of leave per conduit	No. of exits per highway	0.379 (±0.064)	No. of synapses per neuron	3/8 = 0.375
(d) Diameter of conduit	No. of highway lanes	0.174 (±0.038)	Diameter of white matter axon	1/8 = 0.125
(e) Propagation velocity	Velocity of cross-city travel	0.108 (±0.021)	Propagation velocity of white matter axon	1/8 = 0.125
(f) Total surface area of conduits	Total surface of highways	1.433 (±0.096)	Total surface are of matter axons	3/2 = 1.5
(g) No. of compartments	Population	1.462 (±0.141)	No. of cortical areas	3/8 = 0.375
	No. of concentric ring regions	0.390 (±0.055)		

Source: Changizi, M. A. and Destefano, M. (2009)

2.1 Stage 1: Design Models Concept

These design models, can be identified by establishing mathematical models analogously related to the "Distribution of neurons in Mammalian Neocortex" by trying to identify the best parameters values, to fit the road network area required for different Land Use types. This means defining a formula combining the road network area to the Land Use area by using proportionality factors α, ß.

Moreover, a population - Land use surface area relation, is also be established by using a proportionality coefficient Δ *(Ref: Eng. Walid-Al-Shaar)*. In this research, it is considered that road network surface area (instead of highway) may be estimated to be scaled as the 1.433 power of city land area, close to the 11/8 exponent for the analogous quantity in Neocortex.

2.2 Stage 2: Elaborated Design Models

The basis formulas to be used in the study are depicted below:

- **$A = \alpha \times S^{1.433}$** (A: represents the road network areas instead of Highway surface area)

  (Ref: Eng. Walid-Al-Shaar)

  It is the formulae combining:

  The road network area "A" (Area in square miles) to

  The Land Use area "S" (Area in square miles)

  α is the Proportionality Factor to be calculated, it is relating A to S
- **$P = ß \times A^{1.205}$** *(1)*

  It is the formulae combining:

  The road network area "A" (Area in square miles) to

  The Land Use population "P"

  ß is the Proportionality Factor to be calculated, it is relating A to P
- **$P = \Delta \times S^{1.727}$** (based on relating the above 2 formulas and eliminating the element "A")

  (Refer Walid-Al-Shaar)

It is the formulae combining:

- The Land Use area "S" (Area in square miles) to
- The Land Use population "P"
- Δ is the Proportionality Factor to be calculated, it is relating P to S

2.3 Stage 3: Calculation of Proportionality Factors α, ß and Δ

The third stage of this research is to establish the 5 scenarios for Land use road network in terms of the ratio of road Volume to Capacity (V/C) to be

taken 25%, 40%, 50% and 75% (and 100% only for residential areas), then to determine the coefficient Alfa and Beta to fit the criteria of these ratios. A base condition is taken in this study, where the traffic is considered to be constituted only by passenger car vehicles with dimensions as indicated below:

- The term 'one space' used in the standards refers to standing area only and the recommended minimum dimensions for a car space are 4.8 meters by 2.4 meters. (1)
- A- V/C = 25% means that for each car, it should be a free space reservation area equal to 3 car spaces (free space reservation = 3 x 4.8 = 14.4 m/lane) in addition to the car space.
- B- V/C = 40% means that for each car, it should be a free space reservation area equal to 1.5 car spaces (free space reservation = 1.5 x 4.8 = 7.2 m/lane) in addition to the car space.
- C- V/C = 50% means that for each car, it should be a free space reservation area equal to 1 car space (free space reservation = 1 x 4.8 = 4.8 m/lane) in addition to the car space.
- D- V/C = 75% means that for each car, it should be a free space reservation area equal to 0.33 car spaces (free space reservation = 0.33 x 4.8 = 1.58 m/lane) in addition to the car space.
- E- V/C = 100% means that for each car, there is no additional free space reservation

For each land use area, the number of vehicles (trip generated in the land use) are calculated based on the ITE manual *(3)* which could guide us to set the road surface area required to serve each type of land use trip generations at different above selected volume to capacity ratios. It should be noted that the study shows for each alternative of volume to capacity (V/C) ratio, 3 base conditions

Table 1: Free and Total Space Reservation for Different V/C: Volume to Capacity Ratios

V/C (%)	Length of one passenger car (m/Lane)	free space reservation for each passenger car (m/Lane)	Total reservation for each passenger car (m/Lane)
25	4.8	14.4	19.2
40	4.8	7.2	12
50	4.8	4.8	9.6
75	4.8	1.58	6.38
100	4.8	0	4.8

Source: Eng. Walid Al-Shaar

Table 2: Trip Generation Rates for Different Land Use as per ITE Manual 9th Edition (3)

N°	Land Use Type	Land Use selection from ITE manual	Reference
1	"Industrial Park Areas"	The trip generation model for Industrial Park Areas is the model using the "Average Vehicle Trip Ends vs 1000 Sq. Feet Gross Floor Area" on a "weekday – peak hour of adjacent street traffic, one hour between 7 and 9 am" since the industrial areas in Tripoli are characterized by a mix of manufacturing, service and warehouse facilities with a wide variation in the proportion of each type of use from one location to another.	ITE 9th Edition - Volume 2 - Page 146

Industrial Park
(130)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Number of Studies: 43
Average 1000 Sq. Feet GFA: 427
Directional Distribution: 82% entering, 18% exiting

Trip Generation per 1000 Sq Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.82	0.12 - 2.28	102

N°	Land Use Type	Land Use selection from ITE manual	Reference
2	"Recreational "	The trip generation model for Recreational Areas is the model using the "Average Vehicle Trip Ends vs 1000 Sq. Feet Gross Floor Area" on a "weekday –peak hour of adjacent street traffic, one hour between 4 and 6 p.m. " since the Recreational areas in Tripoli are characterized by letting the community join the recreational and cultural activities.	ITE 9th Edition - Volume 2 - Page 960

Recreational Community Center
(495)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic, One Hour
Between 4 and 6 p.m.

Number of Studies: 7
Average 1000 Sq. Feet GFA: 72
Directional Distribution: 49% entering, 51% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.74	1.05 - 5.37	2.32

<table>
<tr><th>N°</th><th>Land Use Type</th><th>Land Use selection from ITE manual</th><th>Reference</th></tr>
<tr><td rowspan="2">3</td><td>“Residential”</td><td>The trip generation model for Residential Areas is the model using the “Average Vehicle Trip Ends vs Dwelling Units” on a “weekday - peak hour of adjacent street traffic, one hour between 4 and 6 p.m.” since the residential areas in Tripoli are characterized by mid-rise apartments located in buildings with 3 to 10 floors .</td><td>ITE 9th Edition - Volume 2 - Page 388</td></tr>
<tr><td colspan="3">
Mid-Rise Apartment
(223)

Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies Avg. Number: 7
of Dwelling Units Directional: 120
Distribution: 58% entering, 42% exiting

Trip Generation per Dwelling Unit
<table>
<tr><th>Average Rate</th><th>Range of Rales</th><th>Standard Deviation</th></tr>
<tr><td>0,39</td><td>0.15 - 0.54</td><td>0.63</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">4</td><td>“Commercial/ Retail: Variety Store”</td><td>The trip generation model for Variety Store Areas is the model using the “Average Vehicle Trip Ends vs 1000 Sq. Feet Gross Floor Area” on a “weekday - peak hour of adjacent street traffic, one hour between 7 and 9 a.m.” since the scheme of Commercial/ Retail areas in Tripoli are characterized by the Variety commercial Stores.</td><td>ITE 9th Edition - Volume 3 - Page 1451</td></tr>
<tr><td colspan="3">
Variety Store
(814)

Average Vehicle Trip Ends vs: 1000 Sq Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic, One Hour
Between 7 and 9 a.m.

Number of Studies: 15
Average 1000 Sq. Feet GFA: 10
Directional Distribution: Not available

Trip Generation per 1000 Sq Feet Gross Floor Area
<table>
<tr><th>Average Rate</th><th>Range of Rates</th><th>Standard Deviation</th></tr>
<tr><td>3.61</td><td>1.68 - 11.86</td><td>274</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>N°</th><th>Land Use Type</th><th>Land Use selection from ITE manual</th><th>Reference</th></tr>
<tr><td>5</td><td>“ Educational: University-College”</td><td>The trip generation model for University-College Areas is the model using the “Average Vehicle Trip Ends vs Students” on a “weekday - peak hour of adjacent street traffic, one hour between 7 and 9 am”.</td><td>ITE 9th Edition - Volume 3 - Page 1077</td></tr>
<tr><td colspan="4">
University/College
(550)

Average Vehicle Trip Ends vs: Students
On a: Weekday,
Peak Hour ol Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Number of Studies: 8
Average Number of Students: 13,372
Directional Distribution: 78% entering, 22% exiting

Trip Generation per Student
<table>
<tr><th>Average Rate</th><th>Range of Rates</th><th>Standard Deviation</th></tr>
<tr><td>0.17</td><td>0.09 - 0.26</td><td>0.41</td></tr>
</table>
</td></tr>
<tr><td>6</td><td>“ Educational: High School”</td><td>The trip generation model for High School Areas is the model using the “Average Vehicle Trip Ends vs 1000 Sq. Feet Gross Floor Area” on a “weekday - P.M peak hour of Generator”.</td><td>ITE 9th Edition - Volume 3 - Page 1024</td></tr>
<tr><td colspan="4">
High School
(530)

Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
P.M. Peak Hour of Generator

Number of Studies: 44 Average
1000 Sq. Feet GFA: 194
Directional Distribution: 31% entering, 69% exiting

Trip Generation per 1000 Sq Feet Gross Floor Area
<table>
<tr><th>Average Rate</th><th>Range of Rates</th><th>Standard Deviation</th></tr>
<tr><td>2.12</td><td>0.98 - 5.14</td><td>1.74</td></tr>
</table>
</td></tr>
</table>

N°	Land Use Type	Land Use selection from ITE manual	Reference
7	" Educational: Elementary School"	The trip generation model for **Elementary School Areas** is the model using the "*Average Vehicle Trip Ends vs **1000 Sq. Feet Gross Floor Area***" on a "***weekday - peak hour of adjacent street traffic, one hour between 4 and 6 p.m.***".	ITE 9th Edition - Volume 3 - Page 989

Elementary School
(520)

Average Vehicle Trip Ends vs: 1000 Sq, Feet Gross Floor Area
On a: Weekday,
Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.

Number of Studies: 10 Average 1000
Sq. Feet GFA: 84
Directional Distribution: 45% entering, 55% exiting

Trip Generation per 1000 Sq Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
1.21	0.79 - 2.25	1 - 20

Source: ITE trip Generation manual 9th Edition

of lane widths (commonly known/used lane widths): 3.0 m, 3.3 m and 3.6 m to be taken into consideration during the calculation phase.

3. CALCULATION PROCEDURES

3.1 First Design Model Relating Road Network Area and the Land Use Area

Calculation for the interrelation coefficients α, of land use area and the related required road network area, will take place for the Land Use types within the indicated range of units as indicated in the table below, based on trip generation rates provided by the ITE Manual and the following the formulae:

$A = \alpha \times S1.433$

Where

A: Road network area in the related land use areas in square miles

S: Land use areas in square miles

α: Proportionality Coefficient

It is to notice that during the calculation, the used trip generation rates are:

- The minimum values of trip rates indicated by ITE manual (3)
- The maximum values of trip rates indicated by ITE manual, if the percentage of calculated required road does not exceed 35%, otherwise the maximum rate used is calculated based on this assumption (not

Table 3: Land Use Types and the Range of Units Used in the Study

Land Use type	Range of units in the study (1000 Sq. Feet)	Reason for this Selection of the Range of units in the study
Industrial Park	140 – 10,000	The range of units is selected since it is commonly known that the minimum area could be considered 140,000 sq. feet and the maximum would not exceed 10,000,000 sq. feet
Recreational areas	140 – 10,000	
Commercial areas	140 – 10,000	
High school area	140 – 10,000	
Elementary school area	140 – 10,000	

Source: Eng. Walid Al-Shaar

exceeding the 35%) as the urban planners in Lebanon advise to not exceed this percentage.

3.2 Second Design Model Relating Road Network Area and the Land Use Population

The calculation for the interrelation coefficients ß, of Population and the related required road network area, will take place for the Land Use types within the indicated range of units as indicated in the Table 3, based on trip generation rates provided by the ITE Manual and the following formulae:

$P = ß \times A^{1.205}$

Where

P: Population in the Land Use

A: Road network area in the related Land Use (areas in square miles)

ß: Proportionality Coefficient

It is to notice that during the calculation, the used trip generation rates are:

- The minimum values of trip rates indicated by ITE manual
- The maximum values of trip rates indicated by ITE manual, if the percentage of calculated required road does not exceed 35%, otherwise the maximum rate used is calculated based on this assumption (not exceeding the 35%) as the urban planners in Lebanon advice to not exceed this percentage.

3.3 Third Design Model Relating Land Use Area and the Land Use Population

Limitations: This model should be applied only for residential zones. The following considerations should be taken into account prior to start applying this mathematical model and finding the optimal proportionality factor Δ:

- Observations and data collection to determine the average number of car parking basements* for all buildings in the study zone should first of all be done.

Table 4: Land Use Types and their Range of Units Used in the Study

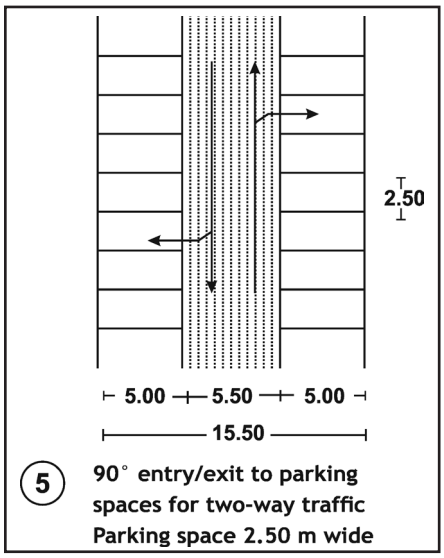
Land Use type	Range of units in the study	Reason for this Selection of the Range of units in the study
Residential areas	2,000 – 25,000 (Population)	Residential areas/compounds studies in this research are considered to have a capacity of a minimum 2,000 residents and the maximum 25,000 residents
University area/campus	140 – 10,000 (Students)	It is commonly known that one university building or one campus can provide the educational services for a minimum of 700 students and maximum 7,000 students except other special cases

Source: Eng. Walid Al-Shaar

- The space reserved in the basement for car parks and maneuvers = 52% of the Land Use flat area (based on common practice of architects in many engineering consulting companies in Lebanon)
- The Area needed for one passenger car (parking area and the entry/exit maneuvers) = (5+ (5.5/2)) x 2.5) m^2 (Figure 2 - Turning and parking space (Neufert 3rd edition))
- Observations and data collection to determine the car ownership rate per capita in the study area.
- Observations and data collection to determine the average household size in the study area.

Figure 2 shows Turning and parking space (Neufert 3rd edition) (4). In this article the study area was the "Tripoli" City in Lebanon.

Fig. 2: Turning and Parking Space



- An assumption of the number of parking basements in residential area was made and it is considered that the number is equal to one.
- The car ownership = 434 cars for 1000 person in Lebanon in 2014 *(5)*
- The average household size = 5.21 person/house *(6)*

* parking basements flat area are considered equal to the building plot/parcel area.

4. FINDINGS: RESULTS AND DISCUSSION

These design models represent a scientific tool and criteria to calculate and find the optimum road network area to be distributed all over the master plan. These results and findings of proportionality factors when used, it may lead to make the master plan optimistically feasible.

Table 5: Coefficient Alfa α in Industrial Areas with V/C = 25% and with Minimum Trip Generation Rates

Number of units in the study (1000 Sq. feet)	Land use Area (mi2)	Min Trip generated at peak hour (during one hour)	V/C = 25% (Min trip generated)			
			Required Road for Min trip generate (km/lane)	Lane width		
				3	3.3	3.6
				Coefficient α		
140	0.005	16.8	0.32	0.736	0.810	0.883
1,000	0.035	120	2.3	0.314	0.345	0.377
2,000	0.071	240	4.61	0.232	0.256	0.279
3,000	0.107	360	6.91	0.195	0.214	0.234
4,000	0.143	480	9.22	0.172	0.189	0.206
5,000	0.179	600	11.52	0.156	0.172	0.187
6,000	0.215	720	13.82	0.144	0.159	0.173
7,000	0.251	840	16.13	0.135	0.148	0.162
8,000	0.286	960	18.43	0.127	0.140	0.153
9,000	0.322	1080	20.74	0.121	0.133	0.145
10,000	0.358	1200	23.04	0.115	0.127	0.139

Source: Eng. Walid Al-Shaar

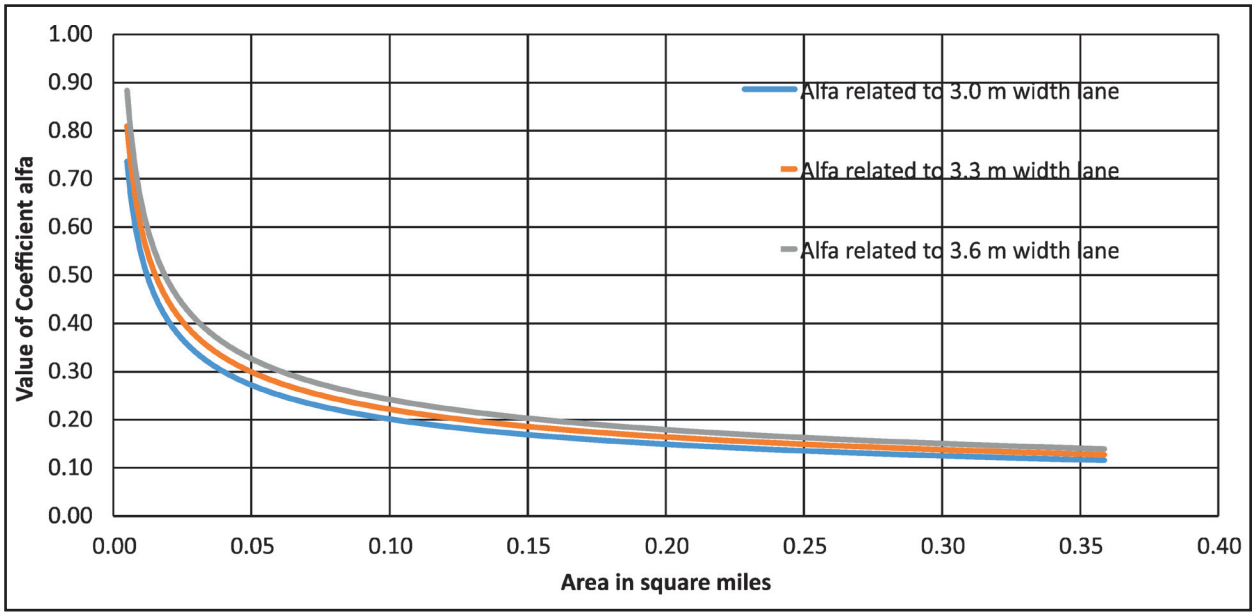
Table 6: Calculation of Coefficient Alfa α in Industrial Areas with V/C = 25% and with Maximum Accepted* Trip Generation Rates

Number of units in the study (1000 Sq. feet)	Land use Area (mi2)	Min Trip generated at peak hour (during one hour)	V/C = 25% (Max accepted* trip generation rate)			
			Required Road for Min trip generated (km/lane)	Lane width		
				3	3.3	3.6
				Coefficient α		
140	0.00502	79.1	1.52	3.467	3.813	4.160
1,000	0.03587	565	10.85	1.479	1.627	1.775
2,000	0.07174	1130	21.7	1.096	1.205	1.315
3,000	0.10761	1695	32.54	0.919	1.011	1.103
4,000	0.14348	2260	43.39	0.811	0.893	0.974
5,000	0.17935	2825	54.24	0.737	0.810	0.884
6,000	0.215	3390	65.09	0.681	0.749	0.817
7,000	0.251	3955	75.94	0.637	0.700	0.764
8,000	0.286	4520	86.78	0.601	0.661	0.721
9,000	0.322	5085	97.63	0.571	0.628	0.685
10,000	0.358	5650	108.48	0.546	0.600	0.655

Source: Eng. Walid Al-Shaar

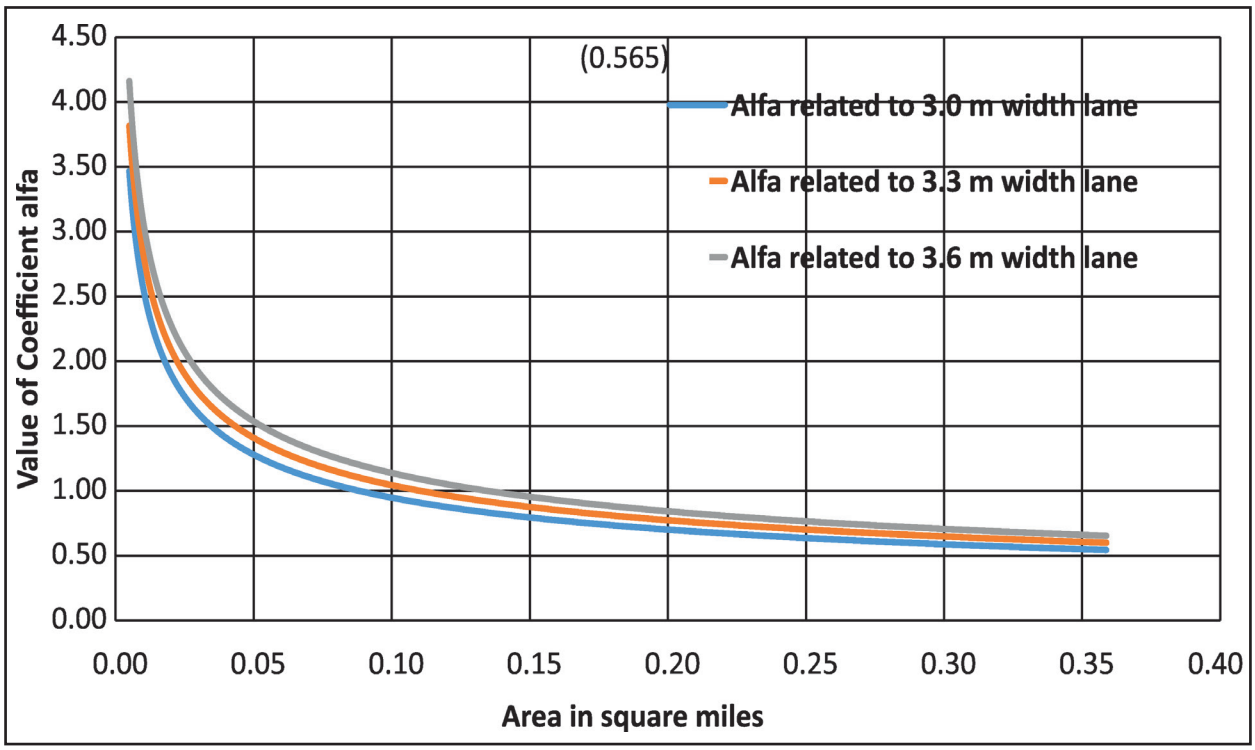
* based on assumption that the total road network area should not exceed 35% of land use area (with roads lane width of 3.0 m)

Fig. 3: Coefficient α in Industrial Areas with 25% Volume over Capacity and Minimum Rate of Trip Generation (0.12)



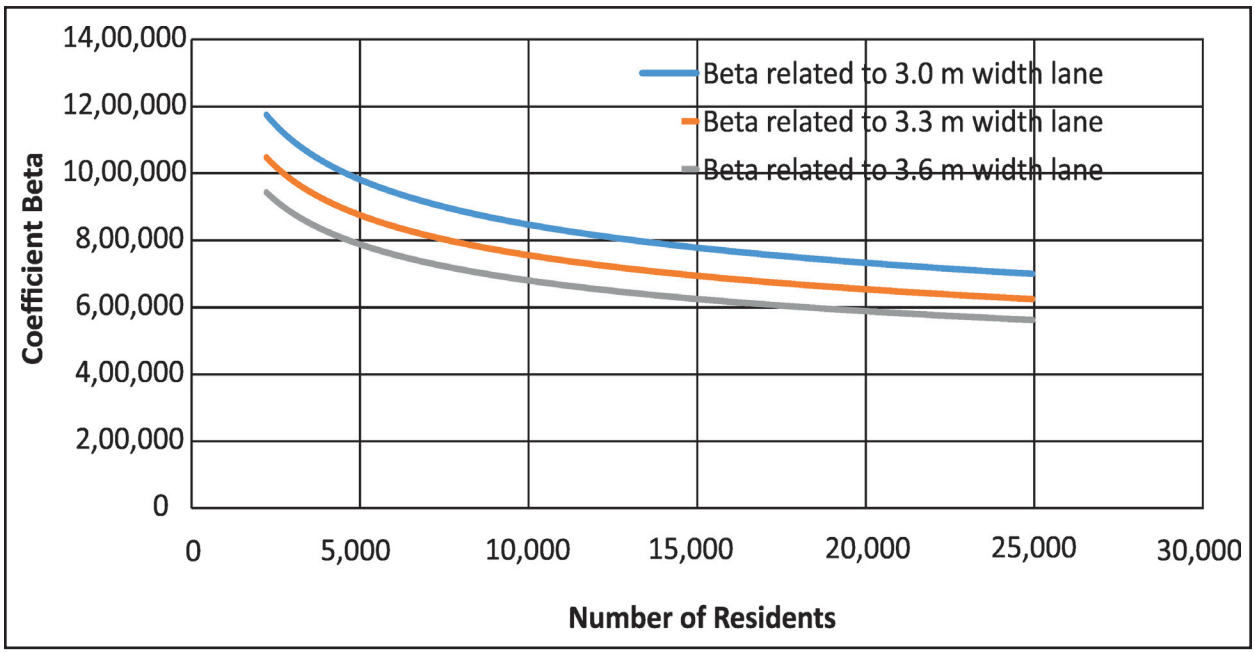
Source: Eng. Walid Al-Shaar

Fig. 4: Coefficient α in Industrial Areas with 25% Volume over Capacity and Maximum* Accepted Rate of Trip Generation (0.565)



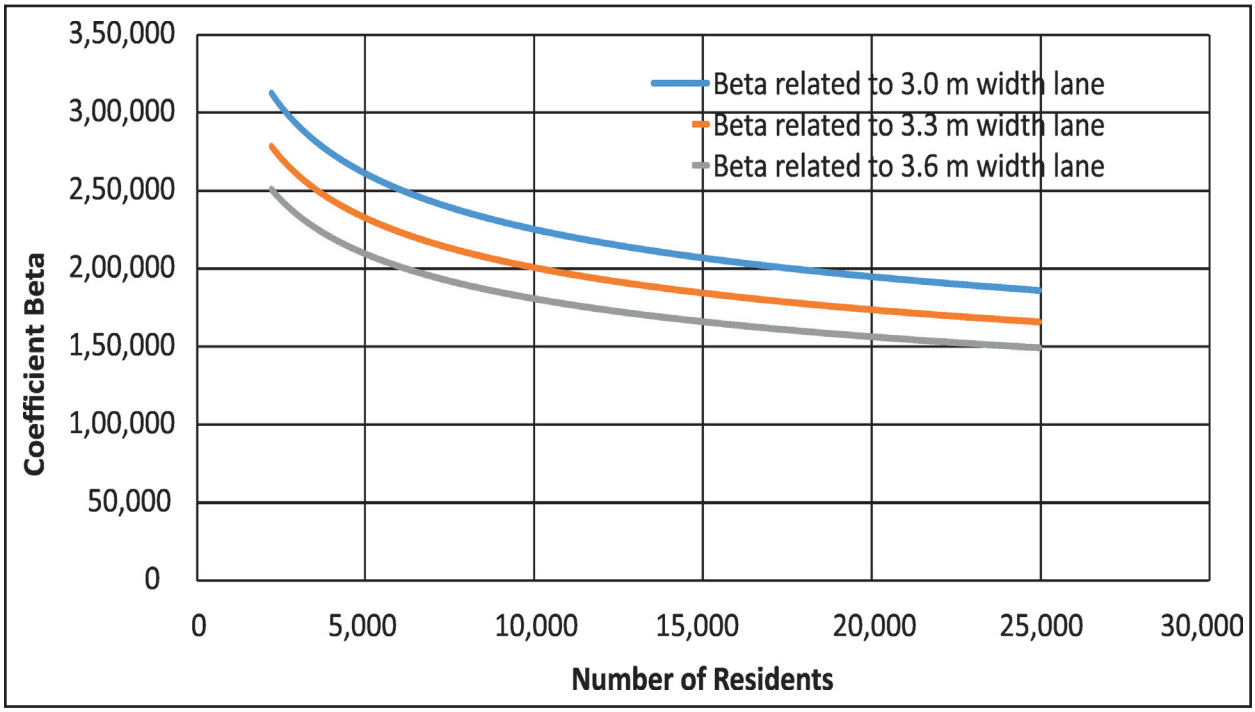
Source: Eng. Walid Al-Shaar

Fig. 5: Coefficient ß in Residential with 25% Volume over Capacity and Minimum Rate of Trip Generation (0.15)



Source: Eng. Walid Al-Shaar

Fig. 6: Coefficient ß in Residential with 25% Volume over Capacity and Maximum Rate of Trip Generation (0.45)



Source: Eng. Walid Al-Shaar

Table 7: Calculation of Coefficient Beta ß in Residential Areas with V/C = 25% and with Minimum Trip Generation Rates

Number of residents	Number of Dwelling units in the study	Min Trip generated at peak hour (during one hour)	V/C = 25% (Min trip generated)			
			Required Road for Min trip generated (km/lane)	Lane width		
				3	3.3	3.6
				Coefficient ß		
2,000	384	58	1.11	1,174,271	1,046,864	942,660
3,000	576	86	1.66	1,080,611	963,366	867,473
4,000	768	115	2.21	1,018,725	908,195	817,794
5,000	960	144	2.76	973,174	867,586	781,227
6,000	1,152	173	3.32	937,472	835,757	752,567
7,000	1,344	202	3.87	908,310	809,760	729,157
8,000	1,536	230	4.42	883,784	787,894	709,468
9,000	1,727	259	4.98	862,700	769,098	692,542
10,000	1,919	288	5.53	844,266	752,664	677,745
11,000	2,111	317	6.08	827,931	738,101	664,631
12,000	2,303	345	6.63	813,293	725,052	652,881
13,000	2,495	374	7.19	800,057	713,252	642,255
14,000	2,687	403	7.74	787,994	702,498	632,572
15,000	2,879	432	8.29	776,928	692,632	623,688
16,000	3,071	461	8.84	766,717	683,529	615,491
17,000	3,263	489	9.4	757,247	675,086	607,889
18,000	3,455	518	9.95	748,425	667,222	600,807
19,000	3,647	547	10.5	740,176	659,867	594,185
20,000	3,839	576	11.06	732,434	652,965	587,970

Source: Eng. Walid Al-Shaar

4.1 First Design Model Proportionality Factors (α)

Results depicted here are limited only for industrial areas with V/C = 25% (because of numerous land Use types). Figures 3 and 4 shows the variation of the value of Coefficient α in Industrial areas with 25% volume over capacity ratio and based respectively on minimum and maximum (accepted) rate of trip generation.

4.2 Second Design Model proportionality factors (ß)

Results depicted here are limited only for residential areas with V/C = 25% (because of numerous land Use types). Figures 5 and 6 shows the variation of the

Table 8: Coefficient Beta ß in Residential Areas with V/C = 25% and with Maximum Trip Generation Rates

Number of residents	Number of Dwelling units in the study	Min Trip generated at peak hour (during one hour)	V/C = 25% (Max trip generated)			
			Required Road for Min trip generated (km/lane)	Lane width		
				3	3.3	3.6
				Coefficient ß		
2,000	384	173	3.32	312,491	278,586	250,856
3,000	576	259	4.98	287,567	256,366	230,847
4,000	768	345	6.63	271,098	241,684	217,627
5,000	960	432	8.29	258,976	230,877	207,896
6,000	1,152	518	9.95	249,475	222,407	200,269
7,000	1,344	605	11.61	241,715	215,489	194,039
8,000	1,536	691	13.27	235,188	209,670	188,800
9,000	1,727	777	14.93	229,577	204,668	184,296
10,000	1,919	864	16.58	224,672	200,295	180,358
11,000	2,111	950	18.24	220,325	196,420	176,868
12,000	2,303	1,036	19.9	216,429	192,947	173,741
13,000	2,495	1,123	21.56	212,907	189,807	170,914
14,000	2,687	1,209	23.22	209,697	186,945	168,337
15,000	2,879	1,296	24.88	206,752	184,320	165,973
16,000	3,071	1,382	26.53	204,035	181,897	163,791
17,000	3,263	1,468	28.19	201,514	179,650	161,768
18,000	3,455	1,555	29.85	199,167	177,558	159,884
19,000	3,647	1,641	31.51	196,972	175,600	158,121
20,000	3,839	1,727	33.17	194,911	173,764	156,467

Source: Eng. Walid Al-Shaar

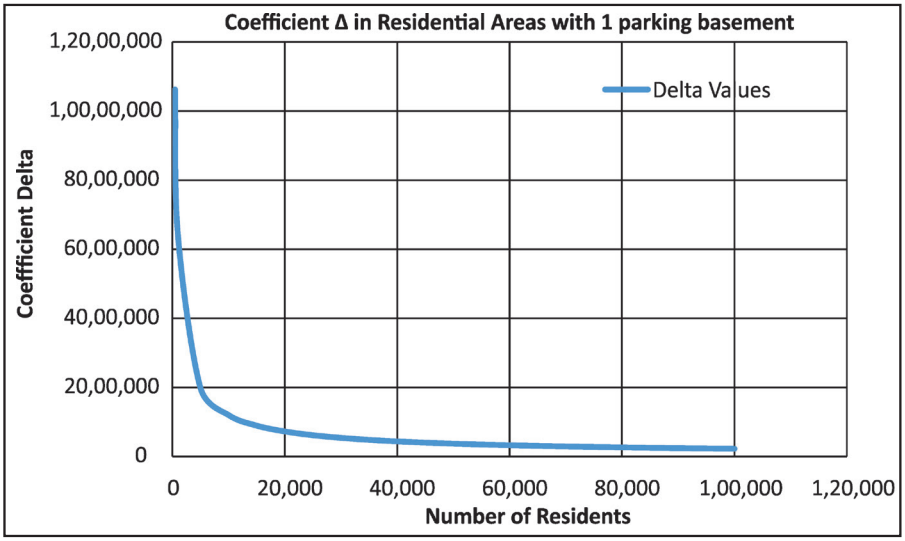
Table 9: Coefficient Delta Δ in Residential Areas with 1 Parking Basement

Land Use Area (m2)	Land Use Area (mi2)	Parking Area (m2)	Number of car park spaces	Number of residents	Coefficient Δ
8,085	0.003	4,204	217	500	10,620,497
16,171	0.006	8,409	434	1,000	6,416,468
80,853	0.031	42,044	2,170	5,000	1,991,337
161,707	0.062	84,088	4,340	10,000	1,203,084
242,560	0.094	126,131	6,510	15,000	895,938
323,413	0.125	168,175	8,680	20,000	726,855
404,266	0.156	210,218	10,850	25,000	618,009
485,119	0.187	252,262	13,020	30,000	541,290
565,972	0.219	294,305	15,190	35,000	483,904
646,825	0.250	336,349	17,360	40,000	439,136
727,678	0.281	378,392	19,530	45,000	403,099
808,531	0.312	420,436	21,700	50,000	373,376

Table Continued...

889,384	0.343	462,480	23,870	55,000	348,380
970,237	0.375	504,523	26,040	60,000	327,025
1,051,090	0.406	546,567	28,210	65,000	308,538
1,131,943	0.437	588,610	30,380	70,000	292,355
1,212,796	0.468	630,654	32,550	75,000	278,053
1,293,649	0.499	672,697	34,720	80,000	265,308
1,374,502	0.531	714,741	36,890	85,000	253,869
1,455,355	0.562	756,784	39,060	90,000	243,536
1,536,208	0.593	798,828	41,230	95,000	234,149
1,617,061	0.624	840,872	43,400	100,000	225,578

Fig. 7: Coefficient Δ in Residential Areas with 1 Parking Basement



Source: Eng. Walid Al-Shaar

values of Coefficient ***B*** in Residential areas with 25% volume over capacity ratio and based respectively on minimum and maximum rate of trip generation.

4.3 Third Design Model proportionality factors (Δ)

Results depicted here are limited only for residential areas with an average of 1 parking basement for all buildings (because of numerous scenarios of number of parking basements (numbers ranging from 1 to 6). The calculations of the coefficient Δ were made for a lot of Population where the number of residents is within the range is from 500 to 100,000 residents. Figure 7 shows the variation of the values of Coefficient ***Δ*** in Residential areas with 1 parking basement.

5. CONCLUSIONS

Proposed research plan accounts for an important city planning or control concern. The knowledge of cities conflicts associated with unplanned urban expansion and population growth can identify the level of saturation of the city in terms of transportation and lead to identify the main problems. It is highly recommended to define criteria and design models in order to make implementation by integrating the planning of roadway transportation systems into city planning and inter-city planning. In Lebanon, cities are encountering

many social and economic problems in terms of high population density and high unemployment rate. Besides the following are important issues:

- Roadway transportation flow is not well distributed;
- Frequent congestions are daily observed in Lebanese road network; and
- In addition to all the above problems, unbalanced infrastructure constitutes a significant issue.

This research should be followed up by other researchers with a focus on research areas such as:

- The best fit of road network distribution into the city (simulations);
- Finding a solution to car parking and the measures to minimize the road friction;
- Dissipating the road flow, eliminating the congestion and minimizing the road service delay and queuing time without adding new road sections more than the required as recommended by the design models;
- Identify the needed actions to be enhanced to solve the problem of cities saturation;
- Proposing the preparation of legal urban planning standards to be used by developers and other city users; and
- Identify the simplest way to move throughout the city, accessing the city center areas, and encouraging people to use public transportation or para-transit pseudo systems.

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Declaration of Interest

The author reports no conflicts of interest. The author alone is responsible for the content and writing of this article.

Rejuvenation of Built Heritage of Porbandar City through Local Area Planning

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Abstract

Local Area Planning (LAP) methodology is the new approach introduced in GTPUD Act of Gujarat in 2014. The city of Porbandar is and example of having organic growth without TP Schemes. However, the LAP methodology could be applied to a city with these urban characteristics. In this study, public opinion was considered for identification of neighborhoods having side effects of urbanization. The proposal for LAP features maximum FSI of 3 and 4 based on the abutting road width. The proposal also features an extra built-up of almost 2 lakh sq m. The proposed road network covers an area of almost 24 per cent of the LAP boundary in compared to existing 26 per cent. The proposal underlines that urban design projects like development of chowks and gardens, can also be covered, and recommends that Improved circulation pattern, reconstituted plot boundaries and availability of additional built-up will lead to healthy urban development.

1. INTRODUCTION

Urbanization is closely linked with the rapid and historic transformation of human social roots where rural culture is converted to urban culture. Many rural inhabitants come to the city for reasons of seeking work and social mobility (Jaysawal and Saha, 2014). In India, most of the modern cities grow in an organic manner. This haphazard development makes it difficult for urban local bodies to have a holistic development in the area. The difficulties are severe in areas like CBD. In India, land acquisition, DP / TP, etc.; are used to maintain the urban growth. Another important tool is 'Local Area Planning' which is specially mentioned in the GTPUD Act (2014 amendment) as Chapter VI under section 76.

Porbandar is one of the examples of the city with side effects of urbanization like traffic congestion, overcrowded residential areas, varying street widths, etc. The city also has its fair share of natural and built heritage with places like Kirti Mandir (birthplace of Mahatma Gandhi), Sudama Mandir and a bird sanctuary. In this study, efforts are made to derive various proposals for Porbandar city using LAP to overcome the problems.

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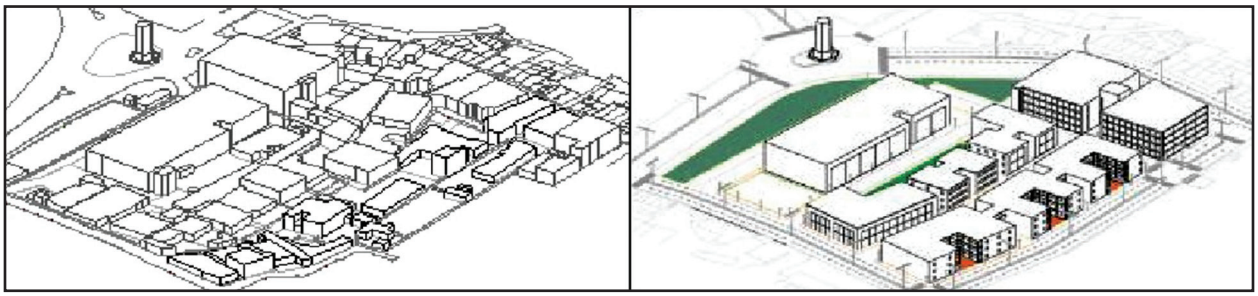
Fig. 1: Implementation of Local Area Planning in Already Developed Urban Area



Porbandar is a town with area of 7 sq km. The city currently does not have non - urbanized land in the city limits and has organic growth. The town with such a nature of urban scenario cannot opt for TP schemes and hence was stuck with future development. Due to such scenario the city is facing multiple urban issues like traffic congestion, overcrowding, varying street widths, absence of hierarchy in transportation network, undevelopable plot sizes, absence of community spaces etc. To overcome these issues the Local Area Planning (LAP) can be adopted.

LAP is concerned with resolving local level problems and issues. Its priorities include overall welfare of the people and development of the local area. Local Area Plans can be prepared for the following scenarios:

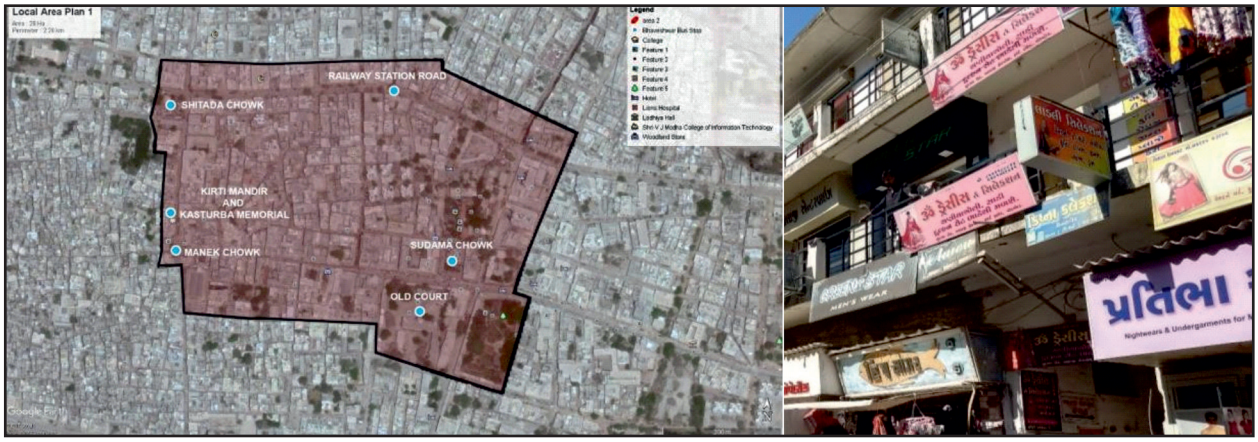
- For planned development of urbanizing periphery or urban village;
- In already developed areas;
- In old, dilapidated and unauthorized areas;
- In a disaster prone part of the city; and
- For heritage site being impacted by the surrounding environment.

In older areas, the local area plan framework could be used to identify deficits of infrastructure in view of the demand and integrate the same in ward level plans. The resulting interventions desired at the local level can have implications for the DP, which could be integrated in the revision process. Such implications could include land-use, built-form and urban design aspects that find mention in local Development Control Regulations (DCR).

2. EXISTING SCENARIO OF PORBANDAR CBD AREA

Delineated boundary for the proposed LAP was achieved through the pilot survey or public opinion. The LAP-The Heritage Square is about 28.14 hectare. The area is predominantly commercial and acts as a CBD for Porbandar city. The overall urban fabric can be visualized as a low-rise, mostly G+2 cluster of adjoining buildings with commercial and residential uses with narrow streets. Housing is mostly introvert with common faliya at the center and land lock plots. These

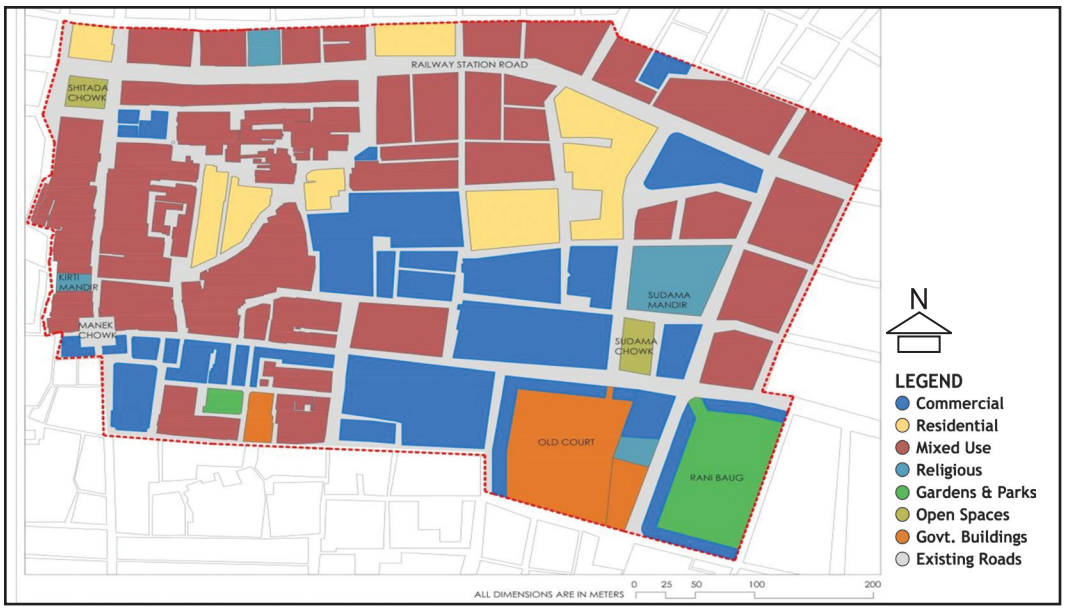
Fig. 2: Local Area Plan – The Heritage Square



central faliyas are currently government Land which is a big advantage for any redevelopment scheme. There are no restrictions over land use of the building unit with respect to its size. Hence, the old dilapidated buildings are converted to commercial shops.

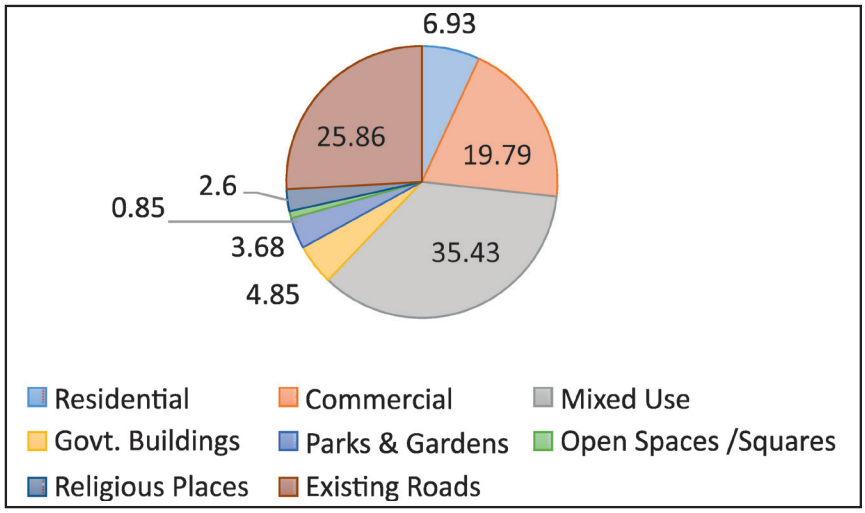
This redevelopment has affected city's infrastructure and density in an unhealthy manner. The small plots were redeveloped without leaving any margins and road frontage and even consumed FSI - 2, more than permissible. This haphazard redevelopment is constantly increasing pressure on all physical infrastructures. These demands for area development policy and strategy which could take care of the entire current situation keeping in mind the future needs.

Fig. 3: Existing Land Use Map at Block Level of LAP



2.1 Existing Road Network - LAP

Fig. 4: Existing Land Use Distribution of LAP



The LAP study area has two major roads running in East-West direction namely - M.G. Road (varying width from 15 m to 7.5 m) on the South and SVP Road (Station Road = 15 m wide) on the North. Another major link is the connecting road between Manek Chowk and Shitala Chowk known as Kirti Mandir Road. Typical block sizes vary greatly throughout the study area and most of them are less than 400 m of perimeter which encourages walkability in the area. Walkable block sizes have resulted into market being fairly pedestrian with vehicular traffic or either through traffic.

Unavailability of footpaths for pedestrians and on street parking has made it difficult for pedestrians to move around the streets. Unavailability of parking

Table 1: Road Network Characteristics in Study Area

S. No.	Road Width (m)	Road Length (m)	Area (sq. m.)	% Length	% Area
Category A					
1.	15	946	14190	14.19	25.18
2.	12	1323	15876	19.84	28.17
3.	9	877	7893	13.15	14.00
4.	7	1179	8253	17.68	14.64
5.	6	864	5184	12.96	9.20
6.	4	525	2100	7.87	3.73
7.	3	955	2865	14.32	5.08
	Total	6669	56361	100.00	100.00
Category B					
8.	Uneven Widths / Chowks		16419		
	Total	6669	72780		

within the plot area even after redevelopment has led to such a situation. Also there is no regularized zone for street hawkers. The street widths currently range from 3 m to 15 m. Footpath for pedestrians can only be seen on 15 m wide roads.

2.2 Existing Built Forms

The built form in the LAP area varies from high density row house clusters and mixed use buildings with commercial on ground and residential on upper floors. The Urban fabric in the LAP area is dense – particularly in the areas of Kirti Mandir, Sutaarvada and Manek Chowk. The building height varies from G to G+3 floors. Also recently in last 5 years, apartment buildings up to G+6 floors have also come up.

Fig. 5: Existing Road Network of LAP

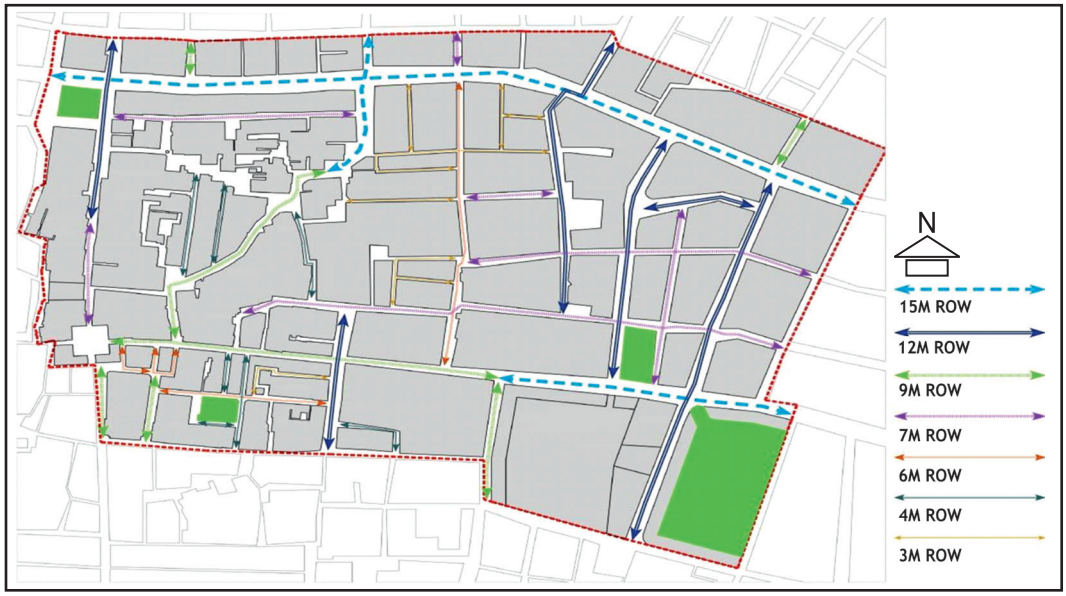
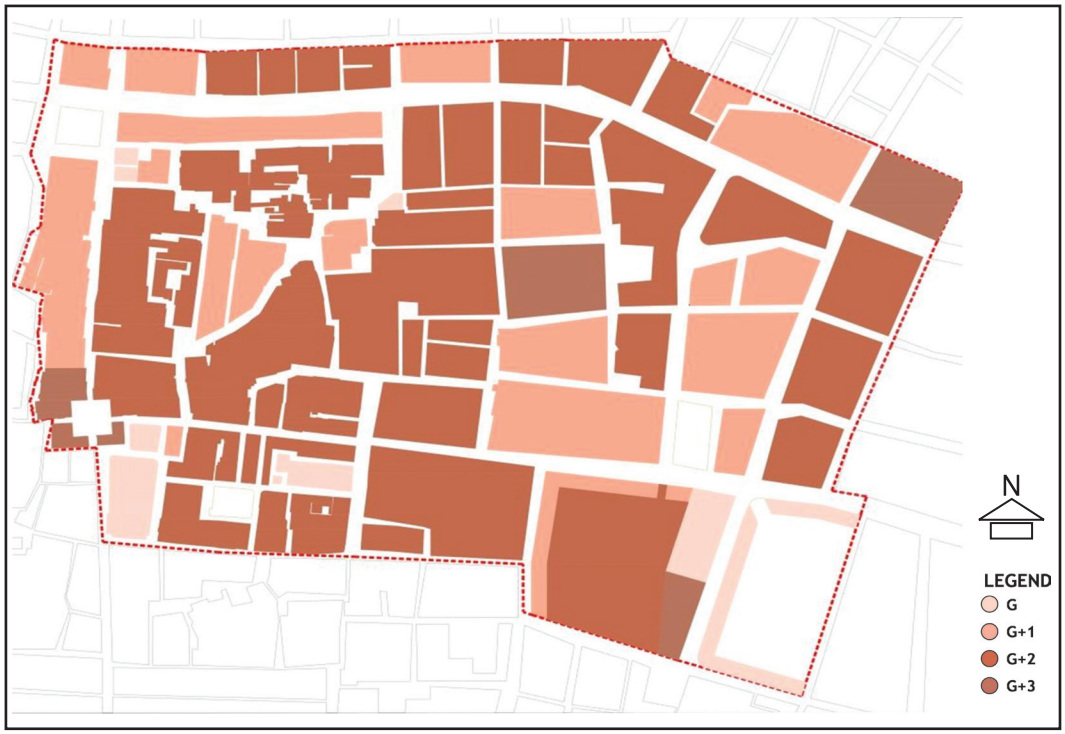


Fig. 6: Existing Road Network of LAP

Fig. 7: Building Height Map of LAP



2.3 Kirti Mandir Block

The Kirti Mandir Block is situated on the Western end of the LAP boundary as shown in Fig. 8. The Kirti Mandir block has an area of 2.12 hectare. The block has two important structures – Kirti Mandir and Kasturba Memorial. The area also features an urban square, two open plots and a police station.

Land use distribution shows a maximum of 33 per cent for residential and 34.30 per cent of roads. Despite of having such a large chunk of land under roads, the area suffers congestion and recessed plot entries due to the irregular street widths,

Fig. 8: Kirti Mandir Block Location W.R.T. LAP

Fig. 9: Existing Land Use Plan of Kirti Mandir

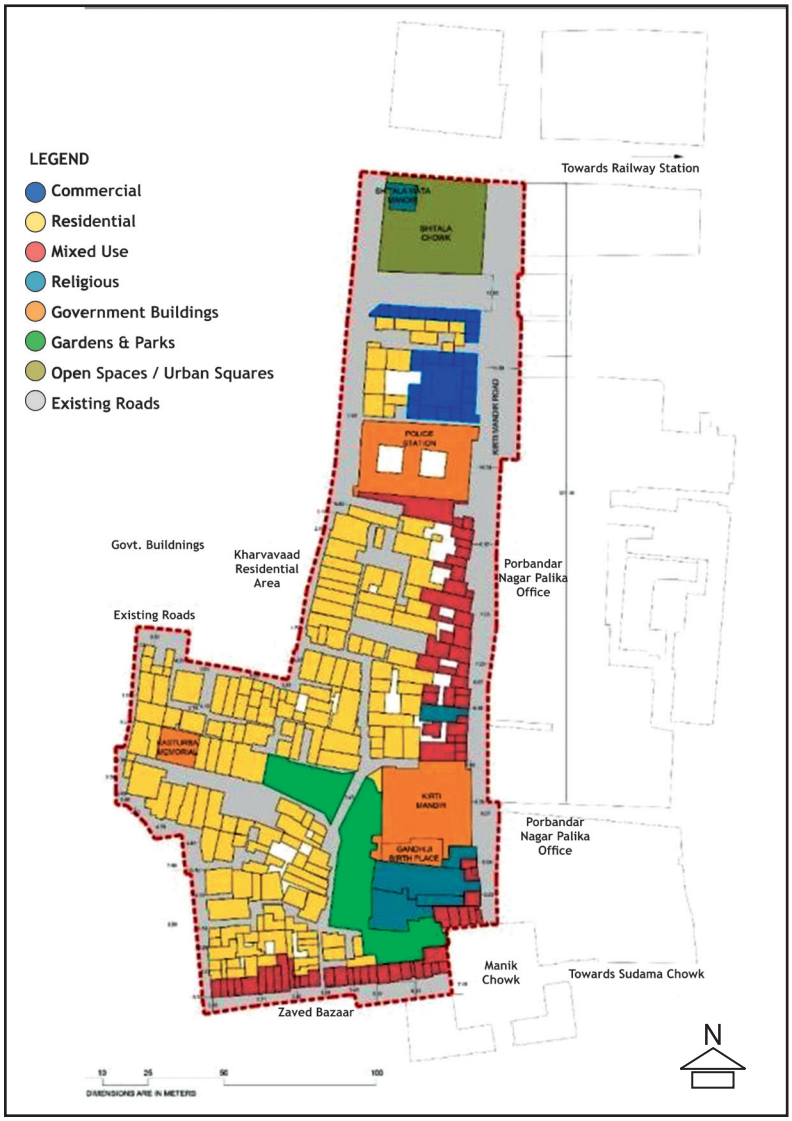


Table 2: Existing Built-up Area of the block

Structure	Built-Up Area (Sq.m.)
G	217
G+1	3135 X 2 = 6270
G+2	4382 X 3 = 13146
G+3	260 X 4 = 1040
Total built-up area	20673

regularization of Otlas and ineffective implementation of build to line during construction process. The existing street widths range from 14 m wide on Kirti Mandir to 1.53 m in the inner residential roads. The back road connecting Kasturba Memorial to the Shitala Chowk has an avg. street width of 1.8 m only.

Despite of having such a historical significance and heritage value for the city, the urban local body has failed to provide the visitors with basic amenities like parking, way finding signboards, drinking water and public transportation connectivity. The housing scenario is also very poor due to overcrowding and poor ventilation. The core reason for this lies in the plot size of the residences as they are as low as 15 sq m in few cases. The building height scenario is as per Table 2:

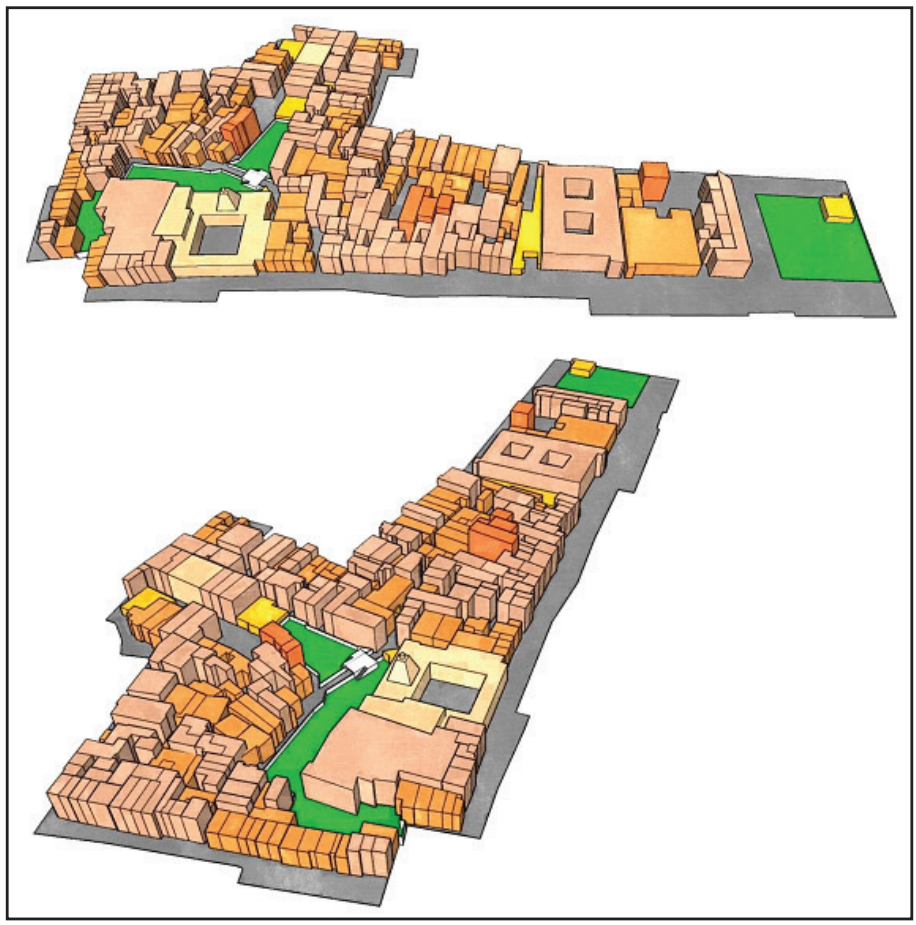
3. PROPOSALS FOR LOCAL AREA PLAN

3.1 Accessibility Improvement

The aim of this LAP was to improve accessibility to all the plots with special reference to the protected monuments. The proposal begins with road widening of some roads within the boundary. The most significant one being the widening of Kirti Mandir Road and 9m wide road at the back. Remaining all roads is widened to at least 6 m.

3.2 Amalgamation and Re-Constitution of Plots

Fig. 10: Birdseye Views of Kirti Mandir Area



The existing plot sizes are too small to be developed according to comprehensive GDCR. Hence, the amalgamation and re-constitution of the plot boundaries seems to be as a feasible option for redevelopment strategy. These new plots will inhabit the plot owners and tenants already residing in this area. In majority of cases, the location of the new plots is same as that of the old one. The new plot sizes ranges from 552 sq m to 2,339 sq m, which are developable plot sizes. In this exercise, the adjoining buildings of Kirti Mandir and Kasturba Memorial are kept intact to avoid any damage to the monument.

3.3 Proposed Built Form

The proposed built form consist of a low-rise structures (upto 18 m height) with commercial on ground floor and upper floors will be residential in nature. The internal layout of the buildings will be finalized through public participation in each plot. Also, for developing a new urban fabric of the CBD area, the G+1 façade would be similar for all the buildings.

3.4 Advantages of Redevelopment Model

- Redevelopment under LAP provides with the additional FSI of 3 in contrast to FSI 2 of Comprehensive GDCR.
- Area falling under LAP has maximum FSI of 3 and hence no regulation for height restrictions.

Fig. 11: Proposed Roads and Re-constituted Plot Boundaries

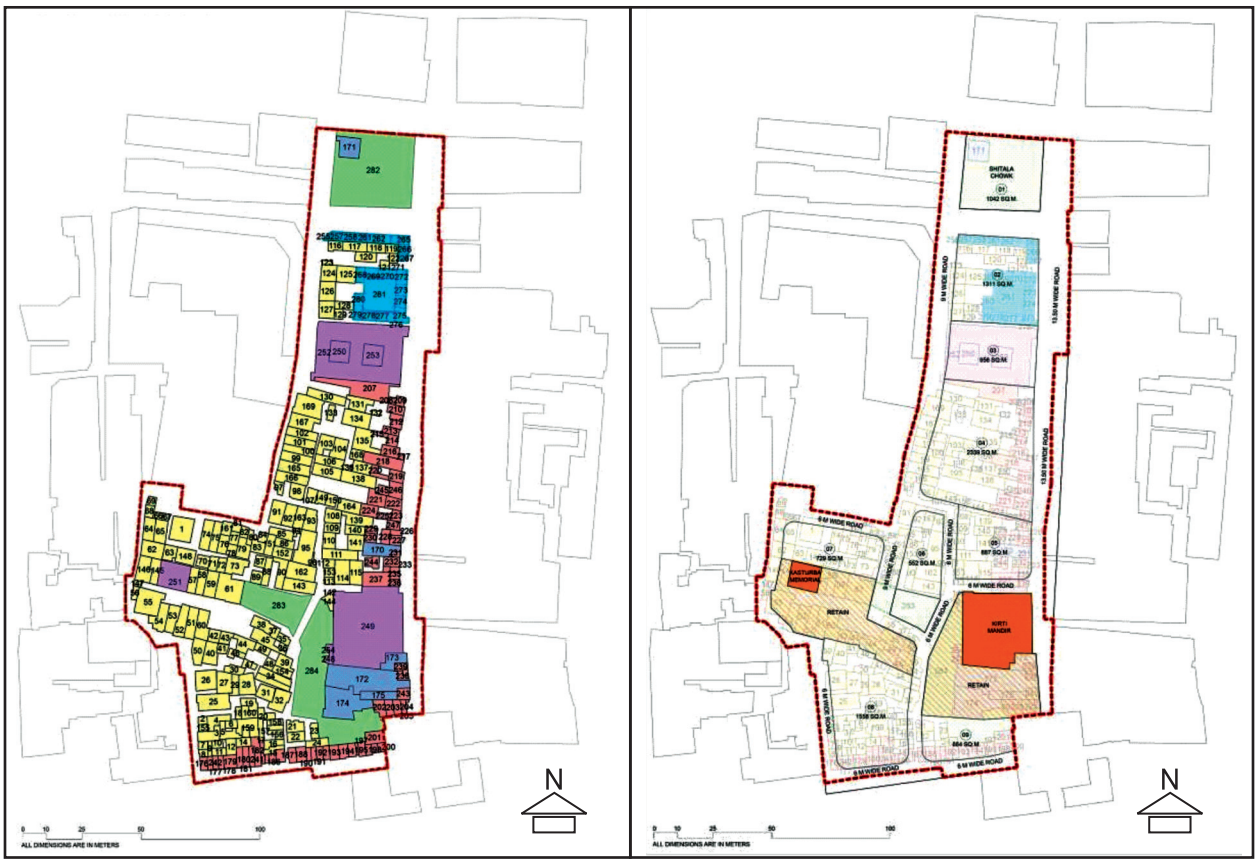


Table 3: FSI and Plot Area Analysis for Kirti Mandir Block

Parameter	Existing	Proposed
FSI (Plot)	2	3
FSI (Gross)	0.97	1.44
Total Plot Area (sq.m.)	12982	12706
Total Built Floor Space (sq.m.)	20673	30659
Streets	34.30 %	35.59 %

- The residents now have multiple options for redevelopment and increased floor space. The issue of overcrowding within the household can now be solved.
- The fire fighting vehicle and ambulance can now reach to every building.
- The redevelopment policy ensures enough parking facilities for all residents in form of underground or surface parking.

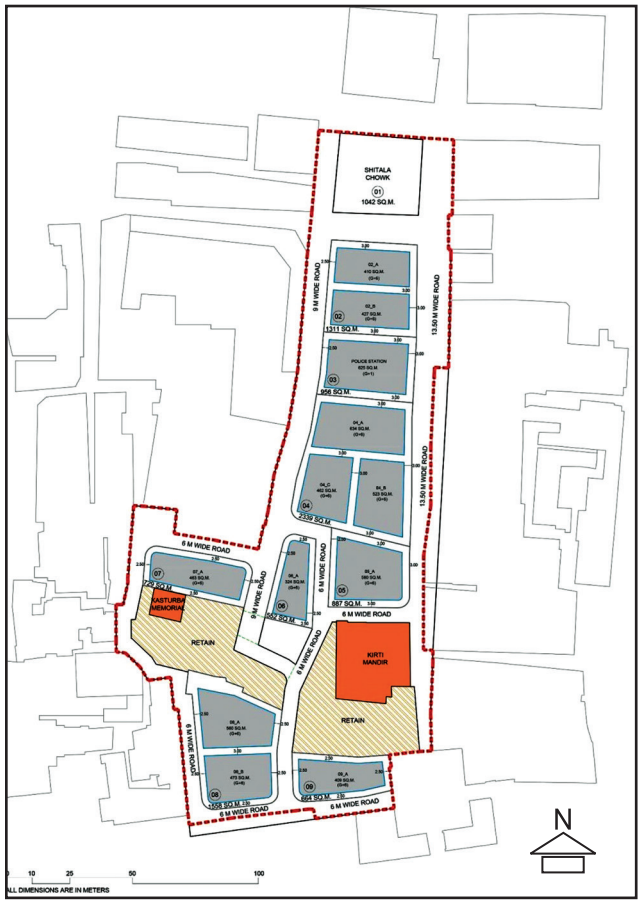
3.5 Proposed Road Layout; Following Hierarchy

The proposed road layout is set to form a hierarchy from arterial roads to collector streets and finally local streets. There are a total of 4 types of streets proposed in the LAP region – three of them are vehicular streets with 15 m, 12 m and 9 m ROW respectively and a 9 m wide pedestrian street. The details of proposed ROW

are as follows:

- Street patterns are such that, it forms overall blocks of perimeter ranging from 250 m to 500 m, which would increase the walkability of the area. The block sizes have either been increased or kept constant from the existing scenario;
- For pedestrians, all the new roads will have footpaths. A few purely pedestrian streets featuring linear parks are also proposed and also accommodates regularized hawker's zone; and
- All the front margins in the new LAP would be declared as public domain; hence the footpaths are designed in that stretch to maximize pedestrian-shop front interaction.

Fig. 12: Proposed Building Footprints for Kirti Mandir Block



3.6 Amalgamation and Reconstitution of Plots: Developable Sizes

The similar system of amalgamation and re-constitution of plots will be followed as in the case of Kirti Mandir Block. The block sizes vary from 250 m to 500 m in perimeter. The plot sizes have increased significantly, ranging from 700 sq m to 3,500 sq m. These increased plot sizes are enough to be able to get developed according to comprehensive GDCR. In comparison to old scenario which had total

Fig. 13: Proposed Birdseye view of Kirti Mandir Block

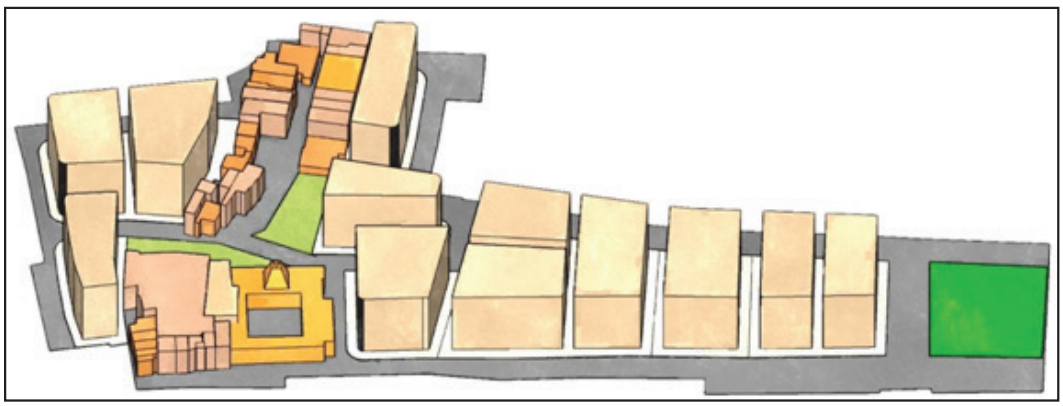


Table 5: Proposed Roads Detail

ROW (m)	Length (m)	Area (sq m)	% Length	% Area
15m (vehicular)	1373	20595	22.71	30.15
12m (vehicular)	1528	18336	25.28	26.84
13.5m (vehicular)	240	3240	3.97	4.74
9m (vehicular)	2156	19404	35.67	28.41
9m (pedestrian)	748	6736	12.37	9.86
Total	6045	68311	100.00	100.00

plotted area of 20.30 ha; the proposal features the plotted area of 21 hectare.

3.7 Building Setbacks

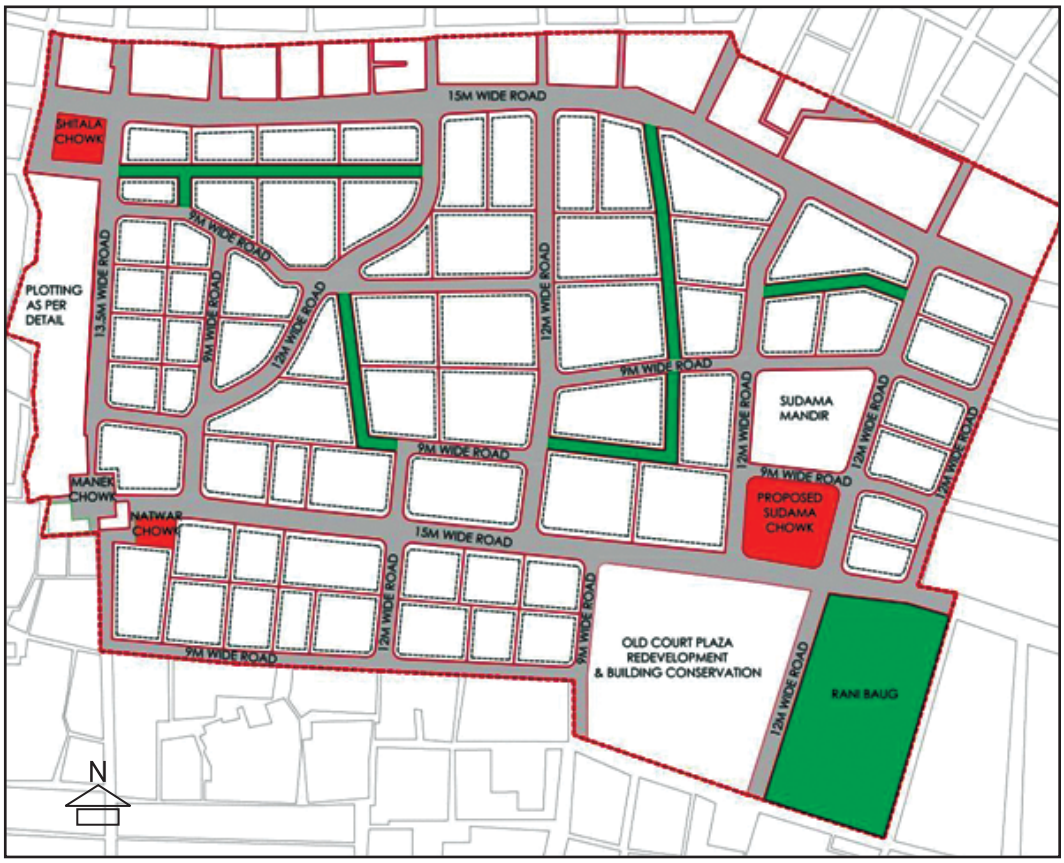
In this LAP, the two setbacks i.e. road side margin and side margin have been assigned a specific function to follow. In respect to this idea, the concept of compound wall has been totally eliminated which leaves us with open boundaries to interact directly to the built form. There are basically three setbacks that are followed in this LAP. They have direct co-relation with the abutting road width and the building height.

3.8 Density Utilization Maps

This map deals with the FSI (free + chargeable) assigned to every plot based on the abutting road widths. The CBD area of Porbandar consists of old dilapidated buildings. Thus, this is one of the prime areas where redevelopment potential is there. The maximum assigned FSI is 4 to the plots abutting 15 m wide road and rest are awarded FSI of 3. Also according to the clause 15.1 of comprehensive GDCR, there are no height restrictions other than through airport authority within the LAP. This would potentially

Fig. 14: Proposed Road Layout

Fig. 15: Setbacks for the Proposed LAP



imply that full FSI could be consumed with careful planning. Also, the base FSI of 2 will be free and the remaining FSI would be chargeable.

The Table 5 suggests that 6.13 lakh sq m of built-up area will be available after complete implementation of the LAP compared to existing 4.15 lakh sq m.

3.8 Building Massing and Façade Guidelines

In recent years, the heritage fabric of the city is being completely neglected. There are new buildings popping up in the CBD area without paying due respect to the surrounding environment in terms of vernacular architecture, built form, materials used, etc. The new building facades have failed to maintain the harmony in the CBD area. This sets the need of unified façade pattern and building material and thus demand for the policy on the same.

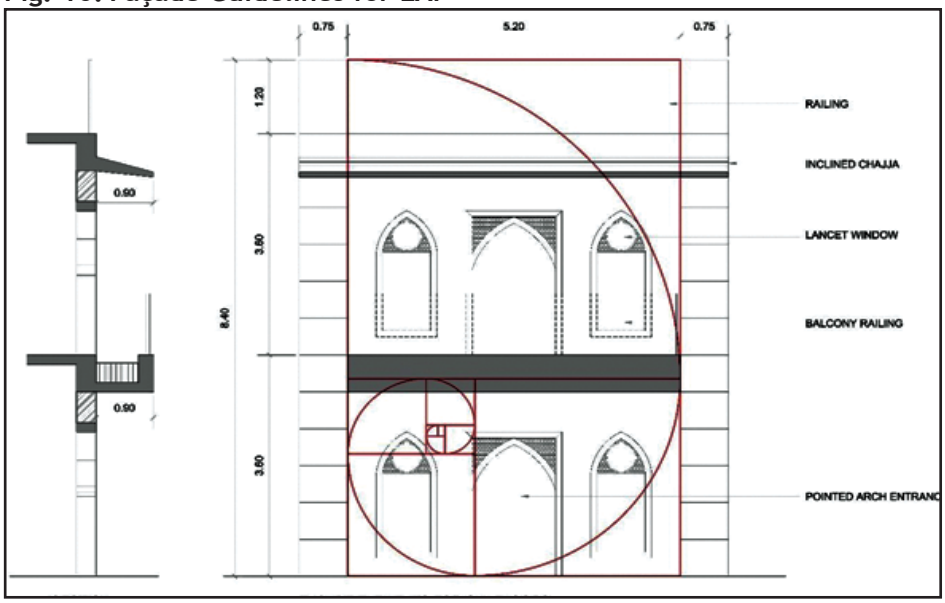
Thus, new façade guidelines are introduced to maintain the uniformity throughout the

Table 5: Calculations for Proposed Built-Up Area in LAP

FSI	Plot Area (sq.m.)	Built-up (sq.m.)
3	129713	389139
4	56060	224240
		6,13,379

Fig. 16: Density Utilization Map of LAP

Fig. 16: Façade Guidelines for LAP



CBD. The façade guidelines include the treatment of G+1 floors of every building. This only includes façade facing roadside only. The elements are taken from the existing built heritage throughout the city. The elements include railing, inclined *chajja*, lancet window, balcony and pointed arch entrances to the shops. The façade is modular in nature with size in golden ratio of 1.618.

4. CONCLUSIONS

Local Area Planning is a third tier of planning in India involving micro level planning to each plot. This new paradigm of planning deals with local issues, which could not be solved through Development Plans. LAPs can be implemented at any place like dilapidated urban areas, core walled city, urban villages, fast growing urban canters, etc. The LAP – 'Heritage Square' is the CBD area of the Porbandar city with an area of 28.14 ha. Proposals for LAP attempted to solve the various issues taking in account the analysis of questionnaire survey are:

- The issue of land lock plots and recessed plot entries was solved by proposing a new road layout juxtaposed on the existing street patterns. The procedure involves road widening at some places;
- The existing plot sizes were too small for regularized re-development, so amalgamation and re-constitution of plot boundaries were adopted to create large developable plot sizes. This leads to decrease in overall plotted allotment for development from 19.58 ha to 18.19 hectare;
- The proposals of new road sections were floated featuring the on-street parking;
- The FSI of 3 and 4 were provided for all the proposed plots (with size larger than 500 sq m) based on the adjoining road width;
- Built form of the buildings would feature a similar façade for G+ 1 floor based on the façade guidelines;
- High-rise mixed use built form with commercial on ground floor and their own residences on upper floors are adopted;
- Road-side margin of all the plots will be considered as public domain and developed as walkways. The buildings will not have a compound wall on the road side margin; and
- LAP also provides with opportunity to undertake urban design projects like Urban Squares, Parks and Heritage building conservation and Plaza redevelopment.

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Rejuvenation of Urban Vacant Spaces in Perspective of Smart City

Mohammad Laraib Ahmad, Muhammasd Shahrukh and Pradeep Singh

Vacant land or dead spaces in a city can be used as green gardens, and parks. Vertical farming concept can be implemented in smart city. This will improve air quality and will help to make such places socially interactive and functional that can act as recreational spaces. Urban areas are densely populated and have much hardscape. Density in urban areas is increasing vertically due to lack of urbanizable land which results in lack of green spaces in urban areas. Need of the hour is to find out such issues and have better solution by introducing green strategies which make urban environment clean and healthy. Aim of the paper is to find out the role of urban green space in Smart City perspective, its impact on urban climate and importance of recreational areas.

1. INTRODUCTION

Smart City guidelines have proposals for preserving and developing open spaces in order to enhance quality of citizens life, reduce urban heat island effect and promote eco balance (Development, 2015). Idea of smart city came into formulation owing to the need to accommodate rapid urbanization of the age. Interest in smart cities continues to grow, driven by a range of socio-economic and technological developments across the globe. Need of the hour was so, as it came into existence people started focusing on structures, jobs, employment, more masses started settling down in urban areas and people ignored importance of urban climate and heat island effect, which now has become one of the most important concern of Smart City strategy (Nasrin Khansari, 2013). There are spaces like institutional buildings which have a lot of softscape in the form of playground or other open green spaces. Those areas are not in use after scheduled timing of institution and can be functioned as some recreational activities on those places which can be utilized for recreation purpose. (Anon., 2012)

This is paper attempts to understand the role of urban green open spaces in Smart City perspective, and to study urban green strategies and techniques, to reduce urban heat island effect; besides to appraise need of green open space in smart city perspective; and to analyze importance of vacant land and heritage sites for recreational purpose.

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2. REGULATORY FRAMEWORK

In 5 year Development Plan of a city the 'Urban and Regional Development Plans Formulation and Implementation URDPFI guidelines' classifies Open Space Zone named as ‘O Zone’ for the development of open green areas in urban region which is sub - divided into: (i) area 0-1 (Recreation); (ii) area 0-2 (Peri Urban Area); and (iii) eco Sensitive Zones (E Zone).

It is also for the development of water body, recreational zones, biodiversity park, reserve forests, etc. There is formulation in URDPFI guidelines (2014) for open green spaces in land use planning that about 25-35 % of total area should be in use for recreational open spaces within the city (Development, 2014). Urban growth has increased number of vehicles on roads and even on streets which results into increase in traffic congestion and give rise to noise pollution. Noise is considered to be one of the most disturbing thing which disturbs human health physically as well as psychologically. Urban green open spaces can reduce its impact on users in cities on daily basis and can create a better living environment.

Noise in urban areas is slowly and gradually increasing day by day and the reason are increase of population and mobility, increase in vehicle on roads creates a lot of hindrance and disturbs human life psychologically and also physically (Patrik Grahna, 2009). There are lot of sites available within the cities which are dead spaces or are not in use, such spaces can be proposed to be treated as retrofitting of vacant land can be done to improve air quality and overcome such issues of noise, health, etc. (E.A. Richardson, 2012)

2.1 Use of Open Space as Recreation

Recreation is an important aspect of city life, contributing towards health of citizens and vitality of the city. Recreation is a service that city provides through parks, playgrounds, botanical garden, resorts, gaming club, etc. Need for recreational spaces depends on local climatic and cultural condition (S.E. Gill, n.d.). Recreation nowadays has become a concern for society. Recreation has got special proposals and concern from government in smart city guidelines so it is need of hour to introduce some green strategies to improve vacant land and heritage sites in cities to make place active for recreation. (Anon., 2012)

2.2 Peri Urban Areas

Peri urban are the areas which resides at the ridge of developed urban areas or at boundaries of developing cities. Use of vacant land using techniques and strategies, innovative planning, provision of affordable housing on such land as the shortage of homes for poor in cities is one of the threatening concern. Area of land which have been previously used for industrial purpose, therefore

retrofitting of such spaces in the inner core of city is brown field development which has its basic function to beautify spaces and improve condition of existing structures or spaces. Existing structures may be in use, so wastage of land on urban level is secured and can be utilized for any other uses. On the other hand Greenfield development provides design flexibility, it is designed to meet future needs it does not consume Greenfield spaces within the urban areas. Vacant sites are valuable but destroys beautification of city, so urban greenfield development helps in promoting urban regeneration of unused vacant land which is a suitable approach towards sustainability on urban level. (Department, n.d.)

Due to scarcity of open space in urban cities, greenbelts are provided on the ridges of cities to promote urban health and maintain air quality and balance urban heat island effect. High building density results in vertical expansions, increase in urban greenfield sites become vulnerable.

2.3 Impact of Eco Park in Neighborhood of Urban Areas

Biodiversity Park has become a home for biologically rich wetlands, grassland communities, and a wide variety of species and an abundance of medicinal herbs. Such parks comprises of native flora and fauna which helps in maintaining meso climate of city. Such parks have been spread over a large chunk of city which helps in balancing urban heat island effect (Department of Leisure, 2002). Biodiversity parks such as Aravalli and Yamuna Biodiversity Park on the ridge of cities like Delhi are strength to the cities in terms of meso and micro climate. Parks consist diverse varieties of plants, trees, shrubs, vegetation, animals, birds and provide large chunk of green open spaces which act as green lungs and helps in maintaining balance between city and its surroundings. The Yamuna Biodiversity Park is covered over an area of 457 acres of land of which 150 acres has already been developed (Agarwal, 2015). Water body within park helps in maintaining temperature but in some regions it becomes the major reason for humidity.

Ecological Restoration is necessary to check, if it is generating ecological sources and goods such as moisture in soil and atmosphere, increase in humidity and rainfall and reduction in dust pollution. Conservation of flora and fauna plays crucial role in deciding urban climate of city. Healthy and urban green space such as wetlands, urban forests and biodiversity parks can be critical to solve water stress, air pollution, heat island and natural disaster mitigation. Green open space and urban biodiversity are vice versa and creates recreation in city. Urban areas have microclimates that always vary from its surrounding climate. An urban city always have more heat island effect as comparison to rural areas. Energy expenditure, air pollution

emission, concrete massing in city, less open green spaces, results in urban health issues.

Strategies to overcome such issues can be solved by vegetative green spaces compelled with high reflective material in place of conventional paved surface have proven to be effective method. Green roofing is also one of the effecting method used in this field and use of light colors on roof top will help in reducing urban heat from the surface. The future is for the high rise structures, so it increases the demand of vertical gardening and vertical farming which can be very beneficial method to improve urban air quality and climate.

3. RETROFITTING OF VACANT LAND

Role of land use planning plays a vital role in urban planning. Vacant land is threat area to urban cities. Land use planning should focus on proper aspects keeping in mind use of vacant land and their utilization of spaces. Spaces which are not in general use such as near railway lines and bridges or roadside property are not for any use, so retrofitting of such areas as green spaces or vegetation or making such place interactive for recreation activities which will create social gathering and improves urban health and maintain heat island effect.

3.1 Role of Greenfield and Brown Field Development in Urban Areas

Use of vacant land using techniques and strategies, innovative planning, provision of affordable housing on such land as the shortage of homes for poor in cities is one of the threatening concern. Greenfield design provides flexibility in order to meet future needs. It doesn't consume Greenfield spaces and performed in vacant land. Vacant sites are ugly but are valuable if restored properly and can generate good recreation facilities and enhance air quality of urban areas. (Giannakodakis, 2013)

It also promotes urban regeneration, make place active and centre for tourist attraction which helps in maintaining urban wealth and economy or revenue generation process. It is a sustainable approach towards a growing smart city which should be sustainably balanced and it is cheaper to develop such vacant land, no need of much maintenance is required as only covering hard surface by green soft covers and planting some native trees and vegetation will do a lot of work as, it will reduce urban heat island effect on both micro and macro level (Rajabi, 2014), it will help in reducing thermal heat from surface and environmental cycle will maintain air quality in region. Softscape cover will reduce impact of noise also, as trees and green covers on roadsides and on vacant sites will act as a barrier to noise which will contradict it.

The main smart city experience are to achieve energy efficiency and sustainable mobility. While developing countries like India is facing problems like over congestion, traffic problems and health issues. In these kind of places Brown field development can be very beneficial as it is a process of redevelopment, regeneration and retrofitting of spaces in urban areas, where other external interventions cannot be implemented to enhance quality of life. This process helps in maintaining quality life of city by not wasting any new site and develop old vacant, unused land to promote beauty of urban areas.

3.2 Greenbelt

Greenbelts define edges of urban areas. It is a solution to problems like congestion, overcrowding and scarcity of land is one the major issue. Due to increase in vertical expansions of structures, urban Green fields sites have become vulnerable. Greenbelts are created on the ridge of cities to promote urban green environment and maintain balance between cities temperature and surrounding that help in maintaining urban heat island effect, which makes greenbelt area mush cooler than core city temperature. (Miskell, 2011)

4. ROLE OF URBAN FORESTRY, IT'S IMPACT ON NOISE AND DUST POLLUTION

Urban trees plays vital role is deciding local air pollution. A 30 inch dia tree removes about 70 times more air pollution in a year than a 3 inch dia tree. Shaded tree can reduce smog level by 5% that is by process of evaporating, cooling, shading city environment (Akbari et al, 2001)

Air floating above, not through vegetation barrier is not filtered. Differently designed vegetation catch different particle size. Vegetation should be close to the source. Air pollution is presence of high concentration of contamination, dust smoke, etc. Ozone gas cause major air pollution in city and inhaling such hazardous gases can cause severe health issues which is a concern for urban health. Dust generation from such activities reduce visibility and breathing issue. (Chaudhary, 2015)

4.1 Sound and Air Quality Impact

The decadal growth of the urban population in India rose to 31.8% during the last decade (2001-2011). Noise is regarded as a pollutant under the air (Prevention and Control of Pollution) Act, 1981. Noise is one of the major issue for urban areas as the population increase number of vehicles on road also increases which creates noise pollution. It is because urban cities do not have much greenery or plants and trees in the surrounding, which does not allow noise to trap into it, hence city is full of noise on roads and even on streets.

Table 1: Estimated Size of Urban Green Space

S.No	Country/Region	Estimated size of urban green space
1	Australia	Average green space is about 24 million meter square i.e. 80 m^2 per capita.
2	USA	Average green space is about 27% i.e. 32 m^2 per capita.
3	Netherland	Average green space is about 19% of 22 largest Dutch cities i.e. 228 m^2 per capita.
4	India (Delhi)	Average tree and forest cover is about 20% of geographical area and about 21 m^2 per inhabitant (FSI 2009,Census 2011)
5	India(Chandigarh)	Average tree and forest cover is about 35.7% of geographical area and about 55 m^2 per inhabitant (Action Plan 2010,Census 2001)

Source: (Anon., 2009) (Anon., 2010)

Noise can cause anxiety, tension, or even illness, and exposure to high levels of noise can cause hearing loss. Noise is regarded as a form of environmental pollution, and is sometimes considered an international health concern. Green space has the ability to mitigate noise in urban areas. Planting noise buffer composed of trees and shrubs can reduce noise by five to ten decibels for every 30 m width of woodland and this reduces noise to the human ear by approximately 50%. Providing greenbelts at the edges of cities helps in acting as a barrier for sound restriction and reducing noise level. This will also help in maintaining urban health factor, maintain air quality and urban climate. (E.A. Richardson, 2012)

The four variables for green space in urban context are quantity (% of filled green spaces in urban areas); quality (to improve urban biodiversity and provide better ecosystem and environment); connectivity (Inter connection and relation between green spaces in urban areas); and accessibility (% of population with green accessibility). It is recommend to have at least a 33% green cover for urban areas as per global standards. As per the best practices over the world, green area per capita for inhabitant should be more than 20 m^2 which gives a figure of around 1.25 ha of land for open space per 1,000 residents. Green spaces should be easily accessible and their approach should be within 250 m of residential areas. Almost all local and native plants should be used for landscaping purposes, as this helps in reducing water usage and maintenance while improving biodiversity on urban level. The Table 1 shows the comparison of different countries of the world as per their availability of open green space available per capita in a region.

4.1 Indian Scenario

Rapidly growing urbanization are resulting in decrease of open spaces mainly in urban areas. There are few cities in India which are exceptionally in good condition. Cities like Chandigarh and Gandhinagar which were developed and planned after the Independence period, where urban greenery was pre-integrated in the Master Plan of city at initial phase of design and planning of city. Chandigarh has 55 m^2 of land per capita for open green space and on the

other hand Gandhinagar has 160 m^2 per capita for open green space within city which is more than traditional green city Bangalore which is famous for it is park and garden. (Pradeep Chaudhry, 2011)

A study by IIS (Indian Institute of Science), Bangalore noted that Bangalore city has lost a lot of it's open spaces and urban wetlands over 35% decline in number of water bodies from 1973 to 1996 due to urban sprawl in the region, which has affected physical infrastructure of city which includes drainage, water table and geographical issues. It has been calculated that Mumbai has only 1.1 m^2 of open space per person in the form of gardens, parks, recreation grounds and playgrounds. The city has 2.5 sq km area for gardens and parks, 4 sq km area for playgrounds and 7.7 sq km area for recreation ground. The total adds up to only 14 sq km area of land for open spaces for the population of 12.4 million people; or 1.1 sq km per person (City, 2012), which helps to analyze the statistics that Mumbai has a poor ratio of urban open green spaces which is approximately 0.03 acre of open space per 1,000 people.

4.2 Best Practice

There are two best practices of the world discussed on the basis of strategies, they used to make use of vacant land and make place interactive for recreational purpose, which helps in maintaining urban health and climate in the region. (Walker, 2004)

Table 2: Way Ahead

S.No.	Parameter	Case Study (Kapurthala)	Way Ahead
1	Urban green space	Kapurthala city in Punjab have very less amount of open recreational green spaces due to lack of land and improper attention towards maintenance of open spaces.	Redevelopment of heritage sites and restoration of vacant land by implementing greenfield and brown field techniques.
2	Recreational Areas	Kapurthala, a princely state having historical buildings, but still not in use for any recreational purpose.	Recreational activities are the need to provide and design spaces according to requirement of user.
3	Noise And Air Quality	Densely populated city have noise and dirty air issues.	Organizing open green spaces and plantation of native trees will help in improving such issues
4	Greenfield And Brown field Development	Kapurthala have very less open green space within city and no proper attention towards historical buildings.	Providing brown field development near historical sites, such as in Amritsar will create a better environment.
5	Greenbelt	City does not have greenbelt, as it lies in the outer boundary of Jalandhar	Greenfield development can be done inside the city on vacant sites near historical sites.

Source: (Author, 2017)

The Table 2 shows the parameter adopted for Kapurthala Region of Punjab state, and also suggest way forward for particular problems.

4.2.1 Beardmore Park (Scotland): It is one of the best example for transformation of derelict, vacant, unused land into a vibrant, multi-functional play and open space area. The land which was abandoned and had no connection with local users are now being used as one of the most happening place of city. The park now contains play area for all groups, event occurring spaces, garden and spaces for rest and relaxation. The local community is playing vital role in changing the layout within the park. Park has toddlers play area also to protect planted trees and use of native plants for landscaping. It stands as one of the best example for use of vacant land as a space which can be utilized for recreational purpose also with green and healthy environment, which improve urban climate and involves community gathering.

5.2.2 The Helix, Falkirk: The helix is an eco-park on the ridge of Falkirk urban area and western boundary of Grange Mouth. It was a huge vacant patch of land of 300 hectares on the boundary of city which later have been developed to be an interactive place. The area includes community, woodland, grazing land, wetlands and canal. The park connects these open spaces and creates a green junction at the centre of a new metropolitan area. The purpose of the project was to reconnect people from different communities at a common place, creating a destination for visitors and tourists, celebrating the culture of region and exhibit world class art.

6. CONCLUSIONS

To maintain urban climate and to promote urban health socio impact in cities, it is necessary to maintain eco balance between cities and their surrounding climate that can be done by taking steps towards retrofitting of urban greenery and restoration of vacant land, heritage sites which can create social gathering and improve air quality, control noise pollution by plantation of trees and providing green cover over the city. Urban heat island effect is one of the most concerning issue in urban cities and that can be resolved only if we pay proper attention towards maintaining balance in nature, as outer ridge of cities always have less heat emission from surface because of less massing and more greenery in comparison to inner core of cities, so planting more trees, restoring vacant land, retrofitting green spaces, provide vertical greenery in high rise structures and providing greenbelts on outer boundaries of cities help in resolving such problems.

Macro climate is always dependent on micro climate, hence implementation of such strategies on micro level and focusing on these issues by finding it's green

solution will have impact on macro climate of city. Urban health is one of the most beneficial thing which can be improved: by addressing such urban issues and making urban environment healthy.

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CO2 Emissions from Uban Transport: Challenges and Opportunities for Non-Motorized Transport in Indian Cities

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Abstract

The paper discusses CO2 emissions by transport sector in selected Indian cities, retrofitting challenges and opportunities for Non-motorized transport (NMT), and attempts to examine the modal share of NMT within the existing travel modes; to estimate the CO2 emissions along with its growth rate; besides traffic index is also analyzed. Regression analysis shows that shorter the trip, greater the share of NMT. In nutshell, the study has analyzed the total vehicle registered, total registered passenger cars, vehicle kilometers travelled (VKT), estimation of fuel consumption and CO2 emissions of passenger cars. In persistence, the study highlights the retrofitting issues, options and policy initiatives for NMT and concludes that, reduction of CO2 emissions is achieved by encouraging public transport and using NMT especially down town areas in the Indian cities.

1. INTRODUCTION

Urbanization is a major change taking place globally. According to United Nation Report (UNDP, 2006), 30 per cent of the world's population lived in cities in 1950 which increased to 47 per cent in 2000. The urban global tipping point was reached in 2007 when for the first time in history over half of the world's population i.e. 3.3 billion people were living in urban areas. United Nation (UN) forecasts show that by 2050, more than 70 per cent of the world's population will be living in cities (UNPD, 2006). Presently, one out of two humans already lives in an urban environment. Census of India (2011) data reveals that 377 million Indians live in urban area, which constitutes about 31.16 per cent of the total population in India. The number is further expected to rise to about 600 million by 2030 (HPEC Report, 2011).

The World Bank study shows that about 75 per cent of global economic production takes place in cities; the share of developing countries is rapidly increasing. But, unfortunately, the 20 largest cities consume 80 per cent of the world's energy and urban areas generate 80 per cent of greenhouse gas emissions worldwide *(*IFS, 2010*)*. According to Rode et al. (2014), urban transport is currently the largest single source of global transport-related carbon emissions and the largest local source of urban air pollution. Recent studies reveal that emissions are growing more rapidly in the transport sector than in any other sector and are projected

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to increase by 50 per cent by 2035 and almost double by 2050 under a business-as-usual scenario (Dulac, 2013; IPCC, 2014b).

In India, the number of registered vehicles in five metropolitan cities, namely, Delhi, Bengaluru, Chennai, Hyderabad and Pune accounted for 49.3 per cent of the total registered vehicles among the 35 million plus cities (MoRTH, 2013). The average trip length in medium and small size cities is less than 5 km, which makes NMT an attractive option for commuting. In bigger cities like Mumbai and Hyderabad 80 per cent of the trips are less than 10 km in length and 70 per cent of the trips are less than 5 km. In cities like Pune 97 per cent of the trips is less than 10 km and 80 per cent of the trips are shorter than 5 km (Tiwari, 2011). Shorter trip lengths which are primarily responsible for higher private vehicle ridership; especially the two wheelers and passenger cars are consequently contributing higher to CO_2 emissions.

2. CARBON-DIOXIDE (CO_2) EMISSIONS SCENARIO

Vehicle plays a vital role in our economic and social prosperity. Road Transport is the largest CO_2 emitter in transportation sector. In 2014, total global CO_2 emissions were 38 Gigatonnes, of which 8.8 Gigatonnes of total transport emissions, 74 per cent (6.5Gt) were from road transport (GFEI, 2016). Among the GHG emissions, CO_2 is the single most important anthropogenic greenhouse gas which contributes about 65 per cent of total GHG emissions (WMO, 2014). The study conducted by Ramachandra et al. in 2015 reveals that, the highest CO_2 emissions is in Hyderabad about 56 per cent, followed by Bengaluru (43 per cent), Delhi (32 per cent), Ahmadabad (25 per cent), Chennai (19 per cent), and Greater Mumbai (17 per cent) respectively. Air pollution has emerged as one of the most serious threats to public health in urban India. India is one of the countries with highest population exposure to PM 2.5, and consequently health risks from PM 2.5 to the people in India are among the highest in the World (WHO, 2014). Fine PM (particles smaller than 2.5 micrometers, known as PM 2.5) can lodge deeply in the lungs and is hazardous to humans and to the environment. Numerous studies have linked PM 2.5 to serious health problems including irregular heartbeat, asthma, heart attack, and premature death, etc. (USAID, 2016).

3. NON-MOTORIZED TRANSPORT (NMT)

Non-Motorized Transport is a sustainable mode of transport (Massink et al., 2011), further defined as walking, cycling, cycle rickshaws, pushcarts, and other forms of mobility that are powered by humans *(*NMTP, Corporation of Chennai, 2014). This is primarily due to the reduced external costs and higher value of benefits (Litman, 2007; Sinnett et al., 2011). The Jan Gehl, an architect who

successfully promoted cycling in Copenhagen, in his book *'Cities for People'* has quoted that 'the city is for the people and not for cars'. NMT vehicles are green modes of transport as their carbon footprint is low, energy consumption is minimal and their emission is zero. In addition they are not dependent on fossil fuels.

National Urban Transport Policy of India, 2006 clearly lists out the role of NMT as a last mile connector for the urban transport systems and as an independent mode for short distances (NUTP, 2006). Non-motorized transport is made up of about of 37 per cent of urban trips worldwide in 2005 (Habitat III, 2015). The share of NMT (walking and cycling combine) in Indian cities in the early 1980's was in the range of 40-60 per cent of the total trips and a recent study pointed out its decline. Bicycle ownership in urban area was 46.00 per cent in 2001; it has declined to 41.90 per cent in 2011 (Census of India, 2001 and 2011). Pedestrians are particularly vulnerable and account for about 35-50 percent of road traffic fatalities in most Indian cities (NTDPC, 2015). Non-motorized transport makes a substantial contribution to reducing air pollution and significant benefits for low income groups, the sick, the elderly, women and children (John Whitelegg and Williams, 2000). This is particularly important in the developing world where so many people live in below poverty.

4. MODAL SHARE OF NMT IN SELECTED INDIAN CITIES

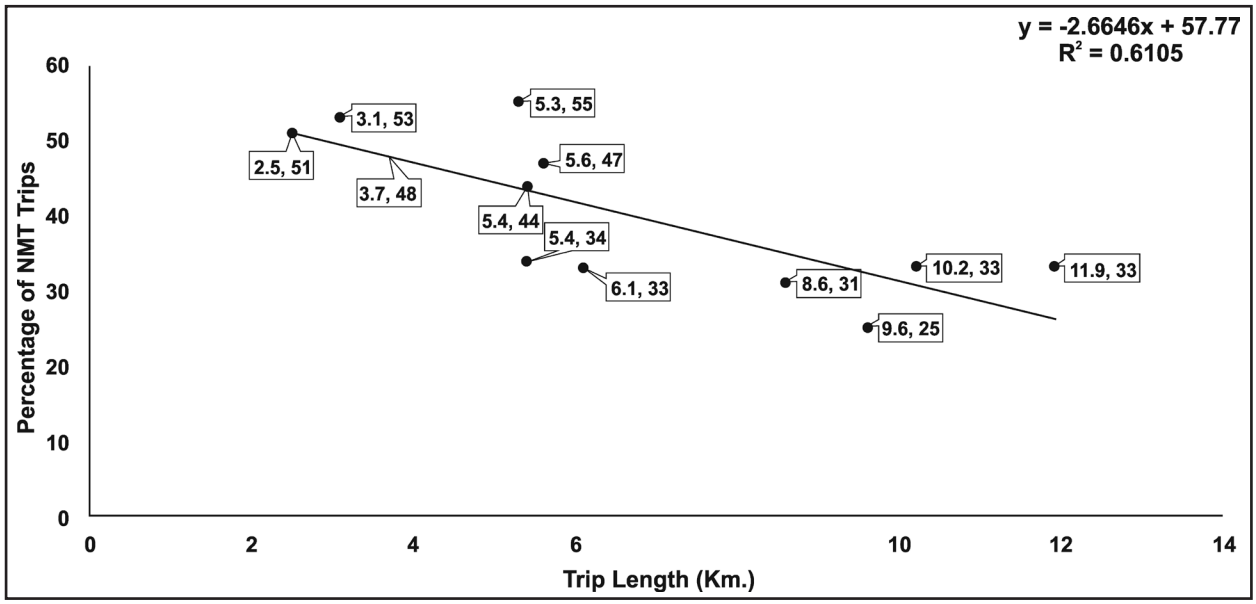
Since 1991, total registered motor vehicle has gone up from 21 million to 141.8 million a more than six fold increases in urban area in India (Planning Commission, 2014). More than 30 per cent of the trips in cities of Ahmadabad, Bengaluru, Chennai, Delhi and Greater Mumbai are by public transport. The average trip lengths (ATL) in these cities are 5.4 km, 9.6 km, 8.6 km, 10.2 km and 11.9 km respectively (Table 1). Trends observed in Ahmadabad, Bengaluru, Bhopal, Chennai, Delhi, Indore, Jaipur, Mumbai, Mysuru, Pune, Rajkot, and Surat reveal that about 34 per cent, 25 per cent, 53 per cent, 31 per cent, 33 per cent, 47 per cent, 44 per cent, 33 per cent, 51 per cent, 33 per cent 48 per cent and 55 per cent are NMT trips respectively. Bhopal, Indore, Jaipur, Mysuru, Rajkot and Surat account for more than 45 per cent of the total trips by walking and bicycle. Generalized relationship between population size, trip length and contribution of NMT trips, as cited in is given Table 1, which reflects that with the increased population size, trip lengths increase and the share of NMT in total trips reduces. In bigger cities like Mumbai and Hyderabad 80 per cent of the trips are less than 10 km in length and 70 per cent of the trips are less than 5 km. In cities like Pune 97 per cent of the trips is less than 10 km and 80 per cent of the trips are shorter than 5 km. Linear regression analysis shows that, shorter the trip length and greater the share of the NMT and vice versa (Fig. 1). Similarly inference is drawn by National Institute of Urban Affairs in 2014 whereby bicycle average trip lengths in Indian cities (excluding walking) range between 2.5 - 4.8 km in small cities and

Table 1: Existing Travel Modes in Selected Indian Cities

Cities	Modal Split					Share of NMT (%)	Average Trip Length (ATL) (in km)
	Population Urban Agglomeration (2011 Census)	Share of Public Transport (%)	Share of Private Transport (%)	Share of Walking (%)	Share of Bicycle (%)		
Greater Mumbai	18, 414,288	52	15	27	6	33	11.9
Delhi	16,314,838	48	19	21	12	33	10.2
Chennai	8,696,010	39	30	22	9	31	8.6
Bengaluru	8,499,399	36	39	20	5	25	9.6
Ahmadabad	6,352,254	30	36	22	12	34	5.4
Pune	5,049,968	13	54	22	11	33	6.1
Surat	4,585,367	14	31	42	13	55	5.3
Jaipur	3,073,350	17	39	37	7	44	5.4
Indore	2,167,447	16	37	27	20	47	5.6
Bhopal	1,883,381	28	19	49	4	53	3.1
Rajkot	1,390,933	14	38	36	12	48	3.7
Mysuru	983,893	26	23	34	17	51	2.5

Source: Compiled from various reports of Census of India, City Development Plans, Bus Rapid Transit System, Comprehensive Traffic and Transportation Plan and EMBARQ, iTrans, 2009 and Ministry of Road Transport and Highways (2012).

Fig. 1: Relation between Trip Length and Share of NMT



4.2–6.9 km. in medium and large cities (NIUA, 2014). Tiwari (2011) also concluded that the average trip length in medium and small size cities is less than 5 km.

Table 2: Traffic Indices in Selected Indian Cities

Cities	2012		2016		Growth Rate (in Percentage)	
	Traffic Index	CO_2 Emission Index (in grams)	Traffic Index	CO_2 Emission Index (in grams)	Traffic Index	CO_2 Emission Index (in grams)
Bengaluru	114.74	5536.77	223.97	7271.69	95.20	31.33
Chennai	179.42	5414.00	139.76	4113.15	-22.10	-24.03
Delhi	142.67	7011.43	268.96	10746.67	88.52	53.27
Greater Mumbai	236.29	1575.00	342.51	7355.60	44.95	367.02
Pune	291.20	16470.00	234.43	8504.90	-19.50	-48.36

Source: https://www.numbeo.com/traffic/indices_explained.jsp accessed on 2nd October, 2016

Note: Traffic Index is a composite index of time consumed in traffic due to job commute, estimation of time consumption dissatisfaction, CO2 consumption estimation in traffic and overall inefficiencies in the traffic system.

CO2 Emission Index - is an estimation of CO2 consumption due to traffic time. Measurement unit is grams for the return trip. To calculate an average estimation of emission in grams for one way commute to work, divide this value with 2.

5. RESULTS AND DISCUSSION

5.1 Traffic Index and CO2 Emissions

Traffic indices of selected Indian cities between 2012 - 2016 indicates that whereas Pune and Chennai showed negative trends i.e. -19.50 per cent and -22.19 per cent respectively, Bengaluru, Delhi and Grater Mumbai reflected incremental trends i.e. 95.20 per cent, 88.53 per cent and 44.95 per cent respectively. The CO2 emission index is an estimation of CO2 consumption due to traffic time and is measured in grams for the return trip. Growth rate of CO2 emission index in selected Indian cities between 2012 - 2016 shows that there is a major change especially in Greater Mumbai, where the index value has increased 367.02 per cent followed by Delhi (53.27 per cent) and Bengaluru (31.33 per cent) respectively. On the contrary, it has negative growth rate in Pune and Chennai i.e. -48.36 per cent and -24.03 per cent respectively (Table 2), which clearly shows that they had implemented NMT system as an integral part of urban transportation planning and share of public transport is also increased substantially over the period.

Table 2 clearly indicates that growth rate of time index and CO2 emission index are positively corresponding to each other and the strength of relationship varies with the efforts made in introducing the NMT into their respective transportation systems. Pune and Chennai appear to have implemented the NMT in their transportation systems more rigorously than Bengaluru, Delhi and Grater Mumbai.

5.2 CO2 Emissions in Passenger Cars

Owning a car is not always about necessity; it is often inspirational and also a status symbol. Today, the USA, Japan, and Europe have car-ownership levels

above 450 cars per 1,000 persons, in India currently has about 15 million cars, which is equivalent to 13 cars per 1,000 populations (Akshima T Ghate and S Sundar, 2014). Ownership level of cars in Delhi 157 cars per 1000 persons followed by Chennai (127), Coimbatore (125), Pune (92), and Bengaluru (85) respectively (MoRTH, 2012). Car travel consumes nearly twice the energy on average compared to urban bus travel (CSE, 2013). The exponential growth of number of cars in metropolitan cities will have serious implication on energy, air pollution and road safety. Over 90 percent of the fuel used for transportation is petroleum based, which includes gasoline and diesel (Kahn Ribeiro et. al. 2007). Further, five Indian cities such as Bengaluru, Chennai, Delhi, Greater Mumbai and Pune were selected for detailing analysis of vehicle kilometers travelled (VKT), fuel consumption and CO2 emissions in passenger cars.

5.3 Vehicle Kilometers Travelled (VKT) in Passenger Cars

VKT is the key data for transportation planning and management, and a common measure of roadway use (DULT, 2010-11). It is dependent on the trip lengths and the number of trips made of the passengers. The average annual VKT in passenger cars has been calculated based on the total passenger cars registered (MORTH, 2012). In 2012, Delhi has the highest VKT in passenger cars with 22.16 million kilometers, followed by Bengaluru (7.69 million kilometers), Greater Mumbai (7.35 million kilometers), Chennai (5.62 million kilometers) and least is the Pune (2.03 million kilometers) respectively (Table 3). While comparing with CRRI 2002 data, the average annual VKT in passenger cars in Delhi, Greater Mumbai and Pune is declining, whereas Bengaluru and Chennai were having increasing trends in the span of ten years, which clearly indicates that, even though encouraging public transport system and simultaneously passenger cars also increasing in these cities.

Table 3: Registered Vehicles, ATL, VKT of Selected Indian Cities

Selected Cities	Population (in millions)	Average Annual VKT in all Motor Vehicles (in million kilometers) -2012	Average Annual VKT in Passenger Cars (in million kilometers) - 2012	Average Annual VKT in Passenger Cars (in million kilometers) (CRRI, 2002)
Bengaluru	8.50	39.90	7.69	5.35
Chennai	4.65	32.40	5.62	5.56
Delhi	11.03	74.97	22.16	30.69
Greater Mumbai	12.44	24.15	7.35	12.10
Pune	3.12	13.83	2.03	3.15

Source: Census of India, 2011, MORTH, 2012, CRRI, 2002.

Table 4: Estimation of Fuel Consumption of Passenger Cars in Selected Indian Cities

Selected Cities	Total Registered Passenger Cars (in millions-2012)	Average Annual VKT Passenger Cars (in million kms)	Diesel (40%) Passenger Cars (in million kms)	Petrol (60%) Passenger Cars (in million kms)	Diesel Consumption Passenger Car in liters (16.2 Mileage/km)	Petrol Consumption Passenger Car in liters (15.3 Mileage/km)	Fuel Consumption (in liters)
Bengaluru	8.50	7.69	3.08	4.61	189877	301569	491445
Chennai	4.65	5.62	2.25	3.37	138765	220392	359158
Delhi	11.03	22.16	8.86	13.30	547160	869020	1416180
Greater Mumbai	12.44	7.35	2.94	4.41	181481	288235	469717
Pune	3.12	2.03	0.81	1.22	50123	79608	129731

Note: Calculation of Fuel Consumption was not considered for Non-availability of data on CNG and Electrical Passenger cars in selected cities.

5.4 Estimation of Fuel Consumption in Passenger Cars

The fuel efficiency of in-use fleet for year 2012 is summarized in Table 4, which is based on (Goel et al., 2015) average mileage of petrol car is 14-15.3 l/km and diesel car is 15.3-16.2 l/km respectively. For calculation considered diesel car 16.2 liters/ km and petrol car 15.3 liters/km and an assumption of 40 per cent of diesel and 60 per cent petrol cars in all the cities. The total fuel consumption of Passenger cars is highest in Delhi, followed by Bengaluru, Greater Mumbai, Chennai and Pune respectively.

5.5 Estimation of CO2 Emissions of Passenger Cars

Estimation of CO2 emissions are directly related to the amount of fuel burnt and the total number of in-use vehicles and vehicle kilometers travelled (Rahul Goel et al., 2015). There are four key components to drive transportation CO2 emissions which are travel activity (i.e., vehicle kilometers traveled, or VKT), mode share, fuel intensity, and fuel carbon content (Lee, S., Celine, M. and Roger, G, 2000). For the petrol and diesel vehicles Inter-governmental Panel on Climate Change (IPCC) Guidelines for calculating CO2 emission of Diesel Passenger car is 2.3035 kg/l and Petrol Passenger car is 2.6256 kg/l (IPCC, 2006) were considered. Delhi passenger Car emits 1.23 million tones Carbon – dioxide (CO2) equivalent, followed by Bengaluru (0.15), Greater Mumbai (0.13), Chennai (0.08) and least is the Pune i.e. 0.01 (Table 5).

CO2 emissions/ kilometers (USEPA, 2014) $= \frac{\text{CO2 emissions/ litres}}{\text{Mileage/ literes}}$ x Average Vehicle Travelled Kilometers

Emissions (g) =No. of Vehicles X Vehicle Kilometers Travelled (VKT) X Emission factor (G/KM)

Table 5: Estimation of CO2 Emissions from Passenger Cars in Selected Indian Cities

Selected Cities in India	Average Annual VKT in Passenger Cars (In Million kms)	Diesel (40%) Passenger Cars (in million kms)	Petrol (60%) Passenger Cars (in million kms)	CO2 Emissions Diesel Passenger Car (2.3035 kg/l)	CO2 Emissions Petrol Passenger Car (2.6256 kg/l)	CO2 Emissions Diesel Passenger Car (In tones)	CO2 Emissions Petrol Passenger Car (In tones)	Total CO2 Emissions of Passenger Cars (In tons)	Total CO2 emissions of Passenger Cars (In million tons)
Bengaluru	7.69	3.08	4.61	0.0023	0.0026	54,488.00	93,160.65	147,648.65	0.15
Chennai	5.62	2.25	3.37	0.0023	0.0026	29,101.87	49,756.80	78,858.67	0.08
Delhi	22.16	8.86	13.30	0.0023	0.0026	452,467.84	773,605.10	1,226,072.95	1.23
Greater Mumbai	7.35	2.94	4.41	0.0023	0.0026	49,776.33	85,104.89	134,881.22	0.13
Pune	2.03	0.81	1.22	0.0023	0.0026	3,797.00	6, 491.90	10,288.90	0.01

6. CHALLENGES

Various studies and academic research have come across to addressing towards integration of transport and land use at city level. The recent studies have come up with different approaches of urban forms to resolve the urban issues such as 'transit oriented development', 'non-motorized transport', 'smart growth', 'down zoning' and 'new urbanism', etc. But, if these are to be achieved then strong governance framework is required for effective implementation of spatial plans. The major challenge is to retrofitting issues for NMT especially in Indian cities are as follows:

- Issues related to segregation of lanes for (bicycle paths and sidewalks) NMT increasing the pressure on road density; existing roads do not have dedicated facilities for pedestrians, bicycles or buses, and have high rates of fatal crashes per km per year based on five years of traffic fatality data in Delhi (Rankawat et al., 2012);
- Presence of discontinued foot paths discouraged to pedestrian usage in Indian cities. The major obstacle of discontinued footpaths are "potholes, open manholes, poor maintenance of paver blocks, trees planted in the centre, parked vehicles, street furniture like light poles, electric wires, and discontinuity due to driveways" (Goel and Tiwari, 2014);
- Urban sprawl negatively impacts the non-motorized travel as trip length increases. On the contrary, the studies reveals that majority of the trips, even in mega cities, are shorter than 5 km, revealing high potential for NMT in Indian Cities (Tiwari and Jain, 2013);
- Issues for creating compact environment for NMT in old and compact cities; and
- Factors associated with NMT which includes demographic and socio-economic characteristics, trip characteristics, environmental factors, people attitude and individual perception.

Fig. 1: A Defunct Cycle Track in the City. PMC's Past Efforts in this Regard have Failed.

Source: (Courtesy by Sandeep Daundkar) http://indianexpress.com/article/cities/pune/pmc-flogs-tired-tested-cycling-project-again-2842150/.

- Pune Municipal Corporation has introduced Public Bicycle Sharing (PBS) in 2008 under JnNURM. It has constructed 123 kilometers of cycle tracks. But most of it is in a bad condition presently.

7. OPPORTUNITIES

Mysore City Corporation was started India's First Public Bicycle Sharing (PBS) System. The Government of India has taken up 20 smart cities for development in Round 1 of the Smart City Mission. Pune, Coimbatore and Chennai, as part of the Mission, have proposed to invest over 88 million USD (600 Crore rupees) in sustainable transport projects. A Master Plan of the road network proposed for Nanded city includes: rationalization of major vehicle lanes to accommodate all users, separate lanes for NMT, pedestrian precinct around the Sachkh and Gurudwara (Pradeep Sachdeva Design Associates, 2012). The following Indian cities have attempted to integrate with retrofitting options of NMT.

7.1 Mysore City Corporation

Mysuru is the third biggest city in the State of Karnataka covering an area of 128 sq km and a population of 8.87 lakh *(Census of India 2011)*. It is located 140 km away from Bangalore, the State Capital. The Mysore City Corporation has introduced India's first Public Bicycle sharing project in Mysuru (Photos 2). The project is funded by the World Bank under its Global Environment Facility Grant and State Government. The Mysore City Corporation (MCC) has implemented the

Fig. 2: Public Bicycle Sharing System, Docking Station and Students and General Public Using Public Bicycle Sharing System

project in collaboration with Directorate of Urban Land and Transport (DULT). The total project cost is Rs. 20.00 crore. A total 450 bicycles and 48 docking stations setup across the City including major tourist destinations, universities and offices. The docking stations are automated and users can use a smart card to take bicycles from one docking station and return at any other docking station. The Bicycle users has to be registered as member by paying Rs. 350 a refundable deposit and obtain a smart card by swiping which they can take out a bicycle from docking station.

7.2 Pune Municipal Corporation (PMC)

Pune is the ninth most populous city in India and the second largest in the state of Maharashtra with a metropolitan area population of 5.057 million. Pune Municipal Corporation (PMC) has a population of 3.124 million (Census of India, 2011). Pune is an educational hub and is emerging as a prominent location for IT and is centre of concentration of manufacturing and automobile industries. The current share of trips by walk and cycle are 32 per cent. PMC has prepared urban street design guidelines and called for global tender worth Rs. 9.5. crores to implement PBS system in city, which is about 42 km long having 1200 bicycles and 112 station. PMC will be developing about 225 km pedestrian paths and initiative of 'Walk Smart Policy' for pedestrian facilities and safety in Pune city (Pune Smart City Plan, 2016).

7.3 Coimbatore Corporation

Coimbatore is the second largest city in Tamil Nadu with a population of 0.226 million in the greater metropolitan area (Census of India, 2011). Coimbatore City Municipal Corporation (CCMC) has been implementing 30 km corridor for non-motorized tracks for cycling and walking. The corridor has been envisaged as connecting vantage points of lake, parks, Ukkadam bus stand, bustling market streets and residential areas. In addition, various projects in the pipeline include, 9 km of new footpaths, 34 km of protected cycle tracks, and the pedestrianization of Big Bazaar Street in the heart of the city (Fig. 3). This also included under signature initiatives under area-based proposal in the Smart City Project initiatives (Coimbatore SCP, 2016).

Fig. 3: A View of Coimbatore's Car-Free Sunday

Sources: http://itdp.in/coimbatores-car-free-sundays-spark-demand-for-better-pedestrian-facilities/

7.4 The Corporation of Chennai

Chennai is the fourth most populous metropolitan area in India with population of 8.69 million (Census of India, 2011). The Corporation of Chennai (COC) has introduced Non-Motorized Transport Policy in 2014 and initiated to develop wide,

Fig. 4: New Footpaths, Pedestrian Plazas, Separate Cycle Tracks, Car Free Sunday in Elliot's Beach Road in Chennai

Source: https://www.itdp.org/category/program/cycling-and-walking/ http://www.newindianexpress.com/cities/chennai/Chennais-First-Car-free-Sunday-in-City-a-Big-Draw/2015/10/12/article3075611.ece accessed on 25th October, 2016.

continuous pedestrian footpaths along all of the city's arterial streets. The policy aims to arrest the current decline in walking and cycling in the city by creating safe and pleasant network of footpaths, cycle tracks, green ways and other NMT facilities (Fig. 4). The Corporation of Chennai has earmarked about 60 per cent of urban transport fund to be allocated to NMT in Chennai city. About 75 per cent of its primary and secondary road networks should have NMT infrastructure before 2020 (Corporation of Chennai, 2014).

8. POLICY INITIATIVES FOR AN APPROACH TO SUSTAINABLE URBAN TRANSPORT

8.1 Global Scenario and Initiatives

About 10 million trips are made every day in urban areas around the World (World Bank Report). Share of NMT in the world is to the tune of about 37 per cent in 2005, but a recent study pointed out its decline. In Global scenario, various cities have initiated NMT system in a sustainable manner. Copenhagen is one of the top bicycle city in the World, where more than 45 per cent of the journey is made by bicycles and is also known as World green capital (Copenhagen City of Cyclists, 2014). League of American Bicyclist-1880 has initiated Bicycle Friendly America (BFA) with the focuses of bicycle friendly community, bicycle friendly business and bicycle friendly university (League of American Wheelmen, Inc., 1880). California Bicycle Transportation Plan was prepared under California Cycle Transportation Act. Germany opened first 5 km stretch of a traffic-free bicycle highway that is set to span over 100 km (AFP, 2015). European countries have initiated auto-free zones in downtown areas, bicycle streets and Public Bicycle System (European Commission, 2004). Seoul and Singapore was started the initiatives of Walkable and Bikeable Cities (Centre for Liveable Cities, 2016).

8.2 Indian scenario and initiatives

NMT system is key elements of the transport system in Indian cities. NMT is sustainable mode or green modes of transport; their carbon footprint is low; energy consumption is minimal; and emission is zero. Share of NMT in 1980's in Indian cities was 40 - 60 per cent. In 2008, modal share for walking and cycling in urban areas was 38 per cent, whereas public transport and intermediate public transport had 33 per cent share and private vehicles, 29 per cent (IIHS, 2011; Pai, 2010). NMT constitutes a significant share of the total traffic in Indian cities and all have a relatively high rate of bicycle ownership and a high proportion of bicycle traffic. In Indian cities, the share of NMT at peak hour varies from 30 - 70 per cent. The proportion of trips undertaken by bicycles range from 15 to 35 per cent; the share tending to be higher in medium and small size cities. The patterns of NMT use change with growth in city size (Dinesh Mohan, 2002). Incremental increasing of middle income families and India is the third largest CO2 emission country. WHO report reveals that 13 of the 20 most polluted cities in the world

are in India (Hindustan Times, 2015). NMT makes a substantial contribution to reducing pollution and significant benefit for low income groups.

The Ministry of Urban Development (MoUD) has encouraged Indian cities through various initiatives and programmes to adopt NMT as a key component of their integrated urban transport system. One of the objectives of National Urban Transport Policy, 2006 is to encourage NMT and public transport with central financial assistance (MoUD, 2006). National Mission for Sustainable Habitat under the Prime Ministers National Action Plan on Climate Change has constituted sub-committees for specially focusing on urban transport. The committee has listed eight primary principles to ensure sustainable approach to urban transport planning, of which first two are 'Walk' and 'Cycle' (NMSH, 2011). A Working Group on Urban Transport under 12th Five Year Plan document recommended to create dedicated funds to improve, maintain and upgrade existing walking and cycling infrastructures (Planning Commission, 2011). Smart city initiatives program have emphasized on to promote mixed land use in area based development and creating walkable neighborhoods (MoUD, 2015). Atal Mission for Rejuvenation and Urban Transformation (AMRUT) has identified 500 cities; it will focus on the trust area of pedestrian, non-motorized and public transport facilities (MoUD, 2015). MoUD, 2012 has prepared Public Cycle Sharing Systems - a planning toolkit for Indian cities under National Public Bicycle Scheme, December, 2012 (MoUD, 2012). The MoUD has initiated the Sustainable Urban Transport Project with support of Global Environment Facility (GEF), United Nations Development Program (UNDP), World Bank (WB) and Participating States and Cities. Under this initiative MoUD has selected four demo cities. They are; Pimpri-Chinchwad in Maharashtra, Naya Raipur in Chhattisgarh State, Indore in Madhya Pradesh and Mysuru in Karnataka. Government of India has also launched the National Electric Mobility Mission Plan (NEMMP) 2020 with an aim to address the issue of rising vehicular pollution, and increasing concerns over the energy security of the country.

9. CONCLUSIONS

CO2 emissions are the major alarming issues in the Indian cities. Walking and cycling is the most desirable modes of urban residents for shopping and other activities. Detailed analysis of modal share of NMT is quite enormous. The study indicates that whichever cities have implemented NMT has substantially increased public transport, and experienced remarkable decline in the CO2 emissions e.g. Copenhagen and Paris having negative growth rate of CO2 emissions. At present, in Copenhagen almost 50 per cent of urban residents use NMT. In addition, few Indian cities have made attempts to implement NMT, but there are issues concerning lane segregation, obstruction of utilities and dedicated funding for effective implementation. In this paper, the detail analysis of VKT, fuel consumption and CO2 emission of passenger cars is quite huge. While comparing VKT in passenger

cars from 2002 to 2012, it is found that in Bengaluru it is constantly increasing followed by Chennai, whereas in Delhi, Greater Mumbai and Pune it is declining. It indicates that, few cities have implemented mass-rapid transit system such as Metro, BRTS, etc. Based on the analysis, the study suggests restricting the passenger cars entry into the downtown areas and encouraging sustainable modes of urban transport such as NMT and public transport.

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GIFT City - A Unique Model of Urban Development

S. G. Sonar, Ph. D.; and Rajesh S. Phadke

Abstract

This study of GIFT City model provides an important lesson that, while building a new city, it is essential first to create the infrastructure and then only to start building offices and residences. It is observed that GIFT City offers a model by which city can be built with private investment by capitalizing land. Ministry of Urban Development, Government of India in its Mission Statement and Guidelines on Smart Cities published in June, 2015 has rightly mentioned GIFT City as a good example of "Greenfield Smart City".

1. INTRODUCTION

1.1 Overview of Gift City

In the history of the country, a new city is being set up for the first time in a Public- Private Partnership (PPP) mode by name Gujarat International Financial Tec-City (GIFT) in the State of Gujarat. In terms of scale and sheer physical scope, GIFT City is designed to be at par with presently acknowledged globally benchmarked Financial Centres, such as, Shinjuku Tokyo, Lujiazui Shanghai, La Defense Paris, London Dockyards, etc. GIFT City is envisaged as a future city in many ways. GIFT City Master Plan spreads over a total land area of 886 acres. The total planned built-up area (BUA) is 62 million sq ft; commercial area 42 million sq ft, residential area 14 million sq ft and social area 6 million sq. ft. About 60 % of the land is proposed to be kept permanently open. GIFT City is divided into two zones: one for Domestic Financial and IT Services (625 acres), and the other (261 acres) for Multi Services including International Financial Services under Multi Services-Special Economic Zone (SEZ). Approvals for SEZ and International Financial Services Centre (IFSC) are obtained by GIFT City. It targets service sector in general and International Financial Services Centre in particular as its economic base for employment generation. Further, city does not have any scope for Industries or Service Industries to contribute in its employment generation. This being, the state does not have a strong base of service sectors, like, financial services which are concentrated in economic capital i.e. Mumbai.

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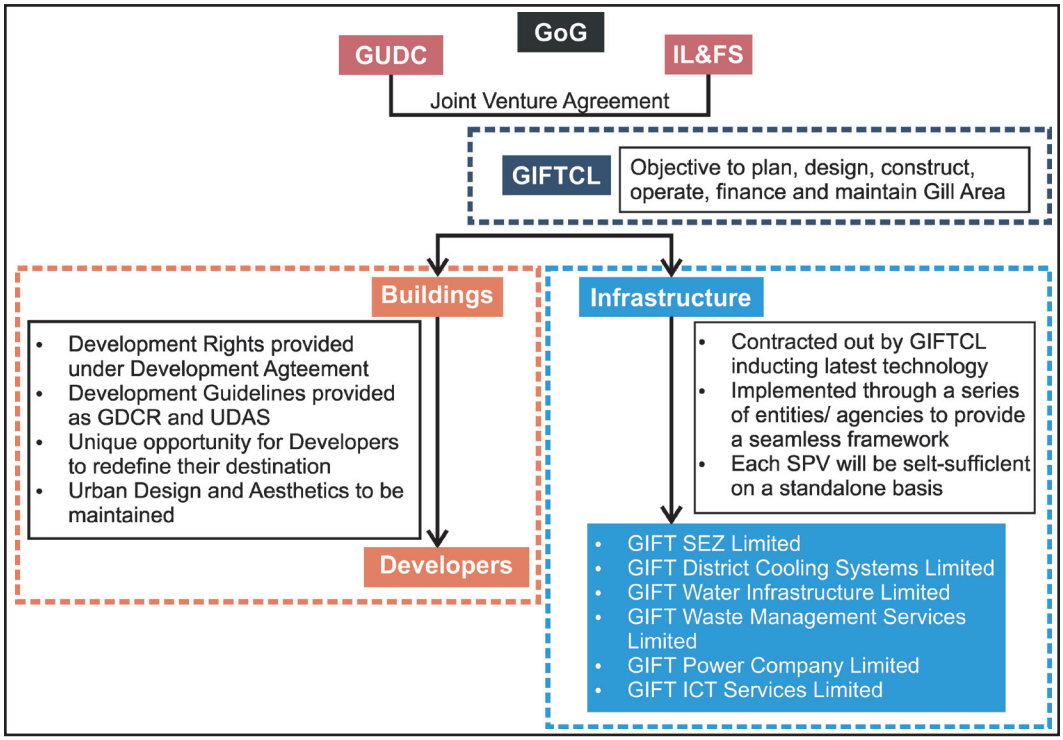
2. PUBLIC-PRIVATE PARTNERSHIP

Government of Gujarat (GoG) has had an excellent record of promoting large projects in partnership with private sector. The government decided to partner with Infrastructure Leasing and Financial Services (IL&FS) Ltd. for GIFT City; which had established itself as a leading infrastructure company in the country. Public sector usually lack in real estate skill and expertise to develop and private sector is unable to make large scale real estate project economically viable. The solution can be a PPP Project which can avail benefits of both public and private sectors. In June, 2007 a joint venture company GIFT Company Limited (GIFTCL) was formed with 50 % equity contribution each from Gujarat Urban Development Company (GUDC), a fully-owned company of the Government of Gujarat and IL and FS. Government handed over its own land with a condition to share profit with the government and to act as a resource for the project. Government developed the trunk peripheral infrastructure required for this project. This includes two bridges on river Sabarmati, access roads to project site, lying of electric transmission lines till sub-station, allocation of water from Narmada Canal, etc. All approvals, sanctions, clearances like approval of Land-use Zone Plan, DCRs required for project are supported by government. The record indicates that government facilitated in obtaining finance, development and promotion of the project

Fig. 1: GIFT City Development Framework



which is a great advantage for any large scale project in its initial stages. The role of IL and FS is that of an Equity Partner, Project Manager and also an Anchor Investor. It has contributed in Master Planning and providing state-of-the-art infrastructure services and in globally positioning the project. It has used its skill in bringing the right developers, right clients and right partners. Its presence on the Board facilitates quick and often risky decisions, while the presence of the government and Independent Directors can ensure due regard for processes and transparency. Such a combination of Board Members is quite different when compared with other companies of large scale development. Development Framework for GIFT City has been presented in Fig. 1.

3. LOCATION AND LAND FOR PROJECT

Accessibility and location is very crucial for the success of any Urban Development Project. It is important to have seamless connectivity for sale of project. Fortunately, GIFT City is located on National Highway 48 and is well connected to Ahmedabad and Gandhinagar (developed cities in the immediate vicinity). Ahmedabad Railway Station is approximately 17 km and Sabarmati Railway Station is located approximately at 15 km from GIFT City. A big advantage is closeness to airport. Ahmedabad International Airport is located at 12 km from the site and is presently well connected by roads. There is a proposal to connect Airport with GIFT City by eight lane expressway. The notified area of 3.65 sq kms (886 acres) is very minimal for accommodating 1.0 million projected employments. The great step was taken by the government by approving and allotting 673 acres of its land for the project for a token payment of one rupee in January, 2011. The project was on paper from 2005 till government handed over land in 2011. Handing over of land proved to be a starting point for the project. Additionally, nearly 10 acres of land was acquired by GIFTCL following land acquisition procedure, Some critical parcels of private lands admeasuring 17 acres were purchased by GIFTCL at market rates from private owners. Land assembly which is a major hurdle for any green-field project was not a problem for GIFT City. Still 196 acres of land is not yet in possession of GIFT Company. All 261 acres of land notified for Special Economic Zone (SEZ) is in possession of GIFT Company.

4. MASTER PLAN FOR GIFT CITY

A careful analysis of GIFT Master Plan shows that it envisages a development model that is different from that being practised by regular Urban Development Authorities and Urban Local Bodies in Indian context. GIFT Master Plan is prepared to achieve specific urban form, public realm, pattern, mix uses and to accommodate 0.5 million direct employments and equal number of indirect employments. The Plan is designed considering all these factors with an

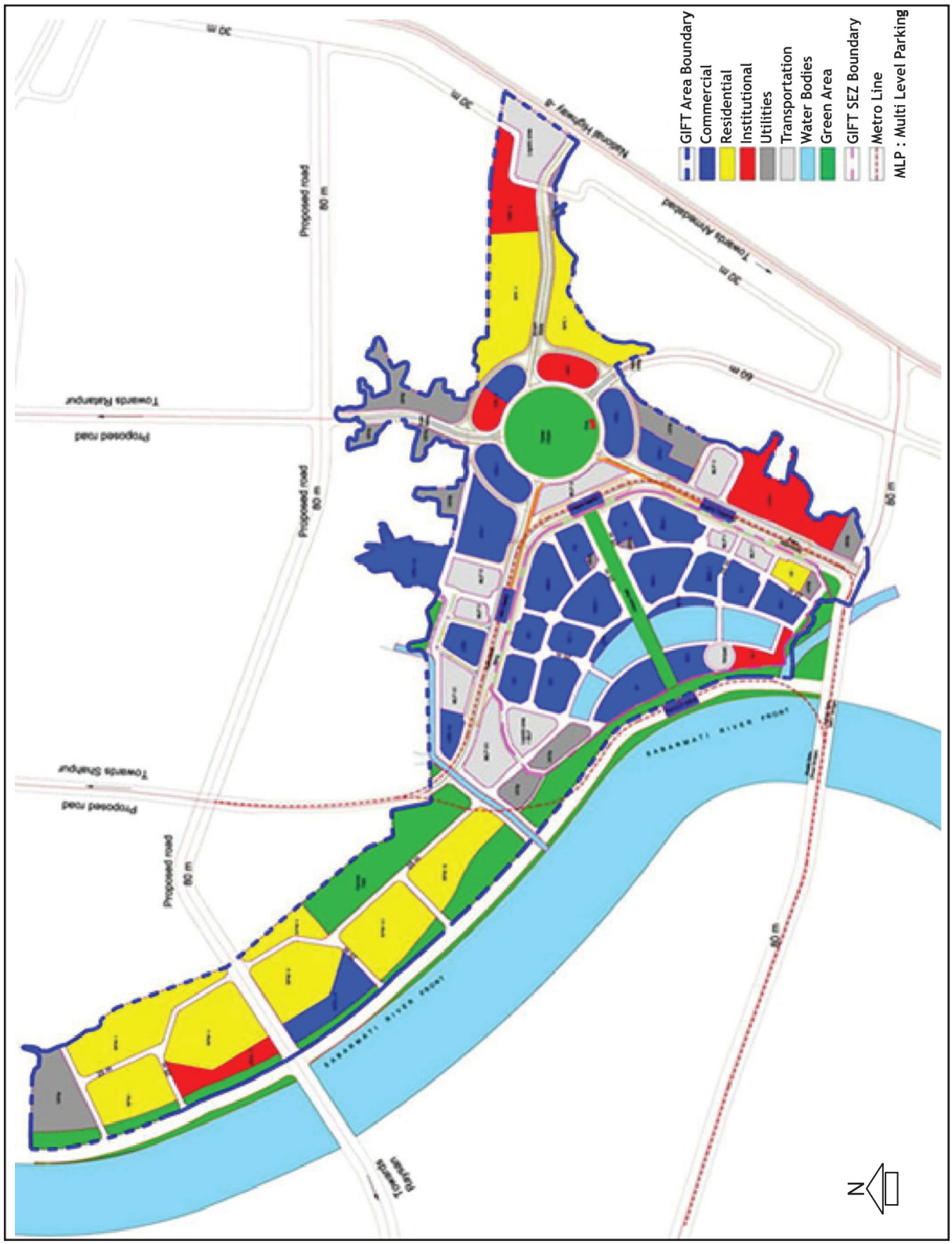


Fig. 2: GIFT City Master Plan

aim to develop built-up area of about 62 million sq ft on 886 acres of land. In order to achieve its skyline with high-rise buildings up to 410 meters some different concept of Floating and Higher Floor Space Index (FSI) was needed. The planners proposed Global FSI with 3.65 factors to achieve High Rise High Density Development. It was proposed in DCRs and approved by government. It was not possible with usual plotted development with FSI 1.0. This Global FSI factor of 3.65 was granted first time to any Urban Development Project in Indian context. It was required for GIFT City to achieve the planned High Density High-Rise Development on the limited land area. The concept of Global FSI is being used in its true sense for the first time in

Gujarat State. As per the development model, GIFTCL sells only Development Rights to the developers with Basement Extent and Building Footprint marked as per the Urban Design and Architecture Sheet (UDAS). It is issued to developer to prepare building plans. It includes guidelines regarding building development relating to building envelope, built-up area, open spaces, building form, building height, facade, vertical zoning, landscape, urban design, architectural features, access, utilities and services, etc. The built-up area generated using Global FSI is distributed across various blocks to achieve a certain built-form. This concept of "Form Based Development" is being successfully implemented. There is no plotted development in GIFT City. Also, compound walls to buildings are not permitted in GIFT City as per its DCRs. Its Master Plan has been presented in Fig. 2.

4.1 GIFT City Development Control Regulations (DCRs)

The DCRs prepared for GIFT City are intentionally made different than the DCRs of all Urban Development Authorities in Gujarat State. The details when studied reveal that these DCRs are also different than the one usually followed in the country. The intent and purpose of the DCRs clearly reflects that these are to promote innovation and creativity. The DCRs are unique as they promote a form-based controls rather than prescriptive controls. The regulations authorize GIFTCL to scrutinise the building plans. The total technical scrutiny is done by technical team of GIFTCL. The scrutiny is not limited to architectural drawings but it also scrutinizes engineering services, structural drawings and designs of the building proposal. The important aspects, like, entry of utility tunnel, gas pipeline, sewage connection point, storm water drain with levels are checked at the time of development permission itself. The permission drawings are issued with co-ordinates which are on universal co-ordination system. These detailing leaves no chance for any ambiguity or last minute amendments for developers. Every aspect of building and services is decided before permission. As per GIFT City DCRs, the applicant gets development permission only for architectural drawings. The applicant has to apply and obtain Commencement Certificates

separately for structural works and services. The consultants appointed by the applicants need to submit structural design and drawings as well as design and drawings of mechanical, electrical, plumbing and fire fighting services. GIFTCL appoints proof checking consultants at the cost of the applicant to review all design and drawings of structural and services. Without obtaining Commencement Certificate for structural drawings the applicant is not allowed to start construction.

GIFT DCRs has made following mandatory provisions for each and every building which makes it different from other regulations:

- Follow Green Building Norms and obtain Green Building Certificate;
- Submit all drawings in REVIT Model which include all structural and services drawings;
- Prepare and submit Emergency Response Plan and Disaster Management Plan;
- Integrated Building Management System (IBMS) is mandatory;
- Duel Plumbing System is mandatory to use recycled water;
- Provisions for use of Solar Energy Mandatory;
- All approval drawings should be on Universal Co-ordinate System; and
- The developer need to prepare and submit plans in soft-copies in prescribed format required by software developed for online approval of plans.

4.2 Online Development Approval System (ODAS)

GIFTCL has developed an Online Development Approval System (ODAS) for development permission. ODAS is the unique and innovative way of automatic scrutiny of building proposal by reading CAD drawings in pre-DCR formats. The system reads CAD drawing in pre-DCR format and produces scrutiny reports in a few minutes, mapping all DCRs of Authority to the drawing entities. Thus, it reduces paper work, valuable time and effort of developers, consultants and the Authority. Though this is no more a new technique in Indian context, in GIFT City it is implemented right from the first permission that makes it different.

4.3 Environmental Clearance and Height Clearance

GIFT Company has obtained Environmental Clearance for the entire project. Also, the required Height Clearance for all the buildings in the project is obtained by the company. This has saved valuable time and efforts of individual developers from obtaining Environmental and Height Clearances for their individual buildings. In all other Urban Development Authorities Environmental and Height Clearances is left to the individual developer. Such initiatives taken by project proponent make it a good place for ‘ease of doing businesses’.

5. GOVERNANCE MODEL FOR GIFT CITY

It is observed that the development of green-field large scale development always poses a challenge with respect to local urban governance of such developments. The promoter / developer has to provide and maintain services till such time a democratically elected governance structure is in place as per the provisions of the Constitution of India. This transition period is critical for the promoter / developer as the rights of the local authorities namely the gram / village *Panchayat* are not extinguished. In order to resolve this problem in case of GIFT City, Urban Development and Urban Housing Department, Government of Gujarat by notification dated 15th March, 2012 declared the areas of GIFT City as Industrial Township in exercise of its powers under proviso to Clause (1) of Article 243 Q of the Constitution of India. Thereafter, by another notification government constituted a Committee for the Industrial Township in exercise of the powers under Gujarat Municipalities Act, 1963. This "Notified Committee" is empowered as Urban Local Body for GIFT City. With this, it has come out of village *Panchayat* jurisdiction. This saved its residents / developers from levy of property tax and from the hassles of obtaining various permissions / NOCs from village *Panchayat* as local body. Getting the status of Urban Local Body from start of the project is a unique feature of GIFT City. This model is worth repeating by all other states for large scale green-field development projects.

5.1 GIFT Urban Development Authority (UDA)

Initially, GIFT was conceptualized, as a part of the Gandhinagar Urban Development Authority (GUDA). In order to achieve a specific built form, the separate DCRs were prepared and sanctioned for GIFT City in 2011. When, it was observed that the process of granting building permission through GUDA was time-consuming and there was a shortage of dedicated team to address the Unique Building Permission Process stipulated in GIFT DCRs, government constituted a separate 'GIFT Urban Development Authority (GIFT UDA)' on 15th March, 2012 to regulate the development in GIFT City. It was not envisaged with an exclusive full-fledged staff. The technical staffs of GIFTCL provide the necessary technical support. Such an arrangement is unique, happening for the first time in the state and also in the country. For the first time in the state, a separate UDA is formed for such a small area of 886 acres. A separate UDA has given the required autonomy and flexibility to the Authority. The setup of GIFT UDA is quite different. It is headed by Principal Secretary / Additional Chief Secretary, Urban Development and Urban Housing Department. The members are Government Officials. The Chairman and Managing Director of GIFTCL are the members. GIFT UDA has constituted the Development Committee for granting approval to the Building Plans (issue of Development Permission), issue of Commencement Certificate and Occupancy Certificate in GIFT City. The Development Committee has the following three members.

- Managing Director, GIFTCL;
- Chief Town Planner, Govt, of Gujarat; and
- Member Secretary, GIFT UDA.

As per the arrangement sanctioned by government, the approved DCRs; GIFTCL scrutinizes the application for development permission and recommends the same to the GIFT UDA. Thus, all buildings are administratively approved by GIFT UDA and GIFTCL provides technical support. Such an arrangement is not a usual for any Planning and Development Authority in Indian context.

6. UNIQUE INFRASTRUCTURE

GIFT City management had taken bold decisions to use new concepts, techniques and technology for the first time at city scale. Dedicated Power Distribution Company, Utility Tunnel, District Cooling System and Automated Waste Collection System are planned and provided at city level for the first time in the country. This modern infrastructure has made GIFT City a unique large scale development project.

6.1 GIFT Power Company Ltd.

Getting power distribution license for SEZ area is common but to get it for entire city is different. GIFTCL has formed its fully owned subsidiary named as GIFT Power Company Ltd. for procurement and distribution of electricity within its jurisdiction. The company has obtained the electricity distribution license from Gujarat Electricity Regulatory Commission; the regulatory authority in April, 2013. This has given autonomy to purchase power and decide electricity tariff, execute infrastructure and distribute power as per required specifications.

6.2 Utility Tunnel

GIFT City management had taken a bold decision to give its citizens a place which will function without digging of city roads for maintenance, repairs, replacement and augmentation of all services. In many urban development projects 'Utility Trenches' are seen whereas; GIFT City has planned Utility Tunnels for entire city to carry all services except sewage, storm water drain and pipe gas. The alignment of utility tunnel is not below roads. This has saved roads from digging for various reasons. The roads are without service manholes. This concept has necessitated marking of additional land for services. All pipes and cables are housed in an underground concrete tunnel, equipped with ventilation, fire fighting equipment and sensors to detect faults and leaks. A utility tunnel measures average 7.6 meter by 6.2 meters. This tunnel in GIFT City has a provision of a repair and maintenance vehicle to manoeuvre through it. This concept has definitely high cost implications. But considering importance of un-interrupted services for continuity of business this is tried for the first time in India. Moreover, for High-Rise High Density Development it is a good option. GIFT City demonstrates what can be done for un-interrupted services as services are backbone of any development (Fig. 3).

Fig. 3: Utility Tunnel in GIFT City, District Cooling System (DCS)

The window or split air conditioners which hang out of window, radiate heat, spill water, guzzle power and create noise are not allowed in GIFT City. All the buildings in city are planned to be air-conditioned using District Cooling System, which supply chilled water to every building through insulated pipes which runs in utility tunnel. This is made mandatory through DCRs. District Cooling is energy-efficient and pollution-free. This is an efficient and reliable service for the occupants of GIFT City. It saves energy, its noiseless, clean technology, saves space in every building. DCS at city level is done for the first time in India. It is used earlier elsewhere for captive areas only.

6.3 Domestic Gas

The domestic gas is not an after-thought for GIFT City which usually happens for brown field development. A specific corridor was earmarked for domestic gas well at planning stage to avoid future complications. All the occupants of GIFT City would have piped gas for domestic / commercial uses. This has eliminated the requirement of gas cylinder movement, gas storage yards which has saved important urban land giving a clean neat look.

6.4 Master Balancing Reservoir

GIFT Master Plan has used the requirement of Master Balancing Reservoir and proposed it in the form of an artificial lake which will also act as recreational water body. It will be used to store raw water pumped from Narmada Canal which is a source of water supply for GIFT City. This lake serves the huge daily requirement and the requirement during canal closure period for maintenance, a Master Balancing Reservoir with about 15 days of storage has been envisaged which is on higher side. Besides storage, this reservoir would also be used for water side recreational activities. The lake has added urban character and has enhanced the aesthetic beauty of GIFT City. This has added a social element to GIFT City. It has avoided ugly looking ground and elevated reservoirs may be at the cost of heavy evaporation losses.

6.4 Use of Treated Water

Towards being "Water Neutral", sewage collection, treatment and recycling is planned in GIFT City for sourcing water for reuse so that there is no discharge of waste water from it. This is a much needed step considering location of GIFT City in area where there is a water scarcity. This treated water will be mainly used in District Cooling Plants in Cooling Towers. The balance treated water is planned to be used for horticulture and flushing. Each High-Rise Building has to make provision for duel plumbing system to use recycled water for flushing. This aspect is taken care through regulated development permissions. This is how GIFT Greenfield Urban Development has planned to utilise entire Treated Sewage Effluent (TSE) to reduce fresh water requirement. Such practices can be made mandatory by all State and Central Government for Greenfield urban development considering the scarcity of fresh water in all major cities.

6.5 Solid Waste Management

GIFT City Planners did not want any visible garbage anywhere in city. It was envisaged to have Integrated Solid Waste Management System employing latest Solid Waste Treatment Technologies. Considering the nature of business in the GIFT City, a dedicated e-Waste Management System would be required to ensure pollution less environment for the occupants. After a global search, they selected a system in which the garbage would be dropped into chutes, provided in all buildings, at street level, and evacuated through pipes using high-pressure vacuum, to a Central Collection System, where it would be segregated, processed and the unusable garbage would be eventually incinerated. It has given a clean, neat city. Such an arrangement can be repeated in Central Business Districts of new towns and cities Having High Rise High Density Developments. The concept diagram and building is shown in Fig. 4.

Fig. 4: Solid Waste Management in GIFT City

7. CONCLUSIONS

Government of Gujarat had taken bold initiatives for GIFT City Project which typically State Governments are reluctant to take. This includes formation of

Public Private Partnership in the form of GIFT City Joint Venture Company with 50 % equity contribution each from GUDC and IL&FS Ltd. This is the only city which is being built without any capital investment by the government, both in infrastructure and buildings. The project is financed by leveraging land and BUA (FSI). This approach of planning is a unique and different approach away from the traditional one. Government handed over its own land with a condition to share profit with the government and to act as a resource for the project. Government developed the trunk peripheral infrastructure required for this project, which includes external connectivity, approach roads, bridges, water supply, domestic gas, power supply, etc. Government declared GIFT City as Industrial Township and proposed Notified Committee as an Urban Local Body for professional management of all utilities. GIFT UDA formed for quick decision making in the approval of building plans and other statutory requirements. It has formulated separate Form Based Development Control Regulations in the form of Urban Design and Architectural Sheet to facilitate flexible Global FSI consistent with the Master Plan. It has obtained Environmental Clearance and Height Clearance for entire project in advance and adopted Online Development Approval System. Also, separate Power Distribution Company for the city has been established to ensure uninterrupted power supply. It has also developed Unique Infrastructure, in the form of District Cooling System, Domestic Gas, Utility Tunnel, Master Balancing Reservoir, Reuse of Treated Water, Automated Waste Collection System, etc.

Initiatives taken by Government of Gujarat in the development of GIFT City has set an example for the large scale green-field developments in the form of smart development, good governance and efficient management, world class unique Infrastructure, form based flexible development and that to on innovative concept of public private partnership. Although, this project deals in real estate, it never allows itself to forget that this project is being built in public interest and that, perhaps, has made it a unique urban development model. GIFT City has set an example of smart development which can be replicated for future large scale green-field developments in Indian context.

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