BMS SCHOOL OF ARCHITECTURE

3.3.3 PUBLICATIONS

AY 15-16 (A) INDEX

BMS SCHOOL OF ARCHITECTURE

3.3.3 PUBLICATIONS

AY 16-17 (B) INDEX

Sl No	Particulars (Sample Pages of Publication)		Page No.
	Title of Paper	Authored by BMSSA faculty	
1	Structural Concrete Repair against mechanical and thermal loads	Dr.D Harinadha Reddy	B 1-3
2	Day lighting Analysis in Vernacular Houses of Rural Karnataka	Dr Shaila Bantanur	B 4-14
3	GIS based assessment and gap-analysis of socio-economic infrastructure in Rourkela Town	Ar. Debadutta Parida	B 15-19
4	Rejuvenating the Vernacular Architecture of South India as the representative of Sustainable Architecture: a case study of Hubli, Karnataka	Ar. Deepti Shankar Hegde	B 20-24
5	Sangam City as Faith-based utopia	Ar. Debdutta Parida	B 25-28
6	A Potential Sustainable (Stone) Tourist Destiination, Bandebambli	Dr Nishant Nathani	B 29-33
7	Evaluation of the effect of projection on wind pressure on Low Hiigh Rise Buildings	Dr Nishant Nathani	B 34-38
8	Mobility for the Elderly: A Qualitative Assessment of a commercial precinct in Bangalore	Ar Debdutta Parida, Ar Renjin Cherian	B 39-52

BMS SCHOOL OF ARCHITECTURE

3.3.3 PUBLICATIONS

AY 17-18 (C) INDEX

BMS SA

BMS SCHOOL OF ARCHITECTURE

3.3.3 PUBLICATIONS

AY 18-19 (D) INDEX

Sl No	Particulars (Sample Pages of Publication)		Page No.
	Title of Paper	Authored by BMSSA faculty	
1	International Academic Conference on Applied Research in Engineering, Science & Technology	Ar Shanu Raina	D 1-12
2	Proceedings of IASTE/CEDER, University of California, Berkeley 2018 Working Paper Series	Dr Sapna Papu	D 13
3	Proceedings of27th Annual Conference of Indian Art History Congress and International Conference on Asian Art	Mr Chandan Kashyap S K	D 14-17
4	Proceedings of COSVARD 2018, Assam, Guwahati (International Conference)	Dr Shaila Bantanur	D 18-33
5	Engaging Architectural Science: Meeting the Challenges of Higher Density: 52nd International Conference of the Architectural Science Association 2018	Dr Nikhat Parvez	D 34- 41
6	Proceedings of the 7th International Conference on Research in Science and Technology	Ar Shanu Raina	D 42- 65
7	SPACE : The SPA journal of Planning and Architecture	Ar Supritha M Y	D 66-114
8	Proceedings of International Conference on Research into Design ICoRD 2019	Ar Supritha M Y, Ar Sheetal, Ar Shreyas	D 115- 116
9	Proceedings of National Conference on Recent Trends in Architecture & Civil Engineering towards Energy Efficient and Sustainable Development	Ar Shanu Raina	D 117 – 128
10	SPS-DST Japan-India Forum for Advanced Study	Dr.D Harinadha Reddy	D 129 – 130
11	International Journal of Development Research	Ar Shikha Patel	D 131- 135
12	Proceedings (volume XVI)of Karnataka History Congress (Studies in Karnataka History And Culture)	Mr Chandan Kashyap S K	D 136- 145
13	Proceedings of International Seminar on Sustainability in Planning, Architecture, Technology & Engineering (SPATE 2019)	Ar Shanu Raina	D 146- 154
14	IJRASET- International Journal for Research in Applied Science and Engineering Technology	Ar. Nandini J	D 155- 161

BMS SCHOOL OF ARCHITECTURE

3.3.3 PUBLICATIONS

AY 19-20 (E) INDEX

Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 1758 – 1765

Procedia

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Investigating the role of PES in reviving the social and ecological fabric of Kodagu

A. Seema Naveen[a]*

[a]*BMS School of Architecture, BMSIT Campus, Yelahanka, Bangalore - 560064*

Abstract

Kodagu is one of the green districts in the Western Ghats, which contributes to a major share of coffee production in India with a rich cultural heritage, a significant part of which is a sustainable outlook in all aspects of life. The district is now witnessing a decline in its cultural and environmental vibrancy due to a number of reasons, notably, rapid urbanization, shift from the natural agricultural systems, destruction of the sacred groves, expansion of coffee plantations and reduction of the native green cover. The negative impact is indicated in various environmental statistical records. The College of Forestry, Ponnampet and University of Agricultural Sciences, Bangalore have proposed the Payment for Ecological Services through landscape labeling that could help alleviate the economic woes of the farmers and consequentially provide an opportunity to restore the ecological balance in Kodagu. The scope of the paper would be to investigate whether PES in conjunction with the cultural and social scenarios would be able to create a cultural renaissance in Kodagu.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

*Keywords:*Western ghats; okkas; keris; takkas; ecological services; cultural renaissance; business model

1. The disintegrated fabric of a glorious heritage - Kodagu

The district of Kodagu, located in the Western Ghats, is one among the 25 environmental hotspots (Norman Myers, 2000). The physical and ecological elements of the land have been instrumental in developing the Kodava culture, its traditions and folklore, a way of life for the people of the land. As all ancient cultures, the Kodavas also

* Corresponding author. Tel.: +91 9945298550;
*E-mail address:*alamandaseema@gmail.com

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.212

practised a sustainable lifestyle that was based on their socio cultural interactions with the nature. The Kodava culture that is predominantly built around land ownership, honor for the word and deep respect and reverence for the elements of nature, is seeing a gradual ecological and cultural decline since the past 40 years (Ponnappa, 2013). Various studies undertaken on this aspect have brought to light various factors responsible for this decline, a few being

≠ Rapid Urbanization and migration to various urban centers
≠ Western education systems that have overruled the ancient oral traditional systems
≠ Change in social values and belief systems in the younger generation
≠ Fragmentation of the okkas and keris and the takka system
≠ Increased preference for commercial cash crops for better profit
≠ Sanskritisation of the temples – Change in religious patterns
≠ Encroachment, illegal deforestation and excessive harvesting of forest resources
≠ Political interference in land conversion (Mani S.) (Ponnappa, 2013)

The traditional model where the local communities united as protectors of the land and practised a unique tradition of responsibility, healing and worship including dance and music, is disintegrating under the onslaught of social and economic pressures of the modern world, giving way to the present-day model of the Kodava society that is seemingly detached and individualized in its essence. Various attempts at curbing the deterioration have led to formation of various organizations targeting cultural and environmental amelioration, the strategy being twofold, in terms of resurrection of the oral traditions and culture and rejuvenation of the natural mosaic of the land, using the concepts of the traditional model and realigning them to work to the benefit of the individualized society of today. The methods should also be able to inculcate the feeling of oneness and belonging to the land, the respect and reverence for the culture that has been lost in the recent times. An understanding of the traditional landscape and the culture would throw light on the concepts that can be adopted to restore the dying culture and the landscape in the present day.

2. The traditional model – a forested district

The rugged slopes and forests of the Western Ghats, the river Cauvery and her tributaries, the flora and fauna and deep reverence towards the land is the essence of the Kodava traditions and folklore, which dictated a way of life for the people of the land. These intimidating forests also housed many shrines that are dedicated to nature spirits and guardian spirits that the Kodavas worshipped and appeased through many of their rituals and sacrifices for the wellbeing of the community. The Kodavas has strict rules for preservation of the flora and fauna of the land, highlighted by the concept of the sacred groves, *Devarakadu* dedicated to various forest deities that required being appeased before entering, extracting forest resources or hunting. The land itself was believed to belong to Goddess Kaveri, the Mother Goddess, and the ultimate creative force of nature, on whose behalf the Kodavas tilled the fields and took care of the land. The paddy fields, the coffee plantations, the sacred groves, the streams and springs, the festivals, the social interactions with the land and people developed a natural ecological mosaic that was sustainable in all aspects. This rich cultural heritage of the Kodavas, which is passed on over generations through oral recitations, and demonstrates the deep respect and reverence the Kodavas had for the land and its environment, that has nourished and sheltered them through the wars and assaults that are peppered through the history of the land (Ponnappa, 2013).

The Kodava ethos was embedded in the *okkas* (clans), a patrilineal joint family that traced a lineage back to a common *karana* (ancestor). These *okkas*, the source of a Kodava's identity, status, material prosperity, religious life and expression, were distinguished by their *mane peda* or the name of the house. Embedded in an intricate web of social relationships of friendship and enmity, neutrality and open aggression, each *okka* had mutually supportive relationships with selected *okkas*, to depend on in good or bad times, forming small clusters called *keris*. *Keris*, a cluster of four to five *okkas*, where people get together to prepare for village festivals, completion of public works, or whenever the need arises, is an old system of organizing alliances. . The clusters of simple houses, known as the *ur guppe* and *aine mane*, the ancestral homes built across Kodagu were designed strategically in military preparedness, to cater to the demands of the agricultural year, worship of ancestors and nature spirits and obligations

of the *okkas*, that reflected the rhythm of life in the land. The *aine manes* were the genius loci of the Kodava culture, the grandest houses in the land that have been silenced by the changing economy and the way of life.

The introduction of coffee in Kodagu was one of the most detrimental factors that gave rise to the destabilization of the ecology and culture. Within the first two decades of the British annexation of Kodagu, the landscape that the Kodava people had protected for centuries had changed irrevocably. Initially grown in smaller plots by the *Mapilah* traders, the British began to exploit its potential as a commercial crop, which led to massive deforestation of thousands of acres of prime forest areas converted into plantations which had devastating effect on the ecology, climate, culture and demography of Kodagu, where perennial streams became seasonal, wells ran dry in summer, soil erosion surface run off. Effects on biodiversity was also appalling with fish numbers dwindling rapidly due to drying, silting and denudation of the banks of the streams, birds and wild animals driven out of the forests by the lack of cover.

3. Present Day scenario

Kodavas, in the present day, continue to clear private forests to expand their plantations replacing the *devarakadus* and paddy farming in a rush for profit. The lure of coffee eventually gave rise to a new world which was to alter the identity and way of life of the Kodavas.

3.1. Property division, Conversion of forests and introduction to commercial crops

Large parcels of land that were owned by the ancestors in the land have been reduced to smaller land holding due to generations of property divisions, which has proven to be insufficient for survival in the present day. The farmers are hence prompted to convert larger portions of forest land into plantations as well as explore other commercial cropsto increase productivity of their coffee holdings and to overcome difficulties related to shade management and marketing of native trees owing to ban on green felling (College of Forestry & UAS, 2012). A case study in the village of Kottoli points out that a meager 4% of the farmers in the village had approximately 25 acres of plantations and a good 72% of the farmers owned lands less than 2 acres (ALET, August 2011).A discussion with a village elder and a farmer for 40 years revealed that the reluctance towards planting any of the native timber species as compared to the exotic Silver Oak (Grevillea robusta) and Erythrina sumbubrans was the growth and harvest cycle(Depommier, Summer 2003), which assured them a return on investment, within 10 to 15 years of planting, in comparison to teak, mahogany and rose wood which required a minimum of 30 years and above. Alternatively, silver oak permits equal number of coffee and pepper crops, an arrangement profitable for smaller land holders.

An assessment of change in forest cover during the last 20 years between 1977 and 1997 indicated that the forest cover has declined by 28% (from 2566 to 1841 sq. km), a large part converted into coffee and teak plantations after 1977 in privately owned areas (Elourd, 2000). In addition to land conversion, another important change in the characteristic of the coffee plantations is replacing the previously planted with Arabica coffee maintained under a good cover of mixed shade are being converted to Robusta coffee, which requires sparse shade (when compared to Arabica) resulting in decrease in canopy cover and population of native tree species. Initially encouraged by the government, planting Grevillea robusta gained pace due to the above mentioned benefits till the impact of ecological and agricultural plantation sustainability came to light. Today it covers 20% of the canopy cover in Coorg (Garcia, Marie-Vivien et al. 2007).The findings of the CAFNET project (2011) indicate harmful impact on the bird diversity ratios due to the increase in these trees in the agro forests.

3.2. Land use conversion – forests to coffee; paddy to sites

Reduction in shade trees, expanse of coffee and decrease in paddy farming has also impacted the ground water recharge. Studies undertaken under CAFNET project (http://www.ifpindia.org/Managing-Biodiversity-in-Mountain-Landscapes.html) has indicated that the amount of rain infiltrating into the soil is greater in native plots than in exotic plots especially in the Western and Central zones where there was a lot of rainfall. Therefore, lesser amount of surface water runs off from plantations with native shade trees into rivers, hence recharging the aquifers when compared to the plantations with majority of the exotic plants. The decrease in area under paddy cultivation in the

region due to lower returns and conversion of these lands to residential areas or alternate landuse has impacted the hydrological cycle mainly through reduced water recharge for local water bodies like tanks and streams which in turn impact the inflow to rivers.

3.3. Sand mining – deteriorating hydrology and aquatic ecosystems

The riverine ecology of the land is under serious threat due to extraction of sand from the river beds that is supplied for construction work in and around Kodagu and in Kerala. The sand mining has made the rivers wider and shallower hence impacting the riverine aquatic life.The Lakhsmantheerta River, a major tributary of the main Cauvery River is almost twice its original width due to sand mining (Col CP Muthanna, 2015). The biodiversity of the rivers of Kodagu first impacted by introduction of coffee plantations, now face death not only through sand mining, but also due to rampant encroachment of the river banks thereby allowing direct discharge of sewage and waste into its waters.

3.4. Tourism – Boon or a Curse?

A tourism impact study showed that 80-95% of major water resources are polluted by tourism activity and also same opinions have expressed by other research studies on water pollution in the district (Krishna et al. 2012; Divya et al. 2013; Venkatesha et al. 2013; Vishwanatha et al. 2014; Bhatnagar et al. 2009). The recreational and religious activities of tourists, dumping of solid waste into the water, washing vehicles, tourist hotels, resorts, lodges, home stays and health services, some of the main sources of pollution of the river Kaveri at its source (K.M, 2015) are impacting the ecosystem and services extended tocommunities within and outside the district. The land owners preferenceto build a resort or a homestay to farming and cultivating the land, in the least maintaining a sacred grove has also contributed to environmental degradation, due to increase consumption of local resources like water, wood, land and food as well as herbs.The study indicated that directly or indirectly, tourism has promoted approximately 21% and 7% of deforestation and landslides (K.M, 2015).

3.5. Urbanization and exposure to the Western culture

Urbanization is continuously drawing the youngsters and families to the city in search of educationand financial stability, an expensive westernized lifestyle considered trendy, thereby ignoring their hometowns, seasonal festivals, the dances and the rituals. The cohesive community lifestyle revolving around *okkas* and *keris* are now replaced with narrowness of thoughts and the individualization of the families favoring independent houses and urban lifestyle(Ponnappa, 2013).A conversation with the elders in the villages show that fewer people gather at the village festivals and the children have also lost link with their roots; the life once vibrant has become lonely and insecure in these isolated areas. The faith and the passion that sustained the communities, is dwindling under the changing laws of the land and is breaking down the traditions, leading to the disintegration of the *okkas* and *keris*, destruction of the sacred groves, abandon of the farming practices, disregard towards the other subservient classes of the people in Kodagu, the *Jamma Mapilah,* the *kurbas, poleyas, Gowdas,* etc..(Ponnappa, 2013).

The disintegrating picture of this unique culture is a cause of concern among the various clans back in Kodagu. At the turn of the millennium, when the pace of change is obliterating traces of many cultures faster than they can be recorded, the question that remains is whether the Kodavas will be able to uphold this unique way of life and preserve their identities for the coming generations? Or will the culture also adapt to the new values that have been dangerously altering their identities, and become indistinguishable from the other Hindu cultures? (Ponnappa, 2013)

4. Sustainable Model – Payment for Ecological Systems

At this moment, it is essential to pause and scale the torn fabric of social relationships, gather the loose ends of the culture and strengthen them by devising methods adapting to the changing society so as to handover to the future generations a culture, though changed, but alive. Many non-profit organizations, environmental BGOs, Developmental NGOs and the Karnataka Forest Department have come together to restore the lost glory of the

landscape through public and environmental awareness programmes and re-create a conservation-oriented society. The main themes covered under public awareness programmes were eco-friendly natural non-renewable resource-saving devices concentrating on rainwater harvesting, promoting solar energy devices, fuel efficient devices, organic farming, medicinal plants and conservation of biodiversity. Many alternative models have been developed to inculcate awareness among the people of Kodagu and curb the impending disaster (ALET, August 2011)(Claude Garcia, 2011)(Mani S. &., 2005). A model developed by the College of Forestry, Ponnampet and University of Agricultural Sciences, Bangalore is the Payment for Ecological Services (PES) model, which involves assessment and quantification of the ecological services provided by the forest systems in Kodagu and creating a sustainable system for managing agro-forestry using incentive based mechanisms like PES.

The various bio-resources available in the region, like mandrin, cardamom, Coorg honey, black pepper, valuable timbers like rosewood, teak, ebony, sandalwood, non-timber forest products like medicinal plants, bamboo, Garcinia, along with ecological services that food, water, timber, climate stabilization, recreation, etc.(College of Forestry & UAS, 2012) are extended to communities downstream and have been instrumental in the economic development of Bangalore and agriculture in Tamil Nadu. Hence PES is payment mechanism devised to collect payment from the beneficiaries of these services to help contribute to sustainable maintenance of these forests. Categorized into water services, carbon sequestration, biodiversity conservation and landscape beauty, PES attempts to analyze the contribution of a structured system of income gained from these services in terms of preservation and regeneration of these resources.

The natural mosaic of Kodagu comprises of forests and sacred groves, coffee agroforestry systems, paddy land, grasslands, the Shola forests and the wetlands that once sheltered a unique biodiversity alongside human settlements. The impact of human habitation due to conversion of forests into coffee plantations and commercial crops has led to losses in species richness and reduction in the forest regeneration. PES proposes the involvement of local communities for conservation of the human-dominated landscapes through the incentive based programmes using the landscape labeling approach. PES aims to reward and recognize the farmers who work towards arresting degradation, conservation and management of biodiversity by practicing organic agriculture, maintenance of sacred groves, the natural forest cover and the traditional rainwater harvesting techniques, etc. However, identification of individuals and quantification of their effort being subjective will require involvement of the community or local institutions for a common goodwill (College of Forestry & UAS, 2012).

5. An opportunity for Cultural Renaissance through PES

The system of Payment for Ecological Services using the landscape labeling approach proposed for an ecological revival of the landscape and to curtail further degradation of the environment of Kodagu, also provides a robust opportunity to explore a cultural renaissance within communities as well. The Kodavas, though prejudiced by urbanization and other cultural influences, still hold a deep regard for the land and the community, a deep regret for not being able to uphold the culture. It is only fair to explore a way that could harness this mutual feeling to revive the disintegrating culture of the Kodavas through a few potential techniques as listed as follows:

≠ Exploring the role of the Kodava Samajas in propagation of the culture and heritage
≠ Introducing the concept of sustainability, responsibility and respect towards the environment and the nobility Kodava culture in the education systems
≠ Using land pooling, community farming techniques to revive the *okkas* and *keris* of the land
≠ Proposing a business model where the women folk can contribute to produce and products harvested from the estates and their *pattis*.
≠ Assess the possibilities of other forest products for marketing apart from coffee and timber

5.1. Exploring the role of Kodava Samajas in propagation of the culture and heritage

The decline of Kodava dominance in their homeland due to the impact of colonialism and the Land Reform Act 1974, strengthened by their conversion through the 20th century to the academic and professional classes and their dominance in Kodagu politics.Efforts by community leaders have brought together all Kodava groups from around the world under an umbrella of the "Federation of Kodava Samajas".The Kodava Samaja emerged as an

organization created for the traditional and cultural conservation, social well-being and welfare of the Kodava community, which integrated all the Kodavas who have disconnected from their natives and settled in various parts of the country and the world. Hence, exploring the role of the Kodava Samajas in the cities and villages in educating the younger generations regarding the rich heritage and the instigating the feeling of pride for the land is of utmost importance. These institutions can also hold evening classes or cultural classes in the respective wards in the cities to teach them the oral traditions and rituals. The institution should be able to inculcate a feeling of enthusiasm among the young Kodavas and *Kodavathis* to perform these practised rituals back in their villages could help revive the rituals of the sacred groves. The Kodavas living in cities should be encouraged to plan vacations during the seasonal festivals of the village so that their children are aware of their relationship with the soil. The Kodava Samaja would be considered an integral part for any collaborative efforts planned to integrate the rural and the urban centers for any socio-economic model considered for the revival of their homeland.

5.2. Introducing the concept of sustainability, responsibility and respect towards the environment and the nobility Kodava culture in the education systems

"I have travelled across the length and breadth of India and I have not seen one person who is a beggar, who is a thief. Such wealth I have seen in this country, such high moral values, people of such calibre, that I do not think we would ever conquer this country, unless we break the very backbone of this nation, which is her spiritual and cultural heritage, and, therefore, I propose that we replace her old and ancient education system, her culture, for if the Indians think that all that is foreign and English is good and greater than their own, they will lose their self-esteem, their native self-culture and they will become what we want them, a truly dominated nation." Lord Macaulay, British Parliament, 1835.

Our educational systems and institutions have undergone a massive change during the colonial period, where the ancient texts and way of life was considered as redundant and made to be looked down upon. The various levels of education are a glorified treatise of British contribution to the upliftment of India. The glorious past of India is reduced to a dismal rendering of the various vices and inconsistencies of the societies presented to students as facts, ultimately leading to an unappreciative attitude among the younger generation that is aware of the glorious past of India, but are still unknown to its glory. Blinded by western education, the younger generation tend to question their roots that revolve around sharing and community living, and reject them in complete disregard since they do not match with their education that teaches them individuality and independence. The competitive pressure introduces the mind to greed, selfishness and modern craving for an expensive westernized fashion and lifestyle that unconsciously instills a feeling of dependence on the city banking and financial systems, in turn trapping them as slaves to these institutions. A probable hope for a glorious future would begin with relooking into the educational systems by introducing the origin, history, formulation of *shastras* and folklore of India and the Kodavas, analytical and logical problem solving techniques nature related activities, practice of sustainability, farming and community service and above all humanity, along with the facts of world history and current affairs into the curriculum. Young children should also be encouraged to work on farms from a very young age so as to acquaint them with the essence of the earth.These would in all probability initiate the gradual revival of the cultural systems and reverse the individualized thinking pattern of the youngsters set in by current education pattern. A better understanding of the scientific facts that have led to the formulation of our rituals and customs in the ancient times would instilla feeling of respect for family traditions, culture, land and people and compassion rather than competition. Instilling a profound respect for the land, the environment, the culture, the community and the people should be the goal of education.

5.3. Using land pooling, community farming techniques to revive the okkas and keris of the land

On the rural front, the techniques of land pooling and community farming can be considered as an opportunity to revive the system of *okkas* and *keris* along with the support of the *jamma bhoomi* activists. Farmers with larger land parcels have an advantage over the smaller land holders in terms of reviving the natural mosaic of Kodagu. In these larger portions of land, increasing the native tree cover and plants could have lesser economic impact than when proposed on smaller land holders, due to which there is a general reluctance observed among smaller farmer about

switching back to native shade planting. However, if the lands of the*okkas*and the entire *keri*are integrated and considered to be one large piece of land, it would offer a higher potential to restore the fragile and diminishing ecological mosaic of Kodagu. Applying the PES system and landscape labeling to each *keri*, a co-operative society can be constituted to oversee financial, social, cultural and labor related negotiations, that would also help find labor to help with plantations and paddy fields for the whole *keri.* This also provides an opportunity to reinstate the *takkas* of the land by electing senior Kodavas to preside over the issues. The enthusiasm of the *jamma bhoomi* activists could also be harnessed to help with agricultural and cultural activities, reintroducing the seasonal harvest festivals and rituals, harmonizing and evolution of agricultural and irrigation practices, initiatives on organic farming, dairy farming, agroforestry and composting can be experimented considering the topography of the land not the extent of the land owned by individual farmers.

5.4. Proposing a business model the women folk in Kodagu

The women folk of Kodagu have played an active part in driving the economy of Kodagu through gardening, vegetable farming, growing medicinal herbs and making saleable products from the fruits and vegetables like pickles, jams and wines. The impact of westernized system of education has gradually led to these practices being abandoned at large by the younger generation of women, who have diverted their attention towards a career, employment in the urban centers and luxury and socialization. Nevertheless, the practice is still on in a few okkas spread all across the land, the numbers are diminishing though. There has been a revival of the practice initiated by the College of Forestry along with a few villages, where the women folk are introduced to a business for products like jams, pickles, wines, marmalades, etc. produced from the harvested fruits and vegetables. These women are also encouraged to grow vegetables in their *pattis* and the paddy fields during the fallow season to generate revenue and also keep the fields active through the summers, thus retained the moisture round the year. Paddy farming during the monsoons will inturn help rejuvenate the underground streams and springs, which cumulatively over time would revive the water bodies in Kodagu. Growing fruits and vegetables would also encourage employment for the labor class and revenue from the sale of fruits throughout the year, as opposed to the single time profit of coffee.

5.5. Assess the possibilities of other forest products for marketing apart from coffee and timber

Another recommendation could be to relook at the forest products being harvested for profit. Timber has been one of the main produce of the forests in Kodagu. Fruits and vegetables have also been available in abundance in all plantations for an extended period. However, the plantation owners do not see any profit in selling these fruits to the urban centers and markets. In discussion with a village elder, it was brought to light that there is a dearth of market for fruits in Kodagu since all plantations have the same kind of crop. Transportation to other parts of the country would be cumbersome and expensive for individual farmers. A glance at the fruits grown in Kodagu demonstrates fruits like jackfruits, avocadoes, sapotas, oranges and guavas to be found in abundance in plantations with native trees. These fruits are heavily priced in urban centers. Integrating the land of a *keri* offers an opportunity to explore harvesting these fruits on a larger scale and selling them in the cities. This would also avoid the hassles of haggling with middle men for a good price since the transportation and marketing could be taken up by the co-operative society and the *jammabhoomi* activists. This would shift the focus from timber farming towards fruits and vegetables and also reduce the necessity to invest in Grevillea robusta on a large scale. All *okkas* can individually be involved in planting vegetables in their respective homes that could also be harvested and sold off through the *keri* co-operative society. The population in the urban centers can be involved in the marketing and also be able to co-ordinate with their respective keris regarding harvests and crops. This could also open up avenues for revenue generation that could be a source of a common benefit to the people and land of Kodagu and the country as well.

6. Conclusion

Kodagu is on the verge of an impending environmental disaster, due to the impact of the human settlements, their greed and reckless attitude towards the elements of nature. The ecological services of Kodagu also impact the other nearby towns and cities and the hydrological services are the basis of the economic and agricultural development of

the cities downstream. Rapid urbanization, changed priorities of the needs and ambitions of the Kodavas and globalization of the education systems act as a stimulant for the younger generations to move out of the district in search of an elite westernized lifestyle. People living in the rural areas also have averted from community living and adopted a lifestyle based on individual profit and status, result of which is that the younger generation does not share the reverence for the land that was a way of life for their ancestors. As a consequence, the environment and ecology of the land has seen a sharp decline which is persistent at an alarming pace even today. The PES system that demonstrates a good platform for an appropriate beginning to revive the landscape of Kodagu also holds the potential to revive the socio-cultural fabric of the land. Coupled with the social systems and other initiatives along social lines, the PES system could become a turning point in the challenge towards a cultural and ecological renaissance in Kodagu.

However, it is worthwhile to mention at this stage that the culture of the Kodavas that had preserved the landscape of Kodagu for centuries have always been that of a close knit, introverted and a self-sustaining nature devoid of a financial motive, educated through oral traditions and ignorant of the rampage of modernization. The exposure to urban centers, other cultures and global education systems has acted as a trigger for the fragmentation of the conservation based culture of the land and led to the exploitation of the resources. It is the importance attached to money and progress that has brought about the Kodavas to abandon their belief systems and destroy their own landscape. The thought to ponder over is that what would be a healthier approach to build the future sensibilities of the younger generations; proposing a sustainable model that looks for external markets for the survival which still retains an opportunity for corruption for profit, wherein the shade of trees would end up being sold on papers, or decoupling from the city based dependencies, reverting back to the traditional model and creating a market for their produce within their own community to sustain the livelihood of the people, independent of a financial motive, which could recreate the interdependencies of the society that was abandoned.

Acknowledgements

I thank Dr. C. G. Kushalappa for sharing the concept of PES with me and contributing to my research. I would also like to thank the various farmers, who were interviewed and answered by questions with utmost patience. I would also like to add a special mention for Mr. Salil Khanna who helped me in reviewing the proposals and conclusion.

References

[1] ALET, J. (August 2011). What are the possible current and future dynamics of agroforestry and agricultural landscapes in the Western Ghats (Southern India)?: A case study: Kottoli, a village in Coorg. Pondicherry: French Institute of Pondicherry; AgroParisTech - ENGREF.

[2] Claude Garcia, M. L.-M. (2011). Thinking the Future: Coffee, Forests and People- Conservation and development in Kodagu. Pondicherry: AgroParisTech -ENGREF.

[3] Col CP Muthanna, P. C. (2015, May 09). TO PROTECT AND SAVE KODAGU-LAND OF CAUVERY. Retrieved October 02, 2015, from Karnataka State Pollution Control Board: https://kspcb.wordpress.com/2015/05/09/to-protect-and-save-kodagu-land-of-cauvery/

[4] College of Forestry, P., & UAS, B. I. (2012). Payment of Ecosystem Services (PES) in Kodagu, Western Ghats of India - A Casestudy. Bangalore: College of Forestry, Ponnampet; UAS, Bangalore, India.

[5] Depommier, D. (Summer 2003). The tree behind the forest: ecological and economic importance of traditional agroforestry systems and multiple uses of trees in India. Tropical Ecology, Vol 44. Issue 1, Page 63.

[6] K.M, S. H. (2015). Socio-Economic and Environmental Impact of Tourism in Kodagu District (India): A Case Study. Universal Journal of Environmental Research and Technology , Volume 5, Issue 1: 41-48 .

[7] Mani, S. &. (2005). Coorg – An Alternative Model. 'Education for a Sustainable Future' an international conference on Education for a Sustainable Future. Delhi: Centre for Environment Education (CEE), India.

[8] Mani, S. (n.d.). Practises Concerning Nature Worship - Sacred groves of Kodagu. Retrieved September 28, 2015, from Parampara - Documenting Efforts to conserve India's Living Traditions : http://www.paramparaproject.org/traditions_sacred-groves-of-kodagu.html

[9] Norman Myers, R. A. (2000). Biodiversity hotspots for conservation priorities. Nature: International weekly journal of science, 853-858.

[10] Ponnappa, K. (2013). The Vanishing Kodavas. Mumbai: Eminence Designs Pvt. Ltd., Opera House, Mumbai.

Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 1766 – 1773

Procedia

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Politics of Urbanscape:

Transfiguring the Image of Kolkata

Shreyasi Pal[a]*

[a]*BMS School of Architecture, Yelahanka, Bangalore-560064, India*

Abstract

The claim of aesthetic modernity arriving before social modernity (1) is being investigated with reference to 'intense experiments of city-making' in Kolkata. This brings into focus the socio-political inclination of packaging cities to fit a 'global image of efficiency'. Here a deliberate attempt is made to look for specific geo-political appropriation and/or reproduction and/or rejection of both the global and the traditional aesthetic- thus identifying role of aesthetic convictions of the masses, the bourgeoisie and the State, in *Asian experiments of worlding cities* (2). The recent tendency in urban studies to locate the geography of authoritative knowledge in specific cases of the Global South is the context of this study (2). The paper would touch upon three *beautification* projects of Kolkata, at different stages of the post 90-s neo-liberalization era. The subversive claims of the politically conscious masses juxtaposed with the refusal of middle-class global aspirations to remain in the 'waiting rooms of history' (3) and simultaneous knee-jerk policies to compete for global capital provide an interesting case. Kolkata, both suffering from and celebrating its poignant urbanscape- presents a specific referent of how 21st century Indian cities are not just borrowing Western urban aesthetics but are 'inevitably home-grown' in their construction of appropriate aesthetics. The attempt here is limited to an examination of the desired image of the city, politically defined but socially negotiated, as a locus of possibilities, thus recognising the creativity and violence of space-making in Kolkata as a source of broadly relevant urban theory.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

*Keywords:*Urbanscape; World-class; Image-making; Kolkata; Global South; Worlding; Aesthetics, Operation Sunshine; Barnaparichay book mall; London

1. The Prologue

Lewis Mumford says that "The city...is also **a conscious work** of art,…The dome and the spire, the open

* Shreyasi Pal. Tel.: +0-989-926-4458
*E-mail address:*shreyasi.bmssa@gmail.com

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.214

avenue and the closed court, tell the story, not merely of different physical accommodations, but of essentially **different conceptions of man's destiny**" (4).Aesthetics, as Rancière puts it, is a redistribution of the sensible(5) and here I enquire about what kind ofurbanscape aesthetics makes sense to us now as our deeply historical cities of the subcontinent undergo *worlding* processes i.e. how does the shared public imagination envisage our cityscape? The polar opposites which make claims to our aesthetic sensibilities may include aesthetization of slums (6)or what may be termed a preoccupation with the informal, spurned by the 80-s search for Indian identity and, a Western aesthetic of spatial modernity, appropriated by global capital as the "regulating fiction"(7) of 'image of efficiency'(8). As Roy puts it 'the modernity and globality of Southern cities is studied in the valence of surprise and dismay; they are seen to be weak copies of a Western urbanism, a betrayal of an indigenous urban formation'(2).

2. Case-Studies

I look at popular response to three urban scale beautification projects based in Kolkata- project Operation Sunshine of early 90s through which the informal sector was displaced off the streets of Gariahat, project Barnaparichay through which the *boipara* –the neighbourhood of books- was planned to be relocated inside a mall and the more curious and current stance taken by the State to makeover the image of Kolkata by 'recreating London'. The legitimacy of these case-studies as referents for social technologies that produce Global South models of urban space making, lies in the belief that '"an urban situation can be at once heterogeneously particular and yet irreducibly global." (2)The case-study events under scrutiny, spread across the neo-liberalisation era, are chosen such that shift in both popular and official imagination of the desirable image of the city can be traced over two decades.

These instances revealcontextually generated aesthetic convictions which mighthelptorelocatein the Global South what is called the 'locus of authoritative knowledge' about urban space generation. These hybrid modernities, not as culturally modified forms of singular idea(s) of modernity but re-read (and thus qualified) as originals, can be thought to be produced as a negotiation among the political claims of the masses, nostalgia for urban legacies, perpetuity of traditional urban networks and processes, and the free play of capital and what GuyDebord and later Henri Lefebvrecalls'colonization of everyday life'(9).The focus here would be the various aesthetic judgments associated with the creation, dissemination, reception and rejection of information and images with reference to the specific cases under scrutiny.

2.1. Operation Sunshine: Cleansing of Informality

The following quote from a street trader inMaserucaptures how urban informal sector in all developing nations is in conflict with the modern idea of desirable streetscape- 'My heart sank when we were told that we were being evicted because **we- the people- spoil the beauty of the streets**. It taught me that we poor people who are trying to make a living for our children have no right in this democratically elected government.'(10)The *bazaar aesthetic* is notably a celebrated spectacle of the Indian subcontinent- a part of the repertoire of exotic images associated with an *orientalist* view of traditional India and is often appropriated in niche high culture architecture and urbanism, with carefully controlled reproduction of the messy visual vibrancy. The Delhi*haat*-s, Bangalore *saanthe*-s for example, in a controlled environment recreate artisans' rural markets. This postmodern borrowing of familiar aesthetic is not formally recognized (nor does it really enjoy popular sanction) and has not percolated into official imaginations and thus urban policies. Thus the real bazaars- the informal sector- catering to the teeming masses is under constant threat of, what has been termed, *vigilante urbanism*(2). The distribution and the redistribution of this aesthetic is then essentially a political manifestation of unequal 'rights to the city'(11) and urban commons.

The site of the first event under scrutiny islocated in one of the old mixed-use, predominantly commercialareas of South Kolkata- Gariahat (the name itself suggests it might have been an old*haat* or rural market). As with all cities under developmental pressure, a vibrant informal economy thrived in the by-lanes of the area, exerting rights over almost all available and appropriable public space, contributing heavily in the economic processes of the area. Kolkata is home to about 15 million people and it has absorbed refugees and migrants for years, much before neo-liberalization started. It must be noted that South Kolkata is essentially an upper middle-

class stronghold, with a lot of erstwhile private households, apartments, Government staff-housing etc. As Partha Chatterjee puts it, Indian cities have become bourgeois (at last)(12), i.e., the empowered middle-class are today incidental winners in urban contestations of value-systems and thus it is often the middle-class sensibilities that get reflected in administrative decisions. And hence Operation Sunshine cleared the footpaths of Gariahat 'tidying away the poor' in 1996, amidst much resistance. It was simultaneous with a customary and unwise relocation plan, in complete disregard of the significance of the right location in street trade. It was a typical case of exploitation of the lack of citizenship of the dependent city (13). Roy has noted here a seminal shift in attitude on part of the political party in power, which had rose to almost uncontested power based on their championing of the refugees, migrants and all associated with urban informal sector. But this is not an instance of the uncontested hegemony of Western aesthetics. The twist to the story is the resilience shown by the informal sector and its subsequent resurrection. Today hawkers and informal shops continue to thrive on the footpaths of Gariahat. Steady and successful resistance and political claim staked on public space for livelihood was directed by the Calcutta Hawker Sangram Committee, a union of more than 32 local hawkers' association. Continual resistance and campaigning for their rights prompted the commencement of the rehabilitation process, which started six years after the incident and was fully realized by 2013.

Figure 1. A Screen –shot of a politically-inclined website promoting the current government's initiatives, championing the rights of the informal sectorin direct (and possibly politically motivated) opposition to the street cleansing operation of the erstwhile Leftist government.

In the '"Politics of archiving: hawkers and pavement dwellers in Calcutta", Dr. RitajyotiBandyopadhyay has argued that the critical role played by this so-called *political society* is their putting forward of an alternate image of the informal sector as vital entrepreneurial initiatives, strategically contradicting, putting in sharp contrast and in somewhat unflattering light, the unnecessarily negative image cultivated by bourgeois associations(14). This remarkable resilience on part of the proletariatcan be said to embody strategic maneuvers through which the *political society* appropriates governmental policy making ((12) and in this case, makes claims on built environment. Sterility of modern aesthetics does not allow for the unpredictability, temporality and visual chaosof street vending arrangements but urban public space is an essential physical capital used by poor urban households everywhere. Hostility towards the informal sector is by no means restricted to the Global South and there are documented evidences of the same in the West. Everywhere a common causal factor seems to be the perception of the people and processes, lying outside the formal boundaries, as a nuisance. Street shopping in an informal market is an intense and critical part of the shared lived experience of the city and by extension, a part of a repertoire of images one comes to easily associate with. It has the possibility of being assimilated in the public imagination of a vibrant, safe and livable city. Both street shopping and the formal shopping malls enjoy popular patronage. There seems to be an easy co-existence of images different kinds shopping environments in the public imagination, each not necessarily denigrating the other. Thus we could explore the possibility of an accommodation of the informal aesthetic with global images, which might enablean alternate urban vision where the streets are not periodically and unnecessarily cleansed of people and where working in public space is progressively de-criminalized.

2.2. Boipara: Reigning in the neighborhood of books

'I could not even imagine that books were sold with clothes and vegetables.'- A citizen response to the idea of selling books in malls, as recorded in the paper 'Barnaparichay – a mall in progress, a street in transition' by Anurag Mazumdar(15)

We move our discussion to the older part of Kolkata- the North, replete with memories, associations of old Calcutta charms. The intellectual pulse of the city was, from the time of Bengal Renaissance, centered around her

prestigious academic institutions, e.g. the Presidency College, Sanskrit College, University of Calcutta, in an area which developed intothe College Street*boipara*- a neighborhood of books, catering to students, academics and booklovers of the city. The images one fondly associates with*boipara*are the narrow by-lanes lined with second-hand book shops, bigger establishments on the wider main roads, and of course, the oft-celebrated smoke-filled image of the Indian Coffee House, where all the intellectual stalwarts of the city would once gather and raise storms in teacups. It is a thriving economy, largely informal, where books are the predominant commodity. Conjunct to a move to upgrade all old municipal markets, the State decided to build a mall dedicated to books to relocate all the bookshops. And in keeping with mall typology, the bigger publication houses were to serve as ground floor anchors. The smaller shopswith small margins, dependent on impulse purchases, were designated to occupy higher floors. effectively the layout ensured that they would not be able to bank on the natural shopping tendency of buyers to stroll along horizontal routes.

a b

Figure 2. (a) The street shops, mainly informal, lining private properties; (b) The mall that is slated to accommodate the shops- the hoarding in front is still advertising for its spaces, appealing to book-traders.[by BiswarupGangulyunderCreative CommonsAttribution 3.0 Unported]

The mall as a shopping destination was introducedrelatively late in Kolkata, arriving only in early 2000-s, much later than the rest of the nation. The familiar and culturally celebrated *boipara* had a poignant aesthetic which made a sharp contrast with the generic image of a shopping mall. The loss of both tangible and intangible heritage, the violent disregard of the shared aesthetic, economic and lived space value of the historic area was negatively perceived as, besides being commercially unviable, an attempted commodification of the *boipara* culture in the shared urban imagination of the citizens, in this case, both the marginal and the bourgeois. The official imagination had failed to gauge the significance of the iconicity of the area in public imagination. The project found wide unpopularity and unlike, the previous case where *vigilante urbanism*(2)could get punitive action implemented against the informal sector, even if temporarily, this project found heavy resistance from all sectors.

2.3. Recreating London: Addressing the colonial *other*

The recent State decision to makeover Kolkata along the lines of London has met with skepticism at best if newspaper articles are to be believed. It is the choice of desirable image that is curious and fit for intense deliberation. To elaborate on the existing culturescape along the Hooghly riverfront, it still has dilapidated remains of ports of the British, French, Portuguese, Dutch, Danish from colonial times, besides unique assemblage of temples, ghats, *kumartuli*(clay artisans' settlements), old river-facing mostly neo-classical mansions of the *babu*-s-reminiscent of 18th century Calcutta, besides the iconic HowrahBridge (RabindraSetu) andVidyasagarSetu. Recent interventions have converted a limited stretch into a landscaped promenade, while the main stretch remains as a neglected repository of images of the city's eventful past.

a b

Figure 3. The ghats (paved steps) lining the Hooghly is part of the intensely busy culturescape of the area; its architecture is often either belonging to or reminiscent of the revivalist tendencies of 18th century colonial Calcutta. [byBiswarupGanguly (a) and Bernard Gagnon (b)CC BY 3.0]

a b

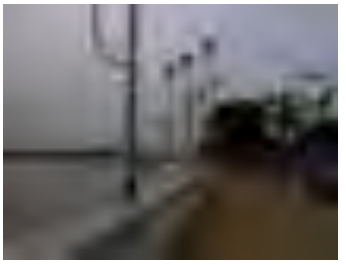


Figure 4. (a) The paved promenade of Millenium park- a part of the ongoing Hooghly Riverfront project;; (b) Thames riverfront with the London Eye. [by Amartyabag (left) under CC BY 3.0 and Kalaha (right) underCreativeCommonsAttribution-Share Alike 1.0 Generic]

Back in 1989, Harvey wrote about how 'Bread and circuses' is a well- tried formula deployed to pacify restless or discontented elements in the population(16). There is a lot of pressure on the State to attract industry and capital, given the pessimistic economic condition. The current strategy of the State to recreate the Thames riverfront along the Hooghly ghats in Kolkata is concurrent with tendencies across the nation to borrow 'images of efficiency' e.g. the National capital Region's stated master plan vision is that of a 'world-class city'. The reflex urban regeneration strategy in Kolkata had so far been the predictable carrots to capital- unnecessary flyovers (notably and surprisingly criticized by mass media) to evade the congested real city, a new and expensive international airport.Andnowit is this curiously unique idea of tapping into a possibly deep seated aspiration towards the colonial *other*- London. It is worthwhile to mention that a more likely reference would have been Asian examples like Singapore, Hong Kong or Shanghai or even American cities.

a b

Figure 5. Architectural vocabulary in the colonial parts of Calcutta is essentially revivalist- where the skyline is deceptively European while the public realm is disengaging- freely appropriated by contemporary flows. [byP.K.Niyogi (a) and BiswarupGanguly (b) under CC BY 3.0]

a b

Figure 6. The old photographs of the city which celebrate its poignancy- the traces of colonial heritage lingers behind all the visual clutter [(a)'A bewildering mass of billboards at the corner of Harrison Street (Burra Bazaar) and Strand Road, Calcutta, 1945' by Clyde Waddell, Public Domain; (b) by Rajesh Saha under CC 4.0]

The idea of public-ness of urban commons in India is a colonial construct where the shared public spaces traditionally would be dependent on the bazaar spectacle and perceived within the diad of the sacred and the profane. The colonial power-subject configuration and the percolation of Western urban design as a desirable superior ideal in the Indian mind is a well-researched phenomenon. The *here* vs *there* thus created has more to do with, both the imagined and the omnipresent neo-classical and neo-Gothic aesthetic in the colonial parts of the city-

the CBD area representative of (the colonial construction of) Western superiority in public imagination. As an exercise if a photograph of colonial Calcutta is divided above the ground floor in two parts, distinct eras, geographies and sensibilities would be revealed- the top portion can be from any part of old London while the bottom part, teeming with humanity, is again a scene befitting a 'bursting at seams' Global South city.

Figure 7. Newer insertions in the city fabric- the IT MNC offices, the shopping mall unapologetically celebrate Western aesthetics [by Kolkatan under CC 3.0]

The reference for the current scheme is however contemporary London with the London eye as one of the models which are slated be faithfully translated on the Ganges bank. The worlding here, triggered by demands of aesthetics of 'planetary capital', is curiously rooted in local and contemporary negotiations of public imaginations both of colonial pasts and global contemporaries. All the images we are made to associate with Kolkata, by popular media, is that of acute nostalgia while this moment in history, demands that we break free from our implied lock-in in the 'waiting rooms of history'(3).

3. The Epilogue

3.1. Popular Imaginations: the Vernacular – Western binary

Ong argues 'There is no single teleology of modernization, no prescribed ladder of development to climb. Instead, the postcolonial condition hosts a multitude of performative and speculative enterprises, all of which operate through geographic referent'.(2) Here the point of enquiry is the socio-political imagining of desirable urban aesthetics on the part of a wide range of participants, often with conflict of interests and convictions. As Goldman puts it, 'Worlding is the "speculative urbanism" of information technology, finance capital, and real-estate development, but it is also the anticipatory politics of residents and transients, citizens and migrants'. The State in its official imagination of the future of the city again has to negotiate between these contesting aesthetic appropriations.

Kolkata is a city which both suffers from and celebrates its poetically poignant urbanscape. Its portrayal in movies, literature and critical writing, unfortunately can fit in perfectly with the universal image of cities of the Global South- 'megacities, bursting at the seams, overtaken by their own fate of poverty, disease, violence, and toxicity. They constitute the "planet of slums," with its "surplus humanity" and "twilight struggles." (2). The billboards, newspapers, the government policies etc. however promote the *spectacle*. The image the State wants to portray, today, to attract capital investment might be more in agreement with 'modern' middle class aspirations, and more critically, the "everyday experience of world-class aesthetic discourse" (17). The omnipresence of images of the 'good life', defined in the West and produced by global capital, construct a utopia which had led to overvalorization of capital and geographies of contradictory spaces, characterized by contestation, internal differentiation and sharpened inequality(18). The billboards, print media, television, academic musings as well as fiction all are proliferated by images tailor-made for our consumption.The*punctum effect* produced by mass media- 'everything that appears is good, everything that is good appears'- the ever insatiable- competes with nostalgia for the seemingly inherently tenacious traditions- (though the vernacular too is allegedly appropriated by capital). Continental postmodern philosophy (Barthes) reiterates that experience no longer exists in a Kantian pure state,– where visual media become messages without a code- as direct links. Images are authentic traces of always only a *part* reality, and lean heavily on either of the two poles- images of 'good life' of un-satiated desire constructed by capitalism or that of memory, association, myth, nostalgia and baggage. That is both the sets are empty- endlessly

redefined simulations with manipulative agencies. The case studies are expressions of yearning and conflict and negotiation while both sets of images in circulation airbrush out the conflicts, reinforcing our convictions of 'lack' (Debord) in both counts.

3.2. Charting new Territories: Re-reading the Overlays

Negri long back had expressed hope about the present juncture of free flow of visuals as a potential moment of free and easier forms of communication- a contemporary culture emancipated by images. Notwithstanding the heavy critique of the same, for example by T J Clark, who dwells on the manipulative compressed pseudonarratives of images, I think Negri's notion in our context warrants some merit. The free flow of images, ideas and their juxtaposition in our context might not mean an 'endless slippage of meaning' but the creation of new meaning – not empty codes- but a *detournement*- a new ensemble of pre-existing elements, undermining the originals in its search for relevance- not schizophrenic or apologetic hybrids but a deliberate and conscious construction of the blind-spot of Lacanian visual field where identity is pleasurably fragmented.

Jean Baudrillard, in his seminal work 'America' argues that contemporary society knows itself unreflexively, only through the reflections that flow from the camera's eye(19).Since the discussion here is of popular dissemination of representations, let me briefly focus on the evolving portrayal of Indian cities on celluloid, with reference to a few popular commercial Bollywood films (and not in serious parallel cinema).

The Indian city was the *other*- a dystopia as seen in Shree 420 (1955), Pyaasa (1957) where protagonists would find themselves alienated. Simultaneously, for the Nehruvian post-independent young nation, confidant in modernist visions, utopia was located the West (mainly Eurocentric), and celebrated in cinema as well e.g. An Evening in Paris (1967). This trend was lost in the 80-s when a broader cultural struggle for search for identity (as reflected in angst of protagonists and loss of faith in the erstwhile convictions) was in prominence. However in the popular films of the post-liberalization 1990-s one again finds frequent foreign locales- the West again had captured the popular imagination as seen, for example in one of the Bollywood blockbusters of the time DilwaleDulhania Le Jayenge (1995). If we jump-cut to the early 2000-s broad cultural commodification tendencies, seen in all spheres of culture, finds application in cinema as well. One notices a deliberate attempt to portray a part realistic 'version' (high culture reproduction of messy vitality) of the city, replete with popular socio-cultural references, as seen in the reference of Lajpat Nagar refugee colony in 'Vicky Donor'(2012) or the Jat settlement in urban villages of Gurgaon or the placeless DDA housing in 'Tanu weds Manu returns'(2015).

The broadly accepted impression might be that the social realism of Indian parallel cinema was a tool of resistance till Neoliberal "Niche" Globalization took over and the images were set for popular consumption. As signs, they lost critical resistance.However Tewdwr-Jones(20) reflectsthat the city is not only that which appears on the screen, but also **the mental city made by the medium of cinema**, **subsequently re-experienced** in the real private and public spaces of the city. With time the notion of the *other*might be thought to have been at least partially assimilated in the *self*, leading to a relaxed attitude about the perceived conflicts.Popular aesthetic judgment in all spheres might have turned amicable to a peaceful juxtaposition of conflicting value-bases- the arrival of the 'Indo-chic' in the cultural politics of consumption being a case. For example in the fashion scene, we see the Kurti-Jeans ensemble has conquered our imagination. The interesting exhibition Jugaad Urbanism: Resourceful Strategies for Indian Cities,curated in 2011, explores and celebrates the 'making do' (*jugaad*) way of designing built environment and life by citizens in contemporary Indian cities- a resourceful but messy alternative that might as well serve as an example of bricolage of essentially inconsistent ideas as an acceptable state of affairs.

In his remarkable essay 'Is There an Indian Way of Thinking?' Ramanujan elaborates on the Indian openness to a multiplicity of possible ways of approaching a problem (21). The Indian way has been throughout history that of slow assimilation.To explain the plurality of applicable and valid procedures Ramanujan refers to a tool-box of ideas- and each situation apparently calls for a 'bricolage' of applicable ideas- from 'a cluttered arsenal'.Ramanujan says that 'the 'modern', the vehemently context-free, becomes just another context for us to assimilate, though it is not easy to contain' (21). This attitude might not necessarily reflect vulnerability or easy susceptibility to new ideas, options and variations but a deep-seated societal inclination to steadily accommodate, appropriate and finally assimilate changes, reproducing contextual versions which qualify as originals in due course.

Tewdwr-Jones says that images or representations communicate ideas about places that can sit heavily on people's emotions and sense of attachment to the represented locations and, additionally, to people's own ideas about the identity and meaning of the place.(20)We are conditioned to the overlaying of various times and spaces in

our cities. The old the traditional and the western and alien, in their juxtaposition, may thus cease to be merely interdependent binary notions but as an overlay necessitate a contextual re-reading- uncertainty and doubt and loss of control in interpreting meaning in these images might just be an opportunity. As designers of built environment the objective would be to be speculative and optimistic(22) about of this moment. DipeshChakrabarty talks about our non-historicist history consisting of heterogeneous temporalities- 'our present epistemology is everywhere at every historical moment from the past up to now' and so to be authentic our images need to be true to all our simultaneous temporalities(3). The production of desirable aesthetics of built environment and the consequent public consumption of the same thus has to tactically accommodate the contradictions in an easy hybrid, socio-culturally sustainable and contextually negotiated.

Acknowledgement

Interdependency between politics and built environment has been an area of interest for a while and related strands have been, on previous occasions, deliberated on, published and presented (e.g.http://www.epw.in/commentary/politics-architecture.html) in collaboration with Thomas Oommen, architect, urbanist and fellow-Director of Collaborative Urbanism.

References

[1] Mehrotra, Rahul.*Architecture in India: Since 1990.* s.l. : Hatje Cantz, 2011.
[2] Roy, Ananya. "Post colonial Urbanism: Speed, Hysteria. [book auth.] Ananya Roy and Aihwa Ong. *Worlding Cities:Asian Cities and the Art of being Global.* West Sussex, UK : Wiley – Blackwell, 2011, pp. 307-332.
[3] Chakrabarty, Dipesh.*Provincializing Europe: Post colonial thought and historical difference.* Princeton : Princeton University Press, 2000.
[4] Mumford, Lewis.*The Culture of Cities.* s.l. : Harvest Books, 1970.
[5] Rancière, Jacques.*The Politics of Aesthetics.* London : Continuum International Publishing, 2004.
[6] Roy, Ananya. Transnational Trespassings: The Geopolitics of Urban Informality. [book auth.] Ananya Roy and Nezar Alsayyad. *Urban Informality: Transnational perspectives from Middle-East, Latin America and South Asia.* Oxford : Lexington books, 2004, pp. 289-317.
[7] *Global and world cities: a view from off the map.* Robinson, Jennifer. 2002, International Journal of Urban and Regional Research, pp. 531–554.
[8] *Frothing Urbanism: Urban Conditions in India.* Gupte, Rupali, Mehrotra, Rahul and Shetty, Prasad. 2007, ARCH+ 185 (November, pp. 41-43.
[9] Lefebvre, Henri.*Critique of everyday life.* Michigan : Verso, 1991.
[10] Brown, Alison.*Contested Space: Street Trading, Public Space, and Livelihoods in Developing Cities (Urban Management).* s.l. : Practical Action, 2006.
[11] Lefebvre, Henri.*The Production of Space.* Malden : Blackwell Publishers Inc., 1992.
[12] Chatterjee, Partha.*Politics of the Governed, The: Reflections on Popular Politics in Most of the World.* s.l. : Orient BlackSwan Pvt. Ltd, 2005.
[13] Roy, Ananya. The Gentleman's City: Urban Informality in the Calcutta of New Communism. [book auth.] Nezar AlSayyad Ananya Roy. *Urban Informality: Transnational Perspectives from the Middle East, Latin America, and South Asia.* s.l. : Lexington Books.
[14] *Politics of archiving: hawkers and pavement dwellersin Calcutta.* Bandyopadhyay, Ritajyoti. 2011, Dialectical Anthropology, pp. 295–316.
[15] Mazumdar, Anurag. Barnaparichay – a mall in progress, a street in transition. *Global South E-Sephis.* July 2013.
[16] Harvey, David.*The Condition of Post-Modernity: An Enquiry into the Origins of Cultural Change.* Malden : Blackwell Publishers Inc., 1991.
[17] Ghertner, D Asher. Rule by Aesthetics:World-class city making in Delhi. [book auth.] Ananya Roy and Aihwa Ong. *Worlding Cities: Asian Experiments and the Art of Being Global.* West Sussex : Wiley- Blackwell, 2011.
[18] *Whose City Is It? Globalization and the Formation of New Claims.* Sassen, Saskia. 1996, Public Culture, pp. 205-223.
[19] Baudrillard, Jean.*America.* s.l. : Verso, 2010.
[20] *Modern Planning on Film: Re-shaping Space, Image and Representation.* Tewdwr-Jones, Mark. 2013, The Urban Fringe.
[21] Ramanujan, A. K. Is there an Indian Way of Thinking? An Informal Essay. [ed.] Vinay Dharwadker. *The Collected Essays of A. K. Ramanujan.* New Delhi : Oxford University Press, 1999, pp. 34-52.
[22] Bhabha, Homi K.*The Location of Culture.* New York : Penguin, 1994.
[23] *Slumdog Cities: Rethinking Subaltern Urbanism.* Roy, Ananya. 2011, International Journal of Urban and Regional Research, pp. 223-238.
[24] Prakash, Vikramaditya. Identity production in postcolonial Indian architecture: Re-covering what we never had. [book auth.] C T Wong G B Nablantoglu. *Post Colonial Space(s).* New York : Princeton Architectural Press, 19, pp. 39-48.
[25] Clark, T J.*The Painting of Modern Life: Paris in the art of Manet and his followers.* Princeton : Princeton University Press, 1999.
[26] *Beyond The Crisis:Towards A New Urban Paradigm.* Castells, Manuel. Amsterdam : The 4th International Conference of the International Forum on Urbanism, 2009. The New Urban Question – Urbanism beyond Neo-Liberalism. pp. 21-44.
[27] Appadurai, Arjun.*Modernity At Large: Cultural Dimensions of Globalization (Public Worlds, Vol. 1).* s.l. : University of Minnesota Press, 1996.
[28] Smith, Neil. New Globalism, New Urbanism: Gentrification as Global Urban Strategy. *Antipode.* 2002, pp. 427-450.

Creep and Shrinkage in Concrete Containing Mineral Admixtures

Abstract

NUMERICAL MODEL FOR CONCRETE EXPOSED TO HIGH TEMPERATURE

Harinadha Reddy[1], Ananth Ramaswamy[2]

[1]*Research Scholar, Department of Civil Engineering, Indian Institute of Science, Bangalore,*
harinadh@civil.iisc.ernet.in
[2]*Professor, Department of Civil Engineering, Indian Institute of Science, Bangalore.*
ananth@civil.iisc.ernet.in

Abstract

Fire in concrete structures causes serious damage in the form of deterioration of strength properties and may lead to failure of the structures. Estimating the extent of damage is very important for repair or retrofitting of the concrete structures. In the present study a Hygro-thermo-mechanical model is developed to estimate the pore pressure, temperature and displacements. These parameters are treated as state variables which intern vary with the extent of the dehydration process when concrete is exposed to high temperature. Concrete is treated as a deformable, multiphase porous material. The model is developed based on the poromechanics concepts. Phase changes and chemical reactions (dehydration) are taken into account in the model development. The model is a coupled chemo-hygro-thermo-mechanical process (accounting for the extent of dehydration). The model accounts for the characteristic of various phases of concrete such as moisture, energy and transport phenomena. Evolution of material properties (porosity, permeability, strength properties) with the extent of temperature of concrete is considered in the model.

Keywords: *Concrete, High Temperature, Pore Pressure, Hygro Thermo Mechanical Model, Damage*

----------***----------

1. INTRODUCTION

The properties of concrete such as elastic modulus, compressive strength, porosity etc. rapidly change when exposed to high temperature. It is very important to know the residual properties ofconcrete after fire for repair and rehabilitation of the structure. Estimating development of pore pressure is also very important for weakly permeable materials such as concrete when exposed to high temperature. If the pore pressure increases beyond the tensile strength of concrete then it causes serious explosive spalling. The subject of this paper is development of thermo hygro mechanical modelling of concrete when exposed to high temperature. The mathematical model is based on the concepts of poromechanics developed by Oliver Coussy (2004). The particular focus of the present work is on the computation of temperature and pore pressure distributions and damage of concrete when exposed to high temperature.The model developed in the present study accounts dehydration phenomena, hygro and heat transport, as well as damage behavior of concrete. The dehydration of concrete is modelled using Bazant (2000) approach. The dehydrated water is also considered in the balance equation which intern contributes to the pore pressure development.Expressions for the thermal damage is similar to those given in Gawin et. al. (2006). Compressive strength, tensile strength and modulus of elasticity are considered as function of temperature specified in the Eurocode.

2. MATHEMATICAL MODEL

2.1. Basic Equations

The basic equations of the model with the following assumptions were developed.

2.1.1 General Assumptions

- Concrete treated as multiphase porous medium consists of solid phase, water and water vapor.
- Concrete is partially saturated.
- Dry air effect in variation of pressure is neglected. According to Dwaikat (2009) the density of water and water vapor is much higher than the mass of dry air, hence majorly vapor pressure contributes in spalling phenomena of concrete.

2.1.2 Balance Equations

The mass balance equation for water and water vapor can be written as

$$\frac{\partial \eta_w \rho_w}{\partial t} + \nabla.(\eta_w \rho_w v_w) = -\frac{\partial w_e}{\partial t} - M^{vap} \quad (1)$$

$$\frac{\partial \eta_v \rho_v}{\partial t} + \nabla.(\eta_v \rho_v v_v) = M^{vap} \quad (2)$$

Where M^{vap} is the rate of mass transfer during vaporization of liquid water, $w_e$is mass of dehydrated water due to dehydration. $\eta_w\rho_w$ and $\eta_v \rho_v$ is the mass fractions of liquid water and water vapor respectively. Further $\eta w\rho_w = \varphi S_w \rho_w$

and $\eta_v \rho_v = \varphi (1-S_w) \rho_w$, where φ is porosity, S_w is the saturation, ρ_w is the density of water and ρ_v is density of water vapor. v_w and v_v are velocity of water and water phase, which is represented as Darcy's law.
Darcy's law of water and water vapor represented as follows

$$\eta_w \rho_w v_w = -\rho_w \frac{K k_{rw}}{\mu_w} \nabla p_w \tag{3}$$

$$\eta_v \rho_v v_v = -\rho_v \frac{K k_{rg}}{\mu_g} \nabla p_v \tag{4}$$

And,

$$p_w = p_v - p_c \tag{5}$$

Where K is the permeability, k_{rw} and k_{rg} are relative permeability of water and gas respectively. P_v is the pressure of water vapor, p_c is the capillary pressure, μ_w and μ_g represents the dynamic viscosities of water and gas.
Combine equations 1 and 2 to eliminate the vaporization term. Considering Darcy's law, the final form of mass balance equation can be written as

$$\frac{\partial m}{\partial t} - \frac{\partial w_e}{\partial t} = \nabla \left[\left(\rho_w \frac{K k_{rw}}{\mu_w} + \rho_v \frac{K k_{rg}}{\mu_g} \right) \nabla p - \rho_w \frac{K k_{rw}}{\mu_w} \nabla p_c \right] = 0 \tag{6}$$

Where, $m = \eta_w \rho_w + \eta_w \rho_w = m_w + m_v$ (6.1)

The capillary pressure p_c is expressed in the form of kelvin equation

$$p_c = -\rho_w \frac{TR}{Mw} \ln \left(\frac{p_v}{p_{sat}} \right) \tag{7}$$

Where p_{sat} is the saturated vapor pressure, which can be represented as a function of temperature by the following formula

$$p_{sat} = \exp \left(23.5771 - \frac{4042.9}{T - 37.58} \right) \tag{8}$$

Where T is a temperature in Kelvins.
Enthalpy balance equation for multiphase system

$$\rho C_p \frac{\partial T}{\partial t} - \nabla . \lambda_{eff} \nabla T = \dot{w}_e H_e$$

Where ρC_p is the heat capacity of the multiphase system which can be defined as follows

$$\rho C_p = \rho_w C_p^w \eta_w + \rho_v C_p^v \eta_v + \rho_s C_p^s \eta_s \tag{9}$$

Where C_p^w, C_p^v and C_p^s are heat capacities of water, water vapor and solid phase of the system, ρ_s is the density of solid matrix and η_s is the volume fraction of the solid phase.

λ_{eff} is the thermal conductivity of the concretegiven by Gawin et.al.

$$\lambda_{eff} = \lambda_e \left(1 + \frac{4 \phi \rho_w S_w}{(1-\phi) \rho_s} \right) \tag{10}$$

and

$$\lambda_e = \lambda_e^{ref} \left(1 + A_T (T - T_{ref}) \right) \tag{11}$$

λ_e^{ref} is the thermal conductivity of dry concrete, A_T is the experimental coefficient and T_{ref} is the reference temperature.

The sorption isotherm for the free water present is proposed by Bazant et.al. (1981)

$$\rho_c \left(\frac{m_0 p_v}{\rho_c p_{sat}} \right)^{1/m(T)} \qquad \text{For } \frac{p_v}{p_{sat}} \le 0.96$$

$$m_w = m_{0.96} + \left(\frac{p_v}{p_{sat}} - 0.96 \right) \frac{m_{1.04} - m_{0.96}}{0.08} \qquad \text{for } 0.96 < \frac{p_v}{p_{sat}} < 1.04 \tag{12}$$

$$m_{w0} \left[1 + 0.12 \left(\frac{p_v}{p_{sat}} - 0.96 \right) \right] \qquad \text{For } \frac{p_v}{p_{sat}} \le 1.04$$

Where ρ_c is the mass of cement per unit volume of concrete, m_{w0} is the mass of water for saturation at any temperature per unit volume of concrete, m_0 is the mass of water for saturation per unit volume of concrete at room temperature. For dehydrated water, a simplified formula given by Bazant and Kepaln is employed in the calculations

$$w_e = \begin{cases} 0 & \text{for } T \le 100^o C \\ 0.04 \rho_c \dfrac{T - 100}{100} & \text{for } 100^o C < T \le 700^o C \\ 0.24 \rho_c & \text{for } T > 700^o C \end{cases} \tag{13}$$

The tensile strength of the concrete is considered as a function of temperature specified in the Eurocode 2 (2004).
Momentum balance equation

$$div \boldsymbol{\sigma} + \rho \mathbf{g} = 0 \tag{14}$$

Where $\boldsymbol{\sigma}$ is the stress tensor, ρ is the density and $\mathbf{g}$ is the acceleration due to gravity.
The field variables chosen for the present model is vapor pressure p_v, Temperature T and displacement vector **u.**

2.2.1 Initial and Boundary Conditions

Initial Conditions at time t=0 for whole domain and boundary,

$p_{v=}\ p_{v0}$, $T=T_0$, $u=u_0$ (15)

Boundary conditions can be Dirichlet's type

$$p_v = p_v^b \text{ on } \Gamma_v$$
$$T = T^b \text{ on } \Gamma_T \quad (16)$$

$u = u^b$ on Γ_u

Neumann Type boundary conditions

$$(\eta_w \rho_w v_w + \eta v \rho_v v_v) n = \beta_c (\rho_v - \rho_{v\infty}) \text{ on } \Gamma_v^q$$

$$(\lambda_{eff} \nabla T) n = -h_T (T - T_\infty) - e\sigma_0 (T^4 - T_\infty^4) \text{ on } \Gamma_T^q \quad (17)$$

$$\boldsymbol{\sigma}.\boldsymbol{n} = \boldsymbol{t} \text{ on } \Gamma_u^q$$

Where n is the unit normal vector, Γ is the boundary, β_c and h_T are convective mass and heat exchange coefficients, e is the emissivity, σ_0 is the Stefan Boltzmann constant and $\boldsymbol{t}$ is the traction vector.

Thermal damage is given by Gawin et. al.

$$D_T(T) = 1 - \frac{1}{3}\left(\frac{E_c(T)}{E_{c,ref}} + \frac{f_c(T)}{f_{c,ref}} + \frac{f_t(T)}{f_{t,ref}} \right) \quad (18)$$

Where D is Damage, E_c is the elastic modulus of concrete, f_c is the compressive strength of concrete and f_t is the tensile strength of concrete.

The weak form of the above equations obtained by means of Gelarkin method. Then COMSOL and MATLAB is used to obtain solution of the equations.

3. VALIDATION

The above described model is validated by comparing the model predicted temperature and pore pressure with the experimental values given in the study byKalifa et. al.(1999).In the above study (Kalifa et. al.(1999)) experiments are conducted on 120mm thick concrete wall by rapid heating at one side and other side of the wall by exposing to environmental conditions. The heating rate was 5°C/sec up to 2 min then they kept constant temperature of 600°C throughout the test period. The temperature was measured at 2mm, 10mm, 20mm, 30mm, 40mm, 50mm and 120mm from the heating side. Pore pressure was measured at the locations 20mm 30mm and 40mm from heating side. Material properties, initial and boundary conditions specified in the test were used to carry out the analysis. The boundary and initial conditions, wall geometry and FEM mesh are shown in the Table 1, figure 1 and figure 2 respectively.

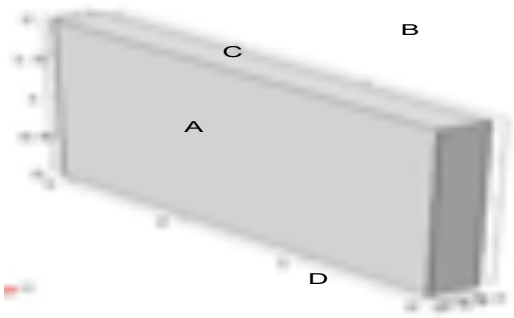


Fig1: Wall Geometry

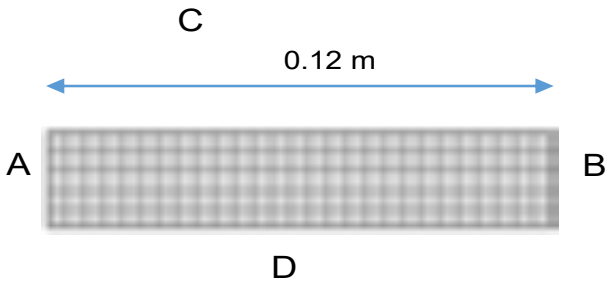


Fig 2: 2D FEM Mesh

Figure 3 shows the comparison of simulated temperature results with present study and experimental temperature data of various locations. The model results is close agreement with the experimental results for all the measured locations. Figure 4 shows the pore pressure comparison of simulated results with experimental data measured at the location of 30 mm from the heating side. Its seen that the simulation results closely agrees with experimental data.

Table 1: Boundary and initial conditions

Boundary Conditions		
Diritchlet Type		
Side	State variable	Boundary condition
D	u_v	0
Cauchy's Type		
Side	State variable	Boundary condition
A	P_v T	p_∞= 1903.9 Pa, βc = 0.019 m/s 293.15+ t*4.833 for t< 120 s T_∞ (t)= 703.15+(t-120)*0.0016 for t> 120 s α_c = 18 W/m^2 K eσ0= 0.5*5.1*10^-8 W/m^2/K
B	p_v T	p_∞= 1903.9 Pa, βc = 0.009 m/s 293.15 K, α_c = 4 W/m^2 K eσ0= 0.5*5.1*10^-8 W/m^2/K
C&D	p_v T	q_{gw}=q_w=0 q_T=0
Initial Conditions		
p_{v0} = 2013.3 Pa T_0 = 293.15 K u=0		

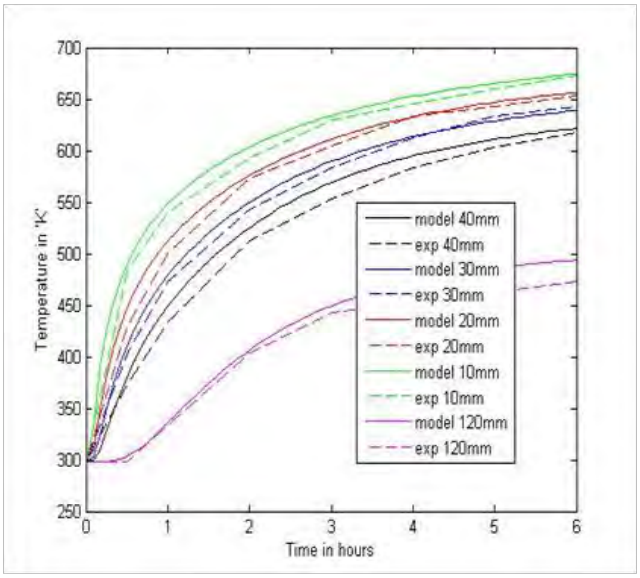


Figure 3: Comparison of experimental and model results for temperature distribution of wall at various locations with time.

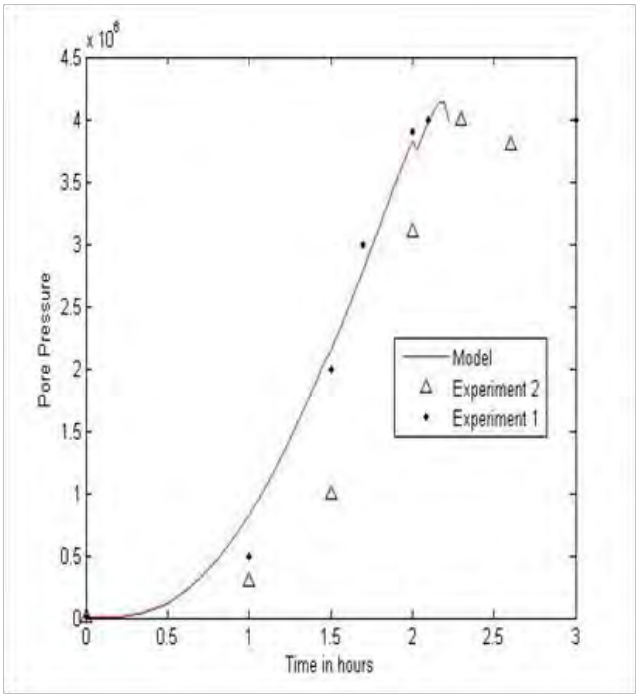


Figure 3: Comparison of experimental and model results for temperature distribution of wall at various locations with time

4. CONCLUSIONS

[1]. A simplified hygro thermo mechanical model based on poromechanics developed to estimate the temperature, pore pressure in heated concrete.

[2]. The predicted results closely matching with the experimental results.

[3]. The work is under progress for estimating damage, which will be presented at the time of presentation

5. REFERENCES

[1]. M. Dwaikat, V. Kodur, Hydrothermal model for predicting fire-induced spallingin concrete structural systems, Fire Safety J. 44 (3) (2009) 425–434

[2]. D. Gawin, C.E. Majorana, B.A. Schrefler, Numerical analysis of hygro-thermic behaviour and damage of concrete at high temperature, Mag. Cohesive Frictional Mater. 4 (1999) 37–74

[3]. D. Gawin, F. Pesavento, B.A. Schrefler, Towards prediction of the thermal spalling risk through a multi-phase porous media model of concrete, Comput. Methods Appl. Mech. Eng. 195 (2005) 5707–5729

[4]. Eurocode 2, General rules—structural fire design, in: prEN1992-1-2: design of concrete structures, Part 1–2, Comite´ Europee´n de Normalisation (CEN), Brussels, 2004

[5]. O.Coussy, Poromechanics, Wiley, 2004.

[6]. P. Kalifa, G. Chene, C. Galle, High-temperature behavior of HPC with polypropylene fibers: from spalling to microstructure, Cem. Concr. Res. 31 (2001) 1487–1499

[7]. Z.P. Bazant, W. Thonguthai, Pore pressure and drying of concrete at high temperature, J. Eng. Mech. Div. ASCE 104 (EM5) (1978) 1059–1079.

[8]. Z.P. Bazant, W. Thonguthai, Pore pressure in heated concrete walls: theoretical prediction, Mag. Concr. Res. 31 (107) (1979) 67–76.

[9]. Z.P. Bazant, J.C. Chern, W. Thonguthai, Finite element program for moisture and heat transfer in heated concrete, Nucl. Eng. Des. 68 (1981) 61–70.

[10]. Z.P. Bazant, M.F. Kaplan, Concrete at High Temperature, Longman, New York, 1996.

Journal of Basic and Applied Engineering Research
Print ISSN: 2350-0077; Online ISSN: 2350-0255; Volume 2, Number 8; April-June, 2015 pp. 640-643

http://www.krishisanskriti.org/jbaer.html

Land and Water Conservation–Abandoned Quarries in Bangalore

Surekha Ramineni[1], Jagadeesh Chandra[2] and Lavanya Vikram[3]

[1]First Year Student of M.Arch, Landscape Architecture School of Architecture, MSRIT MSR Nagar, MSRIT Post, Bangalore–560054
[2]Head of the Department School of Architecture, MSRIT MSR Nagar, MSRIT Post, Bangalore -560054
[3]School of Architecture, MSRIT MSR Nagar, MSRIT Post, Bangalore -560054
E-mail: [1]surekha.ramineni@gmail.com, [2]bsjchandra@gmail.com, [3]lavanyavikram2013@gmail.com

Abstract—*Rapid growth and construction activity to meet the modern requirements of increasing population and housing and infrastructure development needs of the society, has immensely boosted the demand for building materials. Stone quarrying continues to play major role in this process. Stone quarrying is a collective term for extraction of various natural stones, fairly massive and deep deposits of hard or soft rocks, used for structural or decorative purposes in construction and monumental applications. It can also be defined as extraction of non-fuel and non-metallic minerals from rocks, but has disturbed the natural environment and led to degradation of quarry lands.*

This paper discusses the environmental impacts of stone quarrying in Bangalore and recommends effective means for dealing with the practical aspects of conservation and reclamation within the context of environmentally responsible business practices.

1. INTRODUCTION

Bangalore is the capital city of Karnataka State, India. In and around Bangalore there are many hillocks composed of igneous rock formation (granite). In India, stone is considered minor mineral and falls under the control of state government. With the increase in urbanization over the past decade and a half; infrastructure, developmental activities, and building construction has seen a boom. With this, the requirement for granite in the form of ornamental building stone and construction material has increased many folds; due to which, quarrying activity had accelerated up until 2010. Forest department identified the area within 100 m from the forest boundary as sensitive zone and imposed a ban on quarrying. Mines and Geology Department imposed a ceiling of 3m as the depth up to which quarrying can be carried out. These changes in the policy were not favorable to the quarry owners and quarrying was deemed uneconomical which lead to a major dip in quarrying since 2010 and many of the quarry sites have been abandoned. Lack of efforts in monitoring, rehabilitation, restoration, post-mining programs for minimization of adverse environmental impacts has resulted in degradation of quarried land over years.

2. IMPACTS OF ABANDONED STONE QUARRYING SITES IN BANGALORE

The major impact of stone quarrying is aesthetic visual impact. Alteration of natural terrain leads to soil erosion, blockage of natural drainage systems, increased runoff and decrease in ground water recharge. The balance in the hydrological and geological systems is affected. Due to the disturbance of the earth's surface, flora/existing vegetation and ecosystems are disturbed. Loss of habitat for some fauna and flora species and biodiversity reduction due to vegetation clearing of the site. Reduction in grazing areas. In many instances, water pooling can be noticed, which not only poses safety and health issues but also transforms into a mosquito breeding centre. The dust from the quarry sites lead to respiratory issues. As these sites are abandoned with negligible human activity, it may even transform into a setting of social nuisance.

3. MATERIAL AND METHODS

Bangalore, is situated in the southeast of the South Indian state of Karnataka. It is positioned at 12.97° N 77.56° E and covers an area of 2,190 square kilometers (850 sq mi). A landlocked city, Bangalore is located in the heart of the Mysore Plateau (a region of the larger Deccan Plateau) at an average elevation of 920 meters (3,020 ft). Quarry belts in and around Bangalore can be majorly classified as Kanakapura belt, Devanahalli belt, Chikaballapura belt, Kolar belt, Magadi Bidadi and Ramanagara belt, Dabaspet belt. Kanakapura area has been identified as wildlife sanctuary belt and Devanahalli area has been identified as a sensitive area due to the location of Bangalore International Airport in Devanahalli; and hence quarrying activities have mostly been ceased in these two belts.

Methodology included field observation and photo documentation to assess the change and status of environmental impacts of quarrying. A structured

questionnaire to know the local people perception about the impacts of quarrying was administered in the field during the study.

3.1 Jayanagar T block Quarry Site

This site is located in the heart of the city in a completely developed urban setting. Quarrying activity had been discontinued more than a decade and a half ago. The land use of this site was changed to form institutional land about 7 years ago and a college was constructed. No traces of the quarry can be seen now. The depression in the quarry site has been utilized to form basement and the site has not been filled unnecessarily to match the level with the surrounding.

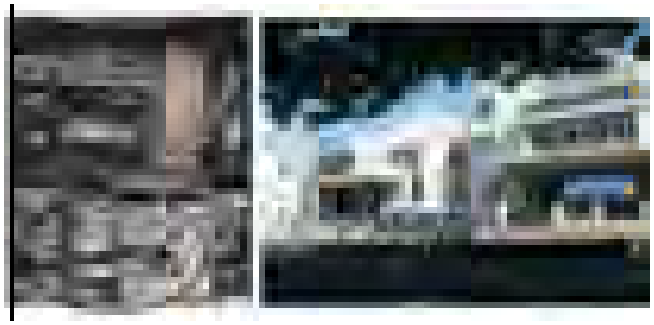


Fig. 1: Location map of Jayanagar T block quarry site showing the current status

3.2 Two Quarry Sites in Banashankari

Quarrying activity had been discontinued more than a decade ago. One of the quarries is abutting the bus stand and the other quarry is abutting the new metro station. Though this part of the city has been dense urban growth over the past 10 years, these two quarry sites have been neglected completely. The quarry site next to the bus stand is completely degraded with water pooling in low lying areas with anaerobic weedy growth and squatter settlement in relatively higher areas in unhealthy living conditions. It's a sore to the eye.

Fig. 2: Location map of Banashankari quarry site next to bus stand showing the current delapitated status with squatters

The quarry next to the new metro station also has water pooling at the low lying areas with squatter settlements created by the metro workers. There is a government proposal of converting this land into a park after completion of the ongoing metro work.

Fig. 3: Location map of Banashankar quarry site next to metro showing the current delapitated status

3.3 M.S. Palya Quarry Near Vidyaranyapura

This quarry site is in the new extensions of Bangalore. Quarrying activity was stopped about 7 years ago. There has been a sudden development and growth of the surrounding area over 5 years with many residential developments mushrooming around the quarry site. Despite this, the quarry site has been neglected. There is water pooling in the quarry site which overflows into the adjacent road network carrying the sludge during monsoon. A thesis has been prepared by a Bangalore based architecture student after thorough study on how this quarry site can be rehabilitated and converted into museum cum recreation centre.

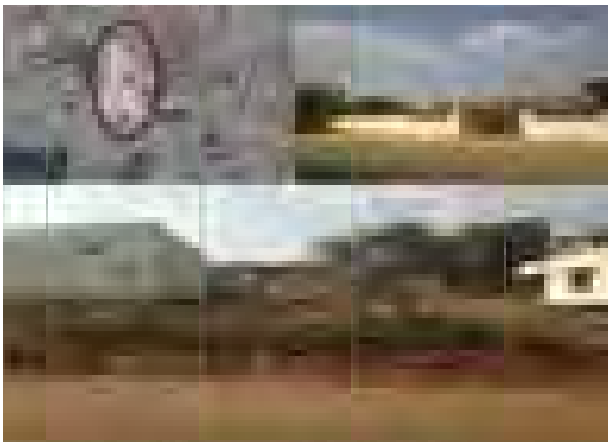


Fig. 4: Location map of M.S. Palya quarry site showing the urban sprawl and the current status

3.4. Chikkasanne Quarry Near Devanahalli

This quarry site is in the outskirts of Bangalore close to the Bangalore International Airport. The zones around the airport have been identified as sensitive zones, hence the quarrying activity has been stopped over the past few months. The surrounding area is sparse residential development with predominant agricultural activity. Water pooling is noted in the low lying area. The same can be further developed into a water body with the construction of check dams at appropriate location to help store water which can be used for irrigation purpose for the agricultural lands in the vicinity. The overflow rainwater can be channelized to the nearby lake. In some parts of the quarry land growth of pioneer species can be observed. Favorable conditions can be provided for the plant succession to facilitate growth of climax community.

Fig. 5: Location map of Chikkasanne quarry showing the current status of the site with water pooling and growth of pioneer species

4. CONSERVATION/RECLAMATION OF STONE QUARRY

The term rehabilitation / conservation can be used for the range of activities relating to the remediation of environmental damage to the surface of a quarry site after extraction is completed. The land is to be rehabilitated to a predetermined and agreed standard or land use which conforms to the concept of sustainable development.

The size of the quarry varies from as small as 3 gunthas to about 25 acres. Reclamation / conservation practice varies widely depending on size of quarry, its location, and the applicable legal requirements. Each quarry requires a particular solution depending on the region where it is situated and the context based on the surrounding land use. The following are some of the consideration,

4.1 Landscaping

Establishment of storm water retention basins at the lower side of the site will help recharge the groundwater table. An overflow system can be worked out for the quarries with lakes in the vicinity which will help restore ecological balance. These water bodies can also be converted into fisheries creating an employment opportunity or maybe used for irrigation purpose.

For the future quarries, the topsoil is to be removed and stockpiled at the commencement of quarrying activity. The erosion from the site can be managed to a minimal by construction of radical terraces towards the periphery and lower part of the site and by planting grass to stabilize the soil.

4.2 Re-vegetation

Re-vegetation to be made integral part of reclamation activities. The reasons for this are that re-vegetation is the most effective and economic method of stabilizing the soil against erosion assists in re-establishing biodiversity in the reclaimed area and helps ameliorate visual impacts. Plant succession can be identified, pioneer species like algae and moss to be introduced initially to facilitate the growth of serule or secondary succession which develops through increasing complexity until it becomes stable or self-perpetuating as a climax community. Depending on in which belt the quarry is located, the climax community may get regenerated into lush green over decades or may just develop into grasslands or made suitable for agricultural fields. Although the results are not immediate, with a long-term vision, this aids in creating lung space within an urban setup.

4.3 Urban Utility

Based on the surrounding land use appropriate land use can be assigned to the degraded stone quarry site. In urban context, the quarry sites can be converted into galleries, museums, recreational spaces, rock gardens, theme parks, lung spaces, multi-level parking areas, public utility spaces, etc. which unifies itself with the urban landscape fabric.

4.4 Policy Changes

During the operational phase of a quarry's life, the impact on the environment can be lessened by planning with future closure in mind. By bringing about appropriate revisions in the existing policies, haphazard stone quarrying activity can be controlled. For the ongoing or future stone quarries, it is essential to generate a environment impact assessment report and a feasibility report. The lessee of the quarry to submit a detailed post-mining reclamation measures report before the kick-start of the quarry. This distributes the liability of development/conservation/reclamation of quarry land both between the government bodies as well as the quarry owners. For the existing abandoned sites, the concerned department should carry out a study to identify the appropriate function that can be assigned to the degraded land and measures have to be taken to revive it.

5. CONCLUSION

Increasing demand for stone and aggregates had led to extensive uncontrolled stone quarrying operations in

Bangalore district causing increased environmental degradation. Although, stone quarrying contributes towards development, the negative environmental impacts, particularly when the quarrying activity is carried out haphazardly and not as per the prescribed norms and regulations cannot be ignored. With proper monitoring and introduction of post-mining programs at policy levels degradation of land can be controlled for the future quarries. For the already abandoned quarries, initiatives have to be taken by concerned departments to put the land into proper use to create lung space within the district or to create a space of public utility to help conserve the land from further dilapidation.

6. ACKNOWLEDGEMENT

The author is extremely grateful to the people from the study area for their time, hospitality, cooperation and sharing their experience. The author is extremely thankful to Ar. Bijoy Chacko, Oikos and to Ar. Rajashekhar Rao, Associate Professor, MSRIT for continued support and guidance. The author express gratitude to Geology and Mines Department for providing the necessary guidance, support and facilities.

REFERENCES

[1] I. Ashmore, M. Motloung, Reclamation and environmental management in dimension stone mining, Surface mining 2008, pp. 155-175

[2] Lad R.J. and Samant J.S., Environmental and social impacts of stone quarrying–A case study of Kolhapur district, International Journal of Current Research Vol. 6, Issue 03, March 2014, pp. 5666-5669

[3] Catherine Keever; H. J. Oosting; L. E. Anderson, Plant Succession on Exposed Granite of Rocky Face Mountain, Alexander County,North Carolina, Bulletin of the Torrey Botanical Club, Sep 1951, pp. 403-420

[4] Ar. Rajshekhar Rao, Ecological restoration of basalt quarry–the case of Timba, Gujarat, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp. 17-19

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 3, Issue 4, pp: (98-101), Month: October - December 2015, Available at: www.researchpublish.com

Rethinking 'Mad after *veena*'

[1]Chandan Kashyap S.K, [2]Dr. Pramila Lochan

[1]M.Phil, Research Scholar, Faculty of Humanities and Social Sciences, Jain University, Bengaluru, India
[2]Guide, Dept. of Humanities and Social Sciences, Jain University, Bengaluru, India

Abstract: **This research paper focuses on the study of the famous painting, 'Mad after Veena' by K.Venkatappa with the aid of archival material and thereby comprehending Venkatappa's passion for learning the musical instrument veena. Self-portraiture of the artist and the complexity of iconographic cluster are discussed by tracing cross-cultural trends and enquire whether the artist's madness in 'Mad after Veena' is instinctive or strategic. This paper addresses its title, stylistic and linguistic aspects and explores how it had contributed a different dimension to the art movement of Mysore State.**

Keywords: **K. Venkatappa, painting, Mysore.**

I. INTRODUCTION

K.Venkatappa (1886-1995) was an artist of national reputation. He studied in the Government Industrial School in Mysore (1902-8) and with the support of the royal patron, Krishnaraja Wodeyar IV, accomplished his higher studies at the Government School of Art in Calcutta (1909-16). Here, Abanindranath Tagore was his Guru and Nandalal Bose was his batch mate. Abanindranath Tagore had high expectations from both Venkatappa and Nandalal Bose. Venkatappa also had interactions with influential art circles including E.B.Havel and Percy Brown. After more than seven years of stay in Calcutta, he decided to return to Mysore and start working for the Palace (1918). It was during this juncture that Venkatappa became passionate about learning Veena and this resulted in his learning from the highly renowned veena maestro, Veene Sheshanna (1917). It was during this time that Venkatappa was inspired to paint the well- known composition, „Mad after Veena" (1921-2).

Some scholars and artists like Dr. Shivrama Karanth, V. Sitaramiah and S.K.Ramachandra Rao, have opined about „Mad after veena" in their writings and describe Venkatappa kneeling down, totally surrendering to the Goddess of veena/ music, pleading for her grace. Everything else for him is meaningless. Behind his back or in the background, one finds abandoned objects including the veiled bust of his guru or teacher, Abanindranath Tagore, placed on the shelf. The discipline of painting is said to have been personified and tied to a tall pillar and neglected for a long time. In the bottom, rolls of painting are discarded and rats play with it besides paint box and brushes that are dry and scattered.

Dr. B.V.K. Shastry [Shastry 2004:64] differs from other writings. Shastry does not describe the deserted elements in the background and the personified figure representing a painting/visual art (who in the painting is tied to the pillar). Instead, Shastry identifies the *veena* whole-heartedly inviting the artist (Venkatappa) who is caught in between two art forms; visual art and music (*veena*). This dilemma of his life is said to have resulted in a psychological conflict and is portrayed well in the composition.

Ramesh Chandra [Chandra 2009:1-6] opines that, since Venkatappa paints his psychological status instead of reality and this was one of the earliest approaches of surrealism in the Indian art scenario.

Venkatappa's passion for music: Venkatappa before returning to Mysore received basic *veena* lessons from Srirangam Ramaswamy Iyengar and in 1914 he fabricated „*Sruthi veena*"[1]. As Rao says [Rao 2004:53] „*Sruti veena*" was agreed

[1]Venkatappaclaims that the instrument facilitates the „demonstration of the ancient (Indian) musical scale and the twenty-two Srutis of 16th or 17th century or earlier". He adds that this type of difficult task was accomplished by very few in India and thereby proudly announces that many theorists and practical musicians have appreciated with satisfaction.

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 3, Issue 4, pp: (98-101), Month: October - December 2015, Available at: www.researchpublish.com

upon by musician-musicologists like Tiger Varadachar, Bidaram Krishnappa, Veene Venkatagiriyappa, Ralapalli Anantha Krishna Sharma, Srirangada Ramaswamy Iyengar, K.Vasudevacharya, T,Chowdayya, Muttayya Bhagavataru and Arikudi Ramanuja Iyengar. It was exhibited in the Dasara exhibition of Mysore in 1916.

Venkatappa was feeling proud of his accomplishment and supporting this, a letter[2]by Editor[3]of Indian Music Journal tested, verified and certified „*Shruti veena*" as a genuine invention by Venkatappa with a discussion about the technicalities of the *veena*[4].

Following this, Venkatappa"s interest in playing the *veena* intensified and he wished to divert his scholarship granted for Fine Arts study towards studying of the *veena*. Venkatappa"s letter reveals him requesting the Maharaja to divert the scholarship amount given for the practice of painting towards learning *veena*[5]. Further, letters of 1917[6] throws light on the struggles of Venkatappa to learn music.

A letter dated 30-05-1917[7] from K.Krishna Rao[8] refers Venkatappa"s letter dated 31.03.1917 through which Venkatappa is mentioned to have requested for utilization of scholarship[9] to learn music in Mysore. As a response to this letter, K.Krishna Rao states that the request was found unreasonable and therefore the scholarship was cancelled.

In a letter dated 27-08-1917[10]Venkatappa states that he had requested for a year to extend scholarship for his study of *veena* in Mysore until he could be sent to Europe to study sculpture. Venkatappa states that he had met K.Krishna Rao (on 16-08-1916) and in return the proposal of learning *veena* was appreciated and was assured scholarship. Venkatappa states that he had received a letter from K.Krishan Rao on 23-02-1917 that had discarded his requisition and recommended to continue the study at the Government School of Art. Calcutta. Venkatappa was displeased with the reply and felt K.Krishna Rao, had no reason nor was there any necessity for him to recommend the grant of Scholarship to continue his studies again at Calcutta School of Art. Venkatappa states that his Principal was satisfied with his accomplishment of in painting and modeling that he had studied for more than seven years. Venkatappa desperately expresses that, "it was the will of God that I should not get encouragement from the Government to develop my natural instinct in classical music". (Same letter dated 27-08-1917)

Venkatappa with everlasting enthusiasm requests to arrange for *veena* classes with Vainikasikamani Sheshanna or Vainika Praveena Subbanna in order to reach perfection in playing the *veena*. Letter dated 07-12-1917[11]states that the request for the arrangement of music class with Vainikasikamani Sheshanna or Vainika Praveena Subbanna cannot be fulfilled. Instead it was recommended to attend Palace Music School where Vidwans can teach elementary lessons in *veena*. After much struggle, Venkatappa was privileged to study under Veene Sheshanna (1917-1927).

It was at this juncture that Venkatappa painted „Mad after Veena". As K.V.Subramanyam states [Subramanyam 2008:76] [12]Abanindranath Tagore got a message that Venkatappa was not practicing painting but was more absorbed with the *veena*. Abanindranath asked Venkatappa about his practice of painting. This inspired Venkatappa to paint „Mad after Veena" in response to the question by his *guru* and sent it to him. In return Venkatappa received a letter from him[13].

II. SELF-PORTRAITURE

[2]Divisional Archives Office of Mysore .Palace Maramath.2-1905. P. 30
[3]H.P.KrishnaRao
[4]He appreciates as follows: *"It is correct according to the principles of Venkatamaki…… Samvadi Sa Ma, Sa Pa, Ga Ni, RiDha, are all kept up and they are correct. Your instrument has suggested certain other facts which require further study"*
[5]Divisional Archives Office. Mysore. Palace Maramath.2-1905. P. 16
[6]Divisional Archives Office. Mysore. Palace Maramath.2-1905.P. 16-22
[7]Divisional Archives Office. Mysore. Palace Maramath.2-1905. P.16
[8]The Inspector General of education in Mysore, Bangalore to K.Venkatappa c/o Messrs.A.Melgiri & Co., Lansdown Bazar, Mysore
[9]granted for the study of Fine Arts at School of Art at Calcutta
[10]DivisionalArchives Office. Mysore. Palace Maramath.2-1905. P. 18. This letter was written by K.Venkatappa addressing His Highness, Sri KrishnarajWodeyarBahadur, G.C.S.I. Maharaja of Mysore, Mysore
[11]DivisionalArchives Office. Mysore. Palace Maramath.2-1905. P. 22.This letter was written by Office of the Durbar Bakshi, Palace, Mysore
[12]Subbramanyam.Venkatappa: SamakaleenaPunaravalokana. P. 76
[13] letter reads; *"…may be mad after veena or painting, but that is not sufficient to put it into a picture; in the same way one may be fond of drinking wine but that does not interest all. Your pictures must contain something which is permanent interest for all, then only it can appeal us."*

ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 3, Issue 4, pp: (98-101), Month: October - December 2015, Available at: www.researchpublish.com

In the painting, a male figure is seen kneeling down in surrender. His uttareya (shawl) has fallen on the ground and goes unnoticed. He is half nude with a wet cloth[14]clinging to his body denoting a sacred ritualistic practice for dedicated learning. His bearded face and matted hair[15] symbolizes a *yogi* who does rigorous penance. His raised hands towards the goddess with *veena* appear to welcome her. This portrait clearly distinguishes him from insanity (psychological disorder) and portrays him as a rigorous mad aspirant of music.

Venkatappa connects the left and the right section of the composition by stretching himself. To the left (behind him) is a veiled bust of Abanindranath Tagore supported by a huge support[16]. The personification of a painting as a lady figure (probably goddess), with brushes in her hand, shown twice to suggest that she is in slumber as a result of long neglect. Rats are busy on rolls of paper. These „aaharyas"[17]speak of his expertise as a painter and sculptor and also his calculated negligence. Venkatappa"s self-portrayal with his firm gaze is oriented towards a female figure with *veena* to the right side (in front of him).With a fine sensibility of a miniaturist, Venkatappa treats each and every element of visual narration with equal care and meticulous detailing. Since the size of the image is very small, it invites the spectator to see within an intimate distance and search for the „aaharyas" he had devised in the image. Color thickness and transparency is excellently executed. One can gauge the thickness used for the portraiture and the transparency for veils. He handles a subtle color palette that enhances the skin complexion of the figures. This in return contributes sensuality and adds emotional enchantment.

Venkatappa had planned the composition in horizontal and vertical sections that add visual rhythm as well as verticality to the image. This verticality is orchestrated with the melting of forms namely the veil that hides the bust of Abanindranath Tagore, the sari that veils the face of the painting personified as lady and the sari of the lady figure depicted next to the *veena*. This „implied" verticality suggests a possible connection with Gothic sensibility prevalent with European Art movements like Pre-Raphaelite Brotherhood and Art Nuevo movements. This verticality of the composition compliments thematically by segregating the left and right sides of the painting wherein the left is for the domain of the painting and the right for the domain of music/*veena*.

The contour lines are very fine and merge with the form and constitute the embossed effect of the forms. The dark color of the *veena* adds more density to *veena* and thus it is emphasized. Veena diagonally standing in between both bridges providing a metaphorical ladder. The steps of *veena* are known for *arohana* (ascending) and *avarohana* (descending) of *svaras* that carry feelings. Herein they become the metaphorical steps for Venkatappa"s spirit to ascend or for the lady figure (with wings) to descend.

III. 'GODDESS' WITH VEENA

Venkatappa refers to some of the iconographic features from tradition instead of producing an actual icon by adhering to *shastras* or scriptures. Lady figure with *veena* is drawn from the iconographic features of Saraswati as the goddesses of learning. Selectively white sari and *veena* are chosen from the iconographic features attributed to Sarswati in Indian tradition. This lady figure is shown with wings that mark the reference to the western concept of an Angel. The verticality orchestrated with this lady figure clearly reminds one of the Gothic Angel. But none of the Christian Angels had dark halo[18]. By further enquiries with European iconographic tradition it perhaps depicts an iconography called „Melancholy".

IV. 'MELANCHOLY' AND ART PRACTICE

„Melancholy" was the daughter of Saturn, She represents intellectual and introspective qualities. The iconography of "Melancholy" is based on human temperament that is melancholy. „Melancholy" though linked with the darker side of humanity carefully balances itself from becoming "really bad"..„Melancholy" is often associated with dualism and the concept of genius. "Melancholy" in modern times was considered as the temperament prerequisite for creative pursuits.

[14]signifies one of the disciplinary code of the traditional system of dedicated learning
[15] that is not black
[16] cupboard visible in strict profile
[17]„aaharya" is used in the context of visual art. The costume, objects, setting and ambience are visually represented in order to facilitate the spectator to connect the representation to his actual life and experience
[18] dark but not black

In Europe „Melancholy" developed as an important iconographic theme for Visual art practice. Albrecht Durer engraved a print titled „Melancholia I" that dealt with a similar theme. Durer too developed a composite iconography (Angel figure) by fusing some of the iconographic features of „Melancholy" with the Greco-Roman iconography of the goddess of geometry and Angel. In Durer"s composition too objects associated with arts are scattered with negligence beneath her feet. Her holding of the compass clearly shows that she is not working but lost in thoughts (probably introspection). This attitude is contrasted with the figure of cupid who innocently (thoughtlessly) works.

Durer through „Melancholia I" addressed the tension of dualism between the two types of genius that was prevalent in the West. By the examples of Italian Masters like Leonardo da Vinci, whose works were introspective and where a work like „Adoration of Magi" satisfied him at an introspective level but remained incomplete. This attitude demanded much time to finish each work. In contrast Michelangelo industriously worked on the murals of Sistine Chapel and accomplished them successfully. „Melancholy" became a part of the vocabulary of the European art tradition. Rembrandt painted his self-portraits with shadow casted on his face. Shadow, that was one of the iconographic features of „Melancholy", became a part of the vocabulary. Goya and Pierre Baudelaire have done portraits in a similar way. Rodin did „Thinker" and that too shares similar linguistic traits. In this way one can notice „Melancholy" as a prevalent dialect that circulated among the modern west.

V. 'MAD AFTER VEENA'

In „Mad after Veena", „Melancholy" is re-contextualized by amalgamating indigenous iconographic references. Venkatappa thereby developed a complex iconography by fusing various iconographical undercurrents namely- some of the iconographic features of goddesses Sarswati, the Western idea of Angel figure and some of the iconographic aspects of „Melancholy". Thereby Venkatappa codifies his cryptic dialect and contributes to the promotion of such cryptographic language in the art movement of Mysore State. This also contributes to the modernization of the art scenario.

VI. CONCLUSION

„Mad after Veena" shares a language that was prevalent in the modern west. Thereby it contributes towards the modernization of the art movement of the Mysore State. One can surmise that the „madness" in „Mad after Veena" is strategic than instinctive based on the strategy of the composition he devices and the visual language he shares. The half nude male figure with wet cloth and matted hair signifies the self (Venkatappa) to be a rigorous aspirant with madness and clearly distinguishes himself from insanity. One finds a composite of; some of the iconographic features of Goddess Sarswati, the angel and some of the iconographic features of „Melancholy" developed by Venkatappa. This composite figure is adopted as vocabulary of the visual language he uses.

The fact that Venkatappa had chosen to paint „Mad after Veena" as an answer to declare that he was not painting but was mad after *veena*, points to the fact that he was not detached from painting and wished to be a "genius" painter introducing a cryptographic language.

REFERENCES

[1] Shivarama Karantha, *Bharatheya Chitrakale* (Banglore: Kannada Pustaka Pradhikara, n.d.)

[2] V.Sitaramiah, *Venkatappa* (New Delhi: Lalit Kala Academy, 1968).

[3] S.K.Ramachandra Rao, *K.Venkatappa a pictorial volume* (Bengaluru: Directorate of Kannada and Culture, n.d.)

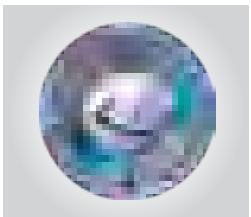
[4] B.V.K.Shastry, VeeneyaHuchhu, K.R.Ramakrishna, R.Gopal and B.M.Chikkamaaregowda (Eds.), *K.Venkatappa* (Hospet: Directorate of Archeology and Museums, 2004) 64.

[5] Ramesh Chandra, Venkatappanavara „Veeneya Huchhu", Manjunath (Ed.), *Drishya, a book on Alternative thought for Postcolonial Visual Culture (Kannada)*. (Bengaluru: „Namma Sumskruthi", 2009) 1-6.

[6] S.K.Ramachandra Rao, K. Venkatappa, K.R.Ramakrishna, R.Gopal and B.M.Chikkamaaregowda (Eds.), *K.Venkatappa*, (Hospet: Directorate of Archeology and Museums, 2004) 116-122.

[7] K.V.Subramanyam, *Venkatappa: Samakaleena Punaravalokana* (Bengaluru. Chitra Kavya Prakashana, 2008).

RESEARCH PAPER | Architecture | Volume : 6 | Issue : 1 | JANUARY 2016 | ISSN - 2249-555X



Seamless Transport System for Feasible Moblity: Case Study

KEYWORDS: Seamless transport, urban transport, sustainable transport system, Multi modal transit System

Nishant Nathani	Prof. S K Gupta	Prof. Sangeeta Bagga Mehta
Ph.D. Scholar, Amity School of Architecture & Planning Amity University Haryana Panchgaon, Manesar, Gurgaon, India	Dean and Director, Amity School of Architecture & Planning Amity University Haryana Panchgaon, Manesar, Gurgaon, India	Chandigarh College of Architecture, Chandigarh, India

ABSTRACT *Urban transport is dominated by people making many short trips, multiple times per day; public transport is a sub set of it. Public transport is a network of passenger vehicles, for use by the public, running on set routes, usually at set times and charging set fares. At present these short trips made by different modes are inconvenient for commuter in terms of time and money. Passenger has to pay for each trip/mode for that they need to stand in a long queue, leads to wastage of time. At the same time the transport modes are not synchronized, it further adds to waiting time of commuter. Seamless transport comprises passenger transportation services which are available for use by the general public, as opposed to private and personalized modes or vehicles for hire, to make the travel hassle free. Generally, the fleet of vehicles and services are provided by a company, corporation or authority and the same is regulated and if necessary subsidized by them. The infrastructure used may be exclusive or shared with private and other vehicles. Delhi, India having population- 16,753,235 (2011 census of India) and daily average trip rate is 1.55 (all modes) has been studied for further understanding.*

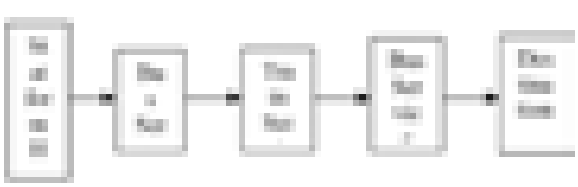
Introduction ***(Heading 1)***

Urban areas require various modes of public transport for their existence and sustainability as per population, area density, socio economic characteristics etc. When two or more modes of transport are integrated for a single trip and used for convenient and efficient movement of passengers, it is defined as the Multi Modal Transport System (MMTS). Public transport is an important constituent of such a system. In metropolitan cities, transportation resources consist of roads, rails, rapid transit systems, automobiles, para transit systems, bicycles, pedestrian, shared and hired vehicles, private and personalized modes, parking facilities, traffic management, development a long and around the transit corridor etc. These resources provide a wide range of travel patterns for the residents for different purposes. Furthermore, transport resources and modal choices are interdependent components of the total urban transport system.

CONCEPT OF SEAMLESS TRANSPORTATION SYSTEM (STS)

Seamless Transport System (STS) relates to single trip consisting of combination of modes i.e. vehicle modes (bus, metro, car, tram, etc.) or service modes (private / public) between which the traveler has to make a transfer. Transfer is an essential part of seamless trip and traveler has to changes modes at transfer points, Fig 1 shows different transfer modes and arrow indicates to reach the next transit point we need to use either walking or sometimes non motorized transport medium. Hence, seamless travel is an important characteristic of the transport system.

Figure 1. Multi Modal Transfer Trip



In other words, STS is an integrated approach to incorporate all components of urban transport into a single coordinated planning and operation system for efficient use of available transport resources and infrastructure to ensure better urban mobility within a wide range of modal options for the commuters. In urban areas, multiple agencies, multiple jurisdictions, multiple modes and multiple disciplines are responsible for planning, designing, construction, operations, administration and maintenance of transport. They are independent but, are highly interdependent. Hence, a well designed and coordinated MMTS is required which has the following advantages:

(a) Smooth and comfortable transfer;
(b) Combined planning, design and operations;
(c) Better utilization of resources;
(d) Better distribution of area wide transit system;
(e) Extended availability of services ;
(f) Single fare and single pass;
(g) Elimination wasteful duplication in the same areas and corridors
(h) Efficient and better interchange nodes ;

Need of Seamless Transport System in Delhi, India

According to "Rail India Technical and Economic Services" (RITES)-2005, public transport in Delhi carries only about 60 % of total vehicular person trips but the same should be 80 % as per population size of the city. The population of Delhi is estimated to grow from 16.75 million (2011) to 23 million (2021). In the same period, the intra city vehicular trips per day are estimated to grow from 19.4 million to 24.7 million [22]. If about 15 % intercity trips are added the total trips to be catered to by 2021 will be about 28.7 million per day. Thus 80 % of these trips, i.e. about 24 mil-

Volume : 6 | Issue : 1 | JANUARY 2016 | ISSN - 2249-555X

lion, should be carried by the public transport by 2021. The present bus services, metro rail and Integrated Rail Bus Transit (IRBT), if implemented as planned together are estimated to carry about 15 million trips per day by 2021. Thus 9 million trips per day must be additionally catered to by other public transport. Hence it is necessary to take appropriate step for optimum use of carrying capacity of public modes and their proper integration with other modes such as monorail Light Rail Transit (LRT) etc.

Wilbur Smith Associates conducted surveys in 30 cities in 2007 and submitted the report to the Ministry of Urban Development (MoUD), Government of India. The report states about decline in the trend of public transport share particularly in metropolitan cities. Kolkata has the highest public transport share 54% and Delhi has 45 % only (Table 1). To enhance rider ship of public transport integration of various modes with Mass Rapid Transport System (MRTS) is required.

There has been a rise in the number of middle class population having desire to own personalized mode. Further, automobile companies are also coming up with new models of cars at reasonable cost. Thus personalized vehicles are increasing, which will further cause deterioration in traffic and environmental conditions. Hence, it is necessary to shift mode of travel from car to walk / cycle for short journey and to public transport for long journey. The main aim of STS is to reduce personalized modes and promote public transport.

Share of Public Transport and other Modes in Selected Metropolitan Cities in India in 2007 (Values in Percentage)

SNo	City	Walk	Cycle	Two wheelers	Public Transport	Car	Intermediate Para Transit	Total in %
1	Delhi	21	12	05	45	14	06	100
2	Mumbai	27	06	07	45	08	07	100
3	Kolkata	19	11	04	54	08	04	100
4	Chennai	22	09	20	31	10	08	100
5	Bangalore	26	07	17	35	08	07	100
6	Hyderabad	22	09	19	35	09	07	100

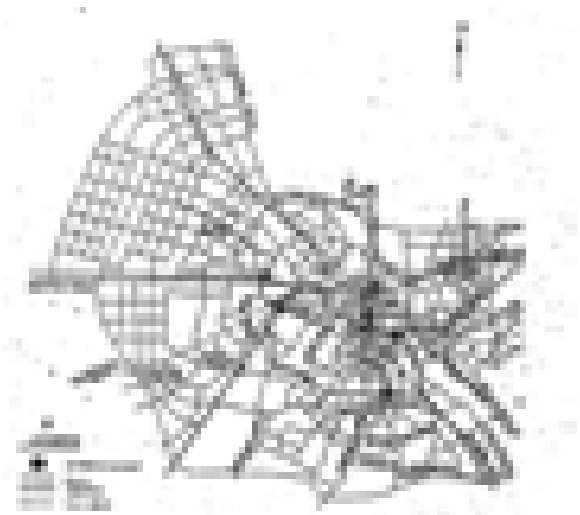
Source Wilbur Smith Associates and M/o Urban Development, Government of India New Delhi (2007)

GOVERNMENT INITIATIVES FOR SEAMLESS TRANSPORT SYSTEM FOR DELHI

Central Road Research Institute (CRRI)

Public transportation is gradually evolving in metropolitan cities in India. Operation of Delhi Metro has given a strong image to public transport. A study was carried out at CRRI, New Delhi (1989) on Planning of MRTS for Delhi. This formed the basis for implementation of Delhi Metro Project (Fig. 2).

Figure 2. Recommended MRTS, Source: Central Research Institute, New Delhi (1989)



MRTS was aligned on optimum corridors which cater to estimated demand projection. The database of this study was used for developing the transport sub models and projected transport demand for the years 2021. For transport analysis, database of household travel survey of Delhi urban area, carried out by Delhi Development Authority (DDA) in the years 1981, was used.

Rail India Technical and Economic Service (RITES)

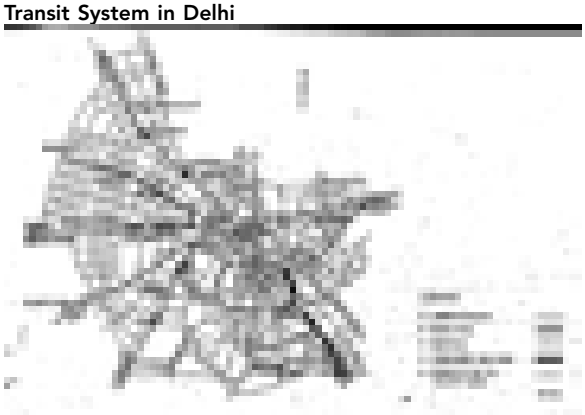
RITES recommended their components of integrated multi modal mass rapid transport system in 1985. It comprised rail corridors, metro corridors and dedicated bus way for a total network of 184.5 Km. Later, MRTS network was extended to connect Vasant Kunj, an additional length of 14 km increasing the length to 198.5 km. In the first phase of the project, following sections of a total length 67.5 Km were to be constructed.

(a) ISBT – Central Secretariat	Metro Corridor
(b) Patel Nagar – Tilak Nagar	Metro Corridor
(c) Shahdara –Nangloi	Rail Corridor
(d) Subzi Mandi – Naya Azadpur	Rail Corridor
(e) Patel Nagar – Najafgarh	Bus Way

Multi modal transport integration was planned for pedestrian facilities, vehicle circulation, parking facilities, feeder buses to and from area to influence of each station and interchange facilities for passengers from National Capital Region and long distance intercity rail and bus modes. Details of Modal interchange facilities were planned for 44 MRTS stations which were proposed to be commissioned by the years 2005. It was estimated that a total of 115 feeder bus routes will be required for implementing the above multi modal transport system, interchange facilities for traffic between Delhi and National capital Region (NCR) were planned at some metro terminal stations which include Holambi Kalan ,Shahdara, Nangolai and Vishwa Vidyalaya as well as other stations ViZ New Delhi, Delhi, ISBT and Tri Nagar (Fig.3).

Volume : 6 | Issue : 1 | JANUARY 2016 | ISSN - 2249-555X

Figure 3: Recommended Integrated Multi Modal Rapid Transit System in Delhi



Source: RITES, New Delhi (1995)

National Capital Region Planning Board

The National Capital Region (NCR) consists of National Capital Territory (NCT) of Delhi (1483 km^2), Haryana Sub region (13, 413 km^2), Rajasthan Sub region (7,829 km^2) and Uttar Pradesh Sub region (10853 km^2). Thus total area of NCR is 33,578 km^2 the development of NCR is a milestone towards balanced and harmonious development of region by addressing large number of planning issues concerning urban and rural settlements.

Extension of multi modal transport network in a metropolitan region framework can encompass number of cities around the identified parent city. Future of Delhi depends on the sequential development of its metropolitan region. As per "Regional plan for NCR 2021" (RPNCR – 2021), the development zones of NCR comprise:

(a) National Capital Territory (NCT) Delhi ,
(b) Central NCR excluding NCT Delhi (earlier Delhi Metropolitan Area),
(c) Highway corridor Zone and
(d) Rest of NCR

Central NCR (DMA) comprise notified controlled area of Ghaziabad, Loni, Noida, Gurgaon Manesar, Faridabad, Ballabhgarh , Bahadurgarh and Sonepat & Kundli having 2000 km2 area . Transport Plan 2021 of RPNCR 2021 has proposal for Regional Rapid Transit System (RRTS) Regional Rail Network and Orbital Rail Corridor. MRTS of Delhi has been extended to Central NCR. MRTS and RRTS has been planned with appropriate integrated feeder rail / road services.

The Proposed Integrated Multi Modal Transport Plan for NCR includes the following components.

(a) An extensive network of regional sub arterials (631 km.) which are the strengthened national highways and upgraded state highways;
(b) An extensive network of regional expressways (1,376 km.);
(c) An extensive network of regional arterials (1801 Km.), which are the strengthened national highways and upgraded state highways.
(d) An extensive network of sub-regional access roads which are the other district roads to be detailed in sub regional plans;
(e) An extensive network of regional collectors / distributors which are the strengthened major district roads and upgraded other district roads.
(f) An extensive bypass system around the regional urban centers;
(g) A large number interchanges on the road network system

Future expansions of the seamless systems are as follows:

(a) a network of regional rapid rail system (523 km) running on dedicated tracks and providing rail services for commuters.
(b) a new rail lines linking some of the regional centers (534 K.M)
(c) an extended network of metro rail system connecting the regional centre;
(d) an extensive fleet of bus system with supporting infrastructure (depots , workshops);
(e) a number of logistics hubs;
(f) a number of bus terminals and rail terminal enabling integration and smooth transfer amongst modes;
(g) a number of integrated freight complexes and truck terminals.
(h) a number of highway transport facility centers;

DELHI DEVELOPMENT AUTHORITY

The Master Plan for Delhi 2021 also advocates about multi modal transport system as future transport mode in the capital city.

Delhi Integrated Multi modal transit System Limited

The government of NCT Delhi has set up, in 2006; the Delhi Integrated Multi Modal Transit System (DIMMTS) Limited, for proposed multi modal network in NCT of Delhi

Ministry of Urban Development, Government of India (2006) formulated

National Urban Transport Policy, 2006 With the broad objective to ensure safe , affordable, quick, comfortable, reliable and sustainable access, for the growing number of city residents to jobs, education, recreation and such other needs within cities. One of the methods to achieve such objectives is enabling the establishment of quality focused Multi Modal Public Transport System that are well integrated, providing seamless travel across modes.

In metro cities the urbanization and migration pattern have direct impact on intra urban and inter urban mode of transport and vice versa. Hence, MRTS, sub urban rail, bus network etc. are required to be integrated with other modes. In multi modal transport system, the urban transit system should complement and not compete with other components of the systems. A coordinated integration of different modes brings about reduced congestion on the road, greater convenience for commuters efficiency and cost effectiveness.

LEVEL OF INTEGRATION AND SEAMLESS MOBILITY

Integrated public transport is defined as a system that provides door to door public transport services for passengers (Janic and Reggiani 2001). The term Inter Modal

Transport is commonly used for the transport of goods. There are as yet no standard definitions of these terms. The objective of integrated public transport is to achieve a high transit modal share with a seamless service using two or, more modes. In this context, various, levels of integration are required for seamless mobility which is presented in table 2.

Volume : 6 | Issue : 1 | JANUARY 2016 | ISSN - 2249-555X

Improved integration among various modes of mass transport helps people of move around easily and reduces the costs and inconveniences of travel. The information regarding parking facilities near interchange stations, unified tickets, coordinated time table and public awareness play an important role in achieving the coordination among various modes.

Levels Of Integration And Seamless Mobility

SN	Integration	Facilities for Seamless Mobility
1	Information Integration	Traveler Information Services (TIS) to provide complete real time information on public transport system at MRT stations, major bus stops interchanges nodes etc. Information on routes, schedules, fares and transfer points for all transit modes by the centralized source.
2	Network Integration	Integration of bus network with MRT, LRT and other modes; Feeder service routes ; Pedestrian facilities.
3	Space Integration	Spatial integration between terminals stations & various levels such as underground, ground and elevated. Desirable space connectors : lifts, ramps, stairs and escalators Reduced gap between platforms and trains / vehicles and tactile floors; Provision of concourse.
4	Institutional Integration	Integration among different agencies operators etc; One Controlling Authority above all; Single Tariff Association (joint tariff and distribution of jointly collected revenues). Transit Federation (with certain power to execute planning and construction works as well as facilitate coordination for routes and schedules);
5	Operational Integration	Operational performance and co-ordination of various modes of public transport; Eliminate wasteful duplication of services; Reduce headways on existing routes and extend services into new areas; Synchronization of time tables of various modes for both peak and non peak hours ; Matching modes to service requirement (high capacity and long haul modes i.e. commuter rail. rapid rail express bus etc. must run on major high density travel corridors while demand responsive services, park & ride facilities are provided in low density areas); Reserved bus lanes and streets. Changes of work schedules (spread peak demand by staggering work hours)
6	Physical Integration	Provision of transfer facilities such as covered link ways. Overhead bridges , under pass subway, bus shelters, taxi stands etc; Multi modal transport terminal Use of standardization identification symbols for various modes and services.
7	Service Integration	Provision for mobility of disabled persons; Provision of for children, women and people carrying luggage Good lit facilities at evening, night etc; Provision of toilets, phones and first aid.
8	Movement Integration	Integration of vehicle movement and commuter movement through organized space Provision for formal and informal space for commuters Sufficient space for maximum accumulation, turn over etc.
9	Fare Integration	Integration ticketing system to allow passengers to travel on MRT. LRT and buses. Unification of fare structure; Graduated fare structure (so that each passenger pays according to length of his total trip); Fare Discount (encourage off peak use of transit through discounts for travel before or after commuter hours. Simplify fare purchasing procedures for regular transit users through weekly or monthly passes, discounted fare for disabled/s senior citizens etc. Single fare systems for all transit modes so that passengers can move freely between the different services without being stopped by barriers turnstiles; Automatic ticket vending machines
10	Financial Integration	Sharing of budget allocation and cost sharing among various agencies : Share of revenues.

CASE STUDIES

Singapore

Multi –modal Public Transport System: Singapore integrated Public Transport Service includes bus mass rapid transit (MRT), light rail transit (LRT) and taxi. The amalgamation MRT of Singapore in the overall transportation system is a good example of multi modal transportation system introduced during 1992. On 01 November 2001, Singapore Bus Service (SBS) Transit came into existence which reflects the multi modal status, a move from being just a bus operator to provider of both bus and train service. Many initiatives, as discussed in the following sections, have been introduced to make traveling via bus MRT, LRT and taxi more attractive and comfortable.

Physical Integration : New transit station is now designed to integrate with commercial development and at least one other transport mode (Tong 2002). The North East Line, which was opened in June 2003, has all its stations well integrated with adjacent activity centers. This policy is a departure of the earlier MRT station design – often separated from the nearby neighborhoods and shopping area by a good 10 minutes walk on average. The Senkang LRT and the Punggol LRT act as feeder services to the North – East Line and are integrated with local neighborhoods.

Existing MRT stations are upgraded to achieve better integration. These include:

(a) Woodland MRT upgraded to have bus interchange:
(b) Novena MRT station integrated with nearby commercial development;
(c) Dover MRT station integrated with roadside bus stop ;
(d) Toa Payoh MRT station integrated with a relocated bus interchange;

More attention is given to the architectural design of new MRT station from both the aesthetic and accessibility points of view. Safe and easy walk paths and elevators are now provided for all users, especially for the ageing population and those on wheel chairs.

Volume : 6 | Issue : 1 | JANUARY 2016 | ISSN - 2249-555X

Network Integration: Bus and rail networks are properly integrated. It is suggested to use bus (or LRT) network so that only as a feeder service to MRT so that there is less surface road congestion on arterial roads, the MRT network is to provide the major share of the long haul travel. In changing the role of the bus network, it is important to ensure that current bus users are not penalized with a walking distance substantially longer than the current 300 m in order to catch a train, the issue of network integration becomes even more important if bus trunk routes are no longer provided.

Fare Integration: A single fare card usable on all public transport modes greatly facilitates integrated transport. Singapore introduced a magnetic stripe, stored value Transit Link fare card in 1990 for bus rail travel. A contact less smart card, called the EZ Card, was intruded in 2002 as a common fare card for all bus MRT and LRT services.

The impacts of such a system are efficiency gain and operating cost reduction. In a train study on the use of the EZ Card, the boarding time of a bus was found to decrease by 62 % compared with cash payment, and 34 % compared with magnetic transit cards. With a single fare card, it is also easy to encourage using public transport by introducing rebates for inter modal transfer ,Using the EZ card and the earlier Transit link Card, a rebate of up to Singapore $ 0.25 is given to an individual passenger who transfers form an MRT station to a bus within 30 minutes. Fare integration and rebates are powerful tools to achieve a high transit modal share.

Information Integration: A service company, Transit Link, was formed in 1989 to produce a transit travel guide and coordinate transit travel information such a routes, timetables and multi modal data at interchanges. The Transit Link Guide provides coordinated and comprehensive information on all aspects of traveling on bus, MRT and LRT in a single book. It is updated every year and remains in use today. An electronic version of the Transit Link Guide is also available through the internet.

In future, real time information could be provided through an I – Transport platform , this is an IT platform that integrates traffic information from road based ITS measures (signal) system, freeway monitoring system roads pricing system and transit based measurers (GPS equipped taxis and buses, MRT/ LRT locations). A traveler would be able to use this real time information to make decisions on modal choices, trip start times and route planning.

Institutional Integration: The formation of a service company such as Transit Link in 1989 was a first step towards institutional integration. In 1995 the Land Transport Authority was formed which combined the function of a planning agency and regulatory body for both public and private transport.

The latest institutional integration takes the form of two key operators. (a) SBS Transit operating the north East Line, the Senkang and Punggol LRT (also in the north east sector of the island) and the majority of island wide bus services. (b) the SMRT Group , which has most of the MRT lines :North South Line, East West Line, the Circle Line that is under construction and the Bukit Panjang LRT Line in the north west sector, Another bus company, TIBS operating on the north side of the island, is now part of the SMRT Group.

There is some overlap of the bus network of SBS Transit and TIBS and hence some competition. The rail networks are quite well segregated geographically. Each operator is thus in a good position to provide integrated services within its designated territory.

Multi modal Transport System –Hyderabad, India

Multi Modal Transport System (MMTS) is local train service in the city of Hyderabad. It is operational since 2003, an associate the South Central Railway (SCR) and is presently running 84 service a day, covering 27 stations. The first phase covers a distance of 43 km of Secunderabad-Falaknuma (15km) at a cost of Rs 173 Cr. Transport in Hyderabad is classified into two categories namely (a) MMTS Stations in Hyderabad (b) Railways stations in Hyderabad. The Falaknuma – Hyderabad (FH) is a rapid transit service of the MMTS of Hyderabad. It covers 17 stations and runs between Falaknuma and Nampally (Hyderabad). It is operated by South Central Railway. There is a combined pass issued by the state owned APSRTC and MMTS. Hence buying a single pass helps in traveling by bus as well as the train.

CONCLUSION

Singapore Public Transport System is one the best examples of multi modal transportation system and integrated planning, All LRT stations are located on arterial roads and integrated with feeder bus routes and covered walkways from station to adjacent HDB blocks similarly. MRT station and LRT stations are vertically integrated, within the station, vertical transportation between LRT / MRT platforms is through escalators and lifts without having to exit the paid area of the station, using the same fare card. It is seamless transfer at its best. The same is linked with bus interchange via bridges and covered link ways. Similarly planning of LRT stations has blended with surroundings commercial and residential development. In fact, integration of various modes and proper planning give faster and more comfortable transportation services to the commuters.

MMTS in Hyderabad lacks various integrations like bus-rail integration and information integration. It also needs restructuring of Bus routes to enhance MMS rider ship, development of new link ways from station entrance to bus shelters as well as interchange design.

In Delhi MMTS has enhanced accessibility in NCR. Economic Growth, Public Health. Environmental protection security safety and social cohesion, there is multiplicity of authorities involved in transportation, Metro rail is operated by DMRC, sub urban rail services by Northern Railway, bus transport services by DTC, and taxi and auto rickshaw by the private operators it is desirable to set up Multi modal Transport Authority as coordinating agency. Having representatives from various stakeholders, to regulate and facilitate the planning and implementation of transport system that is seamlessly integrated across all modes.

As a conclusion, Multi modal transport system is an integrated approach which requires systematic implementation of various measures and services amongst transport authorities agencies operators etc for multi modal travel. The role of bus services and rail network must be as compliment and supplement in nature to enhance rider ship.

There is need to integrate land use and mass transport planning to achieve physical integration. Public transport occupies comparatively less road space and causes less

Volume : 6 | Issue : 1 | JANUARY 2016 | ISSN - 2249-555X

pollution per passenger km than personal vehicles. It provides time cost saving, it generates patronage due to reduced travel time and improved accessibility for bus passengers and is considered as a more sustainable form of transport

The application of intelligent systems is also required to enhance the efficacy and sustainability of multi modal transport system for seamless mobility, Smart card tickets in Delhi metro, car taxi using wireless system in Delhi and Chennai vehicle tracking and monitoring system using GPS, GIS in Bangalore automatic vehicle tracking system using GPS technology by DTC in Delhi are some of the good examples of ITS application.

REFERENCE [1]Ministry of Urban Development, Study on Traffic and Transportation Policies and Strategies in Urban Areas in India, Final Report, May 2008, | [2]Central Road Research Institute, CRRI New Delhi, Planning of Mass Rapid Transit System. For Delhi,1989 | [3]Ministry of Urban Development (Delhi Division). New Delhi, Delhi Development Authority (2007) Master Plan of Delhi for 2021 | [4]DIMMTS Ltd Integrated Multi modal Public Transport network for NCT of Delhi New Delhi., 2008 | [5]Friedrich M. 1998 A Multi modal Transport Modal for integrated Planning paper presented at the 8 world conference on Transport Research Antwerp. | [6]Government of India, 2001, Task force on integrated Transport Policy, Planning commission New Delhi. | [7]Government of India 2006, National Urban Transport Policy 2006, Ministry of Urban Development New Delhi. | [8]I brahim Muhammad Faishal, 2003 Improvements and integration of a Public Transport System. The case of Singapore Cities Vol. 20 No. pp 205-216. | [9]Janic M and Reggiani . A. 2001 Integrated Transport System in the European Union . An Overview of Some Recent Developments Transport Reviews,pp 469 497. | [10]Kumar Pawan Kulkarni, S.Y and Parida (2009). Multi modal Transport System in Urban India , Proceedings of National Conference on Developing Harmonious and Sustainable cities in India for a better Urban Future March 20-21 New Delhi India. | [11]Luk James and Olszewski Piotr. 2003, Integrated Public Transport in Singapore and Hong Kong Road and Transport Research .Dec.2003 | [12]National Capital Regional Planning Board, 2005. Regional plan for NCR 2021 NCRPB. Ministry of Urban Development Government of India New Delhi | [13]RITES, 2005, Integrated Multi Modal Public Transport Network for NCT of Delhi RITES New Delhi | [14]Singh S.K. 2005, Review of Urban Transportation in India, Journal of Public Transportation Vol. 8 No 1 pp 79 -87. | [15]Tong C.Y 2002, The integration of Commuter Facilities at Mass Rapid Transit Stations, Proceedings of National Conference on Seamless and Sustainable Transport. November Singapore. | [16]Wilbur Smith Associates & Ministry of Urban Development, 2008, Study on Traffic and Transportation Policies and Strategies in Urban Areas in India New Delhi. | [17]EPCA report no. 19 (March 2006) , Status report on implementation of the High capacity, bus system in the NCT of Delhi, In response to the Hon'ble court's order dated November 30, 2005, In the matter of W.P.(C) No.13029 of 1985; M.C. Mehta v/s UOI & others | [18]Gupta S K, Nathani Nishant, December 2013, Urban Transport Green: India, International Conference on Emerging Trends in Engineering and Technology (ICETET'2013), Phuet.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 02 | Feb-2016 www.irjet.net p-ISSN: 2395-0072

Problem Identification of Traffic and Transport: Muzaffarpur City, Bihar

Ar. Nishant Nathani[1], Prof. S K Gupta[2], Prof. Sangeeta Bagga Mehta[3]

[1] Ph.D. Scholar, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India
[2] Dean and Director, Amity School of Architecture & Planning Amity University Haryana , Manesar, Gurgaon, India
[3]Associate Professor, Chandigarh College of Architecture, Chandigarh, India

---

Abstract - *India is a fast developing country. With the growth of city its need for traffic management has increased a lot especially in Tier-2 city. This study will talk about the identification of issues of Traffic and Transport of Muzaffarpur city. Survey has been conducted and photographs have been taken to understand the existing scenario and the problems which can be rectified very easily if the local authority took interest for the same.*

Key Words: Traffic and Transport, Right of way, congestion road, problem identification, Muzaffarpur, Traffic issues

1. INTRODUCTION

Solutions could be given only if the problems are identified. To understand the existing development scenario is the basic and prime requirement of any Traffic and transport related study.

The development of fast growing area is based on movement i.e. Traffic and transport. The problem of Traffic and transport is felt in almost all major cities across the India. This is primarily because growth of infrastructure is slow compared to growth in number of vehicles. The role of traffic and transport planning has a very wide scope; for instance improving safety and health, reducing emissions from vehicles, improving equity, enhancing economic opportunities, improving community livability, promoting mobility are all valid. This paper will talk about the existing scenario of Traffic and Transport, Road conditions and the issues related to each condition specific to the Muzaffarpur city..

2. ABOUT MUZAFFARPUR

Muzaffarpur urban area is the centre of commercial, business and educational activities of a large hinterland of Muzaffarpur district. Muzaffarpur is the largest town in northern Bihar and fourth largest city in terms of population after capital city Patna, Gaya and Bhagalpur. The district produces nearly one-third of the entire Litchi production of the country. The total area under the jurisdiction of Muzaffarpur Municipal Corporation (MMC) is about 26.68 Km^2 (2668.44Ha). The town is divided into 49 wards. The Muzaffarpur Municipal Corporation (MMC) is surrounded by River Budhi Gandak on north, Dighra Rampur Sah village on south, the National Highway (NH) 57 and railway line on west and extends upto reserve police station on eastern limit.

1.1 Rail and Road Connectivity

Muzaffarpur district has well developed means of communication. It has a network of railways and roads.

Regional Network of Muzaffarpur

· Muzaffarpur – Hajipur Highway (NH – 77)
· Muzaffarpur – Sitamarhi Highway (NH – 77)
· Muzaffarpur – Rewaghat road (NH – 102)
· Muzaffarpur – Darbhanga Highway (NH – 57)
· Muzaffarpur – Samastipur Highway (NH – 28)
· Muzaffarpur – Motihari Highway (NH – 28)

Map1: Indicating NH and Rail Connectivity of Muzaffarpur
Source : www.muzaffarpuronline.in

3. TRANSPORT SYSTEM IN MUZAFFAPUR

Muzaffarpur City is connected by NH-28, NH-57, NH-77 and NH-102. The total road network of Muzaffarpur city is approximately 72.17 km jointly managed by Muzaffarpur Municipal Corporation (38 km), Public Works Department (17.12 km) and the District Council (16.69 km). Approximately 99% of the roads under the jurisdiction of the corporation are pucca roads. The town has two intercity bus stands, one under BSRTC and the other for privately owned

buses. The key issues affecting the sector are heavy congestion, parking problems especially in the market areas and along the main thoroughfare. Encroachment of roads for commercial activities and for residential use by slum dwellers, lack of parking places, no traffic signals, no road signage and inefficient traffic management are some of the key issues. The situation worsens with water logging and overflow of drains in the rains.

Sl. No.	Roads looked after by	Number of Roads	Length (km)	Remarks
1	Municipal Corporation Roads	74	38.091	RoW varies between 4 and 25 m
2	PWD Roads	12	17.123	RoW varies between 8 and 30 m
3	District Council Roads	13	16.961	RoW varies between 5 and 24 m
4	**Total**	**99**	**72.175**	

Table-1:Roads under Various Authorities in Muzaffarpur
Source: Municipal Corporation, Muzaffarpur

3.1 Major Roads In Muzaffarpur

Compiled data of roads, their right of way, construction material and length of road under each department like Municipal corporation, PWD and district council is listed below:

S.No.	Name of the Road	Type of Road	Length (m)	Width (m)
1	Lalit Narayan Mishra Road (Malgodawn Chowk to Kalyani Chowk)	Pitch & PCC	1642	20-14
2	Mahender Marg Sadar Hospital Road (Lalit Narayan Mishra Road to Dak Ghar Chowk)	Pitch & PCC	476	17-19
3	Bank Road (Dharamshala Chowk to Mahatma Gandhi Road)	PCC	557	14-16
4	Nathu Chaudhary Road (Dharamshala Chowk to Chatha Chowk	PCC	562	12-13
5	Laxmi Narayan Road (Dharamshala Chowk to Achal Chowk)	PCC	517	7-10
6	Tilak Maidan Road (Town Thana Chowk to Navyukth Samiti)	Pitch	370	7-12
7	Sariyaganj Road (Tower Chowk to Navyukth Samiti)	PCC	215	10-14
8	Jawaharlal Chowk (Navyukth Samiti to Kalyani Chowk)	PCC	685	10-12
9	Sutapatti Road (Bank Road to Sarriyaganj Road)	PCC	256	6-11
10	Balughat Road (Akharaghat Road to Budhigandak)	Pitch & PCC	608	6-7
11	Yogender Mukherjee Road (Jawaharlal Road to Raghuvansh Road)	PCC	282	6-11
12	Gola Bandh Road	PCC	650	5-7
13	Raghuvansh Road	PCC	510	6-13
14	Kripnath Mishr Lane (Gudri Road to Raghuvansh Road)	PCC	180	4-8
15	Garibsthan Road(Chatha Bazaar Chowk to Purani Bazaar Chowk)	PCC	285	6-11
16	Kaidarnath Banerjee Road(Kalyani Chowk to Durgasthan Chowk)	PCC	780	9-12
17	Yadhupati Road(Nayi Bazaar Road Majhan Toil Road to Banaras Bank Chowk)	Pitch	310	6-12
18	Roti Wali Lane)	PCC	150	8-10
19	Mahajan Toil Road (Jumma Masjid Chowk to Pakki Sarai)	Pitch	458	9-11
20	Lakdi-Dhai Road (Nawab Road to Uttarbhaya Bandh)	PCC	265	10-11
21	Nawab Road (Banaras Bank Chowk to Church Road)	Pitch & PCC	586	11-12
22	Azad Road (Pakki Sarai Road to Church Road)	PCC	447	11
23	Maharaja Road (Azad Road to Gandak Bandh)	PCC	405	10-12
24	Kurbaan Road (Bhola Chowk to Nawab Chowk)	PCC	450	11
25	Church Road (Jail Chowk to Lakdi-Dhai Road)	PCC	634	5-18
26	Pakki Sarai Road	PCC	1053	12
27	Ali Mirza Road (Nayi Bazaar Chowk to Pakki Sarai Road)	PCC	261	11-16
28	Bhaukla Road (Sahu Road to Chaturbhusthan Chowk)	PCC	513	8-10
29	Kalibadi Road (Chaturbhusthan Chowk to Malighat Chowk)	PCC	948	8-10

30	Rambagh Road (Pakki Sarai Road to Sanskrit College)	PCC	522	6-13
31	Kachhi Sarai Road(Chhoti Kalyani Chowk to Amar Talkis)	PCC	479	8-15
32	Gudri Bazaar Road(Prabhat Sinera Road to Pakki Sarai Road)	PCC	979	6-9
33	Bahel Khana Road(Gudri Bazaar Road to Kachhi Sarai Road)	PCC	330	6-7
34	Pachrang Patti Road(Gaushala Chowk to Malighat Chowk)	PCC	1032	19-25
35	Purani Bazaar Road(Kaidarnath Road to Sahu Road)	PCC	180	9-10
36	Club Road (Kalyani Chowk to Jubbasahni Park)	PCC	1061	10-12
37	Rajju Saha Lane (Club Road to Railway Line)	PCC	360	5-6
38	Mukherjee Seminary Road (Club Road to Sarai Road)	PCC	235	7-9
39	Society Road (Pani Tanki Chowk to Gaushala Road)	PCC	550	8-9
40	Diwan Road (Club Road to Amgola Railway Sampar)	Pitch & PCC	400	8-10
41	Bhayamnandan Road (Town Thana Chowk to Nathu Choudhary Road)	Pitch & PCC	598	10-15
42	Nitivar Marg (Chanderlok Chowk to Kalambagh Chowk)	PCC	551	20-24
43	Padav Pokhar Road(Nim Chowk to Kalam Bagh Road)	PCC	814	4-5
44	Nandan Shah Marg (Nim Chowk to Atardah ke Siman)	PCC	1271	4-7
45	Refugee Road (Kalam Bagh Chowk to Ramdayalu Nagar Station)	Pitch	1121	5-25
46	Chaturbhuj Thakur Marg (Kalam Bagh Road to Refugee Marg)	Pitch	473	3-4
47	Damu Chowk Road (Chata Chowk to Vivekanand Road)	Pitch & PCC	963	9-11
48	Maujhaulia Road (Kalam Bagh Road to Railway Sampar No-5)	Pitch & PCC	1186	6-9
49	Chaturbhuj Sthan Road (Chaturbhuj Sthan Road to Kalibadi Road)	Pitch	235	8-11
50	Khabda Road (Kalam Baghroad to Railway Sampar No-6)	Pitch	883	4-10
51	Spekar Road (Kalam Bagh Road to Bhayam Nandan Road)	PCC	335	6-7
52	Choti Kalyani Road (Kalyani to Choti Kalyani)	PCC	200	5-9
53	Imli Chatti Road (Bus Stand Chowk to Mahbub Chowk)	Pitch & PCC	446	12-14
54	Mahendi Hassan Road (Motihari Road to Laxmi Chowk)	Pitch	820	9
55	Iqbal Hussain Road	Pitch	480	3-5
56	Soda Godaam Road	Pitch	318	3-4
57	Jhatakiya Road	Pitch	408	5-7
58	Juran Chapra Road-1	PCC	211	5-7
69	Juran Chapra Road-2	Pitch	202	5-6
60	Juran Chapra Road-3	PCC	257	5-6
61	Juran Chapra Road-4	Pitch	305	5-7
62	Ayodhaya Prasad Lane	PCC	290	3-4
63	Majlis Sahay Lane	PCC	140	3-4
64	Krishan Toil Road	Pitch	647	4-9
65	Madipura School Road	PCC	172	4-5
66	Chitragupt Puri Road	PCC	477	7-15
67	Ram Raji Road	PCC	464	3-5
68	Professor Colony Road	Soling	233	4-5
69	Bela Road	PCC	529	4-6
70	Pankha Toli Road	PCC	863	4-6
71	Orient Club Lane	PCC	225	4-5
72	Patwa Toli Lane	PCC	273	4-5
73	Pitambar Babu Lane	Pitch	318	5-6
74	Data Lambal Shah Mazar Road	PCC	200	6-7

Table -2 : Major Roads under Muzaffarpur Municipal Corporation

Source: Draft Master Plan, Muzaffarpur –-2027

Sl. No.	Name of the Road	Type of Road	Length (m)	Width (m)
1	Motihari Road (Juran Chapra Chowk to Laxmi Chowk)	Pitch	2583	14-30
2	Rewa Ghat Road (Juran Chapra Chowk to Bhagwanpur Chowk)	Pitch	1637	10-18
3	Kachhari Road (Juran	Pitch	2575	12-

	Chapra Chowk to Banaras Bank Chowk)			24
4	Hajipur Road (Purani Thana Chowk to Ramdayalu Nagar over bridge)	PCC & Pitch	3294	8-22
5	Devaria Road (Brahampura Thana Chowk to Damodarpur)	Pitch	1028	12-25
6	Gaushala Road	Pitch	976	16-19
7	Madipur Chowk to Butler Chowk	Pitch	615	9-12
8	Dak Bangle Road(Malgodam Chowk to Dak Bangla Chowk)	Pitch	376	15-22
9	Butler Chowk to Butler Railway Gumati	Pitch	332	12-13
10	Chakkar Road	Pitch	1262	8-24
11	Sikandarpur Road	Pitch	978	9-19
12	Akhada Ghat Road(Tower Chowk to Zero mile)	Pitch	1467	13-31

Table-3 : Major roads under PWD, Muzaffarpur
Source: Draft Master Plan, Muzaffarpur –-2027

Sl. No.	Name of the Road	Type of Road	Length (m)	Width (m)
1	Kalam Bagh Road (Butler Chowk to Mithan Pura Chowk)	PCC & Pitch	3523	5-17
2	Ladora Road (Madipur Power House Chowk to Railway Gumti)	PCC & Pitch	782	13-15
3	Dalsingh Sarai Road (Masjid Chowk to Gulgula Chowk)	PCC & Pitch	2314	20
4	Padmoula Road (Kachhi Pucki Road)	PCC	2314	20
5	Sahpur Road (Jubba Sahnipark to Nigam Limit)	PCC & Pitch	595	19-22
6	Brahampura Thana Chowk to N.H.-28	Pitch	1000	12-14
7	Ashram Road	Pitch	2263	20
8	Kathal Road	PCC	725	12-16
9	Major Ganj	PCC & Pitch	860	8-24
10	Khadi Board to Ram Bagh Chowk	Soling	439	17
11	Satpura to Bhorpur	Soling	570	4-7
12	Madipur Chowk to N.H.-28	PCC	509	5-6
13	Mithan Pura Road (Bela Road to Gaushala Road)	PCC	1067	11-19

Table -4: Major roads under District Council, Muzaffarpur
Source: Draft Master Plan, Muzaffarpur –-2027

3.2 Classification of Urban Roads and Traffic Characteristics

The type of construction of roads within Muzaffarpur is shown in Table 5. The town has about 26 km long concrete roads and 24.4 km long black top roads, together, which constitutes more than 70% of total road network. In addition, road stretches of 18 km length have been categorised as both concrete / blacktop construction. Nearly 3.7% road length (2.7 km) is kutcha.

Sl. No.	Surface Type	Length of Roads (km)	Percentage
1	Concrete Roads (PCC)	26.738	37.05%
2	Concrete Roads + Blacktop	18.273	25.32%
3	Black Topped/ Bituminous	24.440	33.86%
4	Earthen Road	2.724	3.77%
	Total	**72.175**	**100%**

Table 2.45 Division of Roads based on Surface Type
Source: Municipal Corporation Muzaffarpur

4. ISSUES IDENTIFICATION

This section of the paper will talk about the issues of traffic and transport in Muzaffarpur for this author has surveyed the area and clicked photographs to address the issues.

4.1 Garbage Collection Issue

There is a lack of garbage collection points in the city. Garbage pits has not been found throughout the city except some places, figure 1,2 &3 describes the scenario of garbage in the city.

Figure-1: Garbage on road
Source: Author

Figure-3: Garbage in between road, Chhata Bazar
Source: Author

Figure-3: Garbage on road, Shukla road
Source: Author

4.1.1 Issues:

1) No space for pedestrian
2) Very difficult to ride non motorized vehicle
3) Less Carriage way for movements
4) Cause of traffic congestions
5) Creates Unhygienic conditions as the animals take their food out of the garbage
6) Slow traffic as animals sits over the garbage.
7) No pedestrian movement
8) Difficult to travel NMT modes
9) Unhygienic condition
10) Movement of traffic is slow
11) Foul smell to traveller

4.2 Street Vendor Issue

Most of the major roads of the city is captured by street vendors. They capture 20% -30% Right of way, where as city is already facing the narrow roads and streets. Figure 4 & 5 is indicating such street vendors on the road.

4.2.1 Issues:

1) No space for pedestrian
2) Less Carriage way for movements
3) Cause of traffic congestions
4) 30% to 40% ROW is occupied by the vendors and the customers'

Figure-4: Vegetable street vendor, Chhoti Sariaya Ganj
Source: Author

Figure-5: Street Food vendor
Source: Author

4.3 Bottle neck at major road

Bottle neck in the city is one of the major causes of slow traffic and traffic congestions. Muzaffarpur is also having such bottlenecks in the city figure 6 indicates the bottle neck point in the city

4.3.1 Issues:

1) No space for pedestrian
2) Suddenly traffic gets slow
3) Cause of traffic congestions
4) Accident prone area

Figure-6: bottle neck at Saraiyajang
Source: Author

4.4 Electric Poles On Carriage Way

It has een observed that in many place the electrical poles are standing in between carrige way. Without considering the it will craete another king of bottle neck. It has aldo been observed people use space aroud the pole as a garbage dump area , since there is no movement of vehicle near the pole. Figure 7 & 8 are showing the condition of electric pole standing in between the road.

4.4.1 Issues:

1) Place used as a garbage dump area
2) Suddenly traffic gets slow
3) Accident prone area
4) Carriage way is not utilized properly
5) Area near the pole used as a parking space

Figure-7: Electric Pole on caraigeway
Source: Author

4.5 Water logging Issue

Drains of muzaffarpur are not designed and cleaned properly. Most of the area is facing the issue of overflow of drainge. Drains are open in nature and clogged due to non maintance issue. Grey and black water on the road creates trouble to the padestrian and other vehicular movements some of the area like Kedar nath road is facing this broblem

Figure-8: Electric Pole on caraigeway
Source: Author

Figure-9: Overflow of drain, Kaidar Nath Road
Source: Author

Figure-10: Overflow of Drain
Source: Author

through out the year. Now the traffic and move through that road is negligible as the peaople dont want to opt theat

route. Figure 9,10 and 11shows the scenario of water looging in usual days.

4.5.1 Issues:

1) Around the pole area used as a garbage dump area
2) Suddenly movement of traffic gets slow
3) Accident prone area
4) Carriage way is not utilized properly
5) Difficult to travel NMT modes
6) Unhygienic condition
7) Foul smell to traveller
8) Almost unused lane by travellers
9) Movement of Public transport is nil

Figure-11: Open and clogged drain
Source: Author

4.6 Un-organized Traffic

In the city traffic is not managed properly . enforcement of traffic rule is voilated most of time by the users, this leads to trffic jam and cogestions. User dont follw their lane especially teo wheelers, bicycle and cycle rikshaw. Figure 12 indiactes the scenario of un-organized traffic

Figure-12: Un-organized traffic
Source: Author

4.6.1 Issues:

1) Traffic Jam
2) Pollution noise and fossil fuel

4.7 Movement of NMT modes on Flyover

While designing the flyover the movement space for NMT was not provided in sufficient below the flyover so the NMT are bound to use the flyover which is difficult due to elevation of flyover. Figure 13 shows that NMT using the flyover

Figure-13: Movemnt of NMT on motijheel fly over
Source: Author

4.6.1 Issues:

1) Extra effort to the user
2) De-motivate the user to use NMT
3) Compelling to use motorised vehicle for travelling
4) Traffic gets slow as the NMT moves very slow in ascending direction.
5) To control NMT on descending direction is another difficult task.

4.8 Rope as a divider

Due to minimal width of right of way (ROW) to design proper divider is difficult as divider will take some of the area of carriage way. So the smart solution was thought of by the authority to control the traffic by dividing the road into two way road system. But in the rush hour rope is not able to serve its purpose. Figure 14 shows the use of rope as a divider

Figure-14: Rope as a divider at Tower Chowk
Source: Author

4.9 Other Issues

- No proper parking space in the town
- Intercity bus has not plied on the road
- Traffic is not managed properly
- No space for pedestrian to move
- Minimal carriage way to move motorised 4 wheeler
- IPT modes does not have proper route designated
- Lack in traffic signals on squares
- Zebra crossing is missing from entire city
- No speed limit
- Mix transport modes
- Right of way is shared by Cows in dogs, authority does not take proper care
- Garbage collection system is not proper so it is usually dumped on the ROW.
- Instead of tricycle electric rickshaw should be promoted
- Building norms and byelaws as not been followed proper ly most of the building has illegal construction eating up right of way
- Open Drainage system which eats up the pedestrian space.
- Improper drainage system due to this 20% of the roads or lane are used seldom for movement
- Fly over is used as parking space.
- Poor traffic management
- Big poth holes, slows the traffic
    - Speed breakers are not designed properly creates trouble for NMT as well as mechanically driven vehicle.
    - Big vehicles like MUV's and SUV's are having big share on the roads eating up much of the space of limited carriageway
    - Squares are not designed properly, so movement from one direction to another is difficult and slows down the traffic
    - On an average length of roads are 500 mtrs. 60% - 70 % of the roads/lanes are of less than 500 mtrs. Number of turnings is higher.
    - Bus stand is not designed properly with platforms
    - Street vendors eating up the movement space of narrow streets

5. CONCLUSIONS

It has been identified that most of the issues are related to management of traffic and transport. If the executing body and maintaining authority will work properly many of the issues may be resolved without much expenditure. Issues like open drain, overflow of drain, street vendors, electric pole etc. these issues could be resolved without much hindrance. So If the concern authority look with in and analyze the problems of traffic and transport it can be solved easily.

REFERENCES

[1] Nishant Nathani, Prof. S K Gupta, Prof. Sangeeta Bagga Mehta "Seamless Transport System for Feasible Moblity: Case Study" Volume : 6, Issue : 1, JANUARY 2016, pp 69-74, Indian Journal Of Applied Research, Journal DOI : 10.15373/2249555X

[2] Prof. S K Gupta and Ar. Nishant Nathani, Urban Transport Green: India, ICETET'2013, Phuket, Thailand, pp 103-108

[3] CDP, Muzaffarpur; Urban Development and Housing Department Government of Bihar

[4] National urban Transport Policy, Govt. of India

[5] Draft Master Plan- Muzaffarpur-2027

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

Thermal Performance of Wall & Roof – Efficiency of Building Materials

S K Gupta[1], Nishant Nathani[2]

[1] Professor, Dean and Director, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India

[2] Assistant Professor, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India

Abstract: ***Thermal condition of outdoor & indoor can be measure for the comfort level of human. A human can control the inside comfort level by thermal materials, but outdoor comfort level is not control by human, because man-made is things can only be controlled by the human. Indoor thermal conditions up to a certain extent can be improved by a judicious selection of building components, optimum orientation & proper selection of shading devices. Now-a-days such man-made materials are available which can control the climate. This paper contains the values of the different materials to control & perform better for the thermal performance in architecture & planning fields.***

Keywords: Sustainable, Thermal Performance, Material efficiency, climatic zones, Thermal Conductivity

1. Introduction

Sustainability is the need of time; the word may be used in buildings, towns, cities, traffic and transport etc. Sustainability is the term used for technology and methodology used for saving and conserving energy, it may be in the form of fuel, electricity or other means. While designing the sustainable building, understanding of thermal performance of roof and wall is important. The main aspects of the design of thermally comfortable buildings are minimizing the flow of heat & reducing wall & roof surface temperature under summer conditions. Up to certain extent indoor thermal environment can be controlled by proper design & planning of building sections in relation to the climatic conditions. In this building digest data on thermal performance of the building sections has been provided. This will enable the architects & designers to choose proper section & system to improve thermal environment in building.

2. Thermal Requirements

India is country with diversified climatic zones. Table-A represents the name of cities falls under different climatic zones. After that Method for calculation of overall heat transfer coefficient (U) has been used in illustrated at the end. The thermal conductivity of different building materials is shown in Table-B.

In earlier building digests the thermal performance of building sections were evaluated in terms of the parameter. 'Thermal Performance Index' (T.P.I.), in case of unconditioned buildings excess of peak inside surface temperature over 30 degree has been taken as the criterion & 08 degree temperature rise over this base temperature is taken as equivalent to 100 of T.P.I. Suitable criteria for rating & classification was also evolved & has been given referred building digests.

Table below listed out the names of cities in India according to climatic zones.

Table-A: Some Representative Towns Under Hot & Arid, Hot Humid, Warm & Humid, & cold Zones

S.N.	*Hot & Arid Zone*	*Hot & Humid Zone*	*Warm & Humid Zone*	*Cold Zone*
1	Agra	Ahmadabad	Cochin	Darjeeling
2	Ajmer	Asansol	Dwarka	Dras
3	Akola	Bhavanagar	Gauhati	Gulmarg
4	Aligarh	Bhuj	Puri	Leh
5	Allahabad	Bombay	Sibsagar	Mussoorie
6	Ambala	Calcutta	Silichar	Nainital
7	Bareilly	Calicut	Tezpur	Shillong
8	Bikaner	Cuttack	Veraval	Simla
9	Gaya	Dohad		Skardu
10	Jabalpur	Jamnagar		Srinagar
11	Jaipur	Jamshedpur		
12	Kanpur	Madras		
13	Khandwa	Madurai		
14	Kota	Mangalore		
15	Lucknow	Salem		
16	Ludhiana	Midnapur		
17	Nagpur	Nellore		
18	Neemuch	Patna		
19	New Delhi	Rajkot		
20	Roorkee	Ratnagiri		
21	Sambalpur	Masulipatam		
22	Sholapur	Surat		
23	Umaria	Tiruchirapalli		
24	Varanasi	Vellore		

Table B: Thermal Conductivity (K-Value) of Building Fabrics at Medium Temperature

S.N.	*Name of building Fabrics*	*Density Kg/m3*	*Mean Temp.*	*Thermal Conductivity K.Cal/hr/°CM*
1	Brick	1820	45.6	0.697
2	RCC (Mix 1:2:4 by weight)	2288	42	1.360
3	Cement Mortar	1648	45.6	0.808
4	RCC Brick	1920	42.5	0.945
5	Lime Concrete	1446	41	0.628
6	Mud Phuska	1922	42	0.446
7	Brick Tile	1892	41	0.586
8	Cement Plaster	1762	42	0.620
9	Cinder Concrete	1406	43	0.590
10	Cellular Concrete	704	42	0.162
11	Foam Concrete-1	704	42	0.128
12	Foam Concrete-2	250	40.8	0.054
13	Window Glass	2350	59.5	0.701
14	A. C. Sheet	1520	44.1	0.240
15	Timber Various	720	41	0.124
16	Gypsum Board (with layer of Hessian Cloth)	939	41	0.035
17	Vermiculite (loose)	264	42.0	0.059
18	Dolomite Brick	675	53.9	0.092
19	Crushed Dolomite	688	51.2	0.027
20	Thermocole	22	41	0.027
21	Foam Glass	160	41	0.047
22	Foam Plastic	24	29	0.027
23	Saw Dust	188	42	0.044
24	Soft Board	249	33	0.040
25	Wall Board	262	37	0.046
26	Chip Board	432	35	0.058
27	Chip Board (perforated)	352	35	0.057
28	Particle Board	750	37.20	0.084
29	Coconut Pith Insulation Board	535	44.0	0.052
30	Bartex Insulation Board	329	59.6	0.058
31	Jute Felt	291	37	0.044
32	Mineral wool slab	192	43.1	0.035
33	Crown Fiber Glass	32	40.1	0.032
34	G. I. Sheet	7520	50	52

Table C discuss about the quality performance are peak hours

Table-C: Quality Performance

Sl. No.	*Peak Degree Hrs. °C above 30°C*	*T. P. I.*	*Class*	*Quality Perform-ance*
1	< 6°C	<75	A	Good
2	> 6°C < 10°C	>75 <125	B	Fair
3	> 10°C < 14°C	>125 <175	C	Poor
4	> 14°C < 18°C	> 175 <225	D	Very Poor
5	>18°C	>225	E	Extremely Poor

Table D discuss about the correction factors of Material, Surface finish, Shades in different climatic zones like Hot Dry, Hot Humid, Warm –Humid

Table-D: Correction Factors

SN	*Description*	*Design Factors*	*Hot-Dry*	*Hot-humid*	*Warm Humid*
1	Material	Roof	1.0	0.95	0.92
		Wall	1.0	0.85	0.75
2	Surface finish				
	Roof	Dark	1.0	1.0	1.0
		Light	0.73	0.74	0.69
	Wall	Dark	1.0	1.0	1.0
		Light	0.79	0.77	0.75
3	Shade	Roof	1.0	1.0	1.0
		Wall	0.31	0.27	0.26

Table-E discuss about the Thermal Performance Index, U values & Overall Heat Transmission Value of different section and thickness of Walls (Hot Dry Climate)

Table-E: Thermal Performance Index & Overall Heat Transmission Value of Walls (Hot Dry Climate)

Sl. No.	*Specifications*			*U*	*TPI*	
	Basic	*Interior*	*Exterior*	*Kcal/m2hr°C*	*Value*	*Class*
Walls						
1	7.5cm brick Panel	-	-	3.379	231	E
2	7.5cm brick Panel	1.8 Cm cement plaster	1.8 Cm cement plaster	3.077	198	D
3	7.5cm brick Panel	7.5cm sundried Brick+1.8cm mud Plaster	1.8 Cm cement plaster	2.119	124	B
4	7.5cm brick Panel	Air space +1.5cm Sundried brick	1.8 Cm cement plaster	1.579	101	B
5	7.5cm brick Panel	11.5cm sundried Brick +1.8cm mud Plaster	1.8 Cm cement plaster	1.857	102	B
6	7.5cm brick Panel	Air space +11.5cm Sundried brick + mud Plaster	1.8 Cm cement plaster	1.429	84	B
7	11.5cm brick Panel	1.8cm mud plaster	1.8 Cm cement plaster	2.589	157	C
8	11.5cm brick Panel	11.5cm Mud sundried Brick +1.8cm mud Plaster	1.8 Cm cement plaster	1.688	85	B
9	11.5cm brick Panel	1.8cm mud plaster	1.8 Cm cement plaster	2.130	119	B
10	23 cm brick Panel	1.8cm mud plaster	1.8 Cm cement plaster	1.801	87	B
11	15.0cm cement Conc. Block	-	-	3.163	175	C
12	15.0cm stone block	1.8cm lime plaster	-	2.920	161	C
13	20.0cm stone block	1.8cm lime plaster	-	2.668	132	C
14	30.0cm stone block	1.8cm lime plaster	-	2.187	89	B
15	25.0cm mud wall	-	-	1.43	79	B

Table-F discuss about the Thermal Performance Index & Overall Heat Transmission of Roof Sections (Hot-Dry Climate

Table-F: Thermal Performance Index & Overall Heat Transmission of Roof Sections (Hot-Dry Climate)

Sl. No.	*Specifications*			*U*	*TPI*	
	Basic	*Interior*	*Exterior*	*Kcal/m2 hr°C*	*Value*	*Class*
1	10cm RCC	1.50cm Plaster	9.0cm lime concrete	2.221	134	C
2	10cm RCC	1.50cm Plaster	5.0cm mud Phaska+5.0cm Brick tile	2.056	122	B
3	7.5cm cement Concrete	1.50cm Plaster	9.0cm lime concrete	2.320	149	C
4	11.5cm brick Panel	1.50cm Plaster	7.5cm lime concrete	1.977	132	C
5	5.0cm timber	-	15.0cm mud Phaska+ Cow dung Coating	1.069	89	B
6	13.0cm RCC	1.50cm Plaster	9.0cm lime concrete	2.11	121	B
7	7.5cm stone	-	12.0cm mud Phaska	1.881	126	C
8	3.5cm brick Tile over wood rafter	-	12.0cm mud phaska	1.327	121	B
9	7.5cm brick Tile over wood rafter	-	12.0cm mud phaska	1.748	104	B
10	15 cm brick Tile over wood rafter	-	1.5cm cement concrete	2.58	161	C

Table-G: discuss about Thermal Performance Index over Heat Transfer Coefficients of Slop Roofs

Table-G: Thermal Performance Index over Heat Transfer Coefficients of Slop Roofs

Sl. No.	*Basic Elements*	*Interior Lining along the Slopes*	*U*	*TPI*	
			Kcal/m2hr °C	*Value*	*Class*
1	0.640 A.C. Sheet	-	4.24	378	E
2	0.640 A.C. Sheet	Air space 2.5cm fiber glass	0.932	104	B
3	0.32 G.T. Sheet	--	4.76	425	E
4	Country tile on bamboo matrix	--	3.422	322	E
5	Mangalore tiles	--	4.419	390	E
6	7.5cm compressed straw boards	--	0.826	102	B

3. Correction Factor

The correction factor (F) for calculating T.P.I. values due to other climatic zones for unconditioned buildings were obtained & are shown in Table-D. The modified T.P.I. value can be obtained from the simple equation.

Corrected T.P.I. = (T.P.I. – 50) x F + 50

3.1 Example

The Find the corrected T.P.I. values in Hot-Dry & Hot-Humid region for 7.5 cm brick panel (light color surface finish) with 1.75cm thick cement plaster on both sides. T.P.I. value from Table-E is 198 for the wall & correction factors are 0.79 & 0.77 (from Table-D).

1) Corrected T.P.I. in Hot-Dry region (Light colors)
= (198 – 50) x 0.79 +50 = 166.92
2) Corrected T.P.I. in Hot-Humid Region

Similarly the effect of surface finish & shading can be calculated.

4. Inferences

It can be observed from Table-E that a layer of mud plaster can be used to reduce T.P.I. & U-values. The results also indicate that it is more effective when used on exterior surface. The thermal performance improves considerably with the increase in thickness of brick wall. It is also observed that cement concrete block & sand stone masonry are inferior to brick wall for the equivalent thickness. However, mod walls are better than brick wall. It may be noted from Table-E that an additional layer of 7.5 cm sundried brick wall & air space in between improve the thermal performance to a great extent. The increase in thickness of sundried brick from 7.5 cm to 11.0 cm further reduces the T.P.I. values from 101 to 84.

Thermal performance of roof without any insulation treatment does not satisfy the thermal requirements. It can be improved by additional treatment of insulating materials. A treatment of 5.0 cm to 7.5 cm of mud phaska on RCC & RBC improves the thermal performance considerably as may be observed from Table-F. On the type of insulating materials like foam concrete, thermocole, wood wool board can also be used. 2.65 cm thickness of insulating materials will be sufficient for these purposes.

It can be observed from Table-G, that the thermal performance of sloped roofs can be improved to a great extent, this surface as done in suspended ceiling.

5. Calculation of U-Values

The u-values can be calculated from knowledge of K-values of different materials, their thickness & surface coefficients. The K-values of different type of materials are given in Table-F. The formula for calculating U-values is:-

U =1/RT = Ro + R1 + R2 + Ri
Where Ro = 1/fo, Ri = 1/fi , Ri = Li/k1 , R2 = L2/k2
Where RT = Total Resistance offered in the materials.
fo = Outer surface coefficient.
fi = Inside surface coefficient.
L = Thickness of material.
K = Thermal conductivity.

One example of calculation U-values is given below:-

Example:
To calculate the U-value for a 20 cm thick brick wall, with 1.0 cm thick cement plaster on both sides:

K1 = 81.8 (plaster), K2 = 69.7 (Brick), K3 = 81.8 (plaster) Kcal/ hr cm^2 per cm.
L1 = 1.0, L2 = 20.0, L3 = 1.0 cm, f1 = 8, fo = 19.42
R1 = L1/K1 = 1.0/81.8 = 0.0122
R2 = L2/K2 =20.0/69.7 = 0.2870
R3 = L3/K3 = 1.0/81.8 = 0.0122
Ri = 1/f1 = 1/8 = 0.1250
R0 = 1/fo = 1/19.42 = 0.0515
RT = 1/fo + 1/f1 + R1 + R2 + R3 = 0.4879
U = 1/RT = 1/ 0.4879 = 2.05 Kcal/hr cm^2.

Equalize the length of your columns on the last page. If you are using *Word*, proceed as follows:
Insert/Break/Continuous.

6. Recommendations

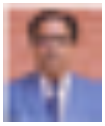
From the data on thermal performance index & U-values presented in this paper can assess the relative performance of wall & roof sections. It will enable them to make proper choice of materials to obtain better indoor thermal conditions. These values refer to Hot-Dry climate. From the correction factors, the thermal performance rating can be calculated for other climatic zones.

By using these methods and materials the energy could be saved which will contribute to build a sustainable building. Properly selected material according to climatic zone will help in reducing the use of active means of cooling or heating.

References

[1] Dr K.N. Agarwal , Scientist, C.B.R.I. Roorkee 1974.
[2] Dr R. Prasad HOD mechanical Deptt. U.O.R Roorkee 1972.
[3] IS 3792-1978
[4] Gupta, S. K., & Nathani, N. (2015). Quantitative Measurement Techniques Daylight and Artificial Light: Housing Design. Sustainable Constructivism: Traditional vis-à-vis Modern Architecture ISBN: 978-93-83083-76-3, 104-109.
[5] Gupta, S. K., & Nathani, N. (n.d.). Urban Transport Green: India.
[6] Gupta, S. K., Khan, M. R., Nathani, N., & Prakash, P. (2014). Pedagogy for Green Building: India. International Journal of Environmental Research and Development, 27-32.
[7] Khan, M. R., Nathani, N., & Prakash, P. (2015). Sustainable Indian Architecture, "Case Study – Bandebambli". Journal of Basic and Applied Engineering Research, 654-659.
[8] Nalin, R., Prakash, P., Nathani, N., & Khan, M. R. (2014). Climate Specific City Planning Guidelines. Sustainable Constructivism: Traditional vis-à-vis Modern Architecture ISBN: 978-93-83083-76-3, 98-103.
[9] Prakash, P., Khan, M. R., Nathani, N., & Ranjan, N. (2014). Green building—traditional approach for future. International Journal of Applied Engineering Research, 185-192.

Author Profile



Prof. S K Gupta has completed his B.Arch. & MURP from IIT Roorkee. After his Post graduation he worked with Ansal Group as a chief Architect then Retired from Chandigarh college of Architecture, Chandigarh as a Principal. At present he is Director in Amity School of Architecture & Planning, Amity University Haryana.

Ar. Nishant Nathani has completed his B.Arch. from VTU, Belgaum and then Post Graduated from IIT Roorkee. Then he worked with Architect Hafeez Contractor. At present he is Co-Ordinator, Architecture in Amity School of Architecture & Planning, Amity University Haryana. He has won Yuva Ratna Award, Pidilite Award for Excellence and a design competition organized by Sarv Shiksha Abhiyan, Haryana.

International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

Climatic Elements & Their Impact on Building Design

Prof. S K Gupta[1], Ar. Nishant Nathani[2]

[1]Dean and Director, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India

[2]Assistant Professor, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India

Abstract: ***Climate plays very important role in architecture designing. It has so many parameters to govern the climate as a whole. The resultant after applying the climate parameters is quite different than normal architectural design. While in architectural designing, the architects have to consider all the parameters together to achieve sustainable energy efficient and green building.***

Keywords: Building design, Human Comfort, Climatic element

1. Introduction

Designing of sustainable green building is on priority now days. The climate plays an important role while designing a building so the consideration of climate while designing is of great importance. Climate varies with the places. The climate of a particular region is determined by the pattern of several elements & their combinations. The assessment of climate parameters is to be considered in true manners to get the correct architectural design.

2. Human Comfort

The main elements for building design & human comfort considered for this study are:-

2.1. Air Temperature

The rate of heating & cooling of the earth's surface is the main factor determining the temperature of air. Since the air is transparent to all solar radiation therefore it has only an indirect effect on the air temperature. But the air layer, in direct contact with the warm ground is heated by conduction & this heat is transferred to upper layers by means of convection, turbulence & eddies currents. These eddies currents & winds brings large masses of air in contact with earth surface to be warmed up & so on.

In winter: at nights, the earth is usually cool on account of long wave radiation to the sky and therefore the heat exchange is reversed and the air in contact with ground is cooled.

Water bodies are affected at a low rate than the land surface under same condition of solar radiation. So the land surface is warmer in summer and colder in winter than the sea surface on the same attitude.

Change in altitude also alters the temperature. On rising, the air moves from a higher pressure to lower one therefore it is cooled & vice-versa. This difference is 1°C per 100 meters.

When water vapour condenses to form droplets, the latent heat is evolved in the process & this heat thus reduces cooling as long as the condensation continues. This decrease is known as the lapse rate. The lapse rate varies with season and the time of the day, but on an average it is 0.6°C per 100 meter. Lapse rate is more during day near the ground as the air layer near the ground is warmer. This heated air expands and tends to rise, making lower air layer unstable and constantly mixing with upper layer. But at night the earth surface cools more than the air therefore the air near the ground becomes cool earlier than the upper layers. This results in a reversal of normal vertical temperature gradient near the ground. This phenomenon is known as *surface inversion*. Since the lower air layer is cool and heavy, this becomes stable and vertical air movement is suppressed. These conditions prevail in long nights, clear sky, dry air and in the absence of wind flow. The cold air near the ground tends to concentrate in low areas, such as valleys where the temperature may be many degrees lower than over high grounds.

2.2. Humidity

Atmospheric Humidity refers to the water vapour content of the atmosphere. Water vapour enters the air by evaporation, primarily from the ocean's surfaces. The vapour is carried & distributed over the earth surface by the winds. The capacity of air for water vapour increases with the temperature, which results in uneven distribution of the vapour over the earth's surface. It is highest in the equatorial zone and decreases towards the poles.

2.2.1. Absolute Humidity
Weight of water vapour per unit volume of air terms (g/m^3).

2.2.2. Specific Humidity
Weight of water vapour per unit weight of air terms (g/m^3).

2.2.3. Vapour pressure
Is the part of the whole atmospheric pressure that is due to the water vapour (mm. Hg).

2.2.4.Relative Humidity (RH)
The relative humidity at any temperature is the ratio of Actual Absolute Humidity to the maximum moisture capacity of the air at the temperature or the ratio of water vapour in the moisture to the water vapour in the saturated

air and is expressed in percentage e.g. if the Absolute Humidity of air for any given temperature is equal to 8 g/m^3 & the saturated air at same temperature contain 10g/m^3 the ratio is 8:10 which when expressed in percentage, the RH will be 8x100/10 = 80%. When the air actually contains all the water vapour it can hold, it is said to be saturated & then relative humidity is 100%.

Physiologically, vapour pressure of the air is the most convenient way to express the humidity conditions, because the rate of evaporation from the body is alpha to the vapour pressure difference between the skin surface and ambient air. The RH also affects the behavior of many buildings and their rate of deterioration. The Humidity does not affect directly the heat load operating on the body, but it determines the evaporative capacity of the air and hence the cooling efficiency of sweating.

The air in the lower layers of the atmosphere always contains a certain amount of water vapour resulting from evaporation of the earth's surface. The rate of evaporation depends primarily on temperature and wind. Observations in the tropics show that the surface of ocean evaporates 0.3 m deep layer of water in a year. However, there is a limit to the amount of water vapour the air can absorb, since the further evaporation will super saturate the air. As is known, if saturated air is heated it can absorb additional water vapour and on the contrary, if cooled saturated will change to super saturation. Thus it is clear that the ability of air to absorb & retain the maximum amount of water is directly related to the temperature, values given in Table-1. The moisture content of the temperature can be expressed in several terms i.e.

Table-1: Amount of water vapour in air V/s its temperature

Air temperature Degree Celsius	Max. amount of water vapour g/m3 of air
-20	0.94
-10	2.15
0	4.57
+10	9.14
+20	17.36
+30	31.51

2.3. Precipitation

Large-scale cloud formation and precipitation result from adiabatic cooling of large air masses and are affected greatly by the vertical stability of the air. A mass is raising air cools by expansion, eventually reaching its dew point. Then the large scale condensation occur forming clouds composed of innumerable tiny water droplets and sometimes icy crystals. Heavier enough droplets begins to fall and withstand the evaporative loss during the descent, thus finally precipitation occurs.

The basic purpose of planning/designing is to create a desirable & efficient environment for good, pleasant and healthy living. A well designed building is the best possible compromise between the various aspect that govern the design i.e. the unit design, the grouping of independent units, building materials used, physical layout, landscaping, orientation with respect to sun and wind etc.

Table 2: Response of Human body to Temperature and Relative humidity

Factors	Human body response (Feeling)
Temperature Range	
35°C & above	Very Hot
30°C – 35°C	Desirable level
20°C – 30°C	Cool
Less than 20 °C	Cold
Relative Humidity (RH)	
0% – 25%	Very Dry
25% - 50%	Dry
50% - 75%	Humid desirable range -+10%
75% - 100%	Very Humid

Proper orientation of the single unit or building cluster plays a major role in increasing the efficiency of the housing unit. Traditionally, in any given time and place, climate has always played a very significant role in bringing out a characteristic building 'form' along with other aspects mentioned above. The climatic considerations were as important as other socio-technological aspects. The sloping roofs of the houses built on southern slops of cold hilly regions, the extended 'Aangan' (sit out verandah on residential street) in the areas of moderate climates and the essential building features of a hot dry climate such as basement, verandah, jharokhas, narrow streets as in Jaisalmer (Rajasthan) are a proof of this climate. A unit, when properly designed, can achieve a high degree of efficiency without the use of mechanical energy device and help to reduce the load on mechanical devices considerably. The human work output, nature and even health can directly affected by climate. Air temperature, radiation, humidity, air movement are various factors that can effect work out-put nature and even health get directly affected by the conditions of comfort or discomfort created by climate on human body explained in table-2.

When temperature is increased the condition would change from humid to dry. A humid or very humid situation can be very uncomfortable in the absence of proper air movement. In order to plan/design in any part of India, it is most desirable to get familiarize with the climatic conditions prevailing in the region. Climatic data for Delhi region:
A) Latitude - 28°-85'
B) Longitude - 77°-12',
C) Mean Sea Level - 218 m elevation
D) Mean Rain Fall - 666.6 mm

Table 3: Seasons in Delhi

S	Season	Effect
1	Cool & cold temperate: December to February	Heat desirable both at day & night time. Sit out in sun during day time quite desirable.
2	Temperate Season: Sept. – Dec.	Comfortable conditions prevail during evening & morning.
3	Hot Arid Season: April – June	Low humidity, high air temperature very uncomfortable conditions prevail. Cooling desirable especially during day time. Hot dry sun must be kept out. Sleeping out on open terrace desirable.
4	Warm Humid (Monsoon) June – Late Aug	Air temperature somewhat low, high humidity, bearable discomfort, free air movement very desirable. Cross ventilation of air very comfortable.

For Delhi region the building is best oriented with respect to sun when its longer axis is placed East – West & with respect to wind when the axis is placed North – South. The combined effect with respect to sun and wind shall be best suited when the shorter axis is at inclination of 20 degree East of South.

Shading /louvers by chajjas and fins would ensure the entry of the winter sun, cutting out the undesirable summer sun. Shading/louvers can also be embraced by proper plantation. Reduction in heat reflection by using proper paving material and by choosing correct building materials, their colour & texture, minimizing the dimensions of East-West and at the same time placing the non critical areas such as toilets, stair cases, stores etc. on these faces.

Courtyards, verandah & porch are effective in mitigating the summer heat effect. A courtyard encloses a cushion of air which retains the cool of earth, shaded from the sun. For this reason a courtyard with a longer East – West dimension is not so effective as the one with a shorter East –West direction, where the courtyard is exposed to the summer sun for shorter time. For the same reason it may be that narrow street tend to remain shadier & hence cooler in summer.

Air movement affects body cooling. It does not decrease the temperature but causes a cooling sensation due to heat loss by convention from body & due to evaporation from body.

Table 4: Effect of wind sped on human body

Wind Speed (meter/ second)	Effect on human body
0.00 - 0.25	Unnoticed
0.25 - 0.50	Pleasant
0.50 - 1.00	Generally pleasant but causing awareness of air moment
1.00 - 1.50	Slight draft effect to annoying drafty
1.50 - above	Require corrective measure

- Vapour pressure is exerted by quantity of water vapour in air – More than 15 mm of Hg – People feel depressed. Over 15 mm of Hg Vapour Pressure (V.P.) each additional mm of V.P. can be counter acted with 0.45 meter / second wind.
- Evaporation decreases Dry Bulb Temperature (DBT). The temperature decrease caused by evaporation of added moisture will restore comfort temperature. The Bio climatic chart is plotted with DBT on one axis & R.H. on the other then in the middle is comfort zone.
- The condition determined by DBT & R.H. can be plotted. If plotted point falls in comfort zone we feel comfortable in shade (Table-5).
- If it is outside, higher than upper perimeter wind in needed.
- If temperature if high & R.H. low we feel dry & hot then wind is of little help, so evaporative cooling is required. This can be done by adding grains of moisture / pound of air to reduce temperature.
- At lower perimeter – radiation is needed.

Table 5: Chart showing different levels of DBT and RH

1	DBT 75% R.H. 70%	Comfort zone
2	DBT 75% R.H. 50%	280'-0' wind to counter act V.P.
3	DBT 50% R.H. 56%	260'-0' BTU /hr sun radiation
4	DBT 75% R.H. 50%	Comfort zone
5	DBT 87% R.H. 30%	By two layers - 300'-0' wind evaporative cooling by adding 8 g moisture / lb of air
6	DBT 95% R.H. 20%	Comfort cannot be achieved by wind alone even 700 FPM wind have to supplemented by 9 g moisture/ lb of air

2.4. Solar Radiation

This is an electromagnetic radiation of different wave lengths and is measured in a unit called microns (= 1/1000 of millimeter). The quantity of heat transmitted in one minute to 1 cm^2 of earth surface is defined as solar constant which is equal to 2 cal per cm^2 per minutes. Solar energy is transmitted as:-
Ultra Voilet (short waves) < 0.40 micron
Infra Red (long waves) > 0.76 micron

Most of the radiation is perceived as heat & only an insignificant part as visible light (visible to eye) 0.4 to 0.76 micron. As radiation penetrations the earth atmosphere its intensity is reduced due to:-

2.4.1. Absorption
Radiation is absorbed in the atmosphere according to wave length. U.V. are absorbed by ozone I.R – by water vapour & CO_2.

2.4.2. Reflection
Takes place from water droplets. Clouds also reflect back considerable fraction of radiation to outer space & the remaining reaches earth surface in diffused form.

2.4.3. Scattering
When the light impinges on molecules, similar or smaller then the wave length, radiation is reflected & diffused in space. Smaller molecules scatter shorter wave length i.e. blue & violet giving blue color to sky. When the atmosphere contain larger particles of dust the air turbidity is increased which scatter long wave radiation i.e. yellow & red giving white color sky.

Therefore the earth received considerably less solar energy due to various above losses.

- Part of the solar radiation is reflected by surface of clouds.
- Part is absorbed by atmospheric ingredients.
- Some is scattered by molecules in the atmosphere but some of this is regained as diffused radiation.
- Part of the radiation received by earth surface is reflected but most is absorbed & changes to heat & raise the temperature of air, ground & surrounding objects.

Of the total amount of solar energy reaching the earth, the atmosphere absorbed 15%, consequently the depletion of solar radiation by dispersion & absorption for different

latitudes varies greatly. This is dependent on the incident angle of the sun's rays.

Table 6: Depletion of Radiation V/s Incident angle & length of Path traversed by Sun rays

Incident angle of Ray	90°	50°	30°	10°	00°
Length of path traversed by ray	1	1.3	2	5.56	35.4
Degree of radiation depleted	25%	31%	44%	80%	100%

2.5. Long Wave Radiation to the sky

Long wave radiation is emitted by the surface of the earth to the atmosphere & outer space. The intensity depends on the difference between the temperature of the earth surface and of the absorbing. The long wave radiation is emitted in all the directions by the gases in the atmosphere & the downward component of this is absorbed by the earth. In the atmospheric gases, water vapour is the principle long wave radiation absorber along with CO_2 which is less important.

The difference between the discharge of radiation from earth surface & that emitted back to earth by the atmosphere is net radiation heat loss. When the sky is overcast this loss as the water particles in the clouds absorbs & emitted the whole long wave radiation / spectrum emitted by the earth, in contrast with the limited absorption by water vapour in case of partially cloudy overcast sky where all the radiation given out by the earth is absorbed at the base of the cloud. Thus the net radiation heat loss is high when the atmosphere is clear and dry.

For the radiation balance of a city, reflected radiation is of great importance. Its magnitude depends on the intensity of direct solar irradiation & the reflection factor. This reflection factor of building materials, soil, green spaces etc. depends on the color, texture & other physical properties of the surface.
Light Concrete - 30 – 35%.
Light Marble - 45%.
Lime Stone - 50 – 65%.
Rough grey Asphalt - 25%.
Lawn - 20%.
In urban areas these surfaces are the additional source of reflection heat and so substantially raise the heat load.

2.6. Wind

The character & distribution of winds over a region are determined by several factors. The main determinants are:-
a) Seasonal global distribution of air pressure.
b) Rotation of earth.
c) Daily variations in heating & cooling of land and sea.
d) Topography of the region and its surroundings.

The wind flow is caused due to high & low air pressure areas. The main cause of the pressure belts is the uneven distribution of solar radiation over the earth and the resulting variation in surface heating. On the equatorial regions, a large quantity of radiations is received & the air is heated above the level of air in adjacent regions. This heated air expands and is lifted upwards, leaving a belt of low pressure to wards which air flows from the surrounding regions. As the centre line of the maximum radiation zone in each hemisphere is shifted in summer towards the subtropics, the low pressure belt also moves accordingly. The distribution of land masses & oceans in these regions determines the position of maximum heating zone & consequently the pressure belts.

Air flows from higher pressure to lower pressure zones. The permanent & semi- permanent regions of high pressure are sources of large masses of air which acquire specific physical characteristics according to the nature of the surface on which they rest.

The main regions generating such air masses are:-

a) The polar regions (throughout the year).
b) The cold land masses of Asia, North Africa & North America (in winter).
c) The subtropical high pressure belts, particularly over the ocean (in summer).

2.6.1. Trade winds
Originates in the sub tropical high pressure regions of the two hemisphere and converge at inter tropical front forming the low pressure equatorial belt. These winds have similar temperature, humidity and flow to
- South West in North hemisphere &
- North West in South hemisphere.

Over most of the oceans these winds produce small disturbances owing to constant direction and speed (15 to 30 km/hr), but over the Indian Ocean the direction of winds are reversed by monsoons in summer.

2.6.2. Westerly's winds
Also have their origin in the subtropical regions & flows towards sub arctic low pressure regions & converge at polar fronts. Due to large difference of temperature of westerly's & polar winds, the fronts are stormy.

2.6.3. Polar winds
These winds are formed by the cold air masses spreading out from the polar and arctic high pressure regions.

2.6.4. The Monsoon Winds
The difference between the annual mean temperature patterns over land & sea produces the winter land winds & summer sea winds known as monsoon.

2.6.5. Land & Sea Breezes
During the day the air over land is heated more than that over sea surfaces on the same latitude. The cold sea air replaces the rising warmer air. At night this process is reversed. These winds are known as breezes.

2.6.6. Mountain & Valley Winds
In mountain areas local thermal differences result in local wind patterns. The winds are directed up the mountain at day time & down at night. The air near the mountain surface is heated mere than the free atmosphere at the same height & so rises up at day time & at night the process is reversed.

Table 6: Characteristics of Wind Force & Speed

Description	*Speed (meter/sec)*	*Effect of wind on land*
Calm	00 .00- 00.20	Smoke rises vertically
Light air	00.30 - 01.50	Direction of wind indicate by movement of smoke
Light Breeze	01.60 -03.30	Resting of leaves wind on face
Gentle Breeze	03.40 -05.40	Movement of thin branches & leaves.
Moderate Breeze	05.50 - 07.90	Raising of dust, movement of trees & branches
Fresh Breeze	09.00 -10.70	Small trees sway
Strong Breeze	10.80 -13.80	Wires hum
Moderate Gale	13.90 - 17.10	Walking becomes difficult
Fresh Gale	17.20 - 20.70	Branches are broken, walking difficult
Whole Gale	24.50 - 28.40	Damage roofs
Storm	28.50 - 32.60	Severe damage
Hurricane	32.70 - above	Severe destruction

In the Delhi region, the prevalent wind direction for the year round is from North West. The hot dry winds of May tend to blow from North & west & the cool winds of Dec./Jan tend to come from the West. The only exception to this direction is the monsoon months of late July – August, when the wind blows from the East. While orienting a unit for wind, best results would be obtained if the window surface is perpendicular to the directions of the wind. However, if the face needs to be turned away from this optimum, a turn of up to 60 degrees away from the perpendicular direction would reduce the velocity by 30%. Thus, the loss of benefit is not so much as in the case of solar orientation.

Cross ventilation or through movement of air current is highly desirable especially in the hot humid period of during 7 immediately after the monsoon season. This movement should be ensured at sill level or lower if natural ventilation is to be of any use while sleeping at night. Air circulating at higher levels is relatively useless.

Wind velocity through the dwelling unit can be increased by permitting the wind through small opening on the wind ward side and a larger one on the lee ward side (ratio of 1:2.5). This requirement alone makes it necessary to have controllable opening on both the opposite faces.

Since the windows are thin glass surfaces, they also become heat transmitters. For this reason, the window area must be kept to an optimum ($1/8^{th}$ or $1/10^{th}$ of floor area).

The temperature difference that exists between the air inside the dwelling unit & the air outside, due to the disparity in weight causes the warmer air to rise, by displacement. This movement caused is called the stack effect. It is this effect that causes the air current inside the dwelling unit to move.

For a site which has several buildings, some of them, tend to come in the way of the direct wind movement line of the others. On the leeward side of the building 'eddies' zone of weak & indefinite air current, are created. The depth of an eddy is determined by several factors such as the height of the building, the depth of the building, the face on which the wind is hitting it & the angle at which the wind meets the face of the building. While planning a group of buildings on one site an attempt must be made to keeps one building out of the wind shadow of the other.

2.7. Condensation & precipitation

When air containing a given amount of water vapour is cooled, its moisture holding capacity is reduced, increasing the R.H. until it becomes saturated. The temperature at which becomes saturated is known as the dew point. The dew-point at a given atmospheric pressure depends only on the vapour pressure of the air. Cooling of the air may be affected by three processes:-

1) Contact with cooler surfaces.
2) Mixing with cooler air.
3) Expansion associated with rising air currents.

The first two processes result in Dew & Fog formation, the third one can cause large-scale precipitation.

2.7.1. Dew

Cooling by contact with colder surface is limited to the lower air layers. When condensations result, it takes the form of dew on the cold surface.

2.7.2. Fog

Fog is formed when the air does not come in direct contact with the cold surface and it is cooled below the dew point.

The conditions promoting the formation of fog are:-

- Cloudless sky, which promote long wave radiation to outer space & cooling of the ground & lower layers.
- A temperature inversion near the ground, which prevents vertical mixing of lower air layer with upper layers.
- Absence of winds, which may also prevent heating of the air layer by nertical mixing.

Fog is thicker & more prevalent in valleys & topographic depressions where the colder, heavy air tends to collect. This also occurs in coastal regions with shore winds bringing moist air in contact with a colder land surface.

3. Conclusions

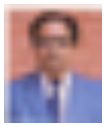
Climatic points are to be discussed above all important while designing the dwelling unit. It is look after the location, surrounding, sun path, rail fall, wind & etc. The professional architects must be considered the all the points while designing the buildings. Even this study will be used in education extensively to make the young architects aware of these parameters. The students shall be used these factors while designing the buildings. The resultant of these factors provides the masses of society better & workable solutions in practical life. Pedagogy of green building should start from very initial and grass root level only then it will be possible for architects and engineers to convince their client to go ahead with green building.[4]

References

[1] Givoni, B., 1969. Man,Climate & Architecture, Elsevier Publishing Company Limited.

[2] Koenigsberger,O.H., Ingerrsoll,T.G., Mayhew, A.,Szokolay,S.V.,1973.Mannual of tropical Housing & Building Part I.Climate Design,Orient Longman Pvt.Ltd.
[3] Krishanan,A.(ed), Baker, N.,Yannas, S.,Szokoly,S.,2001. Climate Responsive Architecture – A Design Handbook for Energy Efficent Buildings, Tata McGraw-Hill Publishing Company Limited, New Delhi.
[4] SK Gupta, Mustakeem R Khan, Nishant Nathani, Pragnya Prakash , Pedagogy for Green Building: India, International Journal of Environmental Research and Development. , pp 27 – 32 ,Volume 4, Number 1 (2014)

Author Profile



Prof. S K Gupta has completed his B.Arch. & MURP from IIT Roorkee. After his Post graduation he worked with Ansal Group as a chief Architect then Retired from Chandigarh college of Architecture, Chandigarh as a Principal. At present he is Director in Amity School of Architecture & Planning, Amity University Haryana.

Ar. Nishant Nathani has completed his B.Arch. from VTU, Belgaum and then Post Graduated from IIT Roorkee. Then he worked with Architect Hafeez Contractor. At present he is Asst. Professor, Architecture in Amity School of Architecture & Planning, Amity University Haryana. He has won Yuva Ratna Award, Pidilite Award for Excellence and a design competition organized by Sarv Shiksha Abhiyan, Haryana.

ISSN: 0973-9483

1st International Conference On Universal Human Values

Organized By The

Bahá'í Academy

(A Recognized Institution of Shivaji University),

In Association With the

Dept. Of Education, Shivaji University,

And

International Institute of Organizational Psychological Medicine (IIOPM), Australia

Panchgani, 11-12 June 2016

SOUVENIR

Part 2- Papers Presented

THE COMPASS
(Special Issue)
Vol. 10 , No. 1 , November 2016

THE COMPASS

Special Issue
Vol.10, No.1
November 2016
Part 2: Papers Presented

Actions and Reflections:
Proceedings of the
1st International Conference
On
"Universal Human Values"

Organized by the Bahá'í Academy, Panchgani
(A Recognized Institution of Shivaji University)
In Association with the Department of Education,
Shivaji University, Kolhapur and International Institute of
Organizational Psychological Medicine, Australia,
11th-12th June 2016.

The magazine of the Bahá'í Academy, an institution engaged in research and action in the field of Value Education for institutions of higher learning.

Editors: Mr. Lesan Azadi; Dr. Shashi Gaikwad and Dr. Jeanne Aguirre

Bahá'í Academy, 2016

Bahá'í Academy,
Shivajinagar,
Panchgani- 412 805,
Maharashtra
www.bahaiacademy.org
thecompass@bahaiacademy.org

Table of Contents

Ecology or the Human Mind- Where is Home?

Author: Ms. Shweta Gupta
Assistant Professor, BMS School of Architecture, Bengaluru

ABSTRACT

The past few years have been signalling a huge wake up call to humanity; tsunamis, earthquakes, cyclones, rising sea levels, mass areas being destroyed, thousands losing their lives and thousands having to start from scratch.

How did all of this happen? And how did it happen so fast? Let us make an attempt to understand the immediate past. The following statement needs to be examined in some detail for us to be able to understand and decode patterns, start points, triggers and catalysts which contributed to this unprecedented change.

"The 20th century is a testimony to HUMAN AMBITION, to the WILL OF MAN. "

The century had the first global-scale total wars between world powers across continents and oceans in World War I and World War II. **Nationalism became a major political issue in the world in the 20th century**, acknowledged in international law along with the right of nations to self-determination, official decolonization in the mid-century, and nationalist-influenced armed regional-conflicts. Due to continuing industrialization and expanding trade, many significant changes of the century were, directly or indirectly, economic and technological in nature. Inventions such as the light bulb, the automobile, and the telephone in the late 19th century, followed by airliners, motorways, radio, television, antibiotics, frozen food, computers and microcomputers, the Internet, and mobile telephones affected people's quality of life across the developed world. Scientific research, engineering professionalization and technological development drove changes in everyday life. (Wikipedia)

As much as all of these advancements brought the world closer, they still reflect the underlying power play yet a part of nations-- one which competes for resources, competes for a better quality of life, for survival and superiority. The wars were over, but another inward looking war had begun, an attitude of society which wanted to forget all of the past burdens - slavery, colonialism, racism, sexism to name a few. The developed world marched forth with its advancements at the cost of the developing nations; the developing countries succumbed to developmental demands to bring themselves out the peril colonialism had imposed on them.

"Capitalism became the new Colonialism in a GLOBAL Economy."

The ONE common sufferer in this story common to all geographies and cultures is MOTHER NATURE. The fierce desire of PROGRESS embedded in every nation's DNA has led to mindless extraction of natural resources focusing only on economic needs and new-found desires of man. This has also created vast inequity in Socio-economic realities of people.

It is extremely urgent to understand that NATURE is the common thread amongst all nations for their survival and prosperity. And without everyone understanding that, not only in essence but also in terms of its operating logic, we cannot achieve a coherent future for either the current 6 billion or the rising numbers in the next 20-30 years.

For this reason a common understanding, a unanimous thinking is needed. An excellent method to achieve this desired common ground is an education in Universal Human Values for all. The proposed paper would like to examine and advocate the role of universal human values in the background and future imagination of our planet from an environmental perspective.

Keywords: Global world, Power play, Survival and Superiority

Introduction

Significance of the Topic

70,000 years ago humans were insignificant animals. The most important thing to know about prehistoric humans is that they were unimportant. Their impact on the world was very small, less than that of jellyfish, woodpeckers or bumblebees.

Today, however, humans control this planet. (1)

Objectives

In light of this fact it becomes worthwhile to examine the acts and thinking of humans across history. How did the significance grow? What were the events and processes that shaped this dominance? And most importantly, how has this control been won in human hands amongst the myriad ecological actors which constitute the earth?

Also, if indeed humans control the planet, then why is nature seeking such vengeance, and why are we so helpless about it?

Scope and Limitation

This paper will make an attempt to identify connections between multiple truths, an attempt to read the big picture and highlight broader issues related to the differentiation that has shaped global history. Rather might we call it global ecological history?

Unfortunately all such documentations are extremely compartmentalised. Global history is full of human history, of human conquests, wars, treaties, land ownership, kingdoms etc..Within the more evolved and varied researches of the later 20th century, one finds there is still a struggle to bring forth many serious issues, like those of slavery, sexism, socio-economic inequity to name a few. And then there is the problem of this discourse being uneven across geographies owing to difference in culture, religious beliefs, political regimes, law and order setups, and so on.

Needless to add, the differences extend to ecological frameworks as well, since each land mass has a specific geographic orientation and resources of its own.

The scope of this study is to understand humans and the dialogue humans have with elements other than themselves, or the lack of it, since it is imperative for us to understand the role humans play in the current ecological setup.

However, a holistic examination is a much longer discourse and cannot be contained in 2500 -3000 words. This paper will restrict itself towards creating an outline which can be a serious trigger for the thinking that is needed for future dialogue.

Hypotheses- The human mind as the pivot; perhaps the most widespread and insidious form of human violence is ideological control (2)

How have humans become the prime actor ?

Review of Literature/Researches

One assumed reason because of which humans have risen to the top of the ecological chain is the human ability to think and imagine. Modern evolutionary theory has it that we owe our brains - our art, our inventiveness, and presumably much of our deviousness - to our sexuality. We dance and paint and joke and tell stories to impress potential mates- or such at least was the crude beginning of our wits, on which we have built. But pigs and squirrels and elephants are clever too. They must also attract mates. So why have pigs produced no concert pianists, or professors of jurisprudence? Another ingredient is needed - one suggested a long time ago by more conservative biologists - dexterity. Our brains and our dexterity evolved together : they are an exercise in co-evolution. Pigs are clever, but their hands are hoofs: nothing there with which to express their dreams and insights. We by contrast can translate our thoughts into action: our artefacts are ideas in space. Hands provided the encouragement, the selective pressure, to make our brains even brainier; and the growing brains in turn encouraged more dexterity. But the only reason we have such dextrous hands and whirling arms is that our ancestors had spent 80 million years or so in the trees. Arboreal life requires dexterity and hand-eye co-ordination. Squirrels almost became intellectuals, but not quite. Our ancestors, somewhere in Africa, came to the ground when the climate dried up and the trees retreated. They learned to walk on two legs and freed their versatile hands and arms for other purposes. Were it not for that pedigree we would remain as intellectually frustrated as elephants and dolphins sometimes seem to be. (3)

And then there is the fact that human beings can talk, and write and hold conferences amongst a variety of communication methods they have invented thus far. Steven Pinker, in his book - The Language Instinct, defines language as an instinct to acquire an art. To Quote - " For you and I

belong to a species with a remarkable ability: we can shape events in each other's brains with exquisite precision. That ability is language. Simply by making noises with our mouths, we can reliably cause precise new combinations of ideas to arise in each other's minds." This also forms the basis of storytelling, of fables and is a pertinent reason humans exist in groups, as friends, family, colleagues, villages, cities and nations.

A common language connects the members of the community into an information sharing network with formidable collective powers. Anyone can benefit from the strokes of genius, lucky accidents, and trial and wisdom accumulated by anyone else, present or past. And people can work in teams, their efforts coordinated by negotiated agreements. As a result, Homo sapiens is a species, like blue green algae and earthworms, that has wrought far-reaching changes on the planet.

Archeologists have discovered the bones of ten thousand wild horses at the bottom of a cliff in France, the remains of herds stampeded over the cliff top by groups of paleolithic hunters seventeen thousand years ago. These fossils of ancient co-operation and shared ingenuity may shed light on why saber-tooth tigers, mastodons, giant woolly rhinoceroses and dozens of other large mammals went extinct around the time that modern humans arrived in their habitats. Our ancestors apparently killed them off. (4) The real difference between us and other animals is on the collective level. Humans control the world because we are the only animal that can cooperate flexibly in large numbers. Ants and bees can also work together in large numbers, but they do so in a very rigid way. If a beehive is facing a new threat or a new opportunity, the bees cannot reinvent their social system overnight in order to cope better. They cannot, for example, execute the queen and establish a republic. Also only Homo sapiens can cooperate in extremely flexible ways with countless numbers of strangers. One-on-one or ten-on-ten, chimpanzees may be better than us. But pit 1,000 Sapiens against 1,000 chimps, and the Sapiens will win easily, for the simple reason that 1,000 chimps can never cooperate effectively. Put 100,000 chimps in Wall Street or Yankee Stadium, and you'll get chaos. Put 100,000 humans there, and you'll get trade networks and sports contests.

Cooperation is not always nice, of course. All the terrible things humans have been doing throughout history are also the product of mass cooperation. Prisons, slaughterhouses and concentration camps are also systems of mass cooperation. Chimpanzees don't have prisons, slaughterhouses or concentration camps.(5) Incidentally, they also don't tell each other what to wear, or other such lifestyle diktats.

Yet how come humans alone of all the animals are capable of cooperating flexibly in large numbers, be it in order to play, to trade or to slaughter? The answer is our imagination. We can cooperate with numerous strangers because we can invent fictional stories, spread them around, and convince millions of strangers to believe in them. As long as everybody believes in the same fictions, we all obey the same laws, and can thereby cooperate effectively. This is something only humans can do. You can never convince a chimpanzee to give you a banana by promising that after he dies, he will go to Chimpanzee Heaven and there receive countless bananas for his good deeds. No chimp will ever believe such a story. Only humans believe such stories. This is why we rule the world, whereas chimps are locked up in zoos and research laboratories.

A mountain is something real. You can see it, touch it, smell it. But the United States or Israel are not a physical reality. You cannot see them, touch them or smell them. They are just stories that humans invented and then became extremely attached to. Indeed, money is probably the most successful fiction ever invented by humans. Not all people believe in God, or in human rights, or in the United States of America. But everybody believes in money, and everybody believes in the dollar bill. (6) **Money is a Universal Entity.**

Data Analysis

One key difference we can understand from the research is that humans have benefitted hugely from some unique characteristics which belong only to them. Thinking, Imagination, Dexterity, Hand-eye coordination, Language, Fiction, Ideologies, Beliefs etc. A significant one also being MOBILITY. Mountains cannot move and so can't trees. Rivers will flow where the path is; even when rivers shift they do so because of the volume and velocity of water governed by external factors, climatic conditions, the melting of ice, glaciers etc. Rivers cannot look at a map and decide where to

go, they simply follow the principle of flow.

Yet it is the human who has acquired language, thinking, tools and techniques to look at a map, to decide where to go, what to do, how to be. A river is pure material behaviour with no fixed agenda, no manipulation and not necessarily a mind of its own. It is only guided by its intrinsic material logic. And the innate logic of the human is the mind or inner drive.

The human mind with its beliefs and thinking have shaped our history, and in the context of that a few questions arise -

- How do Humans identify and treat each other?
- How do Humans identify and treat other non-human life forms?
- What is the relationship between Humans and Nature- past and present?

Findings

1. How do Humans identify and treat each other ?

a. Child Slavery in the LRA- For 18 years, the Lord's Resistance Army (LRA) guerrillas of northern Uganda has been kidnapping boys to train them as soldiers and girls to turn them into sexual slaves of the commanders. In 2002, as many as 20,000 children were controlled by the LRA.

b. Forced sterilization for disabled underage girls - The involuntary sterilization of disabled underage girls in Australia is still lawful in 2014.

c. Forced vaginal examinations of Afghan women - In Afghanistan, invasive vaginal examinations are forced on women to test “virginity” every time a girl is arrested on a morality charge.

d. Uganda's “Anti-Gay Bill” - Uganda has recently signed into law a bill that toughens penalties against individuals who are gay and defines homosexual acts as crimes punishable by life in prison.

e. Slavery in The United States - After being brought to the American colonies, Africans were stripped of human rights, enslaved, brutally treated and considered lesser than their fellow human beings for centuries.

f. The Holocaust - The Holocaust is among the most systematic and well-known violations of human rights in recorded history. Adolf Hitler's plan to “cleanse the world” denied humanity to Jews, homosexuals, communists, Slavs and more.

g. Modern Sex Trafficking - The international sex trade remains a huge problem around the world and may involve upward of 27 million people. The sale of the women's and girls' bodies is a result of gender inequality and is viewed as acceptable by many countries. (7)

h. Dowry deaths - are deaths of women who are murdered or driven to suicide by continuous harassment and torture by husbands and in-laws in an effort to extort an increased dowry. India reports the highest total number of dowry deaths with 8,391 such deaths reported in 2010. (8)

2. How do Humans identify and treat other non-human life forms?

Every day in countries around the world, animals are fighting for their lives. They are enslaved, beaten, and kept in chains to make them perform for humans' “entertainment”; they are mutilated and confined to tiny cages so that we can kill them and eat them; they are burned, blinded, poisoned, and cut up alive in the name of “science”; they are electrocuted, strangled, and skinned alive so that people can parade around in their coats; and worse.

A few examples -

a. U.S. **fish industry** slaughters more than 6 billion fish each year, and sport fishing and angling kill another 245 million animals annually. Without any legal protection from cruel treatment, these intelligent, complex animals are impaled, crushed, suffocated, or sliced open and gutted, all while they're fully conscious**.**

b. **Chickens** are arguably the most abused animals on the planet. In the United States, approximately 9 billion chickens are killed for their flesh each year, and 305 million hens are used for their eggs. The vast majority of these animals spend their lives in total confinement from the moment they hatch until the day they are killed.

c. The **snakes, alligators, crocodiles, and other reptiles** who are killed for their skins suffer immensely. Snakes are commonly nailed to trees and their bodies are cut open from one end to the other as they are **skinned alive**, in the belief that live flaying keeps the skin supple. Their mutilated bodies are then discarded, but because of these animals' slow metabolism, it can take hours for the snakes to die.
d. More than half the fur in the U.S. comes from China, where millions of dogs and cats are bludgeoned, hanged, bled to death, and often **skinned alive** for their fur.
e. Despite the availability of more modern, humane, and effective alternatives, **rabbits** are still tormented in the notorious Draize eye irritancy test, in which cosmetics, dishwashing liquid, drain cleaner, and other substances are dripped into the animals' eyes, often causing redness, swelling, discharge, ulceration, hemorrhaging, cloudiness, or blindness. The rabbits are killed after the experiment is over.
f. **Elephants, tigers, and other animals** that circuses use to entertain audiences do not stand on their heads, jump through hoops, or balance on pedestals because they want to. They perform these and other difficult tricks because they're afraid of what will happen if they don't. To force animals to perform, circus trainers abuse them with whips, tight collars, muzzles, electric prods, bullhooks (heavy batons with a sharp steel hook on one end), and other painful tools of the circus trade.
g. **Animals in zoos**, pseudo-sanctuaries, traveling shows, and roadside displays are forced to spend their lives behind bars just to entertain the public. They are kidnapped from their home to live a sedentary life behind bars. This deprivation combined with relentless boredom, loneliness, and sometimes even abuse from the people who are supposed to be caring for them causes many captive animals to lose their minds.

We cause our wild neighbors far more trouble than they cause us, as each day, we invade thousands of acres of their territory, destroy their homes, and kill them and/or their family members. As an example, the following can be a simple tip for living in harmony with our wild friends:

If a bird is trapped inside your house, turn off all indoor lights, close all curtains, blinds, or shutters, and open an outside door. The bird should fly toward the light outside. If the bird does not exit, wait until dark, then open a door and put a light outside it. Turn out all house lights the bird should fly out toward the light. Be patient! This usually works. (9)

The only thing we have to acquire is some patience and wisdom to co-exist with our fellow ecological members who have inherited this earth just the same as us!

3. What is the relationship between Humans and Nature - past and present ?

a. Human consumption of animals is impacting species worldwide. Over the past 2000 years, the spread of human societies throughout islands in the Pacific Ocean led to the over hunting of many bird species. As many as 2000 species may have gone extinct, representing 20% of all known bird species, and an extinction rate 1001000 times greater than natural rate of species loss over geological history (Pimm et al. 1995, Steadman 1995). As a result of industrialized fishing, the populations of many seafood species, including marlins, tunas, swordfish, codfish, sailfish, and sharks have declined 80-90%, pushed to the brink of extinction over the past half century (Baum et al. 2004, Myers & Worm 2003)

b. One of the byproducts of economic development has been the production of pollution products and waste materials that are harmful to human and ecological health. The rise of pollution corresponds to the increased use of petroleum in the twentieth century, as new synthetic products such as plastics, pesticides, solvents, and other chemicals, were developed and became central to our lives. Many air pollutants, including nitrogen and sulfur oxides, fine particulates, lead, carbon monoxide, and ground-level ozone come from coal and oil consumption by power plants and automobiles. Heavy metals, such as mercury, lead, cadmium, and arsenic, are produced from mining, the burning of fossil fuels, and the manufacture of certain products like metals, paints, and batteries.

c. Aquatic ecosystems such as rivers, lakes, and coastal oceans have traditionally been used for pollution disposal from industry and sewage treatment plants, but they have also

> been subject to unintentional runoff from upland watersheds, such as nitrogen and phosphorus loss from agricultural soils and home septic systems as well as plastics washed into rivers and oceans from storm sewer systems. We often don't think of nutrients like nitrogen and phosphorus as pollutants. However, humans now add more nitrogen to the biosphere through fertilizers than is added naturally each year by all of the nitrogen-fixing bacteria on the planet (Vitousek 1994). The Pacific and Atlantic oceans now have garbage patches full of plastic that are possibly as large as the continental US. These are strong indicators of global change humanity now dominates the global movement of nitrogen and other materials on Earth. (10)

Inference and Conclusion

The above examples reiterate the human drive for power, for superiority, the conflict that different ideologies present, and the ignorance that prevails. It is still a hugely disparate effort, the one we make towards material gain and one towards collective evolution and existence.

The research and the factual observation of what has been happening around us for the past so many centuries clearly speaks of the power of the human mind, of human cooperation, of human abilities that first differentiated it from other animals and are capable of application with far reaching consequences.

The pertinent question then becomes what did we do with all these abilities that we acquired? What have we really understood or made of with our extra-ordinary gifts? Much time till now has been a self absorbent exercise, we have existed only for ourselves and even among ourselves with much differentiation. Our intelligence which we have been boasting about for millions of years, has led us to differentiate and acquire a sense of superiority amongst each other based on skin colour, gender, religion, OPINION.

Trees are also different but they really don't opine much about each other. They don't tell each other which fruits to grow or that my leaves are better than yours, or that the colour of my fruit is better and that makes me superior enough to enslave you, and so on. They go about their business of sharing nutrients, pollination, letting out oxygen and absorbing the carbon dioxide without much calculation.

Now us humans can calculate. But we truly need to calculate better, understand better. In most conversations we attribute a lot of negative traits as natural, borrowing examples from the natural world, such as the nature of predator and prey, this one being a universal analogy used in all cultures. But maybe we need to look closer and deeper and maybe much longer at nature to borrow the right kind of metaphors. And we need to make this pursuit universal, because the earth is ONE entity. Us humans have divided it into nations, linguistic zones, separation based on what we eat, look like, believe in etc. but we suffer all the same when nature turns against us, or maybe it is just that we made some bad calculations and disasters happened. Just as science is a universal value and tries to uncover the mysteries of the material world, maybe we need to consider human values as a science which will help us uncover the mysteries of the existential world. And the way to do this is by better understanding, knowledge, compassion, tolerance and most importantly respect, respect towards our differences, curiosity about our differences and what it is that we can learn from each other. Aboriginals, tribes, trees, animals, modern society, to what extent can we all co-exist, will seriously depend on these virtues. But we cannot act wisely if we don't know enough, and we will not know enough if we have not acquired the curiosity and patience and commitment to know more, and be willing to accept that this is a continuous process so we will continually need to think and act with these set of values and more.

To quote Lord Buddha - “The trouble is we think we have time”

Clearly we are running out of time and running out of breath, operating in different directions simply because we are shying away from being ONE, one in our approach towards the environment that sustains us. If it is time for anything, it is the time for starting the dialogue to come to a common ground, come to universally applicable rules and thinking. A universal language of compassion, collective thought and behaviour, of universal human values. No better place to start than education, at all levels and for everyone.

(Citation and references listed overleaf)

Citation and References

1. Why humans run the world, June 16, 2015, Yuval Noah Harari http://ideas.ted.com/why-humans-run-the-world/ (accessed on 29th May 2016, 6:13pm)
2. Line 23, pg. 219, The Biology of Belief - Unleashing the Power of Consciousness, Matter & Miracles, Bruce H. Lipton, Ph.D, HAY HOUSE INC., updated copyright 2015 by Mountain of Love Productions (Kindle edition)
3. Line 5-26, 34-43, pg. 5, Line 4-13, pg.6, The Secret Life of Trees - How They Live and Why They Matter, Colin Tudge, PENGUIN BOOKS, copyright Colin Tudge 2005 (Kindle edition)
4. Line 28-42, pg. 16-17, The Language Instinct, Steven Pinker, PENGUIN BOOKS, copyright Steven Pinker 1994
5. Why humans run the world, June 16, 2015, Yuval Noah Harari http://ideas.ted.com/why-humans-run-the-world/ (accessed on 29th May 2016, 6:13pm)
6. Why humans run the world, June 16, 2015, Yuval Noah Harari http://ideas.ted.com/why-humans-run-the-world/ (accessed on 29th May 2016, 6:13pm)
7. 10 Worst Human Rights Violations of All Time, Audrey Grace, June 20, 2014 http://www.borgenmagazine.com/10-worst-human-rights-violations-time/ (accessed on 1st June 2016, 5:20pm)
8. Wikipedia - Dowry Death - https://en.wikipedia.org/wiki/Dowry_death (accessed on 1st June 2016, 6:06pm)
9. Source: www.peta.org, http://www.peta.org/issues/ (accessed 1st June 2016, 7:02pm)
10. Source: nature.com http://www.nature.com/scitable/knowledge/library/global-change-an-overview-13255365 (accessed on 1st June 2016, 9:04pm)

Journal of Civil Engineering and Environmental Technology
p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 3, Issue 7; April-June, 2016, pp. 608-611

http://www.krishisanskriti.org/Publication.html

Architectural Anthropology in the Study of Traditional Indian Architecture

Aiswarya Shylaja Baburaj

Department of Architecture, Aakar Academy of Architecture, Visvesvaraya Technological University Bangalore, India
E-mail: aiswarya.s.baburaj@gmail.com

Abstract—*India is in the stage of rapid industrialization and modernization. Adapting to the international architectural practices, the country's urban landscape has gained a complete face-lift over the years. . In this context, when India boasts of a rich traditional built heritage it seems unfair of the current professional practices to go about the design process with such neglect of the past. There is a need and urge for the inclusion of new critical perspectives of design by inclusion of understanding the social and cultural importance of built spaces through an anthropological approach to its study as there is a rapid depletion rate and obsolescence of the vernacular structures in the country. This paper investigates into the significance of architectural anthropology in the Indian context as well as its application in the regional contexts. Indian architecture both expresses and prescribes culture as reflections of social, political and financial aspects of a region and this parameter will influence contemporary and future understandings the built design. As such, anthropology may through its theories, approaches and methods provide comprehension into the cultural aspects that influence built forms, both in the past and in the present. A multi dimensional analytical framework could be developed for studies of architecture through anthropology in which the cultural influences and relevance of architectural expressions can be explored.*

Keywords*: Architectural anthropology, Culture, Tradition, Built form, India*

1. INTRODUCTION

The built environment, in which we live as humans, is a subject of high interest and research that affects society and the way we live. The built landscape deeply structures our lives in and around them since time immemorial. However, architecture, as it is designed and built today in our modern-urban context, is often insensitive to various factors like social, cultural, economic, material, symbolic, ideological, etc. as determinants of built form development to the communities. Modern design process is greatly influenced by the standard history but instead should be conditioned and regulated by the social and cultural context. Hence these changes in the approach of built form design in the present modern context, creates differences in way of life, social culture and architecture. The wider human condition is often neglected in various projects of urban or domestic projects in India, and not integrated with the intangibles regional aspects of that place and community. Human is represented as a user for whom the standardised functional need is seen as the design solution. In this context, when India boasts of a rich traditional built heritage it seems unfair of the current professional practices to go about the design process with such neglect of the past. Consequently, architectural anthropology maintains that horizons of analysis of built form have to be broadened, integrating it into anthropological parameters, including socio-cultural, political and environmental considerations.

Architecture and Anthropology have a compliant relationship, which respectively represent the analytical and the creative aspects of built spaces. Anthropology is the study of people—their origins, their development, and contemporary variations, wherever and whenever they have been found (Ferraro & Andreatta, 2014). And through its study there should be a way to establish a sequence of priorities between space and culture which is essential in the meaningful analysis of the immense built heritage of India. Traditional architecture as Powel Elior defines is a type of architecture which grows from inside the societies and accommodates itself with social, climate and technological situations over time and improves and is harmonious with the values, economy and life styles of its culture. And hence Indian architectural wealth demands for the inclusion of new critical perspectives by inclusion of understanding the social and cultural importance of built spaces through an anthropological approach to its study as there is a rapid depletion rate and obsolescence of the vernacular structures in the country. Among the most urgent and delicate aspects to which anthropo-architecture must respond is that of the diversity of dwelling forms and types in the country, even at the smallest regional scale in the various states.

2. IMPORTANCE OF ANTHROPOLOGY

India is in the stage of rapid industrialization and modernization. Adapting to the international architectural practices, the country's urban landscape has gained a complete face-lift over the years. Many new cities have taken shape along with the strong and pervasive drive of urbanization. Many new towns and cities were planned and designed and

some existing urban centres renovated for expansion and development, with much more improved infrastructure and transport systems. The building scenario has also made a bouncing leap with multiple high-rise buildings springing as part of the digital and construction boom in the country. The urban housing landscape has been taken over by the multi development housing schemes, adding new perspectives to the design domain. As a country of diversified natural conditions with the huge expanse of land and many regional states, architectural built forms, lifestyles of the people as well as socio-economic conditions are significant various between each other; and this inherent architectural heritage seems lost in the urbanization process. This fast modernization and development has issues of non-sustainability, and commercialization and uncharacteristic or insensitive architectural trends. Being insensitive to the design process is majorly a concern on the sheer neglect on socio-cultural aspects of the people of the region for which buildings are designed. Added to that, environmental pollution is also an alarming concern where water bodies, agricultural land etc that were once part of the way of life of the people are all filled and levelled to provide land for large scale developments. Open spaces and parks are also narrowing down. These adverse environmental issues affecting people and their habitats across the entire world have given way to new directions and approaches to design in the building industry – Sustainable development. India too has adapted to the new emerging trends in sustainable and green building design. However somewhere the finer aspects of life in the form of culture and traditions of the rich built heritage of the land seems to be un-noticed and not got the due investigation it requires to carry forward the lessons from the past into the future.

Architecture has always been an important way for thoroughly portray reflections of the culture of the people and its place. Be it the monuments like the Taj Mahal or the traditional dwellings like the Toda house, each built form reflects deeply the story of that time, and how the people of that time wanted to convey their culture and way of life to the future or the next generations. It also carries forward a knowledge transfer of the built traditions that is handed down to future generations. “Culture is not composed of elements which can be disassembled and re-composed: culture has to be lived, cultures mature and sediment slowly as they become fused into the context and continuity of tradition” (Pallasmaa, 2007). And Indian culture, often is labelled as an amalgamation of several various cultures, spanning across the Indian subcontinent and has been influenced and moulded by a history that is several thousand years old (Mohammada, 2007). So it is very crucial to investigate the various aspects of Indian culture through the medium of built form analysis, as there is a rapid decline in the existence of these forms as well as the knowledge transfer. Unravelling the finer principles of form and space, ornament, imagery and symbolism is essential, thereby incorporate sensitive and manifest a newer meaningful life into the built forms of modern India. Anthropological studies will enable a holistic analysis with help in achieving an overall and synthesised view of society and culture, through architecture, to create a more liveable built society in the future.

Certain fundamental aspects relating to the functional and social use of space, customs and rituals, ways of living, religious practices etc are the aspects that need an anthropological approach of study. In India, with a multitude of cultures, there is a large scope for research through sociological and anthropological in design and planning. Drawing on the philosophy of anthropological research, this method ‘has enabled designers to gain insights into users’ activities in daily life but also keep up with the fast paced needs of commercial business practice’ and it ‘enables designers to gain access to people’s worlds and help them to understand their situation’ (Bichard & Gheerawo, 2011). The anthropological method offers a rich form of dialogue to the architectural profession and ‘the transient and ephemeral way in which artefacts, people, ambiences are encountered’ (Iacucci & Wagner, 2003).

3. LINK BETWEEN ARCHITECTURE AND ANTHROPOLOGY

The relationship between architecture and anthropology is that of dependency, similarity and mutual support, as in architecture, ethnography is a widely used tool of research which is also the key method of anthropology. In anthropology, ethnography is a well-established method of data collection through qualitative methods such as participant interviews and interviews. Ethnography can be used in architecture as a method of observation, data collection and visual/ graphic or statistical representation; a way of interacting with, documenting and responding to a specific people, time, place and circumstance (McGowan, 2011). Establishing a dynamic relationship between the researcher and the people of the region under study is critical here, to perceive and understand their way of life. It is generally small-scale and focuses on rich, deep data rather than broad, quantifiable facts, and it is up to the ethnographer’s discretion whether or not to consider historical and/or macro factors and engage in a critical cultural/political discourse (O’Reilly, 2009). Providing descriptive, rather than prescriptive, accounts, the anthropologist takes a cultural relativistic approach, attempting to understand the type of socio-cognitive interactions that take place within everyday life from the point of the people studies (Askland, Awad, Chambers & Chapman, 2014).

Whereas anthropology seeks to understand what it means to be a person belonging to a particular region, architecture provides conditions for being that person and responds to the condition. Various researches are happening across the world, to find how the built environment, support and be part of socio-cultural ways of life of the peoples. And most of the vast

sources of ethnographic research illustrate how architectural built forms and their various configurations represent sustained and significant repositories of knowledge and cultural meaning (McWilliams, 2005). As a discipline, anthropology is often perceived as a 'key to Culture, charged with operationalizing knowledge about culture and represents an instrument, a stepping stone, the means by which to mobilize Culture' (Reddy, 2008).

Architects need to understand those elements of culture that drive or impede cross-cultural collaboration. Interdisciplinary research signifies that place identity arises in a dialectic involving both the qualities of places and their characteristics and relations of people to their places (Steele, 1981). According to Rapoport, built forms are primarily influenced by socio-cultural factors modified by architectural responses both to climatic conditions and to limitations of materials and methods. This explains why the houses of the Naga tribe are entirely different from the Toda houses in the Nilgiris, as the regional context varies; their socio-cultural practices are also changing with climate and materials available.

4. APPLICATION OF ANTHROPOLOGICAL STUDY IN THE INDIAN BUILT FORMS.

Anthropological analysis offers a comprehensive approach in research to architecture. Like vernacular architecture, 'it favours completeness, recognizes diversity and seeks ways to […] tell better versions of the human story' (Glassie, 2000). Standardization of built form, the erosion of distinct rural and regional landscapes, and geographic mobility are thought to devitalize physically encoded meanings of the landscape, thus weakening personal identification with locale (Buttimer 1980; Klapp 1969; Relph 1976). Be it the metro cities like Mumbai or Chennai, or the smaller cities like Jaipur, Trivandrum etc the regional built forms are rapidly being pulled down to construct the modern structures. Each of these regions has a rich building tradition which is slowly becoming obsolete. Anthropology seeks an emic understanding; that is, an understanding of the people studied on their situation and terms (Maykut & Morehouse, 1994). On this note if as we analyse some of the Indian dwellings, interesting facts on their socio cultural practices, family structure, rituals etc come to light. The Wada houses of Mumbai or Maharashtra state was typically a large building of two or more storey with groups of rooms arranged around open courtyards, which evolved under the reign of Peshwas. The design of the Wada was not influenced much by the climatic factors rather it was has impacts more by the social and cultural factors, where the most significant features was the zoning of public, private and semi-private spaces. Whereas the Chettinadu courtyard houses in Tamil Nadu was planned keeping their cultural context on focus. When most of the traditions in India never had a dominating female culture, these houses depicted a unique social life, where at the apex of the family household, is the "Aachi" or the senior most woman of the house who managed the finances and the entire household matters. Rather than having spaces with privacy for women in the household they had smaller courtyards that allowed women to socialize. There was also an exclusive woman domain in the houses, where they could go about their domestic work etc. So there was a culture of upholding the needs and comfort of the woman member in the Chettinadu built houses. There is a need for understanding these built forms on a cross cultural approach to investigate how anthropology can find deeper meanings in these dwellings. Anthropologists have been interested in the influential associations that link people to place, the way the rooms, buildings and land are endowed with emotional meaning, and the aspects of individual identity that have a desire for, memory of, and emotional attachment to, a physical setting (Hochschild, 2010). Thus architectural research links anthropological concepts of culture and social practices of a community or a region which makes it crucial to adopt these methods for a critical study of Indian built forms.

5. DISCUSSION AND CONCLUSION

As the Indian context necessitates connecting architecture and anthropology, it is important to note that, though both the disciplines support each other in motive, theory and method of work, their integration and application is subject to a lot of challenges. A major setback that would come along when an anthropological approach is introduced in a study is the fact that both the investigation into culture and ethnographic observations and field work, data analysis are all very time consuming. In India there are various organizations working towards the protection of the dwelling forms of the region. However on the majority scale, much of the structures are being pulled down, for the need to build modern structures, which hardly have any connection with the cultural past of the traditional dwellings that once stood in their place. Typically a anthropology researcher to get involved into the research work, conduct fieldwork and produce huge sets of data, consisting of interview transcripts, field notes, observations, reflections, photographs, video recordings, secondary data will consume an enormous amount of time. So the challenge for architects would be to conduct such extensive studies and analyze and develop a framework to include the neglected parameter into the design of contemporary built forms.

This initiative is necessary as the demolition and destruction of many of these traditional built forms seems almost inevitable for various reasons like lack of financial funds to maintain them or joint ownership or dismantling for purposes of sale of some of the artistic features of the buildings or the damage to the structure in itself. There is every possibility that these invaluable evidences of a way of life, of an extraordinary age in history could be erased forever. Though in some parts of India like Chettinadu the government is taking initiatives to safeguard the courtyard houses by joining in with the UNESCO Asia's "heritage passport " programme, there are other specific locations where there is immense threat to the built heritage; like in Kerala where the Ezhumavil Ilam, a prominent Naalukettu house was demolished a few years back.

So it is time initiatives are made for understanding the worth of these built forms and take lessons from the past to put meaning into the present and future.

REFERENCES

[1] Askland, H.H; Awad, R; Chambers, J; Chapman, M. (2014). "ANTHROPOLOGICAL QUESTS IN ARCHITECTURE: PURSUING THE HUMAN SUBJECT". Archnet-IJAR, Volume 8 - Issue 3.

[2] Bichard, J., & Gheraawo R. (2011). The ethnography in design. In A.J. Clarke (Ed.), Design Anthropology. Object Culture in the 21st Century (45-55). Wien, New York: Springer.

[3] Buttimer, Anne. (1980). "Home, Reach, and The Sense of Place." New York: St. Martin's Press.

[4] Ferraro, Gary & Andreatta, Susan. (2011). "Cultural Anthropology: An Applied Perspective". Cengage Learning Edition 9.

[5] Glassie, H.H. (2000). "Vernacular Architecture". Bloomington: Indiana University Press.

[6] Hochschild, T.R. (2010). "Our club: Place-work and the negotiation of collective belongingness". Journal of Contemporary Ethnography.

[7] Iacucci, G., & Wagner, A. (2003). "Supporting collaboration ubiquitously: an augmented learning environment for architecture students". In K. Kuutti, E.H. Karsten, G. Fitzpatrick, P. Dourish & K. Schmidt (Eds.), Proceedings of the Eight European Conference on Computer Supported Cooperative Work. ECSCW 2003 (139-158). Helsinki: Kluwer Academic Publisher.

[8] Klapp, Orin. (1969). "Collective Search for Identity". New York: Holt, Rinehart and Winston.

[9] Maykut, P., & Morehouse, R. (1994). "Beginning Qualitative Research. A Philosophical and Practical Guide". London: The Falmer Press.

[10] McWilliam, A. (2005). "Houses of resistance in East Timor: structuring sociality in the new nation". Anthropological Forum: A Journal of Social Anthropology and Comparative Sociology

[11] Mohammada, Malika (2007). "The foundations of the composite culture in India". Aakar Books, ISBN 81-89833-18-9

[12] O'Reilly, K. (2009). "Ethnography". London, Thousand Oaks, New Delhi, Singapore: Sage Publications.

[13] Pallasmaa, J. (2007). "Architectural regionalism: Collected writings on place, identity, modernity, and tradition" New York: Princeton Architectural Press.

[14] Rapoport, A. (1969). "House Form and Culture". Englewood Cliffs, NJ: Prentice-Hall

[15] Rapoport, A. (1976). "Socio-cultural aspects of man-environment studies". In The Mutual Interaction of People and Their Built Environment, ed. A. Rapo-port, The Hague: Mouton

[16] Reddy, D.S. (2008). "Caught in collaboration. Collaborative Anthropologies", 1, 51–80 [online]. Available from: PMC (US National Library of Medicine National Institutes of Health), http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2854552/pdf/nihms115009.pdf

[17] Relph, Edward. (1976). "Place and Placelessness". London: Pion.

[18] Steele, Fritz. (1981). "The Sense of Place". Boston: CBI.

NZWARA

NATURAL and BUILT ENVIRONMENT, CITIES, SUSTAINABILITY and ADVANCED ENGINEERING

2016

Published in New Zealand in 2016 by
New Zealand Academy of Applied Research Ltd
ISSN 2463-5960 (print)
ISSN 2463-5979 (online)
145 Symonds Street, Auckland 1010, New Zealand
info@nzaar.com
www.nzaar.com

NZAAR SCIENTIFIC COMMITTEE

Professor Alan Balfour, Georgia Institute of Technology, USA
Professor Derek Clements-Croome, University of Reading, UK
Professor Hashem Akbari, Concordia University, Canada
Professor Nicholas Temple, University of Huddersfield, UK
Professor Mari Vaattovaara, Helsinki University, Finland
Professor Virginia (Gini) Ann Lee, University of Melbourne, Australia
Professor Arto Kiviniemi, University of Liverpool, UK

NZAAR INSTITUTIONAL PARTNERS

MALAYSIA GREEN BUILDING CONFEDERATION (MGBC)
CONTINENTAL AUTOMATED BUILDINGS ASSOCIATION (CABA)
SCIENCE PUBLICATIONS

NZAAR INSTITUTIONAL SPONSOR

SCIENCE PUBLICATIONS

NZAAR INTERNATIONAL EVENT SERIES ON NATURAL AND BUILT ENVIRONMENT, CITIES, SUSTAINABILITY AND ADVANCED ENGINEERING

Encompassing

ALBE 2016	*International Conference on Architecture, Landscape & Built Environment*
CEASCM 2016	*International Conference on Civil Engineering, Advanced Structures & Construction Management*
EERE 2016	*International Conference on Environmental Engineering & Renewable Energy*
GCS 2016	*International Conference on Geography, Climate & Sustainability*
UDCP 2016	*International Conference on Urban Design & Cities Planning*

NZAAR-ALBE-16-75	**VERTICAL MONUMENT VERSUS HORIZONTAL LANDSCAPE COMPARISON OF CHINESE AND WESTERN CONTEMPORARY MEMORIAL** Li Zhang*	33-44	**ALBE 2016**
NZAAR-ALBE-16-87	**PREFERRED TEMPERATURE IN AN AIR-CONDITIONED BUILDING: A CLIMATE CHAMBER EXPERIMENT** Nur Dalilah Dahlan*	45-47	**ALBE 2016**
NZAAR-ALBE-16-88	**CULTURAL SUSTAINABILITY IN ARCHITECTURE** Aiswarya Shylaja Baburaj*	48-54	**ALBE 2016**
NZAAR-ALBE-16-93	**INTELLIGENT ALIVE ARCHITECTURE WITH BIOLOGICAL APPROACH TO DYNAMIC DESIGN, ROLE OF COMPUTATION AND PARAMETRIC TECHNIQUES AS SMART WAYS OF CONTROLLING ARCHITECTURE** Mahdiar Ghaffarianhoseini*& Roxane Fallah	55-56	**ALBE 2016**
NZAAR-ALBE-16-94	**THE ESSENCE OF PROMOTING GREEN ROOFS FOR BUILDING COOLING ENERGY REDUCTION IN NEW ZEALAND** Farnaz Sheikh*	57-58	**ALBE 2016**
NZAAR-ALBE-16-95	**PARAMETRIC ANALYSIS OF THE THERMAL COMFORT CONDITIONS OF UNSHADED COURTYARDS IN THE TROPICAL CONTEXT OF KUALA LUMPUR** Pegah Maroofee*, Amirhosein Ghaffarianhoseini, Norhaslina Hassan	59	**ALBE 2016**
NZAAR-ALBE-16-96	**THE ROLE OF GREEN ROOFS TOWARDS ENHANCING THE VISUAL APPEARANCE OF URBAN NEIGHBORHOODS** Ziba Kazemi & Amirhosein Ghaffarianhoseini*	60-62	**ALBE 2016**
NZAAR-CEASCM-16-16	**RELEVANCY MEASURES OF ERRORS IN DISPLACEMENTS OF FINITE ELEMENTS ANALYSIS RESULTS** A.B. Bolkhir* & T. K. Yousif	63-71	**CEASCM 2016**
NZAAR-CEASCM-16-68	**EFFECT OF DIFFERENT MIXING WATER ON COMPRESSIVE STRENGTH OF CONCRETE** Salmaliza Salleh* & Amithira Subramaniam	72-76	**CEASCM 2016**
NZAAR-CEASCM-16-69	**PRODUCTION OF HIGH STRENGTH CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATES WITH RECYCLED GLASS** Salmaliza Salleh* & Mohammad Arshad Hossany	77-85	**CEASCM 2016**
NZAAR-CEASCM-16-70	**EFFECT OF USING COPPER SLAG AS A SAND REPLACEMENT IN MORTAR** Salmaliza Salleh* & Umanee Dasan Dayananda	86-89	**CEASCM 2016**
NZAAR-CEASCM-16-91	**GEOTECHNICAL STABILITY OF GABION WALLS** Chandr Toshan Rampat*	90-98	**CEASCM 2016**

NZAAR-ALBE-16-88

CULTURAL SUSTAINABILITY IN ARCHITECTURE

Aiswarya Shylaja Baburaj*
Department of Architecture, Aakar Academy of Architecture, Visvesvaraya Technological University Bangalore, India
*aiswarya.s.baburaj@gmail.com

www.nzaar.com

Abstract

This paper intends to examine existing studies on cultural sustainability and thus advance this emerging area of research by understanding the linkages between the concepts of culture, architecture and sustainable development. The highlights of the study includes the increasing recognition of culture as powerful and important aspect in fostering economic, social and environmental domains of sustainable development. By understanding culture and built environment relationships, there is a greater scope in generating a greater awareness of the people of a place and understand the beliefs and values they share as a society, and to comprehend the uniqueness and differences that make them and their built environment distinct from one another. When there is a deeper understanding of the things that are important to people, the built environment and their inter-relationships, architects and planners can make decisions about the future to meet the users' social and cultural needs and at the same time, preserve the environment for the next generation through sustainability principles.

Keywords: *Architecture, Culture, Sustainability*

1. Introduction

The face of built environment has rapidly undergone significant changes as the result of globalization, when sustainability surfaced to untangle its social, economic and environmental problems. Sustainable design practices began to be adopted across the world in response to the growing environmental awareness to reduce the human impact on the environment. However "cultural irrelevance" was spreading across our built environments in the quest to create and evaluate this new and modern approach to architecture. The terse definition of sustainable development put forward by the World Commission on Environment and Development for the United Nations General Assembly in 1987, states "Meeting the needs of the present without compromising the ability of future generations to meet their own needs". Architecture was always about bridging the gap between new architectural techniques and older techniques, where this looking back was slowly dying out as a more focus was on the physical aspects of sustainability than the tangible and intangible values in culture.

2. Culture & Cultural Sustainability

In order to understand cultural sustainability, an understanding of the term 'culture' becomes essential. Culture is "a way of life" for a civilization, a "social production and transmission of identities, meanings, knowledge, beliefs, values, aspirations, memories, purposes, attitudes, and understanding" (Hawkes: 2001). There is immense value behind the social expressions divulged through the built form architecture of a place, which makes it essential to understand culture deeply, for practical sustainability. The significance of culture in a sustainable built environment is becoming more evident today, for a healthy and sustained development of our societies. Rapoport asserts that socio-cultural factors are considered primary in shaping built form, whereas climate, construction materials, methods, and technologies secondary (Rapoport: 1969). To maintain the balance

and harmony in the natural environment there is a need to understand sustainability not only through the commonly associated social, economic and environmental issue but also through a cultural perspective. Culture is recognized by Hawkes as the "fourth pillar of sustainability" and it's a key component and drives to achieve a sustainable and healthy society (Hawkes: 2001). Hence the focus of cultural sustainability design is to meet the users' social and cultural needs and preserve the environment for the next generations. Cultural sustainability involves efforts to preserve the tangible and intangible cultural elements of society in ways that promote environmental, economic, and social sustainability (NZMCH 2006; Duxbury 2012). This has paved way to a new approach in the perception of sustainability.

3. Relevance of Cultural Sustainability

Culture is a key parameter in sustainable development as it frames people's relationships and attitudes towards the built and the natural environment. Sustainable development is an integral part of the society and culture; affecting all aspects of operations in the built environment. Research in cultural sustainability is essential for understanding the concerns for cultural continuity, which can be investigated in the traditional dwellings/homes from across the world by identifying existing traditional technology and settlement patterns etc. Studies of ancient cultures reveal that this cultural-sustainable parameter has been fully accounted for in determining a logical synthesis in place making. With modernism the cultural context in the design process started to fade, wherein a universal design methodology which is not in context with the cultural values of a particular society/ place began to be adopted. So starting to look deeper into what once existed and how it came about is crucial to find clues for developing a sustainable built environment. Scrutiny and analysis of culture will help find solutions that benefit people's strengths and values (Boschi: 2003).

4. Culture in/for Sustainability.

Sustainable architecture is usually approached as an issue of technological and energy performance due to which the discourse surrounding it has remained separate from the broader perspective of architecture as a cultural project. "Current technologically based sustainable architectural approaches and design methodologies often fail to coincide with the cultural values of a particular place or people" (Guy and Farmer 2000: 80), which calls for a need to identify the role of culture in sustainability. "Traditional wisdom and lore in building, using renewable resources and indigenous skills, may still offer wisely managed, economically effective and culturally appropriate solutions to the world's increasing housing needs" (Oliver, 2006) which gives cues that probe into the cultural aspects of a place, would yield design solutions that are responsive to local conditions and those that are economically viable and have withstood the test of time. Indigenous architecture has been inherently sustainable and modern architects have employed those principles in creating architecture that is in relevance to culture and kinder to the environment (Dayaratne: 1999, 2000, 2003, 2007).

Recent researches have demonstrated both the value and logics of learning from vernacular for sustainability where social and cultural values are closely associated with building design style and function. Hence there is a definite connection between architecture and culture which relates to location, and so over time its characteristics become representative of a locality's cultural heritage. And cultural sustainability and the connection with the built environment involve the development

of building forms, materials and construction methods resonant with the local culture and expertise (Williamson et al. 2003).

Keeping the past as reference, buildings are critically important in the domain of cultural sustainability as they are the built reflection of the aspirations of those for whom they are built (as well as for those who design and build them), and collectively they represent the beliefs and priorities of their society through its history (Beynon 2009). A less quantitative, more qualitative perspective on sustainability is crucial in the assessment of architecture in the today's context.

5. Architectural Practices should adopt Cultural Sustainability.

An efficient sustainable built environment that includes economic and socio-cultural sustainability supports local economy (Allen 2009).

The built environment is an integral part of spatial construction, and the history of building is a history of identity and therefore any alterations to buildings, involve elements and forms that relate to particular cultural and societal patterns (Beynon 2010).

Culture is a crucial instrument that will drive sustainable development with broader social, economic and environmental impacts on the society and hence it should be placed at the centre of our development strategies. Today many cities across the world use cultural heritage to encourage sustainable urban communities and cultural heritage and infrastructure can serve as strategic tools for revenue generation. Culture plays an important role as a non-renewable resource that is a vital part of our cities; the adaptive re-using of the historic urban environment adds to the quality of life of their inhabitants by strengthening their sense of belonging, social cohesion and providing a pleasant environment that mitigates excessive urbanization (UNESCO 2012b), thus fostering cultural sustainability.

Historic towns and the historic parts of cities are of immense worth for their uniqueness and identity (Duxbury 2012). Culture contributes to sustainable built environment through the protection of historic buildings which need to be conserved for economic as well as cultural continuity. Other measures that can be adopted are sustainable urban retrofit schemes and regeneration/urban renewal programmes on an urban scale. Design practices focussing on sustainable architecture and smart/sustainable cities, within the dominion of the societies' identity to protect its continuity, is also very essential. The cultural heritage of a place is a powerful asset for inclusive economic development, since it attracts investment and ensures green, locally-based, stable and decent jobs relating to a wide range of sustainable activities in areas such as conservation, construction and adaptation (Hosagrahar 2013).

Culture, sustainability and sustainable development are complicated concepts wherein a comprehensive framework of study is essential to formulate policies integrating strategies that include the environment, the economy and quality of life. Development measures and schemes should ensure a strong 'cultural flow' in policies and enable a culturally sustainable society after a thorough understanding of the current flaws and difficulties in its application towards development.

6. Difficulties and Threats

With the progress of knowledge about the adequacy and impact of sustainability, its attainability has been explored into different walks of life. Architects and planners, however; are trying to establish their knowledge in four areas: environmental, economic, social and

cultural, popularly termed as the four pillars of sustainability. While a connection between culture and sustainability is under exploration, researchers need to focus on culture as a distinguished aspect with credible methods of assessment for their effectiveness in design. Environmental and economic aspects of sustainability have been deeply researched and practiced in the design of built environment with strong means of assessment of their effectiveness, but social and cultural aspects of sustainability, still lacks reliable and suitable solutions to implement them in design. The domain of cultural sustainability is still emerging, where there should be an opportunity to compare the effects of design interventions.

Another issue which forms a threat to culture is the emergence of globalization, which has brought about rapid social change & urbanization which is at the cost of existing cultures and built environment. Due to this modernization the traditions are vanishing and there is also a irreplaceable loss of knowledge bearers. Damage by tourism and competition with commercial media is adversely affecting the region's original identity, for the sake of technological and economic advancement. Political projects which override common values and lack of financial support to support these sustenance are others threats to their rapid loss and deterioration. These phenomenon have introduced an important number of risks for culture; such as: the loss of regional cultural spaces, of local urban culture, of historical "originals." More often we have seen these aspects disappear; and sometimes they replaced or reproduced as a commoditization of the original cultural heritage (Fithian & Powell: 2009). These combined insights and threats give us make evident that we have to change our present ways of looking at sustainability and incorporate cultural aspects into our values system. Mass produced system of modern architecture to solve social problems has come to its limits and a new approach to sustainability inclusive of the four pillars needs to be adopted.

7. Discussion and Conclusion.

Of all important factors affecting the society, culture is one essential aspect that should emerges as an independent parameter in the realm of sustainable architecture. It must be a separate, distinct, and integral part of the design policies and strategies of sustainable development. Studies focuses on the sustainability of the culture of a place will lead decision makers to create improved cultural centers and meaningful urban spaces. When such an approach to design is established along with the other physical aspects of sustainable development, a culturally sustainable community will evolve which will have better ability to sustain and build on its own resources. By investigating the concerns and issues discussed in this paper, building a culturally sustained built environment in harmony with the natural and social environment could be realized by designing with the vision and objectives of sustainable architecture. This approach can effectively maintain cultural integrity, continuity and solidarity among the community as well as at the same time to preserve the environment for the next generations.

8. References

Allen A (2009). "**Sustainable cities or sustainable urbanisation?".** 'Palette'- UCL's J Sustain Cities. Available at: www.ucl.ac.uk/sustainable-cities.

Al-Jamea M (2014). "**Towards social and cultural sustainability in the designs of contemporary Saudi houses**." Int J Sustain Hum Dev 2(1):35–43

Ayalp, N. "**Cultural Identity and Place Identity in House Environment**." *2nd International Conference on Arts and Culture*, pp. 64-69, Montreux, Switzerland, 2011.

Beynon D (2010) "**Defining cultural sustainability in multicultural built environments**." Int J Environ, Cult, Econ Soc Sustain 6(5):255–266

Boschi, N (2003). **"Culture, Management startegies and policy issues in the Sustainable Built Environment".** Sustainable Built Environment – Vol II, EOLSS

Burton, R. and Paragahawewa, U. H. 2011. **"Creating culturally sustainable agri-environmental schemes"** , Journal of Rural Studies 27 – 1.

Davison, A., (2001), **"Technology and the Contested Meanings of Sustainability"**, Albany, NY: State University of New York Press.

Dayaratne, R. (1999). "**The Vernacular settlements and Sustainable Traditions of Sri Lanka"**. in the Proceedings of the First International Conference on Vernacular Settlement, Depok, Indonesia.

Dayaratne, R. (2000) "Learning **from Tradition for an Environmentally Responsive Architecture: A Formal Practice"**, in Open House International. Vol. 25. No. 03

Dayaratne, R. (2003) "**Earth Architecture for Contemporary Urban Living: Prospects and Potentials in Open House"** International. Vol. 28. No. 03

Duxbury N (2012). "**Cities, culture and sustainable development, Summer Lab'12: art, climate change and community development**." Torres Vedras, Portugal, 5 Sept 2012. http://www.ces.uc.pt/myces/UserFiles/encontros/1097_DUXBURY_Torres_Vedras_05.09.2012.pdf.

Duxbury N, Jeannotte MS (2010). "**Culture, sustainability and communities: exploring the myths**". Oficina do CES Nr. 353, Universidade de Coimbra. A paper presented at the 6th international conference on cultural policy research, Jyväskylä, Finland, 24–27 Aug 2010

Duxbury N, Cullen C, Pascual J et al (2012). "**Cities, culture and sustainable development**." In: Anheier HK, Isar YR, Hoelscher M et al (eds) Cultural policy and governance in a new metropolitan age. The cultures and globalization series, vol 5. Sage Publications Ltd, London, pp 73–86

Duxbury, N.; Eileen, G., (2007), **"Culture as a Key Dimension of Sustainability: Exploring Concepts, Themes, and Models"**, Creative City Network of Canada - Centre of Expertise on Culture and Communities.

Guy, S. and Farmer, G. (2001). "**Reinterpreting Sustainable Architecture: The Place of Technology**." *Journal of Architectural Education,* Vol. 54, No. 3, pp. 140-148.

Guy, Simon and Graham Farmer (2000). **"Contested Constructions: The Competing Logics of Green Buildings and Ethics"** in W. Fox, (ed.) *Ethics and the Built Environment*, London: Routledge, pp. 73-87.

Hawkes J (2001). "**The fourth pillar of sustainability: culture's essential role in public planning**." Common Ground Press, Melbourne

Hosagrahar J (2013). "**Built Heritage and sustainable development: a case study from South Asia**." In: Proceedings of The Hangzhou international congress, session 3a-culture's contribution to achieving sustainable cities, Hangzhou-China, 15–17 May 2013

Kohler, Niklaus (2003) "**Cultural Issues for a Sustainable Built Environment**" in R. Cole and R. Loach (eds.) *Buildings, Culture & Environment: Informing Local & Global Practices*, Oxford: Blackwell, p. 85.

Kumar, Satish et al.(2002) "**Introducing comparative analysis to the LEED' system: A case for rational and regional application**", in *Proceedings of the ACEEE 2002 Summer Study on Energy Efficiency in Buildings*, American Council for an Energy-Efficient Economy.

Lewis JO (2012) "**Renovate or demolish/rebuild: what are the drivers?"** EuroACE Brussels, Renovate Europe Day, 11 Oct 2012.

http://www.renovateeurope.eu/uploads/REDay2012%20ppts/REDay2012_Workshop_Owen_Lewis.pdf.

Macy, Christine (1998). "**Appropriate Technology" in *Canadian Architect"***, February 1998, v. 43, n. 2, pp.16-19. Toronto: Southam Magazine Group.

McDonough, William and Michael Braungart (2002). "**Cradle to Cradle: Remaking the way we Make Things**", New York: North Point Press.

McMinn, J. and Polo, M. (2005). "**Sustainable Architecture as A Cultural Project**". *Proceedings of the Conference on World Sustainable Building*, pp.4537-4544, Tokyo, Japan, 27-29 September 2005

New Zealand Ministry for the Environment (2009). "**Rethinking our built environment: towards a sustainable future**." New Zealand Government

NZMCH (2006). "**Cultural well-being and local government report 1: definition and context of cultural well-being**." New Zealand Ministry for Culture and Heritage (NZMCH), Wellington

Opoku A, Ahmed V (2013). "**Understanding sustainability: a view from intra-organizational leadership within UK construction organizations**." Int J Archit Eng Constr 2(2):133–143

Oliver, P. (2006) **"Built to Meet Needs: Cultural Issues in Vernacular Architecture."** UK: Architectural Press.

Oliver, P. (1997). **"Encyclopaedia of Vernacular Architecture of the World".** UK: Cambridge University Press.

Parodi O (2011). "**Three steps towards a culture of sustainability**." In: Parodi O, Ayestaran I, Banse G (eds) Sustainable development-relationships to culture, knowledge and ethics. KIT Scientific Publishing, Karlsruhe, pp 76–92

Rapoport, A. (1969). "**House, Form and Culture**." Prentice Hall.

Taylor C (2009) "**Building cultures for sustainability**." Oxford Leadership J 1(1):1–3

UCLG (2010) "**Culture: fourth pillar of sustainable."** UCLG policy statement, UCLG committee on culture and world secretariat policy statement for Mexico City, United Cities and Local Governments (UCLG), Barcelona, 16 Sept 2010

UNESCO, (2000), **"Culture for Sustainable Development, United Nations Educational, Scientific and Cultural Organization",** (http://www.unesco.org/new/en/unesco)

UNESCO (2012a) "**Culture: a driver and an enabler of sustainable development**." UN system task team on the post-2015 development agenda, The United Nations Scientific, Educational and Cultural Organization (UNESCO).

http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/post2015/pdf/Think_Piece_Culture.pdf.

UNESCO (2012b) "**The future we want: the role of culture in sustainable development**." The United Nations

Scientific, Educational and Cultural Organization (UNESCO).

http://www.unesco.org/new/en/rio-20/culture-for-sustainable-development/.

Williamson T, Radford, Bennets H (2003). **"Understanding sustainable architecture".** Spon Press, London.

19th IABSE Congress 2016

Challenges in Design and Construction of an Innovative and Sustainable Built Environment

IABSE Symposium Report

Stockholm, Sweden
21 – 23 September 2016

Part 1 of 4

Editors:

Lennart Elfgren
Johan Jonsson

ISBN: 978-1-5108-3590-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571

Some format issues inherent in the e-media version may also appear in this print version.

Printed by Curran Associates, Inc. (2017)

International Association for Bridge and Structural Engineering (IABSE)
c/o ETH Zurich
Honggerberg HIL E 21.3
Stefano-Franscini-Platz 5
8093 Zurich
Switzerland

Phone: +41-44-633 2647
Fax: +41-44-633 1241

secretariat@iabse.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Theme: M - Materials

Advanced Concrete

Session chair: Rob Vergoossen

Advances in Concrete Structures

Session chair: Mikael Hallgren

FRP / GFRP I

Session chair: Ane de Boer

JOURNAL OF ARCHITCTURE, PLANNING & CONSTRUCTION MANAGEMENT
Volume 6 Issue 2, 2016

DAY LIGHTING ANALYSIS IN VERNACULAR HOUSES OF RURAL KARNATAKA, INDIA

Shaila Bantanur, Sanketh P Bharathish

Srinivas School of Architecture, Karnataka, India

ABSTRACT

Day lighting is an important passive strategy for indoor architecture which helps in reducing the consumption of electrical energy or reliability on artificial lighting, thus enhancing the psychologically and physiologically effects on the health and wellbeing of building occupants. The paper analyses the day lighting in typical rural houses more specifically, three vernacular residential dwellings in Mala village situated in Karkala District, Karnataka, India. The survey includes enlisting or recording building materials used in construction, dimensioning individual rooms, doors and window openings and total number of lighting fixtures used in each room. Ratio of window to floor area (AW/AR) is calculated in each room of the dwellings. Monitoring the daylight and further, illuminance at various levels is measured with the help of Lux meter . Three houses are further simulated using ECOTECT2011- software. The ratios of areas of window to floor of each room in all the houses are less than 10% resulting into poor illuminance. The quality of the light inside the kitchen was still poor. Adopting few strategies like making wall surfaces more reflective and few modifications in the grill patterns will help to increase the indoor illumination.

Keywords: Day lighting analysis, Ecotect, Floor to Window Ratio, Vernacular housing, Sustainability

INTRODUCTION

India's large population lives in its villages. Villages are known for their local/regional rich tradition and culture, which are also reflected in their rural settlement patterns. Understanding the traditional architecture with respect to climate responsive built-environment, construction techniques, air movement, humidity, thermal comforts and day lighting provides vital lessons for prevailing architectural practice in the region. Vernacular houses were analysed in many ways to identify performance of traditional houses constructed to withstand extreme weather conditions. The materials used for the construction also help to

improve the energy performances of the dwellings/buildings, (Zhai and Previtali 2010). Vernacular housing designs were analyzed on the aspects of building physics and identified that under extreme climatic conditions the measures may not be sufficient (Nguyen et al. 2011)Climate responsive strategies of Iranian houses were analyzed application of the building elements and solutions to bring daylight into different parts of traditional courtyard houses concluded that adopting these strategies will even enhance the quality of modern houses as well (Nabavi, Ahmad, and Goh 2013). Vernacular houses strongly reflect the culture and traditions of the local region and responds to the local climate (Dili, Naseer, and Varghese 2010,Majid, Shuichi, and Takagi 2012, Jayasudha et al. 2014, Bodach, Lang, and Hamhaber 2014),(Shanthi Priya et al. 2012). Furthermore, few suggested modifications to the existing houses can achieve better performances (Xuan 2013). Few researchers analysed that vernacular dwelling follow all the principles of bio climatic strategies (Bodach, Lang, and Hamhaber 2014), (Shanthi Priya et al. 2012). Energy performance of historic rural houses were analysed in three countries namely Estonia, Finland and Sweden. The study explored the potentials of improving the building service or infrastructural systems (Alev et al. 2014). Similar study was also being conducted by using Ecotect Software v.5.2 and potential improvements were proposed (Michael and Malaktou.2015). Solar passive techniques in vernacular houses (n=150) of north east part of India has been studied including temperature, humidity, illumination level and building design parameters. The study provided range of comfort temperature for different seasons. The study also identifies low performance during winters (Singh et al. 2010).

A study conducted in Suggenahalli village of India to understand the thermal comfort in naturally ventilated vernacular dwellings using Fanger's predicted mean vote (PMV) and Humphrey's adaptive thermal comfort and proposes aggregated PMV model (Shastry, Mani, and Tenorio 2016).The study majorly highlights that vernacular housing is climate responsive and strongly reflects the social and cultural identity of community and place. Study focusing on daylight highlights, optimization methods of day lighting using lighting simulations (Haqparast and Maleki 2014). The present study thus, analyses the day lighting

with respect to floor to window ratio, luminance level within the rooms and finally simulating with the Ecotect-2011 software.

STUDY AREA

The present study is conducted in the village called Mala in the district of Karkala, Karnataka state, India (Fig.1) .It is situated at the foothills of westernghats. The area of the village is 11617.29acre (as on 2015).Total population as per 2011 census is 5998 with 2920 male and 3078 female. Total number of households in of the village is 1338, 150 households have water supply connections. Village is located at the latitude 13.2374789 longitude 75.1100228. The average annual temperature is 26.8 degree celcius with an average rainfall 4372.7 mm. Water for the domestic purpose is from-underground water resources like hand pumps (37 nos) and wells (12nos) are used. The settlement is scattered and constructed using locally available material by local craftsmen or with local craftsmanship finishes. The houses were provided with the traditionally designed teak wood panel and battens which reflects the use of traditional building material with Laterite stone and mud for walls, teak wood for windows, cement for flooring and sloping roof with Mangalore tiles. Most of the houses observed in the villages are single-storey, load-bearing structures. Typical house includes rooms like verandah, living room, bedroom (varies from one to three in number), kitchen and cattle shed situated outside. Storage spaces were generally provided above kitchen.

Source:mapsofindia.com
Fig.1: Showing the location of the study area

RESEARCH METHODOLOGY

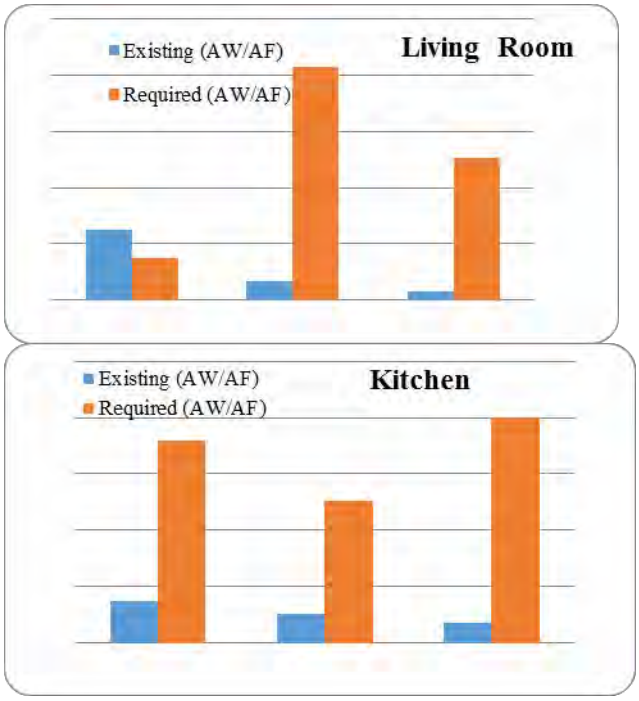
All the three dwellings differ in terms of area and number of rooms, but they follow the similar principals of traditional architecture (fig 2).

The primary survey was conducted in the month of January, 2016. The survey includes listing of building materials used for various parts of the building, measuring the size of individual rooms, measurements of doors and window openings and total number of lighting fixtures used in each room. With the help of the measurements, ratio of window to floor area is calculated for each room of the three dwellings. Monitoring the daylight and its illumination at various levels is measured with the help of Lux meter (LX1102). All the readings of the Lux meter were recorded at the height of 1.0 m from the finished floor level of the respective room. Based on the room sizes, relevant grids were made on the floor and data was collected accordingly. All the artificial lighting fixtures were turned off, while conducting the experiment. Maximum and minimum data for each grid point is measured. Finally, the collected data is simulated using ECOTECT 2011 software. During the simulation the following conditions are pre-considered window cleanliness as -dirty x (.075), sky component as-15000lux, overcast sky condition with the increased accuracy mode. With this input data results were analysed and discussed in detail.

Fig.2: Houses selected for the study of Mala Village, India

DISCUSSIONS

The three houses of Mala village were analysed by taking detailed dimensions of indoor spaces. The ratios of areas of window to floor of each room in all the three houses are calculated and crosschecked with the standards, which suggests that the size of the openings should be 10% of total floor area (("Model Guidelines for Development & Building Construction Including Safety Provisions for Natural Hazards in Rural Areas", 2008). The result shows that the windows provided in each room are extremely inadequate as shown in (Fig 3.)The quality of the light inside the kitchen area was very poor. The illumination level using the lux meter was also recorded at certain nodes. It shows that the illumination level in living room ranges from 36-65 lux, in kitchen from 1.1-9.33 lux and in bedroom, it is from 0.36 -37.4 lux. This shows day lighting in kitchen and bedroom is comparatively very less. Biomass was used as cooking fuel due to which most of the walls were covered with the soot resulting into less reflective wall surface. It is also noted that most of the time the windows were shut in fear of wild snakes.



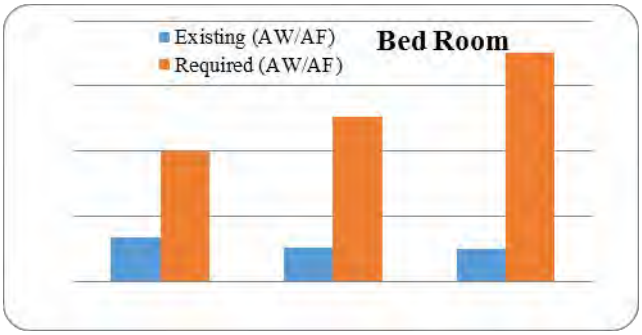


Figure (3): Window to Floor area percentage/ratio in living room, Kitchen and Bed Room

Further, all the indoor spaces were simulated using ECOTECT Analysis 2011 to study overall daylight illumination. The result shows that most of the areas were less illuminated to perform day-to-day activities (Fig.4, 5, 6) which affected the physiological and psychological health of users. This would undoubtedly result in increase in the energy consumption. Adopting few strategies like making wall surfaces more reflective and few modifications in the grill patterns will help to increase the indoor illumination.

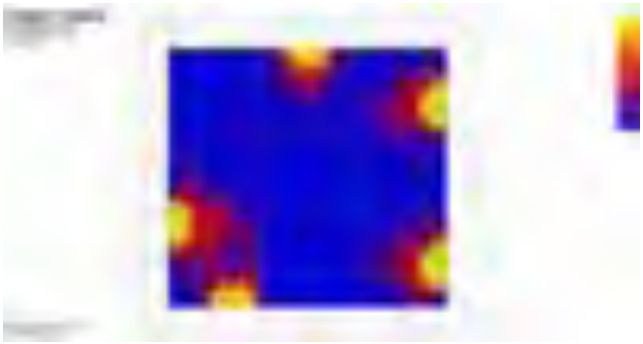


Fig.4: Simulation of House .1 through Ecotect

Fig.5: Simulation of House .2 through Ecotect

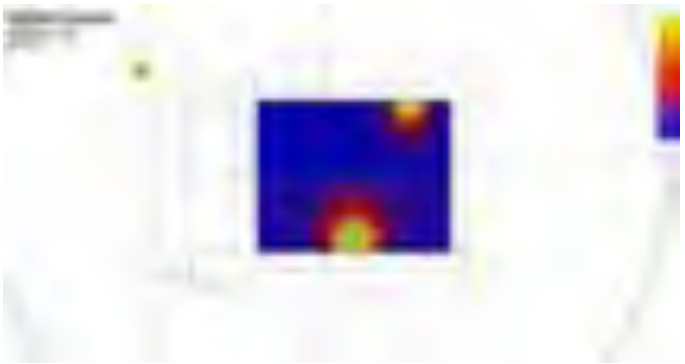


Fig: 6: Simulation of House .3 through Ecotect

CONCLUSIONS

The three rural houses were studied and analysed with respect to day lighting in this paper. Data related to village profile, carpet areas of the houses, opening details and material specifications were collected. Further, day lighting illumination was recorded with the help of the Lux meter at specific points and using the ECOTECT software indoor illumination levels were simulated.

Based on the study, the following conclusions are drawn:

1. Architectural built forms of the vernacular settlements reflected traditional building materials, vernacular construction techniques along with socio- cultural aspects.
2. Size and proportions of the rooms plays an important role. Rooms with greater depth with smaller windows resulted with unequal distribution of the sunlight. Size of the windows provided was very small with respect to room sizes. Ratio of window to floor area is poor.

3. As compared to living room, Illumination levels inside the kitchen and bedroom were more critical.
4. It is observed that less reflective wall finishes and soot deposition on kitchen wall further reduced the reflectivity making the space more dull and dark.
5. Most of the rooms have only one window due to which distribution of daylight throughout the spaces was not uniform. Few modifications in the existing building can improve considerable indoor day lighting.

ACKNOWLEDGEMENT
The authors would like to thank Ar. Premnath, practicing architect from Mumbai, for his financial support.

DECLARATION
An earlier version of this paper was blind reviewed by two referees and presented in the **3rd ICABE** Conference held in Kuala Lumpur, Malaysia, 5-6 October, 2016.

REFERENCES

Alev, Üllar, Lari Eskola, Endrik Arumägi, Juha Jokisalo, Anna Donarelli, Kai Siren, Tor Broström, and Targo Kalamees. 2014. "Renovation Alternatives to Improve Energy Performance of Historic Rural Houses in the Baltic Sea Region." *Energy and Buildings* 77: 58–66. doi:10.1016/j.enbuild.2014.03.049. http://dx.doi.org/10.1016/j.enbuild.2014.03.049.

Almssad, Asaad, and AmjadAlmusaed. 2015. "Environmental Reply to Vernacular Habitat Conformation from a Vast Areas of Scandinavia." Renewable and Sustainable Energy Reviews 48: 825–834. doi:10.1016/j.rser.2015.04.013. http://www.sciencedirect.com/science/article/pii/S13640321 1500283X.

Bodach, Susanne, Werner Lang, and Johannes Hamhaber. 2014. "Climate Responsive Building Design Strategies of Vernacular Architecture in Nepal." *Energy and Buildings* 81:

227–242. doi:10.1016/j.enbuild.2014.06.022. http://dx.doi.org/10.1016/j.enbuild.2014.06.022.

Dili, a. S., M. a. Naseer, and T. Zacharia Varghese. 2010. "Passive Environment Control System of Kerala Vernacular Residential Architecture for a Comfortable Indoor Environment: A Qualitative and Quantitative Analyses." *Energy and Buildings* 42 (6): 917–927. doi:10.1016/j.enbuild.2010.01.002. http://dx.doi.org/10.1016/j.enbuild.2010.01.002.

Haqparast, F, and B Ahmadkhani Maleki. 2014. "Daylighting and Daylight Simulation" (September): 116–120.

Jayasudha, P, M Dhanasekaran, Monsingh D Devadas, and N Ramachandran. 2014. "A Study on Sustainable Design Principles : A Case Study of a Vernacular Dwelling in Thanjavur Region of Tamil Nadu , India" 13 (October): 762–770.

Majid, Noor Hanita Abdul, Hokoi Shuichi, and Nozomi Takagi. 2012. "Vernacular Wisdom: The Basis of Formulating Compatible Living Environment in Oman." *Procedia - Social and Behavioral Sciences* 68: 637–648. doi:10.1016/j.sbspro.2012.12.255. http://www.sciencedirect.com/science/article/pii/S1877042812057382.

Michael, Aimilios, and Eleni Malaktou. "Lighting Performance in Rural Vernacular Architecture in Cyprus : Field Studies and Simulation Analysis ."

"Model Guidelines for Development & Building Construction Including Safety Provisions for Natural Hazards in Rural Areas."UNDP report,2008.

Nabavi, Faezeh, Yahaya Ahmad, and Ai Tee Goh. 2013. "Daylight Design Strategies: A Lesson from Iranian Traditional Houses." Mediterranean Journal of Social Sciences 4 (9): 97–103. doi:10.5901/mjss.2013.v4n9p97. http://www.mcser.org/journal/index.php/mjss/article/view/1050.

Nguyen, Anh Tuan, Quoc Bao Tran, Duc Quang Tran, and Sigrid Reiter. 2011. "An Investigation on Climate Responsive Design Strategies of Vernacular Housing in Vietnam." *Building and Environment* 46 (10): 2088–2106. doi:10.1016/j.buildenv.2011.04.019. http://dx.doi.org/10.1016/j.buildenv.2011.04.019.

Shanthi Priya, R., M. C. Sundarraja, S. Radhakrishnan, and L. Vijayalakshmi. 2012. "Solar Passive Techniques in the Vernacular Buildings of Coastal Regions in Nagapattinam, TamilNadu-India - A Qualitative and Quantitative Analysis." *Energy and Buildings* 49: 50–61. doi:10.1016/j.enbuild.2011.09.033.

Shastry, Vivek, Monto Mani, and Rosangela Tenorio. 2016. "Evaluating Thermal-Comfort and Building Climatic-Response in Warm-Humid Climates for Vernacular Dwellings in Suggenhalli (India)." Architectural Science Review 59 (1): 12. doi:10.1080/00038628.2014.971701. http://dx.doi.org/10.1080/00038628.2014.971701.

Singh, Manoj Kumar, Sadhan Mahapatra, S. K. Atreya, and Baruch Givoni. 2010. "Thermal Monitoring and Indoor Temperature Modeling in Vernacular Buildings of North-East India." Energy and Buildings 42 (10): 1610–1618. doi:10.1016/j.enbuild.2010.04.003. http://dx.doi.org/10.1016/j.enbuild.2010.04.003.

Xuan, Huang. 2013. "Daylighting Analysis of Vernacular Architecture in Guizhou Province , China" (December): 1–8.

Zhai, Z. J, and Jonathan M. Previtali. 2010. “Ancient Vernacular Architecture: Characteristics Categorization and Energy Performance Evaluation.” Energy and Buildings 42 (3): 357–365. doi:10.1016/j.enbuild.2009.10.002

Journal of Civil Engineering and Environmental Technology
p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 4, Issue 1; January-March, 2017, pp. 50-54

http://www.krishisanskriti.org/Publication.html

GIS based Assessment and Gap Analysis of socio-economic Infrastructure in Rourkela Town

Debadutta Parida

BMS School of Architecture
E-mail: debadutta.parida2011@gmail.com

Abstract—*The steel town of Rourkela originated in 1960 as a new experiment in urbanism in Post-Colonial India. The present study focuses on GIS based assessment and gap analysis of socio-economic infrastructure in thirty-three wards of Rourkela Municipal area, referred to in the paper as Rourkela Town.*

1. *The study was carried out for six broad criteria viz. educational facilities, healthcare facilities, safety and security services, postal services, socio-cultural facilities and banking facilities. Altogether data was collected for identified facilities, which was later mapped using GIS tools. The data was further compared with required standards for socio-economic infrastructure as prescribed by UDPFI (Urban Development Plan Formulation and Implementation) guidelines.*
2. *Data collection has been through expert discussions, observation survey, collection of field data, secondary sources as well as satellite imagery available from various sources.*
3. *The results indicate that there is shortage of infrastructural facilities in terms of numbers (when compared with UDPFI Guidelines) as well as geographical distribution for eight of the eighteen facilities investigated. Additionally, two facilities each fell short either in required numbers or geographical distribution. Eight facilities were adequate in numbers as well as their geographical distribution.*
4. *In totality, it was inferred that there is a disparity in terms of available infrastructure as well as their distribution between the Rourkela Steel Plant area and the Municipal wards. Also, there is urgent need for augmentation of healthcare facilities in Bondamunda area.*
5. *The findings emphasize the significance of GIS mapping as a tool to assess the distribution pattern of infrastructure in an area. The findings have potential implications for all planning agencies in the town to develop strategies for augmentation of open spaces in the study area.*

Keywords*: GIS based assessment, Socio-economic infrastructure, UDPFI Guidelines, Rourkela Town, Gap Analysis*

1. INTRODUCTION

The industrial town of Rourkela was set up in the 1950s along with its counterparts such as Bhilai, Durgapur and Bokaro, as a result of Central government policies towards industrialization of the country. Unlike colonial urban forms, it did not represent juxtaposition of traditional urban core with modern planning approaches. It was rather built from scratch. The initial planning of the town was conceived in totality, with a clear segregation between the steel township, the resettlement colonies and the steel plant. Recent developments in the last three decades however have been incremental in nature as a response to socio-economic and cultural changes in the town. The town has grown from a village to a steel town into an urban agglomeration in recent times. The population of Rourkela has grown from 90, 287 in 1961 to 5,52,239 in 2011(Parida, 2014a). The Urban Agglomeration is broadly divided into Steel.

Township and Civil Township area. This study focuses on the thirty-three wards in the Civil Township under the control of Rourkela Municipal Corporation, henceforth referred to as Rourkela Town. The population of Rourkela Town was 2, 73,040 in 2011 and is forecasted to increase to 3, 78,479 in the year 2031.

The development of the town in the 1970s and 1980s was often hampered by a 'one-sized-fits-all' mentality, prescribing reforms from a centralized perspective, without regards for the territorially specific needs of a given population or community(De, 2003). However, it is to understand that any single aspect of a town (cultural heritage, economy, infrastructure, environment etc.) cannot exist in isolation without being influenced by one another. An integrated approach is therefore necessary at local levels which makes these aspects of the city 'interact' with each other and develop in tandem.(Parida, 2014b). In this context, Rourkela Town can be considered as a system in which there are several sub systems which are inter dependent as well as closely linked. The various subsystems can be physical, socio-economic, environment and ecology, infrastructural(transport, social and economic), institutional, disaster related etc.(Parida, 2014b). The present investigation focuses on the existing situation of socio-economic infrastructure in Rourkela Town.

2. KEY ISSUES IN THE STUDY AREA

Some of the key issues in Rourkela Town are as follows:

1. There is severe dichotomy in the infrastructure levels between the areas under Rourkela Municipal Corporation and Rourkela Steel Plant.
2. Nearly 43% of the population of Rourkela Town is in slums and squatter settlements. This number is expected to increase as the town grows towards an urban agglomeration.
3. The current draft master plan prepared for the town lacks intent due to lack of integrated planning. There is not much focus on correcting various weaknesses of the town in terms of augmenting the economic as well as social subsystems.
4. The quality of open spaces, socio-cultural spaces, postal services, safety and security services in the town are below acceptable standards.
5. There is lack of proper spatial data for the town presently.

3. METHODOLOGY

After the identification of issues in the study area, the investigation focused on identifying parameters relevant to social infrastructure. Six broad categories were identified through expert discussions and survey in the area. Data was collected and mapping of facilities was done for eighteen tangible facilities under the six criteria for further analysis and assessment. Gap analysis of the existing data was done through comparison with the acceptable standards as per UDPFI Guidelines. The two criteria for analysis were quantity of service provided and distribution of services. Broad inferences were then drawn from the investigation.

Broad categories – Educational facilities, Healthcare facilities, Safety and Security services, Postal Services, Socio-cultural facilities and Banking facilities

Facilities studied: Secondary School, Library, College, Polyclinic, Intermediate Hospital, General Hospital, Police Station, Fire Station, Post Office, Community Halls, Clubs, Cultural center, Theatre, Spiritual Center, Music/Dance School, Cremation/Burial grounds, Sports grounds/stadium, Open spaces and parks and banks.

4. RESULTS AND DISCUSSION

Table 1 shows the comparison of all of the above facilities with the required standards of UDPFI Standards.

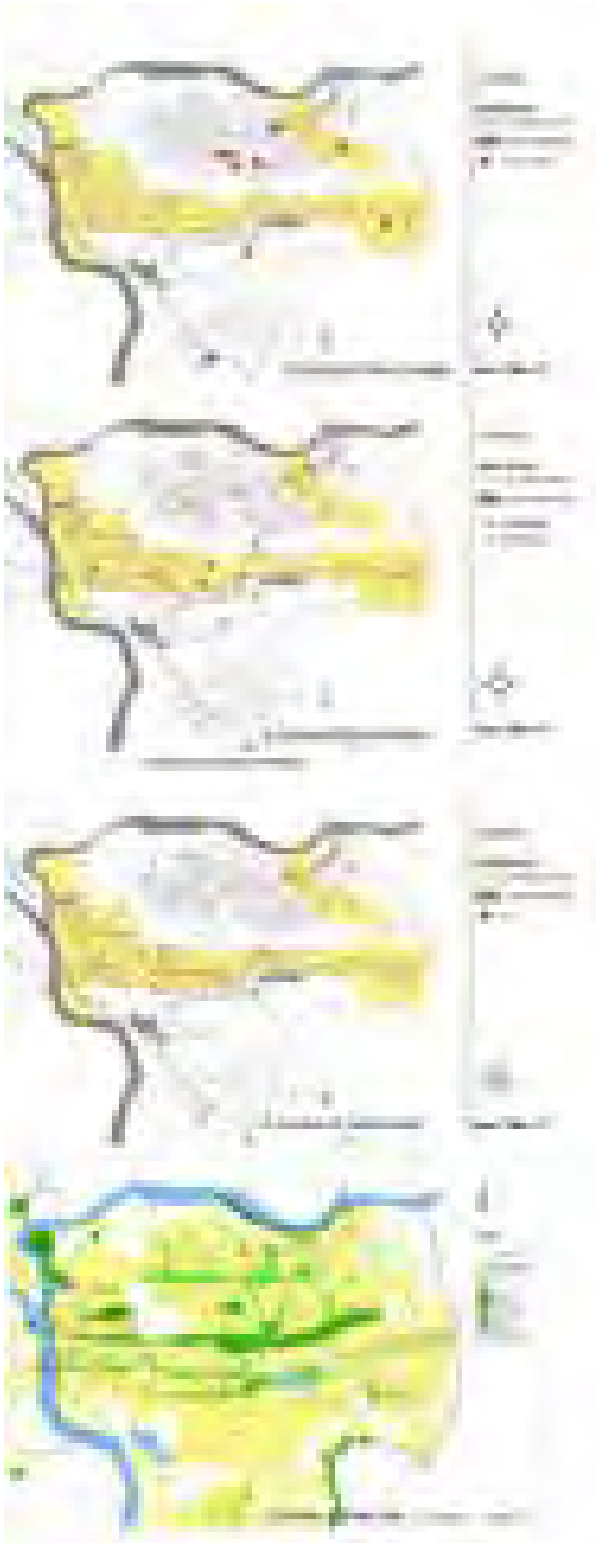
Sl. No.	Facility	Required*	Existing	Shortage	Remarks
1	Sec. school	55	11	44	US
2	Library	18	03	15	US
3	College	37	14	24	US
4	Intermediate Hospital	08	27	-	S
5	Polyclinic	07	23	-	S
6	General Hospital	03	03	-	S
7	Police Station	02	02	-	S
8	Fire Station	02	02	-	S
9	Post Office	18	11	7	US
10	Community hall	18	03	15	US
11	Club	03	01	02	US
12	Cultural Center	03	00	03	US
13	Spiritual center	03	00	03	US
14	Music School	03	01	02	US
15	Cremation/burial ground	03	09	-	S
16	Stadiums	01	10	-	S
17	Parks and playgrounds	28	13	21	US
18	Banks	-	50	-	S

**The calculations have been made according to the population of 2,73,040 of Rourkela Town according to Census of India 2011*

US – Unsatisfactory, S - Satisfactory

Table 1 Comparison of facilities with UDPFI Standards

It was seen that ten of the eighteen facilities did not meet the required standards corresponding the population of the town. It is observed that the healthcare facilities were adequate in the town area. Also, there is adequate provision in terms of sports complexes as well as banking facilities. However, it was yet to be checked if their geographical distribution in the study area was adequate. Hence it was inferred that a GIS-based assessment was necessary to show the extent of physical coverage of each of the facilities in the town.



Figures 1 & 2 shows the geographical extent of various facilities in the town. It is seen that the Bondamunda area(Wards 23 to 27) have low level of infrastructure development compared to other wards. Most of the socio-cultural facilities are concentrated near the denser wards as well as in Civil Township area.

Majority of the wards do not have easy access to educational facilities. The students have to rely on schools in the Rourkela Steel Plant area, which increases the distances to educational facilities. There is also need for augmentation of healthcare facilities in Bondamunda. Also, there is urgent need to develop and maintain more parks and playgrounds in the study area, since majority of the parks currently are in Civil Township.

5. CONCLUSION

Table 2 below shows the overall performance of all the facilities in terms of quantity and geographical distribution.

Table 2(a to i): Mapping of various facilities of socio-economic system in Rourkela Town

Sl. No.	Facility	Quantity (a)	Distribution(b)	Overall rating(a+b)
1	Sec. school	0	0	0
2	Library	0	0	0
3	College	0	1	1
4	Intermediate Hospital	1	1	2
5	Polyclinic	1	1	2
6	General Hospital	1	1	2
7	Police Station	1	1	2
8	Fire Station	1	1	2
9	Post Office	0	1	1
10	Community hall	0	0	0
11	Club	0	0	0
12	Cultural Center	0	0	0
13	Spiritual center	0	0	0
14	Music School	0	0	0
15	Cremation/burial ground	1	1	2
16	Stadiums	1	1	2
17	Parks and playgrounds	0	0	0
18	Banks	1	1	2

Eight of the eighteen facilities studied are unsatisfactory both in terms of quantity as well as geographical distribution, while eight facilities are satisfactory both in quantity as well as geographical distribution. Only two facilities are satisfactory either in quantity or in distribution.

It is inferred that there is shortage of facilities such as secondary schools, library, post offices, parks and playgrounds in Rourkela Town. For other facilities such as community halls, clubs, theatres and cultural centers, the residents rely on the facilities available in the Rourkela Steel Plant area.

There is urgent need of augmentation with logical distribution of open spaces (parks and playgrounds) in the study area. In recent times, proposals for seven new parks have been initiated in Civil Township, Basanti Colony, Koel Nagar and Chhend Colony, which is encouraging. Yet, there is immense disparity that exists in terms of per capita open spaces in the Steel Plant area and Rourkela Town.

6. DIRECTIONS FOR FURTHER RESEARCH

The study recommends ward level GIS based analysis and assessment of various parameters for the urban agglomeration. There is also potential for quantitative studies of assessment of per capita open space in all the wards in the study area. Recently, Rourkela Urban agglomeration was ranked 46th among the list of 97 cities released by the Government of India in 2016(Smart City Report, 2016). This is expected to give rise to opportunities for improvement of the facilities which are currently in neglect due to various reasons. Future studies can be carried out using similar methodology and approach for other subsystems (as mentioned earlier in this paper) such as transport, social quality of life, economy etc.

7. ACKNOWLEDGEMENTS

The author wishes to gratefully thank the kind involvement and advice of Dr. V. Devadas, Professor, Department of Architecture and Planning, IIT Roorkee, India during the course of this investigation. Also, the author would like to acknowledge Prof. Markus Neppl, and Prof. Rob Van Gool of Institute for Landscape and Urbanism, Karlsruhe Institute of Technology, Karlsruhe, Germany for giving their valuable suggestions on the theme. The usual disclaimers apply.

REFERENCES

[1] Dara, P.K, Singh, D.K., & Rout, P. . (1997). Role of Environmental Degradation in Changing the Urban Morphology: A Case Study of Rourkela in Orissa. In *Geography and Environment* (pp. 224–234). Retrieved from http://books.google.de/books?id=JuxzP-YSddMC&pg=PA223&lpg=PA223&dq=rourkela+town+ecological+study&source=bl&ots=Fgq9GQ8mCD&sig=i2ifOEnjXaSX2LJ0LuNjOLULagE&hl=en&sa=X&ei=V1sHU_vYAYig7AaWlICgDQ&ved=0CF8Q6AEwBg#v=onepage&q=rourkela town ecological study&f=false

[2] De, J. A. (2003). An Integrated Approach to Rural Development : Dialogues at the Economic and Social Council. *United Nations Publication*, 10–17.

[3] Koroneos, C. J., & Rokos, D. (2012). Sustainable and Integrated Development—A Critical Analysis. *Sustainability*, *4*(12), 141–153. https://doi.org/10.3390/su4010141

[4] Municipality, R. (2011). *City Sanitation Plan Draft Report October 2011*.

[5] Parida, D. (2014a). *Planning for Integrated Development of Rourkela Town*. IIT Roorkee.

[6] Parida, D. (2014b). *Planning for Integrated Development of Rourkela Town*.

[7] Parida, D., & Devadas, V. (2014). Qualitative assessment of performance of ULBs in Rourkela Town. *International Journal of Research*, *1*(5), 435–442. Retrieved from http://edupediapublications.org/journals/index.php/ijr/article/view/178

[8] Rourkela Development Authority Webpage. (2017). Retrieved from http://rdarourkela.in/

[9] Rourkela Municipal Corporation Webpage. (2017). Retrieved from http://rmc.nic.in/index.html

[10] Roy, S. (2007). *Urban Imageries : Locating the Modern City*. (T. Çınar, Alev and Bender, Ed.).

[11] Sinha, A., & Singh, J. (2011). Jamshedpur: Planning an Ideal Steel City in India. *Journal of Planning History*, *10*(4), 263–281. https://doi.org/10.1177/1538513211420367

[12] Smart City Report. (2016). Ranking_of_Smart Cities.pdf. Retrieved from http://smartcities.gov.in/upload/582d8612850c7Ranking_of_Smart Cities.pdf

Rejuvenating the Vernacular Architecture of South India as the representative of Sustainable Architecture: a case study of Hubli, Karnataka

Dr. K.Thirumaran, Deepti Shankar Hegde

Abstract— Every region has its unique identity with climate base responsive building designs and its knowledge in the form of Vernacular Architecture. It is the growing awareness of energy efficiency and sustainable architectural design, which pushes vernacular architecture to the forefront, to have a design which impacts or correlates with environmental issues of the region. Thus vernacular architecture provides a basic and a simple solution with regard to sustainability issues. That is why, sustainable architecture which features sustainability through environmental friendly resources like low energy techniques, and approaches that are integral to the form, orientation and materials obtained from local resources. This paper talks about one such vernacular settlement located in Hubli, Karnataka, achieving sustainability through planning, orientation, materials and architectural practices evolved from long time due to the socioeconomic, climatic and environmental factors of that place. The study of local vernacular architecture and lessons can be helpful to generate an approach towards the sustainable architecture, which the trained designers of modern era have mostly ignored.

Keywords—Vernacular Architecture, Climate responsive design, Sustainable Architecture, Energy Efficiency techniques, Hubli.

1 Introduction

VERNACULAR Architecture is "the local or regional dialect, the common speech of the building. As such it comprises a range of building traditions as wide as that of the linguistic traditions" [1]. According to Lawrence [2], vernacular architecture of the particular region are designed by the human and the development of relationships among social factors, economic, material, and ecological. So it reveals the combination of culture, tradition, climatic condition, social life, the technology of the region. Vernacular architecture has evolved as the result of trial-and-error methods. At face, these methods seem trivial but in fact, they are quite complex and effective as they are tested over the period of time.

Building industry consumes more than 40% of energy use and this is increasing rapidly. The built environment has a significant impact on the natural environment, human health and economy. The concept of sustainability gives the environmental friendly approaches to deal with the issues like depletion of energy resources, thermal comfort, atmospheric emissions, use of renewable energy, indoor environmental quality, water consumption etc. Sustainable design involves integrating environmental, social and economic objectives.

Since the beginning of 21st century, the globalization has had a major impact on the human lives. We, humans, are behind bringing the more and more comfort and convenience into our daily life style, this is leading to reduce the meaning of art, architecture, culture and interrelationship with the natural environment. The theory behind the architecture encompasses the factors like an art of building, the influence of society and tradition.

Vernacular architecture gives simplest solutions for the sustainable issues. Vernacular architecture has significant environmentally features which respond to the concept of sustainability such as low-energy techniques, approaches that are integral to the form, orientation, and materials that are obtained from local resources, to give comfort to the human being. In the recent years, professionals have begun to incorporate vernacular architectural features into their design to provide a sustainable built environment. Dayaratne [3] conducted the study on learning from tradition for an environmentally responsive architecture exhibits that the vernacular architecture has been naturally sustainable. The study on climatically responsive indigenous buildings and settlements in two desert conditions of India conducted by Krishnan et al. [4] presents that these buildings possess high thermal performance compared to the current contemporary buildings.

When we look back to our history, it is evident that all the human settlements were built out of sustainable techniques. All those settlements were defined by firmly unified buildings and land use pattern. People had adapted the art of living in harmony with nature.

In the energy efficiency and sustainability context, understanding the sustainable features of vernacular architecture will provide significant lessons and ideas to develop a sustainable built environment. This study of vernacular architecture is focused on the knowledge and the experiences related to sustainable features and considerations practiced from the past. Also to understand and designing a space in harmony with the nature and the environment to achieve balance between man and nature through most efficient and sustainable ways and techniques.

2 Vernacular Architecture

Vernacular architecture can teach some lessons and principles

- *Author Associate Professor, Department of Architecture, National Institute of Technology, Tiruchirappalli, India, PH-0431 2501801. E-mail: ktm@nitt.edu*
- *Co-Author Deepti Shankar Hegde is currently pursuing master's degree program in energy efficient sustainable in National Institute of Technology, Tiruchirappalli, India, PH-0431 2501801. E-mail: 201116010@nitt.edu*

which can be an inspiration and which have to be integrated into the design to solve the problems which we are facing in the building construction industry.

2.1 Participatory paradigm

In the 21st century, it is very challenging to provide shelters for the rapidly growing population. Here the process of self-help and participatory mechanism plays a most economical and affordable way. The flexible and adoptable design is another factor in vernacular architecture. So houses should provide flexibility and opportunity to use the spaces as per the choices and interests of multi-generational users. Also, building should put less impact on the ecosystem and energy resources.

2.2 Density and Sense of Place

Vernacular houses are characterized by their efficient utilization of space, compact form, building science and ecology with respect to the environment, economy, and society [5]. The land is an important resource which has to be regulated and used in a crucial manner. Usually, vernacular settlements are defined by high degree of complexity and cohesiveness. This high-density design has advantages of ease of services such as transportation, water supply, sanitation, electricity etc. This will leads to cost efficiency and energy efficiency. Also, higher density housing design must be associated with the life style, traditional values, privacy and security of the families.

2.3 Local Materials

Vernacular architecture represents the style and construction method of the particular region. Material selection is a crucial and complex process because it plays a major role in reducing cost and energy consumption [6]. Vernacular buildings are constructed out of locally available materials and technologies, which makes building more green and sustainable. In today's scenario, new building practices must adapt the use of local materials and technologies to minimize the embodied energy of the building. For example, adobe brick has low embodied energy compared to RCC. Local material cuts down the energy used for transportation and manufacturing. Also, these are having less impact on the environment.

2.4 Energy Conservation

Since building industry utilizes more energy it is essential to take steps towards energy conservation measurements. Vernacular buildings are good examples for optimization of energy use. Utilization of natural resources from micro level to building level will helps to conserve more energy. Energy conserving design strategies will include the following factors: Orientation of building with respect to sun path and wind flow direction, spatial organization, passive solar techniques, materiality, building envelope, courtyards, landscape elements etc. The main aim of green building or sustainable building is to provide comfort and healthy environment to the occupant with less impact on the ecosystem. Vernacular architecture is better way to achieve sustainability. A comparative study done by Mohammadzadeh E. Akhavan farshchi M, Ford A. [7] on energy use in vernacular building and modern building shows that, energy consumption in the modern building is higher than the vernacular building.

3 Hubli, A Vernacular Settlement in Karnataka

Fig. 1. Location of Hubli in Karnataka

3.1 Location and Climate

Karnataka has got different regions because of its diversified climatic zones like, hot and dry, warm and humid and moderate climate. Each zone is characterized by its own socio-economical-cultural pattern and architectural style. The city of Hubli, situated in south-east of Dharwad district, is the commercial center and business hub of North Karnataka region (Fig.1). The city is situated at coordinates of 15°21‟42”N, 75°05‟06”E and 671 m from mean sea level [8]. Hubli has a tropical hot and dry climate, where summers are hot and dry, lasting from late February to early June. Then monsoon season with moderate temperature and average rain fall of 830mm. When we look into the architecture style, one can see the influence of Maratha dynasty.

3.2 Vernacular House in the Rural Region of Hubli

In rural area houses were built as per the social class and the wealth of the people. Most of the families are depending on agriculture for their livelihood, also we can see houses of weavers, merchants, carpenters etc. Here study has been done on a house typology called Wada. Basically, Wadas' are houses of landlords and sarpanch (head of a village). Bigger the Wada wealthier the family. Typical Wada house will have a central courtyard with separate public and private zones. Planning and organization of spaces will showcase the climatic requirements and different levels of privacy issues. This study is focused on vernacular principles which are climate responsive and sustainable approach for the region. This particular Wada was built around 200 years back, which has a glorified history.

3.3 Data Collection

In this case study, the existing vernacular houses in Hubli, Karnataka was selected. The survey of Wada houses across the

rural areas of Hubli was carried out. The study provides a detailed examination of the current condition of the vernacular houses. The main focus was to finding out the vernacular techniques and sustainable considerations such as solar passive features, building plan and orientation, materials and technology used in the particular region with respect to climate, culture and social life.

4 Evaluation of the Vernacular Houses in Hubli

An investigation of the vernacular houses in terms of sustainable architecture criteria consisting of thermal comfort and natural ventilation as the effective matter, which includes the natural lighting also. The following characteristic features of the vernacular houses has been analyzed and the sustainable architecture criteria have been discussed.

4.1 Orientation and Planning

Usually, vernacular buildings will be in square or rectangle in plan and oriented towards the cardinal points. The reason is, it will help to control the climatic factors like wind, solar radiation etc., with the passive solar techniques. This particular Wada is having the introvert plan with the central open courtyard. Corridors around the courtyard act as a transition space between the open and closed spaces (Fig.2). These spaces are broadly divided into private space and public space with the consideration of security and privacy. Wada also has secondary courtyard where the cattle's shed is kept.

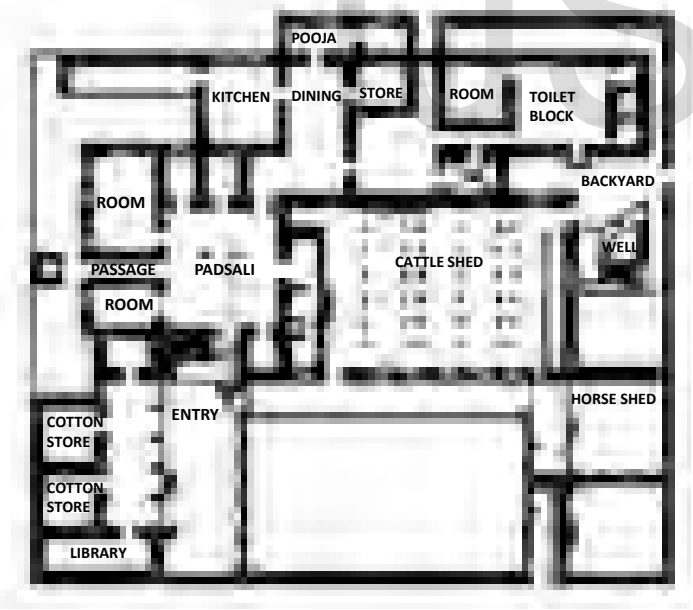


Fig. 2. A Typical Layout of Wada

4.2 Spatial Organization

Spaces are organized in such a way that it should fulfil both privacy and climatic requirements. Semi open space in the form of corridor and varandah around the open courtyard reduces the direct exposure of inner rooms to the solar radiation and keeps interior thermally comfort. Public space is close to entrance so that privacy is maintained. Since this family grow cotton, storage space for that also kept next to courtyard. Toilets are placed at backyard of the house, which is in the North-West direction (prevailing wind direction). This keeps interior odorless and hygiene. Main entry is from south direction (Fig.3).

Fig. 3. Main Entrance of Wada

4.3. Building Envelop and Openings

In hot and dry climate main design criteria is to resisting heat gain by increasing thermal capacity, providing shading, reducing exposed areas, controlling and scheduling the ventilation. In this Wada all these criteria's are taken into account and achieved by some design intervention. Both interior and exterior walls are of heavy mass (Fig.4). Thickness of the walls are around 80cm to 100cm. These thick walls acts as a thermal barrier, which reduces the heat penetration inside the building.

Fig. 4. Section of the Wada House

Window covers area of about 10% of the floor area. Exterior windows are relatively smaller and have high sill level compare to interior windows, those are facing courtyard (Fig.5). This kind of arrangement of openings helps to enhance the cross ventilation and keeps the interior cool by venture effect. Jaalis are used in the exterior walls, which cut down the solar radiation into inside space, at the same time it allows light and ventilation. There are double height spaces with clerestory windows which enhances the venturi effect where hot air rises up and passes through upper level windows (Fig.6). This will keeps interior cool.

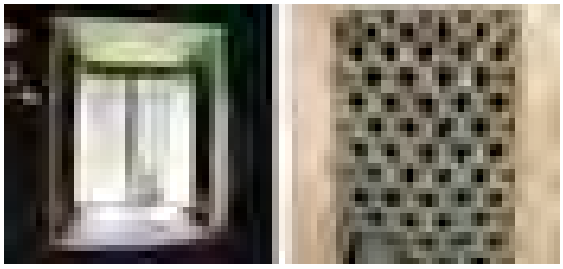


Fig. 5. Small Windows and *Jaali* on the exterior wall

Fig. 6. Double Height Space and Clerestory windows

4.4 Courtyard

The central courtyard is rectangle in shape and open to sky (Fig.7). Courtyard is sunken about 45cm deep. Courtyard will play major role in passive solar design. Size and proportion of the courtyard will decide the wind flow pattern. Here ratio between heights of the building to width of the courtyard is about 1:1. Studies showed that, courtyard increases the air movement through principles of stack effect. As air passes through the interiors it heats up and starts rising. The courtyard allows this hot air to escape (Fig.8).

Fig. 7. Central Courtyard and Verandah

Fig. 8. Air Circulation by Stack Effect

4.5 Materials and Technology

Wada is a load bearing structure, combination of stone, brick, mud and wooden components. Walls are about 1m thick taking the load of the super structure made of stone and brick masonry with mud and lime plaster on it which acts as good thermal insulation. Thickness of the wall and material used for plastering plays a major role in reducing the heat transfer through wall. There are 2 types of flooring we can see in the wada. 1) Red oxide flooring 2) Patikallu (type of stone) flooring. Patikallu is a good thermal insulator. Upper level floors are made of timber with mud flooring and stone slab placed on it, along with the layers of gunny bags and dry Neem tree leaves as a pest control. All together thickness of the floor is about 60cm, which provides thermal insulation (See Fig. 9).

Fig. 9. Upper Level Floor Detail

Wooden columns, beams and rafters were adopted to support the upper floors. Attic place was created to store the household things (Fig.10). Doors and windows are also made out of wood. Door height is relatively less compared to today's design. Door frame has rich carvings. Both doors and windows are supported by wooden lintels. In this Wada all the materials adopted were locally available, thus it makes more sustainable and cost effective design. Embodied energy of the building is very less due the technology and material it has adopted, which is more efficient and environmental friendly.

Fig. 10. Wooden Columns and Rafter

5 Conclusion

Vernacular architecture is not just a style, it was a way of life. Vernacular architecture not just talks about the form, shape of the buildings, it showcases the culture, social and economic life of the region. This particular study has proved that vernacular architecture is sustainable and energy efficient in nature. It shows the harmony between the built form and nature. Clever use of natural elements like wind, sun, topography etc. to deal with the issues like climatic variation, comfort, protection etc, makes vernacular building more efficient and sustainable. The vernacular house of Hubli, Wada is

found to be more sustainable and environmental friendly in nature. The design has been executed with the factors like energy efficiency, climate responsiveness, and indoor comfort through a sustainable approach. Local materials and natural resources were used very smartly and efficiently in order to achieve the comfort. Use of natural ventilation and natural lighting has made the house more energy efficient. Thermal comfort is achieved by the orientation, spatial organization, shading devices and materials used. Easy and practical solutions to the issues like privacy, security and comfort. Cost effectiveness has also achieved. Today's scenario, from region level to global level, concept of sustainability have become necessity. Instead of searching here and there for the inspiration and lessons, it is better to look back to our roots and learn. It will be more sensible and reasonable

REFERENCES

[1] Oliver Paul, 1997, Encyclopedia of Vernacular Architecture of the World, vol1 Cambridge university press, Cambridge

[2] Lawrence, R. J. (2006). Learning from the vernacular: Basic principles for sustaining human habitats. In: Asquith, L. and Vellinga, M. (ed.). Vernacular architecture in the twenty-first century. Theory, education and practice. Milton Park, Abingdon: Taylor & Francis.

[3] Dayaratne, R. (2000). Learning from tradition for an environmentally responsive architecture: A formal practice. Open House International. 25 (03), 10-15.

[4] Krishnan, A., Baker, N., Yannas, S., and Szokolay, S. V. (2001). Climate responsive architecture: A design handbook for energy efficient buildings. New Delhi:Tata McGraw-Hill

[5] Manoj kumar singh, Sadhan Mahapatra, S.K.Atreya, Bioclimatism and vernacular architecture of north-east India, Building and Environment 44 (2009) 878-888

[6] Halıcıoğlu, F.H , Analysis of vernacular architecture in terms of sustainable considerations: the case of şirince village in western turkey, Alam Cipta Vol 5 (2) December 2012

[7] Mohammadzadeh E. Akhavan farshchi M, Ford A. Vernacular architecture and energy use in buildings: A comparative study , International journal of advance in mechanical and civil engineering, ISSN: 2394-2827

[8] https://en.wikipedia.org/wiki/Hubli

International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 4 Issue 5, May 2017

ISSN: 2394-4404

Sangam City As Faith-Based Utopia

Debadutta Parida

Assistant Professor, BMS School of Architecture, Bangalore, India,
B.Arch., M.U.R.P. (Master of Urban and Rural Planning),
IIT Roorkee, A.I.I.A., A.I.T.P.

Abstract: ***The Mahakumbh Mela is a religious festival which attracts millions of people, and is the biggest gathering of human beings anywhere in the world. Every twelve years, on the flood plains where the Ganga, Yamuna and the mythical Saraswati River meet in the outskirts of Allahabad, India, a massive and functional megacity is built in a matter of weeks. This "pop-up" megacity is referred in this paper as "Sangam City". This paper attempts to observe the unfolding of the extraordinary romanticism that exists in Sangam city through the lens of "faith" and relate it with the concept of "faith-based utopianism". The data collected is through personal interviews and interactions during the Mahakumbh Mela in 2013, as well as various secondary sources on utopia and the Mela in general. The paper concludes by providing an integrated definition of faith-based utopianism and recommends changing the gaze while looking at communities around the world rather than continue with obsession with their geographic and spatial characteristics.***

Keywords: ***Mahakumbh Mela, Sangam city, faith-based utopia, settlement planning***

I. INTRODUCTION

The Sangam city is an ephemeral city born out of „instant urbanization" – a transformation in weeks from an underwater flood plain to a megacity inhabitated by millions – making it a "pop-up megacity (Mehrotra, 2013). This phenomenon of „pop-up megacity" is by virtue of two significant characteristics: „rapidity" and „scale". It is in many ways comparable the Hajj pilgrimage in Mecca (although the visitors in Mecca are roughly one tenth of the size compared to the Kumbh Mela), or the Woodstock festival in the US in 1968. It is different from planning aspects in the Olympics villages as well. Unlike the Games Village, Sangam city does not leave behind a legacy of infrastructure after the phenomenon is over. In fact, in a matter of months, there is no trace of the city whatsoever. It is this temporality and ephemeral nature of Sangam city that has caught the attention of many scholars and researchers. The fact that separates Sangam city from other megacities is its exclusivity. Various scholars have multiple views about the very basis of thought of utopianism. (Hardy, 2005) says that „Utopianism provides a radical perspective of the future, designed to show how much better it can be. What is utopia for some will be an anti-utopia for others". For some, the Mahakumbh may be a logistical nightmare (Somvanshi, 2013) and perhaps a physical dystopia due to the massive environmental effects it has. However, it can be argued that since the basic reason for existence of the Sangam city is faith itself and no other physical or social needs, the megacity is based on faith-based utopianism. Without this measure of immense faith, the Sangam city would simply not exist in the first place, and hence this study would not have any relevance at all.

This paper is an exploratory study in the context of utopian communities. It aims to gain familiarity with the phenomenon of utopian principles proposed by various scholars as well as achieve a new insight into it. Specifically, the paper examines the possibility of a theoretical base for faith-based utopian communities by drawing an analogy between Sangam city and Faith-based Utopian communities. The important research question is "Is Sangam city a faith based utopia?" The paper has been divided into three parts. The first part contains information regarding various aspects of the Mahakumbh and the formation of Sangam city. This is followed by a review of various notions of utopia, which comprises the second part of this paper. Concepts of religious utopia and social utopia have been extensively researched for

centuries by scholars. However, very few scholars have explored into the concept of faith-based utopia; hence it remains largely an unexplored topic. The third part provides a new definition of faith based utopia by the author, and the notions that objectively contribute to it. The paper loosely concludes exploring relationship between faith and physical issues due to temporality (Mehrotra, 2015), and possibilities of finding a balance from the point of view of utopian planning.

II. MATERIAL AND METHODS

The investigation is based on qualitative data collected personally by the author during his visit to Sangam city for the Mahakumbh Mela in 2013, through interviews with local people in the Mela. Apart of the visit, the study was partially carried out as an academic research work by the author since 2013, followed by in-depth study of various secondary data related to the subject. Most of the publications referred in this paper are English language publications, which makes the study slightly biased in terms of language. Also, given the growth in attention of scholars towards the Mahakumbh, similar studies may have been published since this research was undertaken.

III. SANGAM CITY

Sometime in 1895, after visiting the Mahakumbh in Sangam, Allahabad, the great writer Mark Twain said "It is wonderful, the power of faith like that, that can make multitudes upon multitudes of the old and weak and the young and the frail enter without hesitation or complaint upon such incredible journeys and endure the resultant miseries without repining. It is done in love, or it is done in fear, I do not know which it is. No matter what the impulse is, the act borne of it is beyond imagination, marvellous to our kind of people, the cold white." (Gupta, 2013). The Mahakumbh Mela is a religious festival which attracts millions of people, and is the biggest gathering of human beings anywhere in the world. Every twelve years, on the flood plains where the Ganga, Yamuna and the mythical Saraswati River meet in the outskirts of Allahabad, India, an ephemeral megacity is built in a matter of weeks. This ephemeral megacity is referred in this paper as "Sangam City".

Before getting into the discussion regarding the relevance of the existence of Kumbh as a faith-based utopia, it is necessary to understand the basic thrust of the event, which has been drawing people towards it since centuries. It is the size of the city itself. Between 2000 and 2010, the population of New Delhi increased from 15 million to 22 million, while Shanghai‟s population increased from 14 to 20 million (Khanna, 2013). If we compare that with the Sangam city near Allahabad – the first day of the Mahakumbh Mela in 2013 had a gathering of ten million people. It is estimated that by the end of five weeks, approximately 100 million people would have moved into and out of the city. It took nearly 60 years for the population of Istanbul to grow tenfold from 1 million and nearly 50 years in case of Lagos. At Sangam city, the population rose from zero to 10 million in just a week‟s time. (Khanna, 2013). There is a sharp contrast to the other cities of similar magnitude by virtue of Sangam city‟s sheer „rapidity‟ of growth and „hugeness‟ in terms of numbers. It is this mammoth people flow that has attracted many research teams of all natures and varied aspirations to the city. The scale of the Mela, along with the explosion of various senses makes people attracted towards the spectacle through sheer faith. The Mahakumbh Mela is attended by millions as a culmination of their pilgrimage which involves a single-day of ritual bathing in the Ganges. Bathing in the waters of the rivers is tradionally a sacred act, which is believed to bring about spiritual cleansing and a rebirth of sorts of the human mind. These devotees may be called as „faithful‟ for this study since they do almost all of the work in good faith even in absence of perfect order and amongst apparent chaos during the Mela.

IV. CONCEPT OF UTOPIA

The concept of utopia has been explored since a long time. The concept was introduced by Thomas More in 1516 in his book "Utopia", wherein he mentioned utopia as an original idea of a perfect society. Although he pointed at social and urban aspects of the world at that time, various scholars have explored into other aspects such as physical (Friedmann, 2000) (Fitting, 2002) (Ahmed, n.d.; Koch, 2012), political (Koch, 2012; Moraes & Fagerlande, 2009) and religious (Boyle, 2006; Friedmann, 2000). In totality, utopia was understood as a perfect social-political-legal society. Other thoughts on the subject looks upon utopia as a concept that was hopeful (Friedmann, 2000; Hardy, 2005) towards the future. In fact, (Friedmann, 2000) argues that utopia is the capacity to imagine a better future which is based on everyday experiences of the people. He further advocates a radical approach in urban planning, in which utopian thinking can be both critical as well as constructive. (Moraes & Fagerlande, 2009) further says utopian society must have a great degree of freedom of thinking without the presence of authoritarianism in any form.

A lot of scholars argue that the concept of utopia is philosophical and highly subjective (Boyle, 2006; Ganjavie, 2012; Hardy, 2005). (Hardy, 2005) says that "what is utopia for some may be an anathema for others". This idea finds further support in fields such as urban planning, wherein scholars put light on the fact that utopia is ideally a geographical concept (Fitting, 2002; Koch, 2012) and cities have their own individuality, own life and they go through a variety of emotions such as tragic, joyful, sorrowful or lively (Alston, 2012). A lot of scholars agree universally that utopia is a positive concept (Alston, 2012; Boyle, 2006; Fitting, 2002; Friedmann, 2000; Moraes & Fagerlande, 2009). However, this idea is not without its share of criticism. (Friedmann, 2000) argues that there is considerable ambiguity among urban planners about achieving utopia, and hence advocates radical approaches in planning. He further recommends focussing on the process rather than outcomes, and other important aspects such as good governance and practices of all stakeholders. (Ganjavie, 2012) further states that "there is lack of coherence" in various creative urban ideas existing currently. In the modern context, narratives of

false modernity and utopia have become a dominant way of reading (Koch, 2012). (Koch, 2012) further proposes utopia to be a subject of bordering practice, something like a boundary object for research, allowing inter and multi-disciplinary studies on the matter. In doing so, it can also be understood as a realm in between imaginary and real.

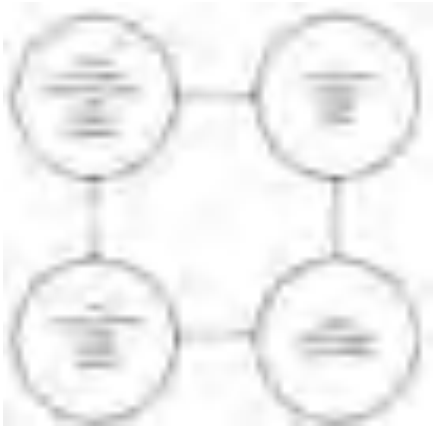
Very few scholars have mentioned faith as an important component of study in the subject of utopia, especially in physical context. Only (Boyle, 2006) and (Friedmann, 2000) agree that religious faith can provide satisfactory experiences to the society. Western notions of utopia is a result of unjust principles of nineteenth century planning (Fitting, 2002), which are usually biased towards physical and geographic aspects with few exceptions. (Boyle, 2006) argues the importance of sharing of similar beliefs and having belief in an eternal divinity, which is the base of existence of a religious society. However this view can be contested on the grounds that religious utopia refers to a kind of single mindedness which is uncharacteristic of a just society. Religious beliefs may satisfy sections of society, yet they are bound by a set of written social rules and regulations. Hence, the author proposes the concept of "faith-based utopianism" which is an integration of various concepts discussed, yet is very particular about subjectivity, focus on individual freedom rather than a collective belief, which is global but works local, where there is no room for authoritarianism, and where superstitions and alternate philosophical ideas are easily accepted and respected.

V. FAITH BASED UTOPIANISM

In order to delve further into the concept of faith based utopia, one needs to understand the basic difference between „religion" and „faith". While religion essentially deals with a collective belief where everyone exists in harmony by believing in a common path, faith is an individual"s beliefs and thus may differ from person to person. Scholars have proposed concepts of social utopia and religion based utopia in the past, but the basic crux of faith-based utopianism is that it is conceptually broader than thoughts about religious utopia since it reaches out to everyone in the society, simply because everyone may have his or her own set of beliefs, which may differ from others in the same geographical boundaries. The perception of faith-based utopia is not only geographic (Koch, 2012), but is in fact a philosophical concept in line with Thomas Moore"s utopia (1526), wherein utopia is related with a society where all systems are perfect, only adding that the viewer of the society must change his or her gaze. The author hence proposes a more adoptable and flexible explanation of faith-based utopianism which is given as follows:

"Faith based utopia refers to a philosophical, geographic and socio-political concept, highly temporal, whose existence is based on a common faith or goal (supernatural, material, legal, social etc.), wherein all responsibilities are carried out by individuals in good faith, even though other aspects such as material comfort and good governance are present adequately or not".

In the context of Sangam city, it can be strongly argued that it is the people or the „faithful" who wilfully share responsibilities out of faith, and do not interfere in each other"s individual roles before and during the existence of the ephemeral city. Each visitor to the Kumbh mela goes with a unique set of aspirations and a certain sense of hope to fulfil his soul. Faith-based utopianism is a philosophical concept where in spite of numerous physical problems and lack of basic amenities, people in the Sangam city stay in those five weeks without complains, in spite of minimal infrastructure facilities. For the "faithful", the place is a utopia (not geographically but philosophically just like (Boyle, 2006)"s concepts), while for others who would like to see it through the lens of planning or management, the city might seem to be a physical dystopia and logistical nightmare. There is a significant common sense, logical application, concentration and motivation among the people to find their way among the chaos to satisfy their souls through a dip in the holy river. Various interactions with the people on the ground in Sangam city during the Mahakumbh mela confirmed that majority of the people do not care about the chaos and unhealthy conditions in the city – but are more concerned about fulfilling their souls. Despite unhealthy conditions, extreme weather, poor food and risk of disease, devotees who attend such collective rites have higher levels of mental and physical wellbeing. An ecologist from Pakistan, Dr. Arshad Ali Beg, states that, "all humans, including people who feel a sense of calm and bliss over the polluted Ganga, are under stress, and hence look for reversal of the stress. Since they go to the yatra with firm belief, are blessed in some ways that satisfies their soul. To them the polluted water does no harm" (Beg, 2012). Since the millions of „faithful" carry out all their responsibilities during the Mela with total faith and are not bothered by the numerous social, physical, psychological challenges put forth by the city, there are aspects of faith-based utopianism in Sangam city.



Source: author

Figure 1: Conceptual framework of Faith-based utopianism

However, one must realise that physical issues in settlements is a significant consideration which cannot be undermined or overlooked while looking at the planning of faith based communities such as Sangam city. Studies by (Seth, 2013) and (Somvanshi, 2013) on the after effects of the Mela in 2013 on the environment reveal how the Mela contributes to increasing the pollution levels of Ganges. Cleaning of the Ganges is not merely an aesthetic issue, but a livelihood issue for hundreds of families depending upon it for irrigation. Add to all of this the enormous amount of waste

generated by the Mela resulting in banned practices such as manual scavenging after the Mela. It must be acknowledged that the success of the Mela depends a great degree on its temporality. If the Mela would go on for a few more months, then it would pose serious health hazards, logistical issues apart from issues of law and order. Hence the integration of temporal nature of geographical space in the proposed definition was vital.

VI. CONCLUSION

This paper primarily focussed on understanding the various aspects of utopianism both as a process and a concept. Two ideas form out of the overall narrative. Firstly, the concept of utopia is highly subjective and contested. The concept is multi-faceted (physical, social, religious, faith, political etc.). It can be also seen as a boundary object, so that multi-disciplinary opinions can be integrated easily. Secondly, Sangam city is a classic example of temporality, wherein a megacity is constructed and deconstructed within a few weeks. Almost all the planning processes, human to human interactions and human to nature interactions happen with complete faith, in spite of all the logistical and physical issues prevalent. This makes it a case of faith-based utopianism in terms of planning and existence itself. Conceptually and theoretically, the paper has proposed an integrated and flexible definition of faith based utopianism with a conceptual framework, wherein the four main parameters have been provided. It is important to acknowledge that the concept proposed is not a fixed set of parameters but set of loosely woven aspects which focuses on processes through which an ideal society can be viewed. This notion questions the very idea of utopia, which is seemingly something that does not exist or is unachievable. But perhaps, there are various conceptual formations of utopia around us for societies to unravel and see, only if we choose to change our gaze towards them, away from the geographic and material point of view that we are so obsessed with.

ACKNOWLEDGEMENTS

The author is grateful to Dr. Sandeep Agarwal, Professor & Inaugural Director, University of Alberta for going through the earlier drafts of this paper and giving his valuable suggestions on the theme. The author is thankful to Manjul Pratap Singh, K. V. Abhishek and Neelakshi Joshi (urban planners) for their kind help and coordination during visit to the Kumbh Mela in February, 2013. The usual disclaimers apply.

REFERENCES

[1] Ahmed, W. (n.d.). Neoliberal Utopia and Urban Realities in Delhi.
[2] Alston, R. (2012). Class cities : Classics, utopianism and urban planning in early twentieth-century Britain. Journal of Historical Geography, 1–10. http://doi.org/10.1016/j.jhg.2012.04.006
[3] Beg, M. A. A. (2012). Life Processes Health Disease and Aeging. Karachi: Research and Development Publications.
[4] Boyle, J. (2006). Theological Designs : Religion in Utopia, 1, 94–95.
[5] Fitting, P. (2002). Urban Planning/Utopian Dreaming: Le Corbusier"s Chandigarh today.
[6] Friedmann, J. (2000). The Good City : In Defense of Utopian Thinking *, 24(June).
[7] Ganjavie, A. (2012). Role of Utopia for Design of Future Cities : Utopia in Urban Planning Literature, 5(3), 10–19. http://doi.org/10.3968/j.sll.1923156320120503.1922
[8] Gupta, A. (2013). Unfolding faith: A journey to the Kumbh.
[9] Hardy, D. (2005). Utopian ideas and the planning of London, 20(January), 35–49.
[10] Khanna, T. (2013). Studying India"s Mahakumbh Festival. Retrieved April 28, 2013, from http://www.hbs.edu/news/Pages/item.aspx?num=90
[11] Koch, N. (2012). Urban "utopias": the Disney stigma and discourses of "false modernity," 44(page 51), 2445–2462. http://doi.org/10.1068/a44647
[12] Mehrotra, R. (2013). Kumbh Mela. Retrieved April 28, 2013, from http://www.gsd.harvard.edu/#/academic-programs/urban-planning-design/urban-design/ud-work/faculty-work/kumbh-mela.html
[13] Mehrotra, R. (2015). Kumbh Mela: Mapping the Ephemeral Megacity.
[14] Moraes, S., & Fagerlande, R. (2009). Research in progress Penedo: a Finnish utopian colony in the tropics, 24(2), 241–254. http://doi.org/10.1080/02665430902734343
[15] Seth, S. B. and B. L. (2013). Can Faith heal? Retrieved February 21, 2013, from http://www.downtoearth.org.in/content/can-faith-heal
[16] Somvanshi, A. (2013). Don"t congratulate us. Retrieved April 29, 2013, from http://www.downtoearth.org.in/content/dont-congratulate-us#slidenumber
[17] Mallet, V. (2013). Could Hindu festival "pop-up megacity" be an unorganized model for India? Retrieved April 28, 2013, from http://www.indiaafricaconnect.in/index.php?param=news/5772/panorama/115
[18] Hindu, T. (2013). Kumbh "pop-up" megacity sparks Harvard case study. Retrieved April 28, 2013, from http://www.thehindu.com/todays-paper/tp-in-school/kumbh-popup-megacity-sparks-harvard-case-study/article4327079.ece
[19] Pais, A. J. (2013). Inside the ultimate pop-up megacity. Retrieved March 11, 2013, from http://www.rediff.com/news/slide-show/slide-show-1-special-inside-the-ultimate-pop-up-mega-city/20130311.htm[2013]

Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/4594
DOI URL: http://dx.doi.org/10.21474/IJAR01/4594

RESEARCH ARTICLE

A POTENTIAL SUSTAINABLE (STONE) TOURIST DESTINATION, BANDEBAMBLI.

Ar. Nishant Nathani[1], Ar. Pragnya Prakash[2] and Ar. Mustakeem R Khan[3].
1. Asst. Prof., Architecture & Planning, Amity University Haryana, India.
2. Asst. Director, Town Planning, Karnataka.
3. Asst. Prof., Architecture & Planning, Amity University Haryana, India.

Manuscript Info

Manuscript History

Received: 24 April 2017
Final Accepted: 26 May 2017
Published: June 2017

Key words:-
Sustainable village, tourist destination, Stone construction, traditional knowledge

Abstract

Indian village are by default sustainable because of their indigenous sustainable construction techniques and uses of building material. Sustainability in Indian settlements is a phenomenon which is shaped based on the living practices rather than an induced character to the built habitat. Bandebamli is one of such village in Karnataka which stands out due to its special architectural character. This paper will talk about the sustainable material and construction technologies used in the settlement. The basic material used for construction is visually appealing rustic stones available in plenty near to the village. The building is designed according to hot dry climate, prevailing that region. Social, economic, and artistic character of the settlement is evolved with a quality character. Explicit wooden joinery details in load bearing structure and exquisite wooden carvings symbolize the social and economic classes among the society are few unique features. Due to migration of people out of settlement for economic reasons, many of these unique houses are in stage of dilapidation and require urgent attention to save the rich traditional wisdom. There is a need to develop this settlement as a sustainable tourist destination.

Introduction:-

Sustainability in Indian villages is an inbuilt indigenous phenomenon. This paper focuses on one such vernacular settlement describing the traditional approach towards sustainability. The settlement is almost 600 years old and the buildings are 250-300 years old. The settlement - "Bandebambli", etymologically defined in "Kannada Language" as Bande – Rock, Bam – back, Bli – near, the village is situated at the back of the granite rock. Enunciating sustainability through Planning and Architectural practices shaped due to socio economic and environmental practices. This paper will point out the sustainable practices used by the village, which is worth to be developed a potential sustainable tourist destination.

Location & Demography:-

The settlement is in Yadgir district, state of Karnataka in India. 38 Kilometers from the district headquarters and is connected by Other District Road (ODR) [1]. Latitude - 17° 46' 60N, Longitude - 76° 45' 0E, Altitude - 355 meters, Area: 1.8 sq. km. It has a population of 4000 as per 2001 census. Temperature in this region varies from 48 degree Celsius in summer to 13 degree Celsius in winters. The settlement lies at the bank of river Krishna and in between Krishna and Bhima rivers, the area is named as Sagara Nadu.

Corresponding Author:- Ar. Nishant Nathani.
Address:- Asst. Prof., Architecture & Planning, Amity University Haryana, India.

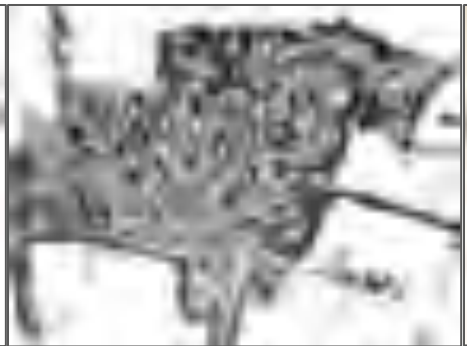




Fig 1:- Settlement Location **Fig 2:-** Plan of village **Fig 3:-** Square acting as stack effect

History - Evolution of Settlement:-
History of settlement dates back to 14th century. The revolt of Muslim officers appointed from Delhi resulted in founding of Bahamani Sultanate by Hassan Gangu, who chose Gulbarga (approx. 125 km from settlement) as his capital. The Bahmani Sultanate chose Bandebambli as a refugee camp for their soldier's family, while the soldier is serving in war or in danger [2].

The presence of river and granite rock influence the location of the settlement. River serves for agrarian purpose, a similar practice of traditional settlements around world and granite rock serving as a defense for watching area to keep vigilant to far places. The granite rock also used as building material for construction of buildings. The bold, rustic and massive elevation made out white granite resembles the concept of forts having elements such as Overhangs, Chatries, Courtyards, highly decorative entrance doors add on to the aesthetics.

Sustainable aspects of the village:-
Village Planning:-
Village planning is per the basic principle of Hot Dry Climate. Where the village is having narrow streets measuring 1.5m to 5 m wide. Low height buildings in narrower streets while building height increases with increase in street width, to shadow the streets on sunny days.

Village square:-
Village is planned in such a way that there are squares at designed among few houses. Squares of village used for stack effect to drag air: The shaded streets would lead to squares. The squares paved by stones heats up air, hot air goes up, to fill that gap the air comes from the shadowed streets. Squares are major component of the settlement fabric with multiple functions as social gatherings, agriculture produce processing with larger courtyards being used for festival gatherings and entertainment purposes.

Sustainable Construction Material:-
White granite stone is the main building material used for construction. It is sustainable because found within 50 KM radius. Quarrying process is manually done. Animal driven vehicle is used for taking material to the site instead of biofuel. Masons and artisans are locally available.

Fig 4:- Stone wall construction

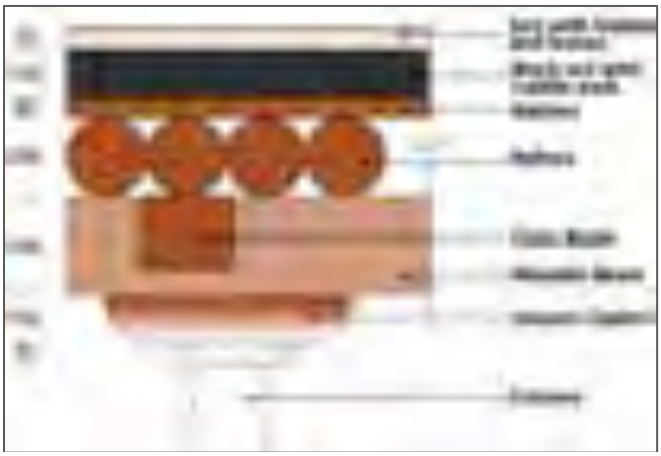


Fig 5:- Sustainable roof construction (Dimensions in MM)

Sustainable wall construction:-

The walls are made up of stone having thickness between 600-800 MM throughout the settlement irrespective of internal or external wall. Lime and clay is being used as binding mortar instead of cement Mud and lime also helps to increase heat lag, therefore reducing transmission of heat due to convection. . Section of typical stone wall has been shown in fig-4

Sustainable roof Construction:-

The roof of the buildings is sustainable and is of great significance. The roof consists of 5 layers; starting with wooden beam, second layer is rafter, third is batten, fourth is Black Soil with rubble pack and top layer is clay, leaves and straw. The thickness of the roof increased in longer term as the new layer of mud applied on the top layer before rainy season. Section of typical roof has been shown in fig-5

Fenestration:-

In the hot dry climate, it is desired that the fenestration should be minimal to avoid air change and stop sun to enter the house. Such kind of minimal fenestration is seen throughout the village. This artistic fenestration became one of the characteristic of village.

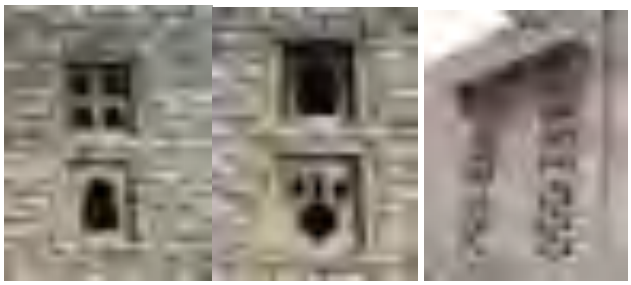


Fig 6:- Types of fenestration

Fig 7:- Split level for animal habitat

Split floor level for Animals:-

Animals are integral part of the villagers. To protect animals from the heat and sun, animals living spaces has also been designed in the house. To optimize the space utilization, animals have been placed in split floor level. In higher income group houses, cow shed was segregated from living area but in lower income group cow shed is the part of living area as shown in figure -7

Water supply techniques from well to interior:-

The caste and class system is still prevailed in the village. Because of this stigma, several unique techniques were evolved in architecture. The higher class employed workers of lower class who were not allowed inside house or certain part of house. The source of water to house is well in the backyard of the house. Workers were employed to

fetch water from well and arrangements are made in the building features with channels connecting from backyard near well to kitchen and bathroom inside house, explains in figure -8

Fig 8:- Water supply system outside to inside

Fig 9:- Underground grain storage system

Sustainable Grain Storage Technique: i) ***Under Staircase:-***
For the optimization of space utilization a staircase is being used for storage purposes. The part below steps is used to store grains. Maize is dropped from the top landing of the staircase. For daily use, a small opening is kept at the first riser from the ground level to pull out required maize. ***ii) Underground Storage*****:** Storage chambers were made underground in the courtyards or sometimes outside the house in the lane. The inner surfaces of the chambers were treated with soil, kerosene oil and cow dung and chaff. The maize was stored and the surface is made as before for regular usage, open for traffic, as shown in Fig-9

Sustainable Toilets:-
Fig-10 explains that the community toilets were present since the inception of the settlement. The toilets were raised stone slabs about 1 meter above ground and enclosed platform with slit slabs as toilet seat. The excreta slip through the slit onto the ground or pit where it is manually cleaned later or animals cleared the waste.

Fig 10:- Community toilet detail

Fig 11:- Plan & Section of steps and racks

Steps Used as Storage Racks A stone slab is fixed in wall in such a way that half of the portion towards exterior of the house is used as staircase and another half which is inside the house is used as a shelf in kitchen. These slabs are jammed at centre by stone wall as shown is fig-11.

Jharokha (Balconies) The concept of Jharokha was adopted from Rajasthan. Jharokha were projecting and were supported by cantilever stone slabs. These cantilever stone slabs were carved to resemble the “neck of the horse” and visually pleasing. Interior of the balconies was of compactly arranged stone chips and plastered from Exterior. As in figure 12

Fig 12:- Location of Jharokha (balcony) in a house

Fig 13:- Stone Chiseling Work

Stone Chiseling:-

The villagers possess technique of obtaining granite from the rock without heavy tools. The stones are removed in layers for use. Required part of the rock is identified and fire is burnt on top of it continuously for a day or two. Due to the heat, the rock becomes brittle. It is chiseled off with minimum tool and dressed (surface preparation) as per the need. Through this technique the whole settlement is built.

Conclusion:-

Bandebambli has a potential to develop as a sustainable tourist destination. As the village is practicing all indigenous the sustainable technique such as use of locally available material, construction practices, farming etc. any of the practices in the village is not polluting the environment.

References:-

1. Gazette of India – Gulbarga
2. National Association of Students of Architecture documentation, 2005- PDA college of engineering, Gulbarga, Karnataka, India.
3. Vastu Shastra Readings- Dr. A . Achiyutan
4. Dictionary of Architecture- Dr. Henry Parker
5. Indian Canvas Re- rendered – NIDC cell, NASA, 2004
6. Khan M R, Prakash P & Nathani N, Sustainable Indian Architecture, "Case Study – Bandebambli", Journal of Basic and Applied Engineering Research, 2015, volume -2, issue – 8, http://www.krishisanskriti.org/ijbad1.php?Id=225

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

Evaluation the Effect of Projection on Wind Pressure Low High Rise Buildings

Prof. S K Gupta [1], Ar. Nishant Nathani[2]

Dean and Director, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India[1]

Asst. Professor, Amity School of Architecture & Planning, Amity University Haryana, Manesar, Gurgaon, India[2]

ABSTRACT: This paper describes the effect of external projections of the building on wind pressure distribution towards the windward wall of the buildings. It is noted that horizontal projection located above in stagnation zone produces insignificant change in the wind pressure at points underneath the projection and reduces the pressure at the wall surface above the projection. Contrary to this, horizontal projection below the stagnation point enhances the pressure at points above the projection and course reduction in pressure at location below the projection. A vertical projection provides right at the edge of the wall enhances wind pressure at points close to the wall end, but a projection located slightly away from the wall edges causes reduction in wind pressure at points between the projection and the edge of the wall.

KEYWORDS: Buildings, Wind pressure, Projections, and overhang in buildings

I. INTRODUCTION

The bulk of the data on wind pressure distribution on buildings available in literature is the yield of large number of wind tunnel studies on wind pressure measurements on isolated models with smooth surfaces. However, buildings have rarely smooth wall surface and provision of some sort of protrusion there from is quite common. It is, therefore, pertinent to know whether the wind pressures determined on models with smooth wall surface are truly representative of those acting on prototype buildings adorned with external projections. An exploratory type of study on the effect of millions on the wind pressure distribution on a two-dimensional building model (H>>W) exposed to uniform flow conditions was carried out by Leutheusser in 1970. The results indicate that for the wind blowing normal to the front face, the suction on side walls increase for closely spaced ribs, while for the widely spaced ribs, the suction on side walls remains almost unaffected. On the other hand, the pressure coefficient on windward wall for widely spaces ribs increases and becomes heavily negative at the corner while pressure on the front wall with closely/spaced ribs is not so much affected by these ribs.

In 1970, Roshko conducted studied concerning the effect of surface roughness modelled by mullion like grooves on wind pressure action on A circular and prismatic cylinders an aeronautical wind tunnel. It was reported that in the presence of mullions, the pressure distribution on sharp edged objects also depends on the Reynolds number. In 1971 Standen et al., using flat plate boundary layer theory, deducted that the scale of mullions should be the 4/5 power of the overall geometric scale of the model. For example, for a geometric scale of 1:400 the mullion scale should be 1:120.

In 1974 Newberry and Eaton reported that provision of several balconies on a result in the creation of a series of pockets of pressure across the windward wall. Because of this, pressure coefficient values should be slightly enhanced for wall adorned with balconies.

Based on the results of full scale as well as wind tunnel tests, Templin and Cermak in 1976 reported that the primary regions affected by the presence of mullions were the sides of the building on which the main flow reattached after separating from the upwind corner. The effect of mullions was mainly to reduce the magnitude of mean and root mean square pressure. Only slight suction increases occurred in the separated regions of the flow, between the first and second mullions on the side wall.

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

In 1977, Arens studies the effect of wind on energy consumption in buildings and presented a schematic diagram of pressure distribution on the face of a high-rise apartment block with balconies. It is demonstrated that the positive and negative local pressures at the top and bottom of the balcony space exceeded the total pressure which can cause substantial air leakage through the joints of doors and windows.

In 1988, Stathopoulos conducted studies on the effect of uniform roughness and of balconies on wind pressure distribution on walls of an enclosure for different directions of incident wind. It was found that the uniform roughness reduces Cpmean and Cp minimum buy a small amount except for the edge region of the windward wall, which experience higher suction for greater roughness. Presence of balconies on windward wall reduced the positive pressure near the top of the wall, while balconies on side walls produce a reduction in the suction. The + ve and - ve pressures are further reduced due to provision of walls on the balconies. However, variation in the width of the balconies from 2 to 4 meters does not alter the pressure distribution. It is also reported that for low buildings, the appurtenances did not show any pronounced effect on wind pressure on walls except at the edge area for 90° azimuth where some high suctions were observed. In 1990 Stathopoulos reported a study concerning effect of mullions or vertical ribs of different kinds on the local wind pressures on building cladding. It is stated that mullions induce adverse wind effects at wall edges. For tall buildings, mullions induce significant suction increases for wind incident at 105°. Different geometries of mullions in the corner area do not release these high suctions on the wall edges, unless a mullion is attached at the edge as an extension to the wall. For low buildings with mullions, significant suction increase has also been registered for the critical wind direction (105°).

It is noted that prior to the investigations carried out by Stathopoulos, most of the available studies related to the effect of external projections on wind pressure distribution on buildings were of an exploratory type and were not carried out in three-dimensional boundary layer flow which is a well-established prerequisite for achieving reliable results through model tests in wind tunnels. Hence for the basic understanding of the effect of horizontal and vertical projections on characteristics of wind flow around buildings provided with projections model studies were carried out in a boundary layer wind tunnel. Findings of these studies and general characteristics of wind flow patterns derived there from have been presented in this paper

II. DETAILS OF EXPERIMENTAL SETUP

The studies were carried out on a 14x12x10 cm high model in an opencircuit boundary layer wind tunnel having 2.4x1.8 meter high test section.The wind speed profile and variation of turbulence intensity in the free airstream at the location of test model in the wind tunnel. Wind pressures were measured at nine points on one of the longer walls of the model. The positions of these points figure1 were chosen so as to cover central and corner locations at various heights above the ground level. Pressure holes each about 4 mm in diameter were drilled at each ofthese points and 25 mm long pieces of stainless steel tube with 3 mminternal diameter were fixed therein. One of the end of each of these tubes was flush with the outer surface of the model while other ends were connected to a pressure measuring system consisting of a scanning box,a digital micro manometer, a personal computer and its peripherals.During the course of observations, the model having smooth surfaces wasmounted on the test table of the wind tunnel in a way such that its long side fitted with the pressures measuring tubes was oriented perpendicular to the incident wind stream in the tunnel. Then by giving appropriatecommand, mean pressures were determined at all the nine points. Similarmeasurements were also taken after mounting a 10 mm wide and 2 mmthick **perspex** strip on the entire width of the windward wall of the modelabove and below the observation points at the three levels above theground. Subsequently, pressure measurements were also taken aftermounting the perspex strip over the entire wall height on the two sides of the vertical rows of the observation points. Wind pressure measured at all the nine points were expressed in dimensionless form as follow:

$$Cp = \frac{P-Ps}{0.5\,\rho\,V^2}$$

Where

Cp	=	Pressure coefficient
P	=	Measured surface pressure on the model
Ps	=	Free stream static pressure
V	=	Free mean wind speed at roof level height of the model

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

ρ = Density of air

The provision of a horizontal projection under the observation points enhances wind pressure on the wall at points 4,5,6 and also at points 7,8,9 but reduces the pressure at the points marked as 1,2,3. On the other hand a horizontal projection mounted above the observation points causes reduction in wind pressure on the wall at points 4,5,6 and 7,8,9. However, wind pressure at points 1,2,3 is not affected much due to the provision of a horizontal projection over these points. It is also observed that a vertical projection provided in the vicinity of points 2,5,8 does not produce any significant change in the wind pressure distribution on the wall, but the wind pressure at the points 1,4,7 gets enhanced when a projection is located in their vicinity towards the end of the wall. In the latter case, shifting of the vertical projection on the other side of the points 1,4,7 causes significant reduction in wind pressure at the points 1 and 4 and creates suction at the point 7.

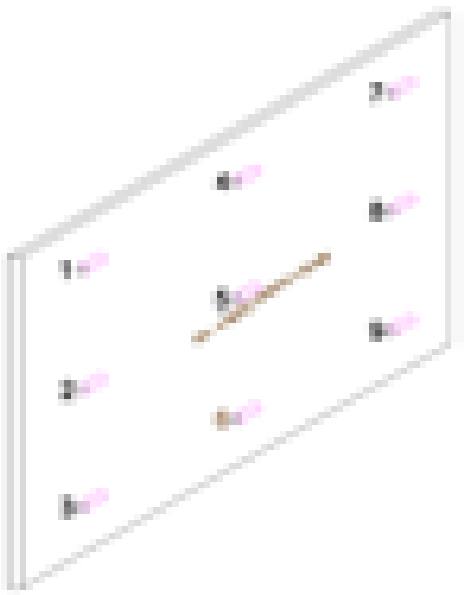


Fig.1. Nine points on longer point

III. RECOMMENDATION

Your Conference Paper must follow these overall formatting specifications: A critical examination of the results of these studies reveals that external projections do affect the distribution of wind pressure on building surfaces. The extent of variation in magnitude of pressures coefficients on different walls depends, inter alia, on the type, size, location and number of projections, and on the direction and velocity gradient of the incident wind. Theoretical prediction of the quantitative influence of these parameters is difficult and experimental techniques have to be adopted for such predictions. However, based on the existing knowledge of wind flow around buildings and flat plate boundary layer theory, the influence of external projections can be predicted qualitatively as described below; A projection on a wall influences the flow of wind around the building in two ways; (1) it interrupts the free flow of incident wind before its impingement on the wall and (2) it also disturbs the flow of wind over the wall surface. These two events joints contribute to the changes that are produced in wind flow patterns around buildings due to the projections on walls.

Wind Flow around a Projection: The most prevalent projections on buildings are made up of thin reinforced concrete slabs with thickness and width (dimension perpendicular to the wall) varying from 5 to 7.5 cm and 30 to 90

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

cm respectively. Projections may cover the full or part of the wall height, or wall width, while mounted vertically or horizontally. For normal incidence of the wind, the projection surface facing the wind has one of its dimension several times greater than the other dimension. Hence a major part of the incident wind, after deflection at the wind facing edges of the projection, flow around its longer sides. In this process, the flow separates at the leading edges and subsequently gets reattached at the surface of the projection. Because of the surface friction, the wind flows the vicinity of the projection slows down, and a boundary layer is developed on the projection surface. As a result of this, the speed of wind striking on an otherwise unadorned wall gets diminished near the projection on the wall and remains almost unchanged at points away from the projection,

Wind Flow Patterns around Buildings with Smooth Wall Surfaces: Information on the basic characteristics of wind flow patterns around buildings is already available in the literature. The flow patterns are governed by the ratio of height to width of the frontal projection, and the absolute height of the building is immaterial relative to this ratio. In the case of low buildings (L»H), flow around the sides is negligible compared to that over the top. A return flow is also set up along the floor because of the adverse pressure gradient created ahead of the wall due to the stagnation on the wall. Thus, a stable eddy with a horizontal axis is formed along the front of the wall at the base. The variation in pressure on the front wall is also small.

In the case of tall buildings (L<<H), the air layer close to the surface is subjected to strong vertical pressure gradient, and a strong flow down the wall results. Near the top of the building the downward flow is superimposed on the natural upward flow caused by the wind deflection at the end. This cause considerable reduction in the quantity of air flowing atop the wall.

Effect of Horizontal Projection: The fore-going description of wind flow over the smooth surface of a windward wall demonstrates that the flow is bound to be subjected to modifications when protrusions are provided on the wall. A projection provided in a horizontal plane will not interrupt the wind flow in the lateral direction, but will have an important bearing on the flow in the vertical direction. Since wind flow over the major part of the windward wall of a low-rise building takes place in upward direction above the stagnation point and downwards below the stagnant point, the influence of a horizontal projection on the wind flow pattern will depend upon the distance and location of the projection with respect to the stagnation wall end. This implies that provision of a vertical projection should not alter the pressure distribution at higher levels on the front wall of a high-rise building but a change in pressure distribution at points below the stagnation zone is inevitable.

IV. CONCLUSIONS AND SUGGESTIONS

A brief review covering salient features of the findings of earlier studies on the effect of external projections on wind pressure distribution on structures has been presented. The available information in conjunction with the flat plate boundary layer theory and some experimental studies on wind pressure measurements on building models fitted with external projections have been used to describe the probable wind flow patterns around the wind facing wall of buildings provided with horizontal and vertical projections. The important conclusions and suggestion of the study are given as below;

1. The influence of a projection on the free wind stream is less pronounced as compared to that on the flow of wind over the wall surface.
2. The effect of a vertical projection depends upon its distance from the wall edge, whereas location, whether above or below the stagnation zone, is the parameter that governs the influence of horizontal projection.
3. A horizontal projection located above the stagnation zone produces insignificant change in wind pressure at points underneath the projection, but causes reduction in the pressure at the wall surface above the projection. Contrary to this, a horizontal projection below the stagnation zone enhances the pressure at points above the projection, and causes the reduction in pressure at locations below the projection.
4. Vertical projections provided right the wall edge result in enhancement of wind pressure near the wall corner, but projections located slightly away from the wall produce a reduction in wind pressure at points between the projection and the edge of the wall.

ISSN(Online): 2319-8753
ISSN (Print): 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

REFERENCES

[1] Leutheusser, H.J., Influence of architectural features on the static wind loading of buildings, Building Science Series 30, proceedings of Technical Meeting Concerning Wind Loads on Buildings and Structures, National Bureau of Standards, Washington DC, 1970, pp.73-86.
[2] Roshko, A. On the aerodynamic drag of cylinders at high Reynolds numbers, Proceedings of Seminar on Wind Load on Structures, University of Hawaii, Honolulu, 1970, pp.87-96.
[3] Standen, N.M., et al. A wind tunnel and full-scale study of turbulent wind pressures on a tall building, Proceedings Third International Conference on Wind Effects on Buildings and Structures, Tokyo, 1971, pp. 199-209.
[4] Newberry, C.W. et al. Wind Loading Handbook, Building Research Establishment Report, Garston (U.K.) 1974, pp. 58-60.
[5] Templin, J.T. et al. Wind pressures on buildings: effect of mullions, Technical Report CER 7677JTTJEC24, Fluid Dynamics and Diffusion Laboratory, Colorado State University, Fort Collins, Colo, 1976
[6] Arens, E.A. et al. The effect of wind on energy consumption in buildings, Energy and Buildings, Vol. 1(1977), pp. 77-84.
[7] Stathopoulos, T. at el., Wind pressure on buildings with appurtenances, Journal of Wind Engineering and Industrial Aerodynamics, Vol.31 (1988), pp.265-281.
[8] Stathopoulos, T. at el., Wind pressure on buildings with mullions, Journal of Structural Engineering, ASCE, Vol.116 No.8(1990), pp.2272-2291.
[9] Ishwar Chand et al., Studies on the effect of mean wind speed profile on rate of air flow through cross ventilated enclosures, Architectural Science Review, Vol. 35, No.3 (1992), pp. 83-88.
[10] Ishwar Chand, A low speed wind tunnel for studying the problems on natural ventilation in buildings, Indian Journal of Technology, Vol.ll (1973), pp.267-271
[11] Gupta, S. K., Nathani, N. (2016). Thermal Performance of Wall & Roof – Efficiency of Building Materials. International Journal of Science and Research (IJSR), 1354-1357. https://www.ijsr.net/archive/v5i5/NOV163707.pdf
[12] Gupta, S. K., Nathani, N. (2016). Climatic Elements & Their Impact on Building Design. International Journal of Science and Research (IJSR), 2378-2383. https://www.ijsr.net/archive/v5i5/28051601.pdf

Mobility for the elderly: A Qualitative assessment of a commercial precinct in Bangalore

Authors: Debadutta Parida[1] & Renjin Cherian[2]

Abstract

One of the greatest assets of a city is its public spaces being inclusive and accessible for all. While various agencies in the western countries have begun to address the issue of exclusion of elderly in public spaces, their Indian counterparts have serious ground to cover in achieving age-friendly public spaces. This study aims to explore mobility issues of elderly in a busy commercial precinct in Bangalore. The main objectives of the study are to identify the most relevant parameters pertaining to mobility for elderly in streets in Bangalore, and measure and analyse risk perception among the elderly with respect to the same. The study area comprises of five landmark streets viz. MG Road, Brigade Road, Church Street, St. Mark's Road and Commercial Street. Based on the major determinants which influence mobility (cognitive, physical, socio-cultural, environmental, financial etc.), eight parameters were identified. Questionnaire based survey was conducted altogether on a sample of 75 persons (mean age 66 years, without physical disabilities) through random sampling. The respondents were asked to state weightage as well as degree of influence of each parameter on their experience and risk perception associated with a street. Rating scales were used to evolve scores at various times of the day for all the streets which were later analysed graphically. In addition, semi-structured interviews with 15 elderly people were conducted and data was analysed through method of Content Analysis. The results indicated relationship between risk perception with street ambience, overcrowding and accessible design features (ramps, railings etc.). The study concludes by suggesting the importance of mobility management program for elderly as a significant step towards achieving age-friendly spaces in Bangalore.

Keywords: Age-friendly spaces, mobility, elderly, qualitative assessment

1. Introduction

1.1. Overview

One of the greatest assets of a city is its public spaces being inclusive and accessible for all. While various agencies in the western countries have begun to address the issue of exclusion of elderly in public spaces, their Indian counterparts

[1] Assistant Professor, BMS School of Architecture, Bangalore, Contact : +917760 912103
[2] Assistant Professor, BMS School of Architecture, Bangalore, Contact: +91 8130 166653

have serious ground to cover in achieving age-friendly public spaces. The World Health Organization classifies old age in two different categories based on their age, 60-74 years as 'elderly' and those older as 'aged'(Goel & Gupta 2008 as cited by (Eighty, Siu, Yeh, Cheng, & Centre 2013)). In India, "Senior citizens" as defined by the Ministry of Health & Family Welfare, Government of India, is a person who is of the age of 60 years or more. The United Nations also consider persons of age 60 years or more as senior citizens (Mishra & Patel 2013). In this paper, the term 'elderly' refers to all people of age above 60 years.

The pace of population ageing is faster in developing than in developed countries. Currently, nearly 64% of elderly are in developing countries(UNDESA Report 2009 as cited by (Frye 2013)). India is witnessing a demographic revolution, leading to a considerable increase in the number and proportion of elderly(Prakash 2008)(Lakshmi Priya G 2008). Currently, 5% of the elderly population have problems with physical mobility in India(Lakshmi Priya G 2008). In spite of the demographic dividend expected in the next few decades, the process of ageing has begun in India and will have an impact on the economy and therefore on fiscal policies(Singh 2013). By the year 2020, it is estimated that nearly 16% of the world's elderly population will be in India. Also, 40-50% of elderly require psychiatric or psychological intervention at some point in their twilight years(Helpage India n.d.). Old age often brings along with it problems of deteriorated health conditions, loss of economic and physical dependence, social isolation, social abuse, loneliness, boredom and loss of self-esteem, lack of confidence and humiliation(Helpage India 2011). The elderly lack the necessary social security needed in old age(Singh 2013). From the planning perspective, it is essential to adopt a community based inclusive development to empower people of all ages. Currently, most of the policies are fiscal in nature, overly focussed on fiscal policies such as pension schemes, healthcare benefits etc., while overlooking basic infrastructure needs through age-friendly community spaces which can impact their mental state positively. It is necessary to promote age-friendly spaces which invite more inclusion and participation of people of all ages in the development and decision-making process(MobilityIndia 2012).

There is very limited understanding and recognition of the importance of mobility for the elderly(Whelan 2006), their mobility needs, transportation needs, impact of reduced mobility on their quality of life, as well as their increasing contributions to the economy due to their increasing population. From the standpoint of the elderly, mobility is one of the key deciding factors for them in their experience of a public space. At a larger scale, mobility is extremely essential for overall economic and social development in both urban and rural areas(WBCSD 2009). Mobility cannot be understood merely as an access to unhindered access (WBCSD 2009). It is linked with a larger array of spaces designed for varied usage. An old man's right to cross the street is just as valid as a young company executive who wishes to drive to work. However, development of mobility in today's condition in India has come at the cost of heavy congestion, air and noise pollution due to increased traffic, accidents and negative impact on environmental and ecological factors, especially in urban areas. These facts are nowhere more acutely witnessed than large cities especially in Indian context, wherein the existing infrastructure does not cater to people of all age groups, leaving certain categories of persons highly vulnerable

in the urban transport system(UN Habitat 2013). Safety of older communities is an issue of growing concern on Indian roads(Frye 2013). The planning projections are usually based on inadequate datasets and weak assumptions, leading to unrealistic plans that are difficult to achieve(WBCSD 2009).

1.2. Background

Bangalore city has grown from a university town, known for its greenery into an administrative, high-tech industrial and a cultural capital of the Indian state of Karnataka. As a result, the city has expanded rapidly, resulting in enormous pressure on the existing transport infrastructure. This sprawl has created a larger demand for mobility within the city, and has made life inherently difficult for the elderly to commute such larger distances(Rosenbloom & Ståhl 2003). There is a great degree of quantitative and qualitative deficiency in age-friendly infrastructure and subsequent bottlenecks which affect the mobility of various groups negatively(Hayashi 2008). Mobility in Bangalore is divided by class and location of the individuals. Residents in Bangalore spend nearly 15% to 25% of their household income on travel in Bangalore city(WBCSD 2009). This has a conflicting effect on spending on other necessities such as health, shelter and food. In Bangalore, three pedestrians are killed on roads every two days and more than 10,000 are hospitalized annually. Elderly people and school children carry a large share of 23 % of the fatalities and 25% of the injuries(IIHS 2015)(UN Habitat 2013), which shows how vulnerable they are in the streets. In terms of guidelines and policies pertaining to mobility, no specific guidelines pertaining to the elderly is seen in the CPWD Guidelines and Space Standards for Barrier free Build Environment for Disabled and elderly persons(CPWD 1998). The guidelines only focus on various physical disabilities of elderly; however the issue of their mental health and risk perception is not taken into consideration. Even local guidelines concede that "the attempts to improve mobility appear to be negligent of pedestrians, non-motorised and local area travel"(DULT 2011). The improvements are obsessed with large scale investments such as widening of roads and building elevated corridors, while ignoring the importance of street-based transport solutions, especially for the vulnerable groups like elderly and small children. Most of the streets in the country are not designed with the intention of accommodating all the functions of the streets, with only 30% streets having pedestrian facilities(IIHS 2015).

1.3. Aim and objectives

The present study focuses on understanding how elderly people perceive risk while experiencing and negotiating public spaces in Indian context. The paper aims to explore mobility issues of elderly in a busy commercial precinct in Bangalore city in India. The study area comprises of five landmark streets viz. MG Road, Brigade Road, Church Street, St. Marks Road and Commercial Street. The investigation was governed by two main objectives viz.

1. To identify various parameters (based on literature review) that influence risk perception of elderly.
2. To measure and analyse risk perception among elderly in their experience of commercial streets in Bangalore.

All the streets mentioned above are in central Bangalore and are historical in nature. Since independence, these streets have attracted people of all ages due to their bustling cafes, bookstores, theatres as well as commercial shops and offices. These streets were shortlisted from an extensive list of streets in Bangalore since the elderly still visit frequently and associate them with the charm and essence of the Bangalore of 1970's and 1980s.

The paper has three main parts. The first part focuses on various materials and methods employed in carrying out the research. The second part is a broad summary of various literature sources pertaining to the study area, and the third part discusses the results and analysis of the data collected through survey and semi-structured interviews. The paper concludes by emphasizing the significance of city wide mobility management through plausible planning strategies to promote age-friendly public spaces in Bangalore. These findings have potential implications for urban planners and designers to evolve methods and strategies to make all public spaces in Bangalore city more age-friendly.

2. Mobility for Elderly

It is an established fact that people change mentally and physically when ageing(Svensk et al. n.d.). Sometimes, these changes have a serious impact on their independence, especially due to the avoidable mismatch between the designs that surround them and their altered capabilities(Jonsson 2003 as cited by (Svensk et al. n.d.). (Patil et al. 2015) further states that "result of ageing is a progressive, generalized impairment of functions resulting in loss of adaptive response to stress and increasing risk of age related diseases and disabilities". Elderly encounter a lot of falls mostly due to unsuitable design of their immediate environment, both indoors and outdoors(Rosenkvist 2009). Decreased mobility as a result of ageing has been linked positively to increased risk of falls(Roberts et al. 2009). All these factors mentioned above can lead to decreased confidence and isolation, which may in turn discourage participation and motivation towards any physical activity. Mobility is hence considered as a prerequisite requirement for elderly people to handle their day-to-day activities and to maintain social contact(Wennberg H. 2009). Also, habits and experiences earlier in their life influences various choices and strategies of the elderly during the latter part of their life(Levin 2011).
Losing the ability to drive can affect most elderly very badly, since they have to negotiate the poorly designed sidewalks, which are the most important space for them to interact – a connector to public spaces(DULT 2014). For an inclusive approach towards age-friendly spaces, it is extremely essential to understand the needs and wishes of all the people who are directly or indirectly affected by the decisions made and designs executed. Some important factors for creating age-friendly spaces are:

1 Accessibility and availability of public transport
2 Safety and security of vulnerable communities, especially the elderly and children
3 Ambience and character of the street environment

4 Accessibility and maintenance of infrastructure

In the context of Bangalore, much of the street infrastructure is unsuitable for the elderly. Despite a large revenue generated on a daily buses from commuters and advertisement license of 915 bus-stops, there is not a single stop designed for the elderly(CISTUP Report 2012). (DULT 2011) report on Mobility Indicators concedes that "attempts to improve mobility appear to be negligent of pedestrians, NMT and local area travel". Despite recent attempts in the city such as Tender SURE proposals for many roads, majority of the streets in the town are still below the desired standards.

3. Material and method

3.1. Survey Design

The investigation employed a qualitative approach in terms of collection of data and analysis. The survey design is based on psychological measurement. It has been established that perceived risk, even though highly subjective in nature, is quantifiable and predictable through Psychometric techniques(Paul Slovic, Baruch Fischhoff n.d.). Based on the major determinants which influence mobility (cognitive, physical, socio-cultural, environmental, financial etc.) as well as multiple literature sources of similar nature, eight parameters were identified viz. Kerb height, Footpath width, Lighting level, Street furniture, Street ambience, Encroachments, Overcrowding and Accessible features(railings, ramps, texture of pavement etc.). Questionnaire based survey was conducted altogether on a sample of 75 elderly persons (mean age 66 years, without any major physical disabilities) through random sampling. The respondents were asked to state weightage as well as degree of influence (high or low) of each parameter on a scale of 1 to 5 on their experience and risk perception associated with a street. Rating scales were used to evolve Z-scores of all parameters for all the streets which were later analysed graphically. The Z-score for each street was evolved using the following formula:

$$\text{Z Score} = \frac{\sum W \times S}{\sum W}$$

, where W is the sum of the weightage provided by the respondent against each parameter and S is the Perception score (high or low) given by the respondents with respect to each parameter for a particular street.

3.2. Rating Scale

The Rating Scale is an effective method to conduct risk perception based survey. The rater is given a set of ordered categories, each associated with a numerical rating, and asked to judge the asked question in one of those categories(M Parida Purnima Parida, Najamuddin 2007; Parida & Devadas 2014). The implicit assumption is made that the rater can translate his perception to the number provided(M. Parida Purnima Parida, Najamuddin 2007). Further, it is assumed that the data points have equal intervals i.e. a parameter rated 1 is exactly as different from a rating of 2. If any variability occurs among the ratings of a given object across a group of judges, this variability reflects disagreements about the status

of object but does not reflect any disagreement about the boundaries of intervals into which objects may fall.(M Parida Purnima Parida, Najamuddin 2007).

3.3 Semi-Structured Interviews

In light of the above, it has to be accepted that studies of risk perceptions need to be further refined, both methodologically and theoretically(Boholm 1998). Respondents sometimes may have difficulty in understanding the questionnaires, which may affect the desired accuracy of results based on the rating scale method. This is particularly applicable to the elderly, since they are slow to react(DULT 2014) and may sometimes give ambiguous answers to rating based questions. Hence for this study, a mixed method approach was adopted, wherein fifteen semi-structured interviews were additionally arranged amongst the shortlisted respondents from the questionnaire survey. Spontaneous discourse helped to understand some direct personal experiences of the elderly people. The data collected involved their age, purpose of visit to the streets, description about their experience of the streets in the current scenario and comparison with the experience a few decades ago, their insecurity in crossing streets and general safety, opinion about the authorities' efforts towards upgrading the pedestrian infrastructure and finally suggestions to improve the same. All the interviews were conducted using direct interview method, and the responses were either recorded or noted with due consent from the interviewees.

For analysis of interviews, Thematic Content Analysis was used(as described by Bardin 2011, cited by (Evangelista et al. 2014). There are three major steps in Content Analysis, which are described as follows:

1. Pre-Analysis – It is the organizational phase which is intuitional, but it aims to operationalize and systematize the initial ideas, so as to lead to a precise scheme of development of successive operations, in an analysis plan(Evangelista et al. 2014)
2. Material Exploration – It is the analysis of the data collected, through categorizing, aggregating and encoding the data.
3. Interpretation of Results – Raw results are treated as meaningful and valid(as described by Bardin 2011, cited by(Evangelista et al. 2014). It is summarizing of data coupled with raw quotes of the interviewees.

4. Results and Discussion

4.1. Summary of Responses from Interviews

In total, fifteen semi-structured interviews were conducted, wherein the questions were aimed at understanding the general feeling, perception and desire of the elderly with respect to the age-friendly spaces. Most of the interviewees have been visiting the streets from their childhood and have observed the various changes in the streets in the last few decades very closely. The responses can be categorized into two broad categories, what the elderly perceive, and what they desire for the future. They are described below:

Perception among elderly

A lot of elderly are unhappy with the major changes in the streets, particularly MG Road. They feel that the streets have lost their character. They are also concerned by the character of the traffic in the present day. These facts are evident from responses such as:

"People are careless in the street"
"Youngsters are ruthless, traffic has increased so much"
The essence of Bangalore has gone. There is overpopulation, traffic and complete lack of safety. The streets are bad now."
The crowd has changed"
Previously, there were fewer buildings. Only residential houses used to be there, hence less people on the roads. That was much better.

A lot of elderly said that the streets are quite safe to visit even after late evening time; however their biggest fear was from speeding vehicles and rash driving by the younger generation. This is seen in the following opinions:
"The teenagers seem ruthless and unfriendly. The streets are now mostly for the youngsters more than the old ones"
The main roads are quite safe, but the inner roads are not that safe."
"Yes, I find it difficult to cross the streets. Young drivers cannot be trusted since they are driving carelessly these days."

There is however hope and positivity among the elderly towards the new development happening in terms of street infrastructure. This is seen in the following:

"Yes, now the experience is better. Earlier it was difficult to travel to work. Now it is much easier to travel because of the Metro."
"Present day traffic is horrible. But the footpath and road designs are better now, although poorly maintained."
"The authorities have good intentions, but poor execution."
"I am happy with the government's recent attempts"
"The road widening is a good attempt. Now roads only have to be maintained.

Desire for future

A lot of elderly people desire less traffic in the streets for a livelier, enriching experience that they were used to a few decades ago. They also feel that more street furniture needs to be added to the streets. Since many elderly persons felt that rash driving by youngsters was a problem, they suggested that mechanisms must be enforced to make young people follow traffic rules diligently. A few other elderly who visit the streets (especially MG Road and Brigade Road) for morning walks, felt that footpath in both the sides of the roads needs to be developed. Some of the desires of the elderly were:

"There must be a restriction of vehicles to this road (Church Street)"
"Better lighting and more trees are required."
People must be made to follow traffic rules; more traffic policemen are required."

"Not many benches are there in this street (Brigade Road), MG Road is the only road where there is seating."
"There is no need for benches as it becomes a gathering place and adds to disturbance."
"Advertisement hoardings in the street must be banned. It affects the whole experience".

4.2. Responses from Questionnaire Survey

Of the sample size of 75 people, 20 people each have been interviewed from Brigade Road and MG Road. , 12 each from Church Street and St. Mark's Road. 11 people from Commercial Street. Since the mentioned streets are commercial in nature, as anticipated 43% came for leisure, 39% for work related and 12% exclusively for shopping. Only 23% of the respondents said that they wouldn't prefer to visit the street alone, which suggests that majority of them feel safe in these streets. However, only 45% of the elderly prefer to walk on these roads and only 36% use their personal vehicles. This is again an indicator that these streets need to be accessible from public transport and compatible for the elderly. Only 11% use public transport to access these places. Street furniture was a very important parameter for this study. About 45% of the people responded that they are very necessary. Of all the eight parameters, textures/ railings etc. were moderately important for the elderly. Street ambience, overcrowding and encroachment were matters of concern for many, as it blocks the continuous flow of pedestrians. Many desired the footpaths to be wider. Surprisingly, lighting wasn't a major concern which may be due to the ambient lighting from the shops lit up the streets in evening.

The result of Z-Score analysis of the consolidated data from 75 responses to the questionnaire is shown in Table 1 below. MG Road and St. Mark's Road have shown a higher Z-Score, which suggests that these streets have better performance with respect to all the eight parameters for the study from the perspective of the elderly.

Street	Z – Score(out of 5)
Church Street	3.22
St. Mark's Road	3.83
MG Road	3.75
Brigade Road	3.35
Commercial Street	3.23

Table 1: Z-Score evolved from questionnaire survey for all streets against all eight parameters

The graphs alongside (Fig. 1) show the performance of each street with respect to all parameter and vice versa, which are described in detail as follows:

1) **Church Street**

Church Street is one of busiest streets in the study area. It is a mixed-use street housing many restaurants, offices and residences. At the time of survey, construction work was going on for the sidewalks as part of the TenderSURE development of the sidewalks. This may have had an impact on the low score responses of the elderly. Lack of street furniture and improper street ambience is a matter of concern for the elderly.

2) **St. Mark's Road**

The TenderSURE road sections have been incorporated in this street, due to which there is adequate scope for pedestrians of all ages. Lack of street furniture is the only problem associated with this street.

3) **MG Road**

MG Road is one of the major roads in Bangalore, having historical and commercial value. The addition of the Metro line has evoked mixed feelings amongst the elderly. However, in general the street is age-friendly in terms of lighting and ambience. The new sidewalks developed could still incorporate more accessible features such as ramps, tactile flooring etc.

4) **Brigade Road**

Brigade Road is considered one of the major commercial nodes along with MG Road and Commercial Street in Bangalore. It scores very low in terms of kerb height, footpath (part of the stretch of the road has

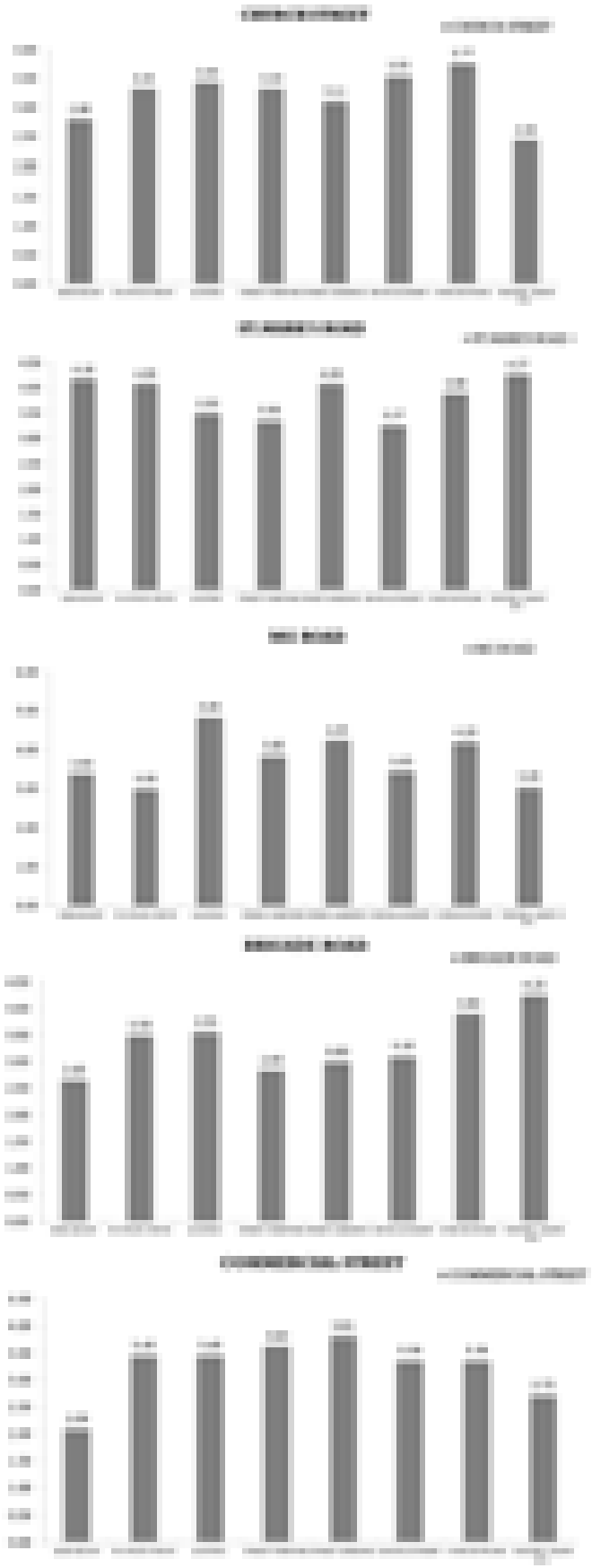


Figure 1 Charts showing scores as per ranking method for all streets surveyed (Parameters in the graphs in order: Kerb height, Footpath width, Lighting, St. Furniture, St. Ambience, Encroachments, Overcrowding and Texture, ramps etc.)

footpath only on one side), lack of street furniture and overcrowding.

5) **Commercial Street**
Commercial Street is one of the most vibrant streets in Bangalore with a rich history. It scores quite high on a lot of parameters, except kerb height, texture and ramps as well as encroachment and overcrowding.

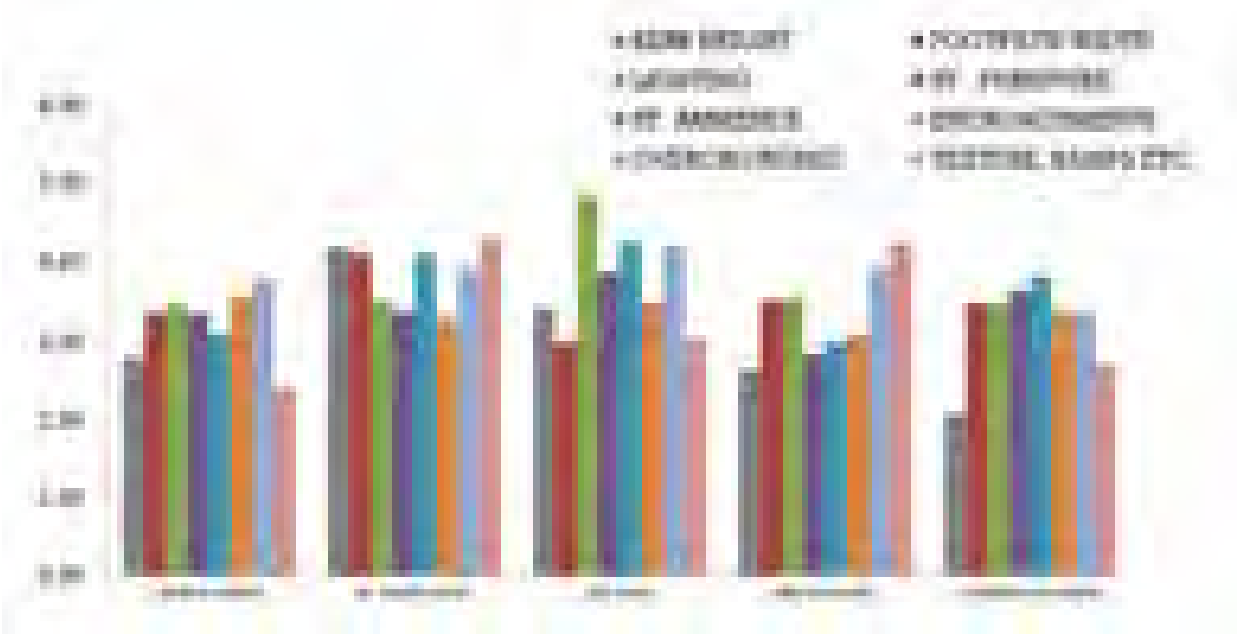


Figure 2 Graph showing consolidated scores of all streets for all parameters studied

5. Conclusion

The study aimed at identification of various relevant parameters to study risk perception among elderly in commercial streets in Bangalore. Ranking method was applied to the data collected in the survey, through which it was inferred that street ambience is the most important characteristic of a street that affects the elderly in a positive or negative way. Other important factors are overcrowding and improper footpath width. Semi-structured interviews revealed that lot of elderly people are unhappy with the increasing traffic flow and desire some mechanisms for proper enforcement of traffic rules. Overall, the elderly are saddened by the change in the character of the streets due to rash driving by the younger drivers, irregular sidewalks and footpath width as well as encroachment on the streets.
People experiencing ageing show limited mobility which has a substantial burden on the individual, families, community and the society at large. It is extremely essential for the planners to look at strategies at physical and social level for promoting age-friendly spaces in cities. It is necessary to provide accessible, affordable, safe and coordinated transport options which are specifically tailored for the needs of the elderly. At a city wide scale, it is important to have mobility management programmes designed keeping in mind the personal safety of the elderly.

Acknowledgement

The authors gratefully acknowledge the contribution of seventeen students of BMS School of Architecture, Bangalore (Keran, Vinay, Ruhaani, Shreelekha, Navyashree, Shubhashree, Shubhangi, George, Nidhi, Yash, Karandeep, Sandra, Minmini, Keerthan, Archita, Romil and Mahek), who helped during data collection and questionnaire survey.

Bibliography

Boholm, A., 1998. Comparative stu dies of risk perception : a re view of twenty years of research. , 1(2), pp.135–163.

CISTUP Report, 2012. *Bus Stop and Bus Bays in Bangalore : A Status Report*,

CPWD, 1998. *Guidelines and Space Standards for Barrier Free Built Environment for Disabled and Elderly Persons*,

DULT, 2011. *Bangalore Mobility Indicators 2010-11 Draft Final Report*,

DULT, 2014. *Guidelines for Planning and Implementation of Pedestrian Infrastructure*,

Eighty, O. et al., 2013. *Improving Quality of Life of Senior Citizens in Residential Neighbourhoods in the Indian Context Broad area : Motivation / Need for the Study :*,

Evangelista, R.A. et al., 2014. Perceptions and experiences of elderly residents in asylum. , 48, pp.81–86.

Frye, A., 2013. Disabled and Older Persons and Sustainable Urban Mobility.

Hayashi, Y., 2008. Mobility for Sustainable Development: Bangalore Case Study.

Helpage India, Comparative Demographic Facts.

Helpage India, 2011. Helpage India Report. Available at: http://en.wikipedia.org/wiki/Elder law in India [Accessed June 18, 2016].

IIHS, 2015. *Urban Transport in India: Challenges and Recommendations*,

Lakshmi Priya G, 2008. Condition of Disabled Elderly in India. , 14(2), pp.27–33.

Levin, L., 2011. Mobility patterns among older people in Sweden: a study of women's and men's experiences and modal choices from a life course perspective.

Mishra, A.J. & Patel, A.B., 2013. Crimes against the Elderly in India : A Content. , 8(1), pp.13–23.

MobilityIndia, 2012. *Mobility india Annual Report*,

Parida, D. & Devadas, V., 2014. Qualitative assessment of performance of ULBs in Rourkela Town. *International Journal of Research*, 1(5), pp.435–442. Available at: http://edupediapublications.org/journals/index.php/ijr/article/view/178.

Patil, S.S. et al., 2015. Circumstances and Consequences of Falls in Community-Living Elderly in North Bangalore Karnataka. , 4(4), pp.27–35.

Paul Slovic, Baruch Fischhoff, S.L., WhyStudyRiskPercep.pdf.

Prakash, I.J., 2008. Aging, Disability, and Disabled Older People in India. *Journal of Ageing and Social Policy*, pp.85–108. Available at: http://www.tandfonline.com/doi/abs/10.1300/J031v15n02_06?journalCode=wasp20 [Accessed June 14, 2017].

Purnima Parida, Najamuddin, M.P., 2007. Development of Qualitative Evaluation Methodology for Sidewalks in Delhi. *ITPI Journal*, 3(2007), pp.27–33.

Purnima Parida, Najamuddin, M.P., 2007. Development of Sidewalk Evaluation Methodology for Sidewalks in Delhi. *ITPI Journal*, 4(February 2007), pp.27–

33.
Roberts, M.L. et al., 2009. The perceptions of physical activity in an elderly population at risk of falling : a focus group study. , 37(July), pp.85–92.
Rosenbloom, S. & Ståhl, A., 2003. Automobility among the Elderly.
Rosenkvist, J. et al, 2009. The Challenge of Using Public Transport : Descriptions by People with Cognitive Functional Limitations. *Journal of Transport and Land use*, 2(1), pp.65–80.
Singh, C., 2013. Working Paper No. : 442 Ageing Population in India : Select Economic Issues. , (December), pp.1–27.
Svensk, A., Jönsson, B. & Malmborg, L., Mobility and Learning : Engaging People in Design of their Everyday Environments. , pp.1–8.
UN Habitat, 2013. *Promoting Non-Motorized Transport in Asian Cities: Policymakers' Toolbox*,
WBCSD, 2009. Mobility for development.
Wennberg H., 2009. *Walking in old age*. Lund University.
Whelan, M., 2006. *The Elderly and Mobility : A Review of the Literature*,

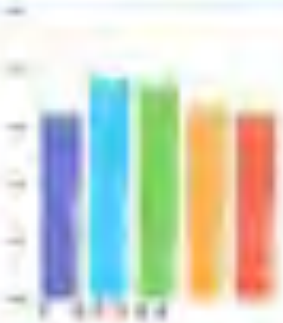
MOBILITY FOR ELDERLY

INTRODUCTION

AIM AND OBJECTIVES

METHODOLOGY

ANALYSIS



International Conference on Advances in Construction Materials and Systems (ICACMS 2017)

RILEM Proceedings Pro 118

Chennai, India
3-8 September 2017

Volume 1 of 4

Editors:

Manu Santhanam
Ravindra Gettu
Radhakrishna G. Pillai
Sunitha K. Nayar

ISBN: 978-1-5108-9527-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571

Some format issues inherent in the e-media version may also appear in this print version.

RILEM Publications
4 avenue du Recteur Poincare
75016 Paris
France

Phone: +33 1 42 24 64 46
Fax: +33 9 70 29 51 20

dg@rilem.net

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Planning in Steel Towns in Postcolonial India: A case of Rourkela

Debadutta Parida

Abstract

This paper has adopted a two pronged approach, on one hand, it aims to generate database of the physical maps of the town, showing chronological morphology using GIS mapping tool. Additionally, the paper attempts to trace the changes in spatial structure and form of Rourkela town since the beginning of its existence, and relate it with changes in socio-cultural patterns in the region. The paper concludes by identifying core challenges that plague the town presently and possible opportunities and approaches to deal with them.

1. INTRODUCTION

When India obtained independence, one of the main priorities of the government was industrialization of the country. Various towns were identified for setting up large scale industries viz. Rourkela, Durgapur, Bokaro, Bhilai, etc. Almost all of these towns looked forward to planning theories and concepts adopted in the planning of Jamshedpur city - India's first indigenous industrial development grown from a company town to an Urban Agglomeration in recent times. After the grand experiments in designing cities like New Delhi, Bhubaneswar and Chandigarh, planners in India looked up to designing cities of a different kind, with a vision of transformation of underdeveloped rural areas into modern industrial towns with a cosmopolitan character. Rourkela was established nearly five decades after the establishment of company town of Jamshedpur with the help of the then German Government and the companies Krupp and Demag and Siemens. It was a highly ambitious vision to achieve a fine balance between modernity, cosmopolitan character and contribution to economic growth of the country in the long run. In fifty years, Rourkela has evolved from an industrial township to an urban agglomeration. Massive urbanization has resulted in typical problems, which any industrial town finds itself in – spatial dichotomy in terms of infrastructure and increase in slums. A visual as well as social tension between planned development in the steel township areas and recently developed unplanned and organic growth in the municipal town is visible today in the urban landscape.

Similar to that of early planning in Jamshedpur city, the initial planning of Rourkela town was built around the Steel Plant, which was the primary

Debadutta Parida, *Assistant Professor, BMS School of Architecture, Bangalore, E-mail: debadutta.parida2011@gmail.com*

source of employment and directly governed all aspects of the lives of the residents. The one major difference in this regard is that while Jamshedpur city did not have any precedents in India, Rourkela had one to look up to as a model industrial town. This is noteworthy since most of the planning in the initial stages especially in the residential colonies in the town took some leaves out of the books of planning approaches in Jamshedpur city. Furthermore, the initial lay-out of Rourkela town is based on the principles of neighborhood unit concept, which seems to be influenced by Königsberger's plan for nearby cities of Jamshedpur and Bhubaneswar proposed not long ago. These factors played a formative role in the eventual built form of the town.

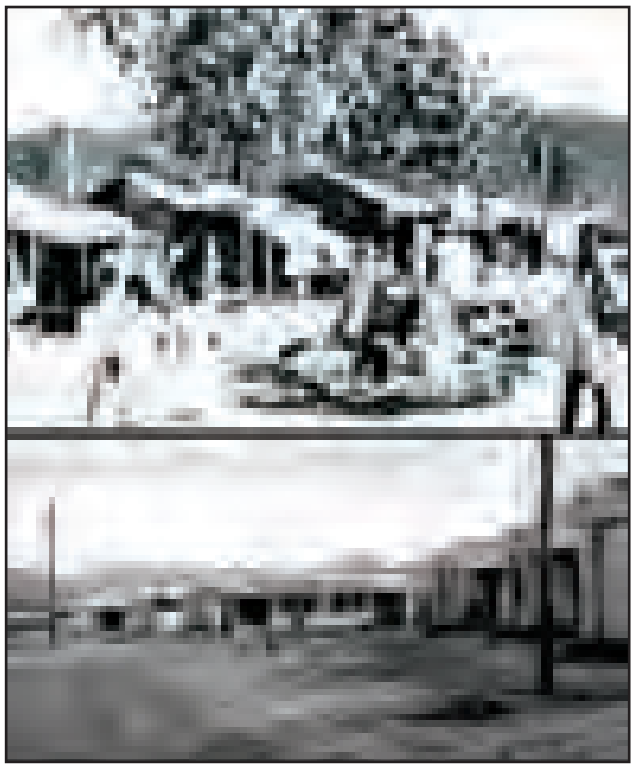
The new planning in an under developed area also brought forward new opportunities for the planners in the country, since they did not have to worry about balancing the existing urban form with new modernism. They attempted to create "an entirely new kinds of places inhabited by new kinds of people who would directly participate in the grand project of building the nation" (Roy, 2007). The towns were seen as modern, dream towns built in Post-Colonial India providing new opportunities and a better quality of life to its residents, as well as having a tremendous impact on nation building. In doing so, the planners selected concepts and designs from a wide range of available cases while being primarily influenced by the Neighborhood Unit concept. However, to what extent they were able to exercise this romanticism is highly debatable. While they were able to adopt certain elements suggested by a concept, they had to reject (for whatever reasons) certain other attributes of the same. This resulted in a conflicting urban space, which although being aimed to be an urban utopia has not tasted appropriate success due to multiple reasons that shall be discussed later in the narrative. It is quite surprising that despite the initial ambitious approach by the government in building various steel townships in the post-colonial era, the authorities did not follow it up with adequate measures for maintenance of the town as a whole. In two decades, the results started to show, gaps started to appear in the form of increase of unplanned settlements, environmental degradation, loose planning and wastage of spaces due to uneconomical densities adopted in the initial design of the town. Also, later on with the coming up of new residential colonies, the problems have only deepened due to lack of a distinct vision in the absence of an updated Master Plan. There has been very little spatial documentation and analysis of the initial planning and chronological morphology of Rourkela town, and it still remains a gap in history of urban planning in India. The Master Plan was formulated in 1960s and is obsolete, resulting in all decisions being made at the local level

(Parida, 2014a). As the town is progressing towards future growth through revitalization of core areas and development of infrastructure to cater to future population in-flow, an examination of early planning efforts carried out in the town will be highly useful for further studies.

2. EARLY DEVELOPMENTS

The history of the town can be analyzed as in two phases, viz. development before independence and after the construction of the steel township in the 1950s. The town had a rather humble beginning before the steel plant came into being. Its origins have not been so well documented apart from efforts by a few authors. Moreover, very limited information has been documented spatially in this matter. The whole region was a predominantly rural area with limited connectivity during the British rule during late 1890s. The Bengal-Nagpur Railway Company constructed a main railway line between Howrah and Nagpur in 1890s which ran through the area which consisted of a few villages such as Durgapur (present day Uditnagar and Basanti Colony), Kuarmunda, Urtum (now Steel Plant), Langi Berana (present day IG Park area), Bagdihi Gaon, Jhirpani, Tumkela, Purunapani (present day Steel Township Sector area), Mahulpalli, Rourkela, etc. The then Railway station of Rourkela was within the revenue village of Mahulpalli. The Railway Stations of Rourkela, Panposh (settlement near river Brahmani) and Bondamunda in the east were established at the same time (rourkelacity.com, 2013).

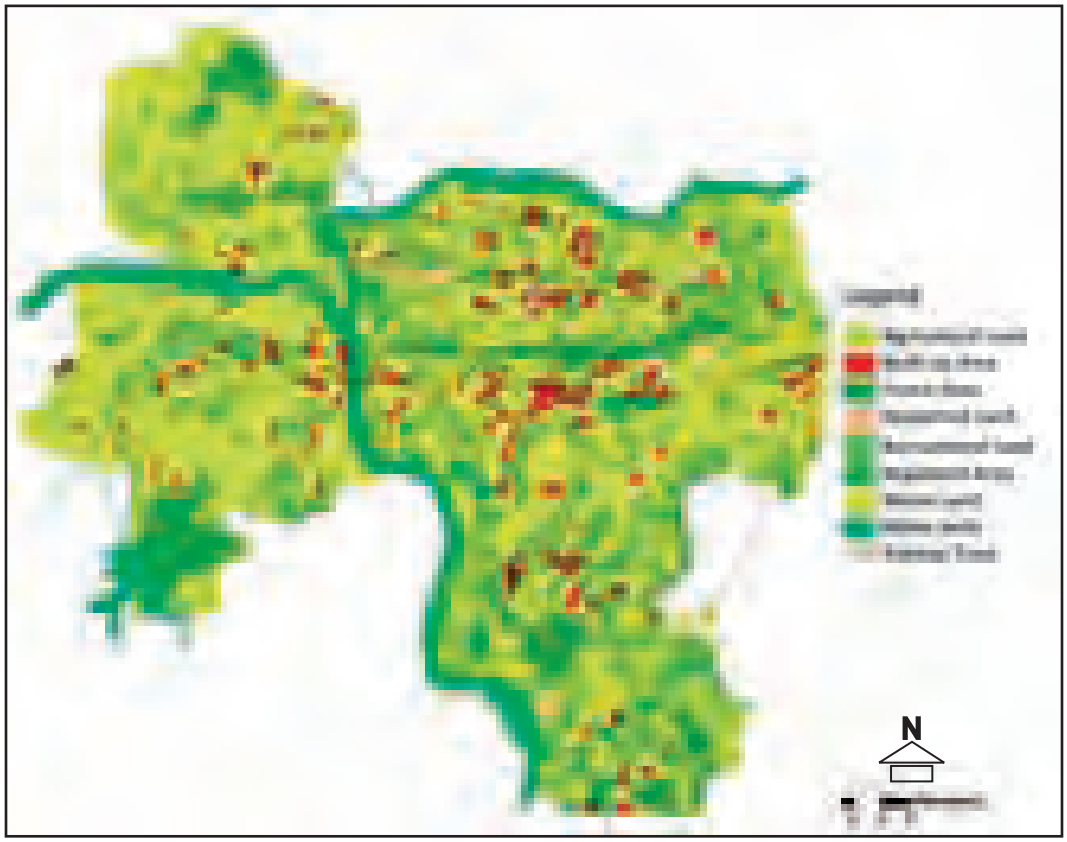
Fig. 1: Early Settlements and Construction in Rourkela



Source: (Saad, 2007)

Rourkela was declared as an 'Urban Town' in the 1931 census after the businessmen and merchants started to settle in areas along the railway line in the 1920s. The population of Panposh (2,252) was much larger than that of Rourkela (493). Furthermore, another railway line connecting Birmitrapur and Rourkela was constructed and became operational by 1926. During this period, there was an in-flow of population mainly comprising of traders from nearby regions as well as railway workers stationed there. In 1945, a Sub-Divisional Court Building was constructed in Durgapur village, present day Uditnagar.

Fig. 2: Various Locations of Indigenous Settlements in Rourkela, 1921

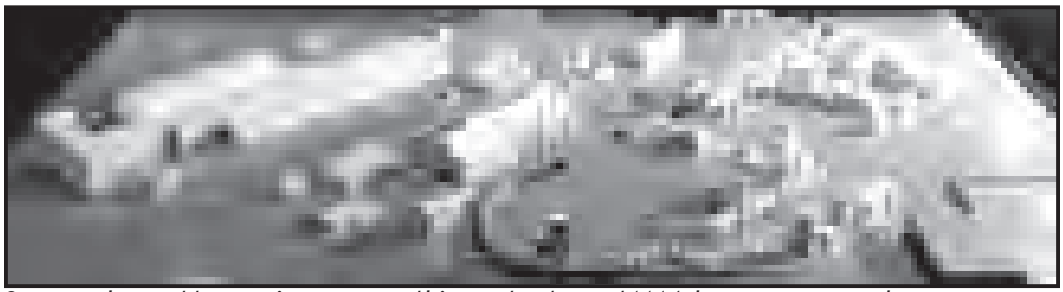


Source: author

3. NEW BEGINNINGS

After India achieved independence, as per the second Five Year Plan (1956 to 1961), various steel plants were established. Surveys and land acquisition works had commenced earlier in Rourkela since the beginning of 1950s, wherein nearly 80 sq miles land was acquired. German companies Siemens, Krupp and Demag stepped in for technical and financial advice. An additional 32 sq km land was acquired nearby which resulted in displacement of 31 revenue Villages. Nearly

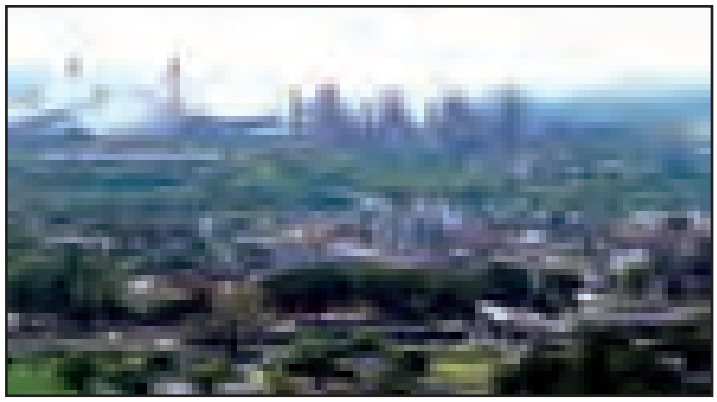
Fig. 3: Model of Rourkela Steel Plant 1960



Source: https://www.siemens.com/history/en/news/1114_hannover-messe.htm

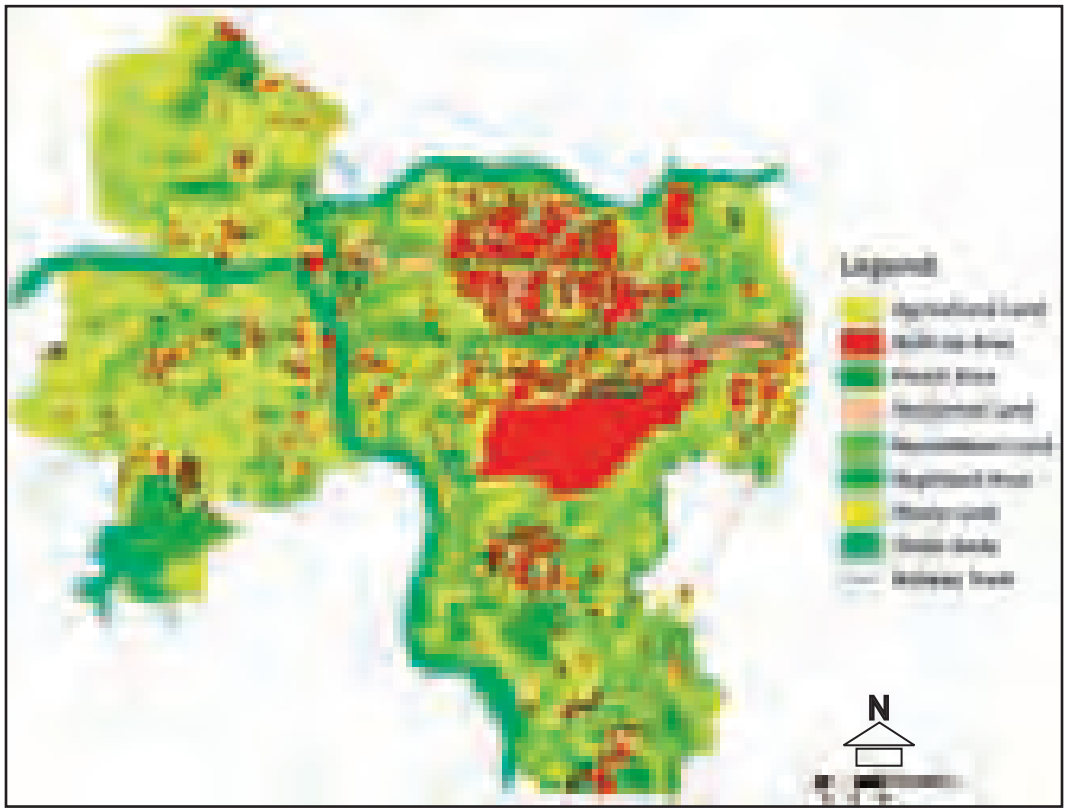
13,000 people (2,424 families) were displaced in the process. Later, another 10,000 acres of land was acquired in order to construct Mandira Dam which displaced another 31 Revenue Villages. Another 20,000 persons were displaced when further acquisition of land was carried out for construction of new railway lines to Hatia and Barsuan. By the year 1960, the Rourkela Steel Plant, Fertilizer Plant and Township and Steel Township were constructed on the areas acquired earlier by the then government of Orissa. Also, a Marshalling Yard was established in Bondamunda. The presence of the high Durgapur Hill Range was used strategically in the early design of the town, as it could serve as an excellent buffer to maintain the quiet character of the town from the noise of the steel plant, the highway and the main Calcutta-Bombay railway line (Roy, 2007). Also most of the buildings in the industrial area are aligned in the south east - north east direction to ensure minimum exposure to the direct wind and rain. The Steel Township was designed as twenty one sectors (neighborhoods) on record, while in reality Sectors 10, 11 and 12 do not exist. The sectors were planned with predominantly rectangular lay-out with plenty of open spaces. The Town and Country Planning estimated that 7,500 workers would be employed in the pursuit of the target of one million tones of steel ingots, and an additional 2500 persons would be required as secondary workers to cater to the various needs of 7,500 primary workers. The average family size taken was five, and the planners designed the township in the form of various self-sufficient neighborhoods, with schools, hospitals, parks, playgrounds, police stations and social homes for a population of 50,000 initially. This reveals the influence of Königsberger's ideas of neighborhood concept implemented in the cities of Bhubaneswar as well as the 1944-45 plan of Jamshedpur. In case of Jamshedpur, Königsberger had to deal with the designs implemented of his predecessors, especially Temple's Plan, and hence he had tried to implement the garden city concept and neighborhood unit concept in all those areas where there was scope. On the other hand, he could design self-sufficient neighborhood units in the capital city of Bhubaneswar. The initial plan of Rourkela is also on the same principles. It had its fair share of advantages, yet within a few decades this approach seemed to have backfired, simply because the planners simply adopted certain attributes of the concept implemented while they conveniently rejected certain other aspects necessary for the concept to be successful. For instance, although the idea of self-contained neighborhoods was adopted in the design of

Fig. 4: Rourkela Steel Plant with the Four Giant Blast Furnaces



Source: www.rourkelaonline.in

Fig. 5: Rourkela, 1960 after the Formation of Steel Plant and its Township



Source: author

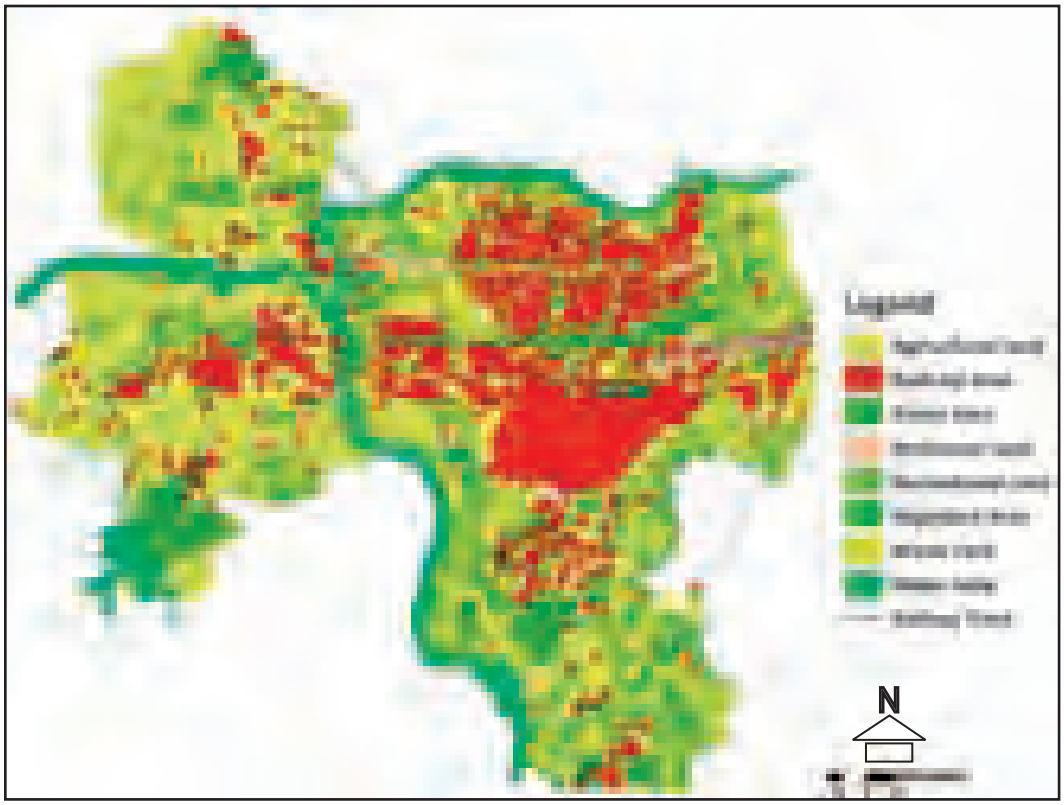
the new township, yet the principle of reserving an agricultural belt in the outskirts of the garden city was conveniently rejected (Roy, 2007). This 'hybrid planning', although highly distinctive in approach finally exposed many lapses as years passed. Firstly, the town experienced increasing economic polarization and lack of interaction between different classes of workers of the town. The economically challenged section was forced to live in isolation from the rest of the classes. This led to further inequalities in the workplace and reduction of social cohesion. Moreover, due to the design of self-sustained neighborhoods where essential amenities such as market place as well as educational facilities were within each neighborhood, the social interaction between classes was rare, thus increasing polarization and segregation. Secondly, with rapid industrialization and increase in population of the town, there was a sharp increase in informal settlements and slums throughout the town, along with the newly planned civil townships. The neighbourhood sectors had also to deal with stagnant spaces such as over-crowded schools, poorly equipped hospitals and a semi-developed market disguised as Central Business District (Roy, 2007). Thirdly, there was very little communication between people in the town, which gradually led to growing communal mistrust

between communities, as is evident from the riots in the town in March, 1964, in which indigenous population were involved who had no such violent history (Roy, 2007). Add to all these "deterioration of quality, beauty as well as healing capacity of the environment" because of multiple forms of pollution in the town (Dara, Singh, and Rout, 1997). Lastly, inadequate implementation of urban planning principles and hasty decision-making based on short term vision in recent times has led to lack of character in the urban skyline as well as mindless show of architectural built form influenced by impatient capital throughout (Parida, 2014b).

4. RECENT DEVELOPMENTS

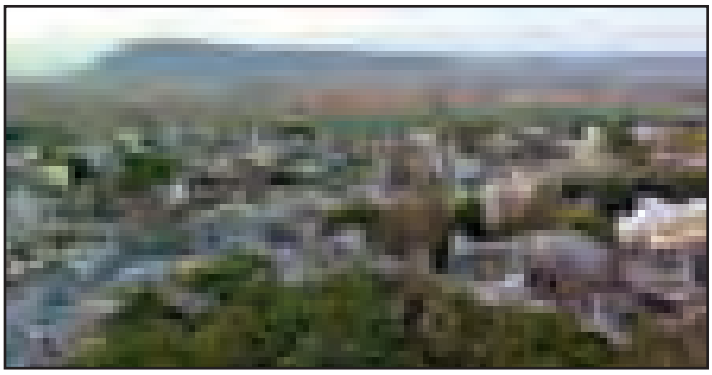
There was immense urbanization in the town in 1970s and 1980s, especially towards north-east and western areas. Planned townships like Chhend Colony, Basanti Colony and Koelnagar came up in order to cater to the increase in population of the town. This period is also characterized by increase of informal settlements and overall decrease in the quality of urban life that the town had promised in its early years (Parida, 2014a). Factors like modernization of the steel plant in 1980s helped increase revenue of the Steel Plant in early

Fig. 6: West Wards Growth along the Transportation Lines, in Rourkela (2000)



Source: author

Fig. 7: Chhend Colony with the Dominating Landscape in the Background. Recent Development in Newer Colonies Like Chhend Colony is Devoid of Human Scale, Hence Affecting the Urban Skyline



Source: https://en.wikipedia.org/wiki/Chhend_Colony#/media/File:Chhend.colony.rourkela.jpg

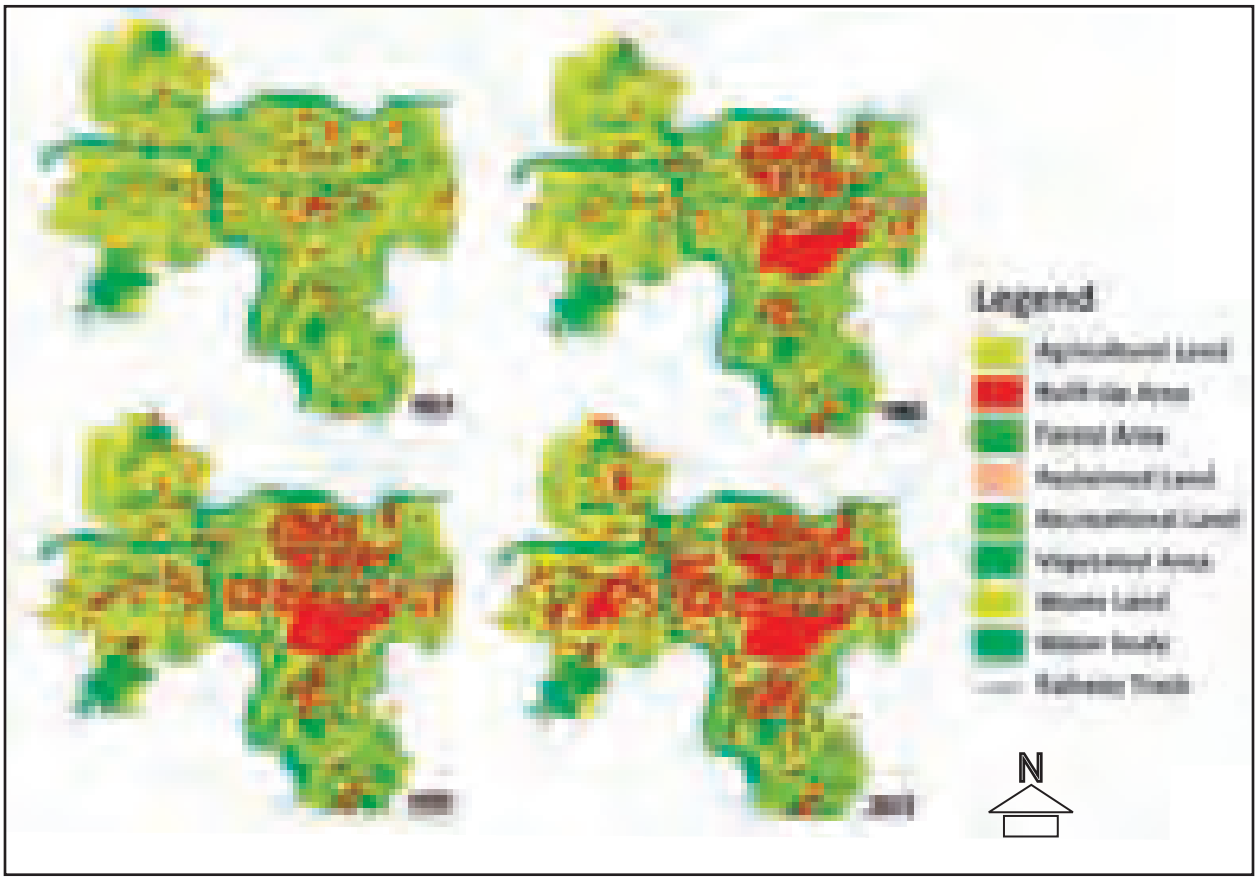
1990s. This coupled with the economic liberalization policy of the central government resulted in increase in density of the planned colonies such as Chhend Colony and Shaktinagar.

Delineation of the planning boundary was a major concern for the authorities. Due to lack of scientific action and an obsolete Master Plan, the town witnessed rise in multiple housing typologies within a short period of time, which was in sharp contrast to the already existing urban landscape of the town (Fig.). Development after 2000 has been mere continuation of the development in 1990s. It was also the period which was the peak of the economic consequences of liberalization and modernization.

Newer planned colonies such as Chhend Colony, Balughat and Jagda were habituated during this period. However, this change was also accompanied by increase of further unplanned growth in terms of informal settlements especially near river Brahmani, Bondamunda and Jagda. Moreover, the quality of the built environment is in constant decline in older colonies near the railway station. This has resulted in a tension between the planned colonies of the town on one hand and unplanned organic growth on the other. It is therefore, imperative that the planning measures carried out in future must focus on connection between needs of the inhabitants and quality of the urban realm which connects them. Some of the core issues that plague the development of the town are stated below:

- Population in resettlement colonies are still socially and economically vulnerable – cross-cultural differences have been totally ignored;
- Growth of slums in the municipal area (According to Census 2011, nearly 43 percent of the population in Municipal Township is residing in slums);
- Irreparable environment damage during construction of the town as well as high pollution levels in recent times (Chatterton, 2006) (Goswami, Swain, and Panda, 2013) (Pradhan, 2010);
- Rapid growth along the transportation corridor, thus putting huge pressure on the lone bridge connecting the town with the industrial areas beyond Panposh;
- Unplanned growth in the urban-rural fringe areas;
- Inadequate public transport system in the town; and

Fig. 8: Chronological Morphology of Rourkela Town.

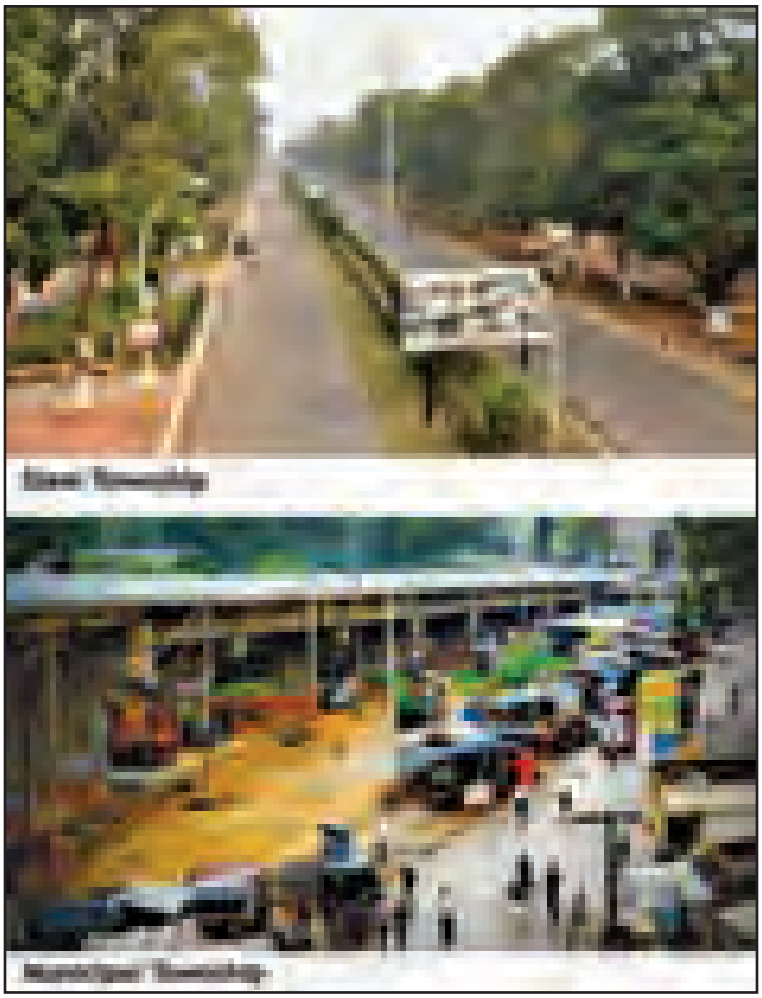


Source: It is Clear that the Development is Happening Rapidly in Linear Fashion along the Transportation Arteries and is Spreading beyond River Koel in the West

- Disparity in geographical distribution of infrastructure in the town (Municipality, 2011).

In order to deal with the above, a holistic approach in planning in the next decade is the need of the hour. Integration of various dynamic aspects of the town has to be looked into, in order to achieve a long term, sustainable development. These solutions lie much deeper than one generally expects. For example, widening of roads or development of high density colonies are a good way to deal the above problems pragmatically, but this approach is too narrow. The real challenge for planners lies in its ability to integrate and imbibe the pluralism in terms of the already existing tribal settlements (majority of which reside in the resettlement colonies) and the newly emerging colonies which in principle are in contradiction to the earlier planned township in 1950s. It is essential to understand that the core town built in the initial days should not be allowed to decay into a dead company town within a rapidly

Fig. 9: Disparities between Steel Township and Municipal Township



growing agglomeration. At the same time, it is also necessary to strike a balance between the needs and aspirations of the present and future generations of the town on one hand and the environmental conservation of various parts of the town on the other. For example, newly proposed plotted schemes by the Rourkela Development Authority, although functional, are just a mere continuation of the oddity. Rather, vital cues can be taken from principles of incremental housing. The Belapur Incremental housing in Navi Mumbai by Charles Correa is an excellent example where incremental housing has been used as a tool to achieve low rise-high density colonies (Correa, 2010).

It is absolutely essential to improve physical connectivity across the river Koel, since the town is rapidly growing in a linear fashion. Rather than focusing only on redevelopment, the focus should be on attracting the existing population in congested areas towards better facilities and amenities elsewhere. It must be noted that people come to an industrial town not in search of housing but in search of work. Hence the distance between the workplace and housing is a very important factor which will determine the success or failure of such a strategy. Policies which promote the growth of small scale industries using local indigenous techniques as well as the people can be successful in providing sustainability in the long run.

5. CONCLUSIONS

In depth analysis of fifty years of planning in post-colonial era in Rourkela town shows that the planners were clearly influenced by the principles of neighborhood planning proposed by Königsberger for the nearby towns of Bhubaneswar and

Jamshedpur. The town, which was envisaged as a utopian setup comprising of cosmopolitan character and was supposed to host a perfectly cosmopolitan society provides a rather pessimistic scenario today. Physical mapping of the town showing the morphological development clearly helps in identifying planning issues over the years and mapping them for future reference. It is clear that the steel town has much to learn and explore the transferability of the developmental attitude of the west to solving urban problems in Indian context. There is a lot of difference between forced rapid change brought about by industrialization and modernization and gradual change through an evolutionary process (Sarini, 2006). There has been complete destruction of social values and fabric, as well as economic and moral strength of the Adivasi in the region. It is unfortunate to note that both the State Government and the Rourkela Steel Plant are indifferent to the development of the indigenous population of the town and in the periphery. The citizens of the town are the victims of unplanned growth, impractical housing densities and loose planning.

The questions still loom large over all, as aptly put by (Roy, 2007) "To whom does Rourkela belong? Who belongs to Rourkela? Whose dream world and whose catastrophe is it anyway?" It is imperative that for a better future of the town, it is essential to look into various social, political, geographical and legal aspects, which affect daily life of people not only of the town but also of the whole region. No amount of planning in the town will be successful without solving various cross-cultural difficulties in terms of human rights, environment and public participation. A major challenge in front of the social scientists, planners and decision makers of the town is how to tackle the issue of changing cultural pattern of the indigenous people such as ethnic characteristics, land ownership, settlement patterns, social as well as spiritual practices, etc. In trying to do so, they have to get above these existing cross-cultural differences and try to prevent further social exclusion through active and constant dialogue as well as public participation. Unless these foundational issues are adequately debated and dealt with, it is safe to say that Rourkela town in a matter of few decades, shall lose its identity as a special place for special people, and shall be remembered as a failed attempt in postcolonial urban planning.

REFERENCES

Chatterton, T. J. (2006) Managing Air Quality, *1*, 155–164. http://doi.org/10.2495/AIR06016

Correa, C. (2010) *A Place in the Shade,* Penguin Books India, New Delhi.

Dara, P.K, Singh, D.K., and Rout, P. (1997) Role of Environmental Degradation in Changing the Urban Morphology: A Case Study of Rourkela in Orissa, *Geography and Environment,* pp. 224–234.

Goswami, S., Swain, B. K., and Panda, S. K. (2013) Journal of Environmental Biology, *34*(September), 891–895.

Parida, D. (2014a) *Planning for Integrated Development of Rourkela Town,* IIT Roorkee, Roorkee.

Parida, D. (2014b) Qualitative assessment of performance of ULBs in Rourkela Town, *International Journal of Research*, Vol. *1, No.* 5, pp. 435–442.

Pradhan, S. (2010) *Unpublished Thesis - A comparative analysis of water collected from Koel River and water released from Rourkela steel plant (RSP),* National Institute of Technology, Rourkela.

Roy, S. (2007) 'Urban Space, National Time and Post Colonial Difference: The Steel Towns of India', in T. Çınar, Alev and Bender (eds.) *Urban Imageries : Locating the Modern City,* University of Minnesota Press, Minneapolis.

rourkelacity.com. (2013) About Rourkela and its History. Retrieved March 23, 2016, from http://www.rourkelacity.com/about-rourkela/history/

Rourkela Municipality (2011) *City Sanitation Plan Draft Report October 2011*, Rourkela Municipality, Rourkela.

Saad, A. (2007) Rourkela Das Doppelleben einer Indischen New Town, *Arch plus*, (November).

Sarini, O.P.N. (2006) *Rourkela and After* (pp. 1–44).

Sinha, A., and Singh, J. (2011) Jamshedpur: Planning an Ideal Steel City in India, *Journal of Planning History*, Vol. 10, No. 4, pp. 263–281.

I like the idea of trying to look after great cities, trying to raise their level, of making them beautiful cities, not only with beautiful buildings, but with healthy, efficient human beings, or loving people, co-operating with each other and not trying to knock each other down and exploit each other and make each other miserable. That is the ideal of the great city that I should like to have and I like to work for.

Jawaharlal Nehru

DOI: 10.23968/2500-0055-2017-2-3-11-20

A SITE-BASED PRACTICAL IMPROVISATION FOR THE ANALYTICAL DETERMINATION OF ASPECT RATIO

Rajesh Gopinath[1], Deepak D.G.[2]

[1] Department of Civil Engineering, BMS Institute of Technology and Management, Bengaluru, India

[2] BMS School of Architecture, Bengaluru, India

[1] dr.rajeshgopinathnair@gmail.com

Abstract

'Aspect Ratio', a commonly used indicator to describe typical urban geometry is computed as the average ratio of the building heights 'H' to the canyon width 'W'. Its determination techniques in the present urbanization scenario is bound by certain assumptions which falter as most cities across globe does not project a well-planned street pro le. An urban canyon factor is of most signi cance in climatic and air quality studies.

The study showcases how the standard assumptions cited in literatures for Urban Morphological Analysis cannot apply to most urban canyons in any townships that have evolved rampantly. The present research recommends a rationally feasible methodology of analytically ascertaining and representing Aspect Ratio for variant street canyons. The research objective envisaged selection of 3 random locations encompassing heterogeneous street canyon geometries. At each of these locations its land-use pattern and road network was mapped for a radius of 250m by supervised-classi cation to assist in extracting the canyon geometry features, namely building height and road width across all the streets.

The revised methodology judiciously delves upon when stations also have plots without pre-de ned boundaries for creation of layouts. The logic encompasses complete dimensional analysis, and accounts for all four directions, the dynamic road width and building length measured along street about each focal point. The present research recommends this technique for a study of any magnitude; and encompassing just a street or even an entire city; as it's practically applicable to any site condition and does away with errors due to the 'idealistic' assumptions.

Keywords

Aspect, canyon, dimensional, elevation, ratio, urban.

Introduction

A typical urban morphology is often projected as an urban canyon comprised of the walls of adjacent buildings, the street between them and the air volume enclosed within it (Nicholson Sharon, 1975). 'Aspect Ratio', a commonly used indicator; is computed as the average ratio of the building heights 'H' to the canyon width 'W' (Oke, 1988a). 'Aspect Ratio' is hence also denoted as H:W (Steyn, 1980).

The pro ling of an urban canyon is based on the universally accepted 'Classi cation of Canyons' as Avenue (Figure 1), Regular (Figure 2), Narrow (Figure 3), and Deep (Figure 4); i.e. based on the Aspect Ratio values as <0.5, 1, >1 and >2 respectively (A q et. al, 2012).

Rationale for Study

Several researchers have tried to establish the relationship of canyon geometry for a city with its Climatic variations (Yamashita et.al, 1986; Oke, 1981; Gopinath, 2014), Energy balance (Marciotto et.al, 2010; Oke, 1988b), Wind ow pattern (Chang and Meroney, 2003), Air quality (Chan et.al, 2003) etc. The present research postulates that, as long as the street geometry is restricted to urban micro-climate studies (single/isolated monitoring points); the cited assumptions are more or less sufficient. However, if the ambit extends to a macro-level with a single representative value from a multitude of H:W values, then the existing logics in literatures do not suffice (Gopinath et.al, 2014) thereby demanding further research in improvisation for better representation of canyon framework in terms of H:W, and the present study attempts to resolve this research lacunae.

Research Methodology

The research objective envisaged selection of 3 random locations encompassing heterogeneous mix of street canyon geometries ranging from wide to deep, in Bengaluru, India.

a b

Figure 1. An Avenue Canyon: a – A Typical Avenue Canyon; b – Representation of a typical Avenue Canyon

a b

Figure 2. A Regular Canyon : a – A Typical Regular Canyon ; b – Representation of a typical Regular Canyon

a b

Figure 3. A Narrow Canyon : a – A Typical Narrow Canyon ; b – Representation of a typical Narrow Canyon

a b

Figure 4. A Deep Canyon : a – A Typical Deep Canyon ; b – Representation of a typical Deep Canyon

DOI: 10.23968/2500-0055-2017-2-3-11-20

At each of these locations its land-use pattern and road network was mapped for a radius of 250m by supervised-classi cation to assist in extracting the canyon geometry features, namely building height and road width across all the streets. Further the canyon geometry across these stations was logically reasoned for Aspect Ratio with logics cited in literatures. Figures 5 to 7 highlight the extracted "urban-fabric" along with legend (Figure 8) for the 3 sample stations in Bengaluru (India).

Inferential Outlook

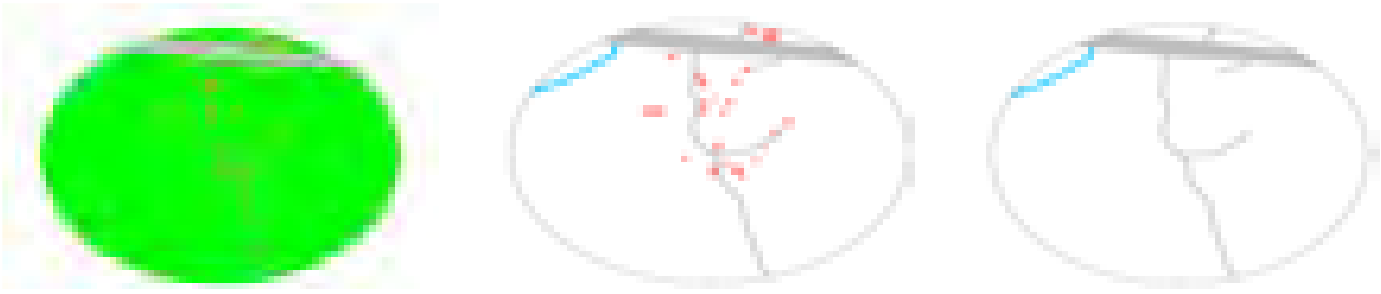
As may be observed, these extracted features showcase an outright preview of non-applicability for the prime assumption made in urban climatology i.e., "the streets are uniform and of in nite length, with same height buildings laid in a well-planned phased manner" (Nicholson, 1967). Primarily it is obvious that this prime assumption can only be applicable to township pro les with idealistic and well-planned canyons (Figures 5a, 5b & 5c); and eventually ignores contributions from within urban canyons with buildings that are scattered very close to each other (Figure 6a), or non-uniformly (Figure 7a), or with ‘abrupt’ canyons (Figure 9).

a b c

Figure 5 (a, b, c). Land-use, Building-height and Road Network of a well-planned locality in Bengaluru

a b c

Figure 6 (a, b, c). Land-use, Building-height and Road Network of an ill-planned locality in Bengaluru



a b c

Figure 7 (a, b, c). Land-use, Building-height and Road Network of a peri-urban locality in Bengaluru

a b c

Figure 8 (a, b, c). Legends for Land-use, Building-height and Road Network for Figures 3, 4, 5

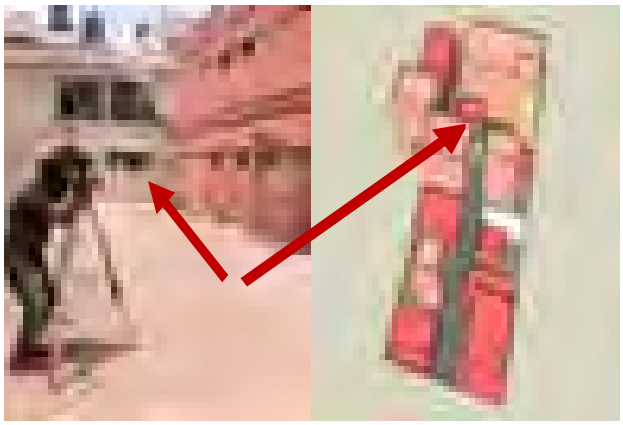


Figure 9. An Abrupt Canyon

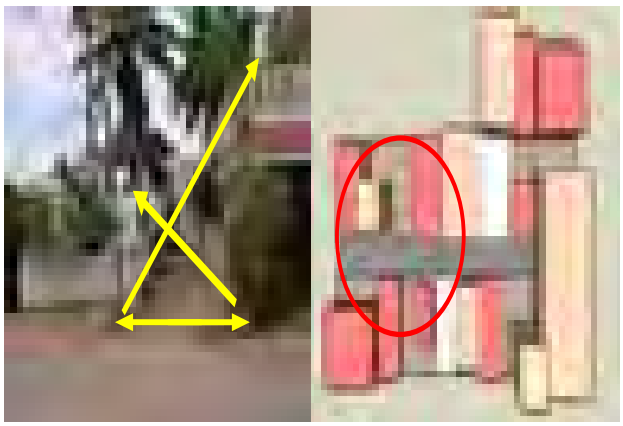


Figure 10. Sample inorganic Canyon Layout

DOI: 10.23968/2500-0055-2017-2-3-11-20

In the present urbanization context; the cited assumption falters especially in developing and underdeveloped nations wherein most cities does not project a well-planned pro le in terms of their building framework (Figure 6b) or street alignments (Figure 6c). Hence, even the underdeveloped layouts are at a similar risk (Figure 7b and Figure 7c).

This argument was defended by extracting a random layout from the station depicting inorganic canyon pro- le. Processing of Figure 4c to obtain canyon pro ling about each street; revealed that there were certain streets wherein the buildings were constructed as and at dead-ends (Figure 9), irregularly (Figure 10) and very often with variable heights (Figure 11). Hence these clearly depict violation of "uniform canyon & uniform building height" theory. Figure 12 also signi es the non-applicability of the de nition of canyon that has been deftly incepted to urban studies as "a street with buildings lined up continuously along both sides" (Oke, 1981).

There exists streets in Bengaluru (India) wherein there are random open spaces facing the buildings, which due to legal reasons can sustain as so, for several years and decades to follow. This situation triggers two potential debates. First, under these circumstances can the classi cation of canyons as ‘short’, ‘medium’ and ‘long’ (A q et. al, 2012) be applicable? The length of canyon (L) and height ‘H’ illustrates the street canyon as Short when L/H=3, as Medium when L/H=5 and as Long when L/H=7 (Ahmad, 2005). Second, whether this urban situation can even be termed as a canyon? Geographically speaking canyon is “a shallow portion with steep abutments on ‘either’ sides”.

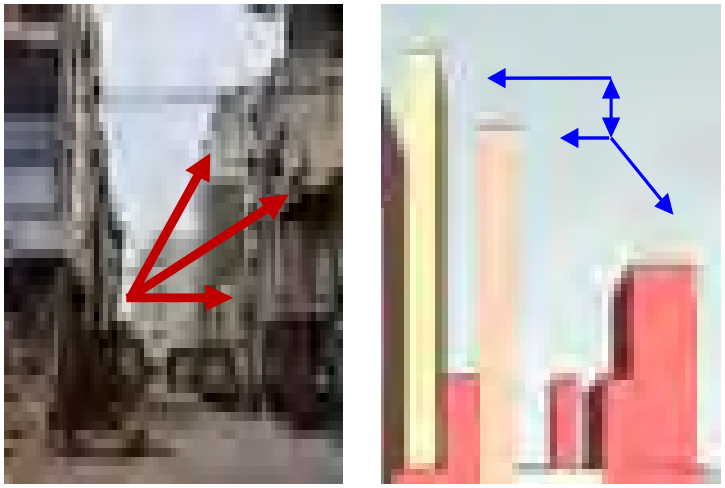


Figure 11. Irregular Building heights

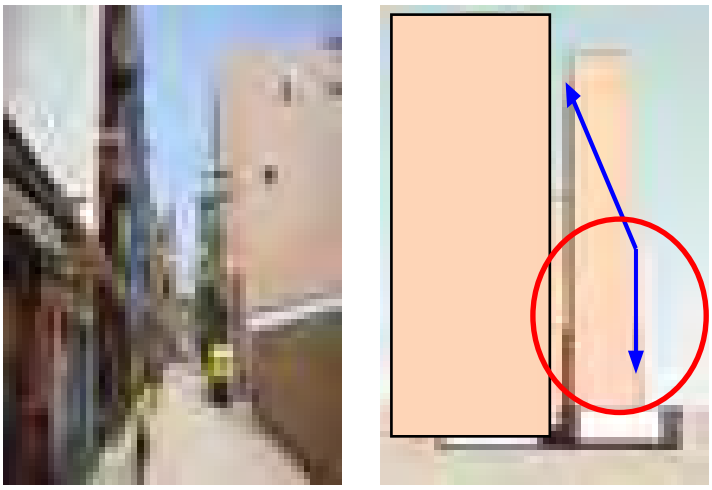


Figure 12. Tall buildings facing Empty site

For further introspection; the in uence of a 'Deep' canyon in practicality can be marginalized due to di erential heights of houses facing each other. For instance, the practical value of > 2 can be achieved if an undeveloped or vacant plot is facing a very 'tall' building as depicted in Figure 12. A further addendum to this issue is the dwarfing e ect from two more site-based situations. Firstly, wherein a tall building exists behind an empty site that faces a street, as depicted in Figure 13. Secondly, when the building that's constructed behind an existing house is much taller than it, as depicted in Figure 14.

The practical act of shifting the observatory in researches have been oriented about randomly or approximating at the mid-point of home's total length. This is a concern since, the concept of xed length of houses (dimension as measured along streets) is not a reality even in a modernized metropolitan such as Bengaluru (India) that hold plots of varying and irregular dimensions. Hence errors may creep in due to the relative deviation of the facing heights observed along oppositely facing buildings. This may be due to factors such as the wall-edges of oppositely facing houses are not at 0° with each other (Figure 15), or when the adjoining houses share a common load-bearing wall (Figure 16), and this situation may also arise in case of an empty site facing a house (Figure 12).

To summarise the ndings from site-based conditions, the idealised site-based conditions are far from what the developed, developing and underdeveloped nations present under the guise of Urbanisation upon their townships (Rajesh Gopinath et.al, 2015). Consequently, the assumption for 'urban canyon' does not apply to all townships, and hence their application in climate research and air quality studies can introduce erroneous outcomes.

Therefore to overcome the limitations posed by complex urban con guration, the present study has developed a 'logic-based' improvised computation tool for any township irrespective of its 'canyon' geometry and components. The same is presented as Equation 1:

$$\frac{H}{W} = \frac{\left(\frac{\sum H_i \times L_i}{\sum L_i}\right)}{\left(\frac{\sum W_i}{n}\right)} \quad (1)$$

Herein 'H_i' is the mean of 'derived' heights from all directions about each measuring point, 'L_i' is the distance between each observatory, 'W_i' is the width of full street for every observatory on the carriageway, and 'n' is the number of times the observatory has been shifted for taking 'angle of elevation'.

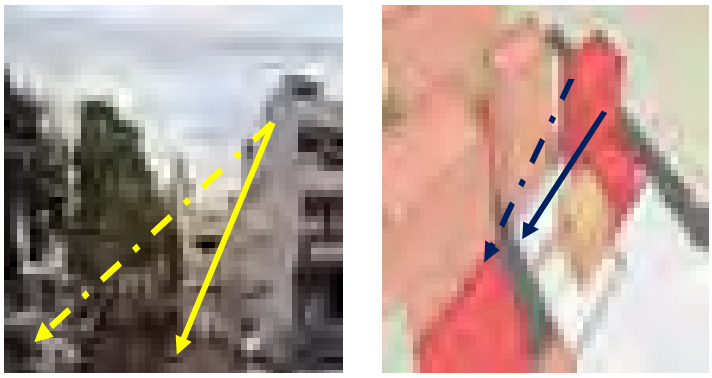


Figure 13. Dwar ng e ect on empty site

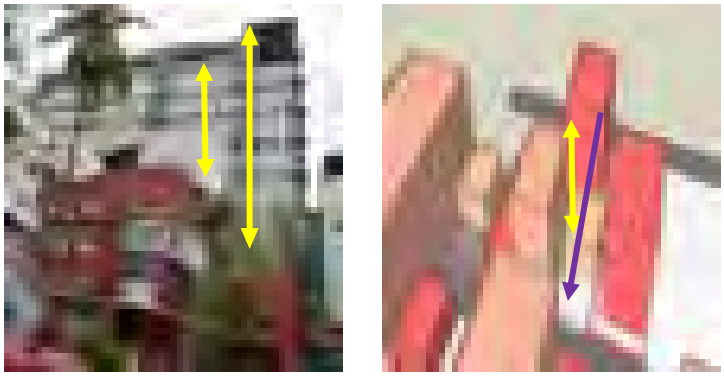


Figure 14. Dwar ng e ect on house

DOI: 10.23968/2500-0055-2017-2-3-11-20

$$H_i = (Tan\ \alpha_i \times W_i) + S_i \quad (2)$$

The logic for deriving mean 'H' is depicted in Equation 2, wherein W_i refers to width of the road and 's_i' is the respective intercept. In literatures, the respective mean of H_1 and H_2, and the sum of W_1 and W_2, methodology facilitates to obtain Aspect Ratio (Oke, 1988b). The revised logic however has considered all directions irrespective of the presence or absence of buildings, and hence multiple angles of elevation (α_i) ought to be measured above 'line-of-sight'. Subsequently, the angles of elevation measured alongside axis of street could be or may not be 0° about each observatory, subjected to presence or absence of an abrupt canyon. This improvisation is based on the argument that an abrupt canyon has a skewed H:W and hence must be included wherever applicable. In this context, it is to be also noted that in certain literatures the value of 'W' was not practically quanti ed and was considered as uniform about each measuring point along the entire canyon (Chen-Yi Sun et.al, 2009). This is especially a setback in case of most streets in Bengaluru (India) wherein width of carriageway is dynamic.

The study also ignores the e ect of edges (Equation 3). The improvised logic (Figure 18) overcomes these limitations, as it strives to shift observatory w.r.t. edge of buildings (Figure 17); and not mid-point of each building length. Also the methodology always maintains focal point on street itself; thereby overcoming hurdles o ered by taller buildings overlooking empty sites and shorter buildings. Hence, this ensures contribution of the 'taller' house as well to H:W.

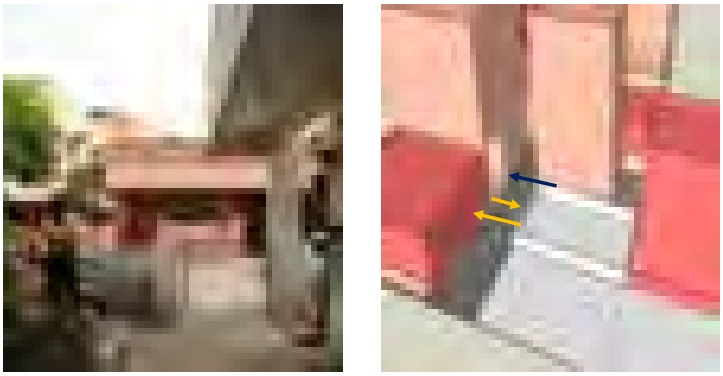


Figure 15. Sample Street View

Figure 16. Sample Street View

Figure 17. Edge and site based measurements

Figure 18. Supervised Classi cation

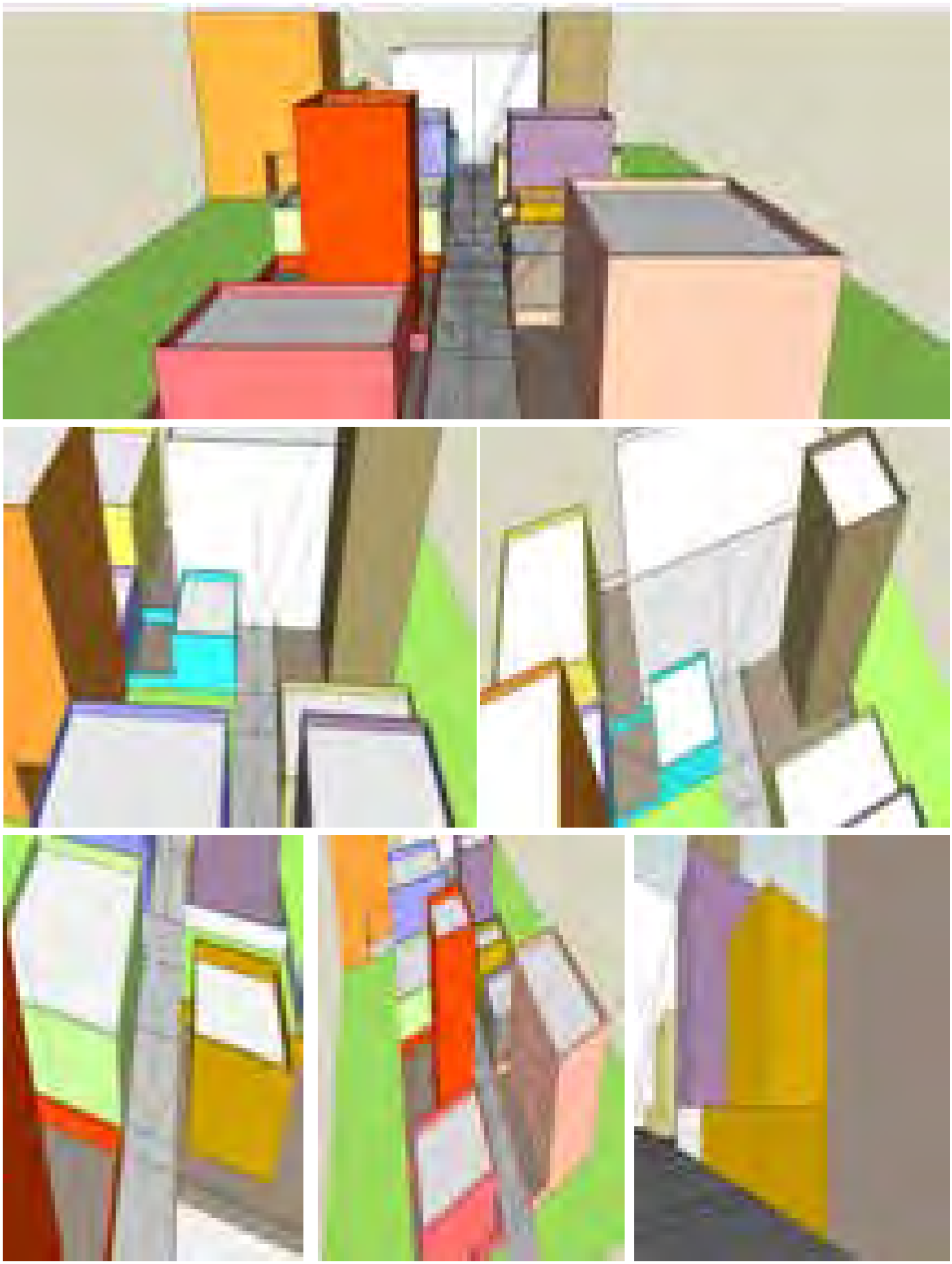


Figure 19. Compilation of artistic impression for Methodology as per Revised Logic by Authors

DOI: 10.23968/2500-0055-2017-2-3-11-20

$$H/W = (\Sigma Hi \times Di)/(\Sigma Di) / W \quad (3)$$

This revised logic and methodology needs to be judiciously worked upon when stations also have plots without pre-de ned boundaries for creation of layouts. For this the latest town map or updated google satellite images needs to be procured and adequately analyzed for e ective supervised classi cation on site (Figure 18). On a macroscale aspect, this was magnanimously ignored in the literatures, as the focus was laid only on developed urban canyons. Also the representative Aspect Ratio value for a station was often considered to be the largest value (Marlos et.al, 2013) thereby potentially re ecting at the effect of outliers. Herein by this new-logic, the representative Aspect Ratio shall be a mean of all H:W contributory values, and also the addition of undeveloped observatories will eventually dip the H:W value.

Conclusion

The H:W ratio basically describes how tightly or loosely spaced the buildings are with respect to their heights. Its determination techniques in the present urbanization scenario is bound by certain assumptions which falter as most cities across globe does not project a well-planned street pro le. In the present research a logically-improvised analytical approach has been described which precisely estimates Aspect Ratio. The present research recommends this technique for a study of any magnitude; and encompassing just a street or even an entire city; as it’s practically applicable to any site condition and does away with errors due to the 'idealistic' assumptions.

References

A q, W.M.Y., Azwadi, C.S.N., Saqr, K.M. (2012). E ects of Buildings Aspect Ratio, Wind Speed and Wind Direction on Flow Structure and Pollutant Dispersion in Symmetric Street Canyons: A Review. *International Journal of Mechanical and Materials Engineering*, 7(2), pp. 158–165.

Ahmad, K., Khare, M., Chaudhry, K.K. (2005). Wind Tunnel Simulation Studies on Dispersion at Urban Street Canyons and Intersections-A Review. J*ournal of Wind Engineering and Industrial Aerodynamics*, 93 (9), pp. 697–717. DOI: 10.1016/j.jweia.2005.04.002

Chan, A.T., Au, W.T.W., So, E.S.P. (2003). Strategic Guidelines for Street Canyon Geometry to Achieve Sustainable Street Air Quality-Part II: Multiple Canopies and Canyons. *Atmospheric Environment*, 37 (20), pp. 2761–2772. DOI: 10.1016/S1352-2310(03)00252-8

Chang, C.H., Meroney, R.N. (2003). Concentration and Flow Distributions in Urban Street Canyons: Wind Tunnel and Computational Data. J*ournal of Wind Engineering and Industrial Aerodynamics*, 91(9), pp. 1141–1154. DOI: 10.1016/S0167-6105(03)00056-4

Chen-Yi Sun et.al. (2009). A Thermal Environment Investigation Of The Urban Street Canyon In A Hot And Humid City, Taichung City, Taiwan. In: *Proceedings of The seventh International Conference on Urban Climate*. Yokohama, Japan.

Eeftens, M. et.al. (2013). Quantifying urban street con guration for improvements in air pollution models. *Atmospheric Environment*, 72, pp. 1–9. DOI: 10.1016/j.atmosenv.2013.02.007

Gopinath, R. et al. (2014). An Analytical and Practically Feasible improvisation over representation of Sky-View-Factor. *American International Journal of Research in Formal, Applied & Natural Sciences*, 6(2), pp. 147–150.

Gopinath, R. et.al (2015). Change Recognition in Land-Cover Dynamics for Bengaluru (India) City due to Rampant Urbanization, using Quantum G.I.S. *International Journal of Engineering, Business and Enterprise Applications*, 13(1), pp. 34-36.

Gopinath, R., Akella, V., Bhanumurthy, P.R. (2014). In uence of Bengaluru (India)'s Canyon Geometry on the Intra-Urban Ambient Air Temperature. *Scientific Herald of the Voronezh State University of Architecture and Civil Engineering*, 23(3), pp. 40–50.

Marciotto, E., Oliveira, A.,Hanna, S. (2010). Modeling Study of the Aspect Ratio in uence on Urban Canopy Energy Fluxes with a Modi ed Wall Canyon Energy Budget Scheme. *Building and Environment*, 45(11), pp. 2497–2505. DOI: 10.1016/j.buildenv.2010.05.012

Nicholson, S.E. (1967). A Pollution Model for Street-Level Air. *Atmospheric Environment*, 9, pp.19–31. DOI: 10.1016/0004-6981(75)90051-7

Oke, T.R. (1981). Canyon Geometry and the Nocturnal Urban Heat Island: Comparison of Scale Model and Field Observations, International journal of Climatology, 1 (3), pp. 237–254. DOI: 10.1002/joc.3370010304

Oke, T.R. (1988a). Street Design and Urban Canopy Layer Climate. *Energy and Buildings*, 11(1-3), pp. 103–113. DOI: 10.1016/0378-7788(88)90026-6

Oke, T.R. (1988b). The Urban Energy Balance. *Progress in Physical Geography*, 2(4), pp. 471–508. DOI: 10.1177/030913338801200401

Steyn, D.G. (1980). The Calculation of View Factors from Fish-Eye Lens Photographs. *Atmosphere-Ocean*, 18 (3), pp. 254–258. DOI: 10.1080/07055900.1980.9649091

Yamashita, S., Sekine, K., Shoda, M., Yamashita, K., Hara, Y. (1967). Studies on Relationships between Heat Island and Sky View Factor in the Cities of Tama River Basin, Japan. *Atmospheric Environment*, 20(4), pp. 681–686. DOI: 10.1016/0004-6981(86)90182-4

DESIGNING URBAN DESIGN

TOWARDS A HOLISTIC PERSPECTIVE

METUDSYMP2016
PROCEEDINGS

Orta Doğu Teknik Üniversitesi
Mimarlık Fakültesi,
Dumlupınar Bulvarı, 06800,
Ankara/Türkiye

tel : +90 312 210 2202
faks : +90 312 210 2297

Yayın Türü:
Yayın Kurulu Kararı:
Yayın Kurulu:
Derleyenler: Dr. Olgu Çalışkan, Eren Efeoğlu
Kapak Tasarımı: Eren Efeoğlu
Sayfa Düzeni: Eren Efeoğlu

ODTÜ Basım İşliği, 2017

ISBN:

CONTENTS

SOCIO-POLITICAL IMAGININGS OF THE KOLKOTA MAIDAN

Shreyasi Pal
BMS School of Architecture, Bangalore, INDIA
shreyasi.bmssa@gmail.com

Figure 1. Kolkata maidan as a popular public open space appropriated by people from all walks of life (Source: Rangan Datta under CC 4.0)

1. TRANSFORMATION OF THE KOLKATA MAIDAN

To the ordinary citizen of Kolkata the maidan also goes by the name gorher maath, what roughly translates as the fort grounds. Fort William was erected as a British defense stronghold about two centuries ago and now stations the Eastern Zone High Command of the Indian Army. The maidan today is a welcome expanse of green in a bursting megalopolis with a profusion of activities like fairs, sports and recreational clubs, landscaped gardens and dotted with various commemorative statues, minars, the Eden Gardens Cricket stadium and even the grandiose Victoria Memorial Hall. Much akin to the ideas generally associated with the word maidan today, which brings to mind Kiev Maidan square or Cairo's Maidan Al-Tahir, the Calcutta maidan has been and still is a common site for political gatherings, protests and demonstrations.

Though originally an Eastern spatial typology, the colonial rulers applied the spatial device of a maidan as a segregating open space to propagate their sovereignty in foreign soil. Historiography of urban public space in India indicates complex overriding of the concepts of private, civic and public in the indigenous subconscious. In the years leading up to the struggle for independence, the Enlightened middleclass, first through a spiritual domain and then as a political activity, constructed the idea of Indian nationalism amidst the heterogeneous colonial subjects of the subcontinent. The colonial introduction of a (spatially signified) public domain became instrumental to that process as the prerequisite for large-scale political gathering was a urban public place like the Calcutta maidan.

The presence of the iconic Maidan in the lives and imaginations of ordinary citizens brings forth the question of how has the city- the citizens and the State- re-imagined and appropriated the Maidan over the years as its socio-political role evolved. In parallel situations of other British colonies e.g. the padang in Singapore, we see considerable redefinition through architectural re-articulation which consciously undermine the erstwhile colonial hegemonic spatial expression. The paper would trace the tendencies to which the Calcutta has limited herself in re-imagining this heterogeneous space as a socio-political arena.

2. THE ARCHITECTURAL DELINEATION OF THE MAIDAN LIMITS

The maidan as a former centre-piece of British spatial expression of authority is appropriated by diverse uses but the edges can be read as a built record of the city's tryst with colonial rule for two hundred years. Evolving from a strictly Palladian palette to a more accommodating Imperial Indo-Saracenic, the continuity of colonial vocabulary is only rarely broken by modern buildings.

Figure 2. Map of Old Calcutta by Simon Winchester (Morris 2005)

The few concrete high-rises that break the monotony could be credited to the modernist zeal of early decades of independence e.g. the Chatterjee International Center (24 floors) built in 1976. Slowly catching up with neo-liberalist tendencies the maidan is now a part of a grand Kolkata riverfront urban design scheme which aims to 'recreate London'. One of the newer additions to the maidan skyline is the 42, located between the Tata Centre and the Jeevan Sudha buildings in Chowringhee, still under construction.

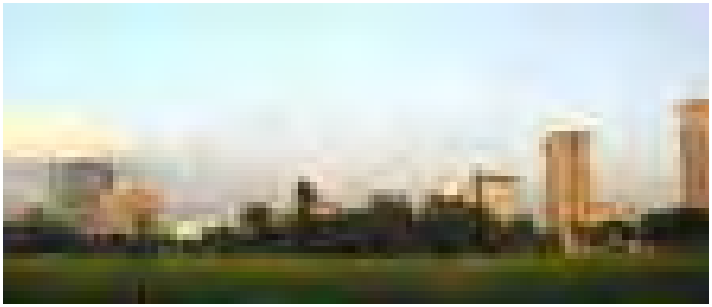


Figure 3. Chowringhee (formerly Esplanade), public domain

The southern limits are marked by the extensive site of the marble-clad Victoria Memorial- the indo-saracenic British answer to the Mughal Taj Mahal, connected axially to the east with the neo-Gothic St. John's cathedral.. On the east running from Esplanade in the North to the cultural complex zone in the South is the Chowringhee promenade with arcades, Art-Deco cinema houses, museums, hotels, commercial and cultural centres. To the north are the Raj Bhavan (former Viceroy's house) and BBD Bagh (formerly Dalhousie Square) with the Mohakoron or seat of Government (formerly Writers' building, St John's church, St. Andrew's church- as vestiges of the European town. The western edge is marked by commercial houses along Strand road. Also to the north is the famous Eden Garden stadium- where the British game of cricket was first introduced in the subcontinent, only to be popularly consumed in epic ways later.

3. THE ALIEN IDEA OF A CIVIC OPEN SPACE

The introduction of the Western notions of public civic space in India as part of colonial-rule induced modernization process must be discussed with the idea of modernity as a heterogeneous negotiated experience, moving away from a Euro-American centric narrative. To deliberate on the concept of the public, I refer to Sudipto Kaviraj's article dealing with spatial concepts in Calcutta.

The standardized and orderly colonial city posed a conceptual anti-thesis to the countryside and even the pre-colonial Indian cities. Kaviraj has located the origins of the Western concept of public space in the eighteenth century in a capitalist-democratic context to mean commons with associations like universal access and openness (Kaviraj, 1997). William J Glover talks about the idea of public space as a municipally owned urban land as well as a domain of political engagement (Glover, 2007). Legal coding of public and private properties was the outcome of sustained urbanization in Europe, supervised by municipal institutions, which also in turn regulated public life, codifying and protecting variable

rights, thus engendering eventually a contested domain. The same was applied to the European colonies in due course and thus gained world-wide prevalence.

The idea of rights in the Indian context was a complex socio-cultural phenomenon based more on one's social position, caste and birth than the homogenous and identity-less ideas of universal right. However socially-agreed concepts of commons and even of common responsibilities existed but, to quote Kaviraj, did not share characteristics like a recognizable source, proper authorization, impersonality, legality, state sanction,. . ., nor did it carry the no less crucial negative feature of being distinguished from private (Kaviraj, 1997). The idea of universality is particularly crucial in its absence as access and rights were encoded in strictly discriminatory social norms.

Through constant surveillance or intervention, the colonial administration had, through a system of sign-s and signifiers, constructed both a physical and conceptual realm where, as Kaviraj puts it, distinctly 'Weberian intelligence acting through the agencies of the State, kept the rules, governed conduct and imposed restrictions, without which the minimal precarious order of modern life threatened to dissolve into chaos' (Kaviraj, 1997). Elaborating on this distinction here is important as conceptually, the colonial city, and particularly the maidan as a spatial boundary, held a disciplinary role in the minds of the indigenes. This restricted-access open space was then a site of reinforcement of the conceptual distinction between the two ends of the power relation. The maidan space was heterotopic - a tool for the power structures to exert authority.

Figure 4. The maidan crisscrossed by wide avenues with Shahid Minar (formerly Ochterlony Monument) in the background (Source: Morris 2005)

The Device of Representation

Pre-colonial urban commons or spaces were not necessarily distinct physically, though possibly resembling in parts the chaos of medieval European cities. But the codification of legality and rights in the colonial civic spaces put into sharp focus the comparative informality of the native urban space counterparts- deemed, as Glover says, indicative of a faulty society 'lacking in civic spirit' (Glover, 2007). This deliberate attempt to not draw parallels between Indian and European spaces has been discussed by Swati Chattopadhyay as the colonial uncanny. She says that the representations of Calcutta at this juncture bears traces of anxiety generated by slippage between desire and experience, the Freudian repression of likeness, familiarity that may not be acknowledged, that marked the passage from picturesque paintings to health maps (Chattopadhyay, 2005).

The Western (Hegelian) conviction that the Indian worldview was enamoured with myths and imaginations as compared to a Western objective viewpoint, Chattopadhay says, prompted a specific way of depiction of colonial landscapes. The Company and privately commissioned paintings and later photographs often reinforced the (orientalist) idea of the other. The maidan with the neo-classical facades, even as incorrect imitations, was an image constructed as a contrast- a civilizing presence- amidst the 'pathological native world of disease, wilderness and darkness' (Chattopadhyay, 2005). Or to 'innocent curious European eyes' it was comfortable disciplined familiarity putting in contrast the novelty and chaos of India. For the European visitors the first glimpse of this world was the wild uncivilized Sagar Island in the Gangetic delta which gave way for the reassuring view of the Calcutta port and Western architecture lining the maidan along the Hooghly. The native squalors, not picturesque as an aesthetic category, were kept well hidden from the European experience as well as representational documentation. The maidan lined with the fine buildings was the extent of the European imagination. To paraphrase Chattopadhyay here, to early European visitors, the white town was the maidan surroundings while the black town was 'seemingly situated somewhere beyond', though socio-economic interdependencies prevented actual insularities.

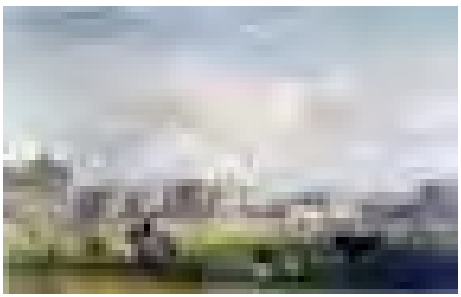


Figure 5. Hand-coloured lithograph of Esplanade Row from maidan by William Wood in 1829 (Source: under public domain from hindoostanrevisited.com)

4. THE RISE OF NATIONALISM AND THE IDEA OF PUBLIC SPHERE

The idea of a modern public sphere losing a politically critical agency to that of passive consumption is contested by Appadurai. Complex power and knowledge relationships in the postcolonial site of India, he asserts, generates a (petty) bourgeoisie public sphere still genders public discussions as consumers are not 'merely objects and recipients but actors and agents' (Appadurai and Breckenridge, 1995). This examination of public tendencies of appropriation of a colonial space is based on the hypothesis that, in the Indian postcolonial condition particularly, 'cultural improvisations of subaltern groups can involve resistance, co-optation and critique of commodified master forms.' In the paragraphs that follow the attempt would be to trace how a colonial spatial bequest- a symbol of Western capitalist Imperialist presence- is imagined and appropriated in popular public culture and in the process look for the experience of (postcolonial) modernity as an 'involvement of complex forms of subjectivity, agency, pleasure and embodied experience.' (Appadurai and Breckenridge, 1995)

The British introduction of Western ethos when internalised by the modernist literate Indian elites eventually generated an ambiguous modern public sphere in Indian minds. The notion that the state of colonial subjugation could be contested by rational argument or by political dissent necessitated the construction of the idea of the homogenous public. In his remarkable essay 'Is There an Indian Way of Thinking?' Ramanujan (1999) elaborates on the Indian openness to a multiplicity of possible ways of approaching a problem. The Indian way has been throughout history that of slow assimilation. The conceptual conflicts between the two ways urban spaces were conceived- the Western notion of universal access, behaviour-controlled, legally public space and the Indian notion of space being sacred or profane, with the rights to commons being socially-encoded, led to a unique negotiated modernity, as experienced by the Western educated Bengali elite. The peculiar configuration produced a discourse when the conceptual mapping of the indigenous inside/ outside was superimposed with the Western coding of public/private. The outside, tamed by civil order, Kaviraj claims, was however the perceived site of modernization- indicative of a world of freedom from orthodox restrictions.

Figure 6. A still from Aparajito (Source: www.latimes.com)

The scene in Aparajito (The Unvanquished)- the second part of Satyajit Ray's Apu Trilogy- where a young Apu, away from his family in the countryside, is struggling to find his footing in the big city of Calcutta as a young student slowly develops an emotional distance with his mother and gets his first tastes of freedom- a respite from all the struggles of his humble rural origins. In the scene he is lying with his classmate on the Hooghly banks along the maidan and daydreams. As a sign of freedom, the maidan area appears in Ray's another movie Parash Pathar, where the protagonist, who has found sudden wealth, escapes from his humble dingy abode and takes a ride in his new car through the wide avenues cutting across the green expanse of the maidan- symbolically conveying his new-found access to the recreational grounds for the relatively privileged.

Figure 7. Newspaper photograph of a predominantly Muslim crowd assembled at the foot of the Ochterlony Monument (now Shahid Minar) in Kolkata, to attend a Muslim League meeting on the Direct Action Day- 16 August 1946 (public domain)

European plazas were essentially large gathering spaces which also served as a site for the political display of State power in front of large crowds who gathered as recipients of the spectacle (Kaviraj 1997). The Mughal durbar spaces operated along similar lines of display of authority. The rise of nationalism engendered a requirement of political gatherings. The protopolitical public, then recently having gained a homogenous identity as the subjugated (as against their erstwhile heterogeneous community identity) constructed a public sphere to facilitate political dissent. The physical spatial need for this new entity was provided for in the colonial civic domain. The initial meetings held in public buildings like libraries, town halls or temples slowly escalated to large gatherings in open public spaces- the maidan being a foremost site of political demonstrations. These acts signified a 'daring inversion of spatial symbolism' (Kaviraj 1997). Kaviraj writes that 'the space around the

Ochterlony monument, meant to be a great symbol of colonial remembrance and authority, was turned into a privileged site of popular public meetings by nationalist parties.

The maidan even today would be the culminating destination of all political processions- the spectacle through which the public claim rights over civic spaces. This trend continues as the neo-liberal condition has produced what is called the political society (Chatterjee 2005) which gains access to resources using political leverage in the democratic system. The activity pattern and the appropriation of the maidan is distinctly petty bourgeoisie- the early morning strollers, the midday crowd of office-goers, the patrons of the fairs, the numerous sports clubs and recreational clubs- all indicate a middle-class appropriation- in keeping with the post-independence trends of bourgeoisie control of civic decisions. However on the days of political demonstrations the space is occupied and belongs to the under-privileged even today 'to mark some episode of defiance' as a 'spectacle of inversion' (Kaviraj 1997).

Figure 8. Maidan (Brigade Parade Ground) as a site for political gatherings (Source: www.leftgovtwb.blogspot.in)

5. AESTHETICS AND SOCIO-POLITICAL ASPIRATIONS

Girish Chandra Ghosh, in 1863, writes about the colonial city as having 'streets smooth as bowling-greens, wide, dustless and dry, where even the lampposts seem to be weekly varnished.' (Morris 2005) The middle-class, Western educated and Enlightened, nurtured a deep appreciation for the ideals of Western civilization- and particularly those of human rights, equality and democracy may have been instrumental in the construction of the Indian nationalist consciousness. Being in close contact with the colonial rulers they formed the bridge between the rulers and the ruled. The richer indigenes did in fact in most cases opt for a re-hashed neo-classical palette for their palatial mansions. From zamindar mansions to relatively modest houses in the older native town show pronounced inclination for a neo-classical façade, though the internal layouts would not necessarily be as faithful. When the colonial mercantile interests evolved into Imperialist tendencies, the elite middle-class contributed to the municipal decisions as representatives of native subjects of the Crown.

The colonial part of the city was a repertoire of neo-classical, neo-Gothic, Art Deco and later Indo-Saracenic styles. In the European worldview the disciplined urban environment 'held out the promise of reshaping the very core of society' while the neoclassical palette stood for the core principles of Western civilization. The predominance of (petty) bourgeois opinions in municipal decisions has eventually shaped our cities, as opined by Partha Chatterjee in his article 'Are our cities becoming bourgeois at last?'. Even after independence the civil servants were primarily the Western educated middle-class. Aesthetics, as Rancière puts it, is a redistribution of the sensible (Rancière 2004) and here we could be curious if it was conviction with or nostalgia for Western values that made the intelligentia celebrate the trope of Western vocabulary in the maidan area. Resistance in the post-colonial condition took the form of rapid renaming of all the familiar colonial spaces. Most of the colonial roads and spaces underwent a conscious change of name in favor of national leaders of the independence struggle, fueled by nationalist zeal in the years that followed independence. However even seventy years after independence in the public memory the spaces around maidan continue to be identified by both sets of names.

With the underprivileged masses emerging as a political class a demand continues to be made on the State for allocation of resources. Registering insubordination by the underprivileged through occupying a contested public space, is according to Kaviraj, an act of token resistance against a condition of inequality. The neoliberal State throughout the world, to lure in capita, has to promote a (Western) image of efficiency. The initiatives to clean-up of the image of Kolkata could be read as

similar attempts.

Recreating London

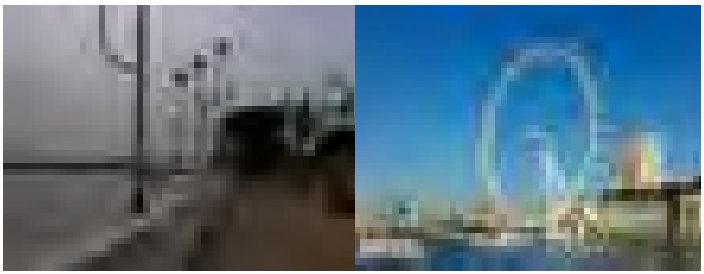


Figure 9. (left) The paved promenade of Millenium park- a part of the ongoing Hooghly Riverfront project; (right) Thames riverfront with the London Eye. [by Amartyabag (left) under CC BY 3.0 and Kalaha (right) underCreative CommonsAttribution-Share Alike 1.0 Generic]

The State promotes today the notion of recreating London in contemporary Kolkata. The scheme incorporates introduction of prominent visual signs including recreation of the London Eye on Hooghly riverbanks and other features of the Thames riverfront development.

The idea of public space universally is a contested domain with multiple claims to scare resources. The poor appropriate every vestige of public land ranging from roads, footpaths to vacant lots as a desperate measure for living and livelihood- read here as a resistance and political negotiation. Kaviraj claims that the notion that Calcutta could turn into London is an 'increasingly untenable narrative' as the ground conditions are of a negotiated experience. Realization of a Euro-centric aesthetic in an urban scale presupposes wide-spread awareness and acceptance of Western concepts of civic, public and private realms. In our context even if we consider aspirational aesthetics, the tendency is to generate juxtapositions and hybrid aesthetics (Pal, 2016). The iconic maidan, with the current timid steps of introducing new high-rises, along with the pre-existing modernist concrete buildings, European revivalist architecture etc is a repository of images of the city's eventful past and hybrid present – the 'heterogenous temporalities' that signify our condition of modernity. Dipesh Chakroborty describes our present epistemology as 'everywhere at every historical moment from the past up to now' (Chakrabarty, 2000). As designers of built environment we could be speculative and optimistic about this condition where the challenge would be to respond to and create architectural aesthetics true to all our simultaneous notions, allegiances and aspirations.

REFERENCES:

Appadurai. A (1996). Modernity At Large: Cultural Dimensions of Globalization (Public Worlds. Vol. 1). University of Minnesota Press.

Appadurai. A and Breckenridge. CA (1995). 'Public Modernity in India'. in Consuming Modernity: Public Culture in a South Asian World. U of Minnesota Press. Minneapolis.

Chakrabarty. D (2000). Provincializing Europe: Post colonial thought and historical difference. Princeton University Press. Princeton.

Chatterjee. P (2005). Politics of the Governed. The: Reflections on Popular Politics in Most of the World. Orient BlackSwan Pvt. Ltd.

Chattopadhyay. S (2005). Representing Calcutta: Modernity. Nationalism. and the Colonial Uncanny. Psychology Press.

Kaviraj. S (1997). 'Filth and the Public Sphere: Concepts and Practices about Space in Calcutta'. Public Culture. pp. 83-113.

Morris. J (2005). Stones of Empire. Oxford University Press. New York.

Pal. S (2016). 'Politics of Urbanscape: Transfiguring the Image of Kolkata'. International Conference on Emerging Trends in Engineering. Science and Technology (ICETEST - 2015). Elsevier.

Ramanujan. AK (1999). 'Is there an Indian Way of Thinking? An Informal Essay'. in V Dharwadker (ed.). The Collected Essays of A. K. Ramanujan. Oxford University Press. New Delhi.

Rancière. J (2004). The Politics of Aesthetics. Continuum International Publishing. London.

Policies and its Implication on the Urban form TDR and Premium FAR— *Mangalore as A Case Study*

Seema Anil
Associate Professor, BMS School of Architecture
E-mail: seemaanil2005@gmail.com

ABSTRACT

Land is the most important component for all infrastructure related development works in urban areas and land acquisition is the major constraint due to the high land cost. Development Rights (D.R) is proposed as an alternate option for land acquisition wherever land parcels are required for any public purpose. Hence, D.R should be more attractive to the land owner rather than getting compensation from the government.

"Transferable Development rights" (TDR) are development rights originating at the plot where the land is surrendered for any public purpose, which are transferable to any other eligible property within the urban area. The provision of DR/TDR is prescribed in Section 148 of KTCP Act 1961 and rules therein.

The objectives of the study involved a thorough understanding of TDR and Premium FAR, its intent and impact on different cities in India. Specific to Mangalore, the intent of these policies and with reference to the changes in Zonal Regulations 1992 and 2011 accentuated its impact on to the urban form. A thorough study on the impact of these regulations on the urban form was carried out with respect to the road width, plot sizes, FAR, contour/landform, density and zoning. To develop an understanding on the relationship of Master Plan proposals and these above mentioned regulations.

A pattern of development was noticed along the streets widened and in the residential neighborhoods and per urban areas. Most representative sample was chosen for a detailed investigation. It was observed that due to the emergence of the new high-rises there is a lack of coherence in the resulting urban form of the neighborhood and the experiential quality of streets. The intent of the paper is to propose possible solutions to enhance the experiential quality of the neighborhood district, ultimately resulting in the coherence in urban form.

Keywords: *Transferable Development Rights, Urban Form, Premium FAR, Development*

1. Introduction

Land is the essential component for all infrastructure development works in urban areas. Especially in case of road development, the cost of land of land is far more than the cost of development of the road itself.

Development Rights (DR) is proposed as an alternate option for land acquisition where lands are required for any public purpose. This can only be a voluntary option for the person surrendering land in claiming compensation from the government.

"Development Rights" is a tool for providing additional floor area in the remaining portion of land (after surrendering the required portion for road widening) i.e., additional floor area received as D.R has to be utilised in the plot where D.R is originated.

"Transferable Development Rights" is the development rights originated at the plot where the land is surrendered for any public purpose, which are transferable to any other eligible property within the urban area.

The provision of DR / TDR is prescribed in Section 148 of Karnataka Town and Country Planning Act 1961 ad rules there in. TDR is used to execute projects like road widening, conserve heritage sites/property, slums. Civic amenities like parks etc.

1.1 Relationship between TDR and Development Projects

In India cities like Bangalore, Chennai, Greater Mumbai, Mangalore, Pune, etc. have utilised the option of issuing TDR in case of different development projects as listed above.

Table 1: Intent and Impact of TDR in Different Indian Cities

	Mumbai	Bangalore	Mangalore
Intent	a Road widening and construction of new roads; b Land reserved for public purpose c Slum TDR	a Road widening b Parks, open spaces etc.	a Road widening b Parks, open spaces etc
Impact	Since the plot where development could take place had to be north of the surrendered plot, it led to congestion of the suburbs • It also led to haphazard and unplanned development in the suburbs • There was an increased the pressure on suburban infrastructure • The court in an interim order banned the use of TDR along the Eastern and Western Express Highways and the Eastern and Western suburban railway tracks • On one hand it could lead to a change in Mumbai's skyline, on the other it could ensure adequate open spaces in the city. • Virtually all construction activity in the suburbs is today carried out with the aid of slum TDR, which the builder can load onto his project as additional FSI to construct extra floors. For instance, if FSI in the suburbs is restricted to 1, the developer can load another FSI of 1 on his project by buying slum TDR from the market.	• Not a successful tool. • TDR Market is not fully developed. • Citizens unwilling to give up ancestral properties • In core area huge no. of tenants are ineligible due to smaller plots. • Of proposed 83 road widening only three to four implemented through TDR process. • 467 rights issued till now, translating to develop area of 516765 m2. • Success of TDR in Bangalore is limited due to lack of information about TDR practices among DRC holders.	• Increase in the High-rises • Density is getting increased haphazardly.

2. Study Area: Location–Mangalore

Mangalore city, a prominent coastal town in Karnataka region, has gone way beyond the town once called Mangalapuram to the second fastest growing city (tier II) in Karnataka next to Bangalore. It is one of the prominent destination for education, health not only within the coast but also at state level. Mangalore's economy is dominated by the agricultural processing and port-related activities. Mangalore has a population of 484,785 per the 2011 census of India (M CC limit). The urban area has a population of 619,664 (L P A limits) while the Mangalore city metropolitan area has a population of 484,785 (2011).

Mangalore city shows a north–south direction growth, parallel to the sea coast. Ribbon type developments are common all along the transport corridors with narrow approaches from the main road to interior development. The old town is thickly built The growth of the city, has a special character, guided by the topography. The topography is undulating with hillocks with steep terrain and natural drain pattern towards the two main rivers, namely Gurupura and Netravathi.

The circulation has followed the ridges and developments have occurred all along, ribbon type, with isolated thick developments depending upon availability of land for development. Mangalore city shows a north-south direction growth, parallel to the sea coast. Ribbon type developments are common all along the transport corridors with narrow approaches from the main road to interior development. The old town is thickly built.

Fig. 1: Mangalore City Map

The areas of study included, the economic hub–Hampankatta, the coastal areas of Bengre, Bunderport, Boloorand sultan Battery, The colonial planned layout of MG road, the developments along the coastal town of Thaneerbavietc.

Few of the streets already widened were chosen to undertake a detailed study like Mangladevi-Pandeshwar road, Hampankatta to PVS Circle, Pump well to Kankanady, PVS to MG Road Pabbas, Mercara Trunk road, Kulur ferry road.

3. Intent of the Study

The intent of the study is to study the city that is undergoing rapid transformation and investigate of one of the main causes that are triggering the transformation i.e., Policy. Establish the relationship between the regulations and the resultant Urban form.

The scope of the study involves proposing a suitable urban design strategy that would address the issues based on in depth understanding and analysis of the city.

4. Establish the Ground for the Study

4.1 Intent of Premium FAR

Premium FAR means additional F.A.R permitted by collecting additional fees as prescribed in the Zonal Regulations of Mangalore 2011.

The amount collected while providing premium FAR shall be used exclusively for the widening of the particular road and thereafter for other road widening works

4.2 Acceptance of TDR in Mangalore

Initially there were issues in its acceptance at different levels from even politicians, Bureaucrats, citizens etc. For the total property surrendered till date TDR issued and TDR utilised indicates its success. Initially there has been cases where people opted out for compensation over TDR and once again opted back for TDR having realised its advantages.

5. Methodology of the Study

A detailed investigation on the impact of TDR and Premium FAR on the urban form was carried out with respect to the master plan proposals, road width, plot sizes, FAR, contour/landform, density and zoning. To develop an understanding on the relationship of Master Plan proposals and these above mentioned regulations.

Table 2: Comparison of Zonal Regulations 2021 and 1992 of Mangalore

Sl. No	Parameter	Zonal Regulations of Revised Master Plan-II (2021) of Mangalore	Zonal Regulations of Master Plan-II (1992) of Mangalore
1	Permissible FAR	It depends on the existing and proposed road widths. 2.5 Maximum–for 24m wide road	3.0 but exempted areas were less
2	Exemptions for FAR	20–25% of FAR is exempted which includes parking areas.	FAR Exempted areas were less. E.g. Open corridors, balconies, services etc. would contribute to 20% of the area.
3	Uulization of TDR and Premium FAR	T.D.R may be claimed exclusively as permitted, without claiming premium F.A.R. subject to the total FAR being limited to that prescribed in the equivalence table	To claim TDR Minimum 50% of Premium FAR should be entailed
4	Utilization of the value of Premum FAR	The amount collected while providing premium FAR shall be used exclusively for the widening of the particular road and thereafter for other road widening works.	Same.
5	How to calculate Premium FAR	Value of premium F.A.R. shall be calculated on permissible floor area @ 50% of the land cost. Land cost shall be as per the guidance value.	No such details mentioned.
6	Collection of Premium FAR	If the proposed road width is 12m or above permission for high rise residential buildings shall be permitted if the premium FAR charges contributes to atleast 50% of the cost of widening the road	No such provisions were there.
7	Road width criteria	Apartment buildings shall not be permitted on plots abutting roads of existing width less than 6m	No such details mentioned
8	Additional FAR for amalgamation of properties	Additional FAR availed by amalgamation of properties or from TDR / DR originated from the same property shall be permitted over the total FAR, subject to maximum FAR of 4, if the proposed road width is 12m and above.	No such provisions were there.

5.1 Master Plan (Revision II) 2021 Proposals

Master plan proposals for road widening suggests that almost every other road is proposed for widening. All the narrow roads were proposed to be widened to minimum 6m width keeping in mind the landform of Mangalore.

The road widened till date shows that the widening has started from the city core area, where the density is more and major connecting routes like Bajpe Airport etc

TDR issued for an area–1120.48 Sq. m

TDR certificates issued till 2013–189 nos

Premium FAR collected–49 crores (till 2013)–Unused due to ambiguity in the Zonal Regulations

It is also noticed that some of the TDR certificates were not even issued where the ownership issues were existing

Fig. 2: Master Plan Proposal Road Widening

The road widening proposals suggest that the city is expected to grow regionally towards the Surathkal, Deralkatte, Mangalore university on one side and towards the Bangalore-Mangalore highway on the other side. Lots of New township projects are projected to come along this corridor.

5.2 Plot Size Categorisation

Across the city, plot sizes were broadly considered as

1. Small size-less than 1000–3000 Sq. m
2. Medium size plots—3000–6000 Sq. m and
3. Large size plots above 6000 Sq. m

High-rises are observed in medium and large size plots. Amalgamation of smaller plots giving way to high-rises and has an advantage of Additional FAR as per the Zonal Regulations.

Fig. 3: Density/Form W.R.T. the Plot Size Variation

The pattern of volume that can come up in the different size of plots were demonstrated as seen in Fig 3.

5.3 Height and Age of the Building

Age of the building and height overlapped reflects on the High-rises are coming up in the recent years. If the same is co related with the master plan proposals suggests that the high-rises have come up on the roads proposed for widening in the Master plan.

But the reality is that the roads are not yet widened its only proposed to be widened, hence the new projects sanctioned end up increasing the density and hence puts pressure on the infrastructure.

Age of the building also reflects that changes in ZR has had a direct influence on the increasing new projects. Some of the high-rises have come up on the narrow roads too.

5.4 Zones of the City Based on the Development

The cities are classified as Intensely developed, moderately developed and sparsely developed areas to plan the growth. TDR generated in Intensely developed area is required to be used in the same zone to adhere to the growth planned. But it was noticed that the TDR generated in the intensely populated area was used in the sparsely developed/ moderately developed area too. There by putting pressure on the infrastructure in the area.

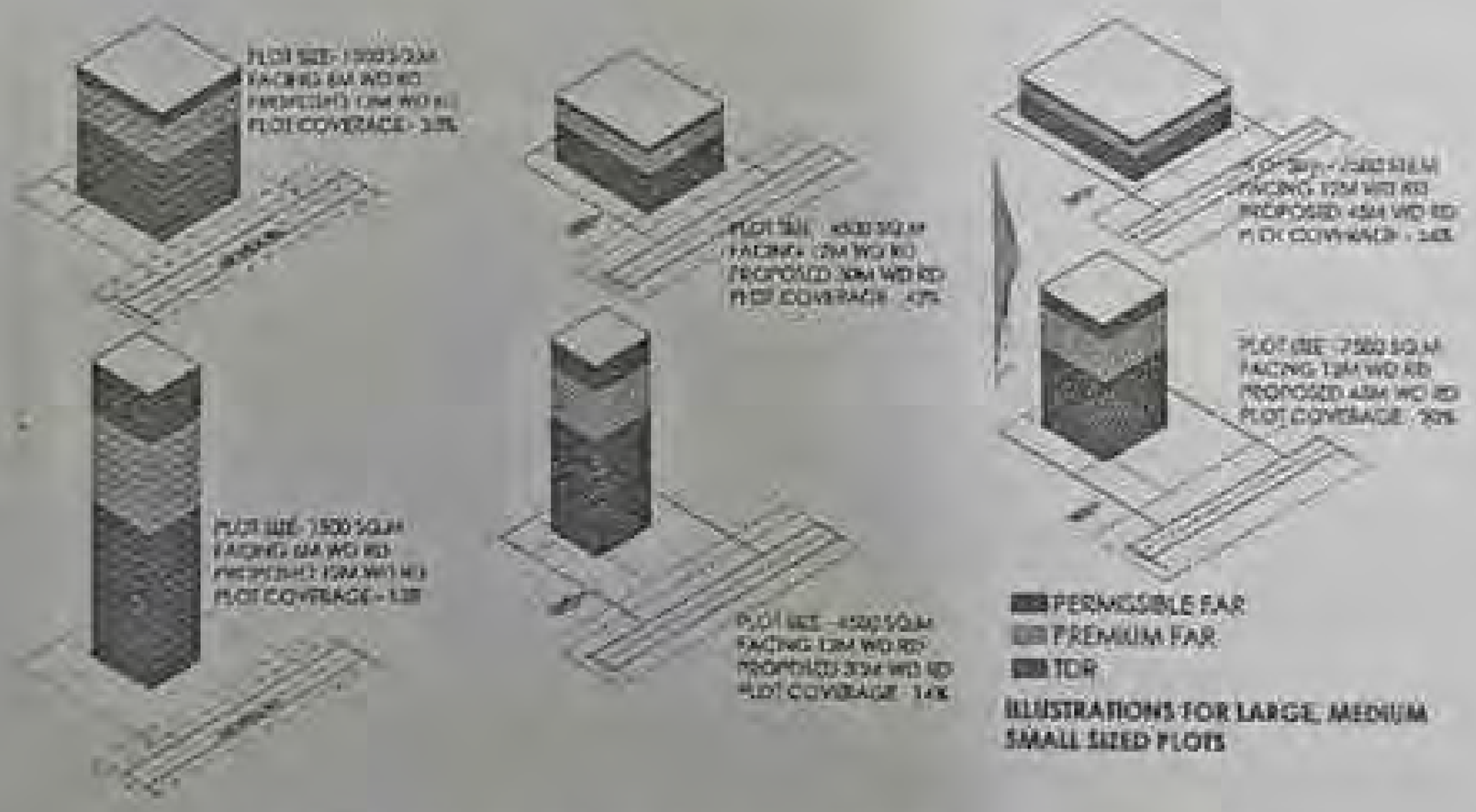


Fig. 4: Illustration of Form/Density with TDR and Premium FAR

5.5 Ward-Wise density

Ward wise density suggests there is least scope for the new projects in the intensely populated area. Though there is some scope for new projects in Zone B

Fig. 5: Zone A-B-C of the City

5.6 Upcoming Projects /Projected New High-Rises

Upcoming projects mapped indicates Zone B concentrated with more High-rises. This reflects that the scope for new projects has been dwindling even in this area.

Plot prices across indicates wherever the landform is steep, the land price is much cheaper. Coincidentally, it is along the same area where new High-rises are coming up, utilising the opportunity of lesser plot prices. This had an impact on the ecology wherein landslides are occurring in Mangalore, due to uneven settlement of the soil.

Fig. 6: Ward-Wise Density

5.7 Sending and Receiving Areas–TDR

The map showing the TDR generated areas and utilised zones indicates disparity. The TDR generated in Zone A is actually supposed to be used in the same zone, but here it has been haphazardly used in even sparsely developed area too Having a direct impact on the infrastructure in that area

Fig. 7: TDR Generated and Received Areas Mapped

Fig. 7: Projects and Land Prices Mapped

6. Issues and proposed Strategies

Table 3: Issues and Proposed Strategies

Parameters	Issues identified through the study	Proposed Strategies which can be developed further
Master Plan Proposals	It was identified that roads proposed for widening are unscientific, since almost all the roads are proposed. It doesn't even take into account the aspect of landform of Mangalore.	Roads proposed for widening should be only considered based on the landform and the density of the zone.
Plot Size Categorisation	It was noticed that due to the incentives mentioned in the Table 2 for amalgamation of properties the density is getting increased haphazardly posing a threat on the infrastructure.	There should be a scientific approach to approve the amalgamation of properties based on the road width and the zone.
Height and Age of the Building	It was every evident as per the Table 2 that the changes in Zonal Regulations has a direct impact on the Newer High-rises. Also based on the Master plan proposals for road widening High rises are coming up on the road which are yet to be widened. Since the FAR calculation is based on the Proposed road width. Also because of the adding up of TDR and premium FAR as seen in Fig. 4.	High-rises should only be approved on the roads which are already widened based on the Master plan proposals. The infrastructure of the area where the High-rises are coming up has to be updated prior to the approval.

Table 3 (Contd.)

Areas of the City	It was noticed that the High-rises are coming up haphazardly in all the zones, even in the sparsely developed areas, which do not have the holding capacity for infrastructure	Based on the Zones classification, the approval should be given for growth only in intensely developed and moderately developed area. Since it has sufficient infrastructure
Ward Wise Density	It was witnessed that there is only scope for newer projects in Moderately developed area.	The growth pattern should follow the Development zones prescribed by the Master Plan
Projected New High-Rises	The High-rises are coming up in huge nos and noticed specifically in the areas with steeper landform since the land price is low over there	Landform has to be considered ecologically sensitive to Mangalore as it is giving rise to Landslides and the steeper areas to be zoned under restricted areas for building
Sending and Receiving Areas of TDR	It was evident that the TDR generated in one zone was utilised in some other zone	It should be clearly stated in the policies that the TDR generated in Zone A should be utilised in the same Zone it should be restricted to the Zone B in difficult circumstances.

7. Conclusion

The Policies like TDR and Premium FAR should be utilised as a policy instrument only for the execution of development projects. The Experiential quality of the neighbourhood lost due to the haphazard growth of new High-rises can be resolved by proposing Perimeter block for the Urban block which would in turn act like edge to the neighbourhood and retains the essence of the urban block internally.

References

[1] Master Plan (Revision II) 2021, Final, Mangalore.
[2] Zoning Regulations of Mangalore 1992
[3] Zoning Regulations of Mangalore 2009
[4] Zoning Regulations of Mangalore 2011
[5] Mangalore—The Fading and Emerging Identity. RVCA Report – 2012 batch
[6] Mangalore needs Transfer of Development Rights (TDR) Scheme' Palemar. Mangalore Today News Network, 7 September.
[7] Maps of Mangalore, Date of access: 1/6/2018.
https://www.google.co.in/search?biw=1517&bih=735&tbm=isch&sa=1&ei=_I8RW7C7D5r6rQHIra24Bw&q=mangalore+map&oq=mangalore+map&gs_l=img.3..0l5j0i5i30k1l2j0i8i30k1l3.27584.28733.0.29124.4.4.0.0.0.0.133.479.0j4.4.0....0...1c.1.64.img..0.4.478...0i67k1.0.KZGp-zI_IWg#imgrc=A7L20ZczeDwbbM
[8] Jadeep Shenoy (2011). TDR certificates valid and relevant: Minister The Times of India, May 31.

REVA UNIVERSITY

Bengaluru, India

BETWEEN THE LINES

CONFERENCE PROCEEDINGS

INTERNATIONAL CONFERENCE ON ARCHITECTURE AND URBAN PLANNING

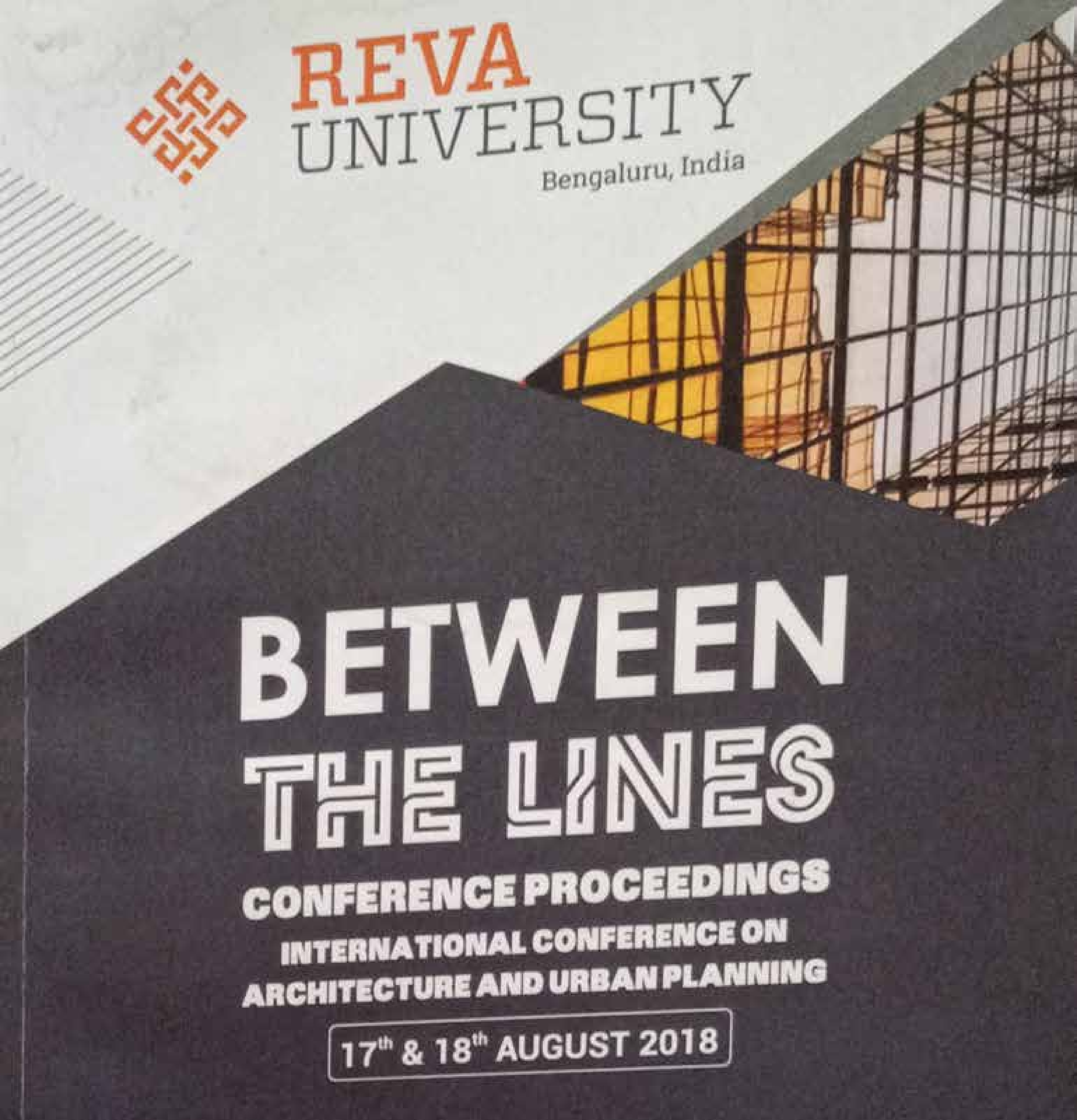
17th & 18th AUGUST 2018

Organized by

School of Architecture

REVA UNIVERSITY

Bengaluru, India



BETWEEN THE LINES

CONFERENCE PROCEEDINGS

INTERNATIONAL CONFERENCE ON ARCHITECTURE AND URBAN PLANNING

17th & 18th AUGUST 2018

Organized by

School of Architecture

www.reva.edu.in

Between the Lines

Conference Proceedings

International Conference on Architecture and Urban Planning
17th & 18th August 2018

First Impression: August 2018

International Conference "Between the Lines" on Architecture and Urban Planning

ISBN: 978-93-86724-97-7

DISCLAIMER

The authors are solely responsible for the contents of the papers compiled in this volume. The publishers or editors do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

Published by
EXCEL INDIA PUBLISHERS
91 A, Ground Floor
Pratik Market, Munirka, New Delhi–110 067
Tel: +91-11-2671 1755/ 2755/ 3755/ 5755
Cell: 9899127755, 9999609755, 9910757755
Fax: +91-11-2671 6755
E-mail: publishing@groupexcelindia.com
Web: www.groupexcelindia.com

Typeset by
Excel Prepress Services, New Delhi–110 067
E-mail: production@groupexcelindia.com

Printed by
Excel Printing Universe, New Delhi–110 067
E-mail: printing@groupexcelindia.com

TRACK 4: Reimagining Cities

Impact of Mixed Use in Townships— Case Study Bengaluru

Supritha M.Y
Assistant Professor BMS School of Architecture
E-mail: suprithabmssoa@gmail.com

ABSTRACT

During the 20th century, there was a rapid increase in population and urbanization patterns in most town and cities. The population and urbanization growth rate was more than the rate of infrastructural development. This led to severe urban issues such as vehicular and population congestion, urban sprawl, slums, pollution, pressure on the available infrastructure and services, environmental and sanitation issues. Concepts like Transit Oriented Development, New Urbanism, Live able Communities, Smart Growth, Form Based Code etc. try to tackle these issues through a holistic planning for living, working, recreation and movement. Most of the Indian cities are already under tremendous pressure due to lack of land for urban expansion and traffic congestion. Therefore, mixed use development becomes a plausible solution as it encourages compact development with a much better work-home-play relationship. Mixed use in townships started developing in large numbers in the pre-liberalization cities and Bengaluru being one of them, experienced tremendous growth.

Mixed use in townships vary with area, type of mixing, densities and other features. In this research, the analysis is based on spatial impact.

Based on the analysis over the parameter, the positive and negative impacts of the mixed use in townships have been identified. The need for the planning interventions for the sustainable development of the city in terms of mixed use in townships have been detailed out in the study proposals.

Keywords: *Mixed Use, Township, Entropy, Sustainable*

1 Introduction

Throughout human history, the majority of human settlements developed as mixed-use environments. People lived in close proximity to their work. Walking was the primary way that people and goods were moved about. Mixed Use gradually declined during industrialization. Migration of people took place in large scale. Migrant workers needed to be accommodated and many new urban districts arose at this time with domestic housing being their primary function. This led to the creation of land use Zoning with specific areas being assigned to specific activities. The introduction of the private automobile, mass transit systems like bus, rail systems, highways and motorways, led to the creation of dispersed, low-density cities where people could live very long distances from their workplaces, shopping centers and entertainment districts.

1.1 Relation between Mixed Use and Impact Indicators

The relation between Mixed Use and Impact Indicators: Spatial Impact

Un Habitat: *Sustainable Neighbourhood Planning (Year: 2014)*

The article explains 5 principles of sustainable neighbourhood planning. The principles are:

- Adequate space for streets and an efficient street network 2
- High density, Mixed land use, Social mix, Limited land use specialization

In the *Principle 3: Mixed Land Use*

At least 40 per cent of the floor space is allocated for economic use in any neighbourhood. Aimed at developing a range of compatible activities and land uses close together in appropriate locations and flexible enough to adapt over time to the changing market.

The purpose of Mixed Land Use is to

- Create local jobs, promote the local economy, reduce car dependency, encourage pedestrian and cyclist traffic, reduce landscape fragmentation, provide closer public services and support mixed communities.

(Source: Gehl Institute 2010)

Social Sustainability and Mixed Land Use, Case Study of Neighbourhoods in Nagpur, India (Sarika Bahadure and Rajashree Kotharkar, 2014)

Social Sustainability: Giving equal opportunities, creating vibrant, diverse and inclusive environment and fulfill the social needs of the inhabitants.

Measurement of social sustainability currently uses simple demographic indicators as population growth, Gender ratio, Income and Health statistics.

Social benefits associated with good urban design based on mixed land use concept are:

Health, Equity and Diversity, Safety and Surveillance, Vitality, Attractiveness and Aesthetics, Employment, Interaction and Sense of Belonging, Quality of Life.

1.2 Analytical Tools for the Impact Parameters

- Spatial impact: Entropy index

Land use entropy is a measure of the variety of land uses within a given radius of a land parcel or grid block.

$$H(S) = \frac{-\sum_{i=1}^{k} [(p_i)(\ln p_i)]}{\ln k}$$

H(S) = Entropy index (Shannon index)
p_i = the area of a particular category of land use over the total area of all categories(within the scope of one district)
k = the number of land use categories in the particular district.

The entropy value lies between 0 and 1. Towards 0 indicates completely homogeneous land use and towards 1 indicate perfectly balanced among all uses.

(Source: Fairfax County Department of Planning & Zoning 2013)

2. Study Location

2.1 Location: Bangalore

Bangalore is the capital of the Indian state of Karnataka. It has a population of about 8.42 million and a metropolitan population of about 8.52 million, making it the third most populous city and fifth most populous urban agglomeration in India. Located in southern India on the Deccan Plateau, at a height of over 900 m (3,000 ft) above sea level, Bangalore is known for its pleasant climate throughout the year. Its elevation is the highest among the major large cities of India.

Bangalore is known as the "Silicon Valley of India" because of its role as the nation's leading information technology (IT) exporter. It is home to many educational and research institutions in India. As a growing metropolitan city in a developing country, Bangalore confronts substantial pollution and other logistical and socio-economic problems. With a gross domestic product (GDP) of $83 billion, Bangalore is ranked fourth in India by overall GDP contribution, after only Mumbai, Delhi and Kolkata.

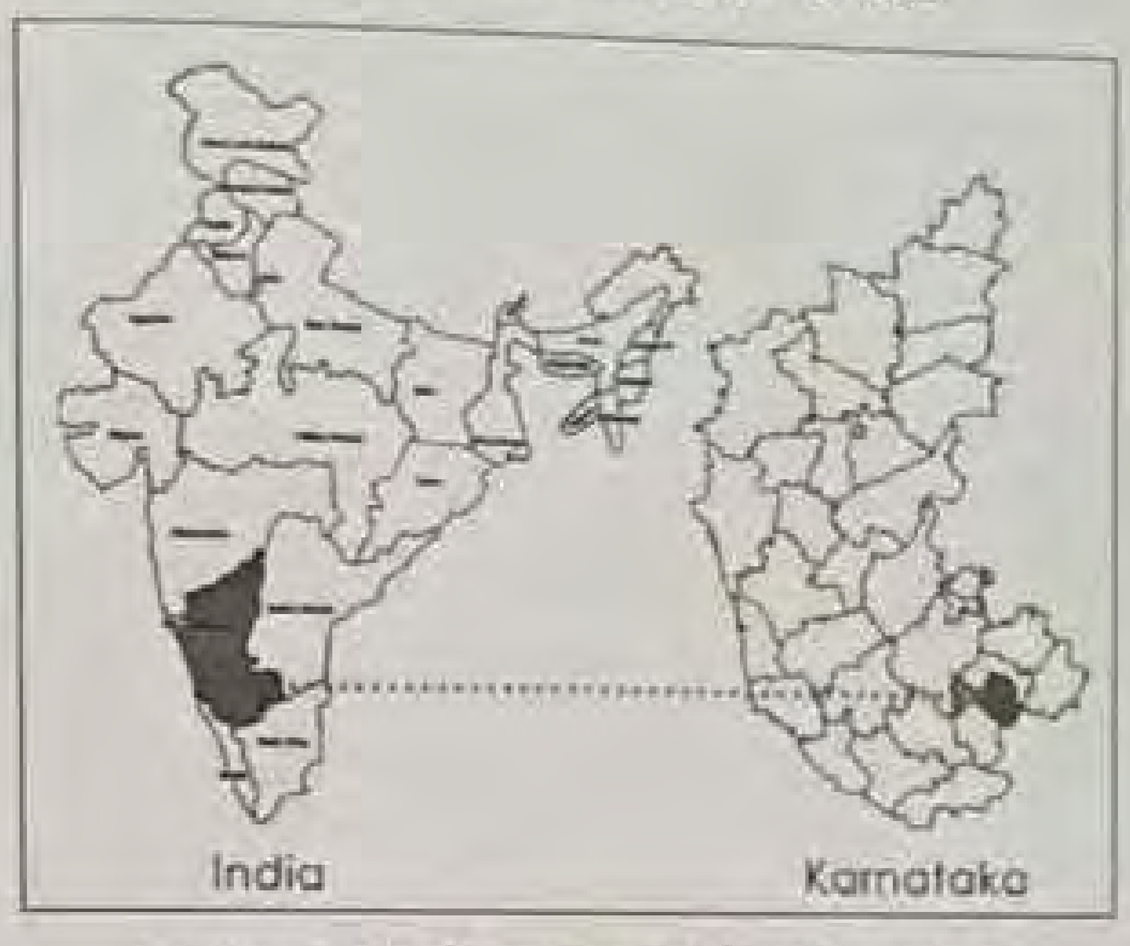


Fig. 1: Location of Bangalore in Karnataka in India

2.2 Rings, Zones and Wards of Bengaluru

The Local Planning Area is delineated into 47 planning districts, based on planning parameters.

Table 1: Ring Division of Bengaluru

1st Ring	Core area
2nd Ring	Developed urban areas surrounding the core area
3rd Ring	Urban extension areas in the city's outskirts

Source: Master Plan of Bengaluru, 2015

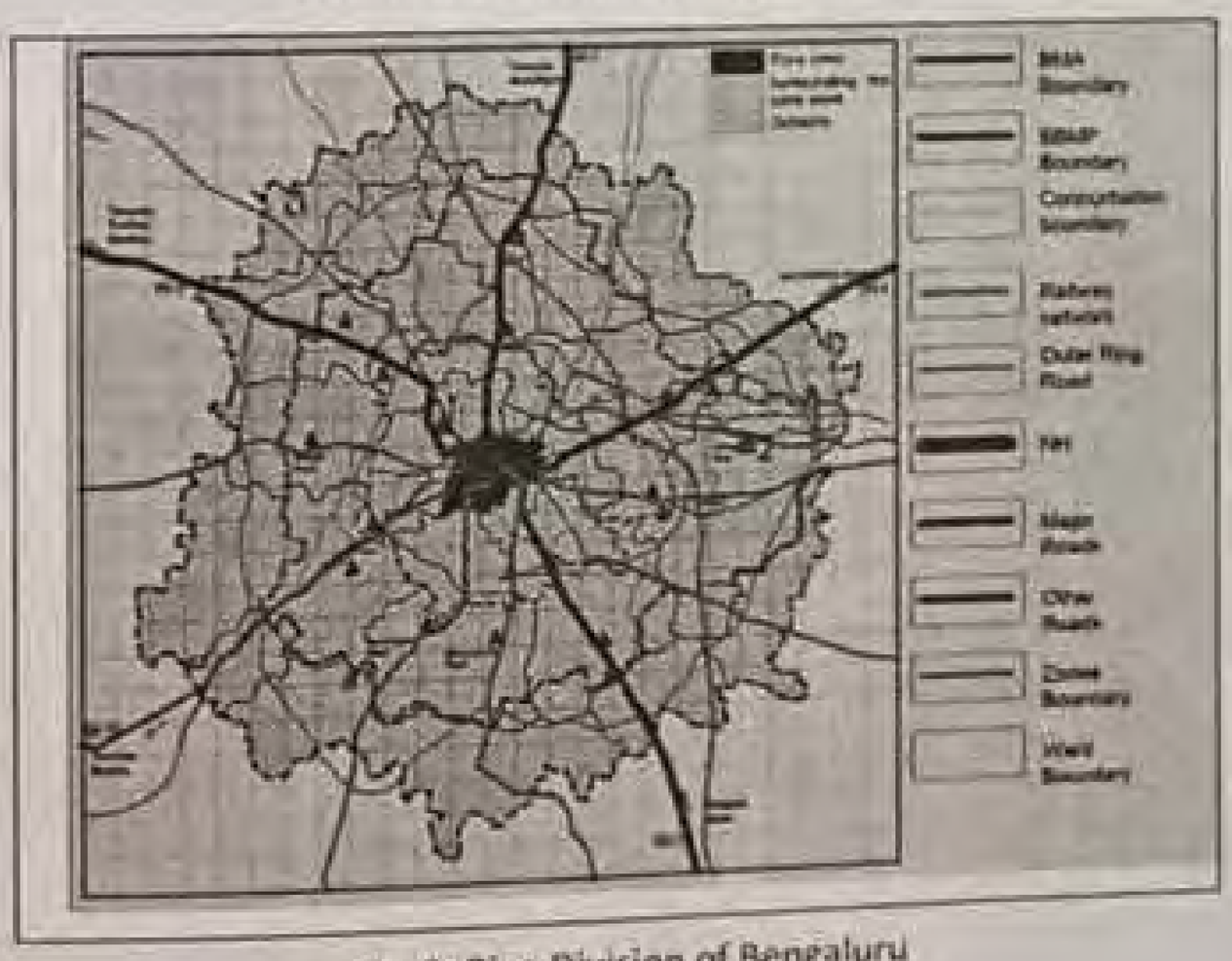


Fig. 2: Ring Division of Bengaluru

Source: Master Plan of Bengaluru, 2015

3. Case Study Areas

The two selected case study areas are located at two different locations – area surrounding the core area and outskirts. The two areas are located in different zones and wards which have varying densities and mixing of uses

3.1 Case Area 1

Brigade gateway. Case area 1 is Brigade gateway which lies in the area surrounding the core area and is ward 66. The residential population of the population case area is 5000.

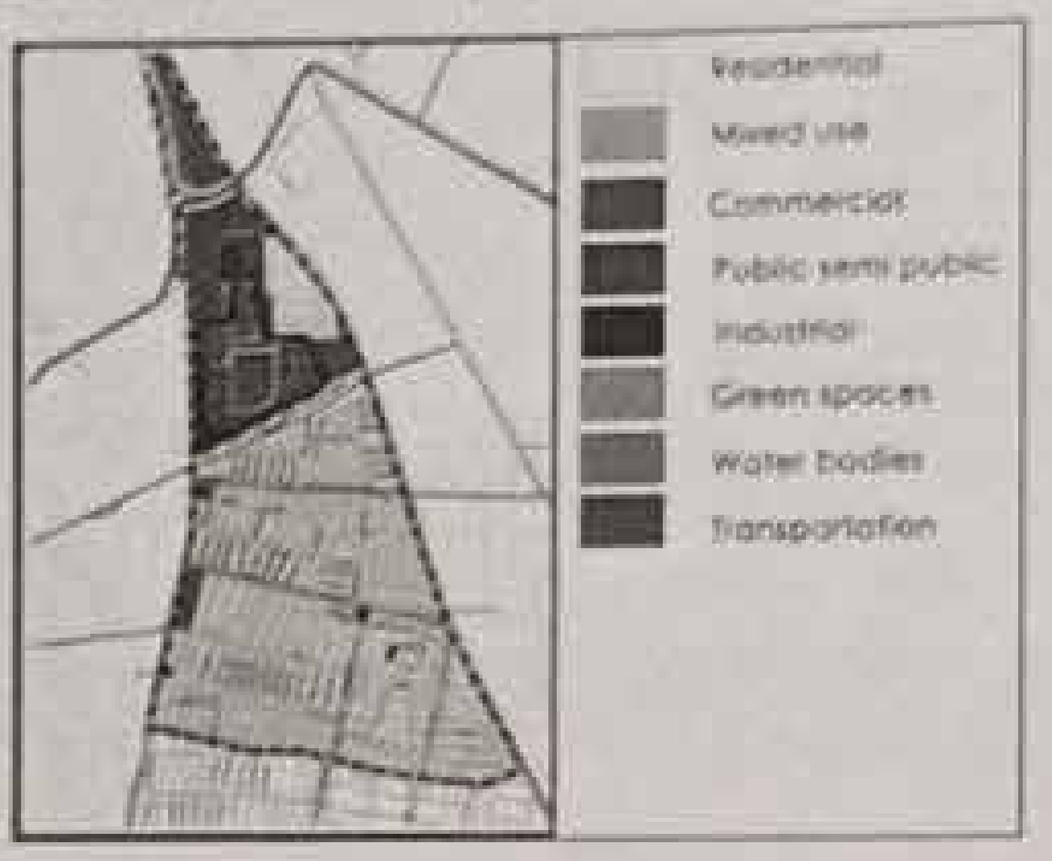


Fig. 3: Location of Case Area 1 in Ward 66

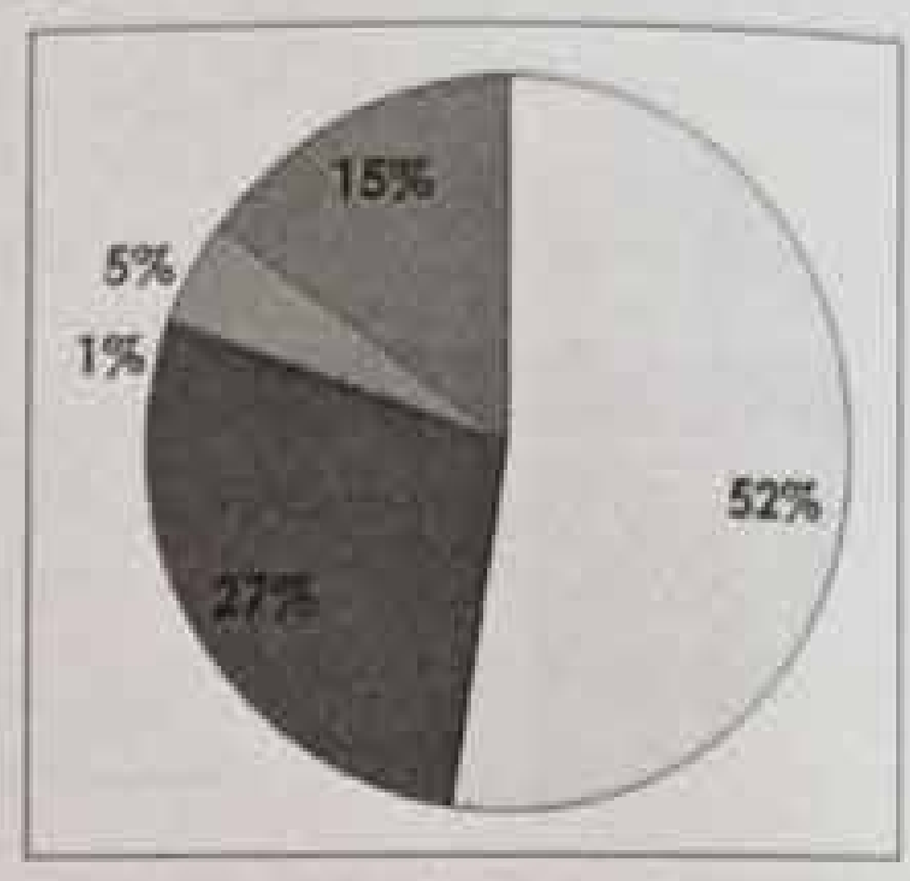


Fig. 4: Land Use Distribution of Ward 66

The township consists of different land use within the development. Namely

- residential apartments,
- commercial buildings which includes the office tower, shopping mall and the hotel,
- public semi public uses such as school and hospital and
- large space has been allocated for water body and green spaces

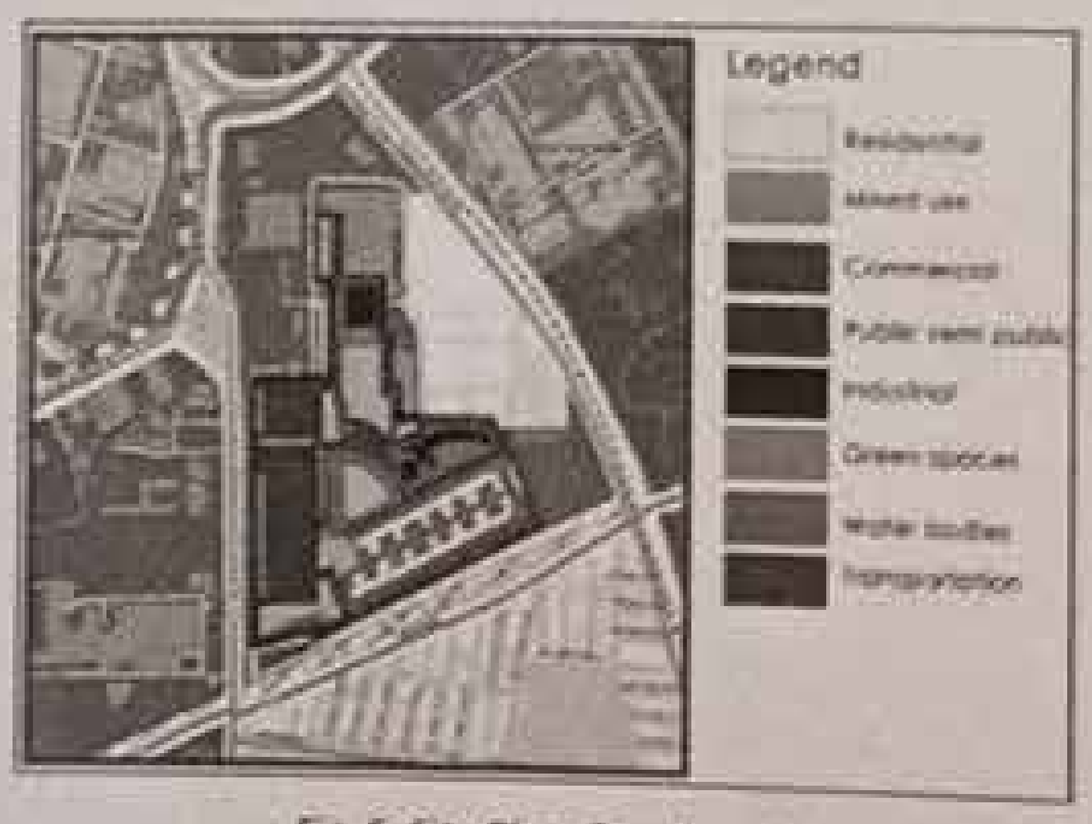


Fig. 5: Site Plan: Case Area 1

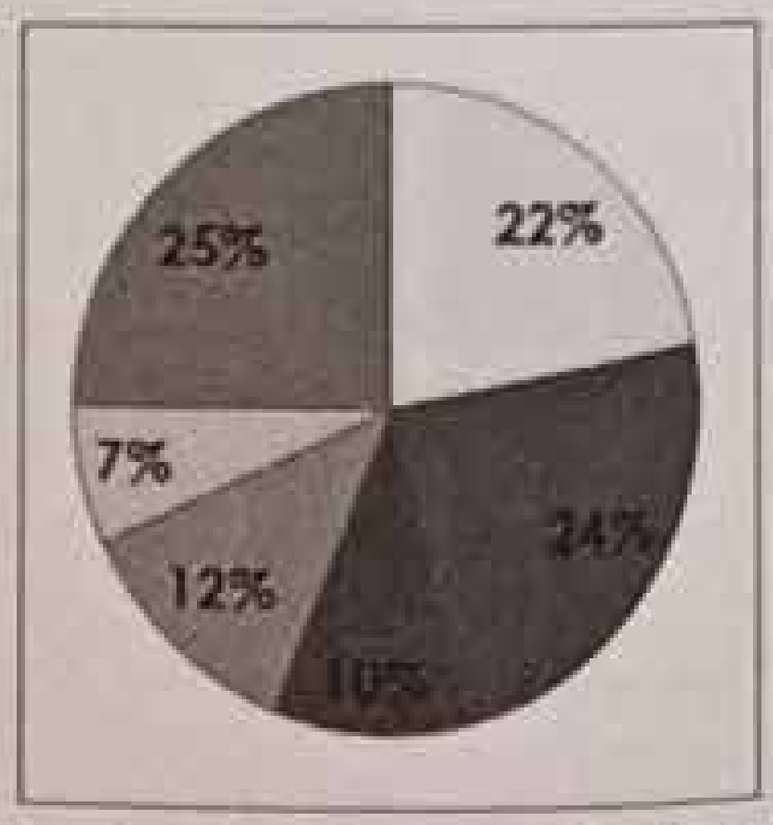


Fig. 6: Land Use Distribution of Case Area 1

Source: Brigade Gateway Sanction Lans, 2006

3.2 Case Study Area 2

3.2.1 Prestige Shantiniketan

Case area 2 lies in the outskirts and in ward 54. The residential population of the population case area is 13500

Fig. 7: Location of Case Area 2 in Ward 54

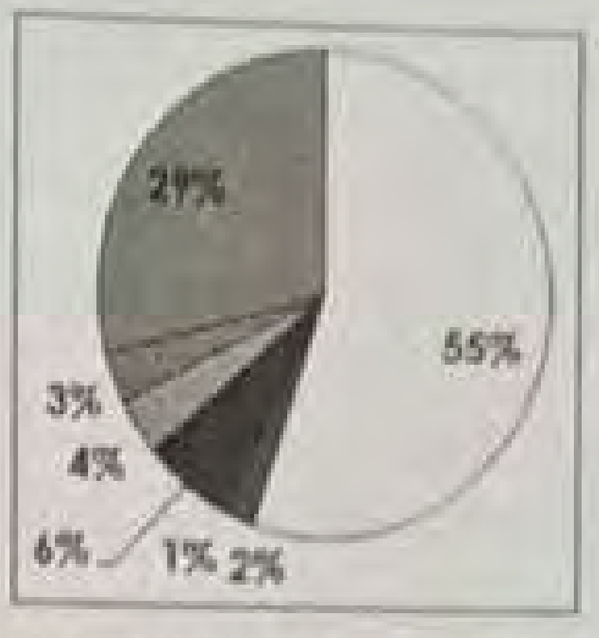


Fig. 8: Land Use Distribution of Ward 54

the township consists of different land use within the development. Namely

- residential apartments,
- commercial buildings which includes the office tower, retail shopping and the hotel,
- large space has been allocated for water body and green spaces

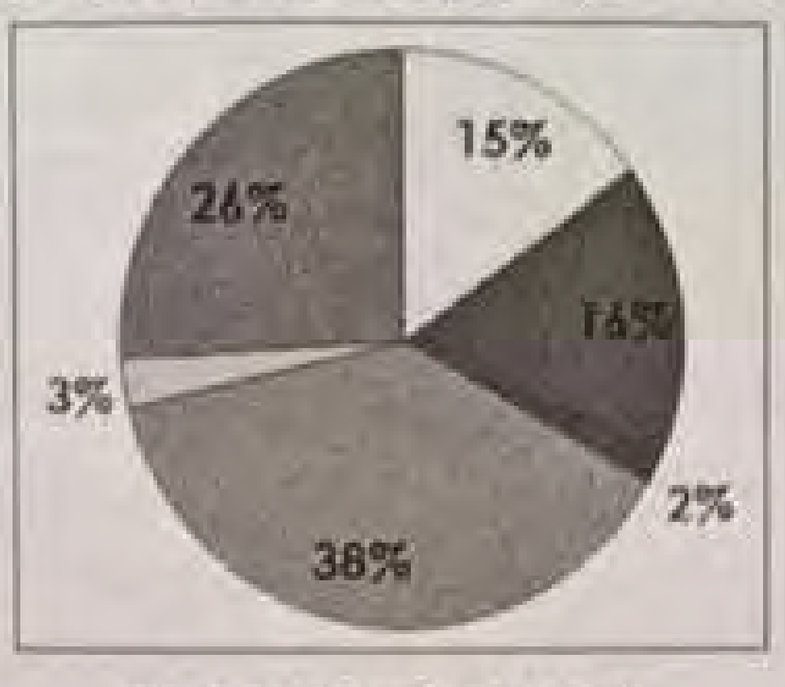


Fig. 9: Site Plan: Case Area 2

Source: Prestige Shantinikethan Sanction Plans, 2008

Fig. 10: Land Use Distribution of Case Area 2

4. Analysis

The case area analysis includes parameters which have been identified earlier—spatial impact, mobility impact; socio economic impact and social infrastructure impact. The analysis are based on the primary and secondary data collected through various surveys.

5. Spatial Impact

Spatial analysis includes the impact on land, type of mixing and degree of mixing in the townships. The analysis of both the case study areas—case study area 1 and case study 2 have been detailed out below.

5.1 Land use 2005, 2015 and 2016

Case Study Area 1

Comparison of the Land use 2005 to 2015(proposed) to the existing land use of the case area are analysed.

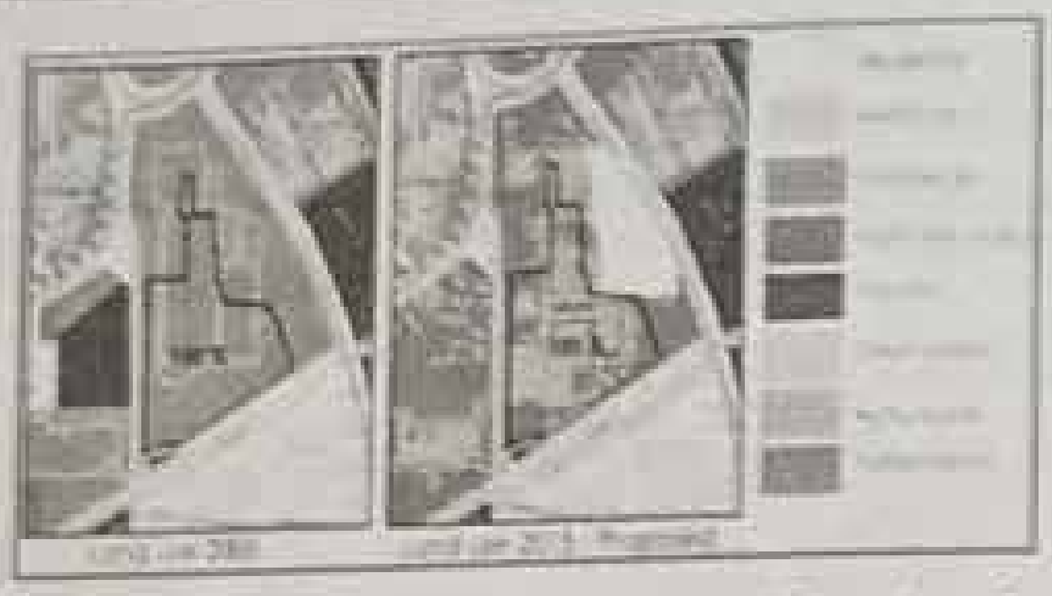


Fig. 11: Land Use 2005 and 2015 (Proposed)–Case Area 1

Source: Master Plan of Bengaluru, 2015

Majority of the industrial land has been converted to commercial land. Some of industries (soap factories) have been closed down and those land are converted to commercial.

The comparison of land use 2005 and 2015 (proposed) has been indicated in the Fig. 5.1.1.2. The land in which the township has been developed is designated has commercial land in the master plan of Bengaluru-2015. Under this land use, the permissible land uses are R, I3, T3, U4

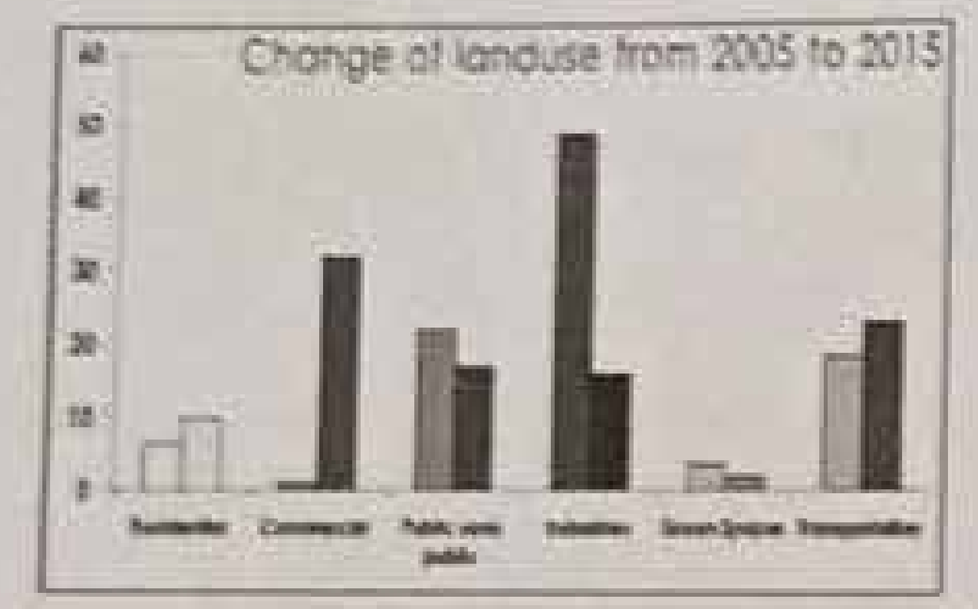


Fig. 12: Land Use 2005 and 2015 (Proposed)–Case Area 1

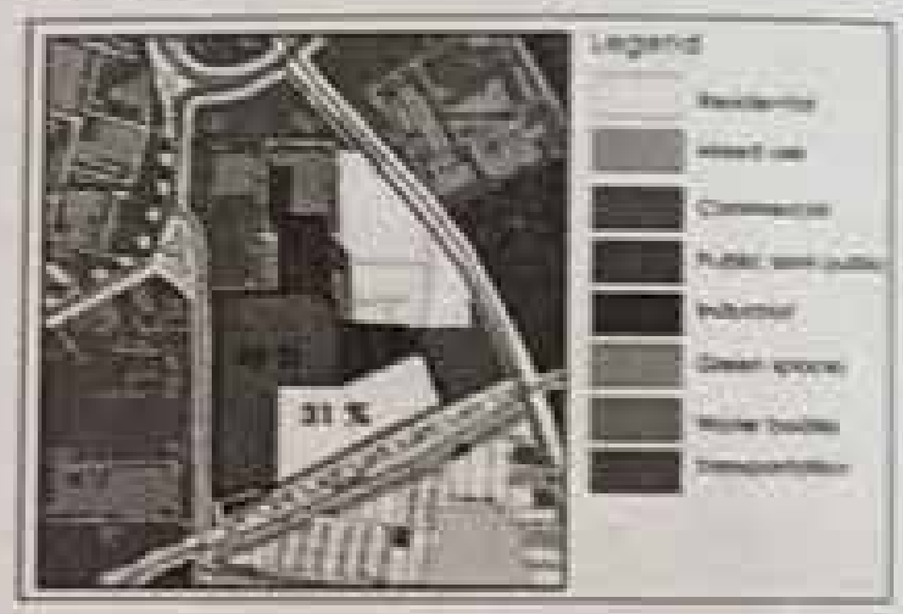


Fig. 13: Land Use 2016–Present Day–Case Area 1

Source: Primary Survey, 2016

The main land use present within the township are broadly divided into residential, commercial and public semi public. The township includes 31% of residential, 48 % of commercial and 21% of public semi public.

5.2 Case Study Area 2

Comparison of the Land use 2005 to 2015 (proposed) to the existing land use of the case area are analysed.

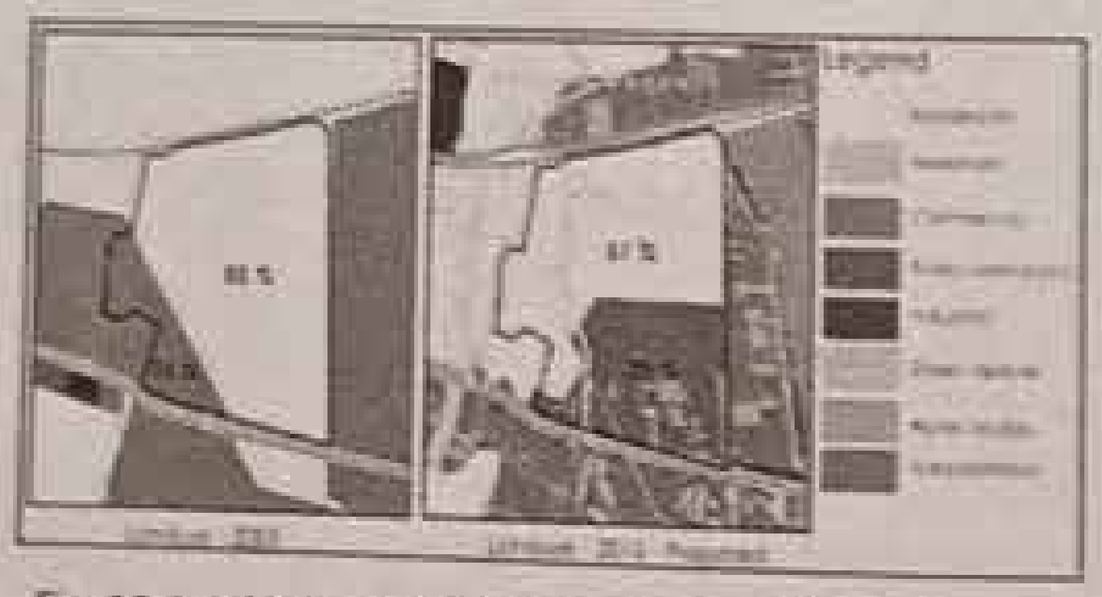


Fig. 14: Land Use 2005 and 2015 (Proposed)–Case Area 2

Source: Master Plan of Bengaluru, 2015

The Industrial use has been reduced. The industries have been shifted towards the penaya industrial area and land had been converted to residential lands.

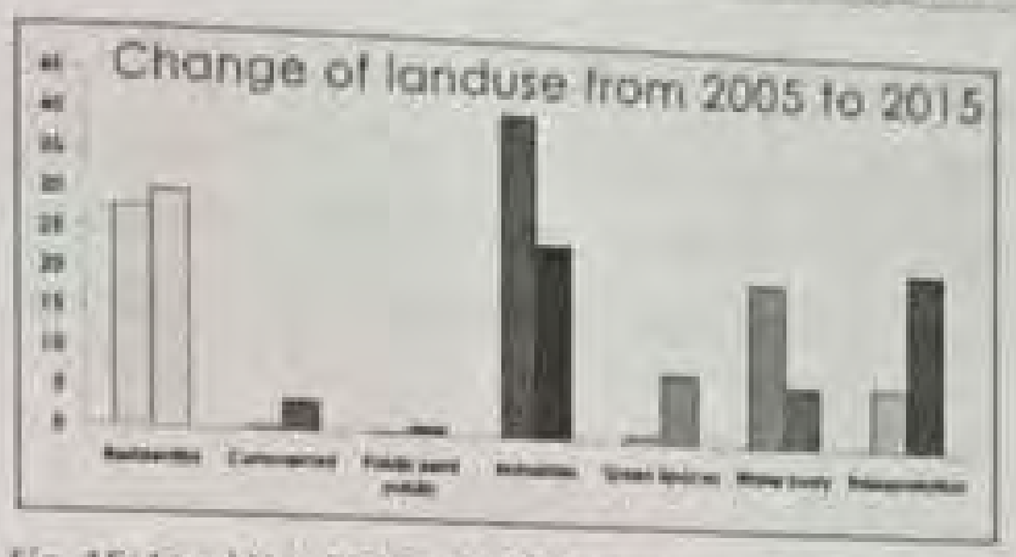


Fig. 15: Land Use 2005 and 2015 (Proposed)–Case Area 2

the comparison of land use 2005 and 2015(proposed) has been indicated in the Fig. 5.1.1.5. The land in which the township has been developed is designated has commercial and residential use in the master plan of Bengaluru–2015. The townships also follows the same as per the division.

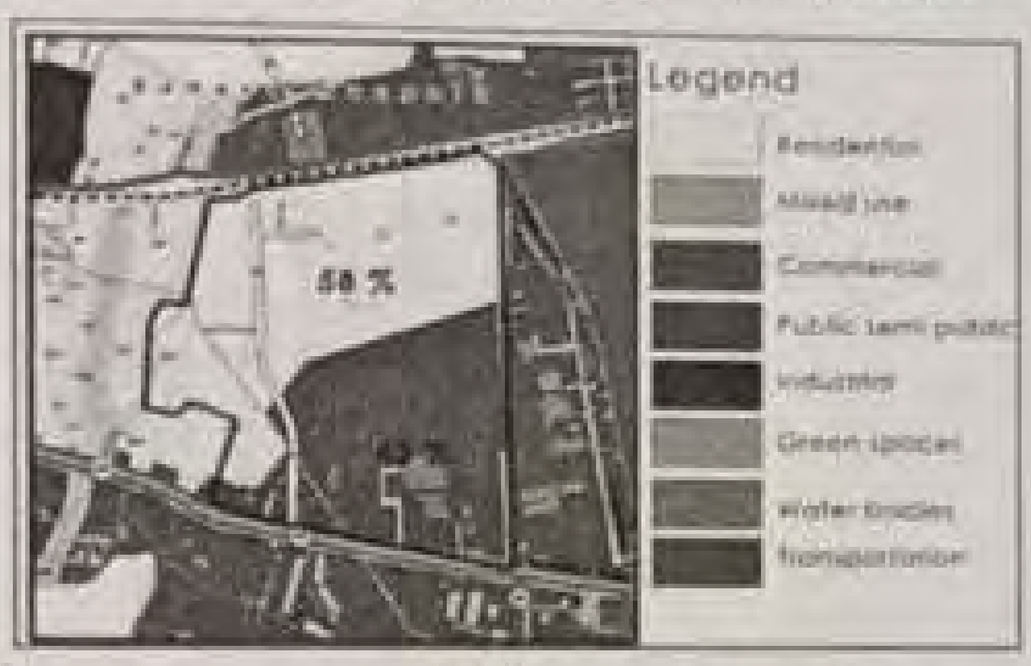


Fig. 16: Land Use 2016–Present Day–Case Area 1

Source: Primary Survey, 2016

The main land use present within the township are broadly divided into residential and commercial. The township includes 58% of residential and 42% of commercial.

5.3 Comparison of Case Area 1 and Case Area 2 with their Respective Wards

The case study area 1 and case study area 2 are compared with each other and with the wards in which they are present respectively. The comparison is listed in the table no 2.

Table 1: Comparison of Case Area 1 and Case Area 2 with their Respective Wards

Aspects		Case area 1	Ward 66	Case area 2	
Area (hec)		23	89	120	
Population	Residential	5600	15709	13500	
	Commercial	10400	–	5000	
Population density (ppl)	Net	445	–	680	
	Gross	250	168	280	
FAR		2.85 (Permissible FAR: 3.00)		2.85 (Permissible FAR: 3.00)	
Land use mix	Type of distribution	Land use	Built up	Land use	Land use
	Residential	22	39	52.4	35
	Commercial	24	37	27.2	16
	PSP	10	5	1	2
	Green space	17	2	4.6	38
	Industries	–	–	–	–
	Water body	7	1	–	8
	Transportation	25	16	14.8	36

Area of the development is higher in outskirts because of availability of land. The residential population is comparatively higher in case area 2 due to high number of housing units. But ward 56 contains more population than ward 54. The case area 1 has a lower density than ward density. The mix of uses within the developed land and ward varies. The percentage of residential use is very high in ward and comparatively balanced with other uses in the case areas. Multilevel car parking is provided in all the developments and adequate car parking facility is being allocated.

5.4 Land Use Entropy (Shanon Index)

The degree of mixing in the case study areas and the townships is calculated using the land use entropy (Shanon index) method.

For the calculation, the land use and the built up distribution of the case study areas and the land use distribution of the ward is considered. The comparative analysis is carried out between the land use distribution of the township and their wards respectively.

Table 2: Land Use Entropy Calculation

Area	Case Area 1			Case Area 2		
	Township		Ward	Township		Ward
	Land use	Built up	Land use	Land use	Built up	Land use
Residential	48967	186647	93196	72843	602172	28936
Commercial	53418	263570	26230	77700	451629	8076
PSP	22258	38061	17118	9712	15054	1543
Recreational	26709	25374	15419	184537	180652	2142
Water body	15580	15541	-	14569	15054	-
Transport	55644	95157	38040	126262	240869	8143
Total	222577	634344	189907	485623	1505431	49762
Value of k	6	6	5	6	6	5
Entropy value	0.94	0.89	0.72	0.85	0.94	0.61

From the table no 3, one can infer that the degree of mixing is balanced in the townships compared to their respective wards.

6. Issues and Potentials

The issues and potentials have been derived through the analysis of various impacts of study on the mobility, socio economic and social infrastructure aspects on the township itself and over the city.

Table 3: Issues and Potentials

Aspects	Issues	Potentials
Spatial	***Low density*** • Case area 1—density less than average ward density (250pph) • Both the case study areas have low density (below 300pph) compared to the high dense wards in city (400pph) ***Densities are not fixed for townships*** • Imbalance in FAR distribution— • The FAR used for commercial (office use) and residential is very high and for and for PSP is very low in case study areas. • Far are fixed for townships has a whole and not for individual uses.	• The entropy value is higher and almost nearing to 1 in the case study area compared to the ward entropy value which indicates high balance in land use mix. • Open space to built up ratio is high in case areas promoting more green spaces in the development—good environment

7. Strategies

To overcome the drawbacks present in the development of townships, policies and strategies are formed in order to achieve sustainable development of the township and of the city.

The strategies formed are for the future developing townships and these will help in guidelines for more sustainable development.

8. Spatial Strategies

The spatial strategies are based on the extent of development, the mixing of uses, density and FAR in the townships and the open space allocations in the townships.

Table 4: Spatial Strategies

Strategies	Descriptions			Policy supported
Land use mixing should be balanced.	Land Use Category	% Distribution	The entropy value is almost 1 which indicates perfect balance among the uses.	• Compact development • Inclusive development
	Residential	25 - 35		
	Commercial	10 - 15		
	PSP	8 - 12		
	Green space	20 - 30		
	Water body	4 - 6		
	Transport	10 - 20		
High residential density should be proposed in the township development.	Net density - 200 ppl/ha within the city limits in the outskirts.			• Compact development
Proportional FAR distribution among 3 main activities – Residential, Commercial and PSP.	FAR is fixed for the entire development based on the road widths. FAR for individual uses should be fixed in order to have balance among the uses.			• Compact development • Inclusive development
Open space 10-12 sq m per Person	Case area 1 – 4.76 sq. m per person Case area 2 – 13.67 sq. m per person			• Ecological Protection

9. Conclusion

The mixed use in integrated townships should encourage the work-home play relationship. The spatial aspects which included the entropy calculation identified that balance of uses are present among the land use and built up distribution.

References

[1] Bangalore Development Authority (BDA) (2015). Master Plan of Bangalore.
[2] Caleb Sackey (2013). Mixed-Use Development, An Urban Design Approach to Cities in Developing Countries.
[3] CB 3 Land Use, Zoning, Public and Private Housing Committee Meeting (8 March, 2012). Seward Park Mixed-Use Development Project.
[4] City Development Plan for Bengaluru (2031) JNNURM.
[5] Central London: The Impact of Mixed Use Development, 2013.
[6] Collaborative for Green Architecture Centre for Science and Environment (2014). Building Sector.
[7] Design Centre for American Urban Landscape (2003). Defining Mixed-Use Development.
[8] Fairfax County Department of Planning & Zoning Planning Division (2012). Mix-Housing Ratios: National Perspectives and Regional and Local Benchmarks.
[9] Geetam Tiwari (2011). Key Mobility Challenges in Indian Cities.
[10] James, R., DeLisle, Terry, and V. Grissom (2011). An Empirical Study of the Efficacy of Mixed-Use Development: The Seattle Experience.
[11] Rabiega, S. and Rabiega (2007). Mixed-Use Development: A Review of Professional Literature.

Narration of Architecture and Built form in the Context of Changing Urban Milieu

Ar. Bhagyalaxmi S Madapur[1], Ar. Shanu Raina[2,]
[1] Associate Professor, B M S College of Architecture, Bull Temple Road, Basavanagudi, Bangalore , Karnataka , India
[2] Assistant Professor, B M S College of Architecture, Bull Temple Road, Basavanagudi, Bangalore , Karnataka , India

Abstract. *'Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody'* - Jane Jacobs

An urban area, with its complex landscape is the frontier of any modern world country offering enriching quality of life to its dwellers. Historically we have witnessed evolution of several resolute examples of great cities shaped by deep rooted understanding of environment, spatial and cultural preferences, and indigenous forms of knowledge, wisdom and skills. These great cities justifiably provided a backdrop for the progression of architecture and built form vocabulary positioned in a specific place and time.

However in the cities of developing countries like India, the rapidly changing urban environmental context which is epitomized through standalone built forms devoid of their contextual settings and its subsequent catastrophes such as degradation of natural and manmade landscapes, floods, water scarcity, congestion, deficiency of affordable housing, lack of accessible amenities, increasing non-inclusiveness (both spatially and socially), increasing mass of characterless manifestations of architecture and urbanism, etc. are rendering these urban areas as muddled models of unorganized growth. These mounting issues have been reflecting upon the fact that it is injustice to represent an urban area only through the lenses of unconnected architecture and built form.

Additionally, our architecture and urban design /planning discourses are increasingly being practiced within a paradigm borrowed from elsewhere which essentially do not recognize co-existing commons resulting in obvious paradoxes in the design and production of architecture and built form.

This paper attempts to shed light on the vital necessity of new narratives that are far more favoring in the advancement of comprehensive ecological thinking of the urban habitat where spheres such as environment, culture, spatial - social equity, economy, shelter, energy, water, food and mobility are seen as equally important contexts in the evolution of an urban milieu well balanced among its context, architecture and built forms.

Keywords: Architecture, Built form, Context, Urban Milieu, Narratives

1. Introduction

An urban area, with its complex landscape is the frontier of any modern world country offering enriching quality of life to its dwellers. The diversity of opportunity attracts people from rural areas to the cities (Arthur B. Gallion, 2003).54.5 percent of world population was living in urban settlements in 2016; approximately 60 percent of people globally are projected to reside in cities by 2030.One million people globally resided in 512 cities in 2016.The number of cities will increase to 662 by 2030 year. Several cities in the global south (nations of Africa, Central and Latin America and most of Asia) are less developed and have limited resources at the same time out of 31 megacities in 2016, 24 were located in global south. It is increasingly apparent that socio-economic and environmental challenges offer opportunities for growth. Political mayhem, social non-cohesiveness and economic disruption are predominant in many cities of the global south. However, the emerging markets, international connectivity, trans-national practices, multi-cultured societies and changing housing dynamics offer growth projections which are continuously manifested in architecture, urban design and urban planning. The prior milieu emphasizes the portrayal of place production while depicting it to the academic and professional community.

2. Urban area and its complex landscape

Looking at cities can give a special pleasure; however commonplace the sight may be like a piece of architecture, the city is a construction in space, but one of vast scale, a thing perceived only in the course of long spans of time (Lynch, 1960). In words of Jane Jacob, Cities are an immense laboratory of trial and error, failure and success, in city building and city design (Jacob, 1960).

Earlier cities consisted of a series of buildings which over a period of time, as an architectural convention defined spatial order for the city as a whole. In contrast with this, the form of the modern city is often independent of individual acts of architecture, design and planning. Architecture was not an object in isolation, a piece of artistic gratification, but a medium to achieve larger humanitarian ends (Bhatia, 1994, p. 44). People from diverse cultures find common ground on a city's complex landscape which facilitates their innumerous activities. Spatial layouts of cities are the reflections of integrated physical setting that emulates multiplicity resulting in collective symbolic community memory which is nothing but ‘sense of identity’.

3. Evolution of Urban form

The word city implies a concentration of people in a given geographic area who support themselves on a fairly permanent basis form the economic activities of that area. The city can be a center of industry, trade, education, government, or involve all these activities (Arthur B. Gallion, 2003). Following are the factors influencing and shaping the city form (Refer Table 1)

Table 1: Factors influencing and shaping city form

Factors Influencing and shaping city form	**Characteristics**
Influence of Geography and natural environment	Location, extend and boundary, Climate, Water and Food Availability, land characteristics, fertility, forest and bio – diversity and minerals
Power and Administration	Type of leadership
Socio - Cultural and Anthropomorphic	Origin and influence, major contemporary events, social grouping, cultural pattern, language, religion, literature and fine arts
Socio - Economics	Trade and commerce – commodities and trade linkages

	Technology – influence in industries, building and construction, transportation, utilities and services.

Source: (Sengupta, 2006)

The history of human settlement can be classified into three broad categories (Sengupta, 2006):

- Ancient phase (12000B.C – 3,000 B.C)
- Intermediate phase or Medieval phase (3000 B.C – 1500A.D)
- Modern phase of organized phase (1500A.D- Till date)

The first settlement evolved in Mesopotamia and the valley of Tigris and Euphrates rivers, approximately 5000 years ago. Agriculture thrived at the river valley civilizations and soon there was surplus of the goods. This lead people to start venturing in to the other skills and the trading began. The trading became the starting point of urbanization. Figure below explain the evolution of man from its primitive living to living in today's cities (Refer Figure 1).

Figure 1: Various concepts of idea livable city by eminent planners

Source: (Sengupta, 2006)

Historically we have witnessed evolution and flourishment of several resolute examples of great cities and societies shaped by deep rooted understanding of environment, spatial and cultural preferences, indigenous forms of knowledge, wisdom and skills in a symbiotic manner. Prior to industrial revolution as well as aftermath of it, cities have dominated their contextual settings influencing every aspect of its inhabitants and their daily lives.

4. Transition to the Industrial city

The industrial areas were the magnet for economic growth and provide numerous employment opportunities resulting in migration of people. These industrial areas soon expanded and became metropolis. Capitalism of the industrial system with few entrepreneurs as the proprietors of many industries led to monopolistic situation (Sengupta, 2006). With coming of railways, development of suburbs started. After Henry Ford made cars affordable for the public by enlarge in start of 20th century, the shape of the cities changed. Coming of automobiles increased the mobility of people by many folds. The industries were now core of the cities. The cities during this time were congested, lacked housing facilities, poor infrastructure, unhygienic living conditions etc. It was at this time that most of the planners felt the need to curb congestion and hence proposed different theories of how an idea livable city should be (Refer Table 2).

Table 2: Various concepts of idea livable city by eminent planners

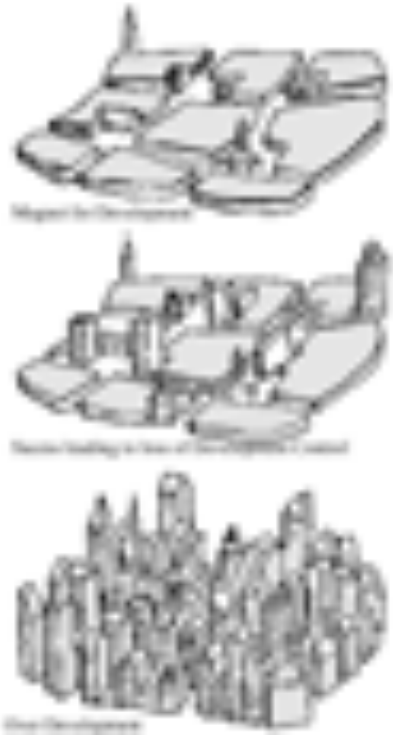
Pioneer City Planners	**Examples of cities**	**Concept**
Ebenezer Howard	Letchworth Garden City (1903) Welwyn Garden city	• Garden City. • Smoke less and slum less cities. • A total of 6000-acre estate. • 1000 acres for central garden city, which will house a population of 32,000. • 5000 Acres of land surrounding central green retained for agriculture and to house 2000 people.
Tony Garnier	Modern Industrial city (1917)	• The idea was to plan a modern city. • Civic centre and residential zones to be bifurcated from industrial zone by creating green belt. • Highways and railway tracks not to have any development abutting the regional route of the communication.
Patrick Geddes	Tel- Aviv (1910)	• House is an inseparable entity of the neighbourhood, the city and surrounding open country and region.
Soria Y. Mata	Linear City (1882)	• Expansion of the industrial cities in concentric form increases the distance between the countryside and urban population. • Pedestrian scale to be the determinant of the total width of the linear city. • City expand on the spine of communication – the highway.
Le Corbusier	Concentric City (1922) Radiant City	• Tower in a park concept. • High density high rise surrounded by green space. • Creation of super block and segregation various land uses. • sought to eradicate the physical complexity of traditional cities, setting the stage for automobile dependency and single-use functional zoning (Hall, 2014).
Ludwing Hilbersemier	The High-rise city	• Organization scheme of relations between parts was the key to city planning. • Communal blocks instead of single house unit. • The idea of high rise city as a socialist city. Activities to be vertically stacked. • All the housing to be stacked with public sector or institutions. • This was to solve the problem of commuting.
Clarence Stein	Radburn city	• The elementary school should be in the centre and all the residential units should be half mile radius. • House enough people to require the elementary school. • No through traffic through the residential area- Cul-de-sacs to be given to avoid the through traffic. • The group of three such units to have high school and a major commercial centre with one mile of radius. • All the sides should be equidistant from the centre.

Frank Lloyd Wright	Broadacre (1932)	• One house unit per acre. • It was the plan which was opposite of transit-oriented development. • The city to have a train station, offices and apartments buildings etc. the apartments dwellers to be expected in less numbers. • Pedestrians to exist within the one-acre plots where most of the population resides and the major transport is done by automobiles.

5. Desolate Cityscape- A Case of Indian Cities

A city, with the passage of time is continually influenced by physical, socio-economic and cultural parameters. Thus, its urban form is the manifestation of diverse existential dimensions crystalized as urban spaces forming the cityscape and strengthens the 'sense of place'. India's initial evolution of globalized economy thrived on the notions of modernism on the proposition of inclusivity. But over a period of time, it has disseminated a mass trans-national culture leading eventually to loss of sense of identity encompassing the spheres of tradition, culture, languages, art, etc. India's urbanization is followed by some basic problems in the field of: 1) housing, 2) slums, 3) transport 4) water supply, sanitation, 5) water pollution, air pollution, 6) inadequate provision for social infrastructure (school, hospital, etc). Class I cities such as Calcutta, Bombay, Delhi, Madras have reached saturation level of employment generating capacity.

Figure 2: Unregulated Development



Source: Authors

With the geometric jump in urbanization forcing cities to be symbols of economic development coupled with rapidly surging population, built environment is manifesting into visible expressions of a dislocated global archetype dominating the cityscape of Indian cities. Cityscape is the visual horizon upon which city dwellers engage with their daily activities (Refer Figure 2). If this visual horizon is composed of discontinuous and disharmonic elements, it affects the physical as well as notional perceptions of the city dwellers.

Architecture of the built environment is the most evident and expressive imagery of creation and transformation shaping the sense of self, space and place. The combined impact of global economic reformation and the international style, is overwhelmingly erasing the built environment that is a strong expression of socio-cultural aspect while paving way for uniformly looking structures and spaces that are devoid of any due considerations for the physical and socio-cultural settings lacking sensory stimulation.

5.1 Indigenous Urban Planning

The spirit of Indian cities is that they contain a myriad of diverse and intense nterconnected vibrant activities. Several well researched evidences shed light on the fact that India's strong historical past of more than two thousand years had town planning as a key characteristic feature in the conceptualization and planning of towns and associated systems.

Planning for towns and cities in India dates back to Vedic times with examples such as Varanasi, Nalanda, Patliputra, Takshashila, etc. which were structured on the principles derived from well informed systematic approaches encompassing diverse dimensions (political, socio-economic, cultural, geographical, ecological, etc.) of the society. These early approaches have resulted in the crystallization of robust, intellectual and organized body of Indigenous knowledge.

The collage of earlier townscape / cityscape mirrored thoughtful expressions of political, socio-economic and environmental frameworks that reinforced the collective spirit of the place.

5.2 Metamorphosis of Indian Cities

In the last two decades, Indian cities are witnessing dramatic transformation from extensively being walkable to automobile bound urban sprawl leading to the fragmentation of cities' character while disconnecting the social interaction. The other, more formidable majority of urban practitioners seek to align their work with the more favourable idea of India as an industrial power. It is a view of exploration. If the country is to enter the global economic stage, there is a price to be paid in misery, hardship and forsaken human rights; if conventional development is to occur, it may create imbalances in ecology and environment; but the end result makes it all worthwhile. Progress is measured by the Gross National Product, and architectural work by the numbers of new offices, factories and shopping complexes realized within one fiscal year (Bhatia, 1994, p. 17).

Currently, Indian cities are increasingly getting morphed into models of uneven modernization and subsequently incomplete urbanization. The rapidly changing urban environmental context which is epitomized through standalone built forms devoid of their contextual settings and its subsequent catastrophes such as degradation of natural and manmade landscapes, floods, water scarcity, congestion, deficiency of affordable housing, lack of accessible amenities, increasing non-inclusiveness (both spatially and socially) increasing mass of characterless manifestations of architecture and urbanism, etc. are rendering these urban areas as muddled models of unorganized growth. However, some of the architects perhaps made more acutely aware of the country's heritage and the depletion of its resources began creating architecture consistent with regional solutions. The works of Raj Rewal, Romo Khosla, Vasant and Revathhi Kamanth and Ashish Ganju among others in Delhi; B.V Doshi, Anant Raje and Jaimini Mehta in Ahemdabad; Charles Correa in Bombay and Laurie baker in Trivandrum, all mirror, and question – to an extent- the relevance of working to a specifically local idea. Each of these architects has formed personal view of history that is supportive of their own interpretation of place and society (Bhatia, 1994, p. 10).

Besides, our existing and so-called futuristic cities are being steadily modelled on the discourses essentially borrowed from antiquated Western theories, narratives and images. Over the past several decades, with the obsessed ambition of being relevant in the accelerated

transitional globalization and conform to models of growth which essentially do not recognize co-existing commons is resulting in cities which hardly have any type of intellectual references for its natural or cultural settings. Also, the adoption of narratives which have been architecture and built form intensive to represent the cityscape through sheer scale and size have been aggravating the snags resulting in obvious paradoxes of imagining the cityscape and urban form.

5.3 Spatial Vacuum between Buildings and spaces

Uncontrolled sprawl fueled by land conversion for different land uses, transportation networks and major redevelopments with their imposing presence occupying large tracts of lands are replacing diversity of the city fabric lacking all sensory stimulation and sense of place. Rapidly growing trends in transitional global economies and advancements in the telecommunication fields are heralding that the 'place is no longer significant'. These occurrences are further reinforced by huge austere conurbations which neither connect with the social fabric nor reflect the identity of a city. Traditional city landmarks such as public buildings, market places, recreation spaces, etc. which were symbols of socio-cultural character are increasingly being replaced by modern landmarks that indicate commercialism (Refer figure 3).

Figure 3: (Top)Basic Modern Building Types, (Bottom) Functional Monotony - Architectural Pathologies

Source: Authors

6. Architecture, Urban Design and Urban Planning as Social Tools

For a common city dweller who is overwhelmingly buried under the age-old problems, architecture, design and planning are mere backgrounds. In the current world, architecture is being perceived as a product showcasing the interest of few individuals rather than focusing on the collective interests of communities. In developing societies such as Indian cities, strategies of form and place making are synonymous with the process of modernization symbolizing the modernism. This modernist vision is raising profound questions, unraveling the ideals of professionals and the expectations of the user groups.

For several decades, the contours of the imaginations of the contemporary Indian architects, urban designers and urban planners have failed to engage with the fundamental issues and challenges of the built environment. Architectural institutions, urban design and planning institutions, professionals and legislations are lagging behind and have lost themselves in the extremes of the micro and macro scales. They have abandoned the tangible environment, the soil, the water, the energy and its finite resources to be processed by crude design and planning tools. Architecture, urban design and urban planning continue to emphasize on highly fragmented and compartmentalized process for the creation of the built

form. Professionals tend to ignore the patterns generated by socio-economic and cultural imperatives while preparing blue prints for city master plans and architectural strategies. They have tendency to follow the heavily borrowed unfamiliar 'imagery' to achieve only aesthetics rather than dealing with the complexities of everyday urbanism. These professionals need to change their perceptions of the way they conceive buildings and the city at large by realigning to confront the problems at hand and not seek conformity with the developments occurring elsewhere.

Development of architecture, design and planning professions as social tools for an understanding of its genesis to provide effective strategies:

6.1 Understanding city as a cohesive form

The primary concern of urban morphology is the structure of urban form and the urban form in turn is the result of internal structures of urban areas. The major morphological factors of cities include natural determinants (climate, topography and local materials available for construction) and manmade determinants (involve politics, religions, defense, planning and functioning). The current trends that are yielding vivid patterns of urban form are the result of un-related, un-connected and most importantly un-coordinated attempts practiced by a wide spectrum of people including policy makers, citizens, urban planners, urban designers, architects and engineers.

Several core overlapping morphological measures such as land use, development regulations, physical and social infrastructure, built form environment, public realm, green/open spaces, user profile can be analyzed to develop quantifiable methods which can be used as indices by planners, designers as well as policy makers to formulate a framework of different schemes to steer the city towards elevating the quality of urban living.

Figure 4: The Compact City

Source: Authors

6.2 People Centered Urbanism- Experiencing city at 5 Km/hour

Cities are for people and hence the focus should be on emphasizing the human scale enriched with visual imagery and interconnected hierarchy of spaces as well as built forms to promote social encounters on daily basis. People centered urbanism creates social capital, interactions and spatial experiences resulting in vibrant public realm.

Medium to high density area with diversity and short distance access to different activities / services coupled with public transit stops can create conducive physical setting to experience city on foot. To positively support this aspect, a built environment must have a sufficient pedestrian network to make accessible area. Variables such as environment, network and destination are the primary effective parameters of built environment and related experiential qualities reinforcing human scale (Refer Table 3).

Table-3: Effective Parameters of Built Environment on experiential qualities

Variables	Features	Parameters
Environment	At the human scale, active transport permits for maximum appreciation and experience of the urban area. High density neighbourhood encourages mixed use development improving accessibility to various functional and recreational activities associated with active transport.	• Aesthetics • Safety • Building orientation
Network	A network provides safe and comfortable use of active transport.	• Accessibility • Sidewalks • Cross walks
Destination	Active transport street system is efficiently used if the network provides different levels of access to various destinations.	• Land use mix and pattern • Diverse activities

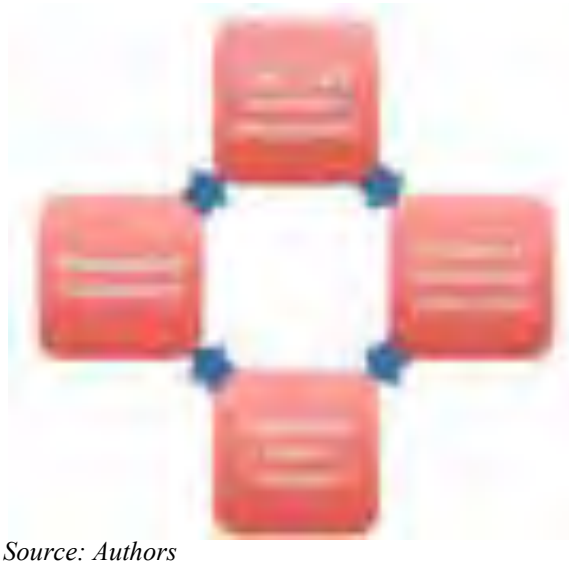
Source: Authors

Several studies in public health domain contemplate premeditated active transport as one of the decisive factors in enhancing urban dwellers' quality of life. Active transport and human powered transportation include walking, cycling and variants such as cycle rickshaws, skateboards, push scooters, hand carts, etc. These modes provide both transportation and recreation and are especially important for short trips that form the largest share of trips in urban areas.

6.3 Equitable Societies - Shattered individual islands or part of living communities

In the past twenty years, extent and consequence of migration has increased manifold. Migrants tend to concentrate in clusters of thriving city agglomerations. This has led to urban polarization leaving other areas in a state of economic stagnation in turn reducing the opportunities for positive social interaction and cohesion. Developing vibrant urban areas can assist in mitigating migratory pressure on cities and manage urbanization processes.

Figure 5: The Sprawling City



Source: Authors

Most of the time certain concepts of architecture and urbanism are superficially understood and are applied leading to the creation of a bias as well as an intellectual void overwhelming the local context and identity.

6.4 Environment

Air and water pollution, flooding and heat waves are most prevalent environmental issues resulting from urban sprawl. Urban sprawl has increased and resulted in growing unregulated consumption of land. Urban life, culture and activities are greatly impacted by the environmental setting and are further influenced by the built form. Built environment is

the largest consumer of depleting resources. Hence, city dwellers, professionals and public sector should encourage adoption of time tested building principles (employing local skills, methods and materials) to ensure holistic growth with high emphasis placed on environmental sustainability.

6.5 Cities serve human beings or human beings serve cities- Economy, Shelter, Water-Energy-Food and Mobility

A range of economic, socio-cultural associations as well as gender and age influence the way in which individuals are affected by or use of the built environment. Cities offer economies of scale with regard to provision of civic and utility amenities such as mobility, water, energy, food, solid waste management. Specific aspects such as priorities of location, level of development of the shelter and tenure that determine dwelling environment change over a period as the situation of the urban dweller changes. Financial crisis and lack of adequate affordable housing especially for vulnerable groups is a critical matter leading to increased spatial and social segregation.

Figure 6: True City and the So-called City

Source: Authors

Continued collaboration, consensus action among authorities, stakeholders and communities is required to develop a trend towards people centered and integrated planning process to address complex socio-cultural, economic and environmental challenges.

7. Discussions and Way Forward

The very nature of city planning and practice of architecture need paradigm shift into experimental territory away from a naive understanding of quantified requirements into design ingenuity to respond to the pressing need of switching, modernizing and upgrading.

In a stressful urban situation, radical narratives and interpretations that cascade beyond the conventional approach to sway from the piecemeal renewals stems as the most appropriate innovation for the urban future. Furthermore, these radical narratives and interpretations should not only be based on economy and technology but socio-cultural facets to breed a range of well-informed solutions to the challenges and issues of the cities. In India, architecture, design and planning is creating an unequal society of those who can conform to its imperatives and those cannot - certainly the majority cannot. Hence, this particular aspect

offers an opportunity to develop diverse innovative narratives. Emerging narratives have to accept the simultaneous validity of difference to address the multiplicities and co-existences can be spatially structured (Refer Table 4).

Table 4: Emerging domains of narratives and their respective scope

Sl. No.	Domains of Narratives	Scope
1	Multilateral Partnerships	Structuring constituencies based on multilateral Partnerships comprised of city dwellers, bureaucrats and politicians to engage with the complex landscape of the Indian democracy.
2	Regulatory	Proposed innovative planning and inventive architectural designs which extend their scope beyond the site and requirements to contribute to civic, conservation, environmental and artistic causes should be granted permission and approved for construction.
3	Participatory	Common and protective ownership values allow city dwellers to participate in the city building process.
4	Professional (Architects, Urban planners & Urban designers)	To stay relevant and to collectively develop new approaches, professionals must transcend substantially beyond the silos of disciplines and extend their roles as promoters of sensible built forms for active engagement with the society.
5	Architectural, Urban planning and Urban Design pedagogy	Pedagogy and training to build capacity to be propositional and venture about the future while augmenting a healthy dialogue between the old and new. Appropriate curricula must be created to respect the 'context' besides undertaking capacity building. This aspect should be a progressive force to mediate the challenges of future urbanization.
6	Advocacy and professional involvement in decision making and bureaucracy	Support through on field action. Creation of tools or instruments for advocacy- communicating, writing, researching, dissemination of information, etc.
7	Active professional practice (Architecture, Urban Planning & Urban Design)	Professionals have to pursue the snags to create synergies among disciplines and recognize new forms of patronage to envisage the solutions leading to novel narratives. The strategies for the architecture, urban design and urban planning should eliminate the debilitating characteristics of professional indifferences and to dialogue and negotiate with the users, society and policy makers in the design and planning developments.
8	Public Realm	Planning for the community: Private realm needs to be exchanged with public realm to regain the interconnected urban community.
9	Built form typologies and urban spaces	1. Public Buildings: Public buildings such as government buildings, public facilities, religious structures, institutions and organizations that have symbolic functions can be the edifices of architectural design. 2. Pivotal and contextual buildings (the physical and metaphorical focus) for common uses and habitation: Contextual design frameworks for this typology will assist in restoring functional and aesthetic urban milieu. Public buildings together with pivotal and contextual buildings define, provide and contain interconnected urban spaces constantly crafting interesting visual imagery.

Source: Authors

Each development framework needs to encompass conscious choices based on ordered strategy, scheme and design specific to a neighborhood's physical setting so that accidental

character could be alleviated. This approach enhances the quality of the urban environment, encourages active transport (walking / cycling), supports built forms and active engagement of inhabitants with their surroundings. Active and engaged citizenship in the development of cohesive urban form would assist in shifting the course of cities away from the revenue maximization towards the welfare of the community. Places are enhanced by shared architectural character of the built forms which are environmentally and socio-economically resilient responding effectively in time and space while co-relating the past to the future. Indian cities need to be self-referential to contain and address the heterogeneity. The time is now to foreground a 'sense of appropriateness' to the local context as the strong global currents are broadcasting the creation of architecture, urban design and urban planning through innovative narratives in the context of changing urban milieu to eco the social ethos and identity. Indian cities need to be modelled on a plurality (temporal- social- economical) of overwhelming multicultural society, wide social and economic disparity all positioned in a context of democracy to be increasingly spatially - socially inclusive, be economically prosperous and be optimistic about the future.

References

[1] Arthur B. Gallion, S. E. (2003). *The Urban Pattern City Planning and Design.* New Delhi: CBS Publisher & Distributors.

[2] Bhatia, G. (1994). *Silent Spaces and other stories of Architecture.* Delhi: Penguin Books India (P) Ltd, pg 10.

[3] Hall, P. (2014). *Cities of Tommorrow: An Intellectual History of Urban Planning and Design since 1880.* WILEY Blackwell.

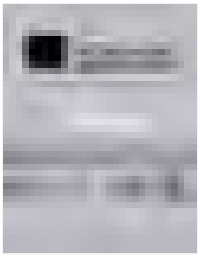
[4] Jacob, J. (1960). *The life and Death of Great American Cities.* New York: Vintage Books.

[5] K, D. (1965). The Urbanisation of Human Population. *Scientific American*, 41-53.

[6] Kundu, A. (1994). *Sectoral Issues in the Indian Economy,Pattern of Urbanisation with Special Reference to Small and Medium Towns in India in Chadha, G. K.* New Delhi: Har - Anand Publication.

[7] Lynch, K. (1960). *The Image of the City.* Cambridge, Massachusetts, and London, England: The M.I.T Press.

[8] Sengupta, B. (2006). *History of Human Settlements.* New Delhi: ITPI.



JOURNAL ARTICLE

THE CULTURE OF CASTE IN THE ETHOS OF CONSTRUCTION

Anjana Biradar and Sapna Papu

Traditional Dwellings and Settlements Review
Vol. 30, No. 1, THE POLITICS OF TRADITION (FALL 2018), p. 79 (1 page)
Published By: International Association for the Study of Traditional Environments (IASTE)

https://www.jstor.org/stable/26877465

27th Annual Conference of Indian Art History Congress
and
International Conference on Asian Art

13-16 December 2018

Hosted by
University of Kerala

ABSTRACTS

Department of Archaeology
University of Kerala
Kariavattom Campus
Thiruvananthapuram - 695581

27th Annual Conference of Indian Art History Congress
and
International Conference on Asian Art

13-16 December 2018

Funded by
University of Kerala

ABSTRACTS

Department of Archaeology
University of Kerala
Kariavattom Campus
Thiruvananthapuram - 695581

Coalition of Photography with Painting and its Ramifications: Case Study: Mysore Princely State

Chandan Kashyap K. S.
PhD Scholar of Architecture
Arsipelago, Doddathoguru Road
Kalyanagar, Bangalore - 560043, Karnataka
Email: chandanarsipelago@gmail.com

The art photography was a great offset of the beginning of [illegible] that measure all the advent of digital cameras. Colonial Royal indigenous [illegible] and majority of higher rank were also focused on this social phenomenon. They possessed [illegible] significantly in front of camera. Photography had lot of significance in Mysore Princely State also. Photographic prints of Krishnaraja Wodeyar III supplemented that huge empire in his portraits, they validated the realistic images that created a contrast to his idealized images. Even though the use of [illegible] artists in the beginning aimed at representation accordingly was developed. As a dialogue between photography and painting some different genres of photography evolved. Some were influenced from European culture that coincided with existing customs. Royal and aristocratic portraits became more important. Events of the State like Mysore Dasara Assemblies, Royal Durbar, Palace with lighting were documented. Documental genre increasingly [illegible] decisive images multiple mediums. Most of them were guided by painting techniques especially photography artists painting with realistic and less descriptive details on developing liability. Consequently on mechanically were particularly visible with the help of a many range of such genres comprising of different materials media and techniques. This study scrutinized these through the considerable contrast and originate that how they fostered the art field to relate to a larger audience with the production and distribution of multiple hand painted copies for several photos. Hence, this research elucidates the fact that painting functions as a artistic and photographic medium as a result [illegible] complemented each other eventually instead of turning antagonistic [illegible].

Proceedings of
The 1st Inte on Smart Villages and Rural Development
COSVARD 2018

12-14 December 2018
Assam Administrative Staff College
Guwahati, Assam, India

Editors:

Dr Hemanta Doloi
Prof Atul Bora
Dr Sally Donovan

The University of Melbourne
Victoria 3010, Australia

Smart Villages Lab

1st International Conference on Smart Villages and Rural Development (COSVARD 2018) hosted by the Smart Villages Lab (SVL) of the Faculty of Architecture, Building and Planning of the University of Melbourne.

Date: 12- 14 December 2018
Venue: Assam Administrative Staff College, Guwahati, Assam, India

Publication Data

This proceedings contains the double-blind peer-reviewed papers presented at the COSVARD 2018 Conference, hosted by the Smart Villages Lab (SVL) of the Faculty of Architecture, Building and Planning of the University of Melbourne, held at the Assam Administrative Staff College, Khanapara, Guwahati, Assam, 12-14 December 2018.

Publication title

Proceedings of the 1st International Conference on Smart Villages and Rural Development (COSVARD 2018)

ISBN 978 0 7340 5518 7 (ebook)
ISBN 978 0 7340 5517 0 (print)

Editors

Dr Hemanta Doloi (Editor-in-Chief), Smart Villages Lab, The University of Melbourne.
Dr Atul Bora (Principal), Assam Engineering College, Jalukbari, Guwahati, Assam.
Dr Sally Donovan (Research Fellow), Smart Villages Lab, The University of Melbourne.

Publisher

Smart Villages Lab
Faculty of Architecture, Building and Planning
The University of Melbourne

Publication Date
26 February 2019

Time	Wednesday 12th	
1.30 pm	**Keynote: Smart Village as the Basic Building Block of a Sustainable World (A. Bora, Principal, AEC)**	
2.10 pm	**Keynote: Smart Technologies and their role in rural development (A. Gokhale, Illinois State University, USA)**	
2.30 pm	**Afternoon Tea**	
3.30 pm	**Session 1: Housing**	
	Chair: Prof Ray Green	**Authors**
	Paper 1 – Housing typology as development indicator	Dr S. Donovan, University of Melbourne
	Paper 12 – Understanding housing design and cultural ecology of Assamese rural communities	V. Katharpi and H Doloi, University of Melbourne
	Paper 19 – A novel approach of constructing ferrocement wall for cost-effective housing	M. Goswami, S. M. Dhar, B. Swargiary, R. Boro, Central Institute of Technology, Kokrajhar; V. Varma School of Planning and Architecture, Delhi
	Paper 29 – Reinventing patterns and traditional elements in vernacular settlements in rural India	S. Bantanur, BMS School of Architecture, Bangaluru
5.00 pm	**End of day**	

Time	Thursday 13th	
9.00 am	**Keynote: Rural Governance (K. Varghese, IIT Madras)**	
10.30 am	**Morning Tea**	
11.00 am	**Session 2: Governance**	
	Chair: Dr Sally Donovan	**Authors**
	Paper 6 - A conceptual model framework of Smart Village for Sustainable Development	Dr A. Chakraborty, AIT; R. Pawani, GIMT; Dr S. K. Deb Assam Engineering College
	Paper 25 - ICT4D for Smart Governance of Rural Development	G. Kimm, Swinburne University of Technology; H. Doloi, University of Melbourne
	Paper 28 - The new Assam smart village dwelling: meeting the challenge of absorbing new technologies	X. Huang, V. Katharpi, University of Melbourne; M. Burry, Swinburne University of Technology
	Paper 31 – Towards the Environmentally Sustainable Smart Village	R. Crawford, The University of Melbourne
12.30 pm	**Lunch**	
1.30 pm	**Keynote: Small hydro in rural development (S. K. Singhal, IIT Roorkee)**	
3.00 pm	**Afternoon Tea**	

“Reinventing Patterns and Traditional Elements in Vernacular Settlements of Rural India”

Dr.ShailaBantanur[1]

[1] *Professor, BMS School of Architecture, Bangaluru India,shailabunty@gmail.com*

Abstract:
Rural settlements are the role models that derived from socio-cultural and traditional practices. Each village is unique in its own way based on the traditional practices. The paper highlights case studies of four Indian villages, namely; Raghurajpur Orissa,Sawantawadi Maharastra, Mattur, and Shirva from Karnataka. Visual surveys were conducted and selected vernacular houses were documented. Socio-cultural surveys were conducted to understand their influence on the built environment. Settlement patterns with traditional elements were listed and analyzed. It was noticed that each settlement is unique and traditional elements are reflected in their own way.

Keywords: *Vernacular Housing, Settlement patterns, traditional architecture,*

1 Introduction

Vernacular Houses depicts socio-economic rituals that are reflected in traditional as well as constructional practices. Traditional practices are always expressed through built spaces, forms, and functions. Depending on the direct and indirect influences, decoding of these elements is either simple or complex. Construction practices are seen through the use of local materials, techniques and man power. The settlement patterns follow traditional practices depending on the local climatic conditions. Each settlements demonstrate smart and sustainable principles since they follow mixed land use, are compact, have easy access, and collective cohesiveness but are diverse in socio-cultural diversity (Dhingra & Chattopadhyay, 2016).Vernacular house are excellent sustainability models because they adopt low energy techniques (Khandekar et. al., 2017) (Khandekar, et.al.2017). There are various factors that influences the housing and settlement patterns for example migrations, natural calamities, environmental behavior, economic, social and environmental dimensions determinants(Ferdous, Kafy, Gafur, & Wakil, 2017). Other factors like increase in income and migration rate, variation in income source, and reduction of joint family are significant for the change in the settlement patterns (Ferdous et al., 2017).The settlement patterns depends on the internal plan and external layouts and both also depend on conditions like location, topography, vegetation and nature of soil (Ahmed, 1979).Social organizations, landscape configurations may be similar across the nations as well(Widiastuti & Vedamuthu, 2009). Traditional materials can be used effectively to make the buildings more sustainable (Architecture & Lanka, 2007) . Topography in turn decides material usage, climate and soil decide the vegetation. Occupation is also an important factor that derives the settlement pattern. The patterns help to understand the community's life. Social hierarchy can be seen through the scale and richness. Landlords are an integral part of the villages and are administrators of the village. Landlord houses in Indian villages reflects unique features with rich carvings and have names that are particular to the region of India, for example: Haveli's in North India, Wada in Maharashtra, Rajbari in West Bengal, Deori in Hyderabad, Cathurmukham in Tamil Nadu, and Nalukettu in Kerala(Susilo,2016).Many studies of settlements and documentation of traditional houses can be seen from various objectives for instance: to understand architectural elements, materials and construction techniques, passive principles, community participation, socio- economic significance, heritage values etc. The case studies of four Indian villages namely; Raghurajpur Orissa,Sawantawadi Maharashtra, Mattur, and Shirva from Karnataka. are discussed with traditional elements that derive the characters to the settlement

2 STUDY AREA:

2.1 RAGHURAJPUR, ORISSA

2.1.1 Introduction:

Raghurajpur is a village in Puri District in Orissa State and is known as a heritage craft village.The climate of the region is tropical, with high temperatures in the summer (35-40^{0}C) and extremely cold in the winter (12-14^{0}C).The village is known for its art and dance forms. The first, *Pattachitra* is an art form that dates back to the 5th BC on palm leaf engravings, also on sheets made of recycled old textile (sarees). Most of the paintings depict the stories of *Lord Jagannath* a lord of Universe is considered a form of Vishnu. The art forms are also depicted by using coconut shells and paper pulp. Waste coconut shells are reused and reshaped in the shell form and hand painted on it to use it as well as wall hangings. Similarly, the paper pulp and cow dung is used to make masks

and toys. In the year 2000, the village was developed as State's first heritage village by India National Trust for Art and Cultural Heritage (INTACH). The place is also known for its *Gotipua* dance form; an Odissi classical form performed by young boys who dress as a women.

2.1.2 Settlement Patterns:

The pattern of the village is display a linear and informal settlements. It is elongated on both side of the central corridor consists of series of temples. Other than the temples it has dance academy, few shops, gathering space and public amenities (Fig.1.0).

2.1.2.1 Houses:

Most of the houses are elongated with a small façade facing towards the main road in the village. The houses are of low rise with common wall on both sides, light and ventilation are through the front verandah and the backyard of the houses. The materials used for the construction are brick, laterite, timber, bamboo, cow dung, concrete floor with red oxide flooring and thatch roof. The scale of the houses varies based on the economic status (Fig.2.0). The verandahs acts like a gallery a location for display of their art work, with most of the works demonstrated on the verandah. The walls of the verandah are painted with stories of lord Jagannath. The indoor spaces are multi-functional, since the art work is carried out in all the spaces based on the other household activities (Fig.3.0).

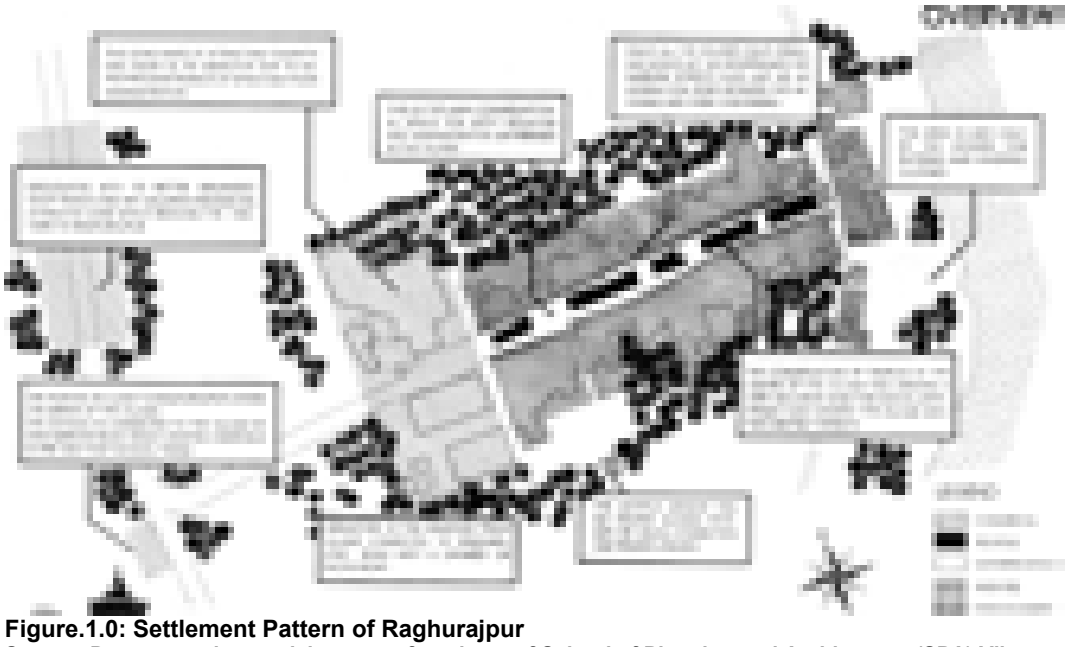


Figure.1.0: Settlement Pattern of Raghurajpur
Source: Documentation work by team of students of School of Planning and Architecture (SPA) Vijayawada, 2015.

Fig.2.0. Different typology of the houses
Source: Documentation work by team of students of SPA Vijayawada, 2015.

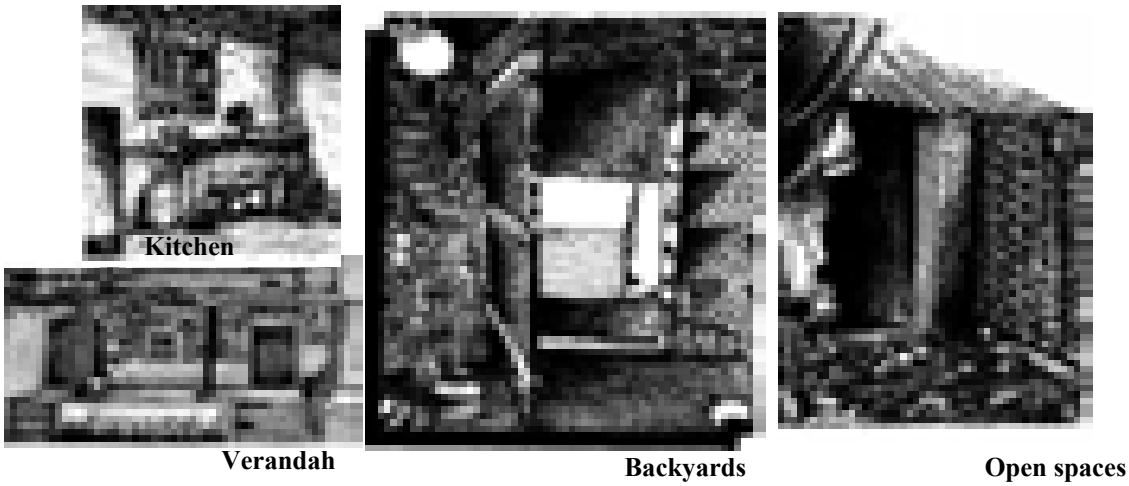


Figure.3.0. Sketches of indoor spaces
Source: Documentation work by team of students of SPA Vijayawada, 2015

2.1.3 Traditional elements:

The traditional beliefs and practices are reflected in their own way. The art forms are demonstrated on the facades of most of the houses. These attract tourists as well as add to the aesthetic of the buildings. The window grills are made from wood and used for hanging masks that are depictions of the heads of lord Jagannath.

Figure.4.0: Walls are demonstrating traditional art forms
Source: Courtesy of the Author

2.2. Sawantawadi, Maharashtra

2.2.1. Introduction:

Sawantwadi is a taluk, under Sindhudurga district in Maharashtra, and has a historical significance and was ruled by Marathas. The town is geographically located within the Sahyadri range towards the east and low lying coastal areas towards the west. Climate of the region is tropical with similar temperature conditions in winter and summer (Average temperature 26^0C. Sawantwadi is known for wooden toys and *Ganjifa cards (*Fig.5.0) which are one of the tourist attractions. Artisans and craftsman belongs to *Chittar community*. In the recent times, there has been a rapid decline in the socio-cultural context within the city due to modernization and urbanization, but still the wooden toys and Ganjifa cards are made in the palace located in the heart of the city.

Figure.5.0 Ganjifa cards and wooden toys of Sawantwadi
Source: Courtesy of the Author

2.2.2. Settlement Patterns:

The history of settlement patterns show many sectors are dedicated to different communities for example: *Vishyawada (*of traders*), Bahir wada (of* Muslims*), Bhat Wada (*of Brahmins*), Kahskil Wada (King* personals*), Matewada*(place for burial) etc. (Fig.6.0). The spaces were divided based on the caste and occupation. However, currently it is difficult to find all the community but many still exists. The present settlement is concentric; lake at the center is a major attraction and is a major source of water for the local residents.

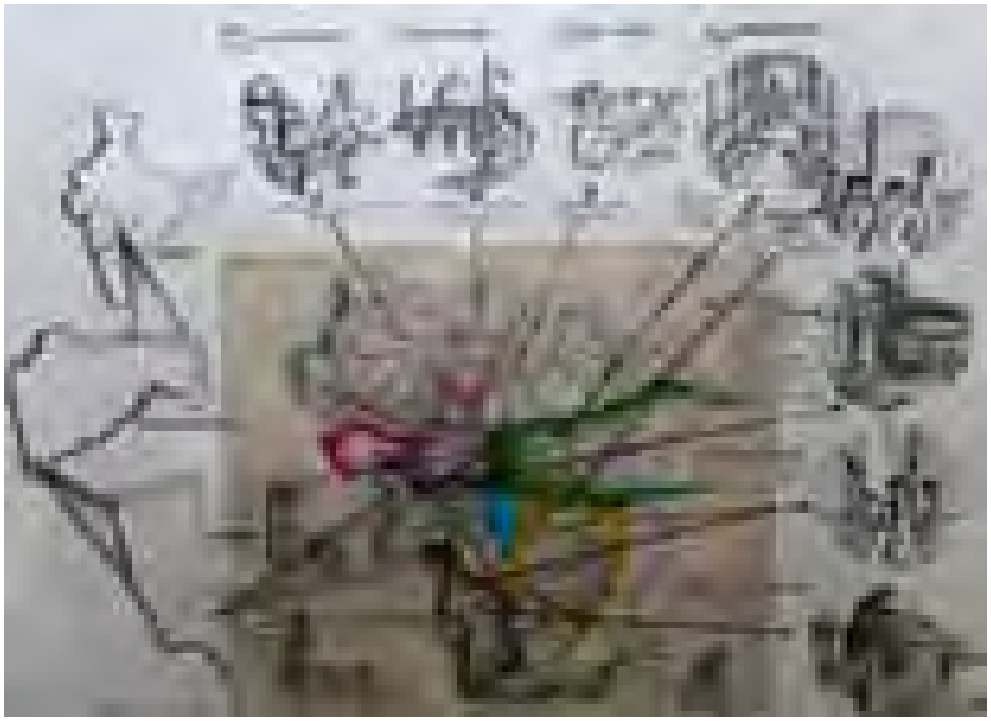


Figure.6.0 Community based settlement patterns
Source: Documentation work by team of students of Srinivas School of Architecture *(SSA*) Mangalore, 2016

2.2.2.1. Houses

The houses are compact, elongated and with a common wall on both the sides with shops in the frontage. The backyard consists of all wet areas (bathrooms, toilets, kitchens). Most of the rooms are arranged on one side of the passage. The houses vary from single to double storeys. The materials used for the construction mud, stone, bricks, Mangalore tile roofs and wood. Light and ventilation are from front and backyard of the houses (Fig.7.0).

2.2.3. Traditional elements:

The Sawantwadi has a different community influence which is reflected in architectural elements. Islamic, Vernacular, Maratha and even Western Architectural styles are seen in the public and private buildings (Fig.8.0).

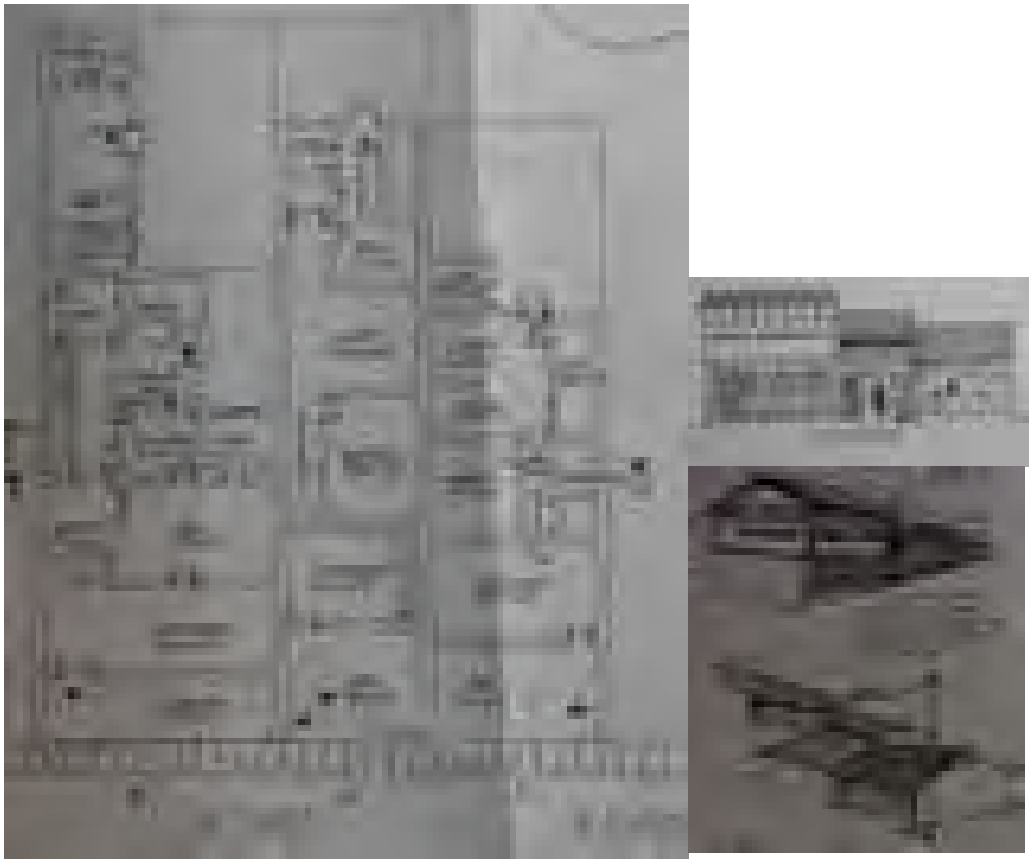


Figure: 7.0 Sample houses of Sawantwadi
Source: Documentation work by team of students of SSA Mangalore, 2016

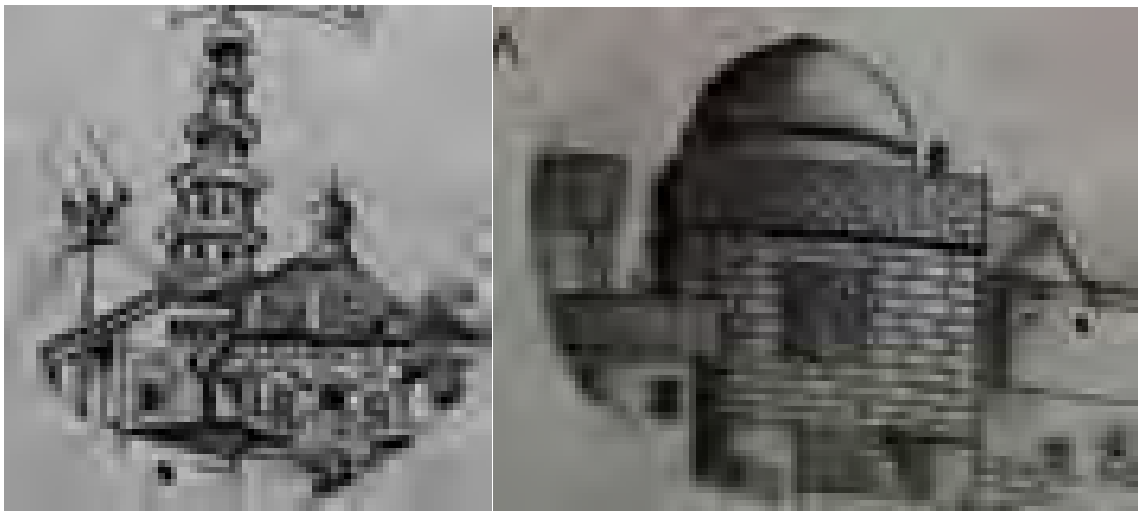


Fig.8.0: Traditional elements of Sawantwadi
Source: Documentation work by team of students of SSA Mangalore, 2016

2.3. Mattur Village, Karnataka:

2.3.1. Introduction

Mattur is a tiny hamlet located on the bank of river Tunga near Shivmoga District, Karnataka. The village is known as "*Sanskrit Village of India".* Most of the people

residing in the village are Brahmins; a community that migrated from Kerala and settled around 600 years ago. Sanskrit and Sankethiare the primary language; around 700 households use Sanskrit for their day to day communications. Social gatherings happen around the temples which are integral part of the neighborhood. It is also an agrarian village, primarily cultivates *areca* nuts and *paddy* (rice).

2.3.2. Settlement Patterns:

The settlement is compact, integrated with religious places of worship (Fig.10). Every house has a verandah in front which is used for social interactions.

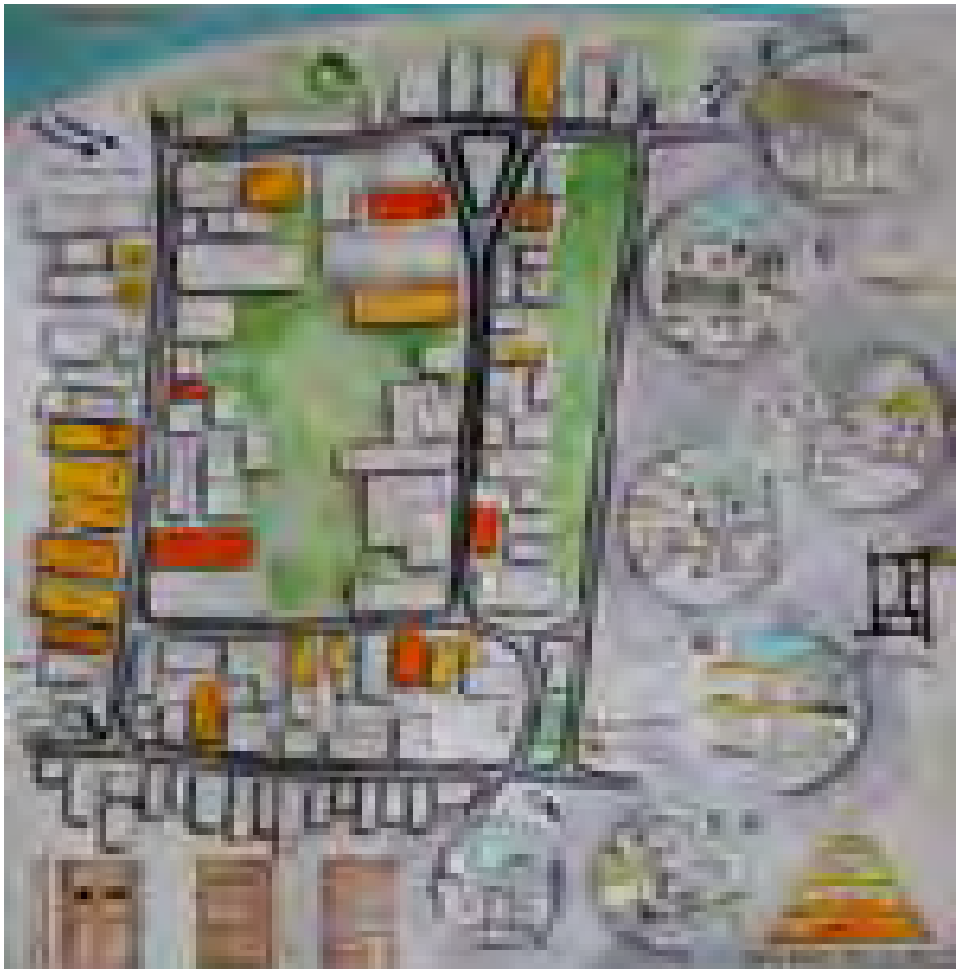


Fig: 9: Compact settlement of Mattur Village
Source: Documentation work by team of students of SSA Mangalore, 2017

2.3.2.1. Houses:

The houses are compact and elongated with verandah in the front leading to the roads. The kitchen and *Pooja* rooms (place of worship) are more auspicious and other caste people are not allowed inside the house, hence the importance of the verandah as a place for social gathering and acting as a threshold. Most of the houses are either single double storeys. Material used for the constructions are laterite, brick and mud for walls, wood for openings, concrete flooring with red oxide finish and Mangalore tiles for roof (Fig.10.0).

2.3.3. Traditional elements:

The tradition is reflected through built and un-built spaces. The columns inside the living room are more ornate and reflect more of Hindu religious elements (Fig.11.0). The

outdoor spaces like river banks, banyan tree platforms on the village squares (Fig.12.0) and temple mandapa's (temple gathering area (Fig.13.0), are used for daily rituals, like the floating platform on the bank of the river to perform yagya.

Figure.10.Sample Houses Mattur Village
Source: Documentation work by team of students of SSA Mangalore, 2017

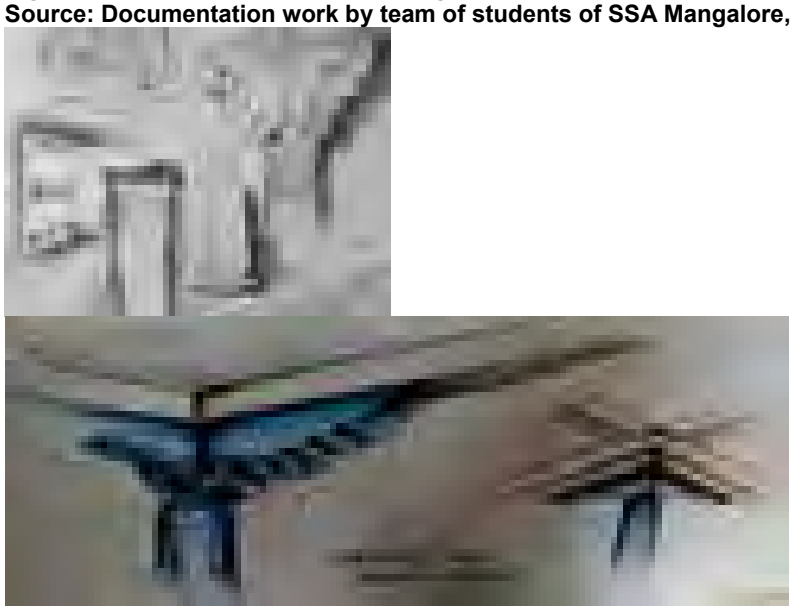


Figure.11.0: Column ornamentation in the interior spaces
Source: Documentation work by team of students of SSA Mangalore, 2017

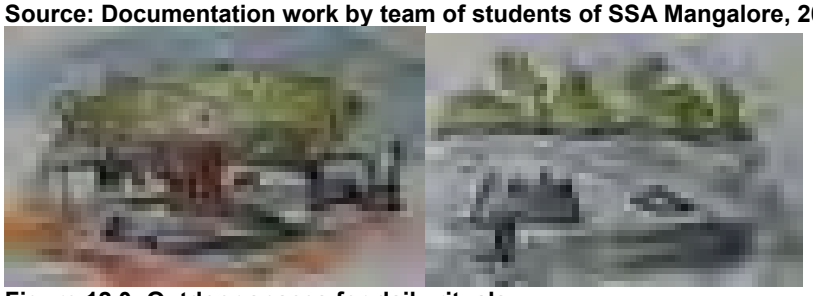


Figure.12.0: Outdoor spaces for daily rituals
Source: Documentation work by team of students of SSA Mangalore, 2017

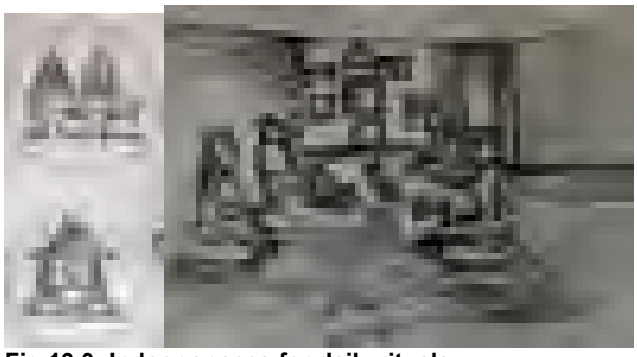


Fig.13.0: Indoor spaces for daily rituals
Source: Documentation work by team of students of SSA* Mangalore, 2017

2.4. NadiBettu,Shirva,

2.4.1. Introduction:

Shirva Village in Udupi District in Karnataka located, 46 Km from Mangalore city.The settlement is scattered with a population around 13,000.Agriculture is the main profession of the villagers with Tulu the spoken language. The traditional practices performed in Tulunadu (Tulu speaking region), some of which are well-known rituals include:Bhootakola (Demon worship), cock fight, Nagaradhane (Snake Worship), Kambala (Buffalo fight), Siri aradhane and, Pili vesh. Folk dances like Siddavesha and Aatikalenja; folk literature like 'pad-danas' (poetic stories); Yakshagana; traditional Tulu practices are the few to name.

2.4.2. Settlement Patterns:

Most of the rural settlement in coastal belt of Karnataka is scattered with the houses surrounded by paddy (rice), Arecanut trees, cashew nut and coconut.

Figure: 14.0: Scattered settlement of Shirva
Source: developed from Google map

2.4.2.1. Houses:

The Guttu's are the territorial units in the village/ Grama. They are not only the spatial or geographic locations but, were also economic production, distribution and surplus appropriation of units which functioned as semi-autonomous, politico-juridical zones in the past. At territorial level, the head of each guttu house was responsible for maintaining law and order and peace. The Chawadi(front verandah) of the houses were used to solve the disputes as well as to discuss the problem at territory level. Each village has sixteen sub-guttu families ranked from 'MundabettuGuttu' to 'PererGuttu' at

the bottom.NadiBettu at Shirva is one such important house as shown in the figure.15.0. Though the elevation is simple (Fig.16), the interior spaces have richly carved columns, ceilings and beams. All guttu houses are typical features of Chawadi, court yard surrounded by private rooms. Chawaadi is one of the important part of the Guttu houses, includes pooja room known as *BhutadKone.* Lower caste people are not allowed to enter the chawadi, unlike in the previous housing type where the verandah was the threshold and place for gather. Here the religious practice actually creates and reinforce the separation farther. Material used for the houses are laterite, mud, brick, jack wood, thatch or Mangalore tiled roofs.

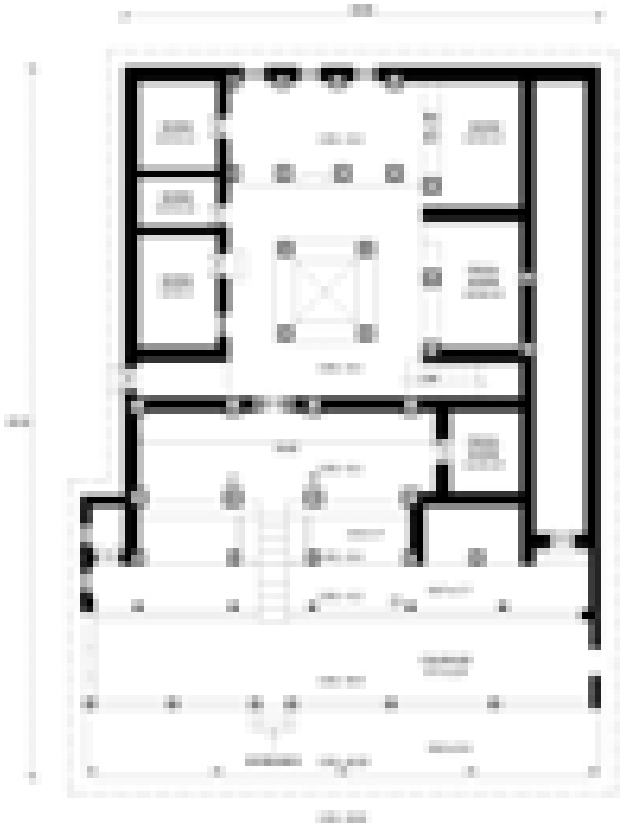


Figure.15.0: Plan of NadiBettu, Shirva

Figure.16.0: Elevation of NadiBettu, Shirva

2.4.3. Traditional elements:

Richness of the Tulu nadu can be seen in the Chawadi, which is auspicious. The exposed columns of Hebbelasu (Jack wood), varies from 450 mm to 550 mm in cross section, tapered towards the top.The columns, beams, ceilings and doors are richly embellished with a variety of motifs with gods and goddess. The motifs such as: a man riding a horse surrounded by floral decorations, geometrical patterns, *Gandberunda(*Two headed mythological bird*)*, and *Nagamandala*(Serpent*)* motifs. Other carving details are parrots, *Garuda* (eagle), elephant, peacock, and floral patterns (Fig.17.0). Apart from the indoor spaces the culture is reflected in the form of *Kambhala (*place for buffalo fights*)(Fig.18.0)*and *Nagabana(* worship for snakes*)*(Fig.19.0)*.*

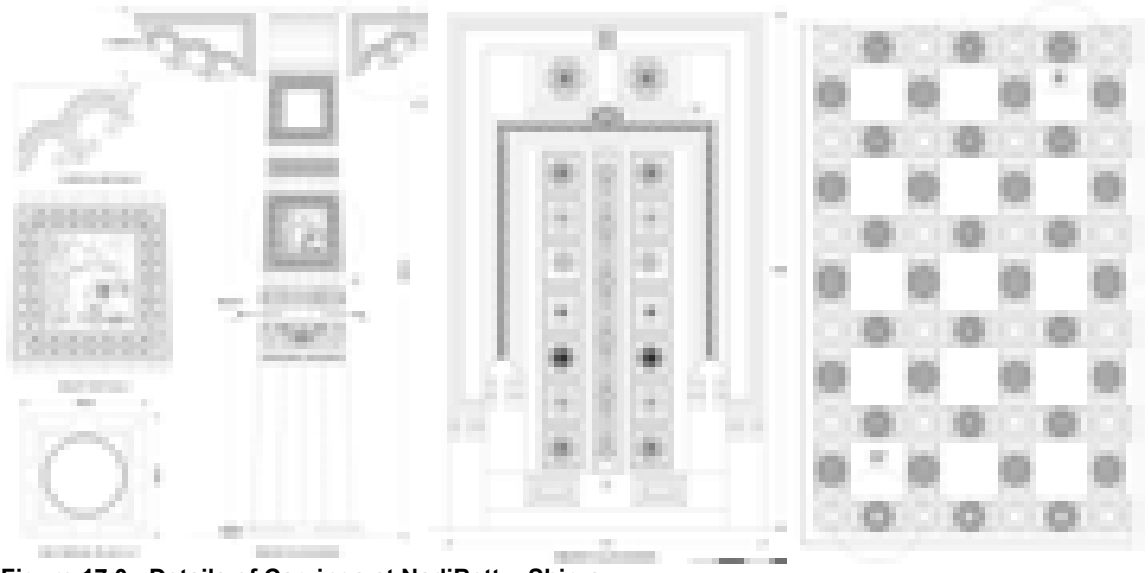


Figure.17.0: Details of Carvings at NadiBettu, Shirva

Fig.18.0: *Kambhala* at NadiBettu, Shirva
Fig.19.0: *Nagabana*a place for worshipping snakes

3 Conclusions:

The socio-cultural and traditional practices are demonstrated in various forms in Indian villages. The patterns and traditional elements create an identity to each village in a unique way. Case studies of four Indian villages were analyzed through settlement patterns, typology of the houses, and their traditional practices. Each, village added its own way to create an image. Raghurajpur is specially known as artisan's village, where linear settlement is observed due to its occupation. Houses are multi-functional, where art forms are practiced, displayed and demonstrated on the walls, columns and on the openings. Reused cloths, and waste beetle nuts and coconut shells are used for paintings. Sawantwadi is known for its wooden toys and for making Ganjifa (playing cards), verandah of the houses are converted into shops, and store next to it. Mattur is another such hamlet, known as Sanskrit Village of India, with a majority Brahmin community. The traditional practices of rituals are performed in both indoor and outdoor spaces.Shirva is a scattered settlement and landlord's house reflects their traditions through rich carvings depicting their traditions, similarly outdoor spaces for *kambala* and *Nagabana*. Thus, each community is unique in its way and is demonstrated either indoor spaces or outdoor spaces. These evolve based on individual practices

Acknowledgement:

Author would like to acknowledge the students of School of Planning and Architecture, Vijayawada (SPAV) and Srinivas School of Architecture (SSA), Mangalore for being a part in documenting the villages.

References:

Architecture, I., and Lanka, O. F. S. R. I. (2007). REINVENTING TRADITIONAL TECHNOLOGIES FOR SUSTAINABILITY : Contemporary Earth Architecture of Sri Lanka, 5(4), 23–33.

Dhingra, M. and Chattopadhyay, S. (2016). Advancing smartness of traditional settlements-case analysis of Indian and Arab old cities. International Journal of Sustainable Built Environment, 5(2), 549–563. https://doi.org/10.1016/j.ijsbe.2016.08.004

Ferdous, L. Kafy, A. Gafur, A. R. and Wakil, A. (2017). An Analysis on Influencing Factors of Rural Housing and Settlement Pattern in Rajshahi , Bangladesh, 2(4), 99–109. https://doi.org/10.11648/j.larp.20170204.12

Khandekar, Y. S. Rahate, O. P. Gawande, A. B. Sirsilla, K. A. and Govindani, S. M. (2017). Vernacular architecture in India, 2747–2751.

Widiastuti, I., & Vedamuthu, R. (2009). A comparative study of vernacular settlement and dwelling culture : A case study in Kerala , South India , and Minangkabau in Sumatra , Indonesia, (January). https://doi.org/10.18848/1833-1882/CGP/v04i02/52833

Ahmad, E., Social and Geographical Aspect of Human Settlements, New Delhi, Classical Publications, (1979), p. 99-104

P. Rajagopalan and M.M Andamon (eds.), *Engaging Architectural Science: Meeting the Challenges of Higher Density: 52nd International Conference of the Architectural Science Association 2018*, pp.503–510. ©2018, The Architectural Science Association and RMIT University, Australia.

Review of Campus Sustainability Rating Systems for Indian Campuses

Nikhat Parvez
Indian Institute of Technology Roorkee, Roorkee, India
ar.nikhatparvez@gmail.com

Avlokita Agrawal
Indian Institute of Technology Roorkee, Roorkee, India
avlokita.agrawal@gmail.com

Abstract: Sustainable campus development is becoming universal with an increase in the number of campuses demonstrating leadership on pursuing sustainability. Even though there are various international campus sustainability rating and ranking systems but they are not completely utilized in India. The purpose of this study is to analyse and compare eight of these rating systems and prepare a comprehensive list of sustainability parameters and their indicators. Further, check the presence of these Indicators in Indian Institute of Technology Roorkee (IITR), India campus to lay the foundation of the problems faced by the Indian institutions while rating their campuses. Also, an attempt to rate the IITR campus has been made to identify the obstacles faced by Indian institutions for rating their campuses. Parameters of sustainable development are approximately same in all the campus sustainability rating /ranking systems. Indian institutions lack a measuring and monitoring system due to which they are unable to rate their campuses, leading to a situation where the institutions are unaware of the extent of sustainable development achieved on their campuses. This obstructs the comprehensive sustainable development of the campuses. This paper identifies a need to study sustainable campus development for higher education campuses in India.

Keywords: Sustainable development; Campus Sustainability Rating systems; Sustainability parameters and indicators; Indian campuses.

1. INTRODUCTION

A sustainable higher education institution is supported by the three pillars of sustainability and advances to protect them (Castro *et el.*, 2013). These are: (a) Environmental protection (b) Promotion of equity and social justice (c) Economic security (Alshuwaikhat and Abubakar, 2007). This sustainable initiative facilitates the campus and in the long run society at a regional and global level to attain sustainability (Velazquez *et al.*, 2006). Sustainable programs result from the "triple bottom line"- environmental, social and economy (Lozano, 2006).

In this paper eight rating/ranking systems for sustainable development of campuses have been studied. These systems measure all the sustainable activities on the campuses in addition to the building performance. Of all the discussed systems, most have originated in the U.S. emphasising on the high level of the sustainability initiatives and sustainable development of educational campuses in the country. This paper studies and evaluates the sustainability of the Indian Institute of Technology Roorkee (IITR) campus, established in 1847, that extends to 144.07 hectares in area (www.iitr.ac.in).

1.1 Evolution of Rating Systems

Sustainability was talked about for the first time in Brundtland commission in 1987. The Stockholm Declaration, 1972 is the first declaration in the international environmental law which recognized the right to a healthy environment (Alshuwaikhat and Abubakar, 2008). The Talloires Declaration, 1990 was composed in France by the university administrators, which made the first formal announcement about achieving sustainability in higher education (Lozano et al., 2013). These charters and declarations led to the development of various rating and ranking systems. Rating and certification systems measure and assess a sustainability project (OECD, 2008). Higher education institutions are influenced and encouraged by assessment tools which give incentives to institutions for attaining sustainable development (Ferrer-Balas *et al*., 2008). As per a study carried out by Shriberg (2002) on various campus sustainability assessment tools, the tools should be computable, comparable and all-inclusive.

Greener U- a company which collaborates with educational institutions to enhance sustainable development by providing sustainable solutions, developed the ranking of the top ten higher education sustainability rating, ranking and review tools. Out of these ten, six have been discussed along with Indian Green Building Councils' (IGBC) green townships. In order to have an overview of the rating systems that assesses the sustainable campuses, a description of their origin and association with remarks is given in table 1. Further, a comparative study has been carried out among these rating systems in this paper.

Table 1: Various rating and ranking systems used for the study

Name	Origin Country/ Year	Association	Web/Reference	Remarks
Sustainability Tracking, Assessment & Rating System (STARS)	U.S./ 2006	Association for the Advancement of Sustainability in Higher Education (AASHE)	(https://stars.aashe.org).	monitors continuous sustainable development; provides goals and incentives
College Sustainability Report Card (CSRC)	U.S./2005	Sustainable Endowments Institution (SEI)	http://www.greenreportcard.org/index.html, (Shi and Lai, 2013)	survey based system process includes selection, survey composition, data collection and verification and assessment.
Princeton Review Green Rating (PRGR)	U.S./2011	AASHE	https://www.princetonreview.com	basis -small survey for sustainable initiatives and achievements
Cool Schools (CS)	U.S./2007	Sierra club, STARS	http://vault.sierraclub.org	ranks according to the institutions' performance in sustainability
Campus Report Card (CRC)	U.S./2001	National Wildlife Federation	http://www.nwf.org	reviews the sustainability initiatives and progress and advancement in environmental performance of institutions
Greenopia College &University Rankings (GCUR)	U.S./2009		http://sustainability.uoregon.edu	rates the schools and provide a list of schools which are sustainable and environmentally conscious
Indian Green Building Council (IGBC)	India/2010	Indian Green Building Council (IGBC)	https://igbc.in/igbc	addresses problems of sprawl, automobile dependency and addresses social and environmental issues.
UI Green Metric WUR (UI)	Indonesia/2010	Universitas Indonesia	http://greenmetric.ui.ac.id	informs about sustainability programs on campus

2. OVERVIEW AND COMPARISON OF RATING SYSTEMS ACCORDING TO THEIR PARAMETERS AND INDICATORS

In table 2, an exhaustive list of sustainability parameters and their indicators is obtained by combining the indicators of all the discussed rating and ranking systems. Further, the presence or absence of these indicators is checked in each of these rating systems. Figure 1 shows the presence of various parameters in sustainability rating systems. It may be noted that IGBC is excluded from this graph as it is not a comprehensive campus sustainability rating system. This comparison clearly indicates the presence of operational parameters in all the rating systems which becomes an important parameter all across. Planning and administration parameters are not that widely covered, whereas engagement and academics are covered in most of them.

Table 2: Rating systems according to their parameters

	Subcategory	Indicators*	STARS	CSRC	PRGR	CS	CRC	GCUR	IGBC	UI
1. Academics	Academics	Academic Courses	Y	N	Y	Y	Y	N	N	Y
		Sustainability Learning Results	Y	N	Y	Y	Y	N	N	Y
		Sustainability in Undergraduate Program	Y	Y	Y	Y	Y	N	N	Y
		Sustainability in Graduate Program	Y	Y	Y	Y	Y	N	N	Y
		Holistic Experience	Y	Y	Y	Y	Y	N	N	Y
		Assessment of Sustainability Knowledge	Y	Y	Y	Y	Y	N	N	Y
		Motivation for New Courses on sustainability	Y	Y	Y	Y	Y	N	N	Y
		On Campus Sustainable Experiments	Y	Y	Y	Y	Y	N	N	Y
	Research	Research on sustainability	Y	Y	Y	Y	Y	N	N	Y
		Support for Research on sustainability	Y	Y	Y	Y	Y	N	N	Y
		Access to sustainable Research	Y	Y	Y	Y	Y	N	N	Y

2. Engagement	Occupant Engagement	Student Training Program	Y	Y	Y	Y	Y	N	N	N
		Student Orientation	Y	Y	Y	Y	Y	N	N	N
		Incorporation of sustainability in Student Life	Y	Y	Y	Y	Y	N	N	N
		Availability of Materials and Publications	Y	Y	Y	Y	Y	N	N	N
		Campaigns for the Masses	Y	Y	Y	Y	Y	N	N	N
		Employee Training Program	Y	Y	Y	Y	Y	N	N	N
		Employee Introduction to Sustainability	Y	Y	Y	Y	Y	N	N	N
		Staff Professional Development	Y	Y	Y	Y	Y	N	N	N
	Public Engagement	Community Partnerships	Y	Y	Y	Y	Y	N	N	N
		Inter-Campus Partnership	Y	Y	Y	Y	Y	N	N	N
		Adult Education	Y	Y	Y	Y	Y	N	N	N
		Community Service	Y	Y	Y	Y	Y	N	N	N
		Community Stakeholder Engagement	Y	Y	Y	Y	Y	N	N	N
		Participation in Public Policy	Y	Y	Y	Y	Y	N	N	N
		Sustainability Trademark Licensing	Y	N	N	N	N	N	N	N
		Hospital Network	Y	Y	Y	Y		N	N	N
3. Operations	Air & Climate	Greenhouse Gas Emissions	Y	Y	Y	Y	Y	Y	Y	Y
		Outdoor Air Quality	Y	Y	Y	Y	Y	Y	Y	Y
	Buildings	Sustainable Building Operations & Maintenance	Y	Y	Y	Y	Y	Y	Y	Y
		Sustainable Building Design and Construction	Y	Y	Y	Y	Y	Y	Y	Y
		Indoor Air Quality	Y	Y	Y	Y	Y	Y	Y	Y
	Dining services	Dining Purchasing	Y	Y	Y	Y	N	Y	N	N
		Low Impact Dining	Y	Y	Y	Y	N	Y	N	N
	Energy	Energy Consumption on Campus	Y	Y	Y	Y	Y	Y	Y	Y
		Renewable Energy on Campus	Y	Y	Y	Y	Y	Y	Y	Y
	Grounds	Sustainable Landscape Management	Y	N	N	Y	Y	N	Y	Y
		Biodiversity Management	Y	N	N	Y	Y	N	Y	Y
	Purchasing	Electronics	Y	Y	N	Y	N	N	N	N
		Cleaning Product	Y	Y	N	Y	N	N	N	N
		Paper	Y	Y	N	Y	N	N	N	N
		Inclusive and Local Purchasing	Y	Y	N	Y	N	N	N	N
		Life Cycle Cost Analysis	Y	Y	N	Y	N	N	N	N
		Guidelines for Business Partners	Y	Y	N	Y	N	N	N	N
	Transportation	Campus Transportation	Y	Y	Y	Y	Y	Y	Y	Y
		Means of Student Transportation and Programs	Y	Y	Y	Y	Y	Y	Y	Y
		Means of Employee Transportation and Programs	Y	Y	Y	Y	Y	Y	Y	Y
		Support for Sustainable Transportation	Y	Y	Y	Y	Y	Y	Y	Y
	Waste	Attempt to Zero Waste	Y	Y	Y	Y	Y	Y	Y	Y
		Waste Diversion	Y	Y	Y	Y	Y	Y	Y	Y
		Construction And Demolition Waste Diversion and Reuse	Y	Y	Y	Y	Y	Y	Y	Y
		Hazardous Waste Management	Y	Y	Y	Y	Y	Y	Y	Y
	Water	Water Use	Y	Y	Y	Y	Y	Y	Y	Y
		Rainwater Management	Y	Y	Y	Y	Y	Y	Y	Y
		Wastewater Management	Y	Y	Y	Y	Y	Y	Y	Y

4. Planning and Administration	Co-ordination, planning & governance	Sustainability Coordination	Y	Y	Y	Y	N	N	N	N
		Sustainability Planning	Y	Y	Y	Y	N	N	N	N
		Governance	Y	Y	Y	Y	N	N	N	N
	Diversity & affordability	Diversity and Equity Analysis and regulation	Y	N	N	Y	N	N	N	N
		Assessing Diversity and Equity	Y	N	N	Y	N	N	N	N
		Help for Underrepresented Groups	Y	N	N	Y	N	N	N	N
		Support for Future Faculty Diversity	Y	N	N	Y	N	N	N	N
		Affordability and Access to all	Y	N	N	Y	N	N	N	N
	Health, well-being & work	Employee Compensation	Y	N	N	Y	N	N	N	N
		Assessing Employee Satisfaction	Y	N	N	Y	N	N	N	N
		Wellness Program	Y	N	N	Y	N	N	N	N
		Health and Safety of Occupants on Campus	Y	N	N	Y	N	N	N	N
	Investment	Committee to Decide on Sustainable Investments	Y	Y	Y	Y	N	N	N	N
		Sustainable Investment	Y	Y	Y	Y	N	N	N	N
		Investment Transparency	Y	Y	Y	Y	N	N	N	N
5. Innovations			Y	N	N	Y	N	N	Y	N

Y-Present N- Absent.
* The indicators are adapted from STARS and other rating systems for comparison

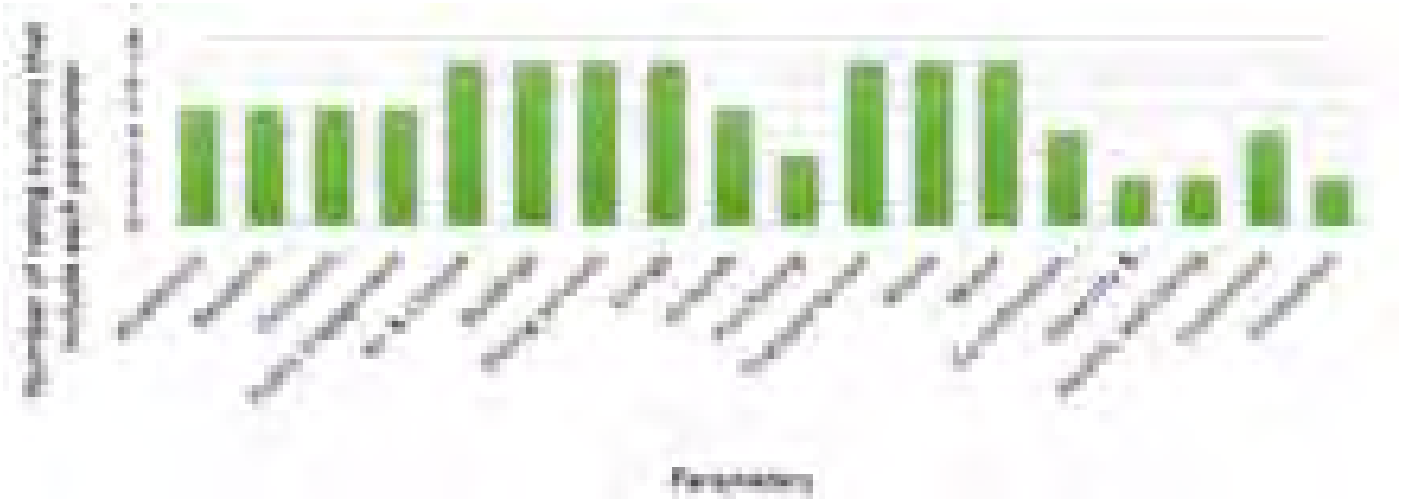


Figure 1: Graph shows the presence of parameters in sustainability rating systems. (source: Author)

3. INDIAN SCENARIO OF CAMPUS SUSTAINABILITY-A CASE STUDY OF IITR CAMPUS

Ministry of Human Resources Development (MHRD) of India has directed the educational campuses to achieve sustainable development (the newsletter for higher education, June 2013). In India there are some residential campuses which are making efforts in achieving campus sustainability, but there is a lack of comprehensive sustainable development (IGBC Green Townships, 2010; S. Bantanur et el, 2015).

IIT Roorkee (IITR) is a fully residential campus in India. IITs are autonomous public institutes of higher education governed by the Institutes of Technology Act, 1961 (Government of India, 2009). In IITR, Bachelor's Degree courses, Postgraduate Degree courses and doctoral works are offered in Engineering, Applied Science and Architecture and planning. The campus has various departments, hostels, staff and faculty residences, recreational spaces, community spaces, sports area, commercial spaces, administrative spaces and a hospital.

Table 3 represents a checklist of presence and absence of various sustainability indicators, compiled in section 3, along with the extent of advances done in that particular indicator for IITR campus. The basis of the checklist is the survey conducted by the authors in the IITR campus. The survey inquired about the various indicators of sustainable development on the campus and was taken up to measure the indicators and collect all the information about them. The indicators in Table 3 are not directly adapted from the comparison but developed after the in-depth study of these indicators. Some

indicators are merged from the comparison whereas some are given new names. The meaning of all these indicators is explained in the remark section of the tables.

Table 3: Checklist for Rating of IITR Campus on Parameters and Indicators Derived from Comparison

Category	Indicators	Presence	Monitoring	Remarks (What has been done related to the indicator in IITR)
1. Administration	(i). Sustainable policies	YES	NO	Policies like- Green office, Green Master Plans, Bio-diversity, Water bodies, minimizing Carbon Foot print and Green Audit. No continuous monitoring of the policies.
	(ii). Administrative committees	YES	NO	A committee comprising of a chairman, coordinator and five members. No record kept separate for sustainability achieved.
	(iii). Sustainability staff	YES	NO	No separate staff; regular staff gets engaged. No continuous monitoring of all the sustainable activities.
	(iv). Office or department	YES	NO	Irrespective of a committee, no full time office or staff; No continuous monitoring of all the sustainable activities.
	(v). Website	YES	YES	Webpage named Green Campus Initiatives is developed which is monitored regularly.
	(vi). Green purchasing	NO	-	
	(vii). Employee outreach opportunities	NO	-	
2. Academics	(i). Academic Courses	YES	YES	Sustainability related courses as a part of the curriculum.
	(ii). Immersive Experience	YES	YES	Department of Architecture and Planning offers an immersive experience in the field of sustainable development.
	(iii). Sustainability Literacy Assessment	NO	-	
	(iv). Incentive for Developing Courses	NO	-	
	(v). Academic Research	YES	YES	No separate list for sustainable researches. It could only be obtained from the comprehensive list of all researches.
3. Transportation	(i). Campus motor fleet	NO	-	Type and number of motor vehicles is known but number of trips is unknown. No data about bicycles.
	(ii). Commute modal split	YES	YES	
	(iii). Support for Sustainable Transportation	YES	YES	
	(iv). Bicycle program	YES	YES	
	(v). Car sharing program	NO	-	
	(vi). Planning	NO	-	
4. Climate change and energy	(i). Greenhouse gas emissions inventory	NO	-	
	(iii). Energy efficiency and conservation	YES	YES	Energy audit; policies- reduce electricity consumption and energy conservation, solar PVs, solar thermal power for cooking and water heating, LED based lamps on streets; Annual saving of Electricity is 12,36,150kWh (2012)
	(iv). Renewable energy generation	YES	YES	IITR Photovoltaic Solar Power Installation. Total-1812 Peak Power Output (kW)
	(v). Renewable energy purchase	NO	-	
5. Food	(i). Locally grown and purchased food	YES	YES	All the food products in the hostel mess is purchased locally and a record is kept of all the purchases.
	(ii). Organic and sustainably produced food	NO	-	

6. Waste	(i). Waste minimization	NO	-	
	(ii). Waste diversion	NO	-	
	(iii). Construction And Demolition Waste Diversion	NO	-	
	(iv). Hazardous Waste Management	NO	-	
7. Water	(i). Water Use	NO	-	
	(ii). Rainwater Management	NO	-	
	(iii). Wastewater Management	NO	-	
8. Green building	(i). Design and construction	YES	NO	All old buildings are climate responsive, but these buildings are not green certified.
	(ii). Adaptive reuse	YES	YES	Different classes are held in the same room at different times.
	(iii). Operations and maintenance	YES	NO	light sensors and green rating appliances; shift to energy efficient appliances; temperature regulation of AC; use of gas based stoves, etc.; no proper monitoring is done
	(iv). Indoor Air Quality	NO	-	
9. Grounds	(i). Landscape Management	YES	NO	Built, unbuilt; paved, unpaved area; etc. is unavailable. needs to be traced from the plans.
	(ii). Biodiversity	YES	NO	Only number of trees known. No information about fauna.
10. Student involvement/ campus engagement	(i). Student Educators Program	NO	-	
	(ii). New Student Orientation	YES	NO	No in person orientation about sustainable development policies and agenda of the campus.
	(iii). Student Life	NO	-	
	(iv). Outreach Materials and Publications	YES	NO	No monitoring at all of the availability of sustainability publications
	(v). Outreach Campaign	NO	-	
	(vi). Sustainability challenges and competitions	YES	NO	Different activities like workshops, seminars and competitions are organized in the campus from time to time but are not monitored.
	(vii). Employee Educators Program	NO	-	
	(viii). Employee Orientation	NO	-	
	(ix). Staff Professional Development	NO	-	

4. DISCUSSION

As indicated by the checklist in Table 3, out of all the 46 campus sustainability indicators only 22 indicators are being implemented on the IITR Campus, out of which only 11 are measured and monitored as shown in Figure 2. This accounts for less than 50 percent of the total list. Figure 2 represents the distribution of various sustainability indicators individually on the IITR campus. As per Figure 2 most of the indicators of operational parameters are present on the campus out of which some of them are monitored constantly. This emphasizes on the fact that Indian campuses are incorporating sustainable development in their campuses. However, comprehensive sustainable development is still not achieved. Even though initiatives for sustainable campus development has started, there is lack of measurability and verification of the extent of sustainable development achieved. The absence of monitoring mechanism creates a shortfall for the use of campus sustainability rating systems. The absence of certain parameters in Indian campuses can be related to the differences in the Indian campuses as it is still a developing country and most of the rating and ranking systems are formulated in the developed countries of the world except UI. All though the indicators of sustainable development are established, the benchmarks for their assessment and measurement in Indian campuses is still missing. Identification of these problems encountered while rating campuses will help the institutions to understand what are the primary barriers in achieving complete sustainable development, address this issue and come up with a solution which will in return catalyze the sustainable growth of the campuses.

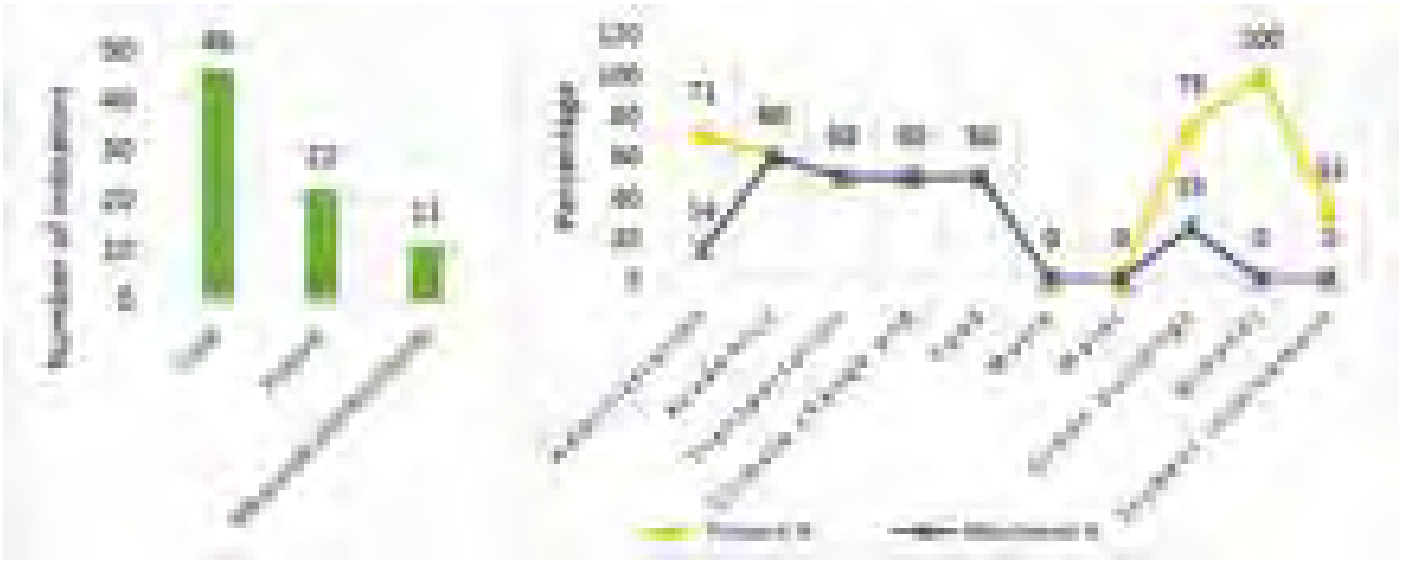


Figure 2: Graphs showing distribution of various indicators on IITR campus. (Source: Author)

5. CONCLUSIONS

The given comparison of the various campus sustainability rating and ranking systems outlines a comprehensive list of parameters and their indicators for sustainable campuses. This list is used to rate an Indian campus- IITR. However, IIT Roorkee campus still cannot be rated due to unavailability of measuring and monitoring mechanism. As IITR is a premier government Institute in India, similar will be the case of majority of Indian campuses. There are many reasons which contribute to the failure of the campus sustainability rating systems in India, majorly the following reasons enlisted below:

- All the parameters and their indicators are not considered. Only some parameters such as operations are targeted in India (Table 3, Figure 2).
- Most of the indicators which are present are not monitored, which expresses a lacuna in the monitoring and verification system to report achievement of sustainable development (Table 3, Figure 2). Measuring and monitoring of sustainability should be made mandatory in all the campuses by the government to ensure a comprehensive sustainable development.
- In the absence of a monitoring and verification system, Indian campuses could not be rated or ranked on any holistic rating or ranking system. Therefore, a special monitoring and verification system for Indian campuses should be designed.
- The inability to rate the campuses on any rating system leads to absence of information about the extent of sustainable development in Indian campuses. Thus, any benchmark cannot be defined for the Indian campuses. Since India is a developing country, its benchmark will be different from those of developed countries.

Indian campuses possess a tremendous opportunity to grow its sustainability initiative. The campuses will work in a more focused and informed way towards sustainable development if there are analysis and feedback in place to direct the overall efforts. There is a need to develop a monitoring and verification system for Indian campuses so that it helps them better determine how campuses are doing with sustainability and pinpoint areas where they can improve. And thus rate the campuses on any rating system available worldwide.

References

"A Greener U guide, campus sustainability and energy solutions", available at http://www.greeneru.com (accessed 20 October 2016).

"2008 Annual report on sustainable development work in the OECD", Organization for economic co-operation and development,2005. Available at https://www.oecd.org/greengrowth/42177377.pdf (accessed 20 January 2017).

"Association for the Advancement of Sustainability in Higher Education (AASHE)", 2012. STARS, available at https://stars.aashe.org/ (accessed 20 October 2016).

"Campus Report Card" (2008), available at http://www.nwf.org/campus-ecology/resources/reports/campus-report-card.aspx (accessed21 November 2015).

"Cool Schools", available at http://vault.sierraclub.org/sierra/201309/coolschools (accessed 21 October 2016).

"Copernicus-Guidelines for Sustainable Development in the European Higher Education Area", available at http://www.unece.org/fileadmin/DAM/env/esd/information/COPERNICUS%20Guidelines.pdf (accessed20 December 2016).

"Greenopia College & University Rankings", available at http://sustainability.uoregon.edu/office-sustainability/greenopia (accessed 22 November 2015).

"Princeton review green rating", available at http://www.princetonreview.com/green.aspx (accessed 21 October 2015).

"University Grants Commission report 2013-14" available at http://www.ugc.ac.in/pdfnews/7938259_Annual-Report-2013-14.pdf (accessed21 October 2016).

Alshuwaikhat, H.M. &Abubakar, I., (2008). "An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices", Journal of Cleaner Production, Vol. 16, pp. 1777-1785.

Alshuwaikhat, H.M., &Abubakar, I., (2007). "Towards a sustainable urban environmental management approach (SUEMA), incorporating environmental management with strategic environmental assessment", Journal of Environmental Planning and Management, Vol. 50 No. 2, pp 257-270.

Bantanur, S., Mukherjee, M., & Shankar, R., (2015). "Emerging dimensions of sustainability in institutes of higher education in India", International Journal of Sustainable Built Environment, Vol. 4 No. 2, pp 323-329.

Castro, R., Jabbour, C. J. C., (2013). "Evaluating sustainability of an Indian university", Journal of Cleaner Production, Vol. 61, pp. 54-58.

Cortese AD. (2005). "Integrating sustainability in the learning community", Facilities Manager, Vol. 21 No. 1, pp 28-35.

Ferrer-Balas D., Adachi, J., Banas, S., Davidson, C.I., Hoshikoshi, A., Mishra, A., Motodoa, Y., Onga, M., Ostwald, M., (2008). "An international comparative analysis of sustainability transformation across seven universities", International Journal of Sustainability in Higher Education, Vol. 9 No. 3, pp 295-316.

IGBC Green Townships (For Townships and Large Developments) Rating System Pilot Version Abridged Reference Guide November 2010, available at https://igbc.in/igbc/redirectHtml.htm?redVal=showGreenTownshipsnosign (accessed 23 October 2016).

Indian Institute of Technology, Roorkee. Available at https://www.iitr.ac.in/ (accessed 21 December 2016)

Lozano R., (2006). "A tool for a graphical assessment of sustainability in universities (GASU)", Journal of Cleaner Production, Vol. 14, pp 963-972.

Lozano, R., Lozano, F., Mulder, K., Huisingh, D., Waas, T., (2013). "Advancing Higher Education for Sustainable Development: International insights and critical reflections", Journal of Cleaner Production, Vol. 48, pp. 3-9.

Lozano, R., Lukman, R., Lozano, F.J., Huisingh, D. &Lambrechts, W., (2013). "Declarations for sustainability in higher education: becoming better leaders, through addressing the university system", Journal of Cleaner Production, Vol.48, pp 10-19.

Shi, H., Lai, E., (2013). "An alternative university sustainability rating framework with a structured criteria tree", Science Direct Journal of Cleaner Production, Vol. 61, pp 59-69.

Shriberg, M., (2002). "Institutional Assessment Tools for Sustainability in Higher Education: Strengths, Weaknesses, and Implications for Practice and Theory', International Journal of Sustainability in Higher Education, Vol. 3 No. 3, pp 254–70.

UI Green Metric World University Rankings, 2016. Available at: http://greenmetric.ui.ac.id/ (accessed 22 September 2017)

UNESCO. Kyoto Declaration. Ninth international association of universities round table,1990. Available at: https://unfccc.int/resource/docs/convkp/kpeng.pdf (accessed 22 December 2016)

UNESCO. The Halifax Declaration. UNESCO,1991. Available at https://www.iau-hesd.net/sites/default/files/documents/rfl_727_halifax_2001.pdf (accessed 22 December 2016)

UNESCO. The Swansea Declaration. UNESCO,1993. Available at https://www.iau-hesd.net/sites/default/files/documents/the_swansea_declaration.pdf (accessed 22 December 2016)

UNESCO. The Talloires Declaration. UNESCO (1990). Available at http://ulsf.org/talloires-declaration/ (accessed 22 December 2016)

UNESCO. Thessaloniki Declaration. UNESCO, 1997. Available at https://www.iau-hesd.net/sites/default/files/documents/thessaloniki.pdf (accessed 22 December 2016)

Velazquez L., Munguia N., Platt A. &Taddei J., (2006). "Sustainable University: What can be the matter?", Journal of Cleaner Production, Vol. 14, pp. 810-819.

7th International Conference on Research in Science and Technology
October 19 – 21, 2018
Munich - Germany

Urban Morphology – Different Attributes that Shape Urban Form

Ar. Shanu Raina[1], Ar. Bhagyalaxmi Madapur[2] and Dr. Mamatha P Raj[3]

[1] BMS College of Architecture, Bangalore-560019, India

[2] BMS College of Architecture, Bangalore-560019, India

[3] BMS College of Architecture, Bangalore-560019, India

Abstract.

Urban morphology in the broadest sense is the resultant of socio-economic as well as cultural processes and refers to the physicality of the urban form. The major morphological factors of cities include natural determinants and manmade determinants. In this paper, core overlapping morphological measures have been critically explored to analyze morphological attributes using Basavanagudi, one of the prominent neighborhoods of Bangalore city, India as a case study. These quantifiable methods can be used as indices by different stakeholders to formulate a framework of different schemes to steer the city towards elevating the quality of urban living.

Keywords—Urban morphology, Urban form, morphological measures, morphological attributes, Urban living, Built environment

1 Introduction

Urban morphology in the broadest sense is the resultant of socio-economic as well as cultural processes and refers to the physicality of the urban form in terms of its land uses, spatial patterns based on physical infrastructure, block layouts, built environment and urban open and green spaces all of which are considered as part of the historic evolutionary process of development of a particular area of the city. The primary concern of urban morphology is the structure of urban form and the urban form in turn is the result of internal structures of urban areas. The major morphological factors of cities include natural determinants (climate, topography and local materials available for construction) and manmade determinants (involve politics, religions, defence, planning and functioning). The current trends that are yielding vivid patterns of urban form are the result of un-related, un-connected and most importantly un-coordinated attempts practiced by a wide spectrum of people including policy makers, citizens, urban planners, urban designers, architects and engineers. Metropolis, across the world are encountering significant morphology amassing different phases and attributes owing to varied schemes, outlines and primacies of the diverse stake holders while expanding the urban fabric into multitude directions. Every successive socio-political decision and physical uncertainties impose new attributes to the city's spatiality continuing the cycle of morphogenesis.

Accelerated urban morphology is inevitable as many cities are undergoing urbanization at unprecedented speed, affecting the quality of urban life to a large extent. Spatial extent and physical grain of the city not only morph into different form but also function as altogether new attributes within the existing city fabric. Several physical paradigms can be studied using urban morphological methodologies. These quantifiable methods can be used as indices by planners, designers as well as policy makers to formulate a framework of different schemes to steer the city towards elevating the quality of urban living. In this paper, core overlapping morphological measures such as land use, development regulations, physical and social infrastructure, built form environment, public realm, green/open spaces, user profile – inhabitants and vendors have been critically explored to analyze morphological attributes using Basavanagudi, one of the prominent neighborhoods of Bangalore city, India as a case study.

2 Bangalore – Mapping the Morphology

Over the past seventy years, Bangalore, the capital city famously referred as Silicon Valley of India has morphed from being a non-descript town into metropolis. Bangalore, ranked as the most dynamic city in the world adds about 500 families and 80,000SqM of built up area per day owing to the economic reforms that are accelerating the pace of urbanization. The transformation of the city has been exceptionally marked by several phases of investments/developments in various socio-economic sectors (public and private), remarkable demographic growth as well as flourishing informal economy. Many of the early organizational and planning attempts belonging to that particular time period have been predominately inscribed by various rulers and administrators which readily got absorbed by each consecutive attempt.

Bangalore's morphology corresponds to four noticeable transformative phases:

- The native town (1537 to 1809)
- Colonial Period (1809 to 1947)- During this period city evolved as evidently two isolated entities; Pete (western part or Native area) and Cantonment (eastern part or British area)
- Science and Industry phase (1947 to 1980)
- Hi-tech phase (1980 to till date)

The emerging city morphology can be spatially categorized into Centers, Corridors, Wedges and Peripheries such as:

- Economic and socio-cultural activity centers
- Mass transit corridors
- Wedges consisting of neighborhoods
- Expanding urban peripheries.

Bangalore, as a 'ridge and valley settlement' was shaped by the source of water supply and considerations of proper drainage of the soil. Bangalore's morphology is geographically determined as it has a close knit relationship with the physical setting of the site. The geographical and spatial distribution of economic activities (administrative capital of the state, public sector organizations, academic institutions, small to medium scale industries and development of information technology / bio-technology related industries) across various parts of the city reflects its different stages of evolution and the distinctive morphology underlying the socio-spatial contexts.

3 Basavanagudi Neighborhood - Compatibility amid Diversity

Basavanagudi, is one of the oldest and historically significant areas of growing metropolitan city of Bangalore. It is named after a huge temple dedicated to bull (Basavanagudi) which is a major religious landmark on the cultural map of Bangalore.

A major epidemic, plague in 1898, forced city administrators to enforce the rules of town planning that emphasized on public health. Basavanagudi was the location of the plague camp. But soon an extension in the form of a layout was planned on 440 acres of dry land and came to be popularly known as Basavanagudi. Several other extensions and new developments such as Chamarajpet, Seshadripuram, Malleshwaram along with Basvanagudi were built strictly according to the grid iron or chess plan and were promoted as 'Model Hygienic Suburbs'. All the blocks were well-spaced and most importantly a heavy downpour would not leave a trace of standing water in the entire neighborhood owing to the well planned block layouts that followed natural drainage system. Basavanagudi extension facilitated built forms to be constructed facing the cardinal points as per the ancient Hindu tradition by following the rectangular design, with boundary roads running North-South and East-West and intermediate roads parallel to them to them (Refer Fig.2). Consideration of the entire neighborhood of Basavanagudi for the analysis of morphology measures is not within the scope of the paper of this length. Hence, an important part of the neighborhood which consists of the main road popularly known as Gandhi Bazaar and the immediate parallel roads along with blocks of this main road have been delineated as the study area (Refer Fig.1 & 3).

Fig. 1.View of the selected study area (Source: Authors)

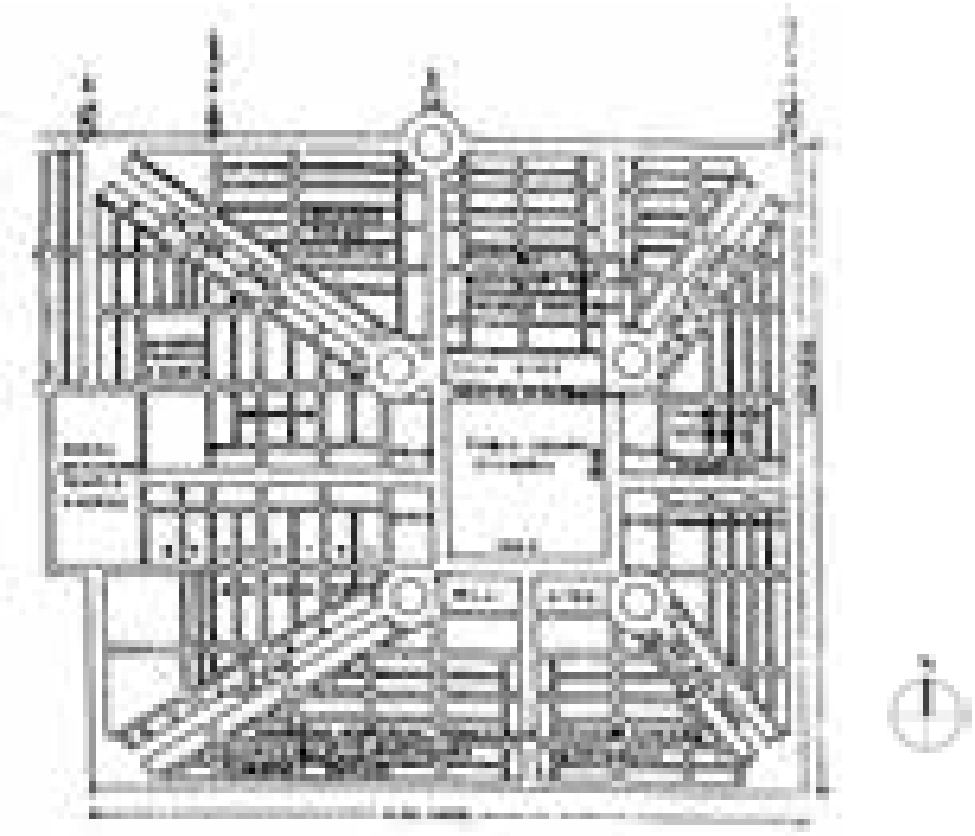


Fig. 2.Plan- Basavanagudi Extension,1894 (Source: Revenue maps, Bangalore)

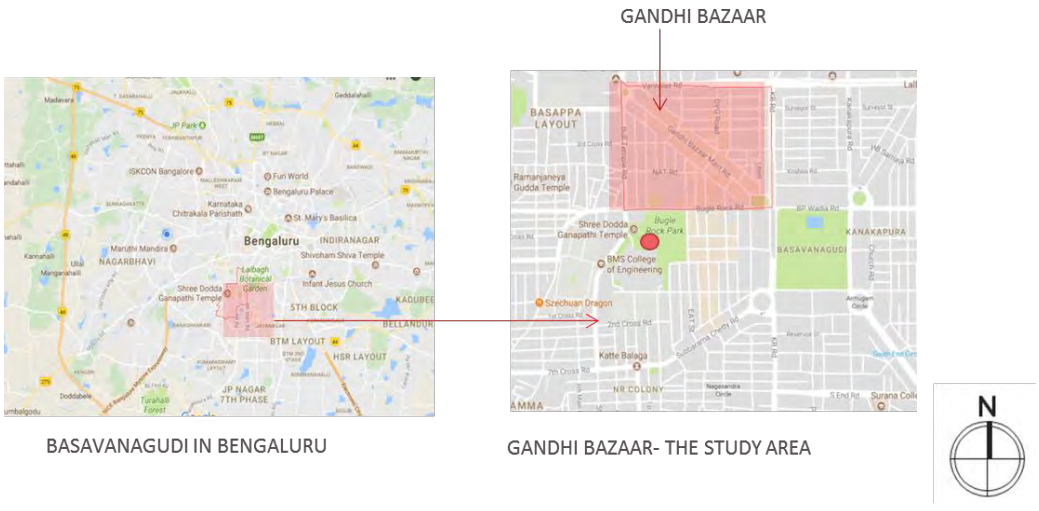


Fig. 3.Location of delineated study area (Source: Google maps and edited by authors)

3.1 Morphological Synthesis

In the delineated study area, core overlapping morphological measures such as land use, development regulations, physical and social infrastructure, built form environment, public realm,

green/open spaces, user profile- inhabitants and vendors have been analyzed to map the morphology and the resulting urban form.

3.2.1 Land use measure

Land being the fundamental resource of society involves surface utilization of developed/undeveloped land on the basis of certain compatible characteristics at a specific given time and space for drafting rational planning to allocate spatial arrangement for specific activities. The major land use in the diagonal bazaar is commercial (mainly shops, retail stores and cafés), while the inner neighborhood is predominantly residential. The residential development is gradually rezoned into mixed use (residence & retail shops or commercial & public or commercial & residential).

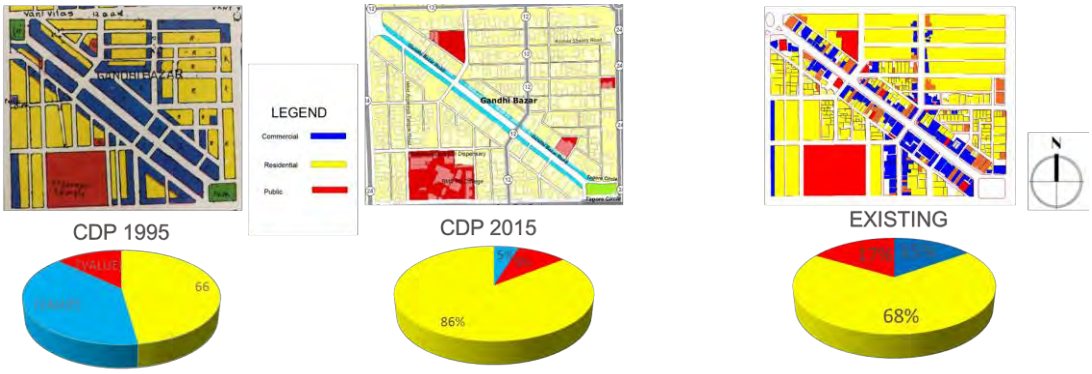


Fig. 4.Proposed and existing land use maps (Source: BDA and edited by authors)

The sub division of the plots is a common phenomenon. Due to many educational institutions in the close proximity the demand for the rental accommodation for students is increasing. The Commercial buildings are located along street edges. The commercial usage compatibility in a predominantly residential neighborhood has not been assessed. This is leading to exploitation of the existing infrastructure and adding to the increased developmental pressure which is evident in the perpetual densification of the area without due consideration for supporting utility networks (Refer Fig. 4 & 5).

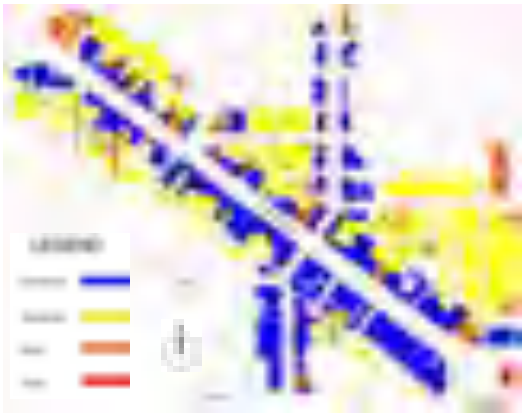


Fig. 5. Land use map of Gandhi Bazaar (Source: Authors)

3.2.2 Development Regulation Measure

When compared to building use recommended by the Bangalore Development Authority, it can be seen that the plots abutting the street were allocated for commercial use but in reality due the economic forces and demand, lot of the residential use has been converted to commercial. This phenomenon has resulted in considerable increase in land value. The map (Refer Fig.7) shows the buildings which violate the development control regulations.

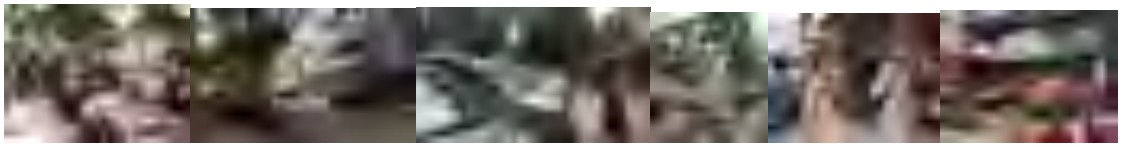


Fig. 6.Series of pictures showing reduced width of footpaths (Source: Authors)

Fig. 7.Map showing extent of violation of development regulations (Source: BDA and edited by authors)

3.2.3 Physical and social infrastructure

- Street - Traffic and Circulation

Street pattern and typologies of it forms the main guiding template in shaping the physical layout of an area or neighborhood having major impact on the accessibility criteria. Denser street networks increase connectivity and offer vibrant negotiations on everyday base. Urban morphology reveals the hierarchical pattern of the street network.

Basavanagudi Extension Plan, 1894 (Refer Fig.2) specifically indicates the prominence given to pedestrians through its street hierarchy to promote walkability of the neighborhood. Earlier streets had 8.0M wide footpaths (Refer Fig.8) which now range between1.15M to 3.9M (most of these shrunk footpaths are occupied by vendors and parked vehicles) owing to uncontrolled growth and increased vehicle density (Refer Fig.6).

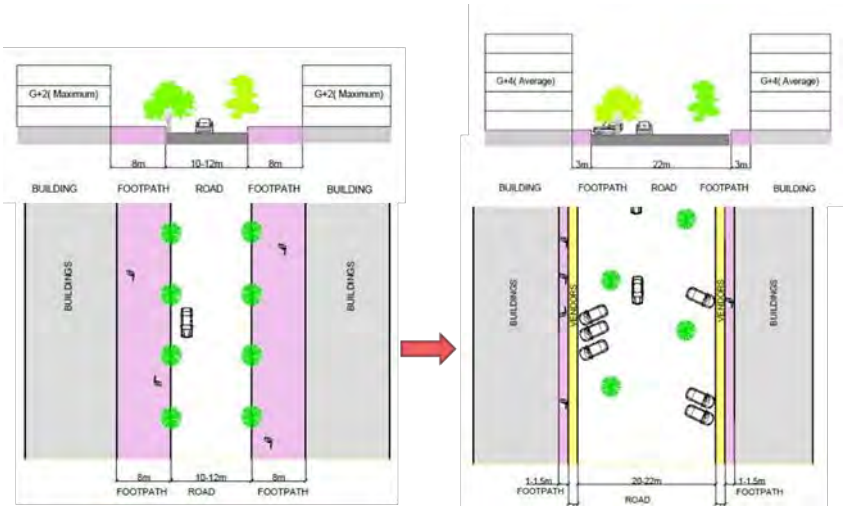


Fig. 8.Reduced width of footpaths (Source: Authors)

The area is well connected by different street hierarchies and public transportation facilities within walkable distances (Refer Fig.9 &10 respectively). The bus route is unidirectional along the Gandhi bazaar main road from Tagore circle to Ramakrishna ashram circle. The metro is also in the close proximity to the market, making it convenient for people of Bangalore to commute to the area. Gandhi bazaar being the famous historic destination for several activities, attracts of traffic both masses and vehicular. The encroachment by the vendors makes it difficult for the pedestrians to walk on footpath. The pavements are narrow and not maintained properly. On – street unauthorized parking leads to the traffic jams and makes walking for pedestrians difficult especially during peak hours and festival days. The area needs better pedestrian infrastructure and streetscape facilities to augment the active transport (walkability and cycling) which is widely contemplated as one of the major decisive factor in enhancing public health and better quality of urban environment.

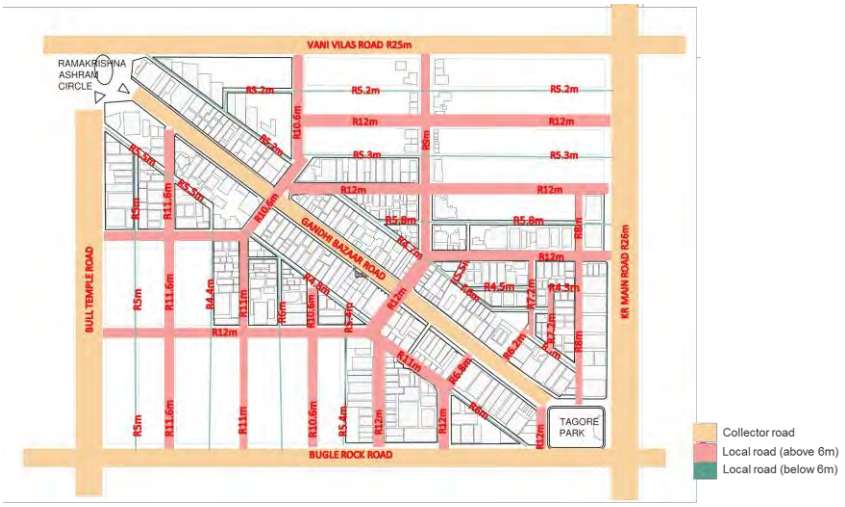


Fig. 9.Map showing different road hierarchies (Source: Authors)

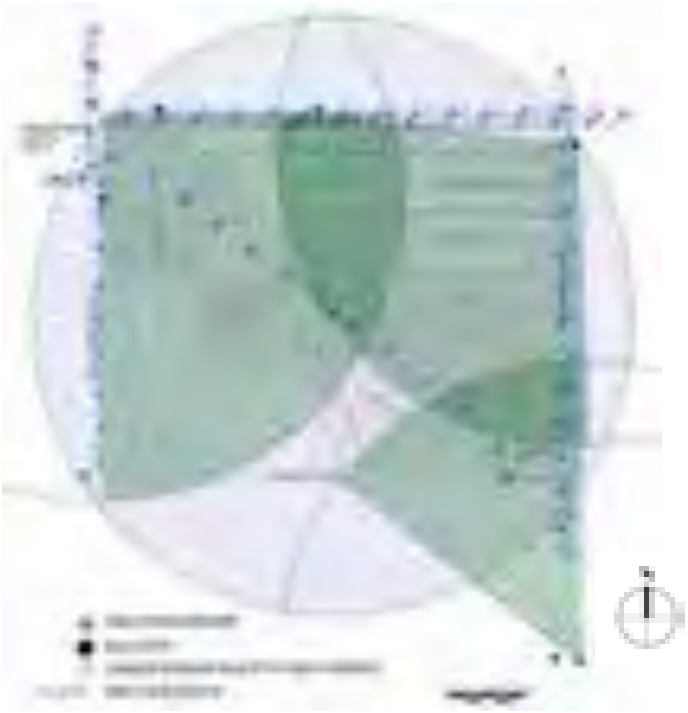


Fig. 10.Map showing major traffic movement along with bus stop locations and walkability radius (Source: Authors)

- Social Infrastructure

A city's human resource is actively productive when it has wider and inclusive accessibility to adequate social infrastructure in turn fostering equitable economic growth. The neighbourhood is well connected with all the social amenities such as schools, health care, post office, police station, fire station etc. (refer Fig. 11).

Fig. 11.Map showing social amenities in the precinct (Source: Authors)

- Fire safety

The conservancy lanes parallel to the main Gandhi bazaar street have a right of way of 5.20 M, whereas per National Building Code the minimum with of any street for the ease of fire tender movement should be 6.0M. Fire station is located 4km always from the area with given traffic fire tender will take at least twelve minutes to reach the destination. Assuming that all the structures are made of RCC and the rate of spread of fire is 1.15M/min. the map (Refer Fig.12) was prepared keeping in mind the evacuation window. From the map it can be summed up that there will be quiet damage in case of fire. It was observed that in most of the cases, material used by vendors/Hawkers for hawking is fire prone. This particular aspect is being aggravated by the absence of strict enforcement of development rules.

Fig. 12. Map showing evacuation window in case of fire (Source: Authors)

3.2.4 Built form Environment

- Building Height

Building heights directly corresponds to the density of the locality and the supporting utility infrastructure. The study shows that approximately 30% of the area is dominantly structures are four floors high. The numbers of these structures are almost the same comprising about approximately 27% of the total built form. The number of single floor structures are the approximately 20% (Refer Fig. 13). Over, the period of time the scale of the precinct has transformed from single floor structures to four and more storeys structures (Refer Fig. 14).

Fig. 13. Building Height map of the study area (Source: Authors)

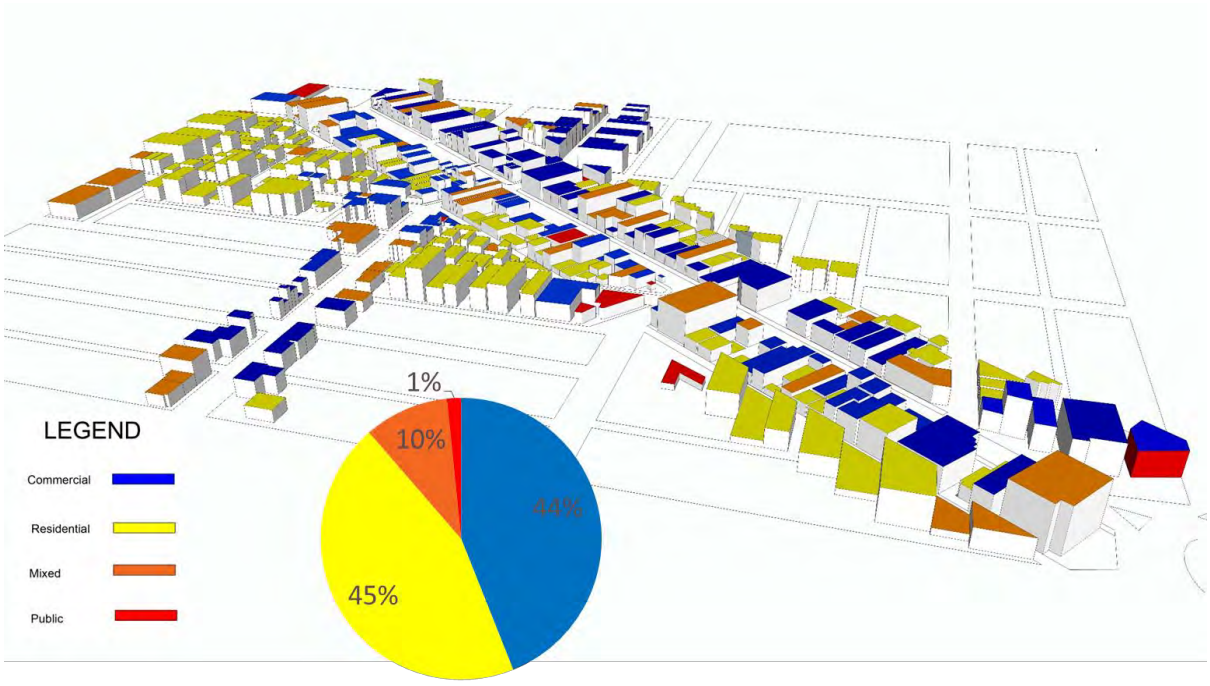


Fig. 14.Percentage composition of building heights along with their uses (Source: Authors)

Under the pressure of increased demand for real estate, old buildings have been either demolished or revamped to suit contemporary necessities (Refer Fig. 15).

Fig. 15.Transformation of built forms to suit contemporary necessities

- Built to Void Relationship

A figure ground diagram allows for clear articulation of urban spaces and the connecting elements to link these spaces. The prime location of land has led to mixed used development of larger foot prints transforming the urban grain from cohesive fine grain (which responds to human scale) to coarse. The buildings are increasingly getting denser over the years due to the strategic location of the area and increase in land value. Figure ground here clearly indicates two distinct typologies of urban void: streets as linear grids and large open spaces as the temple premises, playgrounds and parks (Refer Fig. 16).

Fig. 16.Map showing built to void map (Source: Authors)

- Building Age

The area being one of the early planned extensions has several buildings which are more than sixty-five years old structures (Refer Fig. 17). Flower market building is one of the oldest structures still currently in use in the area. The building is in dilapidated condition and needs immediate restoration. The structural stability and energy consumption audit should be done in order to mitigate the consequences of disaster. Detailed morphological information of the building stock and ccontinuous monitoring and assessment fosters the planning of long term strategies.

Fig. 17.Map showing the dilapidated buildings.(Source: Authors)

3.2.5 Public Realm

Public realm, essentially representing the integral part of shared community space influences form and function of the neighborhoods. The current development of built environment is excluding the user group there by creating inappropriate and meaningless spaces. Thousands of people traverse through the area on daily basis for diverse activities (Refer Fig.18).

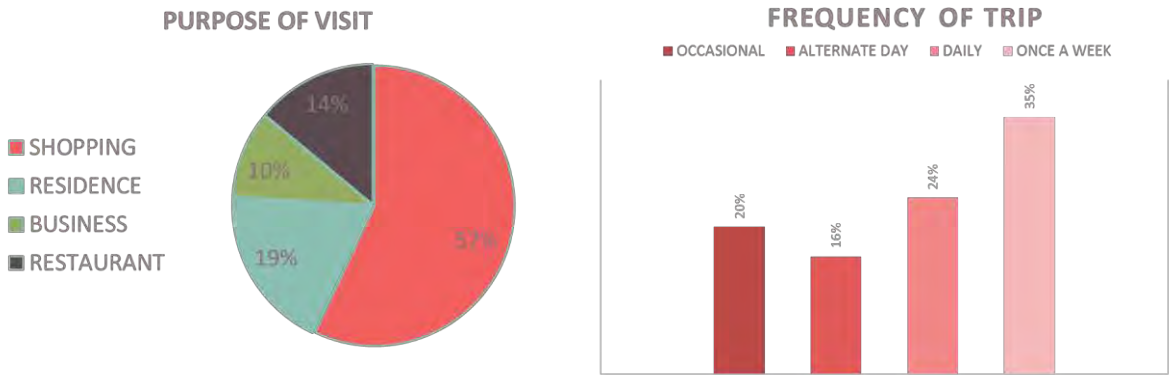


Fig. 18.Purpose and frequency of people (Source: Authors)

The assorted and active environment of the area provides comfort to the pedestrians on any day. The neighborhood and especially the Gandhi Bazaar street is largely seen as a place of transition

rather than a place to pause or to be as it majorly lacks well-articulated spaces for social interactions (Refer Fig.19).

Fig. 19.Non-cohesive streetscape (Source: Authors)

The area with its vibrancy renders one with sensorial experience and exploration. The area's wide network of streets, public spaces and parks/open spaces is not being potentially used to create safe environments (Refer Fig.20, 21, 22 & 23).

Fig. 20.Edge condition – commercial uses on either side (Source: Authors)

Fig. 21. Edge condition – mixed uses on either side (Source: Authors)

Fig. 22. Edge condition – commercial and utility networks on either side (Source: Authors)

Fig. 23. Poor qualtiy of street lighting focussed only on ROW (Source: Authors)

- Building Façade :Imageability and accessibility

The process of building the imageability of an environment is undoubtedly the result of an interaction between the observer and the environment influencing mutually. Continuity is essential in creating imageability and experience. Comprehendible and interrelated built environments foster imageability of a space. The building facades are disordered and discontinuous as they lack any type of architectural language. The survey conducted revealed that on goers find only 17% building as attractive and almost 41% buildings as unattractive (Refer Fig.24, 25 & 26).

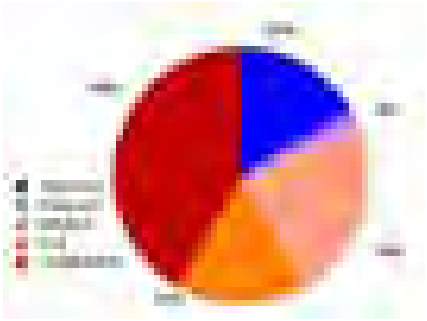


Fig. 24. On goers perspective on façade quality of buildings. (Source: Authors)

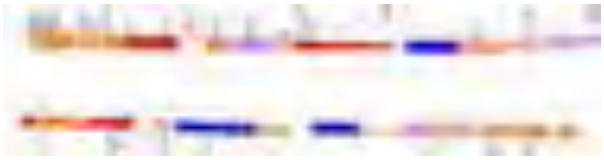


Fig. 25. Map showing on goers perspective on quality of façade (Source: Authors)

Visual clues always do not communicate the fine difference between public and private which are either generally or selectively accessible (Refer Fig.26).

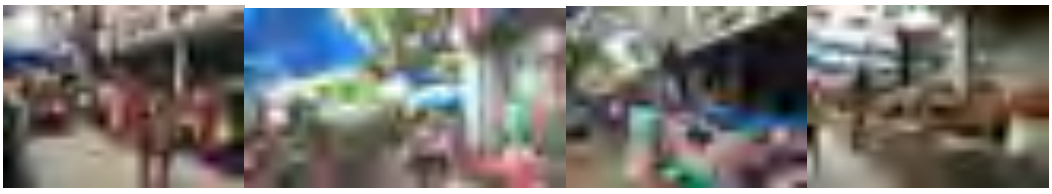


Fig. 26. Images showing lack of communication between public & private (Source: Authors)

- Active Transport- Walking and Cycling

Apart from health benefits (such as exposure to natural space, improved physical activity and psychological health, enhancing creativity), usage of active transport provides a numerous of benefits. Walking and cycling allows in forming a place- based connection with the background, context and community of the neighborhood and city. Furthermore, engaging in active transport facilitates social interaction strengthening a sense of place and belongingness. The footpaths in the area are always encroached by vendors and the situation turns more chaotic during festivities as

well as social occasions (Refer Fig. 27). Huge piles of unsegregated solid waste generated are dumped on the sidewalks further adding to the distresses of pedestrians and cyclists (Refer Fig. 28).

Fig. 27. Images showing encroached footpaths (Source: Authors)

Fig. 28. Analysis of different types of waste generators (Source: Authors)

The positive and transparent facades will portray more sense of welcoming which will create communication between the people and the place. An analysis of form and function through use, access and perception is appropriate to plan and design livable environments that are appreciated by the communities. It can improve the imageability of the neighborhood while safeguarding property values and creating conducive atmosphere.

3.2.6 Green/ Open Spaces

Urban open and green spaces include open spaces, sports fields, edges of roadway/railway/waterways, parks, botanical gardens, patches of vegetation, etc. The study area along with linear greenway (series of trees) has two famous neighborhood parks. Mahogany, Rain tree and Gulmohar trees are prominent trees along with few other native species. The wide spread of canopy and green spaces of the area are home to local flora and fauna (Refer Fig. 29).

Fig. 29. Map showing d types and location of trees (Source: Authors)

Trees besides providing shade and comfort to passer-by, are interactive urban nodes. Not only trees are used by vendors in many ways to display their products also, but also by people who congregate under shade to socialize (Refer Fig.30). These spaces need to be inter-connected and maintained to enhance the user experiences in turn retaining the green cover.

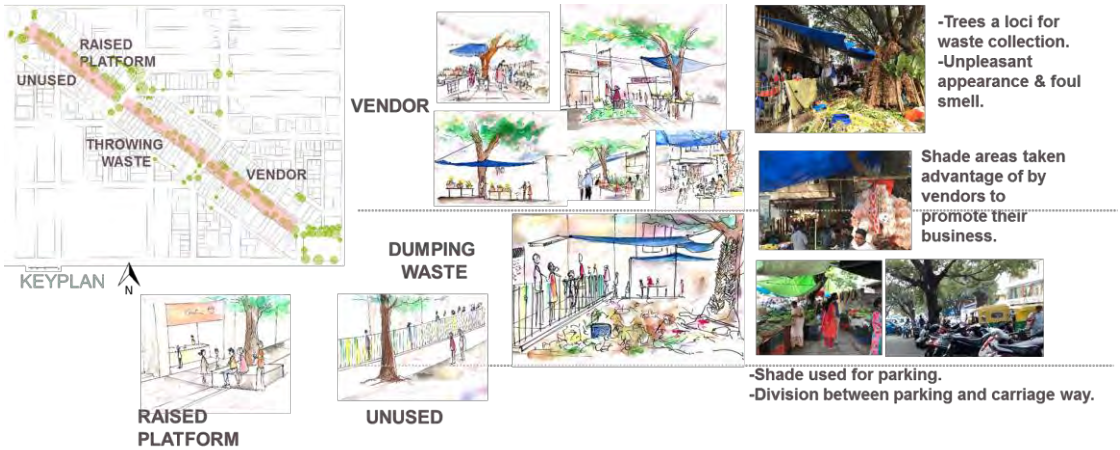


Fig. 30. Trees as activity nodes (Source: Authors)

3.2.6 Users Profile- Inhabitants and vendors

Density, connectivity and fine grained land use diversity factors strongly influence the diverse user group. The density of users in an urban area is the result of the conditions of the built environment.

The temporal distribution and patterns of the number of user group are closely linked to the dynamism of the area and may enhance the experiential quality by providing increased chances of interaction (direct and indirect) with other people and activities. The study area is frequented by diverse users for generic and specific purposes (Refer Fig. 31) and temporal variations do occur at different periods of time (Refer Fig. 32 & 33).

Fig. 31. Frequented locations of users (Source: Authors)

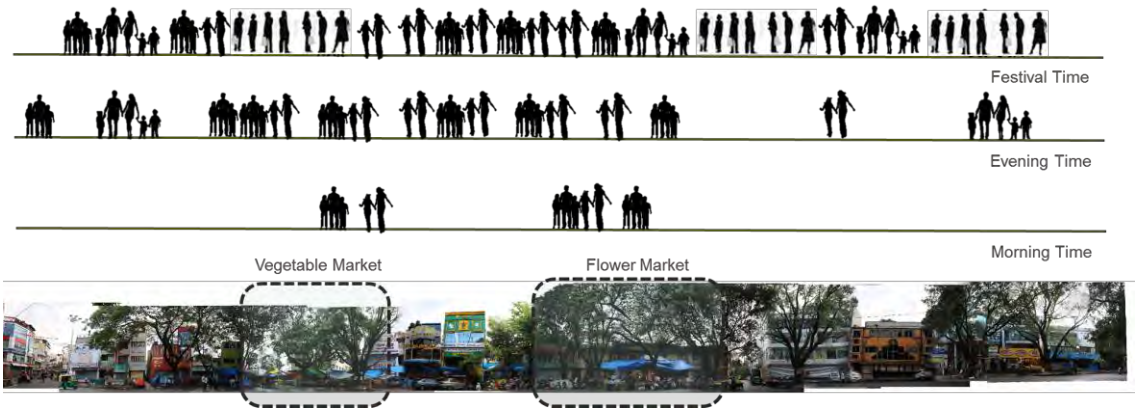


Fig. 32. User density profile (Source: Authors)

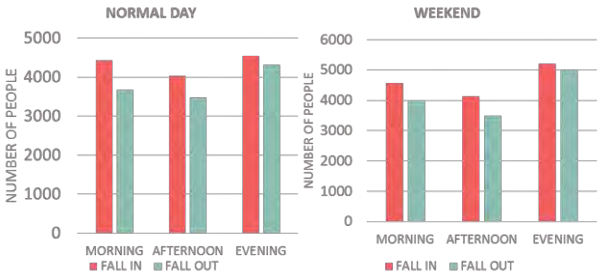


Fig. 33. User density profile – Temporal variations (Source: Authors)

With increasing urban migration and the shrinking formal sector, hawking and street vending have emerged as one of the critical means of earning a livelihood for the urban poor in India. Street vending is an important activity related to informal sector in urban areas. As long as our urban roads are used by the various cross sections of inhabitants, street vendors will remain inevitable. Street vendors are the broadly defined as persons who offer goods and services for sale to the public without having a permanent built-up structure but with a temporary static structure or mobile stall with various area requirements (Refer Fig.34).

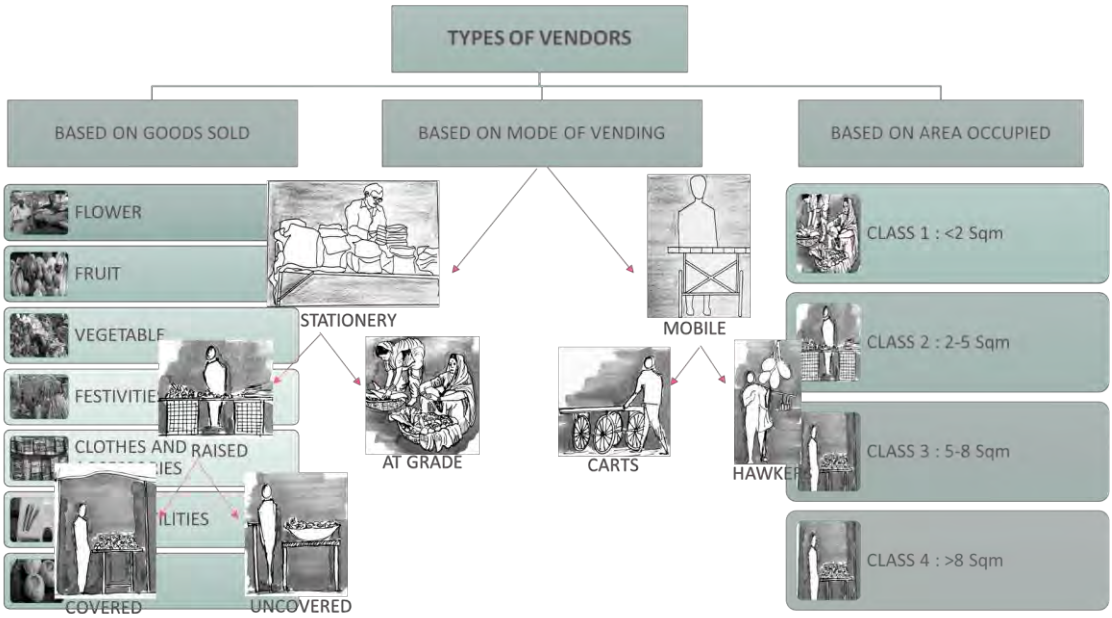


Fig. 34. Vendor typologies (Source: Authors)

Bicycles, pedestrians and bus traffic attract street vendors, often selling stuff which are in demand by road users. Vendors often locate themselves at places which are natural markets for them. A careful analysis of the location of vendors, their numbers at each location and the type of services provided clearly shows that they are needed since they work under completely 'free market' principles. If their services were not required at those locations, they would have no incentive to be there. (Refer Fig. 35, 36, 37, 38 & 39).

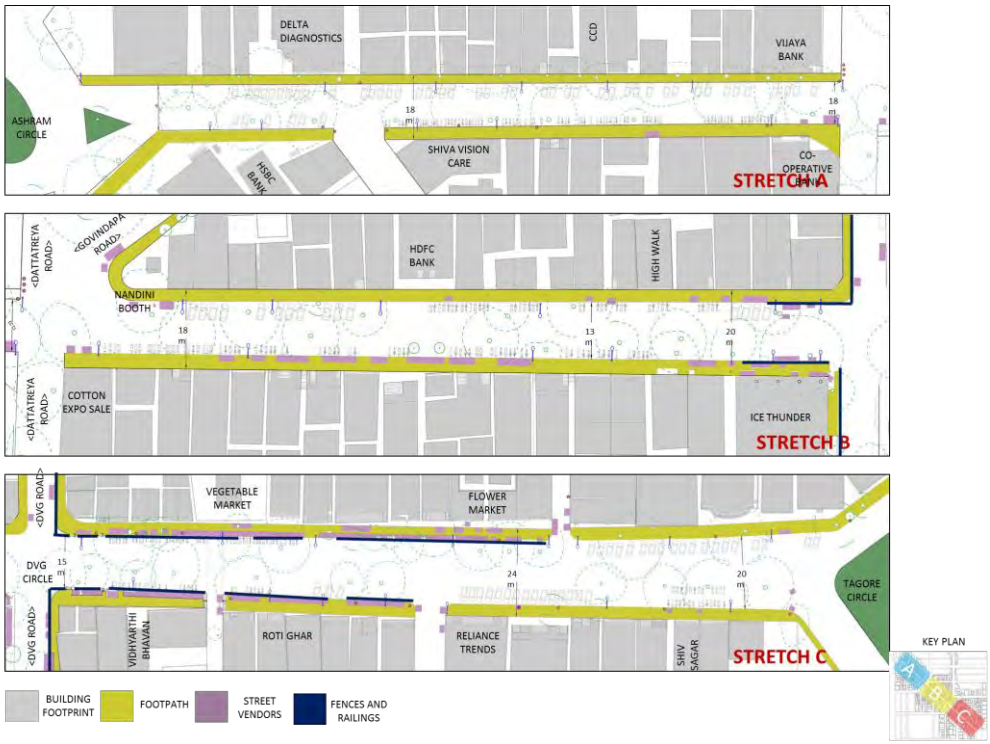


Fig. 35. Mapping the locations of vendors (Source:Authors)

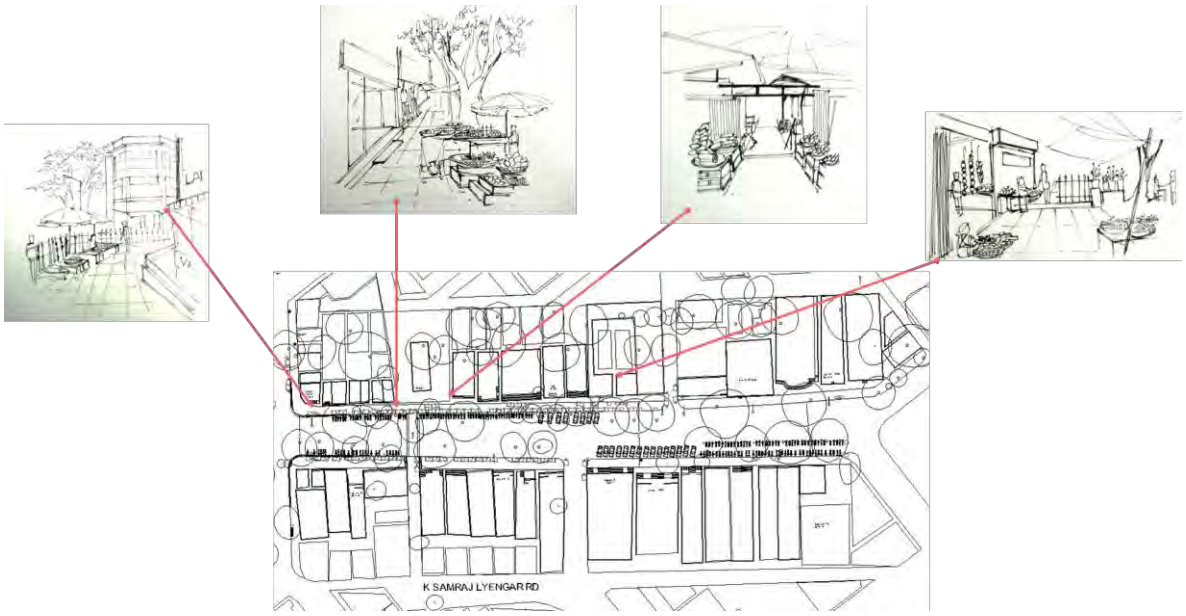


Fig. 36. Location of vendors and typologies (Source: Authors) (Source: Authors)

Fig. 37 Part plan showing vending activities on footpath (Source: Authors)

Fig. 38 Section highlighting vending activities on footpath (Source: Authors)

The spatial arrangement of vending activities is organic and temporal in nature. The arbitrator location of the vendors leads to encroachment of pedestrian space on the footpath. Street vending provides many opportunities: goods and services at convenient locations, and affordable prices; self-employment for large numbers of people; links formal sector with consumers; keeps streets busy and safe, creates an interesting city environment.

Fig. 39 Section showing vending activities on footpath (Source: Authors)

A comprehensive planning policy, design scheme and implementation mechanism needs to be evolved to integrate street vendors into urban form (Refer Table 1).

Table 1. Comprehensive planning policy, design scheme and implementation mechanism (Source: Authors)

Description	**Implementing Board / Committee**	**Funding & Regulatory framework**
a) Spatial management of vending areas through: •Creating space for vendor zones within existing infrastructure by efficient design. •Usage of incidental space to the advantage. •Time sharing of space. b)Provision of proper hawking space to avoid conflict with customers c) Integration of hawking units with organized retail spaces in their present location itself. d) The design of the public squares and spaces can be done in a manner so as to accommodate the hawkers and the street vendors in the design itself integrating the visual context into the image of the urban fabric.	City level advisory body should be formed having adequate representation of the vendors and other civil society groups.	Issuing License (mentioning space and time specific) & photo ID cards (mentioning activity type, location of vending space along with bio- data) against payment of charges to enhance the revenue of ULBs. A part of this revenue could be used for provision of basic infrastructure such as drinking water, toilets and waste collection and temporary or permanent structure for vendors. Zoning regulations and byelaws which indicate that a percentage of the total plot should be left for the use of vending and other types of informal sector activity in commercial areas.

4 Discussion and Way Forward

The study examined physical grain based on different morphological measures. The analysis of the study underlines that the better understandings of urban morphological measures in terms of form and functioning of existing urban fabrics to formulate solutions produces better places and better urbanism while creating structured urban compositions.

The three main identified challenges are:

Two-dimensional land use planning paradigm - The more procedural and conceptual nature of planning proposals and policy apparatus in the context of increased socio-spatial and political complexity has lost the emphasis on the perceived quality of the intermediate scale of urban form.

Absence of socio-spatial perspective-The perceived dislocation from socio-spatial concerns (social equity, environmental balance, diversity, etc.) beyond the enduring economic rationale.

Colossal compositions - This narrates to contemporary development models of larger floor plates that facilitates economic format of current real estate. These seemingly uniform built forms resulting from the consolidation of fine grained collective forms leads to loss of diversity and coherence of urban fabrics of the neighbourhoods.

Although, morphology aspect involves multi-fold of concerns, the urban form of cities considerably affects the quality of everyday life of urban dwellers. Using multiple morphological measures, the study attempts to demonstrate the feasibility of deriving the quantitative results within a given region. Various results of analysis enable comparative assessment of the distributional patterns of morphological characteristics by indicating the overarching variables (Refer Table 2).

Table 2. Attributes and variables urban morphology (Source: Authors)

Urban morphology	Attributes	Urban morphological study uses both qualitative and quantitative analyses. It is an important determinant of the urban pattern, urban form and spatial components. It is an important tool to understand physical or built fabric of urban form and processes and users shaping it. Explorations and prediction of directions of possible urban changes while addressing the social forces within.
Urban morphology	Variables	Micro level - Related to plazas, squares encompassing form, function, pattern, structure, volume urban elements, solid/void, etc. Meso level - Focussed on district/precinct/neighbourhood scale covering blocks, plots, typologies, etc. Macro level- Generally at city scale covering political control, socio-cultural context, incremental nature of economy, contemporary trends, etc.

Several urban morphological variables of cities reflect the evolution and the development history during different period of time. Analysis of urban morphology assists in better collective understanding of the urban form and its structure while facilitating decision making process and structures of management. The morphological measures and the related analysis could be applied to formulate frameworks for more adaptive and resilient urban forms with regard to environmental concerns, economic viability and social acceptability. Neighborhoods, that are in transition need focused approach and well-articulated processes that would enable them to be compact, coordinated, connected and socially inclusive. The place based approach provide an opportunity for improving efficiencies in providing informed growth directions to areas that can support contemporary development while leveraging the benefits of established urban structure and system. It also indicates new opportunities for a better production of urban spaces with due consideration of the intermediate scale of urban form. With increasing deterioration in the efficiency of urban forms

across majority of metropolis, the study attempts to offer certain insights on formulating key morphological measures that can be derived and applied objectively to several other neighborhoods with specific adoptions and modifications to elevate the quality of urban living.

References

1. Conzen, M.R.G (1960). Alnwick, *Northumberland: a study in town-plan analysis* G. Philip
2. Hillier. B.& Hanson, J. (1984). *The social logic of space.* Cambridge University Press, Cambridge
3. MHUPA, *"National Policy for Urban Street Vendors"*, Ministry of Housing and Urban Poverty Alleviation. [Online]. Available mhupa.gov.in/policies, Accessed on 19th June 2018.
4. Rasmussen, S.E. (1969). *Towns and buildings. Cambridge*, The MIT Press.
5. R. Jhabvala, *"Roles and perceptions of street vendors"*, A symposium on reconciling people's livelihood and urban governance.
6. S. K. Bhowmik, *"National policy for street vendors",* Economic and Political Weekly, vol. 38, no. 16, pp. 1543-1546, 2003.
7. UNESCO.(2016). *Global Report on Culture and Sustainable Urban Development:* Report for UN Habitat III.Paris: UNESCO

School of Planning and Architecture
New Delhi

An Institution of National Importance
under an Act of Parliament
(Ministry of HRD, Govt. of India)

4-Block-B, Indraprastha Estate, New Delhi 110 002 India

www.spa.ac.in

Facebook Twitter Youtube

SPACE
The SPA Journal of Planning and Architecture
Volume 22, Number 1-4
January-December, 2018

School of Planning and Architecture
New Delhi
योजना तथा वास्तुकला विद्यालय
नई दिल्ली

Volume 22, Number 1-4
January-December, 2018

SPACE

ISSN 0970-0706

The SPA Journal of Planning and Architecture

www.spa.ac.in

SPACE
THE SPA JOURNAL OF PLANNING AND ARCHITECTURE

Vol. 22, No. 1-4, January - December, 2018

SPACE, the quarterly Journal of SPA, seeks to publish critical scholarly papers in the fields of planning, architecture and design. In planning, SPACE will give preference to papers on urban and regional studies, transport planning, environmental planning, housing and habitat studies, infrastructure planning, and papers on any other aspect of planning such as urban management. Paper writers from the fields of architecture and urban design should focus on the broad areas of architectural conservation, landscape architecture, urban design and industrial design. Papers will be also accepted from the fields of building engineering and management and real estate management.

Contributors wishing to send in their papers for publication in SPACE may send their manuscripts for review and consideration to the Editor. Two hard copies of the paper and one page abstract may be sent along with a soft copy in MS Word format. Papers without a soft copy will not be accepted for publication in SPACE. Papers will be also accepted by E-mail, if accompanied by author's electronic signatures. All communications regarding SPACE should be addressed to the Editor at the following address.

Prof. Dr. Mahavir
Editor, SPACE
School of Planning and Architecture
4 Block-B, I. P. Estate, New Delhi - I I0002, India
E-mail: mahavir57@yahoo.com
Fax: 011-2370-2383
Phone: 011-2370-2395; 011-2335-0879; 011-2370-2381; 011-2370-2384

ANNUAL SUBSCRIPTIONS FOR TWO CONSECUTIVE ISSUES

Inland: ₹ 500 for institutions, ₹ 150 for individuals, and ₹ 100 for students on production of authentic identity. For all categories, ₹ 25 will be charged for postage. Foreign US$ 100 plus $ 10 for postage by sea mail.

PUBLICATION OF ADVERTISEMENTS

SPACE will accept a limited number of advertisements for each issue from renowned publishing firms, academic and professional institutions on publications, announcements, notices or posters on academic programmes, conferences, competition projects and other academic and professional activities related to architecture, planning and allied disciplines. The following rates will apply with 25 percent discount for academic institutions.

Inside half page: ₹ 2,000; Inside full page: ₹ 3,000; special page: Negotiable

All payments should be made in advance through bank draft in favour of School of Planning and Architecture payable at New Delhi.

Technical and administrative assistance provided by **Dr. Ashok Kumar, Library and Information Officer, DPU,** *is highly appriciated.*
Disclaimer: *The SPA and Editor are not responsible for any of the views expressed in the papers.*

NOTES FOR CONTRIBUTORS

1. The Editor of SPACE welcomes original contributions in the form of research papers, short position papers, viewpoints, case studies and reviews, book reviews, conference reports, etc. for consideration. Publishers may also send books for review to the Journal.
2. Contributions are accepted with the understanding that they are original manuscripts and have not been submitted elsewhere for publication.
3. Although there is no strict length limitation, manuscripts will normally be expected to be within 6,000-8,000 words for major papers, 1,500-3,000 words for short papers, and 1,000 words for book reviews.
4. Contributions well illustrated with sketches, diagrams, maps, photographs, etc. are encouraged.
5. Manuscripts, to be submitted in duplicate, should be typed on A4 size paper with double line spacing and sufficient margins all around. The first page of the manuscript should contain title of the paper, name of the author and his or her affiliation and complete address and a short abstract including keywords not exceeding 100 words.
6. Submission of an electronic file of the manuscript along with two hard copies will be appreciated.
7. All submissions should be sent to the Editor: Dr. MAHAVIR, Editor, SPACE, School of Planning and Architecture, 4- B, I.P. Estate, New Delhi-1 10002, mahavir57@yahoo.com.

REFERENCES

References should be indicated at appropriate locations in the text within parenthesis by the last name of the author(s) or the name of the appropriate organization if there is no person's name, year of publication and the page (s) referred to (except for paraphrased references) should be arranged alphabetically at the end of the paper. Entries should have the following items in order of sequence: Name (s) of author (s) (persons and organizations) with last name (s) of person (s) appearing first, year of publication, title of paper, title of journal, book, report (in italics), volume and issue numbers (for journals), location and name of the publisher (for book and report), including page number(s) referred to in the text. In the case of more than one publication by the same author in the same year, these should be distinguished alphabetically, like a, b, c, etc. both in the text and in their complete entries.

The authors are themselves responsible for the correctness of references and use of copyright material.

TABLES AND ILLUSTRATIONS

All illustrations including maps, diagrams, sketches, photographs, etc. and tables should be placed on separate sheets and their location should be indicated in the text. All illustrations should be mentioned as figures and numbered consecutively. References to tables and figures must be mentioned in the text: within parenthesis. Located on the top, all tables and figures must bear titles. High resolution scanned illustrations with lettering large enough to allow reductions for printing should be submitted with the paper. Abbreviations should be avoided as far as possible in the text. Repeated abbreviations should be introduced within parenthesis along with their full forms in their first occurrences in the text. Measurements should be given in metric units. Footnotes, except for tables and figures, should be grouped together and arranged sequentially at the end of the text.

Large quotations should be placed in indented paragraphs in smaller font size with references in parenthesis at the end. Small quotations should be placed within single inverted commas in the font size of the text with references in parenthesis at the end.

Printed at: *Dolphin Printo-Graphics, 1E/18 4th Floor, Jhandewalan Extn., New Delhi-110 055, # 011-23593541-42*

SPACE
The SPA Journal of Planning and Architecture

Vol. 22, No. 1-4
2018

IMPACT OF MIXED USE IN TOWNSHIPS IN A METROPOLITAN CITY: A CASE OF BENGALURU

Supritha M Y
Assistant Professor, BMSSA, Bengaluru
suprithabmssa@gmail.com

Chidambara
Assistant Professor, SPA, New Delhi
chidambara17@gmail.com

ABSTRACT

During the 20th Century, there was a rapid increase in population and urbanization patterns in most town and cities. The population and urbanization growth rate were more than the rate of infrastructural development. This led to severe urban issues such as vehicular and population congestion, urban sprawl, slums, pollution, pressure on the available infrastructure and services, environmental and sanitation issues. Concepts like Transit Oriented Development (TOD), New Urbanism, Liveable Communities, Smart Growth, Form Based Code, etc. try to tackle these issues through a holistic planning for living, working, recreation and movement. Most of the Indian cities are already under tremendous pressure due to lack of land for urban expansion and traffic congestion. Therefore, mixed use development becomes a plausible solution as it encourages compact development with a much better work-home-play relationship. Mixed use in townships started developing in large numbers in the metropolitan cities and Bengaluru being one of them, also experienced tremendous growth.

Mixed use in townships varies with area, type of mixing, densities and other features. In this paper, analysis is based on spatial impact (land use, area, density, entropy calculation, etc.), mobility impact (pedestrian infrastructure, walkability index, modal share, per capita trip length, average trip rate, distance of work place and residence and education, etc.), socio-economic impact (social mix, employment generation, jobs - housing ratio, etc.) and social infrastructure impact (education and health care facilities, playgrounds, religious centres, etc.).

Based on the analysis over the parameters, the positive and negative impacts of the mixed use in townships have been identified. The need for the planning interventions and

sensitiveness needed towards the different income groups of peoples for the sustainable development of the city in terms of mixed use in townships have been detailed out in the proposals.

Keywords: *mixed use; sustainable; entropy; socio-economic; mobility*

INTRODUCTION

Throughout human history, the majority of human settlements were developed as mixed use environments. People lived in close proximity to their work. Walking was the primary way that people and goods were moved about. Mixed use gradually declined during industrialization. Migration of people took place in large scale. Migrant workers needed to be accommodated and many new urban districts arose at this time with domestic housing being their primary function. This led to the creation of land use zoning with specific areas being assigned to specific activities. The introduction of the private automobile, mass transit systems like bus, rail systems, highways and motorways, led to the creation of dispersed, low-density cities where people could live very long distances away from their workplaces, shopping centres and entertainment districts.

Relation between mixed use and impact indicators

The relation between mixed use and impact can be studied through various indicators for assessing spatial impact, mobility impact, socio economic impact and public utilities impact.

Lawrence D. Frank and Gary Pivo (2013) studied impacts of mixed use and density on utilization of three modes of travel, viz., Single-Occupant Vehicle (SOV), Transit, and Walking. The findings from this study suggest that measuring urban form at both shopping and working trip ends provides a greater ability to predict travel choices than looking at trip ends separately. By increasing the level of land use mix at the trip origins and destinations is also related to a reduction in SOV travel and an increase in transit and walking. The reduction in SOV travel was not as significantly associated with increases in population density as it was with employment density.

UN HABITAT: Sustainable Neighbourhood Planning (2014) explains 5 principles of sustainable neighbourhood planning, as follows:

- Adequate space for streets and an efficient street network;
- High density;

- Mixed land-use;
- Social mix; and
- Limited land use specialization.

In the Principle 3, i.e. mixed land use, at least 40 per cent of the floor space is allocated for economic use in any neighbourhood. This is aimed at developing a range of compatible activities and land uses, close together, in appropriate locations and flexible enough to adapt over time to the changing market.

The purpose of mixed land use is to create local jobs, promote the local economy, reduce car dependency, encourage pedestrian and cyclist traffic, reduce landscape fragmentation, provide closer public services and support mixed communities (UN HABITTAT, 2014).

The "People-oriented Cities" series – exclusive to TheCityFix and Insights – is an exploration of how cities can grow to become more sustainable and liveable through transit-oriented development. Mixed use development creates social and economic benefits (Luis Zamorano and Erika Kulpa, 2014).

Atlanta, Georgia was recently announced the most sprawling city in the United States. Residential suburbs are segregated from the city centre, where jobs and opportunities are concentrated. These land use patterns contribute to traffic congestion and air pollution and make it difficult for public transport to serve the extremely dispersed population. Together, these adverse impacts are costing city residents and compromising quality of life. Congestion alone costs the region USD 3 billion in lost productivity and fuel costs per year, and its rising air pollution landed it the dubious honour of being named America's most toxic city.

Social sustainability refers to giving equal opportunities, creating vibrant, diverse and inclusive environment and fulfil the social needs of the inhabitants (Sarika Bahadure and Rajashree Kotharkar, 2014).

Measurement of social sustainability currently uses simple demographic indicators as:

- Population growth,
- Gender ratio,
- Income and
- Health statistics.

Social benefits, associated with good urban design based on mixed land use concept include:

- Health,
- Equity and diversity,
- Safety and surveillance,
- Vitality, attractiveness and aesthetics,
- Employment,
- Interaction and sense of belonging, and
- Quality of Life.

ANALYTICAL TOOLS FOR THE IMPACT PARAMETERS

Spatial Impact: Entropy Index

Land use entropy is a measure of the variety of land uses within a given radius of a land parcel or grid block.

H(S)-Entropy index (Shannon index)

pi - the area of a particular category of land use over the total area of all categories(within the scope of one district)

k- the number of land use categories in the particular district.

The entropy value lies between 0 and 1. Towards 0 indicates completely homogeneous land use and towards 1 indicate perfectly balanced among all uses.

(Source : Fairfax County Department of Planning & Zoning, 2012)

Mobility Impact: Walkability Index

Walkability is a measure of how friendly an area is to walking. Walkability has health, environmental, and economic benefits. Factors influencing walkability include the presence or absence and quality of footpaths, sidewalks or other pedestrian rights-of-way,

traffic and road conditions, land use patterns, building accessibility, and safety, among others. Walkability is an important concept in sustainable urban design.

According to the study on walkability index, walkability is calculated using the formula:

$WAI = (2 * Con) + Ent + FAR + H_{den}$

Where,

WAI = Walkability index

Con = the standard value of the Connectivity index

Ent = the standard value of the Entropy index (Shannon index)

FAR = the standard value of the FAR (Floor area ratio)

H_{dens} = the standard value of the Household density

(Source: Zdena Dobesova and Tomas Krivka, 2012)

Socio-economic Impact

Jobs housing balance refers to the distribution of employment in relation to the distribution of households in an urban area.

Jobs/ household ratio: The jobs-housing ratio is a ratio between a measure of employment and a measure of housing in a given area of analysis.

Jobs/ Housing unit ratio: Spatial relationship between the number of jobs and housing units within a given geographical area.

Jobs/ Residing workers ratio: A provision of an adequate supply of housing to house workers employed in a defined area.

(Source: Fairfax County Department of Planning & Zoning, 2012)

STUDY LOCATION: BENGALURU

Bengaluru is the capital of the Indian state of Karnataka. It has a population of about 8.42 million and a metropolitan population of about 8.52 million, making it the fifth most populous urban agglomeration in India. Located in southern India on the Deccan Plateau, at a height of over 900 m (3,000 ft) above sea level, Bengaluru is known for its pleasant climate throughout the year. Its elevation is the highest among the major large cities of India.

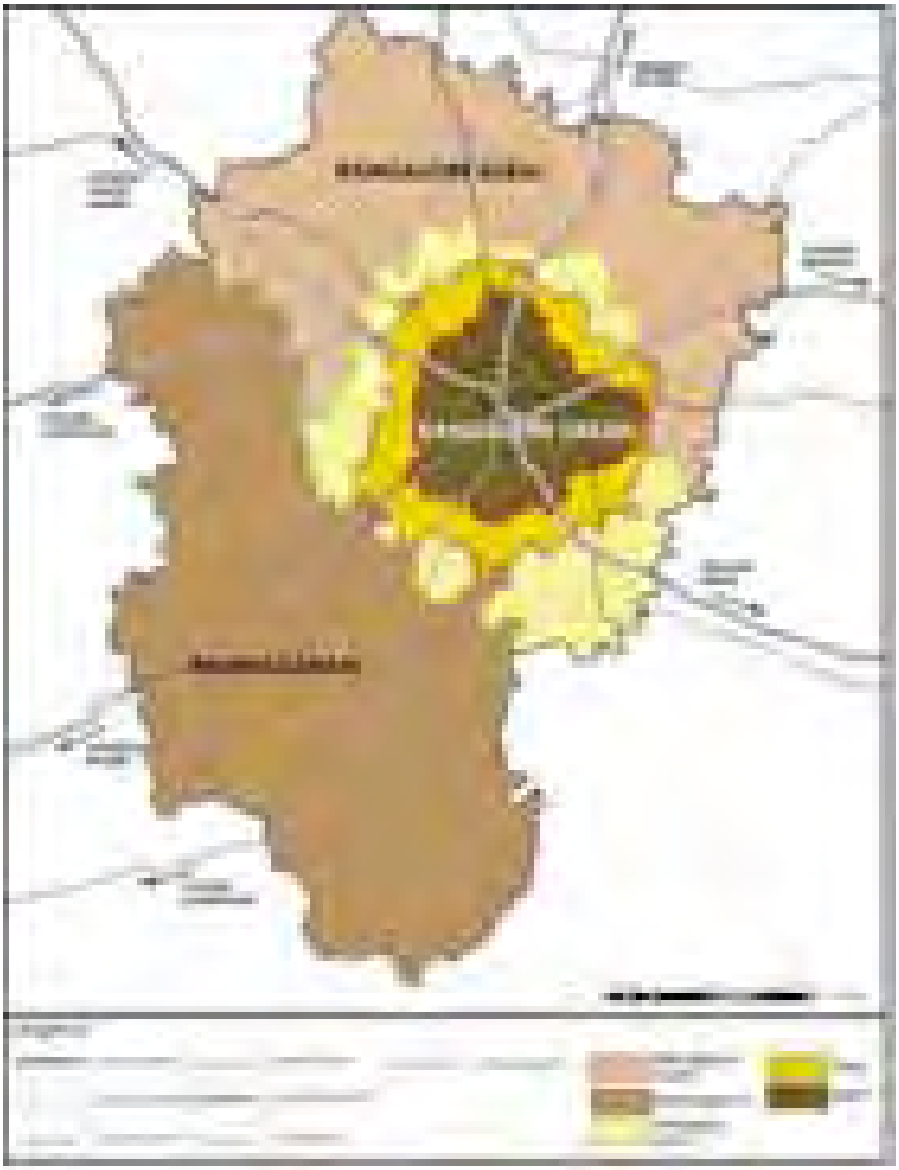
Bengaluru is known as the 'Silicon Valley of India' because of its role as the nation's leading information technology (IT) exporter. It is home to many educational and research institutions in India. As a growing metropolitan city in a developing country, Bengaluru confronts substantial pollution and other logistical and socio-economic problems. With a gross domestic product (GDP) of $83 billion, Bengaluru is ranked fourth in India by overall GDP contribution, after Mumbai, Delhi and Kolkata (Fig. 1).

Figure 1: Location of Bengaluru in Karnataka in India

Bengaluru Metropolitan Region

Bengaluru Metropolitan Region Development Authority (BMRDA) is an autonomous body created by the Government of Karnataka under the BMRDA Act 1985 for the purpose of planning, co-ordinating and supervising the proper and orderly development of the areas within the Bengaluru Metropolitan Region (BMR), comprising of Bengaluru Urban district, Bengaluru Rural district and Ramanagar District. BMRDA covers an area of 8005 km^2, the second largest metropolitan area in India (Fig. 2).

Figure 2: Bengaluru Metropolitan Region



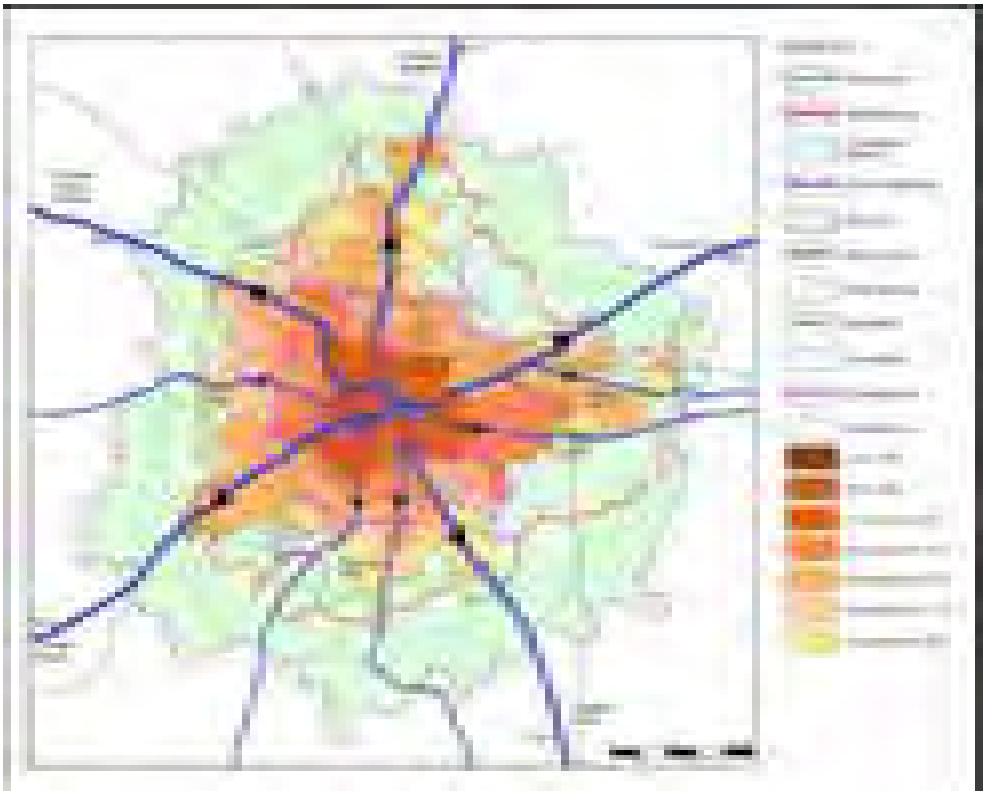
Source: Bengaluru Metropolitan Region Revised Structure Plan 2031

Growth of Bengaluru City

The *Bruhat Bengaluru Mahanagara Palike* (BBMP), the administrative body responsible for the civic and infrastructural assets of the city, was formed in 2007 by merging 100 wards of the erstwhile Bengaluru *Mahanagara Palike* with seven City Municipal Councils

(CMC) - Rajarajeshwari, Dasarahalli, Bommanahalli, Krishnarajapuram, Mahadevapura, Byatarayanapura and Yelahanka, one Town Municipal Council (Kengeri) and 111 villages around Bengaluru. BBMP has now divided Bengaluru, spread over aerial extent of 741 sq. km., into 198 wards. The expansion of Bengaluru City Corporation limits has grown over ten times in last sixty years (Fig. 3).

Figure 3: Growth of Bengaluru City



Source : Bengaluru development authority, - 2007

Bengaluru is characterized by a radial system formed by the axes:

- Mysore Road and Old Madras Road (South, South-West, North, North-East);
- Bellary Road and Hosur Road (North, South-East); and
- Tumkur Road (North-West).

In addition, five other secondary roads complete the main framework (Fig. 4), viz.,

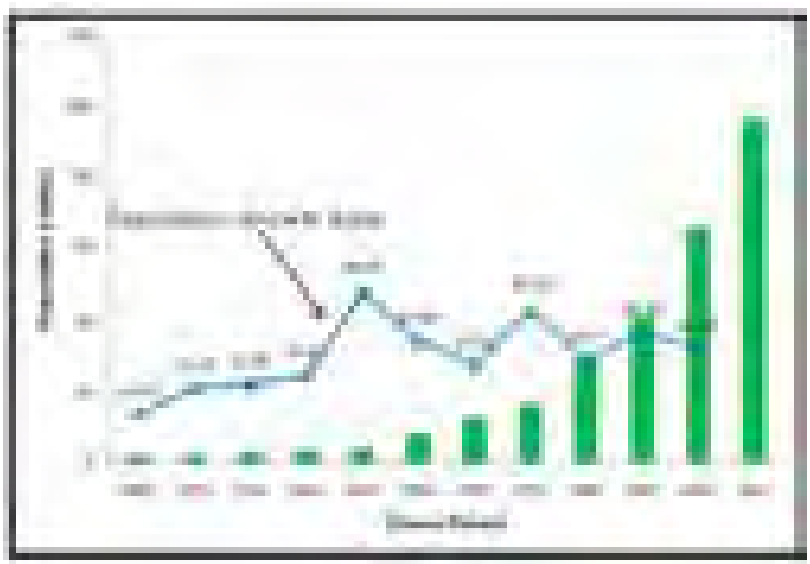
- Magadi Road (West);

- Kanakapura Road and Bannerghatta Road (South); and
- Varthur Road and Whitefield Road (East).

Population

With a total population of over 11.5 million, Bengaluru is ranked number three in terms of most populous city of India. As the city represents modern face of developed Indian economy, it is also home to a large number of people who have migrated from other states to Bengaluru. Bengaluru has witnessed a huge growth in its population between years 2001 to 2011. From a small figure of 5.1 million in 2001, its population has grown to 8.4 million in 2011. One of the main reasons behind this huge growth is the Cosmopolitan nature of the city. Being a major IT hub of South India, the vibrant city of Bengaluru invites people from far and wide. Over the years, it has attracted millions of people from India and abroad who have settled here permanently due to various reasons. Better standard of living and infrastructure are the primary reasons for growth of Population in Bengaluru. In spite of various Government planning and research, Population in Bengaluru is growing at a very fast pace. Bengaluru is currently third most populous city of India after Mumbai and Delhi (Fig. 4).

Figure 4: Population of Bengaluru



Source : Bengaluru Development Authority - 2007 , Census of India - 2001 & 2011

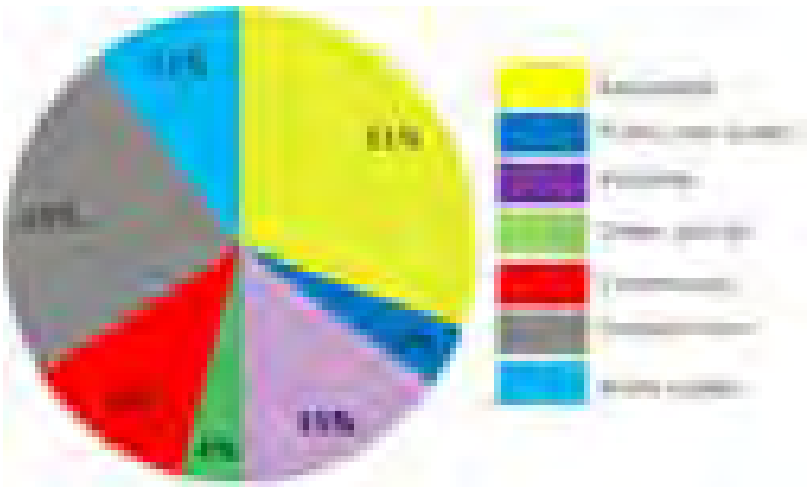
Master Plan of Bengaluru - 2015

The Master Plan of Bengaluru 2015 was prepared in 2007 by the Bengaluru Development Authority.

The new land use rules in the city's Master Plan include mixed land use, a new trend which is visible in the real estate sector in the city.

BDA has proposed to come up with major housing projects with commercial spaces for shops and corporate offices within them around the south and west Bengaluru. Increase in the floor area ratio was also incorporated in Master Plan 2015 (Fig. 5).

Figure 5: Distribution of Land use of Bengaluru City



Source: Master plan of Bengaluru, 2015

Zoning Regulations of Bengaluru - 2007

The Revised Master Plan 2015 vision document envisages a compact, balanced and equitable, urban growth for the city. In order to guide such growth, the Revised Master Plan 2015 uses the proposed land use plans and zonal regulations.

Zoning regulations for mixed use in Bengaluru:

Permissible land uses (Table 1)

- Main land use category: R
- Ancillary land use category: C3, I-2,T2 and U4

- Ancillary land use is permissible up to 30 % of the total built up area.

FAR and Ground Coverage in Residential (Mixed) zone up to 20,000 sq. m.

Table 1: Zoning Regulations for Mixed-use

Sl. No.	Ground Coverage (Maximum)	FAR	Road width (m)
1	Up to 70 %	1.75	Up to 12 m
2	Up to 65 %	2.25	Above 12 to 18 m
3	Up to 60 %	2.50	Above 18 to 24 m
4	Up to 55 %	3.00	Above 24 to 30 m
5	Up to 50 %	3.25	Above 30

Source: Zoning regulations of Bengaluru, 2007

Regulations for Integrated Township

The integrated townships are Permissible in Residential/ Commercial/ Hi Tech/ Industrial zones (Table 2):

Table 2: Township Regulations

Minimum area required	40 Ha (100 acres)
Permissible Land use	Residential
	High-tech
	Industrial
	Commercial
Permissible usage (% of allowable usage)	
Residential	40 %
Non Residential	
High- tech (IT, BT related activities)	55%
Commercial (to support the township)	05 %
Minimum road width required	18 m

Source: Zoning Regulations of Bengaluru, 2007

- 10 per cent of the total area shall be reserved for parks & open spaces.
- 5 per cent of the site area shall be reserved for public & semi-public use/ CA sites and shall be handed over to the authority.

The zoning regulations of Bengaluru have regulations over the use of land and development regulations for a township development. But there are no regulations for the percentage of public and semi-public provision within the townships.

Rings, Zones and Wards of Bengaluru

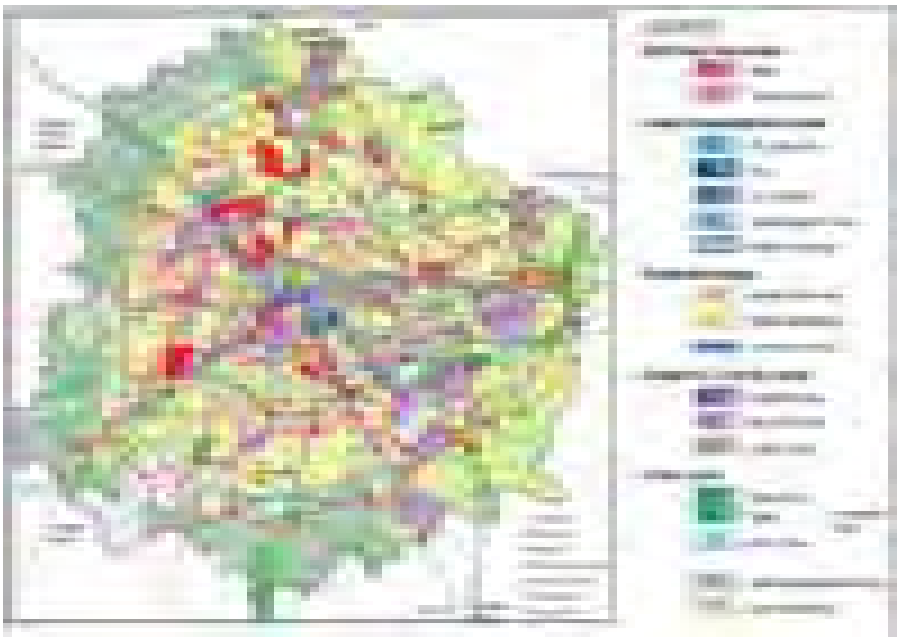
The Local Planning Area is delineated into 47 planning districts, based on planning parameters. Within the BBMP boundary, Bengaluru has been divided into 8 zones, viz.,Yelahanka, Mahadevapura, Bommanahalli, South, East, North, RR Nagara and Dasarahalli (Table 3 and Fig. 6).

Table 3: FAR and Ground Coverage for Integrated Township

Road width	Coverage	FAR allowable
18m<24m	55 %	2.5
24m<30m	50 %	3.0
Above 30m	45 %	3.25

Source: Zoning Regulations of Bengaluru, 2007

Figure 6: Master Plan of Bengaluru, 2015

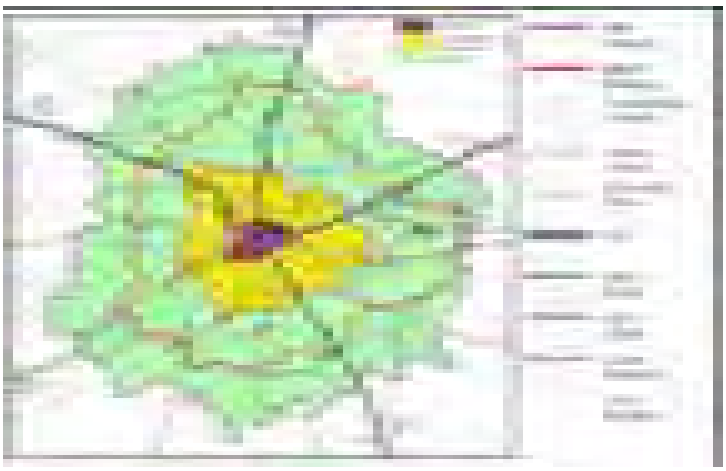


Source: Master plan of Bengaluru, 2015

Transport Network of the City

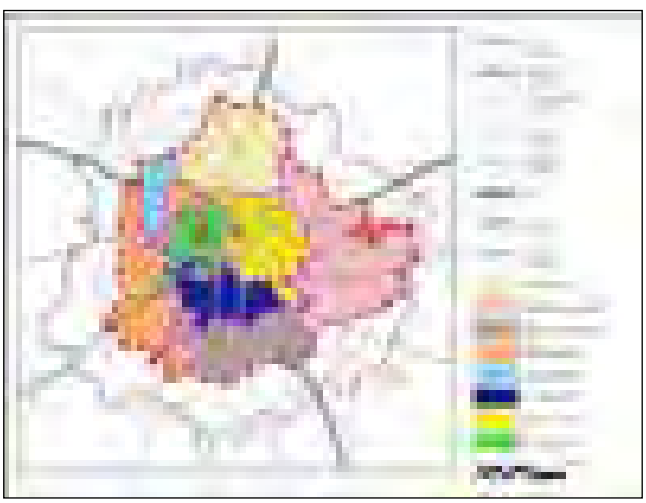
The congruence of lesser road widths and high personal modes lead to congestion. Over 52 corridors/ links could be classified as 'congested', with V/C ratio over 1. The average speed of vehicles in Bengaluru varies between 12-18 kmph, in peak hours, with clear start-stop and obstructed flows on many corridors. Congestion indicators at major intersections are greater than 1.5 (against a standard of 0.8 for free movement). The growth of vehicles is one of the reasons responsible for the traffic congestion in the city (Fig. 7).

Figure 7: Ring Division of Bengaluru



Source: Master plan of Bengaluru, 2015

Figure 8: Zones of Bengaluru



Source: Master plan of Bengaluru, 2015

Ward wise Density of Bengaluru

The city is essentially a low-density built type, with sporadic developments and extensions along the peripheries. The density in the Central Business District (CBD) is as low as 400 p/ha (while other cities like Ahmadabad and Hyderabad have densities of 700 p/ha and 600 p/ha respectively). However, the overall distribution of density in Bengaluru is rather unevenly spaced, with very high densities, up to 600 p/ha, in some neighbourhoods to very low densities, up to 100p/ha in other neighbourhoods (Fig. 9).

Figure 9: Growth of Vehicles

Source: Bengaluru Mobility Indicators, 2010-2011

Townships in Bengaluru

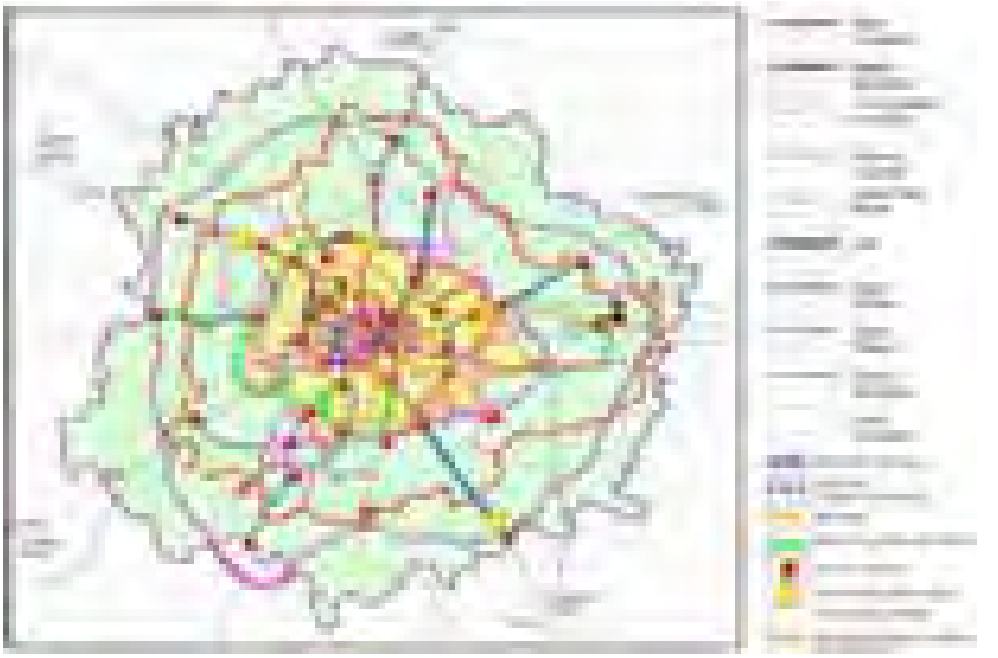
A number of developers have come up with township projects in different parts of the city. Devanahalli, Whitefield, Hoskote and Hebbal are some of the localities that are flooding with integrated townships. For the purpose of this paper, two case study areas have been selected on the basis of location, area, population and density (Table 4 and Fig. 10). The two selected case study areas are located at two different locations, i.e., Brigade Gateway in the area surrounding the core area and Prestige Shantinikethan in the outskirts. The two areas are located in different zones and wards which have varying densities and mixing of uses (Figures 10 and 11).

Table 4: Ring division of Bengaluru

1st Ring	Core area
2nd Ring	Developed urban areas surrounding the core area
3rd Ring	Urban extension areas in the city's outskirts

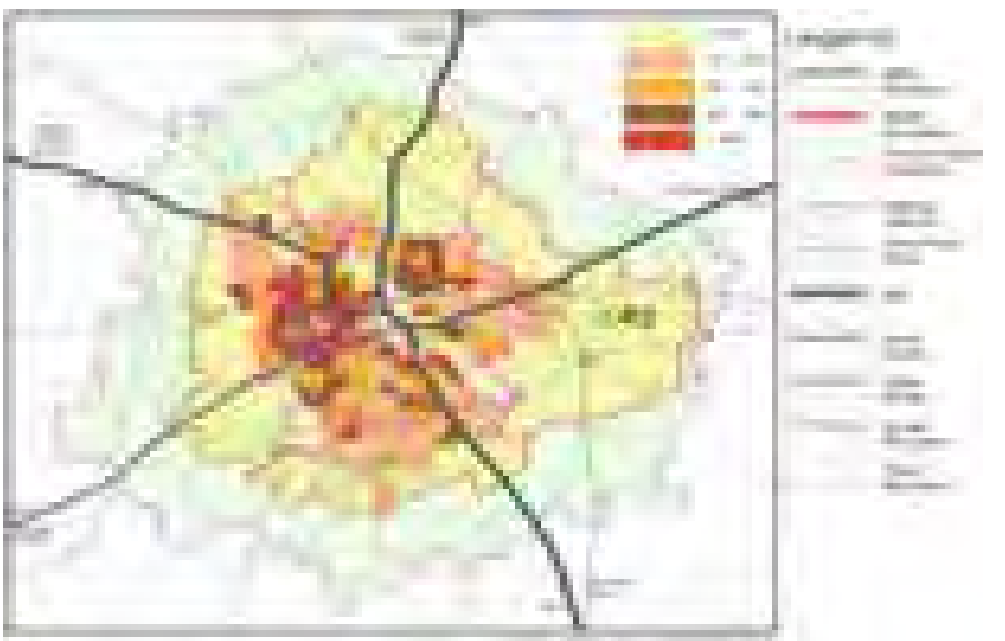
Source: Master Plan of Bengaluru, 2015

Figure 10: Transport Network of the City



Source: Master Plan of Bengaluru, 2015

Figure 11: Ward-wise Density of Bengaluru



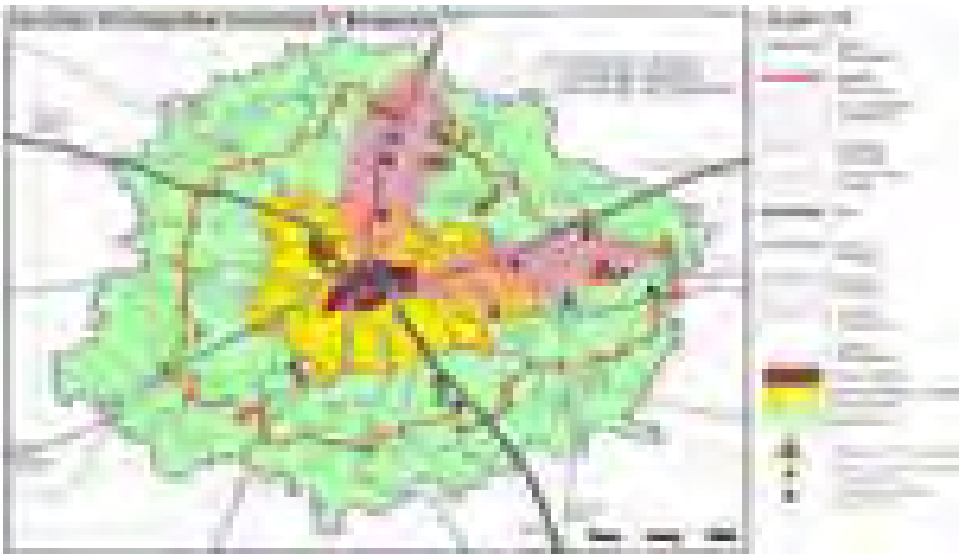
Source: Master Plan of Bengaluru, 2015

Case Area 1: Brigade Gateway

The case area 1 is Brigade Gateway, which lies in the area surrounding the core area, in ward 66. The residential population of the area is 5,000.

The township consists of different land uses within the development, viz., residential apartments, commercial buildings which includes the office tower, shopping mall and hotels, public and semi-public uses such as schools and hospital, and a large space has been allocated for water body and green spaces (Figures 12-13).

Figure 12: Location of Integrated Townships in Bengaluru



Source: Master Plan of Bengaluru, 2015

Figure 13: Location of Case Area 1 in Ward 66

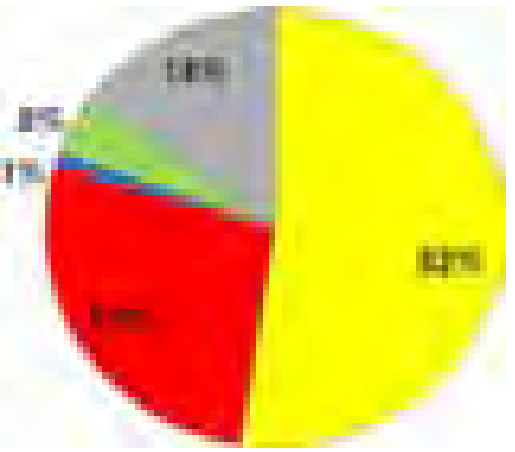
Source: Source : Primary survey,2016

Case study Area 2: Prestige Shantinikethan

The case area 2, Prestige Shantinikethan, lies in the outskirt, in ward 54. The residential population of the area is 13,500.

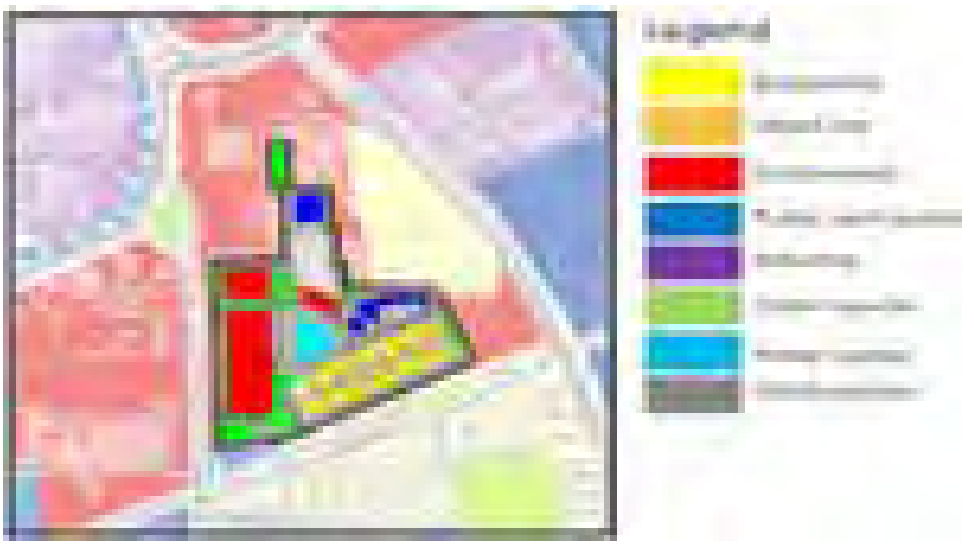
The township consists of different land use within the development, viz., residential apartments, commercial buildings which include the office tower, retail shopping and hotel. A large space has been allocated for water body and green spaces (Figures 14-17).

Figure 14: Land use Distribution of Ward 66



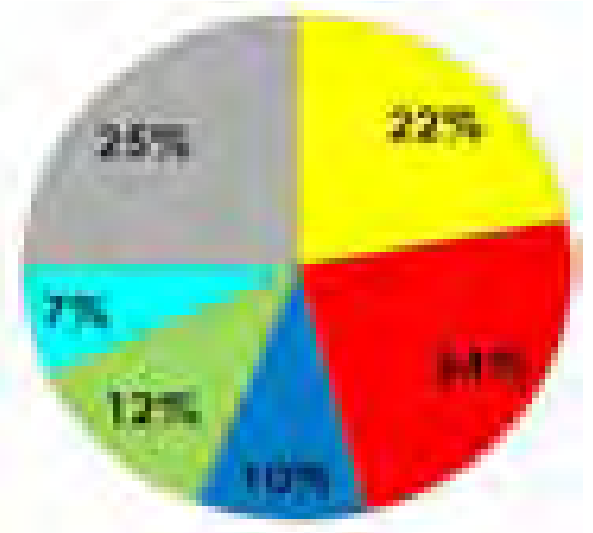
Source: Primary Survey, 2016

Figure 15: Site Plan: Case Area 1



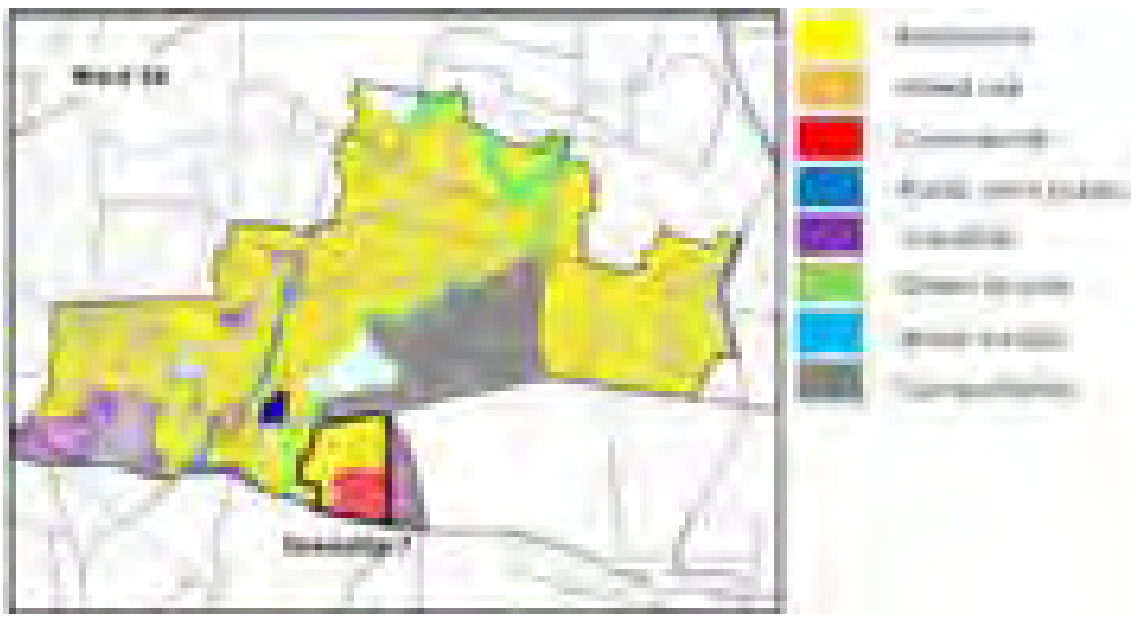
Source: Brigade Gateway Sanction Plans, 2006

Figure 16: Land use Distribution of Case Area 1



Source: Brigade Gateway Sanction Plans, 2006

Figure 17: Location of Case Area 2 in Ward 54



Source: Brigade Gateway Sanction Plans, 2006

ANALYSIS

The case area analysis includes parameters which have been identified earlier, i.e., spatial impact, mobility impact, socio economic impact and social infrastructure impact. The analyses are based on the primary and secondary data collected through various surveys.

Spatial Impact

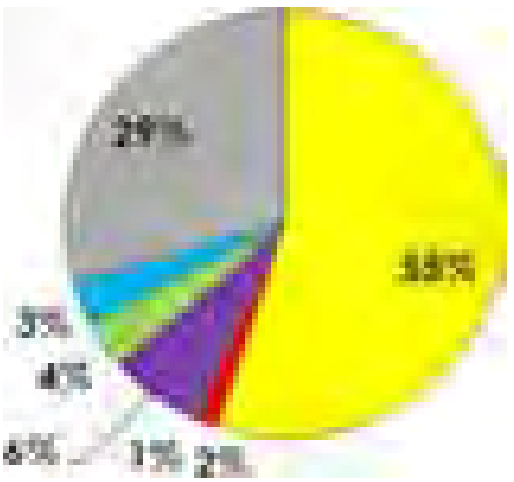
Spatial analysis includes the impact on land, type of mixing and degree of mixing in the townships. The analyses of both the case study areas have been detailed out below.

Land use 2005, 2015 and 2016

Case Study Area 1

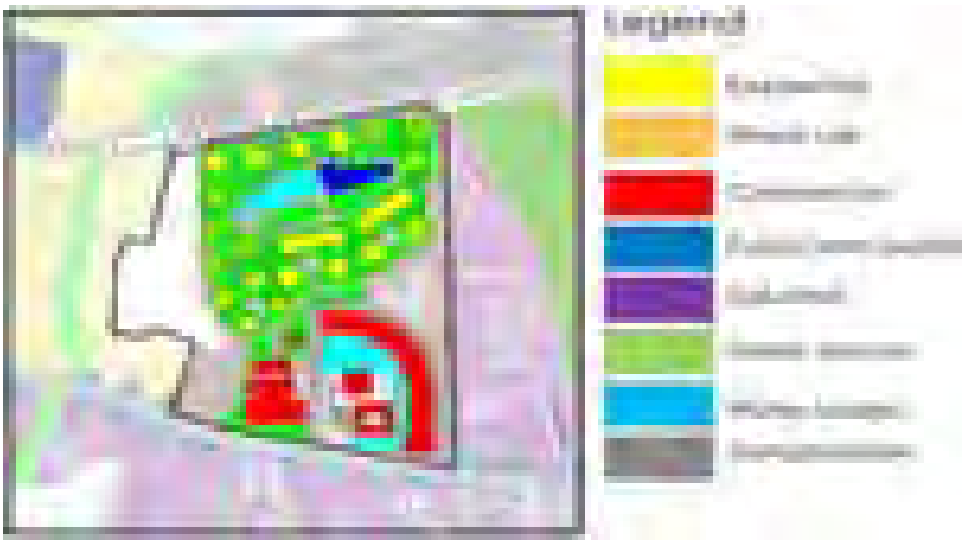
Comparison of the land use 2005 to 2015 (proposed) to the existing land use of the case area are analysed (Fig. 18). Majority of the industrial land has been converted to commercial land. Some of industries (soap factories) have been closed down and those lands are converted to commercial.

Figure 18: Land use Distribution of Ward 54



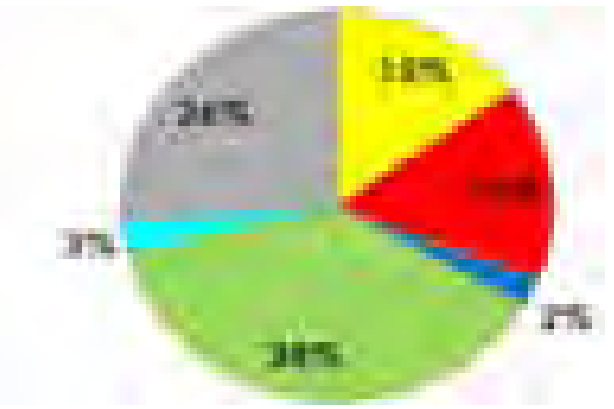
The comparison of land use 2005 and 2015 (proposed) has been indicated in the figure 19. The land in which the township has been developed is designated has commercial land in the Master Plan of Bengaluru - 2015. Under this land use, the permissible land uses are R, I3, T3 and U4 (Fig. 20).

Figure 19: Site Plan : Case Area 2



Source: Prestige Shantinikethan Sanction Plans, 2008

Figure 20: Land use Distribution of Case Area 2



The main land uses present within the township are broadly divided into residential, commercial and public and semi-public. The township includes 31 per cent of residential, 48 per cent of commercial and 21 per cent of public and semi-public.

Case Study Area 2

Comparison of the land use 2005 to 2015 (proposed) to the existing land use of the case area are analysed (Fig. 21).

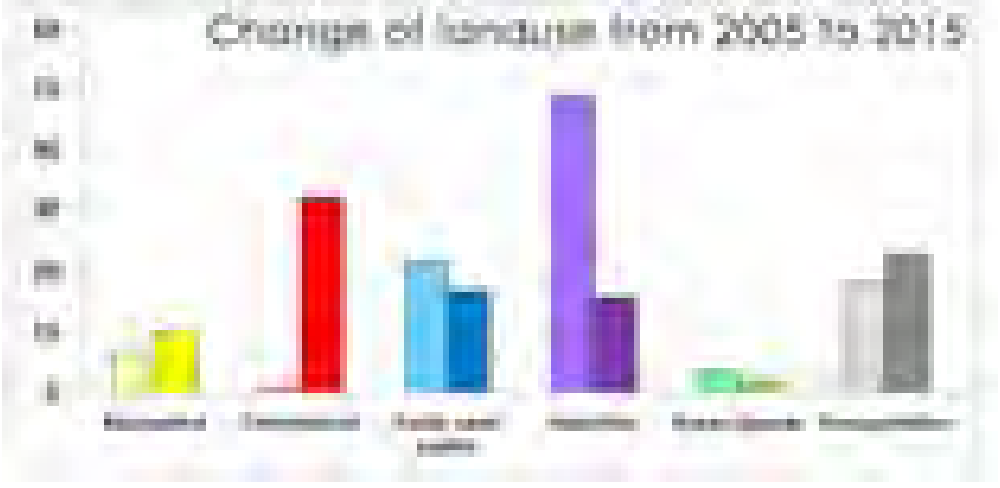
Figure 21: Land use 2005 and 2015 (proposed) - Case Area 1

Source: Master Plan of Bengaluru, 2015

The Industrial use has been reduced. The industries have been shifted towards the Penaya industrial areas and land has been converted to residential.

The comparison of land use 2005 and 2015 (proposed) has been indicated in the figure 22. The land in which the township has been developed is designated has commercial and residential use in the master plan of Bengaluru-2015. The township also follows the same as land use per the division.

Figure 22: Land use 2005 and 2015 (proposed) - Case area 1



The main land uses present within the township are broadly divided into residential and commercial. The township includes 58 per cent of residential and 42 per cent of commercial (Fig. 23). Comparison with Respective Wards is listed in Table 5.

Table 5: Townships in Bengaluru

Townships	Location (Ring/ zone/ ward)	Area in acres	Popula-tion	Density (pph)	Use-premise	Special characters
Brigade Gateway	Surrounding the core area North zone Ward - 66	55	5600	250	Residential Commercial Hospital School Hotel	Bengaluru's largest mall LEED - Grade A++ specification CREDAI Real Estate Award (2013) for the Best Office Building in Bengaluru
Karle town centre	Outskirts Mahadevpura zone Ward – 25	72	7000	240	Residential SEZ office Retail market Banks, gym, cafes	Great deal of emphasis on energy efficiency and sustainability in all aspects. -
Ozone Urbana	Outskirts Yelahanka zone Ward – 01	150	15000	250	Residential Multispecialty hospital Hotel Public school Shopping complex	Bengaluru's largest integrated township. Has multiple option to choose – plots or apartments or luxury residences
Prestige Falcon City	Outskirts Bhomanahalli zone Ward – 184	61	6200	250	Residential Retail Health care centre Convenience store Multi-purpose hall	Smartly planned apartment complex in 41 acres of land area. 7.6 Acres of Commercial development Metro Station is opposite to the project.
Bharatiya city	Outskirts Yelahanka zone Ward – 05	125	14000	280	Residential Hotels IT parks Retail Playgrounds	Project is located in an area which is very convenient for the IT professionals.
Patel Neotown	Outskirts Bhomanahalli zone Ward – 189	120	15000	310	Residential Office Commercial	-
Prestige Shanti-nikethan	Outskirts Mahadevpura zone Ward – 54	120	13500	280	Residential Office Commercial Hotel	LEED Gold Certified Asia Pacific Property Awards 2011 - Mixed Use Architecture India
Brigade Orchards	Outskirts Yelahanka zone Ward – 05	130	14000	265	Residential Office Commercial Playgrounds	Smart township

Figure 23: Land use 2016 - Present day - Case Area 1

Source: Primary Survey, 2016

Area of the development is higher in outskirts because of availability of land. The residential population is comparatively higher in the case of area 2 due to high number of housing units. But ward 66 contains more population than ward 54. The case area 1 has a lower density than ward density. The mix of uses within the developed land and ward varies. The percentage of residential use is very high in ward and comparatively balanced with other uses in the case areas. Multilevel car parking is provided in all the developments and adequate car parking facility is being allocated (Table 6).

Table 6: Comparison of Case Area 1 and Case Area 2 with their Respective Wards

Aspects		**Case Area 1**	**Ward 66**	**Case Area 2**
Area (ha)		23	49	120
Population	Residential	5,600	35709	13,500
	Commercial	10,400	-	5,000
Population density (pph)	Net	445	-	680
	Gross	250	388	280
FAR		2.85 (Permissible FAR: 3.00)		2.85 (Permissible FAR: 3.00)

	Type of distribution	Land use	Built up	Land use	Built-up
Land use mix	Residential	22	39	52.4	15
	Commercial	24	37	27.2	16
	PSP	10	5	1	2
	Green space	12	2	4.6	38
	Industries	-	-	-	-
	Water body	7	1	-	3
	Transportation	25	16	14.8	26

Land Use Entropy (Shanon Index)

The degree of mixing in the case study areas and the townships is calculated using the land use entropy (Shanon Index) method. For the calculation, the land use and the built up distribution of the case study areas and the land use distribution of the ward is considered. The comparative analysis is carried out between the land use distribution of the township and their wards respectively. From the table 7, one can infer that the degree of mixing is balanced in the townships compared to their respective wards.

Table 7: Land use Entropy Calculation

Area	Case Area 1			Case Area 2		
	Township		Ward	Township		Ward
	Land use	Built up	Land use	Land use	Built up	Land use
Residential	48,967	1,96,647	93,199	72,843	6,02,172	2,89,192
Commercial	53,418	2,63,570	26,130	77,700	4,51,629	89,276
PSP	22,258	38,061	17,118	9,712	15,054	15,438
Recreational	26,709	25,374	15,419	1,84,537	1,80,652	21,427
Water body	15,580	15,541	-	14,569	15,054	-
Transport	55,644	95,152	38,040	1,26,262	2,40,869	82,429
Total	2,22,577	6,34,344	1,89,907	4,85,623	15,05,431	4,97,763
Value of k	6	6	5	6	6	5
Entropy value	0.94	0.89	0.72	0.85	0.84	0.61

Mobility Impact

The case study areas are well connected by road network and the details of the transport network are listed below.

Transport networks

The external and internal connectivity through of the case study areas are illustrated through maps and sections.

Case study Area 1

The location of metro stations, bus stops, IPT stands which connects the townships to the city and the pedestrian and vehicular way and the parking spaces within the townships are identified and marked respectively (Fig. 24).

Figure 24: Land use 2005 and 2015 (proposed) - Case Area 2

Source: Master Plan of Bengaluru, 2015

The townships provide good pedestrian infrastructure with wide side walkways and footpaths. Seating is also made available treating them as informal public spaces, plantations are provided along the walkways. Internal roads are mainly one way traffic (Fig. 25).

Figure 25: Land use 2005 and 2015 (proposed) - Case Area 2

The section represents the pedestrian way in the township. Wide frontage is provided for the mall. The pedestrian zone is the intermediate zone to the commercial space and the water body. Being a vehicular free zone, huge informal gatherings takes place in the area (Fig. 26).

Figure 26: Land use 2016 - Present day - Case Area 2

Source: Primary survey, 2016

Case study Area 2

The location of metro stations, bus stops, IPT stands which connects the townships to the city and the pedestrian and vehicular way and the parking spaces within the townships are identified and marked respectively. The internal roads are wide varying from 12m to 24m. They are mostly one way traffic. Plantations are present along the footpaths. The internal roads are wide of 24 m and footpaths are being provided with varying widths of 2 m to 4m. Plantations are provided on either side of the road.

Mobility Indicators

The mobility indicators formulated to measure the performance of the transportation system are listed below:

- Modal share
- Per capita trip rate
- Average trip length
- Distance of work place from home
- Distance of place of education from home
- Distance between employees residence and case study areas.

The analysis of the above indicators is done by comparing the township data with their respective zone level data.

Modal share

The walk percentage and the car percentage is considerably higher than in their respective zones which indicate that the pedestrian infrastructure is good but due to high economic class present the car percentage is also higher in the case study areas (Fig. 27).

Figure 27: Mobility Plan - Case Area 1

Source: Primary Survey, 2016

Per capita trip rate

The per capita trip length in the case area 1 and in the case area 2 is less by 30 per cent and 45 per cent respectively when compared to their respective zone per capita trip rate. Thus, the distance travelled by the people has been decreased which indicates that the land use mixing helps in reducing trip lengths (Fig. 28).

Figure 28: Road Section A-A'

Average trip length

The average trip length is less by around 28 per cent and 22 per cent in the case area 1 and case area 2 respectively when compared with their respective zones' average trip length. This indicates that the residence travel shorter distance for their day to day activities (Fig. 29).

Figure 29: Section B-B'

Distance of work place from home

Around 40 per cent of the people are working within the development and hence the positive impact of mixed use developments in order to reduce the trips has been observed. These contribute to less traffic and hence to pollution free environment (Fig. 30).

Figure 30: Mobility Plan - Case Area 2

Source: Primary Survey, 2016

Distance of place of education from home

From the graph, we can infer that the trips are high due to education purpose. Basic education facilities should be provided within the developments. Travel for higher education can been considerably because of specific field of studies (Fig. 31).

Figure 31: Road Section D-D'

Distance between employees residence and case study areas

It can be observed that due to residential use present in the development at least around 35 per cent of the employees reside within the development only (Fig. 32).

Figure 32: Road Section E-E'

Walkability Index

The walkability index of both the case study areas has been calculated. Walkability index is a relatively comparative index and the walkability between both the case study areas has been compared. The walkability index is calculated using the formula:

$WAI = (2 * Con) + Ent + FAR + H_{den}$

where,

WAI = Walkability Index

Con = the standard value of the Connectivity Index

Ent = the standard value of the Entropy index (Shannon Index)

FAR = the standard value of the FAR (Floor Area Ratio)

H_{dens} = the standard value of the household density

Using the above formula, the walkability index of Case area 1:

WAI = (2 * 24) + 0.94 + 2.85 + 245

WAI = 296.79

and

walkability index of Case area 2:

WAI = (2 * 66) + 0.853 + 3.1 + 412

WAI = 547.95

From the above obtained values, one can conclude that the walkability index of case area 2 is higher than that of case area 1, which infers that case area 2 is more pedestrian friendly.

Socio-economic Impact

The social and economic factors are studied for better understanding of how the combination of both influences the case study area and the city. The case study areas consist of only MIG and HIG housing within the developments.

Social Impact

The social factors considered for the study are:

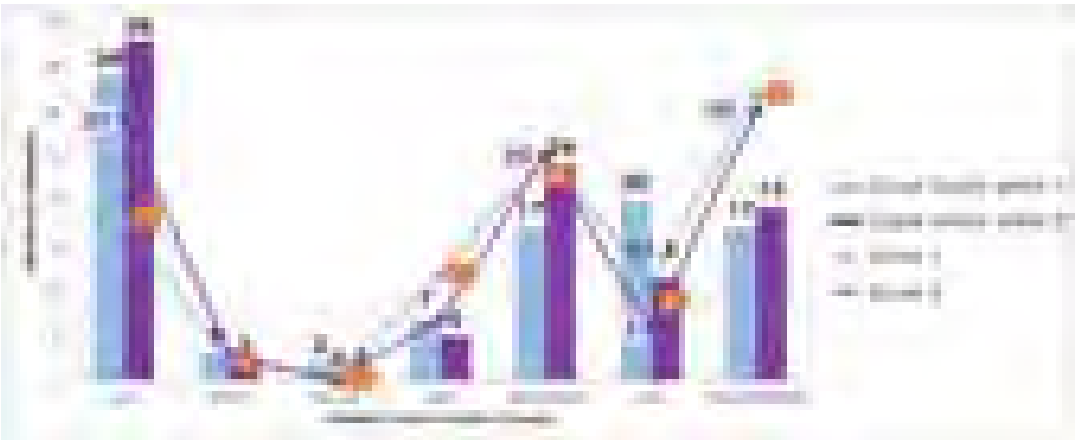
- Age group of the people;
- Income categories of the employees;
- Residential property owned or rented;
- Length of stay in the townships; and

- Reason for shifting to mixed use developments.

Age group of the people

The age groups of people ranging from 0 to 6 years, 6 to 20 years, 20 to 60 years and 60 years and above have been estimated in the case study areas. It has been observed that the maximum population lies between the age group of 20 to 60 years. It indicates that the working population age group is higher (Fig. 33).

Figure 33: Modal Share



Source : Primary Survey, 2016 and Directorate of Urban Land Transport, 2012

Income categories of the employees

The employees are being categorized based on their income levels into (Fig. 34):

Figure 34: Per capita Trip Rate

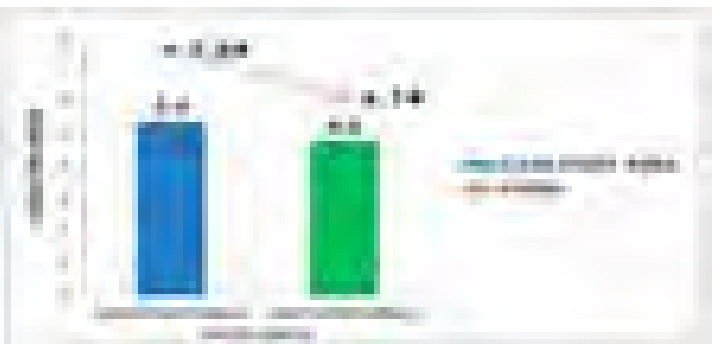
Source: Primary Survey, 2016 and Directorate of Urban Land Transport, 2012

- Economically weaker section (EWS);
- Low income group (LIG);
- Medium income group (MIG); and
- High income group (HIG).

Residential property owned or rented

The residential properties are mainly owned by the owners. Some percentage of the owners is not residing in the layout and also has not rented the property. They have retained the property as second homes. Higher percentage of owners indicates permanent staying idea of the residences (Fig. 35).

Figure 35: Average Trip Length

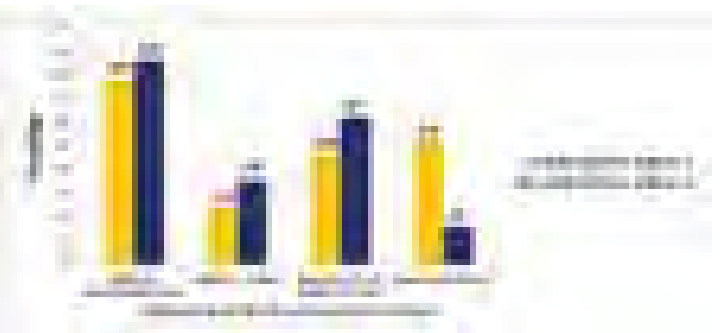


Source: Primary Survey, 2016 and Directorate of Urban Land Transport, 2012

Length of stay in townships

The case study developments are newly developed and among that there is large attraction towards the development in recent years, i.e., from 2 to 3 years (Fig. 36).

Figure 36: Distance of Work-place from Home

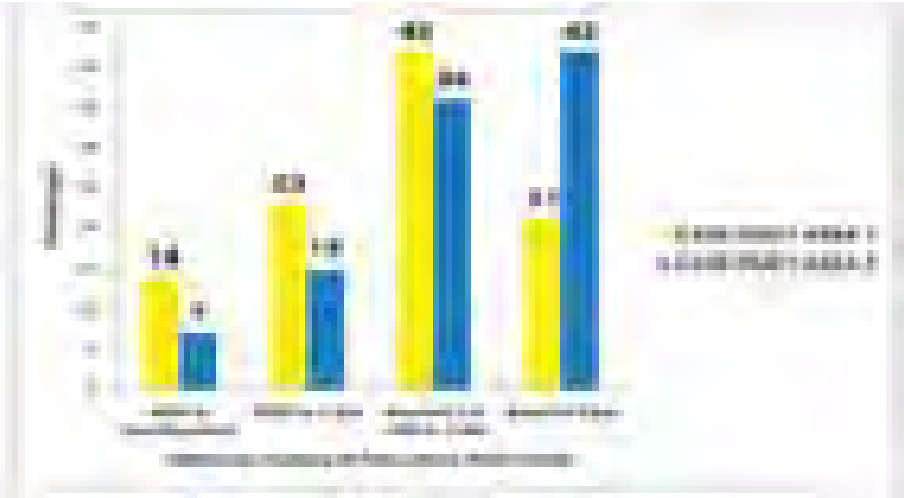


Source: Primary Survey, 2016

Reason for shifting towards mixed use developments

The developments are all newly developed layouts. People have been shifting to these developments in recent years. Higher percentage of people is shifting for work purpose. Hence, a good work home relationship can be observed (Fig. 37).

Figure 37: Distance of Place of Education from Home



Source: Primary Survey, 2016

Economic Impact

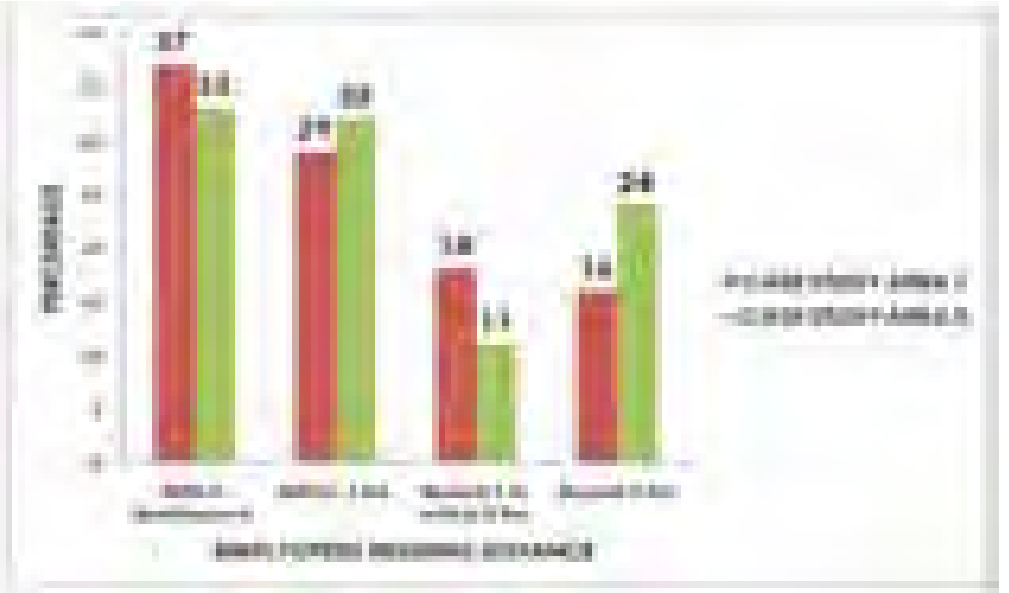
Property value

Guidance value is an indicative market value of a property, and the government would register a sale transaction only at that given value or higher.

Residential property value

The residential property value is highest in the area surrounding the core area. There is an increase by around 18 per cent over three years. With comparison to the ward data, these residential apartments have almost the highest guidance value in their respective wards (Fig. 38).

Figure 38: Distance between Employees' Residence and Case Study Areas

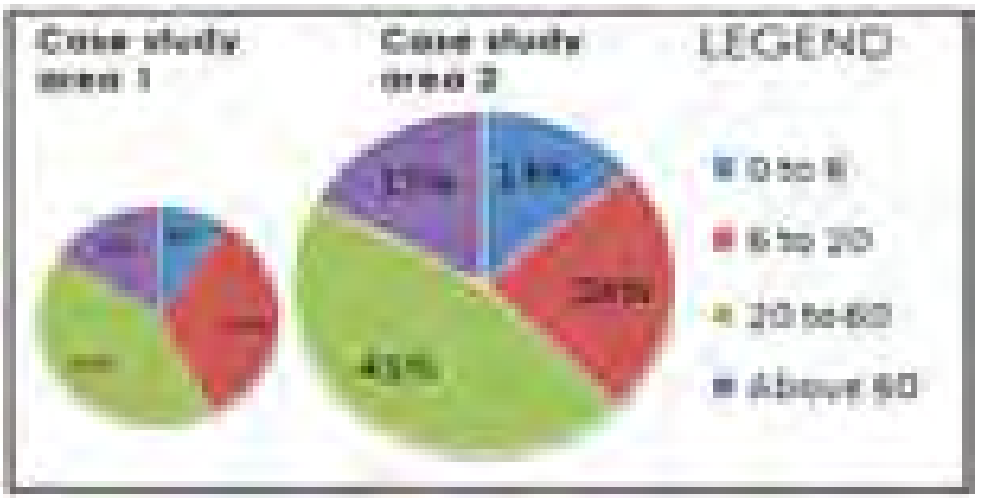


Source: Primary Survey, 2016

Commercial property value

The property value is highest in the surrounding area and is decreasing towards the outskirts (Fig. 39).

Figure 39: Age-group Distribution



Source: Primary Survey, 2016

Employment generation

Employment has been generated in different activities like offices, hotels, malls and schools.

According to NSSO 68th round, the total number of employees in informal sector is equal to 65 per cent of the total number of employees in the formal sector (Fig. 40).

Figure 40: Income Categories of the Employees

Source : Primary Survey, 2016

The highest percentage of employment is generated through the retail mall present in the case area 1. The maximum percentage of employment generation is through private offices in the case study area 2.

Jobs housing balance

The jobs-housing ratio is a ratio between a measure of employment and a measure of housing in a given area of analysis. The analysis is carried out for both the case study areas and the ratio is examined. Three types of jobs housing balance are calculated: Jobs/ household ratio; Jobs/ housing unit ratio; and Jobs/ residing workers ratio.

From the table 8, it is evident that the jobs/ housing ratio is highly imbalanced. Case area 1 is relatively more imbalanced. One of the important reasons for this is the lack of social mix in the housing units and existence of only HIG and MIG housing. The EWS and LIG housing are being ignored in the developments.

Social Infrastructure Impact

The quality of life in any urban area depends upon the availability of and accessibility to quality social infrastructure. The social infrastructure facilities include: Educational

facilities; Health care facilities; Socio-cultural facilities; Recreational facilities; Sports facilities; Distribution services; and Police safety.

The social infrastructure in both the case areas are analysed by comparing the standards mentioned in the URDPFI guidelines.

Case study Area 1

The social infrastructure facilities that are available within the townships and within 500m radius of the townships are mapped and analysed, as in figure 41.

Figure 41: Residential Property - owned or rented

Source: Primary Survey, 2016

A Primary school is present within the development. A higher secondary school is present just beside the development. A park beside the school area is missing. Residents travel beyond the township and much beyond around more than 5km for higher educational purpose.

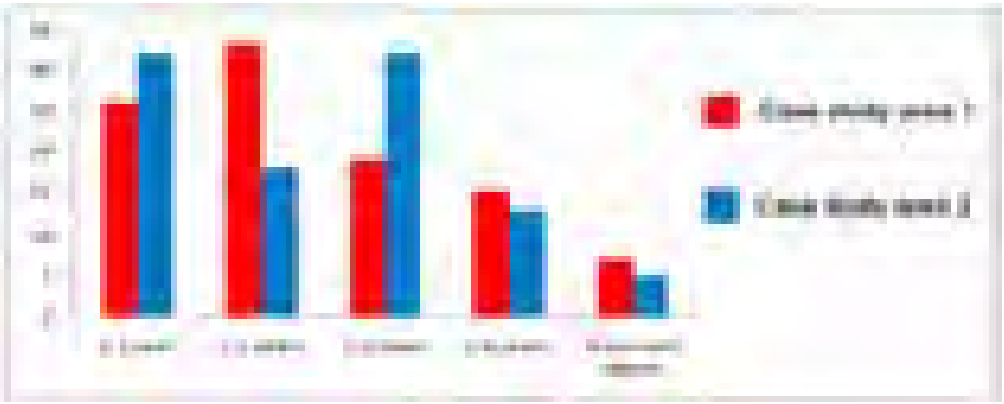
Multi-specialty hospital is present as part of the township. The hospital is one of the large hospitals present in the city. But the hospital mainly caters to the HIG.

An *Anganwadi* is present within the development. A Community centre/ hall is present within the development. A religious centre is also present within 500 m from the township. Tot lots/ small parks are present within the development. Playground is present within 500 m radius.

Case study Area 2

The social infrastructure facilities that are available within the townships and within 500m radius of the townships are mapped and analysed, as in Figure 42.

Figure 42: Length of Stay in Townships



Source: Primary Survey, 2016

There is an overall lack of educational facilities within the development. Nursery homes/ day care centres are present within the development. People travel beyond 5km for education purposes.

Nursing homes are present within 500m radius from the development.

An *Anganwadi* is present with the development. Community centre/ hall is present within the development. Religious centre of 50 sqm is also present within the development.

Tot plots/ small parks, playgrounds are present within the development.

STRATEGIES

To overcome the drawbacks present in the development of townships, policies and strategies are formed in order to achieve sustainable development of the townships and of the city. The policies and strategies formed are for the future developing townships and these act as a guidelines for their sustainable development.

Policies framed for the sustainable development:

- Compact development: high density development without compromising the quality of life of people.
- Inclusive development: means infusion of varying aspects, which lead to growth of whole society into development process, such as integrated infrastructure, sustainable development, poverty alleviation, decentralised decision making with special emphasis on women, elderly and disabled friendly infrastructure and financial planning.

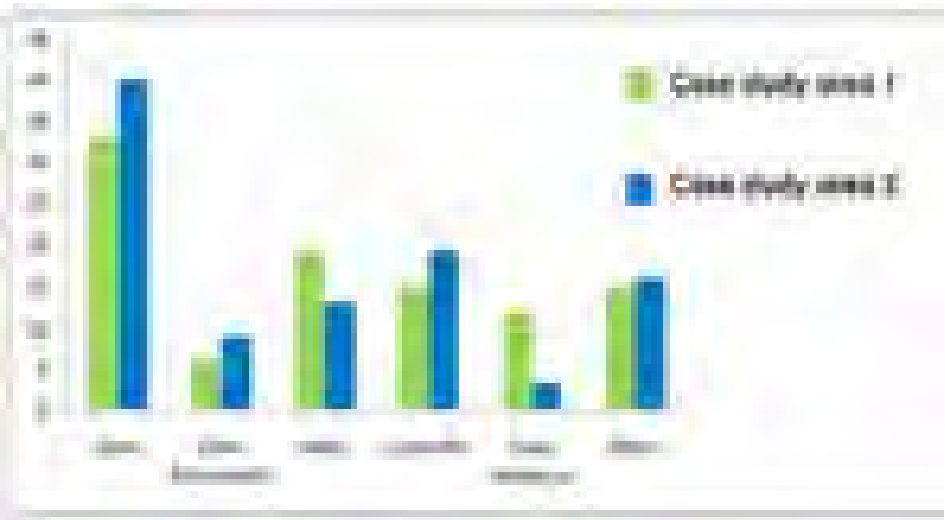
- Affordable housing: implies that the cost of the housing should be affordable to the disposal income of low income group, EWS and the poor.
- Efficient and low carbon mobility planning: 'transport system that encourages the use of low carbon emitting modes of transports, i.e., NMT, public transport and modes using fuels which emit lesser carbon dioxide including improved vehicular technologies'.
- Ecological protection: is a practice of protecting the natural environment on individual, organizational or governmental levels, for the benefit of both the natural environment and humans.

These policies are illustrated through the following strategies.

Spatial strategies

The spatial strategies are based on the extent of development, the mixing of uses, density and FAR in the townships and the open space allocations in the townships (Fig. 43). The mobility strategies are based on the location of the townships, their connectivity, street designing and pedestrian infrastructure (Fig. 44). The socio-economic strategies deals with the social mixing of housing and balance among the jobs housing ratio. The percentage distribution of housing is calculated based on the working population and their income level distribution.

Figure 43: Reason for Shifting towards Mixed-use Developments

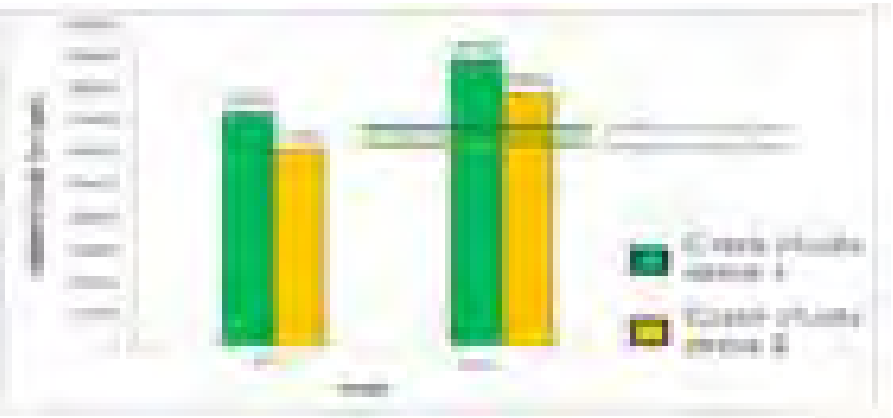


Source: Primary survey, 2016

Figure 44: Residential Property Value

Source: Guidance Value for Bengaluru - 2011 and 2014

Figure 45: Commercial Property Value



Source: Guidance Value for Bengaluru - 2011 and 2014

Figure 46: Employment Generation

Source: Primary survey, 2016

Figure 47: Social Infrastructure - Case Study Area 1

Figure 48: Social Infrastructure - Case Study Area 2

Figure 49: Green-belt of Bengaluru

Source: Master Plan of Bengaluru 2015

Figure 50: Proposed Development Zone of Townships

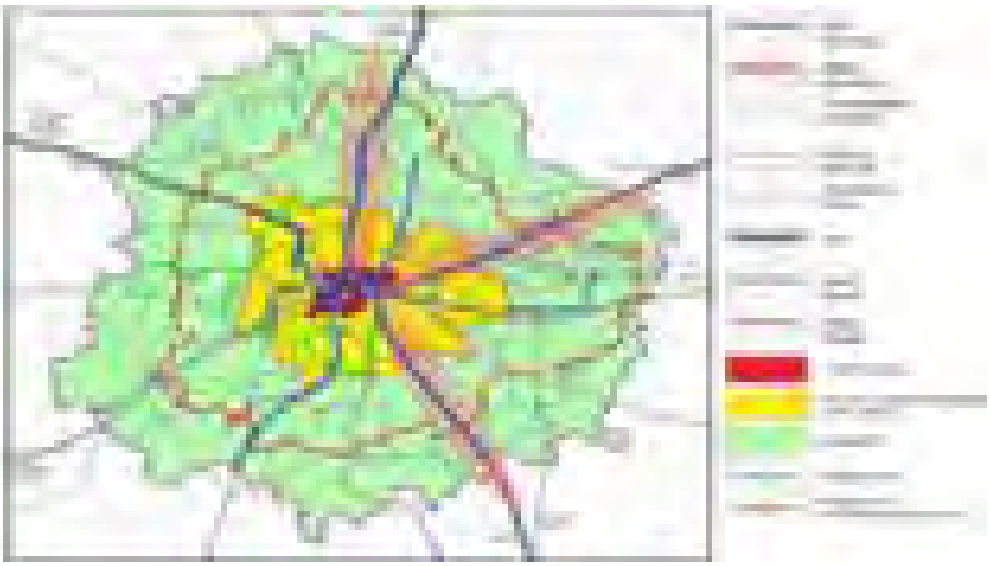


Table 8: Transport Network of Case Study Area 1 and 2

Aspects		Case study Area 1	Case study Area 2
Peripheral road width		24 m	45 m
Entry/ Exits Vehicular and pedestrian		Separate entry and exists for residences and commercial use	Separate entry and exists for residences and commercial use
Internal road width (driveway)	Max	8 m (one way)	24 m (two way)
	Min	4 m (one way)	15 m (two way)
Nearest bus stop		300 m	100 m
Nearest metro station		300 m (in use)	-
Nearest IPT stand		500 m	300 m
NMV (within the development)		Cycle Electric-vehicles	Cycle
Nearest Petrol Pump		300 m	300 m

Table 9: Jobs - Housing Balance

Jobs-housing Balance	Case Area 1	Case Area 2
Jobs/ Household ratio	5.7 : 1	1.14 : 1
Jobs/ housing unit ratio	8.61 : 1	1.65 : 1
Jobs/ residing workers ratio	12.73 : 1	2.15 : 1

Table 10: Issues and Potentials

Aspects	Issues	Potentials
Spatial	• Low density • Case area 1 – density less than average ward density (250pph) • Both the case study areas have low density (below 300pph) compared to the high dense wards in city (400 pph) Densities are not fixed for townships • Imbalance in FAR distribution – • The FAR used for commercial (office use) and residential is very high and for and for PSP is very low in case study areas. • FAR are fixed for townships as a whole and not for individual uses.	• The entropy value is higher and almost nearing to 1 in the case study areas compared to the ward entropy value which indicates high balance in land use mix. • Open space to built-up ratio is high in case areas promoting more green spaces in the development – good environment.
Mobility	• Lack of proximity within the uses and lack of IPT within the development – resulting of high single occupancy vehicle usage within the development. • Dedicated cycle tracks are not present.	• The pedestrian infrastructure facilities are good promoting walkability. • The internal roads are mostly one way which reduces the congestion. • Average trip length has been reduced.
Socio-economic	• Lack of social mix in the township – • Case area 1 – HIG • Case area 2 – MIG and HIG • No provision for EWS and LIG • Leading to increase in housing shortage in the city. • Jobs-housing imbalance – the job opportunities are higher but there is lack of housing units, mix among the housing units.	• Working population percentage is higher. • More job opportunities.
Social infrastructure	• Due to lack and shortage of social infrastructure, • increased trips - increased share of trips or education and health purpose using SOV	• Parks and play grounds are present.

Table 11: Spatial Strategies

Strategies	Descriptions	Policy supported
No development in and beyond the green buffer of the city.	Urban sprawl – major issue in the city growth. The green buffer around the city should be maintained and no development should be encouraged.	• Compact development • Ecological protection.

Land use mixing should be balanced.	**Land use category**	**% distribution**	The entropy value is almost 1, which indicates perfect balance among the uses.	• Compact development • Inclusive development
	Residential	25-30		
	Commercial	22-25		
	PSP	8-12		
	Green space	10-12		
	Water body	4-5		
	Transport	18-20		
High Residential density should be proposed in the township development.	Net Density – 1,200 pph within the city - 900 in the outskirts			• Compact development
Proportional FAR distribution among 3 main activities – residential, commercial and PSP.	FAR is fixed for the entire development based on the road widths. FAR for individual uses should be fixed in order to have balance among the uses.			• Compact development • Inclusive development
Open space 10-12 sq.m per person	Case area 1 – 4.76 sq.m per person Case area 2 – 13.69 sq.m per person			• Ecological Protection

Table 12: Mobility Strategies

Strategies	Descriptions	Policy supported
New townships to be along the transport corridors	The new townships should develop along the major road networks of the city and along the MRTS corridor where the IT sector has its growth potential.	• Transit oriented development
Use of non-motorized vehicle mandatory within townships.	For movement within the township use of NMT which helps in reduction of use of SOV within township. Use of green fill IPT – E rickshaws	• Use of efficient and low carbon mobility
Equitable streets	Reduction of wide roads for only vehicular movement and use of them in an equitable way having provision for cyclists and walking.	• Use of efficient and low carbon mobility • Inclusive planning
Promote walking and cycling in the development.	Provide dedicated cycle and walking tracks in the development. Awareness among people about the benefits of cycling and walking.	• Use of efficient and low carbon mobility • Inclusive planning

Table 13: Socio-economic Strategies

Strategies	Descriptions			Policy supported
Housing for all - Housing provision for all income levels within the townships.	Income level	Per cent of housing distribution	Based on the income level of the employees present in the case areas and to have a balance among the jobs/ household in the township.	• Affordable housing • Inclusive Planning
	EWS	15		
Balance among the jobs housing ratio (1:1)	LIG	10		
	MIG	50		
	HIG	25		

Table 14: Social Infrastructure Strategies

Strategies	Descriptions	Policy supported
Neighbourhood concept - Social infrastructure facilities within 500 m radius of the township.	Schools, hospitals, community centres, religious centres, *anganwadi*, parks and play-grounds based on the URDPFI guidelines should be provided in the townships.	• Inclusive planning

Social infrastructure strategies

The social infrastructure strategies are based on the URDPFI guidelines.

CONCLUSIONS

The mixed use in integrated townships should encourage the work-home-play relationship. The analysis was based on spatial, mobility, socio-economic and social infrastructure aspects. The spatial aspects which included the entropy calculation identified that balance of uses are present among the land uses and built-up distribution. The job-housing ratio calculation inferred that lack of housing in the townships due to lack of social mix in them. The major issues which were identified in the townships are lack of social inclusivity, low density, low carbon foot print and lack of balanced land use. Environmental friendly atmosphere and social security are one of the key potentials of the townships present.

No development in and beyond the green buffer of the city should be allowed. High residential density should be proposed in the township development and have a balance among all uses - residential, commercial, PSP, green spaces, transportation and others with facilitating all income groups - EWS, LIG, MIG and HIG. New townships to be developed along the transport corridors. Use of non-motorized vehicles should be made mandatory within townships. Pedestrian infrastructure and concept of complete streets should be incorporated. Social infrastructure, accessible by all, should be made available.

These townships should include the underlying principles of mixed uses like compact development, inclusive planning, affordable housing, efficient and low carbon mobility, ecological protection policies to achieve sustainable integrated township development.

REFERENCES

1. Bengaluru Development Authority (BDA), 2015, Master Plan of Bengaluru.
2. Caleb Sackey, 2009, Mixed-Use Development, An Urban Design Approach to Cities in Developing Countries.
3. CB 3 Land Use, Zoning, Public & Private Housing Committee Meeting, March 8, 2012, Seward Park Mixed-Use Development Project.
4. City Development Plan for Bengaluru, 2007, JNNURM.
5. Central London: the Impact of Mixed Use Development, 2013.
6. Conclave of Green Architecture, Centre for Science and Environment, 2014, Building Senses.
7. Department of Forest, Ecology and Environment, Government of Karnataka, 2008, State of Environment Report Bengaluru.
8. Design Center for American Urban Landscape, 2003, Defining Mixed-use Development.
9. Directorate of Economics and Statistics, 2009, Karnataka State Strategic Statistical Plan.
10. Directorate of Urban Land Transport, 2009, Bengaluru Mobility Indicators-2008.
11. Directorate of Urban Land Transport, 2012, Bengaluru Mobility Indicators-2011.
12. Fairfax County Department of Planning & Zoning Planning Division, 2012, Jobs-Housing Ratios: National Perspectives and Regional and Local Benchmarks.
13. Geetam Tiwari, 2011, Key Mobility Challenges in Indian Cities.
14. James R. DeLisle, Terry V. Grissom, 2011, An Empirical Study of the Efficacy of Mixed-Use Development: The Seattle Experience.
15. Joseph S. Rabianski, 2007, Mixed-Use Development: A Review of Professional Literature.
16. Joshua D. Herndon, 2011, Mixed-Use Development in Theory and Practice: Learning from Atlanta's Mixed Experiences.
17. Metropolitan Area Planning Council, Mixed Use Zoning, A Planners' Guide.

18. Lawrence d. Frank and Gary Pivo, 2009, Impacts of Mixed Use and Density on Utilization of Three Modes of Travel: Single-Occupant Vehicle, Transit, and Walking.

19. Lisa A. Sturtevant, John McClain, 2010, Examining the Impact of Mixed Use/Mixed Income Housing Developments in the Richmond Region.

20. Pria, Society for Participatory Research in India, 2014, Bengaluru Study Report-2014.

21. Qian Wu, 2013, Jobs-Housing Balance: the Right Ratio for the Right Place.

22. RITES, 2011, Comprehensive Traffic and Transportation Plan For Bengaluru.

23. Sarika Bahadure and Rajashree Kotharkar, Social Sustainability and Mixed Land use, Case Study of Neighbourhoods in Nagpur, India.

24. Sergio Porta, Kevin Thwaites, 2007, The Generation of Diversity: Mixed-Use and Urban Sustainability.

25. Steven Loehr, 2013, Mixed-Use, Mixed Impact: Re-Examining the Relationship between Non-Residential Land Uses & Residential Property Values.

26. Sustainable Residential Development in Urban Areas, 2009.

27. Todd Litman, 2015, Evaluating Public Transit Benefits and Costs.

28. UN-Habitat, A New Strategy of Sustainable Neighbourhood Planning: Five Principles,

29. The World Bank. 2014, The South African Township Economies.

30. Yan Song, Gerrit-Jan Knaap, 2004, Measuring the Effects of Mixed Land Uses on Housing Values.

31. Yang Yang & Wu Songnan, 2009, The Thinking of Mixed Use From a Perspective of the Hutong Protection.

32. Zdena Dobesova and Tomas Krivka, 2012, in Jaroslav Burian (Ed.).Walkability Index in the Urban Planning: A Case Study in Olomouc City, Advances in Spatial Planning.

Redevelopment of Urban Flood Plains

Research into Design for a Connected World pp 437-449 | Cite as

- M. Y. Supritha (1) Email author (suprithabmssa@gmail.com)
- B. S. Sheethal (1)
- K. Shreyas (1)

1. BMSSA, , Bengaluru, India

Conference paper
First Online: 09 January 2019

Part of the Smart Innovation, Systems and Technologies book series (SIST, volume 134)

Abstract

As per Rashtriya Barh Aayog, 12% of the land in India comes under the flooded area, which comprise nearly 40 million hectare land. From 1915 to 2015, India has faced 649 disaster and 302 out of 649 were caused due to flood (CRED). CRED data also highlights that the decadal change of flood and its effect on human life and economy is increasing rapidly. Provision of better quality infrastructure based on vulnerability of areas, considering the socio-economic, environmental and physical aspects of the city will avoid the trigger of floods. Use of modern technology and strategies also plays a very important role in preventing the flood and its immediate effects on environment, further leading to a healthy growth of the city. Based on the analysis over the parameters, the width of the buffer zones, infrastructural development measures have been identified. The need for the design interventions and sensitiveness needed towards the different mitigation strategies for the sustainable development of the city have been detailed out in the study proposals.

Keywords

Sustainability Buffer zone Infrastructure Floods

References

1. Ramachandra, T.V.: Kormangala Floods, Mismanagement of Landscapes: Abuse of Bellandur-Agara Wetlands, Narrowing and Concretising RajaKaluve and Encroachment of Storm Water Drains, Dumping of Solid Waste and Building Debris. Apathy of Civic Agencies (2017)
   Google Scholar (https://scholar.google.com/scholar?q=Ramachandra%2C%20T.V.%3A%20Kormangala%20Floods%2C%20Mismanagement%20of%20Landscapes%3A%20Abuse%20of%20Bellandur-Agara%20Wetlands%2C%20Narrowing%20and%20Concretising%20RajaKaluve%20and%20Encroachment%20of%20Storm%20Water%20Drains%2C%20Dumping%20of%20Solid%20Waste%20and%20Building%20Debris.%20Apathy%20of%20Civic%20Agencies%20%282017%29)
2. National Green Tribunal Act (2010)
   Google Scholar (https://scholar.google.com/scholar?q=National%20Green%20Tribunal%20Act%20%282010%29)

3. http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri_enews/newsletter/issue44/article1/index.htm (http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri_enews/newsletter/issue44/article1/index.htm)
4. Avinash, S.: Flood related disasters, concerned to urban flooding in Bangalore. Int. J. Res. Eng. Technol. **3** (2014)
Google Scholar (https://scholar.google.com/scholar?q=Avinash%2C%20S.%3A%20Flood%20related%20disasters%2C%20concerned%20to%20urban%20flooding%20in%20Bangalore.%20Int.%20J.%20Res.%20Eng.%20Technol.%203%20%282014%29)
5. http://www.bengaluruvarunamitra.info/Default/Index?service=VulnerableSpots (http://www.bengaluruvarunamitra.info/Default/Index?service=VulnerableSpots)
6. Gopal, D.: Vegetation in Bangalore's Slums: Boosting Livelihoods, Well-Being and Social Capital (2014)
Google Scholar (https://scholar.google.com/scholar?q=Gopal%2C%20D.%3A%20Vegetation%20in%20Bangalore%E2%80%99s%20Slums%3A%20Boosting%20Livelihoods%2C%20Well-Being%20and%20Social%20Capital%20%282014%29)

Copyright information

About this paper

Cite this paper as:
Supritha M.Y., Sheethal B.S., Shreyas K. (2019) Redevelopment of Urban Flood Plains. In: Chakrabarti A. (eds) Research into Design for a Connected World. Smart Innovation, Systems and Technologies, vol 134. Springer, Singapore. https://doi.org/10.1007/978-981-13-5974-3_38

- First Online 09 January 2019
- DOI https://doi.org/10.1007/978-981-13-5974-3_38
- Publisher Name Springer, Singapore
- Print ISBN 978-981-13-5973-6
- Online ISBN 978-981-13-5974-3
- eBook Packages Engineering Engineering (R0)

Personalised recommendations

NCACESD 2019
NCACESD 2019

DEPARTMENT OF ARCHITECTURE
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI | TAMIL NADU | INDIA

NCACESD 2019

Proceedings of

1st National Conference

ON

Recent Trends in Architecture & Civil Engineering

TOWARDS

Energy efficient and Sustainable Development

10th – 12th January 2019

Edited By
Dr. K. Thirumaran
Dr. L. Saikala

Proceedings of 1st National Conference on Recent Trends in Architecture & Civil Engineering towards Energy Efficient and Sustainable Development

Department of Architecture
NIT-Tiruchirappalli
10th – 12th January 2019

Published by NCACESD 2019

ISBN 978-93-5346-040-2

TABLE OF CONTENTS

Traditional Sustainable Design Strategies - A Case of Pol Houses of Ahmedabad

Ar. Shanu Raina[1], Ar. Bhagyalaxmi[2] & S Madapur[3]

[1]*Assistant Professor, B M S College of Architecture, Bull Temple Road, Basavanagudi, Bangalore-560019, Karnataka, India*

[2]*Associate Professor, B M S College of Architecture, Bull Temple Road, Basavanagudi, Bangalore-560019, Karnataka, India*

Corresponding Author Email ID: shanuraina.arch@bmsce.ac.in

Abstract: Fast-forwarded urbanism of Indian cities amidst huge pressures of development is resulting in unrelated growth, unplanned urbanization and disconnected urban form. Extreme urban ecological conditions and environmental crisis are the consequential results of this unplanned urbanization in the majority of Indian cities. Various driving forces especially in the residential sector majorly contribute towards environmental quality of the urban areas. The spatial organizations and the quality of spaces of the traditionally built residences are the manifestation of regional context and testimonials to the assertive responses to the prevailing climatic, socio-cultural conditions as well as locally available resources. Most importantly these environmentally sensitive built forms are customarily built by the community. These dwelling units do not control the climatic conditions by themselves, but passively can modify the internal micro- climate even though they are affected by the external environments. The orientation, form, volumes enclosed, the building materials obtained from natural resources and services contribute to the climatically sustainable performances of the housing units. These diverse factors and patterns predominantly reflect in the housing texture in turn in the urban form. Through the case example of Pol houses in Ahmadabad, this paper highlights the influence of traditional sustainable construction technologies in building design patterns and physiographic pattern of a region.

Keywords: Urbanization, Urban environment, Micro-climate, Sustainability, Construction Technologies

INTRODUCTION

The new development in tier one and tier two cities in India is resultant of rapid urbanization. Fast-forwarded urbanism of Indian cities amidst huge pressures of development is resulting in unrelated growth, unplanned urbanization and disconnected urban form. Extreme urban ecological conditions and environmental crisis are the consequential results of this unplanned urbanization in the majority of Indian cities. Various driving forces especially in the residential sector majorly contribute towards environmental quality of the urban areas. The report by KPMG (2014) project construction of 40-45 million housing units by 2028. It becomes very vital for the contemporary growth to be sustainable. This sense of sustainable development very much prevails in traditional architecture.

The spatial organizations and the quality of spaces of the traditionally built residences are the manifestation of regional context and testimonials to the assertive responses to the prevailing climatic, socio-cultural conditions as well as locally available resources. Most importantly these environmentally sensitive built forms are customarily built by the community. These dwelling units do not control the climatic conditions by themselves, but passively can modify the internal micro- climate even though they are affected by the external environments. The orientation, form, volumes enclosed, the building materials obtained from natural resources and services contribute to the climatically sustainable performances of the housing units. These diverse factors and patterns predominantly reflect in the housing texture in turn in the urban form.

The pol hoses are the traditional built forms of Gujarat respond appropriately to the prevailing climatic, cultural and contextual setting. The traditional sustainable design strategies practiced are relevant to the contemporary scenarios and hence they can be adopted with required modifications.

CITY AND ITS EVOLUTION

The UNESCO World Heritage City Ahmedabad is located in Gujarat on the western side of India. The city was founded in 1411A.D by Sultan Ahmed Shah and hence the name Ahmedabad. The location of the city favored growth of trade and commerce. The economic base of the region remained predominantly trading. The city shape and form derive its inspiration from Vedic city form Sarvatobhadra /Dandak plan. With Sabarmati on one

side, the plan must have developed as Karmuka later (Bhatt n.d.). Citadel, three gates and Friday mosque are the key elements which were present in the beginning and the public avenue connected these nodes.

(a) (b)

Figure 1.(a) Map of Gujarat*(Sejpal, 1987);* (b) Walled City of Ahmedabad*(Source: Author 2018)*

The seventeen major road networks adorned the city. The old part of the city (walled city) is layered historic precinct. The built fabric of walled city is a beautiful concoction of Islamic, Hindu, Jain, Colonial style of architecture. Ahmedabad also referred as "Manchester of East India" has seen critical changes in its urban fabric after 1818(after British East India Company took over). The banks of Sabarmati River have witnessed the two distinct type of development on east and west. Eastern side is dotted with cluster neighborhood, approximately three hundred pol houses, historic buildings, religious buildings and many tourist attractions, meanwhile on the western side grew the Cotton textile industries.

Impact of the colonial domination led to modern planned residential and institutional establishments. The river and the bridges (Nehru Bridge, Ellis Bridge etc.) helped in the expansion and urban development of the city. The western side of the city is growing enormously on the eastern side the space seems to have been frozen in time. The impact of the alteration in a way to adapt to the essential needs of present time has resulted in tweaking of architecture.

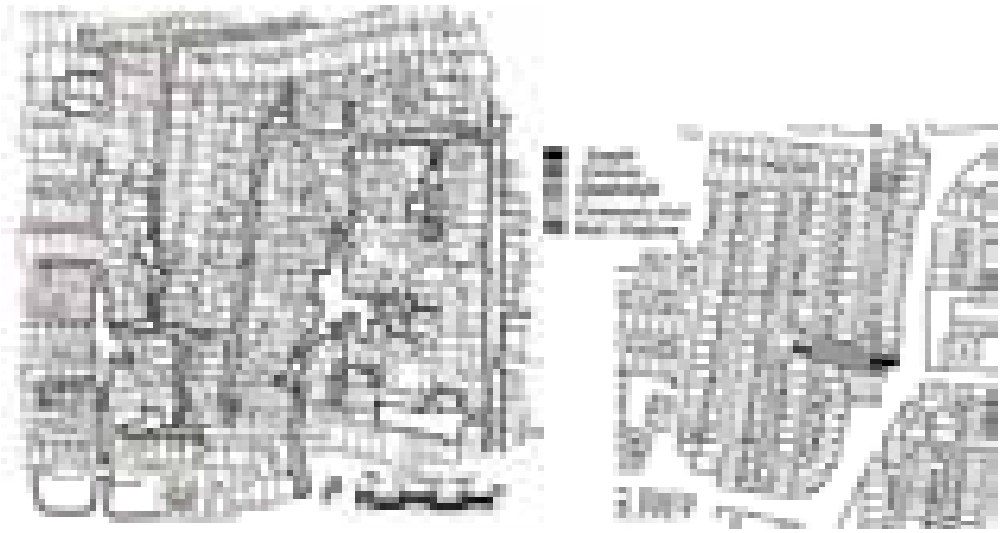
URBAN PLANNING

Urban Form and Morphology

The case example of pol – a dense residential neighborhood has been highlighted for the study of sustainable traditional architecture. The pol houses are the integral part of the morphology of walled city. Many Pol houses are as old as 300 years and have stood by the test of time. These Pols have a well-defined boundary. All the pols have a well-defined main gateway which is connected with neighborhood level streets along with cluster of adjoining houses.

The gates used to be shut at night. The gates had a slate (black board) engraved on the wall adjoining the entrance gate. The important announcement with respect to community would be written on it for everyone to know.

The narrow streets open into irregular quadrangle, with a temple/mosque, chabutra, well or any other community space. The Houses in the pol houses are mostly G+2 or G+ 3 structures which allow the mutual shading in the streets and the common community activity area.



(a) (b)

Figure 2. (a) Pol – A typical map showing dense urban fabric*(Source: Author 2018);* (b) Aminities at Pol level*(Source: Author 2018)*

TRADITIONAL POL HOUSES

A Pol is a dense housing cluster in the historic core of the old walled city built around five hundred years ago. Pols are comprised of several families belonging to diverse caste and occupation. The following sub-sections of the paper explore different traditional sustainable design strategies adopted in the planning, designing and construction at various levels (neighborhood, cluster and individual dwelling units) of Pol houses while focusing on the co-relation between social behavior and spatial organization that are climate, culture, time and place specific responses.

Co-relation between social behavior and spatial organization

Social behavior is the most important trait of human beings and this reflects in the evolution of patterns and order of the societal fabric they inhabit which are highly complex social phenomenon. The social behavior is primarily governed by the space organization and vice-versa. The spatial organizations and layouts of the dwelling units are not only the manifestations of regional contexts with differing resources but are also the prevailing social structure, behavior as well as hierarchy of social interactions. In this context, traditionally built dwelling units mirror the cultural attitude and their form and organization echoes the assertive relationship between human and the environment. Most importantly these environmentally sensitive built forms are customarily built by the community reinforcing the continuity of passing on the skill set to the successive generations promoting local over global.

POLS- NEIGHBORHOOD PLANNING AND DESIGN

Pols are highly dense clusters with meandering narrow lanes form a series of micro-neighborhoods. Singular access with cul-de-sac streets of Pols render them highly secured. The typical form of these bordering rows of houses and the hierarchy of spaces are the prominent character of these houses. City of Ahmedabad is characterized by hot semi-arid climate having strong solar radiation throughout the year with average outdoor temperatures ranging from 20 to 38 degree Celsius. Hence, controlling the solar heat gain is the most effective strategy in the planning of the neighborhood, clusters and individual units.

Traditional Pol houses being strong reflections of their geographical conditions represent a pattern of space governed by intricate conventions and configurations about spaces and their co-relation with specific activities. Spatial organizations of these traditional houses have evolved with the society and the social structure. Various activity areas and their relationship represent inhabitant's response to space. Effective tools such as compact planning, hierarchy of streets and spatial order support in organizing the structure of the neighborhood. Thus the

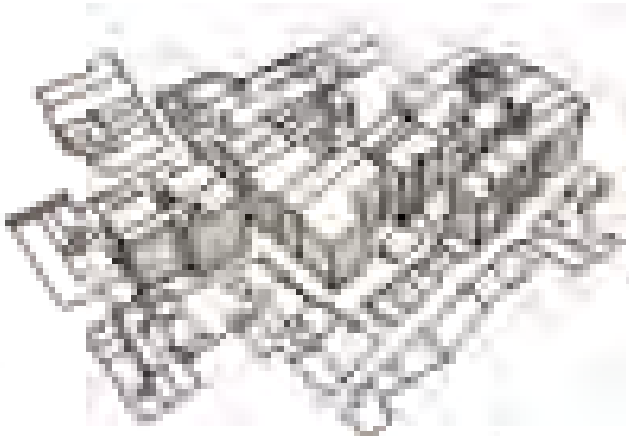


Figure 4. The linear and compact arrangement of dwelling units casting mutual shading*(Source: Author 2018)*

(a) (b)

Figure 3. (a) Pol – A typical map showing dense urban fabric*(Source: Author 2018);* (b) Aminities at Pol level*(Source: Author 2018)*

neighborhood has grown organically into a dense built fabric over the centuries reflecting specifically the culture and climate of the region (Refer Figure 3a).

The streetscape of the neighborhood is characterized by flat as well as sloping roofs. The street orders of the neighborhood create a hierarchy of comfortable micro-climates that help the inhabitants to gradually transition from the partly unshaded main roads to completely shaded inner streets to. The optimum comfort levels are generated largely by the street's hierarchy, orientation, geometry, canyon as well as the outdoor shade by the mass of the built forms (Refer Table 1).

Table 1. Street hierarchy and percentage of shading *(Source: Authors, 2018)*

Street orientation	Height/Width Ratio -1.2	Height/Width Ratio -1.7	Height/Width Ratio -5.7
North-South	70% shaded	85% shaded	95% shaded
East-West	50% shaded	70% shaded	80% shaded
NW-SE & NE-SW	65% shaded	85% shaded	90% shaded
	Primary road	Secondary road	Inner connecting street

POLS- CLUSTER PLANNING AND DESIGN

Traditional Pol houses are distinctive in its character and nature. The characteristic features of Pol cluster is defined by the transitional spaces referred as Otlas. Otlas or verandas with rows of carved columns are semi-covered transitional spaces between the street and the house. It demarcates the extent of the house with steps (acting as plinth) the house. Otlas, shaded by the projections of the balconies in the upper floors promote and reinforce the social encounters of inhabitants. Solar exposure of the built forms is effectively reduced by means of recessed façade and meanwhile it also drops the magnitude of radiation received along the edges of the street.

Various design strategies such as narrow cul-de-sac streets, open-built ratio, interconnectivity, multiple squares, compact and homogenous built forms, etc. have been contributing to the better life quality that has been sustained through centuries. Several considerations and notions can be directly related to design strategies adopted (Refer Table 2).

Table 2. Notions and design strategies *(Source: Authors, 2018)*	
Notions	**Design strategies**
• Cluster geometry & Street hierarchy • Otlas • Chowks • Recessed facade and internal layout	• Thermal comfort for inhabitants & enhanced social interaction • Vibrant street character • Improved air-light ventilation and community interaction. • Internal thermal comfort and privacy

POLS- INDIVIDUAL UNITS PLANNING AND DESIGN

Pol houses occupy the entire plot area and share common walls forming the rows of houses. The houses are 5 to 7-meter-wide and 10 to 18-meter-deep with their narrow frontage facing the road. Most of the houses are two or four stories high and have an open courtyard which renders porous character. This particular aspect is an apt response to the prevailing cultural and climatic conditions. Each house is self-sustained with the capacity to store its own grain and water.

The narrow plan of the houses forms linear arrangements of the spaces following a specific order of spaces from public, semi-public to private and are also functionally adaptable as per the needs of the users. Relation between the space and the related function is specific feature of a dwelling unit. In the case of Pol houses, other than kitchen and toilet (that require specific layout and setup) all the different spaces are not given function specific names which directly implies at the multi-natured usage of the spaces at different times as well as occasions of the day and year. Multi-spatial activities are the trait of the Pol houses. Interestingly, spaces are named on the basis of the nature of the enclosure such as Chowk (courtyard), Otla (verandah), Khadki/Baithak (living space), Parsal (family space), Osri (semi-open family space), etc. (Refer Fig.8, 9 & 10).

The front volume of the house is lower than the rear volume. The volume on the upper floors is separated by the courtyard and is connected by passage.

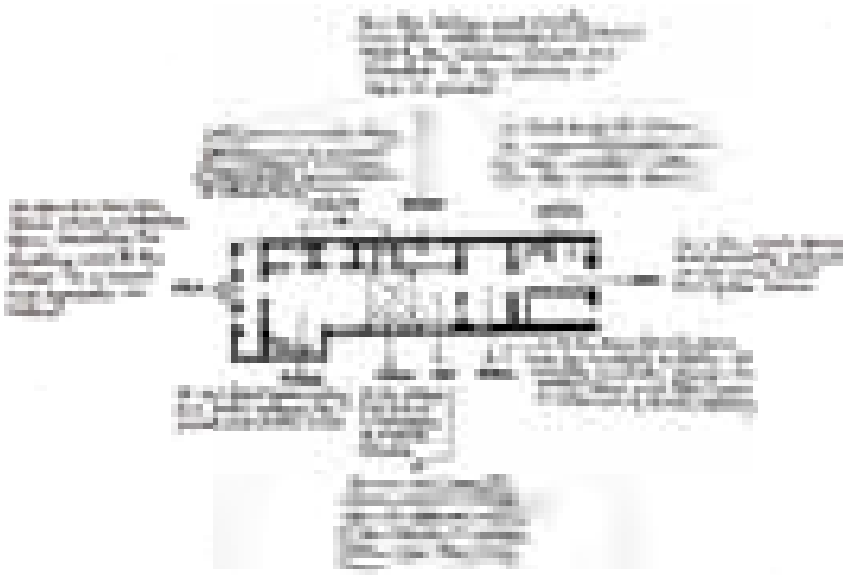


Figure 5. Spatial organization of Pol house*(Source: Author 2018)*

The frontages of the houses have balanced composition of projecting balconies and window openings. Pol houses do not control the climatic conditions by themselves, but passively modify the internal micro- climate even though they are affected by the external environments. These dwelling units respond effectively to the climate with shared long walls, light weight roofs, thick walls with high thermal mass, small but deep courtyards, etc. Siting and orientation of the Pol house provides appropriate shading as the long walls are shared, while only narrow end walls are exposed.

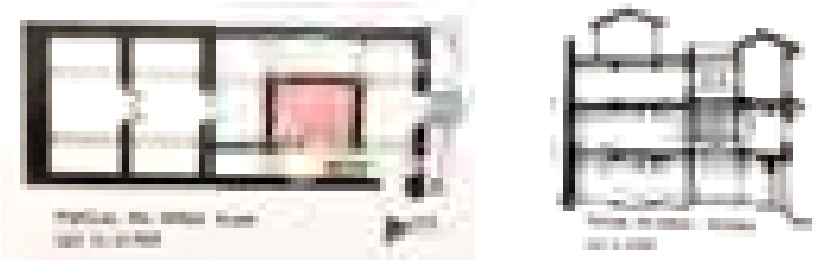


Figure 6. Pol house – Typical plan & section

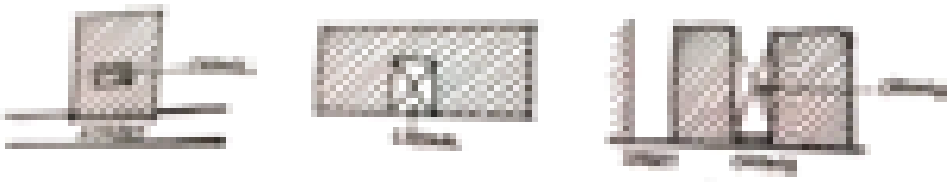


Figure 7. Different configurations of Chowk *(Source: Author 2018)*

Inhabitants respond to extreme weather conditions by having a diurnal and annual cycle of varying multi-spatial use patterns as they rely on passive systems to achieve thermal comfort. Summer daytime is spent on the ground or intermediate floors, whereas upper floors are used during night. Whereas in winter, upper floors or courtyards are used for daytime activities and intermediate floors are used at night. This pattern of migrating occupancy by the inhabitants from the shielding house interiors during the day times to the open roofs at night allows them to take advantages of the coolness of the night sky.

These multi-spatial use configurations are supplemented by the closing and opening of windows which in turn follows a pattern specific to winter and summer. Window openings have detached wooden paneled shutters rather than glass panes. These detached shutters are opened or closed as per the daily activities and the time of the day to take advantage of the prevalent weather conditions.

Chowk (the courtyard)

Although, narrow and densely shaded streets and compactness of the built forms are particularly advantageous for both outdoor and indoor thermal comfort levels, it leads to considerable reduction in the light levels in inner rooms. In this regard, the open spaces are of utmost importance in the dense urban fabric. The courtyard referred as the Chowk is the most important feature of Pol houses as it connects inside to outside functioning as ventilation shaft. The various types of internal courtyards help in maintaining the thermal performance while improving the light and air ventilation. The appropriate and narrower proportions of the courtyards (about 5 to 10 SqM) extending from ground floor to the roof level, act as an aperture in a compact layout serving as a passive climate regulator of the built form. The floor of the chowk is tiled and attached either to a water tank below or to the earth.

Effective evaporative cooling is optimized and supplemented by daily household practices such as washing activities in the Chowk alleviating the increasing solar radiation during summer. The stack effect created by the courtyard flushes in cooler air and exhausts hot air. The Chowk provides a steady micro-climate and acts as a connecter of interiors to exteriors.

Thermal behavior of the Pol houses in different seasons

Thermal behavior of the Pol houses is cumulatively affected by the orienting, positioning and massing of the Pol house along with solar radiation, shading, thermal mass and the occupancy patterns of the residents. The densely packed courtyard houses function as protective envelope by keeping the outside heat away. The strategies of occupants such as having a diurnal and annual cycle of varying multi-spatial use patterns, shading, earth coupling and evaporative cooling to provide cooler surfaces work in combination creating a comfortable micro-climate inside the houses during the summer months.

During the monsoon, the hot-dry desert like climate dramatically turns into hot-humid tropical type of climate. The daily patterns of occupancy on a diurnal basis become less important and make the house as a open connector with the outdoors throughout the daytime. The coolness of the rains becomes important external factor in achieving thermal comfort.

As the temperatures cool down during winter season, the Pol houses resume functioning on a diurnal basis. The upper floors and terraces become hub of activities as they provide much required thermal comfort. The activities co-relate to festivities such as kite-flying in January on the terraces of the houses throughout the day.

POLS- CONSTRUCTION TECHNIQUES AND MATERIALS

Pol houses have evolved through successive generations. Pol house construction is fundamentally based on the framework of wooden posts and beams with infill walls of brick. The street façade characterized by load bearing masonry walls, flat and sloping roofs, projecting balconies, wooden structural and intricately carved columns including carved columns, brackets, window shutters and balconies.

The load bearing walls are constructed using locally made bricks and are plastered externally and internally. Floors have wooden joist- stone slabs and the roofs are made of mud tiles. The sloping roofs of the Pol houses not only shed the monsoon rains, they also provide loft space which is used for various purposes.

However, flat roofs of the majority of the Pol houses provide multi-usage space. Thermal comfort primarily related to the thermal capacity of the materials used. Concealing the exposed mass of the wall with wooden details is the most successful and appropriate strategy to improve the thermal comfort. A shield between incident solar radiation and the thermal mass of the house is achieved through the carved wood facings owing to their low thermal capacity. The internal walls of the Chowk are also detailed with carved wood facings, wooden shutter, windows, etc. to keep the wall mass shaded. The horizontal and the vertical bracing (wooden) in the walls act as not only the aesthetic feature but also provide seismic stability.

WAY FORWARD

Exploring the tested methods especially spatial organization, cluster planning, construction techniques, climatic considerations, etc. and adapting them with necessary changes will support in developing planning and design guidelines for new residential clusters to adapt to the evolving and changing perceptions of the city dwellers. Similar methodology and approach can be deliberated not only in Ahmedabad but in most of the other Indian cities of comparable context and climatic factors. Owing to their unique planning and design characteristics responding to the extreme climatic conditions, the Pol houses perform in assertive manners. They particularly react to the hot-dry climate while minimizing the issues of thermal storage and exposure to overhead sun providing thermal as well as spatial comfort to the dwellers. As discussed in the sub-sections of the paper, Pol houses offer much required solutions for most part of the year. Analysis of the spatial organization and its relevance in contemporary times shall substantially support the fundamentals of the design process in the creating holistic living environment.

REFERENCE

India, WRI India and Embarq. Re- Imagining Manek Chowk Precient. Ahemdabad , Gujurat , India: Ahmedabad Municipal Corporation, January 2006.

Indian Tradition: Voices on Culture, Nature and the Challenges of Change ed. by Carla M. Borden, Smithsonian Institution Press, Washington, 1989, p.339.

K.B. Jain, "Wooden Houses" in Ahmedabad ed. by George Michell and Snehal Shah, Bombay, Marg Publications, 1988, p.157.

Mamun Rashid, Dilshad Rahat Ara. "Modernity in tradition: Reflections on building design and technology in the Asian vernacular." Frontiers of Architectural Research, 2014.

Sanmarga Mitra, Shivashish Bose. "Sustainable Performance of Diverse Regional Vernacular Architecture of India - case srudy of I.G.R.RM.S. Bhopal, India." international conference - Green Urbanism, GU 2016. Elsevier B.V, 2017. 495-513.

Sejpal, Shraddha. Theory and City Form: The case of Ahmedabad. Thesis Report of Master's Degree program, MIT, 1987.

"Sense of place" and identity elements alongside the old and the new highways in Tamil Nadu, India

G. Ophylia Vinodhini[1] & Dr. A. Meenatchi Sundaram

[1]*C.A.R.E. School of Architecture, Tiruchirapalli, Tamilnadu, India*

[2]*Associate Professor, Department of Architecture, National Institute of Technology, Tiruchirappalli, Tamil Nadu, India*

Corresponding Author Email ID: ophyliagodwin@gmail.com

Abstract: Many of identity elements of our old travel routes have appeared to vanish, in a significant measure over the recent decades. Passers-by and vehicular travellers of the previous two decades will remember having seen the many teashops and shading trees that have very limited visibility at existent. The pause points for vehicular fuelling and automatic money transaction centres are the immediate requirements for travellers of today's expressways. Changes in our highway architecture and the ensuring loss of its identity elements remain an area of limited academic pursuit. This paper addresses the need to reconsider our lost components in view of their social imperativeness. The old urban areas have got transmuted by the growing pressure from the developmental agendas. We are in the part of the world that is witnessing rapid changes in the states of economy and habitation, bringing about distinctive, multitudinous changes in the ways of work and commute. An extension of old roads is among the most important happening in our nation. Without exception, the state of Tamil Nadu is susceptible to several transformations in functional requirements and physical changes happening to its landscape. This research paper surveys loss of identity elements of the previous decades alongside the highways and identifies the lacunae in the present landscape of stopover spots that has been a concern to most peregrinators and passers-by. In the end, the amalgamation of components is discussed to provide a character enriched experience with identity elements.

Keywords: identity elements, highways, sense of place, place character, travel routes

INTRODUCTION

Since ages, people have been transforming their ideas and value systems, especially in the experiences along their travel routes. The past three decades has been witnessing uninformed and unexpected levels of transformations in the transport sector. The connectivity between places in lesser time with more comfort of increased speed of travel is the need for the people of the present decade.

The new proposals of highways as well as the widening of old roads have been ingesting more land and growing at an expansive pace. The people in India see it as a scope to expand their business territories alongside the highways, most of which are motels, hotels, resting lodges and restaurants. Highway design is often associated with geometric design, safety and services guidelines; the unseen part of it often associates with the memory of people, associations with their surroundings and orientation of oneself with places along travel routes. An innovative and meaningful design can real to place making along highways. This paper examines the present conditions and the vanishing elements from travel routes with a case study from India.

As elsewhere, the travel corridors of India were well known for certain elements that stood for the place's cultural identity. Our highways lack the visual and functional character that the peregrinators have once rejoiced. Focusing on a highway stretch that the author has been frequently passing by across the years in the state of Tamil Nadu, India, this research informs about the missing elements that once allowed highway riders do develop a sense of place.

The research does not get into the details of highway construction and other services. For data collection, the research asked a group of respondents to complete a questionnaire invoking Likert-type responses on the perception of safety of the study stretch in view of its boring landscape and regarding the absence of elements of interest alongside the highways. With the extent of the country's national highways measuring 96,260 km, two-lane expressway is the majority model, covering 56,362 km (http://planningcommission.gov.in/). Two-lane expressway is also the object of interest to this research. However, the study has fair generalizability to both 2-lane and 4-lane highways. For 6-lane and 8-lane highways, the present research will have little to draw from.

JSPS-DST Japan-India Forum for Advanced Study

"Progress and perspective of the studies on the crustal evolution of the Indian Peninsula from Archean to the present by geochemical, chronological and geological approaches"

7 -16 March, 2019
at Nagoya Univ., NIPR, and Niigata Univ.

7～10 March Nagoya Univ.

- **Session1: Precambrian craton-margin orogenic belts and their tectonic implications**
- **Session2: Continental and marine sedimentation around Indian continent through geological time**
- **Session3: New frontier of research in origin and evolution of continents: Planetary and environmental sciences**

11 March Field excursion 1

12 March National Institute of Polar Research

- **Workshop : Introduction of SHRIMP**

13 March Field excursion 2

14～16 March Niigata Univ.

- **Session4: Continent formation by accretion from Archean to present days**
- **Session5: Supercontinents**
- **Short Course: Application of thermodynamics in Geosciences using Perple_X**

32. Chiranjeeb Chatterjee (Indian Institute of Science) – *Contamination and mixing of older Archean crust during the genesis of the early Proterozoic TTG phase: A study approach from the southeastern margin of the Eastern Dharwar Craton*

March 15, 2019

Venue: Library Hall, Ikarashi Campus, Niigata University

Session 5: Supercontinents

Convenors: M. Satish Kumar (Niigata University), T. Hokada (NIPR), and Sajeev Krishnan (Indian Institute of Science)

9:00 – 9:20 Kazuyuki Shiraishi (National Institute of Polar Research) – *Geology of eastern Dronning Maud Land, East Antarctica --- 60 years of Japanese contribution ---*

9:20 – 9:50 Ian C.W. Fitzsimons (Curtin University) – *Hafnium isotopes and the rise and fall of the Gondwanan super-mountains*

9:50 – 10:20 Chang Whan Oh (Chongbuk National University) – *The continental collision process deduced from the metamorphic pattern in the Himalayan and Qinling-Dabie-Sulu-Hongseong-Odesan Collision Belts*

10:20 – 10:40 Toshiaki Tsunogae (University of Tsukuba) – *Phase equilibria modelling of fluid-induced high-temperature metasomatism in granulite terranes*

10:40 -11:00 Coffee Break

11:00 – 11:40 Bernardo Cesare (University of Padova) – *Nanogranitoids and their bearing on crustal melting*

11:40 – 12:10 Tetsuo Kawakami (Kyoto University) – *Disequilibrium REE compositions of garnet and zircon in migmatites reflecting different growth timings during single metamorphism (Aoyama area, Ryoke belt, SW Japan)*

12:10 – 12:40 Sajeev Krishnan (Indian Institute of Science) – *Continental growth during an inauspicious time*

12:40 – 14:00 Lunch break and poster session

14:00 – 14:30 Eichi Takazawa (Niigata University) – *Drilling of crust - mantle transition in the CM site of Samail ophiolite: the ICDP Oman Drilling Project*

14:30 – 14:50 V. J. Rajesh (Indian Institute of Space Science and Technology) – *Petrogenesis, tectonics and economic significance of Neoarchean Alaskan-type ultramafic rocks in Palghat Cauvery Suture Zone, southern India*

14:50 – 15:10 Harinadha Reddy (Indian Institute of Science) – *Numerical modeling of UHT metamorphism in the lower crust of eastern Gondwana*

15:10-15:30 Coffee break

15:30 – 16:00 Ian S. Williams (Australian National University) – *An Introduction to oxygen isotope geochemistry*

16:00 – 17:00 Ian S. Williams (Australian National University) – *A practical introduction to oxygen isotope geothermometry*

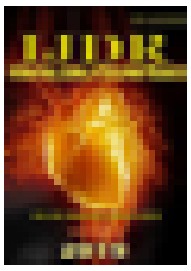
18:30 – 21:00 Closing Ceremony and Banquet @ ANA Crowne Plaza Hotel, Niigata

ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 09, Issue, 03, pp.26136-26140, March, 2019



ORIGINAL RESEARCH ARTICLE OPEN ACCESS

ECONOMY INDUCED RESETTLEMENT: DESIGN PROPOSAL FOR NEW HAMPI

***Shikha Patel**

Assistant Professor, Department of Architecture, BMS School of Architecture, Bangalore, Karnataka, India

ARTICLE INFO

Article History:
Received 22nd December, 2018
Received in revised form
08th January, 2019
Accepted 01st February, 2019
Published online 29th March, 2019

Key Words:
Design intervention, Context,
Socio-economic,
Planning strategies.

ABSTRACT

The paper offers a new spatial arrangement which guides the development of New Hampi, which presently accommodates the displaced people of Hampi. Being a world heritage site, Hampi has an overlap of many jurisdictions which becomes necessary to study in order to propose new planning strategies. While planning a new layout, it is necessary that the proposal compliments the economic loss and spatial arrangement of New Hampi planned by the government in 2008. The multidisciplinary approach used in planning is an attempt to conceptualize certain aspects of development, resettlement and rehabilitation. It focuses on development induced by existing resettlement strategy enhancing the habitat and socio-political environment. The output of the proposal does not only look into the heritage value of the setting but also considers the cultural, economic, tourism and political significance. However, in the broader concept of resilience, cultural resilience is reviewed as the most critical bridge between heritage, tourism and economy. The literature survey covers the understanding of land use pattern and spatial arrangement of built fabric in the neighbouring villages which also falls under the boundary of World Heritage Site. A series of maps have been created and analysed in order to understand the issues and challenges faced by the displaced people of New Hampi.

Citation: Shikha Patel. 2019. "Economy induced resettlement: design proposal for new hampi", *International Journal of Development Research*, 09, (03), 26136-26140.

INTRODUCTION

Brief History of Hampi: Hampi Village is located in the precinct near the ancient Virupaksha Temple. This active temple has its significance since centuries. The customs, rituals and festivals taking place in and around the temple is a demonstration of the socio cultural layer in the urban fabric. However, most of the economic activities also depend on the functional character of Virupaksha temple. Also, the other surrounding temples like the Krishna Temple and Achyutapura Temple have been handed down for tourism under the policies of World Heritage Site. Therefore, Virupaksha temple becomes one of the most important living temples in context of displaying the values as a testament of time memorial. Also, the village next to Virupaksha temple has its significance because it complements the functionality of the temple. In the absence of which, Virupaksha temple would also not be living like the other temples in the precinct.

Brief History of New Hampi: In the year 1992, the government of Karnataka opened a new route from Goa to Hampi, which diverted a huge population of backpackers to Hampi. This led to rapid urbanization of the village of Hampi. New businesses came into practise to serve the needs of this new category of population. Till 1992, the village was fabricated to serve the locals, temple visitors and pilgrims in time of festivals. In order to serve the new population, many families from nearby villages shifted near Virupaksha temple and started encroaching the mandapas and bazaar area of the temple. This not also interfered with World Heritage policies but also offended the authenticity and eccentricity of the temple precinct creating conflicts between locals. On the other hand Virupapura Gadde Island which was gifted by the royal family to Achyuta Swami to continue ashram activities is occupied by private land owners. As a result, the presence of backpackers become even more visible and it gave rise to notable amount of hostels and homestays, which is deeming the integrity of the place. Thirdly, the government approved the construction of 2 suspension bridges connecting Anegundi and Hampi, which acted as visual eyesore to the context of the place. In conclusive to all these reason, World Heritage Site declared Hampi into "endangered site" in 1999. In order to attain the identity of World Heritage Site, the 2 suspension bridge were demolished and warning was given to the locals to vacant the encroached lands. These displaced people were

****Corresponding author:*** *Shikha Patel*
Assistant Professor, Department of Architecture, BMS School of Architecture, Bangalore, Karnataka, India

Figure 1. Distance of New Hampi from Hampi

Figure 2. Relocated land parcel, New Hampi

Figure 3. Base map – New Hampi and Kadirampura

Figure 4. Figure ground map of Base map

shifted to the strategically located New Hampi with the certainty of creating better living standards.

New Hampi: The re location of the displaced people had to be imperative in order to preserve buildings by keeping them in use by way of modernisation with or without adaptive alteration. However, illegal encroachments and constructions, along with unsuitable construction activities made the government to take a rigid step for the relocation to maintain the authenticity and sanctity of the temple and surroundings. The location of New Hampi was strategized based on various grounds. Firstly, the land selected was the nearest non-agricultural land in the surrounding. It was far enough not to merge with the developments of Hampi in future and close enough for the residents to commute to their work place daily. Secondly, the Local Planning Authority (LPA) differentiated the boundaries of core region where all the policies of World Heritage Site are applicable and the peripheral boundary where the policies are not stern. So it was necessary to relocate New Hampi outside the core boundary not to hinder the future developments. Thirdly, it would be rational to locate the displaced people near by an already existing settlement to get the support for amenities. And lastly, the physical setting like the boulders, temple, slopes, gave the people an emotional comfort which was a requisite for relocation. Taking in consideration all the parameter, the land parcel next to Kadirampura village was selected for relocation, 4 kilometres away from Hampi, on the Hampi road.

Documentation and Analysis

Physical Attributes of New Hampi: Spatial organization and physical structure forms the 2 aspects on which the physical attributes of New Hampi are studies. In context of spatial organization, circulation systems, behavioural pattern, type of spatial organization, non-functional areas and private and public zones are mapped. In context of physical structure, impact of natural features, demography and growth pattern, proportion and scale, building typology and occupation patterns are mapped. The identical features identified in the character of Hampi and New Hampi are the presence of boulders, presence of agricultural land in the surroundings, presence of ASI (Archaeological Survey of India) property, presence of living village of Kadirampura and the scope to continue traditional economies due to the presence of the natural features. Also, there is a scope to grow and flourish the relocated land parcel as it is not bounded by the core zone boundary regulations. The growth pattern in case of Kadirampura is catalysed by Hampi road and New Hampi follows a strict grid iron pattern. Though the physical character helps to keep the urban fabric intact, the economies of the displaced people is hampered. The occupation of educated residents now consists of guiding Hampi tours, working in panchayat office or municipal office, driving auto and other small scale businesses. There is not much difference in the occupation pattern of New Hampi and Kadirampura or Hampi, but there is a lack of primary occupation.

Figure 5. Existing Structure Plan of New Hampi and Kadirampura

Figure 6. Proposed Structure Plan of New Hampi and Kadirampura

Adding to it, there is no growth pattern defined from the planning of New Hampi to cater to the increasing population in future. According to demographics, the population growth in the future is also quite certain, guideline for which should be made for planned development.

Social Attributes of New Hampi: The aim of social study is to analyse the cultural, social and religious aspect of New Hampi, in a way to find design solutions to intervene the place. The social parameters include neighbourhood organization, privacy and territory, societal structure and social life while the cultural parameters include history, religion, festivals, traditions and customs and languages.

However, these parameters also help to understand the character of place and its functionality. The community study infers that the plots were allotted randomly and so the place lacks the sense of community and social practices. It can be also concluded that lack of a sacred place nearby (like Virupaksha temple in Hampi) also causes the character to lose its identity. Though there exists a mix of communities, the major communities comprises of Lambanis, Vaishnavas and Naiks. Interaction between communities and residents forms the major basis of balance in social life. There is mix of languages spoken, out of which Kannada and Telugu are mostly used. Also, the festivals celebrated are not following a particular ritual as it happens in Hampi till today. Amavas

(every fortnight), Ganesh Puja (once in a year), Holi (Once in a year) and New Year's Eve (31st December) are some of the major festivals celebrated in New Hampi. Apart from these, the organically built social spaces like the kattes a

nd jugli in the front yard of houses and Tayama temple in the boulders forms an important character in their day to day life.

Issues and Challenges

***Planning Issues*:** The relocation occurred as a conclusive action of encroachments in Hampi village hampering the integrity and sanctity of the place. The relocated land parcel, possessing the physical features like that of Hampi, gives an opportunity to develop in a similar fashion. Although, it can be concluded that the present planning has the following issues: 1) The strict grid iron pattern of the built fabric does not allow the streets and main access to grow in an organic way 2) The physical features like the boulders, greens and heritage monuments, though they give the feel of their original living setting, does not serve its purpose efficiently 3) The relocated land is surrounded by agricultural and farming lands. Yet, the sewage of Hew Hampi entirely is disposed in open farms, which creates unhygienic living conditions.4) Even though planned recently, there are no arrangements for rain water harvesting, which leads the residents into water scarcity situation. 5) The open space network which becomes critical for warm and dry climates is missing.

Socio-Economic Challenges: The social and economy of the displaced people is highly impacted in New Hampi as their socio-economic circumstances were dependent of Virupaksha Temple in the old setting. Lack of which, there is a loss of direction for their social life and economic situation. Some of the challenges are: 1) The plots were not divided following any pattern of their social pattern, due to which the displaced people experience lack of society. 2) The scale of planned streets do not support the daily social activities of people, because of which there is a cut off from the social character of the place. 3) The primary economic catalyst, which the temple in the original setting, is completely missing. All the economic activities along with the small scale businesses were active due to temple and its activities. 4) The vulnerable people have divided themselves among different jobs like guiding tours to Hampi, driving autos and buses, working in panchayat office, which concludes the lack of primary economy. 5) Also, the celebration of all festivals would be in the temple precinct, in the absence of which the rituals and customs of the people have changed. As a result, the lifestyle which guided these customs or vice versa is missing too.

Opportunities: On the other side, there is also a flood of opportunities for the residents owing to new connections introduced, new geography and new living conditions offered.The ancient villages have grown and formed a character over a long period of time. New Hampi has an opportunity to still make its own identity (through its physical and social aspects) and develop in the way that it will guide the future. The only catalyst connecting to Hampi is Hampi Road (Jila Panchayat road), there is a scope to identify new connections to Hampi and other neighbouring villages in order to revive and define it contextually. Even though iron grid pattern hampers the social character of the place, there is a scope to expand the streets in way to guide organic development in the future. Also, the built fabric contains only residential plots, intervening it to sacred or livelihood shops give scope to change the land use pattern in the regeneration plan and guide the development. This might also give activity generators for the streets, which is absent presently. There is a scope to merge the iron grid pattern of New Hampi to linear organic pattern of Kadirampura. Lastly, the house typologies do not help to enhance the living condition or the identity of the place, which creates and opportunity to plan typologies which are more responsive to climate and context.

Intervention

Proposal: The project is divided into 3 parts; the first park looks into the existing resettlement planning and its issues, intervening with strategies to overcome the present weaknesses and threats. Next it looks into connecting the existing resettlement fabric to the proposed layout. And lastly, the project focuses on framing policy which would allow the development to happen according to the guidelines.

Aim: The project identifies the failure of resettlement at methodological level in the inappropriate use of economic, physical and social discipline and in providing principles and guidelines for the design of compensation and resettlement. The scope of work also includes providing outline of the future expansion for the residents of New Hampi.

Assessing Needs of the Residents: The conclusion of the survey highlights the following points: 1) The residents of New Hampi primarily lost their livelihood when resettled. Directly or indirectly they were dependent on Virupaksha temple for economy generation. Need to replace their livelihood support was necessary. 2) Relocated from Hampi, residents of New Hampi are exposed to new networks and opportunities to convert their skills to livelihood support, need a platform for the same. 3) Not only about present, but focusing on the future need too, the residents will need to evolve their settlement into a self-sustained one. Need for public, social and civic amenities. 4) Residents foresee economic progress in having more guest houses and retail shops so that they are not dependent on neighbouring towns for daily needs, need of mixed land use. Considering these inferences as primary, the proposals elucidates a series of changes in the present planning. (Refer image for details of survey).

Design Strategies: The influence of the site character is limited to roads, pathways, boulders and greens. However, the missing parameters like the open space network, hierarchy of spaces and enclosures needs to successfully integrate with the surrounding built form and provide a quality streetscape to enhance lifestyle and culture of the displaced people. One of the important strategies for the project is infill development which includes reclaiming and repair of blighted and abandoned areas within existing revenue village (Kadirampura) and New Hampi by strategically conserving social and economic fabric. Actions like proposing visitors amenities (toilets, parks, museums, recreation centres) in regulated areas, scale and massing of built fabric and redefining the use of vacant plots in existing layout forms the basis of infill development. Secondly, urban intensification is planned to grow efficiently by providing higher density than currently exists through development, redevelopment, expansion and conversion of existing fabric at New Hampi and area of scope.

Figure 7. Survey of assessing the needs of the residents of New Hampi

Figure 8. Proposed Layout

This can be achieved by proposing scaling the streets, proposing livelihood support complex for daily needs and by regulating the use of natural and physical resources. Lastly, urban regeneration is introduced for design intervention and sustainable concepts to improve existing physical infrastructure and more importantly, the declining economy of New Hampi. Some of the measures for urban regeneration is adaptive reuse of regulated areas around ASI monument, improvement of existing physical and social infrastructure in a sustainable manner and by giving platform for the upliftment of traditional skills.

REFERENCES

Archaeological Survey of India. 2014. National Policy for Conservation of the Ancient Monuments, Archaeological Sites and Remains, 1–24.

Floor, I. (n.d.). Hampi World Heritage Site Landscape Study Integrated Design, 0–91.

GoK. 2003. The Hampi World Heritage Area Management Authority Act , 2002, (18), 1–16.

Plan, R. 2010. Hampi World Heritage Area Management Authority , Hospet, (October), 1–76.

Seema, R. L. 2008. Research Design. Retrieved from https://www.slideshare.net/gaurav22/research-design

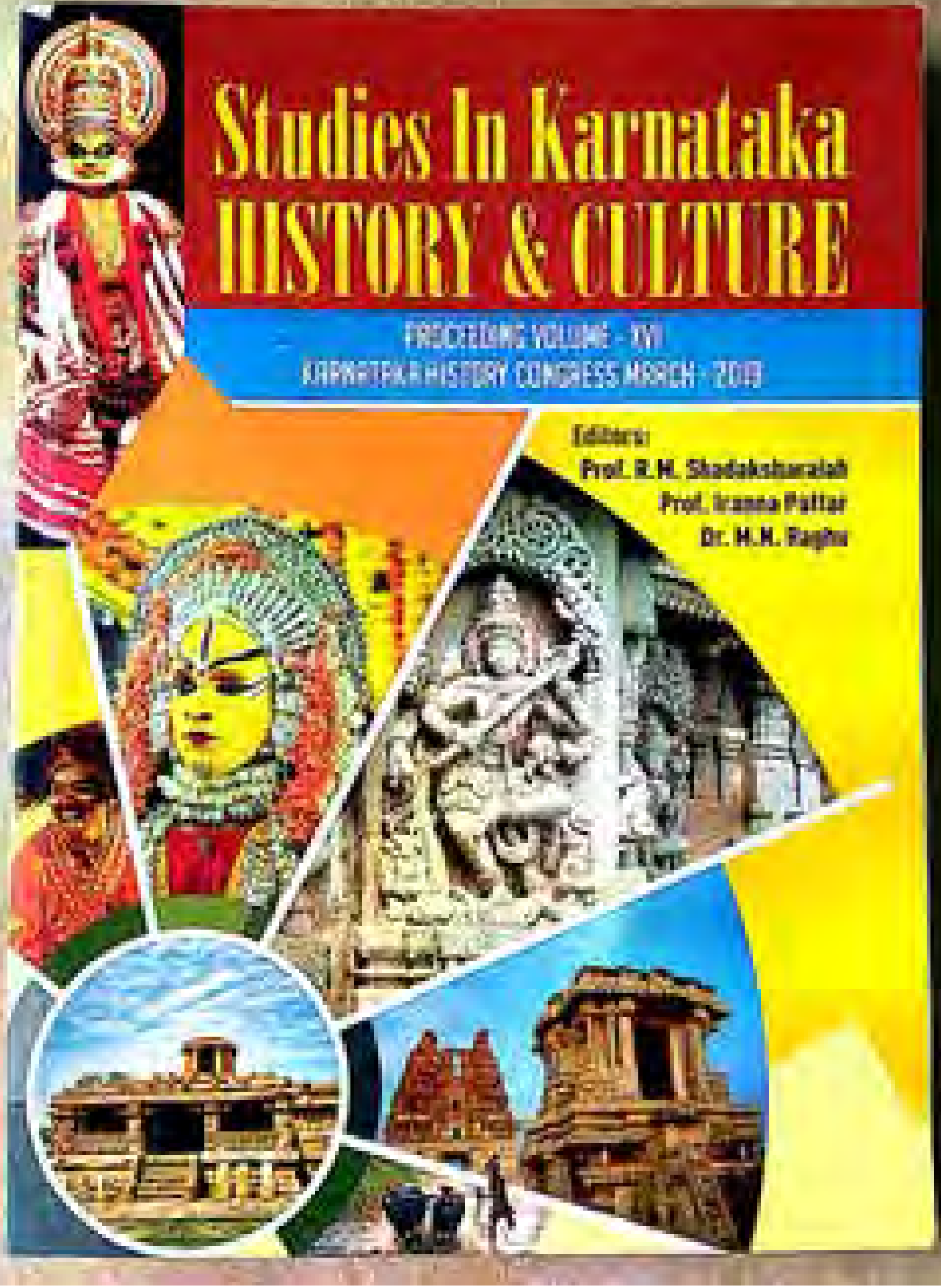
Srivastava, A. (n.d.). Master Plan for Hampi Local Planning Area Hampi village – Virupakshapura, *2021*.

Urban, M. (n.d.). Proposed Conservation Policies and Measures, 180–206.

Studies In Karnataka HISTORY & CULTURE

PROCEEDINGS VOLUME - XVII
KARNATAKA HISTORY CONGRESS MARCH - 2019

Editors:
Prof. R.M. Shadakshariah
Prof. Iranna Pattar
Dr. M.N. Raghu



STUDIES IN KARNATAKA HISTORY AND CULTURE

Editors
Prof. R.M. Shadaksharaiah
Prof. Iranna Pattar
Dr. M.N. Raghu

PROCEEDINGS VOLUME XVI
KARNATAKA HISTORY CONGRESS
MARCH 2019

STUDIES IN KARNATAKA HISTORY AND CULTURE

Editors
Prof. R.M. Shadakshariah
Prof. Iranna Pattar
Dr. M.N. Raghu

PROCEEDINGS VOLUME XVI
KARNATAKA HISTORY CONGRESS - MARCH-2019

STUDIES IN KARNATAKA HISTORY AND CULTURE : VOLUME-XVI
OF PROCEEDINGS OF KARNATAKA HISTORY CONGRESS
EDITED By : Dr. R.M. SHADAKSHARAIAH, Dr. IRANNA PATTAR
and Dr. M.N. RAGHU
PUBLISHED By : KARNATAKA HISTORY CONGRESS

YEAR OF PUBLICATION : 2019

PAGES : x + 330 + 248

© KARNATAKA HISTORY CONGRESS

PRICE : 400/-

PUBLISHED BY : Prof. M. MUNIRAJAPPA
GENERAL SECRETARY
KARNATAKA HISTORY CONGRESS
DEPARTMENT OF STUDIES IN HISTORY
BANGALORE UNIVERSITY
BANGALORE-560056

ISBN : 978-81-930681-6-4

Printed at :
Sathyam Printers (P.) Ltd.,
Kamatchi Nagar, Nijam Road, Bangalore-560 000
Ph : 080 2971 1811 Mob : 9845064261

EXECUTIVE COMMITTEE

President	:	Prof. B. Rajanna (University of Mysore)
Vice Presidents	:	Prof. Iranna Pattar (Karnatak University) Prof. N. Shaik Mastan (Bangalore University)
General Secretary	:	Prof. M. Muniyappa (Bangalore University)
Joint Secretary	:	Prof. N.V. Aski (Gulbarga) Dr. A.C. Nagoli (Shivajinagar)
Treasurer	:	Prof. S. Nagarajaswamy (Bangalore University)
Members	:	Prof. Hanumanayaka (Mangalore University) Prof. Ameresh Yatagal (Karnatak University) Prof. S. T. Megali (Karnatak University) Prof. Vasudeva Bellagra (Karnatak University) Dr. B.C. Gasarkar (Bellakavagal) Dr. V. Anuradha (Bengaluru) Dr. Nagaraja (Shivamogga) Dr. Mustafa Khan (Channapatna) Dr. Venkatesha (K.G.F) Sri. Shafi Ahmed (Chikkaballapura) Dr. B.R. Gangathaiah (Gowribidanur) Dr. Gangadhara Dr. Manjunatha Ms. H. Soulasa Dr. M.N. Raghu (Chitradurga)

Divine modifications: Dynamics of visualization of deities. Case study: Mysore Princely State

Chandan Kathyat S.R.
[illegible]

Introduction:

[illegible]

1. Recognizing the trend historically:

[illegible]

In ancient society one may find a correlation among sculptors, goldsmiths, ivory carvers, carpenters and metal workers all of them had suspended in their respective "span of the arm". Painters too responded in a similar way, widely known Kodungarh portrait of Radha as "Basa Tara" is such an instance where one can see a bond between Rajasthani miniature painters and the poet Bihari Raja Sawarah Singh. Scholars (Roy) believe that Kodungarh portrayal of Radha was based on poetic descriptions of Radha's beauty by the poet Bihari who was allowed by the beauty of Vishnupriya [Vishnu's], who was his partner and maintainer/protector. He had supposedly based his description on her beauty as a model. Another such instance is of the 16th century Bengali poet Chandi Das. He was from a place called Nannur in Birbhum district. According to scholars (M.S. Randhawa) he loved Rami who was a washerwoman. His first experience was a feedback for him to describe Radha's persona and her beauty.

One can notice a paradigm shift in the representations of the images of god and goddess in miniature painting developed in Rajasthani and Pahadi areas as compared with earlier sculptural traditions. Scholars (Bhatnagar) opine that ancient Indian men and women were comfortable with a partial cover or even without covering upper portion of their body, as can be evident in the sculptural tradition with the examples ranging from Dhauli Yakshi, Parkam Yakshi to Ujjain Bronze sculptures of Devi and Harpala "Mathanikas" as ancient pieces. But the entrance of Islamic Sultans in India have shifted the concept of dress that is visible in Rajasthani and Pahadi miniature paintings. Again intervention of British had a profound impact on Indian evolving traditions.

2. At Mysore Princely State:

Mysore princely State was formed by British paramountcy after the death of Tipu Sultan with the aid of Deewan Poornayya. Even though Mysore was subjected to the tone of Colonial influence, since it was treated as a princely [illegible] from British East India Company as well as Madras and Mumbai Presidencies, it had a breathing space so that it can selectively absorb to some of Colonial influences. This fact is evidently seen in the continuation of its religious-cultural traditions with the selective absorption of Colonial cultural influences.

2.1. Divinity and costume:

Historically local legislatures of Mysore (Odeyar) heritage was [illegible] from Vijayanagar Empire since Mysore was a feudatory subjected. Mysore had claimed its political existence since the downfall of Vijayanagar Empire. But cultural legacy was inherited to Mysore including the religiousness of Mahanavami. According to recent research by Dr. Chanda "Chandrasa" [traditional painter] we will have inspired to [illegible] in Mysore and Tanjore. Several mural paintings across Karnataka show the gradual [illegible] of Vijayanagara traditional style of painting in Mysore additional style of

painting. Most of these paintings are mural (fresco), murals, and ornamental floor motifs (rangoli) and geometrical patterns. Even goddesses were portrayed with many different combinations and positions that marks the regional characteristics. One can witness these aspects more prominently in the murals of ancient Jain temples at Sravanabelagola, Moodabidre's Mahavira temple, Shravan Venkatesh temple at Mysore Ambavilas palace premises. Even women like Sri Tulsi Nidhi Sangraha are involved in a same way. Mural at Jinnanathapura and Chennigaraya temple at Chennigarayapatna depicts paintings of many but the sculptures inside the superstructure adheres to the age old convention of depicting goddesses with 4 symbols. Current historians point out that this convention of depictions is concerned with the concept of "mark" (symbols) painted in connection with the concept half reality and unrelated deities are seen.

Under Wodeyar rule in a later period Dyalakunteswara Welcome Mahe Sabhabhavan Swamy had accomplished his drawings for Premium Kempe Achanta for his English version of Mummers. Mahe Sabhabhavan Swamy had drawn them as per the complexities and modifications prevailed in Mummers. He had drawn goddess with 4 symbols and the same is also painted by him. But when he was commissioned by Jagadguruvaradeva academy for more than 60 nos (pieces) for public display at Amba Vilas Durbar hall he painted Goddess with 8 hands and many that showed the mutated values of these contemporary events like, but the symbolics were the strategy to depict Bharata texts. Even his sculptures for the temples of Mysore depict goddess wearing blouse and saree.

3.2. Objects and space constituting diversity:

Murals painted at Premium Krishnaswamy temple is a visual treasury for the immense permutations of Mysore traditional paintings by Krishnaraja Wodeyar III. These murals predominantly narrate Bhagavatapurana and display some iconographical and mythical symbols with decorative motifs. Some images show a significant cultural trend of the time, such is the representation of Lord Krishna learning to music (see fig. 1), and here future classes on performing music in front of Lord Krishna. It is clear that the trend in Karnataka classical music with the departure of Veena, Vedic and Mridangam classes are the full credit of Karnataka classical music. Vedic are newly absorbed by Karnataka classical music students from Western culture. Here with this one can easily connect the mythical religious theme with their contemporaneous life. Another such striking example is the composition that depicts "Yaavudhu Kaning Krishna" (see fig. 2), in the left are the composition shows mother Yashodha is feeding little Krishna, here the functional space and the objects are involved just common motifs that make the overall charm of the composition. At the background one can notice a coconut with Kannada flight, scholars like Prof. S.K. Ramachandra Rao considered this as a measure to the composition and meaningless in terms of diversity. But this research focuses on these aspects and tends to bring forth its significance.

As recent research (Kadlaya) proves not one but many devices like time-piece and clocks become very important in Indian life. At several cities of India huge clock were installed in public places. Mysore clock towers "Ghantagadiyara" and "Dodgadiyara" are the major testimony to the significance of clock in their life as a modernizing agency. There is a connection between the age old norms and their contemporaneous life.

Conclusions:

- Trajectory of depicting devices in reference to time tell the time of depictional contemporaneous tell the time of depicted material culture is undoubtedly a historical phenomena.
- Artist reference to contemporaneous material culture is not merely his dependence on the immediate life to visualize the utmost.
- Further, this historical trajectory is a linguistic strategem to reassure the people with their age old religious themes.
- The concept "Spirit of the age" is employed in the context of shared material culture and not to the spiritual sense with a linear flow in time and space as propounded by Hegel.
- Kaupeshakarana describes the features and attributes of gods and goddess like head gear, anything on their head, ornaments, ornaments, weapons' kinds, gestures of standing, sitting or sleeping. Even it may describe about the color of the deity or the vahana.
- Mamulakarana describes the particular mathematical measurements of the god or goddess in a specific proportion. This governs the structural proportions as well the proportional relationship with another deity.
- Near R.R. Circle, Shivaganga road, Mysore
- Near Gandhi square, Ashoka road, Mysore

Bibliography:

1. A.J. Narasimhan, Aadyakala, Bangalore, Sapna publications, 1995
2. B.V.K. Shastry, S.R. Rao and Traditional painters of Karnataka, Bangalore, Karnataka Chitrakala parishat, 1980.
3. Chaitanya, Krishna, A history of Indian painting: The modern period, New Delhi, Abhinav, 1994.
4. G.Gundanavaki, Sri Kaadasiddeshwara Jeevana Mattu Saadhane, Bangalore, Kannada Pustaka Pradhikara, 1997.
5. Kadlaya, Chandrashekar, The art movement of Mysore State (1799-1950) with special reference to Bangalore, Jain University, 2013.

6 M.S.Nandimath: Kannada paintings of the Jaina tradition, New Delhi: National museum, 1983.

7 N.Manjunatha Jain: Shilpa Saidhantikagranthagalu mattu Mysooru shilpa parishadina shilpagalu. Bangalore: Karnataka Sahitya Academy, 2004.

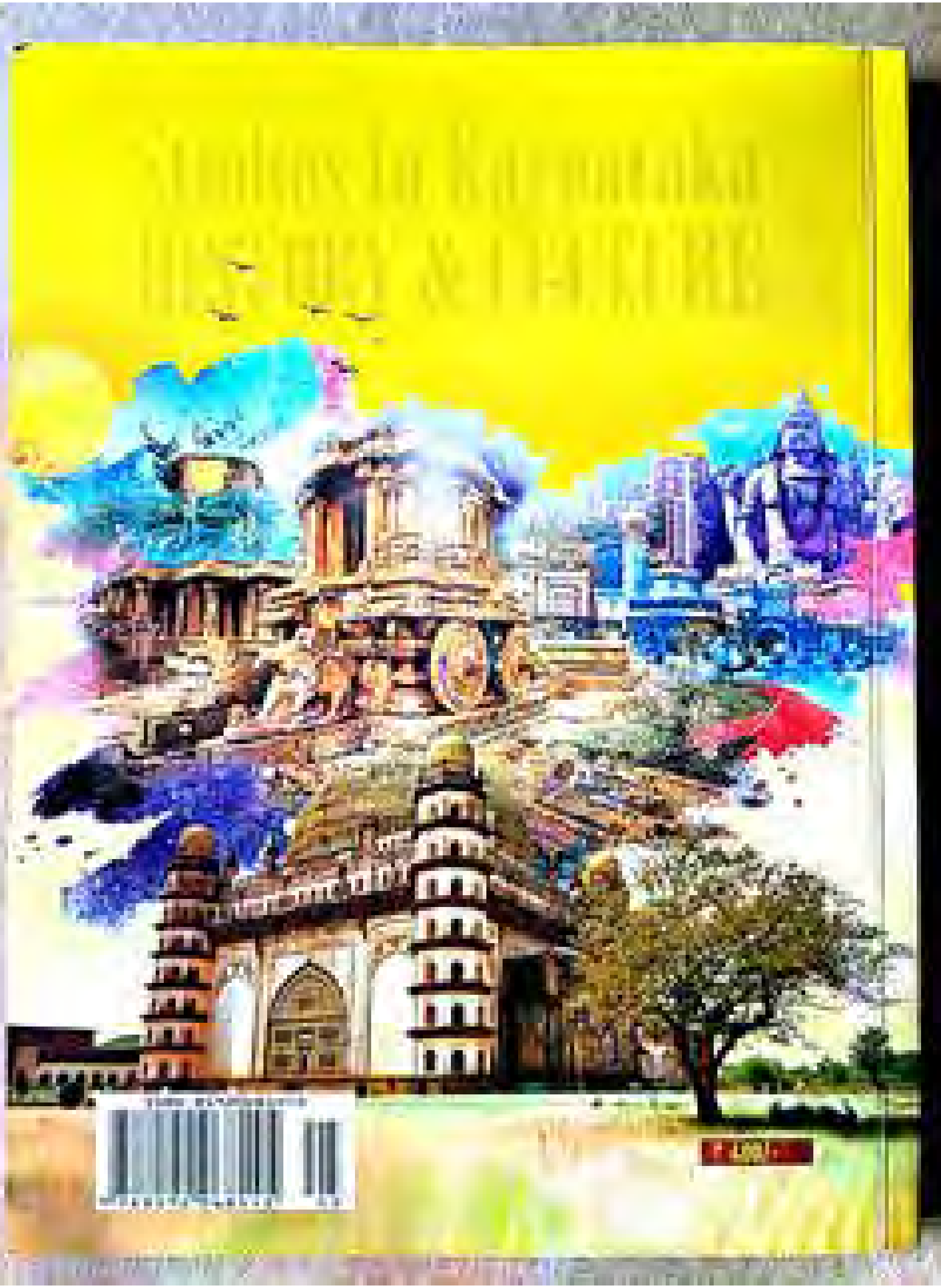
8 Narasimhaiah, A.L.: Karnataka Jaina charitre. Bangalore: Karnataka Sahitya academy, 1998.

9 Panda, Alka: Masterpieces of Indian art. New Delhi: Roli Books, 2007.

10 Preziosi, Donald: "Georg Wilhelm Friedrich Hegel, Philosophy of fine art." Preziosi, Donald: The art of art history: A critical anthology. New York: Oxford University Press, 2009. 80-88.

11 Rao, S.K. Ramachandra: Mysore Dasarinda traditional paintings. Bangalore: Kannada Pustaka Pradhikara, 2001.

■■



INTEGRATED MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM TO REALIZE SUSTAINABLE HABITATS

Ar. Bhagyalaxmi S Madapur [1] Ar. Shanu Raina [2]

Abstract

Unregulated urbanization and rapid population growth is overwhelming the capacity of the most of the municipal authorities which are struggling even to provide the most basic urban utility services. Solid waste which is a by-product of the swiftly changing consumption patterns and lifestyles of urban populace has huge negative output in the form of different forms of waste. The waste is being generated at distressing rate and has greater degradation impact not only on the immediate urban environment but beyond. Hence managing and handling the solid waste is of immediate concern to protect the urban environment from further degradation. Solid Waste Management (SWM) is invariably influenced by regional, social and environmental dimensions of the urban communities. Therefore strategies for SWM system should be environmentally operative, socially acceptable, technically feasible and most importantly economically viable. Against this backdrop, this paper attempts to analyse the prevailing critical conditions pertaining to Municipal Solid Waste Management (MSWM) considering Bangalore Metropolitan Area as a case study. Further, paper deliberates recommendations and strategies for promoting integrated municipal solid waste management system to become the fundamental tool in the planning of urban physical infrastructure to ensure advantageous atmosphere to realize sustainable habitats.

Key Words: Municipal Solid Waste Management, Urban communities, Utility services, Urban environment, Sustainable Habitats

1. Introduction

Swiftly changing consumption patterns and lifestyles of urban populace has huge negative output in the form of different types of wastes (in solid, liquid and gaseous forms) being generated at distressing rate which has greater degradation impact not only on the immediate urban environment but beyond. Solid waste which is a by-product of human activities literally can be referred as valueless or useless materials and hence disposal may be preferred rather than use. The lack of usefulness or value is majorly due to the mixed and often unknown composition of the waste. The recyclable value of the waste decreases as the unsegregated mix composition increases (Refer Fig. 1). Solid waste generally includes domestic waste, organic and inorganic waste, non-hazardous and hazardous waste from different sources (institutions, commercial organizations, construction sites, factories, industries, etc.), sewage sludge, etc. requiring specific methods of collection, segregation, re-cycling, disposal and management.

Fig. 1 Relationship between waste and value
Source: Authors

Across the globe, 1.3 billion tonnes of municipal solid waste (MSW) is generated each year and more than 70% of this waste is either unscientifically landfilled or incinerated. The composition of solid waste varies seasonally and geographically from place to place. Domestic solid waste is more heterogeneous in comparison with the more homogeneous accumulation of solid waste from other sources.

1.1 Solid Waste Management (SWM) System

SWM is invariably influenced by regional, social and environmental dimensions of the urban communities. Hence, strategies for SWM system should be environmentally operative, socially acceptable, technically feasible and most importantly economically viable. Thus SWM system is interconnected with the waste generation control,

collection, storage, segregation, processing, transporting, recycling and disposing with due considerations for societal attitude, public health, economy and environmental conservation. Structuring and operating the different functional elements of efficient SWM system is majorly impacted from the informed knowledge of the sources, types and composition along with the rate at which solid waste is generated and disposed is highly indispensable and vital(Refer Fig. 2).

Fig. 2 Relationship between waste and value
Source: Authors

2. Current status of Solid Waste Management (SWM) in India

India, as one of the fastest growing economies in the world generates close to 65 million tonnes of solid waste on daily basis of which 75% remains untreated and it has infamously acquired the place among the top ten countries generating highest amount of Municipal Solid Waste (MSW).

2.1. Municipal Solid Waste Management (MSWM) - An Urban Challenge

Unregulated urbanization and rapid population growth is overwhelming the capacity of the most of the municipal authorities which are struggling even to provide the most basic urban utility services. At present the SWM is exclusively a service provided by the Urban Local Body (ULB) under its Health Department. But certain ULBs of greater metropolitan areas have established SWM departments to carry out SWM under the guidelines of Solid Waste (Management & Handling) Regulations, 2000. ULBs of the most cities are inadequately equipped to handle the most crucial issue of MSWM owing to inefficient implementation, operational and monitoring mechanisms at key areas (Refer Table 1).

Sl. No.	Key Area	Issues
1	Policy and statutory norms	Absence of guiding framework and regulations for effective enforcement and monitoring
2	Institutional organization	Non-existence of clearly defined roles and responsibilities of MSWM personnel and staff coupled with insufficient economic instruments. Absence of framework for capacity building and skill enhancement training. Unavailability of standards to assess quality of services and accountability. Non-favourable conditions for the private player in MSWM system.
3	Financial	Insufficient funds for developing MSWM infrastructure and absence of incentives for market development.
4	Different stakeholders	Inefficient means of communication to bring awareness among different stakeholders across all the levels.
5	Operational mechanism and Technical upgradation	Inappropriate standards and methods of MSWM and lack of facilities for treatment and resource recovery / recycling.

Table 1: Crucial issues pertaining to MSWM System in ULBs
Source: Authors

3. MSWM – A Case of Bangalore Metropolitan City, India

Over the past seventy years, Bangalore, the capital city famously referred as Silicon Valley of India has transformed from being a non-descript small town into metropolis. Bangalore, ranked as the most dynamic city in the world adds about 500 families and 80,000SqM of built up area per day owing to the economic reforms that are accelerating the pace of urbanisation. The transformation of the city has been exceptionally marked by several phases of investments/developments in various socio-economic sectors (public and private), remarkable demographic growth as well as flourishing informal economy. This rapid and dynamic urban growth is leading to high waste generation per capita and also increasing the unsegregated MSW from 650 Tonnes

per Day (TPD) in 1990s to 5200 TPD in 2017 from various sources (Refer Table 2).

Sl. No.	Source	Percentage of waste generated	Type of waste generated
1	Domestic	54%	Organic, inorganic (recyclable) and non-recyclable inorganic including debris, inert, bio-medical and hazardous waste
2	Educational & medical Institutions, Commercial Establishments	17%	
3	Market areas	20%	
4	Others	9%	

Table 2: Percentage of waste generated from various categories
Source: BBMP, Bangalore

The issue of unscientific solid waste disposal in landfills intensified in the year 2012 following the agitations that resulted in the closure order of Mavallipura landfill site from the Karnataka State Pollution Control Board (KSPCB) citing increasing hazardous conditions in and around Mavallipura rural area.

Cumulative effects of increasing demographic profile and consumerism pattern of Bangalore city is going to increase multi fold in the average MSW generated on daily base. In this situation, it is of utmost importance to understand and analyse the shortcomings of the current mechanism of MSWM system to develop integrated system to structure better MSW management in order to reduce the amount of waste disposed in landfills.

3.1 Current Practices

At present Bruhat Bangalore Mahanagara Palike (BBMP) manages 70% and the remaining 30% of MSW is outsourced to private contractors on contract base via primary and secondary collection and disposal (Refer Table 2 & 3). However, collection of MSW from bulk generators (such as apartment complexes, institutional and office campuses, etc.) is not part of the service contract. The outsourced service contract also outlines scope of work with respect to the importance of waste segregation both at the primary and secondary sources of collection.

Sl. No.	Primary Collection	Secondary Collection
1	Pushcarts and auto tippers are used for door-to-door collection	MSW from primary collection is brought to several identified secondary collection sites in each BBMP wards and is shifted to the transportation vehicles to transfer it to either treatment plant or disposal areas.
2	Sweepers appointed by BBMP (around 4500) and private contractors (around 13000) carry out primary collection.	BBMP and private contractors use MSW transportation vehicles such as tipper lorries, mechanical sweepers, dumper placers and compactors for secondary collection.

Table 3: MSW collection and disposal
Source: BBMP, Bangalore

BBMP has also attempted several SWM initiatives such as at source segregation at ward and city levels, dry waste collection centres, compost Development Corporation, etc. to facilitate destination bound processing of SWM. But these initiatives are neither correlated nor integrated into the entire MSWM system resulting in major inadequacies across different domains (Refer Table 4).

Sl. No.	General	Domestic	Other SWM sources	Administrative structure	Contract agreement	Process & monitoring systems	Policy initiative
1	Waste segregation is not enforced in an organised manner.	Considerable lack of awareness on the methods of waste segregation.	Restricted operation timings of collection and transfer of MSW generated results in decay of the wet waste as well as accumulation of added MSW till it is collected the next shift.	Absence of crucial and effective monitoring mechanism.	Lack of accountability and better monitoring systems to achieve desired results.	Lack of authentic data to measure the performance of the service provider.	Normative standards in policies continue to direct the performance of MSWM system.
2	No formal system to collect systematically segregated waste from the sources	In cases if the community is aware of the importance of segregation at source, the implementation of the same is not followed stringently.	Lack of system to address the problems of littering and the defaulters.	Organizational structure is not decentralised.	Current system of contracts restricts the effective role of non-government organisations, self-help groups, resident welfare associations, etc.	Efficient monitoring systems for regularity and penalty system for defaulters are not in place leading to under performance of both BBMP and contract workers.	Policy of Integrated Solid waste Management, 2012 lacks the ways of both incentivizing or dis-incentivizing different stakeholders and inhabitants for carrying out the process of scientific ay of MSWM.
3	MSW is transferred manually and the lack of complete door-to-door collection the segregated dry waste does not reach dry waste collection centres.	Aspects such as level of segregation at source, primary & secondary collection, etc. are not standardised across the jurisdictions.	Segregated waste is mixed during the process of collection and transfer.	Need to develop adequate training methods for capacity building.	Collection of segregated waste is non-incentive for the contractors as the payment is by weight of the MSW collected.	Absence of standards for collection, segregation, storage, recycling and disposal.	Policy lacks effective implementing mechanisms and the citizen participation in service delivery.
4	Restricted operation timings of secondary collection sites resulting in non-cleared MSW for the day.	Only 40% of the households segregate waste. However, this gets mixed during the process of collection owing to the fact of unscientific and inefficient	Non-participation and lack of awareness regarding MSW management initiatives.	Lack of role clarity and in house limited resources leading to inefficient performance of ULBs.	Technological interface is not being adopted adequately for monitoring on-ground performances.	Lack of training for the on ground workers and are not adequately equipped with safety gear to carry out the assigned tasks resulting in health	The policy does not include the standards to be followed for assessment and monitoring the service provider's performance.

		methods of collection.				hazard and decreased performance.	

Table 4: Major inadequacies of the current MSWM system practiced by BBMP across different domains
Source: Authors

Different inadequacies mentioned in the Table 3 indicate that the current MSWM system is inefficient and under staffed dysfunctional system owing to the organizational and technical issues. Absence of operating as well as implementing/monitoring mechanisms incorporating the effective use of progressive technology coupled with under trained personnel is adding to the already disadvantaged of MSWM system.

Relatively, most of the metropolitan cities and urban areas in India are facing similar types of issues pertaining to MSWM. Hence developing the infrastructure for efficient and effective MSWM plays a key role in protecting the urban environments and it is fundamental to achieving sustained economic growth and sustainable development in the holistic sense.

4. Integrated Municipal Solid Waste Management System (IMSWM systems) – Recommendations

Urban communities need to divert much of the MSW from landfills and incinerators through integrated, innovative and workable methods. Following are the recommendations with regard to the formulation, implementation and operational mechanisms for IMSWM system under different domains (Refer Table. 5).

Sl. No.	Domain	Recommendations
1	Key policy reforms	<u>Extended Producers Responsibility (EPR)</u> Regulations need to framed and implemented to enforce EPR so as to make the producers responsible for the waste generated from product packaging. <u>Institutional organisation reform</u> MSWM system should be re-structured to have trained professionals and staff performing clearly defined duties. These personnel should have incentives offered in the form of performance based career promotion options and professional skill upgradation programs at subsidized rates.
2	Financial Instruments	Adequate financial instruments are required for the efficient performance of MSWM system. The costs of operation and management can be met through the implementation of innovative means / sources of revenue. Revenue can be generated from sanitation services imposed on commercial establishments, various periodically held community activities, fines imposed on various violations, selling the recovered resources from MSW, compost generated from collected wet waste, etc. The foremost mode of cost recovery is through the generation of wealth from the waste. Capitalising on the methane generated from the dumpsites, a large number of landfill gas capture projects should be initiated. This can be monetized in the form of certified emission reductions or carbon credits. Besides the traditional sources of revenue (property tax, grants, user fee, etc.) new income sources are needed. Innovative sources of revenue such as the levy of MSWM

		tax along with property taxes, separate solid waste user fee and charges linked to utility facilities (water & electricity) must be considered by ULBs. **Biofuels and renewable chemicals from MSW:** MSW can be used as a feedstock to produce biofuels and renewable chemicals. This particular method provides a sustainable alternative to the challenges associated with the disposal of non-recyclable as well as non-compostable waste and crafts value added products.
3	MSWM System	Upgrading Dry Waste Collection Centres (DWCC) to MSWM Centres These existing DWCC should be upgraded to MSWM Centres operating at ward levels in collaboration with municipal authority. These centres should have facilities for collecting scientifically collected and segregated waste for further sorting as recyclables and for final disposal of the waste which is beyond any sort of recycling. MSWM Centres should extend support to the urban community at various levels for handling MSW in the form of ready reference guidelines on MSW segregation, usage demonstration and sale of standardised materials/tools related to SWM, etc. **Adequate Staffing and periodic training:** MSWM system is highly labour intensive service and hence not only adequate staffing is essential but investment in periodic training is equally essential for both supervisory staff and field staff.
4	Employment	Wastes are potential resources and extraction of the resources till the final stage is the key aspect for effective MSWM. This aspect supports many avenues of employment for skilled and unskilled labour at various scales. The professional experience of informal waste pickers could be capitalised on by organising and formalising them under certain associations. Once formally recognised, they can be provided with social security and health care facility not only improving their livelihoods but providing them with dignity of recognition.
5	Public-Private-Partnerships (PPP)	PPP based on well framed contract and action plans should be encouraged at all the stages of MSWM system. Contracting models should preferably performance based and payment to the private player should be measured using quality of service as the benchmark. The contract should clearly outline the accountability of the private player for the efficiency and effectiveness of the service.
6	Involving different stake holders for better monitoring and accountability	Citizens / Social Volunteers / NGOs / SHGs / RWAs / Associations / Schools & Colleges, etc. should be involved in consultation, planning and decision making processes

		through diverse modes such as periodic performance reports, digital mediums (social networking sites, mobile phone applications, etc.) to improve the MSWM system. Various innovative incentive schemes (such as free collection of MSW for a specific time period, redeemable coupons, recognition and rewards, etc.) can be provided as a token of motivation and encouragement to best performing individuals and communities in the management of MSW. **Monitoring and tackling defaulters:** Various modes such as awareness campaigns, personal and mass media should be used to generate accountability for citizens. Monitoring Information System needs to be developed at ward levels and should include schedule of MSW services, interactive maps, etc. to streamline the MSWM system while facilitating a better system to tackle the defaulters.
7	Segregation is the key	High positive impact of social value of segregation is inevitably linked to the greater extent of segregation. Segregation at source would help in resource recovery at the least possible cost. The quantity and composition of MSW generated determines the appropriate means of collection, segregation, processing, recovery and the final disposal options. Segregation at the source (domestic, commercial establishments, institutions, campuses, etc.) is vital as the segregation post the collection stage is highly labour intensive, difficult task and costly affair. Segregation can be made an easy process by standardising the collection bins and related signage. MSWM staff and private players should be allowed to take a share of returns from the recovery of recyclable waste.
8	Promoting zero waste campuses and organizations	There are no current industry standards for the term 'Zero waste'. But communities, commerce and industries that achieve more than 90% diversion of waste from landfills and incinerators are considered acceptable in achieving zero waste.
9	Environmental Impact Assessment (EIA) of MSWM system	Periodic EIA to develop long term strategy should be made mandatory for MSWM system to facilitate not only the analysis of service gaps but to mitigate the environmental consequences of inadequate functioning. ULBs must ensure to address the concerns and implement the recommendations the governing authority.

Table 5: Recommendations for IMSWM System under different domains
Source: Authors

5. Way forward

Various significant challenges must be prioritized with short term and long term strategies. Scientific implementation of the recommendations under IMSWM could lead to the transformation of MSWM from being focussed on delivery of service to managing resources for the future. Three governance aspects namely Proactive policies along with structured institutions, inclusivity (both users and

service providers) and economic sustainability are critical for sustainable MSWM system. Further, waste should be considered as a largely untapped opportunity to recover resources, realize environmental-social-economic benefits. Reorganising MSWM on a life-cycle basis could lead to green economy. An IMSWM system if incorporated in MSWM will contribute in developing sustainable habitats by:

- Improving economic efficiency through resource extraction and use in turn reducing the budgetary requirements for MSWM system.
- Reducing adverse impact on public health and the local urban environment
- creating sources of employment
- Spatially and socially accessible urban environment.

IMSWM has to become the integral part of the urban environment and planning of the modern infrastructure to ensure a conducive atmosphere while promoting sustainable habitats.

6. About the authors

Ar. Bhagyalaxmi S Madapur

Associate Professor
B M S College of Architecture,
Bull Temple Road, Basavanagudi, Bangalore, Karnataka, India

E-mail:
bhagya.chandgude@gmail.com
bhagyalaxmi.m@bmsca.org
bhagyalaxmi.arch@bmsce.ac.in
Contact no: +91 99865 36685

Ar. Bhagyalaxmi S Madapur, currently employed as an Associate Professor, in BMS College of Architecture, Bangalore is an Architect and Habitat Designer with over sixteen years of professional experience in the planning and design of varied architectural and urban design projects of diverse nature and scale while being in different contexts. Prior to joining academics, she has worked with various architectural firms handling different responsibilities ranging from conceptualization, master plans, design development, architectural details to completion while effectively managing all resources.

Bhagyalaxmi's professional as well as academic experiences prompted her to author and present papers (national & international) that deliberate on the crucial components and the strong relation among architectural education-research-practice. Workshops, competitions, research programs, discussions, conferences and professional training courses that feature architectural practice, urban, human habitat, ecological development and pedagogical issues interest her and hence she continues to participate in such undertakings.

Ar. Shanu Raina

Assistant Professor
B M S College of Architecture
Bull Temple Road, Basavanagudi, Bangalore, Karnataka, India

Ar. Shanu Raina is an Architect and Urban Planner. Currently teaching in BMS college of Architecture, Bangalore in capacity of Assistant Professor. She completed her Masters in Urban Planning from School of Planning and Architecture, New Delhi. She has been part of several urban design and urban planning projects at city level such as streetscaping for Common Wealth Games, Model Building Bye Laws of Delhi, Local Area Plans, CIDCO Smart City etc. Alongside, she has also been part of

planning studios at School of Planning and Architecture, New Delhi and Department of Architecture, DCRUST, Murthal as visiting faculty. Her Interest broadly lies in architectural research, history of architecture, urban design and urban planning.

7. References

- Asnani, P. U., 2006. Solid Waste Management. Chapter 8 in India Infrastructure Report. Oxford University Press, New Delhi
- Balakrishna, P. &. H., 2014. Munciplan Solid Waste Collection and Disposal in Bengaluru City - A Review. International Journal of Engineering Research & Technology, 3(7), pp. 137-141.
- Central Public Health and Environmental Engineering Organisation (2014), Draft Municipal Solid Waste anagement Manual, Ministry of Urban Development, Government of India, New Delhi.
- Department of Environment Cell, 2012, Policy on Integrated Solid Waste Management, BBMP
- Gupta, N. G. &. R., 2015. Solid Waste Management and sustainable cities in India: the case of Chandigarh. Environment & Urbanisation, Volume 27(2), pp. 573-588.
- Kaushal RK, Varghese GK, Chabukdhara M. 2012 Municipal solid waste management in India—current state and future challenges: a review. Int. J. Eng. Sci. Technol. 4, 1473–1489.
- Pandit, V. K. &. R., 2013. Problems of Solid Waste Management in Indian Cities. International Journal of Scientific and Research Publication, 3(3), pp. 1-9.
- Parvathamma, G., 2014. An Analytical Study on Problems and Policies of Solid Waste Management in India - Special Reference to Bangalore City. Journal of Environmental Science, Toxicology and Food Technology, 8(10), pp. 06-15.
- PV, N. B. a. S., 2016. Solid Waste Management in Bengaluru - Current Scenario and Future Challanges. Innovative Energy & Research, 5(2), pp. 1-3.
- Ramachandra, T., 2006. Management of Muncipal Solid Waste. New Delhi: TERI Press.
- Srinivasarao, A. P. &. M., 2014. Muncipal Solid Waste Management in India: A Review and some New Results. Intwrnational Journal of Civil Engineering and Technology, 5(2), pp. 1-8.

iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: V Month of publication: May 2019

DOI: https://doi.org/10.22214/ijraset.2019.5393

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue V, May 2019- Available at www.ijraset.com

Architectural Education in India: Focusing on Technology Integrated Education

Nandini J
PES University

Abstract: ***This paper provides an overview of the fundamental issues regarding the adoption and integration of Computational thinking in Design process along with BIM in Architectural Education. This paper recognizes the core elements that can be addressed during the integration into the five-year under-graduate program- B.Arch. The paper also attempts at looking into computational design thinking as one of the options towards integrating technology in Architectural Education.***

Keywords: Use of technology in architectural education, BIM

I. INTRODUCTION

Technological engagement across all sectors of diverse professions in an innovative way has now made working more efficient, effective and "smart". It has brought about a huge positive transformation in the working methodology and output driven approach including education system. This transformation clearly indicates that, the adoption and up- gradation to newer technical advancements both in practice and academics, has been assisting in gaining a better working edge, both as a process and a technique or combination of both. Educational Institutions are the root for any change that can be brought about in any industry. It is here that young minds are nurtured and new ideas developed. Every academic discipline has a set of epistemologies with its own established knowledge, typical learning and working methodologies as well as desired professional and social output from the graduating students who are ultimately referred as professionals belonging to different fields. For this matter, even Architectural Education is not an exception.

II. ARCHITECURAL EDUCATION AND ARCHITECTURAL PRACTICE

Architecture, as a building science has experienced unremitting change owing to diverse contextual, climatic and cultural factors. The influence of this change is seen in Architectural education and practice. Therefore, Architectural education and practice both need to be mutually complementing that supports in the adoption of advancements in the related interdisciplinary fields.

Architectural Education and practice place distinctive emphasis on the design process that integrates "Concept, Form and Function" in the design of built-envelope which is specifically referred as Architectural Design. This design process has been comprehended into reality through various set of drawings both in two and three dimensional formats generated manually as well as with the aid of computational techniques. However, market driven forces, global collaboration and integrated- interdisciplinary- collaborative approach have become decisive factors for the Architects to adopt advancements in computational technologies, not just as software but as an approach and methodology into professional practice. These swift technical advancements have influenced thinking process, efficiency in design, and quality in building construction that affects building life cycle to a large extent. This particular aspect requires Architects, both practicing and in academics to be abreast with these computational technical advancements that emphasize in better understanding of the building design process that leads the way in defining newer set of design ideologies eventually resulting in upgraded Architectural pedagogy.

Thus, computational technologies have become necessary and integral part of the architectural design process both in education and practice. This particular aspect emphasizes the fact that the architectural education curriculum must reflect the integration of architectural design and computational technologies across all semesters so that the graduating students are better equipped and competent enough to face the multifaceted challenges of architectural practice.

III. PRESENT SCENARIO

Architectural practice has been swiftly adopting the advancements in computational technologies and new methodologies of "Integrated Systems" as compared against to the Architectural education. This is leading to a widening gap between academics and practice. It is inspiring to know that certain Architectural schools have tried to fill in this gap through changing and upgrading their curriculum. Unfortunately, the number of such schools is very limited on a global scale. Majority of architectural schools are still following the traditional architectural curriculum which has less engagement with computational technologies.

Major reasons that are posing obstruction in the integration of computational technologies in architectural curriculum are:

A. Architectural design process is a creative exploration of different spaces. So, computational technologies might not support this exploration.
B. Architectural curriculum is already encumbered and there might not be any scope for inclusion of computational technologies.
C. Academicians and practitioners might feel the incompetency to get acquainted with ever upgrading computational technologies there by affecting the key role played by an architect in the building induatry.

However, it is a relieving sense to know that these above- mentioned reasons are more skeptical than reality. This means, there exists a tremendous scope for Integration of computational technologies into architectural pedagogy.

IV. SCOPE FOR INTEGRATION OF COMPUTATIONAL TECHNOLOGIES:

Integration of computational technologies in education is not just mere usage of new software. Similar to any other proposition, computational technology too comes with its own methodologies which need to be adopted. This will have a huge impact on the curriculum in two main areas:

A. Implicit proposition so as to how design and project partners should collaborate.
B. The way information (geometric and non-geometric) can be modelled, embedded and shared during active building life cycle.

Computational technology should be able to compliment the holistic growth of students and not be treated as a separate segment. Indian architectural education focuses on various aspects of development at different years throughout the five years of an Under Graduate program. During these five years of Architectural education, a student is made to focus on new techniques and requirements which aid better design thinking process. They are also to take forward with them the learnt aspects in future projects. This is where we can imbibe in students a new way of thinking and working with conditions. Technologies like BIM- Building Information Modelling and Computational design using BIM help students integrate their knowledge of each aspect of design better. This is the true essence of Integrated Systems. This is where every requirement, existing conditions, techniques and ideas come together at once, thus being able to eliminate conflicts and addresses issues in a holistic manner. However, using these tools doesn't automatically ensure a superior level of collaboration and design unless conditions for a successful collaboration are met which are not only through software. Similarly, the ability to virtually build a model with geometric and non-geometric project information doesn't immediately bring maximum efficiency unless the representations are modeled and shared properly, the information needs in the process are understood correctly and a robust technical infrastructure and a proper system for project progress are present.

Table-1: Architectural Design objectives for Under Graduate program (B. Arch)

Year	Architectural Design Objectives	Methodology / Procedure followed	Example for Software
I	Spatial Elements, Colors, Textures, etc.	Visualisation	Sketchup
II	Circulation, Integration of form and function, multifunctional spaces with volumetric analysis, etc.	3D rationale and connecting elements	Revit Architecture
III	Services, Climatic Responsive architecture, etc.	Multi-disciplinary focus, Computational	Revit MEP & Structure, Dynamo

		Design	
V	Campus design, large	Analysis tools	Ecotect,
V	Professional practice	Project	Primavera

Therefore, technology as only software is unsustainable and superficial. Integrating computational technology in architectural education poses fundamental changes like handling and creating information rich models, new ways of working with other disciplines, realigning disciplinary roles and responsibility, opportunities for new additional roles for architects. Universities must also encourage the use of computational technology for collaborative working practices and are currently not meeting the needs of the industry.

A cursory glance at the under-graduate level, there are few Architectural schools who have courageously tried to integrate computational technology in their curriculum. Nevertheless, most of these attempts have stopped looking at technology as a separate, independent course which is neither integrated nor complimenting to other core subjects.

Computational design thinking is not restricted to usage of single software alone. This approach is not sustainable and not effective. Software undergoes many revisions and adapting to software will not help us win any situation. It is required to understand the concept and adopt the methodology required for this concept. This understanding along with technical aids and tools will help in better, more comprehensive design thinking approach. This integration will help in achieving an integrated, information-rich model which will help better performance of this building lifecycle.

A mile stone in Architectural Segment is the advancements in computational design. A few tools like dynamo now question the "form-only" idea.

Computational design aims at being able to have a meaning, a purpose to every edge, every line, every corner and every opening in a designed space. Meaning to say, that form is an outcome of / a mix of all the necessary functions, services. In Computational Design, form follows function and is only a bi-product that we automatically get by adhering to all the necessary functions, the climatic responsive needs and services.

Computational Technologies can also draw several parallel avenues of specialization to architects. It could be in various areas like animation, eco-spatial geographical interfacing related, digital media, etc.

There are many facets that technology now is present in and contributes in its own little way to change the way things would otherwise perform. Many new methodologies are bringing to forte the "integrated systems" concept. Amongst them in Architecture is BIM- Building Information Technology. All along, when a designer had to present his/her ideas, it always was to be converted from a 3D space to a 2D format, which was more commonly used and then drawn.

During this transformation, there was always a chance of an idea not being translated completely or an idea not even grown to its fullest because of its lacking in expression. This can very easily be won over with BIM.

In BIM, a designer is to only design and build his design in a 3d manner. Translation is to be done by technology. This enables a fluid approach to thinking and looking at designing as well. This also eliminates the need for a designer to also be able to convert his idea in his mind and only then communicate; lacking which a possibly brilliant idea would never be expressed.

V. BIM- BUILDING INFORMATION MODELLING & INTEGRATED SYSTEMS: A REVOLUTIONARY TECHNOLOGY CONCEPT.

Computational Technologies like BIM- Building Information Modelling and Computational design using BIM help students integrate their knowledge of each aspect of design better. This is the true essence of Integrated Systems. This is where every requirement, existing conditions, techniques and ideas come together at once, thus being able to eliminate conflicts and address issues in an all-inclusive manner.

BIM is an intelligent, information rich model based process that provides insight to help us plan, design, construct and manage buildings. It simply is the means by which everyone can understand a building through the use of a digital model. Modelling a building in digital form enables those who interact with it to optimize their actions, resulting in a greater life value of the building. Use of BIM goes beyond the planning and design phase of the project, extending throughout the building lifecycle. BIM is a process of working. A few of the advantages using BIM will be:

A. Improved visualization capabilities
B. Improved productivity due to easy retrieval of information
C. Increased coordination of construction documents
D. Embedding and linking of vital information. E. Increased speed of delivery
E. Reduced costs

A BIM model will also have most of the data required for building energy performance analysis. The building properties in BIM can be used to automatically create the input file for building energy simulation and save a significant amount of time and effort. Also, automation of this process reduces errors and mismatches in the building energy simulation process.
BIM Models and manages not just graphics, but also information- information that allows the automatic generation of drawings and reports, design analysis, schedule simulation, facilities management and more-ultimately enabling the building team to make better-informed decisions. BIM supports a distributed team so that people, tools, and tasks can effective building lifecycle, thus effectively share this information throughout the building lifecycle, thus eliminating data redundancy, data re-entry, data loss, miscommunication and translation errors.
Adapting to BIM will help students gain a better advantage.

1) Helps visualize ideas better. Enhances Visualization skills thus enabling better design thinking ability.
2) The need to think and build virtually allows for students to tackle design requirements holistically, considering the building as a whole unit and not as individual views alone.
3) Errors during the conversion of an idea into 2D views are also overcome by using BIM as there is no need for a student to convert before they build their model
4) Better understanding of inter-disciplinary combination
5) Assimilation of analysis information
6) Integration of existing site features
7) Understanding larger impact of a project on its surroundings.

VI. COMPUTATIONAL DESIGN

Computational Design is an intelligent model-process that provides a framework for negotiating and influencing the interrelation of internal and external building parameters. In relation to design, computation involves the processing of information and interactions between elements which constitute an environment. Computational Design with BIM provides a framework for negotiating and influencing the interrelation of both internal and external properties, with the capacity to generate complex order, form and structure. By combining the principles of computational design, a fundamentally new method of building design is made possible.

VII. ADVANTAGES OF COMPUTATIONAL TECHNOLOGY

A. Integration With Architectural Education

There are many advantages of including computational technology in architectural education. To list them would be:

1) *Design*- Digital Technology allows complex calculation, a variety of complex forms to be created with great ease using algorithms and increasing the possibilities in architecture design, rather than simply production. Digital Technologies are enabling a direct relation between what can be designed and what can be built, also they enable a real image for the building before it is actually built and we can see is it looks nice or ugly.
2) *Cost*- Computational Technology has a direct impact on cost. Enabling more accurate drawings and data, helps in increasing productivity. To be able identify and fix several error and interferences helps in reducing re-work and maximizes the quality of construction. To be able to see the model and generate information like the amount of materials and man power required helps in effective planning, thus avoiding snags in construction.
3) *Management*- Maintenance and building management are hugely benefitted by use of computational technology. This helps in correct identification of any problem, its location and severity. This level of diagnosis helps in providing a quick and the right solution for any situation. Identifying these problems not only helps in efficient management of buildings but also helps in saving material, resources, energy and time.
4) *Time*- Computational Technology enables drawings and data to reach its destination on time. This helps in timely completion of assignments and projects according to schedules.

VIII. CONCLUSION

The paper has attempted to give an insight into the latest technologies in Architectural education as well as practice and the need to adapt to its fast-changing methodologies and processes. It is required for the Architectural Education and practice to work together closely to be benefitted out of this change. This will assist remarkably in the elimination of errors while integration amidst multidisciplinary solutions. Use of Computational Design thinking process along with BIM is one of the significant ways towards integrating latest computational technology into Architectural Education. Across the five years of Architectural education, the paper has analyzed the ways of integrating computational technology into the existing system, thus making the implementation easier. Re-alignment in methodologies is also simple and the design thinking process will make way for better, holistic computational design thinking. Architectural Educational Institutions must be able to inculcate into every student the strengths of use of computational technology. This will not only help a student get a better edge in the industry but also allow them to express their ideas in a more practical manner addressing the contextual challenges.

REFERENCES

[1] Achim Menges, Sean Ahlquist, "Computational Design Thinking,".
[2] Asterios Agkathidis , Computational Architecture: "digital designing tools and manufacturing techniques" Aug 2011.
[3] Terri Peters and Brady Peters, "Inside Smartgeometry: Expanding the Architectural Possibilities of Computational Design," 1st Edition.
[4] Isabel Neves, Joao Rocha, Jose Duarte, "Computational Design Research in Architecture," published online April 22, 2014.

crossref

10.22214/IJRASET

INDEX COPERNICUS

45.98

SJIF

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

IGBC Green Campus Rating System: An Initiative to Sustainable Campuses in India

Nikhat Parvez[1] and Avlokita Agrawal[2]
[1, 2] *Indian Institute of Technology Roorkee, Roorkee, India*
nparvez@ar.iitr.ac.in, avliafap@iitr.ac.in

Abstract: This paper reviews the IGBC Green Campus rating system and outlines the essential elements for understanding the various dimensions of this rating system. This rating system is compared with some existing international campus rating frameworks (STARS and CSAF), and an attempt has been made to identify its merits and lacunae to determine the scope for future development. Sustainability is a high level, complex, and multidimensional concept, especially for higher educational institutions. The concepts of sustainable development (SD) and practices in campuses help in addressing the issues of natural resource conservation; good health and wellbeing; and economic vibrancy. In India, the need for green campuses and SD is increasing manifolds due to its status of an emerging economy with constant development in the education sector. To adapt to this need, the Indian Green Building Council (IGBC) has framed a new rating system for campuses. Though this rating system is not solely for educational campuses, it is an initiative in the direction of SD in campuses. IGBC Green Campus rating system is designed for both new and existing campuses. The most tangible benefits green campus is the reduction in water and energy consumption right from day one of occupancy. Intangible benefits of green campus include health & well-being of the occupants, enhancing air quality & promoting biodiversity, safety benefits and conservation of scarce national resources. This rating programme is a tool which enables the designer to apply green concepts and reduce measurable environmental impacts. Though this rating system is primarily based on the environmental aspect of SD, it also contains some aspects of social sustainability. The dimension of the economy, education, administration and engagement are currently missing in this rating system. Though it is an excellent start to SD of campuses in India, it needs specific modification so that the educational campuses can adopt it.

Keywords: Sustainable Development (SD); Sustainable Campuses; IGBC Green campus rating system; Indian campuses.

1. Introduction

Sustainability science has grown and become an important field of science over the last 15 years that seeks to understand the fundamental character of interactions between nature and society. Sustainability is environmentalism along with concern for social equity and economic development.

Revisiting the Role of Architecture for 'Surviving' Development. 53rd International Conference of the Architectural Science Association 2019, Avlokita Agrawal and Rajat Gupta (eds), pp. 79–86.

Extensive researches are being carried out to enhance sustainability in the various fields. Campuses being the representative of larger human settlements is the best example for demonstrating sustainable development (SD). Therefore, sustainability became an integral part of campus life. Higher Education Institutes (HEIs), around the world, are restructuring their academics and lifestyle on the campus following sustainability goals. As per the literature SD in HEIs of developed countries is at an advanced stage with the evolution and extensive use of various assessment systems. Lack of abundant literature on SD in Indian campuses compared to the global scenario of SD in HEIs, marks it as an essential study area. Indian campuses have started to work in the direction of SD, but the pace is slow. There is a lack of holistic SD on Indian campuses. Indian campuses do not have a contextual campus assessment system for SD, and suitable indicators remain unestablished. Thus, there is a general lack of assessment of SD on Indian campuses.

Indian Green Building Council (IGBC) has created awareness and works to provide tools that facilitate the stakeholders for adopting green building practices in India. IGBC Green Campus rating system is one of their recent steps to embrace the green concepts in the various campuses such as administrative campus, convention centres, educational campuses, healthcare campuses, hospitality campuses it parks, industrial parks, leisure and recreational campuses military campuses, religious campuses, etc.

Green campuses address the issue of water efficiency, energy efficiency, reduction in the use of fossil fuel for transportation and efficient handling of consumer, thus conserving natural resources. They enhance the occupant's health, wellbeing, safety and security.

2. IGBC Green Campus rating system

The methodology of the paper is based on the review of the IGBC Green Campus rating system. The features of this rating system are discussed in detail. Further, these features are compared with two international rating systems- Sustainability Tracking, Assessment & Rating System (STARS) and Campus Sustainability Assessment Framework (CSAF). The comparison of the IGBC Green Campus rating system with the other two rating systems led to the identification of the merits and lacunae to determine the scope for future development. Figure 1 enlists the steps of the research.

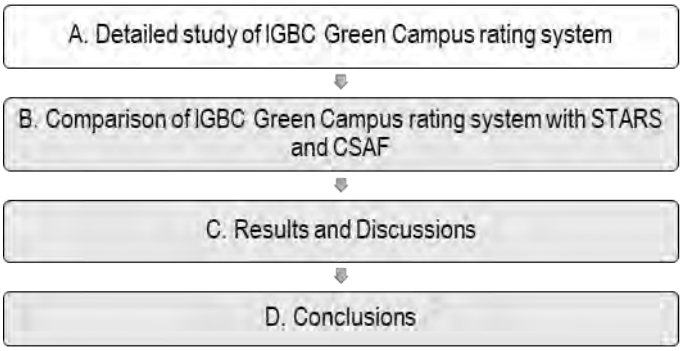


Figure 1: Methodology Chart

3. IGBC Green Campus rating system

3.1 Overview

IGBC Green Campus rating system was developed in January 2017 to facilitate environmentally friendly campuses. It is a comprehensive rating system based on some mandatory and credit points. It majorly focuses on the optimisation of water use for construction; improving lung space in the campus by emphasising on green cover; encouragement to more green buildings on the campus; effective management of waste generated on the campus, using cleaner modes of transportation on the campus and providing facilities to improve the health and well-being of the campus occupants. This rating system has two option to choose from- new campuses and existing campuses. The campuses covered under this rating system can have multiple buildings with the same or different functions with single or multiple ownership.

3.2 Features

The IGBC Green campus rating system addresses features in the below eight categories.

1. Site Planning and Management

This category deals with adequate planning and management of the campus site to enhance sustainable development of the campus. This category weighs 25 per cent of the total weight of this rating system. It comprises of 5 indicators-

- Green Buildings Within the Campus: aims to design and construct high-performance buildings within the campuses to minimise the negative environmental impacts resulting due to development. It includes either certified green built-up area on the campus or retrofitting with green features.
- Site Preservation: aims to reduce the negative environmental impacts on sie by retaining site features like existing landscape, trees, site contour, water bodies.
- Green Cover or Vegetation: aims to promote habitat and biodiversity and minimise disturbances and restore green cover or vegetation on-campus site.
- Heat Island Reduction, Non-Roof: Reduce the negative impact on the microclimate of campus site by minimising heat island effect through increasing impervious area, tree shade and covered parking spaces.
- Outdoor Light Pollution Reduction: aims to enhance the nocturnal environment by reducing light pollution and increase night sky access through perspective approach and simulation approach.

2. Sustainable Transportation

This category reduces the use of motor vehicles on campus hence reduce pollution and carbon footprint. It will encourage a healthier environment and improve the physical health of the occupants. This category weighs 11 per cent of the total weight of this rating system. It comprises of 3 indicators-

- Pedestrian Network: aims to encourage the campus community members to be safe and comfortable walking through designing interconnected pedestrian network.

- Bicycle Lane Network: aims to improve physical activity and health of the campus community members and reduce automobile dependency, thus reducing fuel consumption and vehicular emissions by providing bicycle lane network.
- Access to Sustainable Transportation: aims to provide sustainable public transportation facilities, thus encouraging the use of public transportation on the campus.

3. Water Conversation

This category decrease water usage, increase conservation and protect the habitat on the campus. This category weighs 19 per cent of the total weight of this rating system. It comprises of 6 indicators-

- Rainwater Harvesting: aims to improve the groundwater table and reduce the dependency on municipal water supply through rainwater management.
- Landscape Design: aims to design a sustainable landscape which requires minimum water consumption.
- Management of Irrigation Systems: aims to conserve water through efficient irrigation system and techniques.
- Wastewater Treatment and Reuse: aims to reduce dependency on potable water and conserve water through treating wastewater on campus and thus avoid polluting the environment by safe disposal.
- Optimise Water Use for Construction: aims to minimise potable water for construction by enhancing water use efficiency.
- Water Metering: aims to reduce water wastage and improve water performance through metering.

4. Energy Efficiency

This category decreases energy consumption and increases renewable energy generation on campus thus reducing pollution and conserving resources. This category weighs 21 per cent of the total weight of this rating system. It comprises of 6 indicators-

- Energy Efficiency in Infrastructural Equipment: aims to improve energy efficiency for various power equipment and using lighting controls.
- On-Site Renewable Energy: aims to maximise on-site renewable energy generation thus reducing environmental impacts associated with the use of fossil fuel energy.
- Off-Site Renewable Energy: aims to reduce environmental impacts associated with the use of fossil fuel energy through purchasing renewable energy from outside the campus after maximising the generation on site.
- Energy Metering: aims to encourage sub-metering to control energy consumption on campus.

5. Material and resource management

This category ensures on-campus organic waste treatment and reduces waste and energy spent on waste management by facilitating solid waste segregation, thus encouraging recycling of materials, avoiding waste being sent to landfills and using local materials. This category weighs 6 per cent of the

total weight of this rating system. It comprises of 3 indicators-

- Organic Waste Management- Post- Occupancy: aims to avoid organic waste being sent to landfills and improving health and sanitisation by managing the organic waste through waste treatment on the campus itself.
- Handling of Waste Materials, During Construction: aims to reuse and reduce construction waste through proper management.
- Local Material: aims to reduce energy wastage on transportation by procuring and using locally available materials on campus.

6. Health and Wellbeing

This category works to enhance the health and wellbeing of the entire campus community by providing essential facilities to them on the campus itself. This category weighs 9 per cent of the total weight of this rating system. It comprises of 4 indicators-

- Basic Amenities: aims to improve the health and safety of the campus occupants by providing essential amenities such as a bank, post office, cafeteria, crèche, entertainment facilities, etc. on site itself thus promoting walking and safety of the community.
- Health and Well-being Facilities: aims to provide facilities for physical activities, healthcare and security on campus to improve the health and wellbeing of the campus community.
- Universal Design: aims to ensure the campus design caters to the differently-abled and senior citizens by designing or retrofitting the campus following the guidelines of the National Building Code (NBC) for differently-abled.
- Basic Facilities for Construction Workforce: aims to provide necessary facilities to the construction workers following the guidelines of the Buildings and Other Construction Workers Act. These facilities include housing, sanitary facilities, first aid and emergency facilities, drinking water facilities, etc.

7. Green Education

This category focuses on providing essential knowledge of sustainable practices to campus occupants and local communities. This category weighs 3 per cent of the total weight of this rating system. It comprises of 2 indicators-

- Green Education: aims to organise periodic educational programmes on campus for increasing public awareness on environmental sustainability.
- Green Campus Guidelines: aims to adhere to green features and maintain the green design of the campus by providing a set of guidelines for campus occupants.

8. Innovation in Design

This category seeks innovative solutions to sustainability challenges on the campus. This category weighs 6 per cent of the total weight of this rating system. It comprises of 2 indicators-

- Innovation in Design Process: aims to credit the innovative solutions adopted in the campus for sustainable development.

- IGBC Accredited Professional: aims to encourage the involvement of IGBC Accredited Professional in green campus projects, to integrate appropriate design measures and streamline the certification process.

4. Comparison with Other Rating Systems

3.1. Sustainability Tracking, Assessment & Rating System (STARS)

The Sustainability Tracking, Assessment & Rating System (STARS) was established in 2006 by the Association for the Advancement of Sustainability in Higher Education (AASHE). It is a transparent and voluntary rating system which has a self-reporting framework for rating and checking the comparative growth in sustainable development achieved by the campuses. STARS provide a comprehensive guide with all required details for promoting sustainability in higher education. It targets all categories of sustainable development: education, research, operations, administration and economy. It provides a common standard of measurement for quantifying sustainability in higher education which facilitates significant comparisons over time and across institutions. It leads to a collaboration of institutions with each other and sharing of information about their sustainability initiatives and performances. It encourages the continuous sustainable development of the institutions by providing them with goals and incentives. STARS can be implemented for all institutions, including leaders and beginners (AASHE, 2012). There are four STARS ratings available: Bronze (25 to 44 credits), Silver (45 to 64 credits), Gold (65 to 84 credits), and Platinum (85 and above credits).

3.2. Campus Sustainability Assessment Framework (CSAF)

CSAF was developed by Lindsay Cole and 15 experts in campus sustainability. CSAF was coordinated by a body named as The Sierra Youth Organization Coalition (SYC). SYC is a Non-Governmental Organization (NGO) in Canada with its main aim is to encourage the incorporation of sustainability in educational campuses' operations, academic and research programs, student activities and community outreach. It is a comprehensive measure of an institutions' performance towards sustainability. Eighty institutions and campuses in Canada are using CSAF as a guide. The campuses in Canada have supported CSAF through taking part in the CSAF project on their campuses. CSAF has over 130 different sustainable campus proponents. A comparative analysis of the sustainability assessment tools, audits, rating and ranking systems led to the development of an exhaustive list of parameters and their indicators. CSAF is continuously evolving and emerging as a comprehensive sustainability rating and ranking system through the implementation of its pilot version on various campuses (Cole, 2003).

3.3. Comparison

Table 1 compares the three rating systems based on the weights given to different categories.

Table 1: Comparison as per the weights of different categories

S. No.	Category	IGBC Green Campus rating system	STARS	CSAF
1	Academics	3%	28%	12.3%
2	Engagement	-	19.7%	14.7%
3	Operations	57%	31.5%	39.2%

4	Planning and Administration	-	15.2%	11.7%
5	Innovation and Leadership	6%	1.9%	-
6	Health and wellness	9%	-	11.17%
7	Economy and Wealth	-	2.8	10.5%
8	Site Planning and Management	25%	-	-

4. Results and Discussions

4.1. Results

Academics are given only 3% weight in IGBC Green Campus rating system while it has been given 28% and 12% weight in STARS and CSAF respectively. There is no category which promotes and involves the engagement of the campus community members by working together in IGBC Green Campus rating system. Operations or environmental sustainability is the primary focus of this rating system with 57% weight. The categories- Planning and administration and Economy and Wealth are lacking in IGBC Green Campus rating system. However, it has an additional category of Site planning and management with 25% weight which is not present in STARS and CSAF.

4.2. Discussions

The comparison of the IGBC Green Campus rating system with two leading international rating systems led to the identification of the following merits and lacunae.

Merits

- Site Planning and Management has been incorporated and given 255 weight to improve the sustainable features on the site of the campus.
- Since it is a green campus rating system, due importance is given to the operational category of indicators.
- 6% weight to innovation and leadership will lead to innovative ideas and exemplary performance in sustainability on the campuses.

Lacunae

- Only 3% weight is given to the category academics which is very less.
- Engagement category needs to be adopted in the rating system to enhance the social and cultural sustainability of the campuses.
- Sustainability in Planning and administration should be incorporated in the rating system to work towards holistic sustainability in a planned manner.
- Economic sustainability should be adopted in this rating system.

5. Conclusions

IGBC Green Campus rating system is a green campus rating system for a different type of campuses and not focused on educational campuses. Hence it focuses more on operational/environmental categories. For it to achieve a status of educational campus sustainability rating system, it needs to give more weight to the category academics and involve indicators of social, cultural and economic sustainability. Although it has categories such as site planning and management which deals with the overall sustainability of the campus site, there is a lacks the category of economy, education, administration and engagement are currently missing in this rating system. Though it is an excellent start to SD of campuses in India, it needs specific modification so that the educational campuses can adopt it.

Acknowledgements

Include any acknowledgements to people, funding bodies etc. here.

References

"Association for the Advancement of Sustainability in Higher Education (AASHE)" (2012). STARS, available at https://stars.aashe.org/ (accessed 20 October 2016).

Alshuwaikhat, H.M., &Abubakar, I., (2008). An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices. Journal of Cleaner Production,16, 1777-1785.

Altbach, P.G., (2009). One-third of the globe: the future of higher education in China and India. Prospects 39, 11-31.

Castro, R., Jabbour, C. J. C., (2013). Evaluating sustainability of an Indian university. Journal of Cleaner Production 61, 54-58.

Cole, L., (2003). Assessing sustainability on Canadian university campuses: Development of a campus sustainability assessment framework, available at http://neumann.hec.ca/humaniterre/campus_durable/campus_memoire.pdf (accessed 24 June 2017)

Ferrer-Balas D., Adachi, J., Banas, S., Davidson, C.I., Hoshikoshi, A., Mishra, A., Motodoa, Y., Onga, M., Ostwald, M., (2008). An international comparative analysis of sustainability transformation across seven universities. International Journal of Sustainability in Higher Education, 9(3), 295-316.

Lozano R., (2006). A tool for a graphical assessment of sustainability in universities (GASU). Journal of Cleaner Production, 14, 963-972.

Lozano, R., Lukman, R., Lozano, F.J., Huisingh, D. & Lambrechts, W., (2013). Declarations for sustainability in higher education: becoming better leaders, through addressing the university system. Journal of Cleaner Production, 48, 10-19.

Ridgway B., (2005). Environmental management system provides tools for delivering on environmental impact assessment commitments. Impact Assessment and Project Appraisal, 23(4), 325-331.

Saadatian O., K. Dola, E. Salleh, O.M. Tahir, (2011). Identifying strength and weakness of sustainable higher educational assessment approaches. International Journal of Business and Social Science, 2(3), 137146.

Sari, R.F., (2012). Methodology and evaluation of green and sustainable campus indicators for World University ranking. Proceeding of the International Ranking Expert Group-6 (IREG-6), Taipei.

Sharp, L., (2009). Higher education: The quest for the sustainable campus. Sustainability: Science, Practice & Policy, 5(1), 1-8. Retrieved from https://search.proquest.com/docview/1428638887?accountid=27544

People Place Parity

Knowledge Partners

UN HABITAT
FOR A BETTER URBAN FUTURE

HABITUX

Certificate of Participation

This is to certify that

Avni Gor

Has presented a paper on

Comparative Analysis of Mitigation Strategies for Coastal Flood

In the 4th Annual Research on Cities Summit
Organized by Xavier School of Human Settlements
At Xavier University Bhubaneswar from 7th – 8th February 2020.

Dr. Kajri Misra, Dean
Xavier School of Human Settlements

XAVIER SCHOOL OF HUMAN SETTLEMENTS

Fr. E. A. Augustine, Registrar
Xavier University Bhubaneswar

Comparative Analysis of Mitigation Strategies for Coastal Flood

Avni Gor[a], Dr. Shaila Bantanur[b]

Email ID: avni.gor@alum.cept.ac.in

[a] Student, M. Arch. (Urban Design), BMS School of Architecture, Yelahanka, Bangalore

[b] Professor, BMS School of Architecture, Yelahanka, Bangalore

Abstract

Flooding of various types have affected human settlements. Coastal flooding in urban areas is becoming a frequent phenomenon as climate change and global warming is causing severe rise in sea levels globally. It is estimated that half of the world's population is going to be affected by coastal flooding in the near future. National and International governmental agencies have set out guidelines for resilience and mitigation towards such events. However, frequent flooding and destruction of infrastructure, economy and resources indicate that there are shortcomings in these policies. This paper aims to compare and contrast various nations' guidelines pertaining to coastal flooding with respect to urban design strategies enforced by the planning authorities in the selected international cases.

Keywords: coastal flood, mitigation, policy, urban design

1. Introduction

Disasters of various types threaten the environment we live in. National and international agencies play a vital role in taking preventive measures prior to the disaster, rescue operations during the disaster and rehabilitation after the disaster occurs. Mitigation strategies enforced by agencies of four countries namely United States of America, the Netherlands, India and Australia are discussed in detail in this paper. The aim of this paper is to compare and analyze the gaps that might be present in our existing Disaster Management Policy.

Flood is outlined as overflow of water that submerges land that is usually dry. In the sense of "flowing water", the word may also be applied to the inflow of the tide (Awate, Environmental Geography, 2017). Floods are an area of study of many disciplines in science and construction technology related to hydrology, services, urban development and public health

2. Agencies

2.1 **National Disaster Management Authority (NDMA)**: It is responsible for laying down the guidelines and policies for disaster management in India. This authority is set up according to the Disaster Management Act of 2005. This authority is headed by the Prime Minister's Office and falls under purview of Ministry of Home Affairs. The Central and State departments work in tandem based on the guidelines NDMA had prepared for disaster management. The National Institute of Disaster Management works within this framework of NDMA and specialized force called the National Disaster Response Force (NDRF) is put into action at times of disaster. NDMA takes into account both man-made as well as natural disasters. Events such as acts of terrorism, air accidents, plane hijacks, mine disasters, forest fires, oilfield fires, oil spills, port and harbor emergencies does not fall under the purview of NDMA. It does not notify if any disaster is to be

termed as National Calamity or National disaster. The state government is responsible to carry out disaster management and the NDMA merely provides support. Central agencies participate at the request of the state government. For every state there is another institutional framework at the state level according to Disaster Management Act 2005.

Table 1: *List of Agencies*

Sr.No	Agency	Name	Country	Year of Establishment
1	NDMA	National Disaster Management Authority	India	2005
2	FEMA	Federal Emergency Management Authority	United States of America	1979
3	EMA	Emergency Management Australia	Australia	1967
4	MIWM	Ministry of Infrastructure and Water Management	Netherlands	1953

2.2 **Federal Emergency Management Authority (FEMA)**: -It is an agency under the aegis of the Department of Homeland Security, USA. This agency plays an important role during disasters such as earthquakes, volcanos, floods, or explosions. Under the Stafford Act, the President declares the state of emergency and FEMA has to respond to the crisis. It has three main types of declarations viz Emergency, Major disaster and Fire management assistance.

a**. Emergency** - An emergency is defined as "any occasion or instance for which, in the determination of the President, Federal assistance is needed to supplement State and local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the U.S. (McCreight, 2016)

b. **Major disaster** - A major disaster is "any natural catastrophe, regardless of cause, any fire, flood, or explosion in any part of the U.S. which, in the determination of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance to supplement

the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby." (Service, 2019)

c. **Fire management assistance** - Fire management assistance is available to State, Tribal, and local governments, "for the mitigation, management, and control of any fire on public or private forest land or grasslands, that threatens such destruction as would constitute a major disaster. (Security, 2018)

2.3 **Emergency Management Australia (EMA)**: This agency is headed by Australia`s Attorney General's Department. It delivers programs and policies, which maintain and strengthen Australia's national security and emergency management procedures. Emergency management within the department is primarily undertaken by two divisions: The EMA division is responsible for preparing for emergencies and disasters through the development and maintenance of national plans; coordination of Australian Government crisis response and recovery efforts; and coordination of protective security arrangements (physical and personal) for Australian high office holders, visiting foreign dignitaries, at-risk foreign missions in Australia, as well as security arrangements for special events in Australia or overseas. (Australia, 2018)The National Security Resilience Policy Division provides policy advice on emergency management, protective security, identity security, e-security, critical infrastructure protection, and the security of chemicals.

2.4 **Ministry of Infrastructure and Water Management (MIWM)**: The Netherlands is a country where two third of its land is below sea level. Thus, the culture and society are oriented towards water crises and mitigation. Historically the country has dealt with major floods and this has influenced development of country's biggest infrastructure pertaining to flood protection. The Delta Committee is formed to look after working of three Locks, six Dams and four Storm Surge Barriers. The Delta Programme Commissioner reports to the Ministry of Infrastructure and Water

Management which is headed by the respective minister. However recent concerns are growing for mitigation only policy and the Netherlands is looking at upgrading its policies to look at more inclusive and holistic approach to flooding which is its major concern other than fire and volcanic eruptions.

3. Parameters

Disaster or emergencies addressed by countries discussed in above sections vary due to the variations in the disasters one faces. It is this parameter which dictates the policy and decision making process. NDMA in India is created with specific mandate to tackle natural and man-made disasters while similar agencies in USA, Australia and the Netherlands deal with emergencies of any kind.

Table 2: Parameters comparison of different government agencies

Sr.No	Organization	Types of disaster
1.	NDMA, Ministry of Home Affairs	**Natural** 1 Earthquake/ Mass movement of earth materials, Volcano, Tsunami. 2 Flood, Landslides, Wave Action. 3 Hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that may last for minutes to days 4 Unusual, extreme weather conditions related to long-lived, meso- to macroscale atmospheric processes ranging from intra-seasonal to multi-decadal (long-term) climate variability. 5 Exposure to germs and toxic substances **Human induced** 1. Industrial, Road, Air, Rail, on river or sea, building collapse, fire, mine flooding, urban flooding, oil spills, etc.).
2.	FEMA, Department of Homeland Security	Natural - Earthquakes, droughts, floods, hurricanes, landslides, tornadoes, tsunamis, volcanoes, and wildfires.

3.	EMA, Attorney General's Department	Natural • floods; • severe storms • cyclones • earthquakes; • bushfires; and • landslides.
4.	MIWM, Delta Committee	Natural Cyclones. Earthquakes. Fires. Floods. Volcanoes.

Among the various government agencies mentioned in above section, the parameter on flooding is considered for further study. Table 3 describes the various types of flooding described in available literature of the respective agencies.

Table 3: Definition of flooding by different agencies

Sr. No	Organisation	Types of Flooding
1	NDMA, Ministry of Home Affairs	Areal, Riverine (Channel), Urban flooding, Catastrophic, Estuarine and coastal.
2	FEMA, Department of Homeland Security	Riverine flooding, coastal flooding, and shallow flooding.
3	EMA, Attorney General's Department	Inland Rivers-Slow Onset Flooding, Mountain/Coastal Rivers-Quick Onset Flooding, Flash Flooding.
4	MIWM, Delta Committee	Coastal flooding, riverine flooding.

4. Coastal Flood Mitigation Strategy

A coastal flood is when the coast is flooded by the sea. A flood starts when waves move inland on an undefended coast or overtop or breach the coastal defence works like dunes and dikes. (Indrajit Pal, 2017). The causes of Coastal flooding as given by the NDMA include sea level rise, geology and rapid coastal population growth accompanied by rapid increase of human activities that interfere with natural processes. Reclaimed Land, Urbanisation, Increased infrastructure in coastal zones, Construction activities in ecologically sensitive zones and near the 'high tide line' has increased the vulnerability to coastal floods and Mangrove Degradation.

There are two parts to disaster mitigation: minimising the loss of lives and minimising the loss of infrastructure and livelihood. Revisiting CRZ norms: Promulgation and enactment of a new Act for the protection of the coastal zones—with clear classification of various zones, after due consultations with the fishing communities, stakeholders, scientists and the department concerned—is the need of the hour. Measuring HTL: Public scrutiny of such foundation data sets is critical as this forms the basis of the Coastal Zone Management Plan. Stopping infrastructure construction along the coast and integrating anticipated SLR effects into coastal planning are essential.

Advance preparation for migration into mid-size towns and better ecosystem support in the hinterland are useful ways to collaborate and build regional partnerships. Creating safer housing especially in the coastal regions, and in creating electrical systems that are underground. This will help minimize the need for evacuation. Demarcation of ecologically sensitive zones using existing village survey maps and public participation. Clear land use

plan for these zones specifying flood plains, protected forest areas, agricultural and plantation zones, with details of the types of crops, building usages permitted and the density of buildings permitted. Compensating owners in non-buildable areas, there must be strategies such as Transfer of Development Rights to buildable zones in cities. Cities' master plan should focus on permitting only ecologically sensitive building strategies for these areas by proposing new construction techniques. Controlled development can be proposed using building height rules, floor area ratio control, and restrictions on cutting and filling natural land (India, 2019). Conservation of Blue Carbon Ecosystems for Climate Change Mitigation and Adaptation.

Table 4: Organizations and their mitigation strategies

Organization	Definition of Coastal Flooding	Mitigation Strategy
NDMA	A coastal flood is when the coast is flooded by the sea. A flood starts when waves move inland on an undefended coast or overtop or breach the coastal defence works like dunes and dikes.	There are two parts to disaster mitigation: minimizing the loss of lives and minimizing the loss of infrastructure and livelihood.
FEMA	A flood is defined by NFIP regulations as a general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland or tidal waters or the unusual and rapid accumulation or runoff of surface waters from any source.	- seeks to reduce or eliminate long-term risks, - to make grants to State, Tribal, and local governments to fund mitigation projects before a disaster strikes, - creating safer communities, enabling people to recover more rapidly from floods and other disasters.

Organization	Definition of Coastal Flooding	Mitigation Strategy
EMA	Flooding due to tidal or storm-driven coastal events, including storm surges in lower coastal waterways. This can be exacerbated by wind-wave generation from storm events.	-Leading change and coordinating effort,- Understanding risks, - Communicating with and educating people about risks, - Partnering with those who effect change, - Empowering individuals and communities to exercise choice and take responsibility, - Reducing risks in the built environment, - Supporting capabilities for disaster resilience
MIWM	When a storm develops and the wind stirs up the waves, the Dutch coastal area can become flooded.	Engineered Mitigation, Land use Mitigation, Emergency management Preparedness.

5. Discussion

The measures taken for prevention and mitigation that are categorised as structural and non-structural measures. In structural measures, the Construction, Development of Catchment areas, Flood proofing, techno legal regime and forecasting and warning are the heads under which activities like improving design for irrigation and flood protective structures, construction of dams, flood protection wall, flood diverting channels etc. strengthening /repair of existing roads and bridges and other critical infrastructure in flood plains, strengthening dams and canals, implementation of specific building by laws for buildings and structures in the flood plains, enact and enforce laws regulating developmental activities in flood plain are taken into account. But at the district level these measures are missing in the list of responsibilities in the DDMA document which is made available to the public in the local language.

6. Conclusion

Without such reforms, only the Indian Army and paramilitary forces can remain first responders, and States will continue to cry out for relief. Perhaps, it's time to move on from being focussed only on managing natural disaster emergencies to improving resilience (Verma, 2019). There is no inclusion of special consultants like urban planners, urban designers and architects to formulate the by-laws for building in flood plains and the land use that can be given to low risk flood areas. Also, at the district level implementation of the policy is an issue as the mentioned guidelines are not followed for making the high tide line and flood plain marking to be made available to the public easily and openly. The DDMA document also lacks a vision for future development of the urban area and allowing land for future use in the flood and CRZ zones.

Bibliography

Awate, D. S. (2017). *Environmental Geography.* Ashok Yakkaldevi.

Awate, D. S. (2017). *Environmental Geography.* Ashok Yakkaldevi.

McCreight, R. (2016). *An Introduction to Emergency Exercise Design and Evaluation.* Bernan Press.

Service, C. R. (2019). *Stafford Act Assistance and Acts of Terrorism.* fas.org.

Security, O. w. (2018, 01 08). *The Disaster Declaration Process*. Retrieved from fema.org: https://www.fema.gov/disaster-declaration-process

Australia, G. o. (2018, 12 21). *STATE EMERGENCY MANAGEMENT*. Retrieved from https://semc.wa.gov.au/: https://semc.wa.gov.au/emergency-management/glossary/Documents/StateEMGlossary.pdf

Indrajit Pal, T. G. (2017). *Natural Hazards Management in Asia.* SAGE Publishing India.

India, W. B. (2019, 06 14). *What states can learn from Odisha in disaster preparedness and mitigation*. Retrieved from worldbank.org: https://www.worldbank.org/en/news/speech/2019/06/14/odisha-fani-disaster-preparedness

Verma, J. (2019, 11 08). *Coastal Flood Inida*. Retrieved from jatinverma.org: https://www.jatinverma.org/coastal-flooding-india

Fwd: ARCS4.0 Abstract Submission: J.Rangaswamy_People-Friendly Neighbourhoods A Case of Malleswaram area in Bengaluru city.

Fri, Feb 26, 2021 at 12:56 PM

---------- Forwarded message ---------
From: **ANNUAL RESEARCH ON CITIES SUMMIT** <arcs@xuconf.edu.in>
Date: Mon, Dec 2, 2019 at 11:12 AM
Subject: Re: ARCS4.0 Abstract Submission: J.Rangaswamy_People-Friendly Neighbourhoods A Case of Malleswaram area in Bengaluru city.
To: Jananee R <swathijananee@gmail.com>
Cc: <shailabunty@gmail.com>

Dear Jananee Rangaswamy

We'd like to confirm with pleasure the acceptance of your abstract **People-Friendly Neighbourhoods: A Case of Malleswaram area in Bengaluru city** for the ARCS 4.0 - Fourth Annual Research on Ci es Summit Interna onal Conference on **Ci es for People – Plans, Programs and Policies.** This year we received a record number of abstracts, and the choice was very challenging.

The conference will be held at the Xavier School of Human Se lements, Xavier University Bhubaneswar, India on 7 and 8th February 2020. The par cipants are responsible for their own registra on, travel and accommoda on costs. The registra on payment arrangements will be informed shortly.

Meanwhile, we request you to mail us a short (50 words) bio-sketch of yours in **MS Word format** only by **20 December 2019**, for inclusion in the conference booklet.

We congratulate you on the acceptance of your paper and look forward to mee ng you soon in Bhubaneswar.

Best regards

Tathagata Cha erji
Conference Convener
Third Annual Research on Ci es Summit
Xavier Centre for Urban Management & Governance
Xavier University Bhubaneswar
Plot No - 12 (A) Nijigada, Kurki
P.O. Harirajpur - 752050, Dist. Puri
Odisha, INDIA

People-Friendly Neighbourhoods: A Case of *Malleswaram* area in Bengaluru city.

Jananee Rangaswamy[a], Dr.Shaila Bantanur[b]

Email ID: ar.jananee.r@gmail.com

[a] Student, M.Arch (Urban Design), BMS School of Architecture, Yelahanka, Bengaluru.

[b] PhD, Professor, Deputy Director, BMS School of Architecture, Yelahanka, Bengaluru.

Ignorance and neglect of people as part of the system in city planning initiatives stems mainly from the exponential population growth and rising urbanisation resulting in infrastructure driven growth of the city. While cities are said to be designed for people, in the modern-day, people can seldom connect with the city they live in. This connect isn't new to Indian cities and was forgotten due to the influence of the west. As observed: small scale interventions have large scale impacts, similarly, changes at the grass-root level can bring about a greater change in the city. This research paper highlights the major characteristics of people-friendly neighbourhoods that aims at bringing back the old essence of the place by taking the case of *Malleswaram* area in Bengaluru for the study. Detailed study in terms of parameters such as those of a) Accessibility to major amenities; b) availability of pedestrian and cyclist infrastructure; c) Congestion; d) Last-mile connectivity to other modes of transport; e) Safety, security and gender-equal spaces; and f) decadal changes in *Malleswaram* was carried out to help understand the need to propose a strategy in order to reverse the concept of auto-centric neighbourhoods and promote people-friendly neighbourhoods relying on non-motorised means of transport (NMT).

Keywords: People-friendly neighbourhoods; Non-motorised means of transport; NMT; Urban Connect; Gender-equal spaces.

---

1. INTRODUCTION:

Numbness and disregard of individuals as a major aspect of the framework in urban design activities stem for the most part from the exponential populace development and rising urbanization bringing about infrastructure driven development of the city(A K Maitra, 1993; Asesh Kumar Maitra, 2000). While urban communities are said to be designed for individuals, in the present day, individuals would seldom be able to interface with the city they live in. This form of disconnect can be witnessed by a series of events that have resulted in the present day condition of the cities as shown in the figure given below.

Fig 1.Changing scenario of Present day cities(Preston & Rajé, 2007)

This growing disconnect between the people and their surrounding environment can be measured by various key aspects such as those of:

- Number of pedestrian/bicycle traffic compared to vehicular traffic.
- Crime rates
- Available gender-equal spaces
- Connectivity to public transport
- Available pedestrian or bicycle infrastructure
- Accessibility to major amenities.

In the present-day setting, it very well may be seen that the connection among people and the current urban areas has become exceptionally materialistic and people come up short on a sense of belongingness to their place of territory. Therefore, there is a developing requirement for turning around the situation and that can be viably done by correcting at the grass-root level, for this situation, an endeavour towards people-friendly neighbourhoods.

To understand the term people-friendly neighbourhoods, it is important to understand what the terms mean in isolation and what makes a neighbourhood, people friendly?

2. WHAT IS A NEIGHBOURHOOD?

In English, neighbourhood implies the zone of a town that encompasses somebody's home, or the individuals who live around there. It might likewise allude to a territory of a town or the individuals who live or work around there ("CONSENSUS | meaning in the Cambridge English Dictionary," n.d.).

A Neighbourhood is the basic planning unit for a town. Advanced because of the approach of the industrial revolution and debasement of the city condition caused by:

- high vehicular blockage,
- heavy traffic development through the city,
- insecurity to class going youngsters,
- Distant area of shopping and amusement exercises; and so on.(Lawhon, 2014)

The idea of neighbourhood is about a century old and has advanced with time.

1.1 EVOLUTION OF THE CONCEPT OF NEIGHBOURHOOD.

Table 1: Evolution of the concept of neighbourhood.(Banerjee, Tridib, Baer, 1984; Johnson, 2002; Mumford, 1954; Perry, 1929; "radburn.jpg (800×1074)," n.d.)

CONCEPTS	YEAR	SCALE	DESCRIPTION/DEFINITION
Garden City concept by Ebenezer Howard	1898		
William R Drummonds' Model	1912		"The theoretical and practical parameters, social and physical, of a micro-community in a suburban context with a focus on housing."
Clarence Stein & Clarence Perry	1900s	5000-9000 households	brought light to Aristotle's vision "a city should be built to give its inhabitants security and happiness"
Lewis Mumford			"Neighbourhoods, in some annoying, inchoate fashion exist wherever human beings congregate, in permanent family dwellings; and many of the functions of the city tend to be distributed naturally—that is, without any theoretical preoccupation or political direction—into neighbourhoods."
John Nolen	1920		Applied to the city of Florida
Radburn Layout by Clarence Stein and Henry Wright	1929	25,000 people in 149 Acres	
Duany Plater-Zyberk Model	1994		

The neighbourhood unit as described by Clarence & Perry aimed to make(Banerjee, Tridib, Baer, 1984; Perry, 1929; Vidyarthi, 2010):

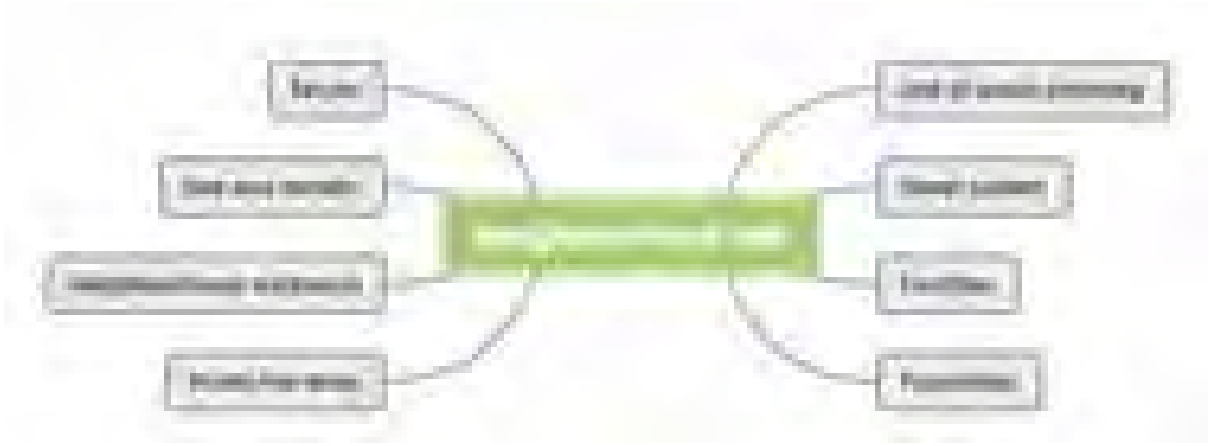


Fig 2. Major characteristics of a neighbourhood unit.(Perry, 1929)

- A safe, healthy, physical condition in which kids will have no traffic boulevards to cross on their approach to class, schools which are inside walking good ways from home;
- A domain wherein ladies may have a simple stroll to a mall where they may get the day by day family units merchandise,
- Employed individuals may discover advantageous transportation to and from work.
- A well-prepared play area is situated close to the house where kids may play in security with their companions for the sound advancement of their psyche and soul.
- A one mile walking radius was considered to determine the scale of the neighbourhood.
- Primary school is the focal point of the unit and inside a one half mile span of all inhabitants in the area, nearby malls situated close to the school.
- Residential avenues are proposed as cul-de-sacs to take out through traffic and park space streams into the area.

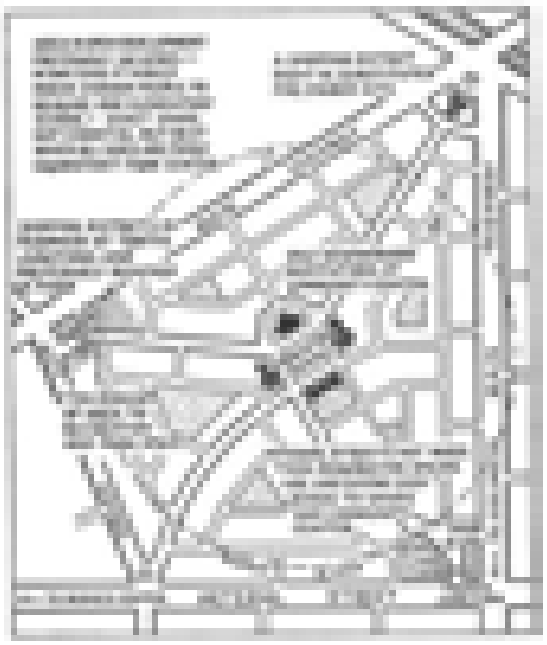


Fig 3. Neighbourhood Unit planned by Clarence &Perry.
(Source: Diagram of Clarence Perry's Neighbourhood Unit, New York Regional Survey, Vol 7.)

3. CLASSIFICATION OF PEOPLE USING A NEIGHBOURHOOD

Fig 4: Classification of People based on various parameters.

People, in general can be classified based on various parameters. Some of these parameters being: Gender, Occupation, Religion, mode of commute they prefer, Age, Religion as shown in Fig 5. Different people have different needs in a neighbourhood. For example, a small family of 4 members -a middle aged couple with 2 kids aged 1 year and 4 years old living in a neighbourhood would have varied requirements such as:

1. A health care facility in the area for any emergency situations
2. Work opportunities for the couple
3. Educational institutes ranging from a nursery to Senior secondary school for the kids,
4. Market area for day-to-day & monthly grocery needs.
5. Parks and open spaces for kids to play.
6. Cafes and restaurants for recreation and regular social interactions

Fig 5: Classification of People in a neighbourhood

A people friendly neighbourhood is one which caters to the needs of the people using it keeping in mind the varying needs of all the different categories of people. Fig 6. clearly shows that the neighbourhood not only caters to the needs of the people living in the neighbourhood but also people passing-by it, working in it, play in it, heal from it, suffer from it, dreaming about it etc.

4. WHAT PARAMETERS OF A NEIGHBOURHOOD QUALIFY FOR A PEOPLE FRIENDLY NEIGHBOURHOOD?

Different models look at different parameters for a people friendly neighbourhood. To understand the various parameters that are necessary for a neighbourhood to be people-friendly, a comparative analysis of 3 different models was carried out based on which a set of parameters were derived. The 3 models that were compared were those of Forbes("12 Things That Make A Neighborhood Truly Great," n.d.), Zhang(Zhang, Zhou, & Kwan, 2019) and Wheeler Model(Wheeler & Org, 2001) as given in the Table 2.

Table 2: Comparative analysis of People friendly neighbourhood models.

FORBES MODEL ("12 Things That Make A Neighborhood Truly Great," n.d.)	**ZHANG ET AL MODEL** (Zhang et al., 2019)	**WHEELER MODEL**(Wheeler & Org, 2001)	**PARAMETERS**
Matching lifestyle	Mental Health	nice, reasonable, well-found lodging	**Familiarity**
Low crime rates		places that vibe protected and tolerating to all clients	**Safety & Security**
Great schools, Outdoor Activities, Shopping centres, entertainment, nightlife etc.		advantageous schools, shops, and administrations available stops and open space a spotless common habitat	**Accessibility**
Sense of ownership	Social Health		**Ownership**
Relation to history of the city		Places that stress nearby culture, history, and nature.	**Authenticity**
Family friendly		assorted, readable, and educative fabricated scenes	**Informative**
Close to public transport	Physical Health	low traffic speed, volume, and blockage	**Last mile connectivity**
Walkability		Conditions that support human network and association.	**Walkable**
Access to medical care			**Amenities**
		an alluring, passer-by situated open domain	**Attractive**

5. CASE OF *MALLESWARAM*.

For the purpose of study, the area of *Malleswaram* in Bengaluru City is taken, which has seen tremendous changes in the recent times with growing urbanisation and infrastructural developments changing the image of the place and is no longer close to being called a people friendly neighbourhood.
Malleswaram is a North-Western suburb of Bangalore city. It was created as an arranged suburb after the extraordinary plague of 1898("'*Malleswaram* retains the Bangalore of yore,'" n.d.), which made numerous individuals move out of the downtown area. It gets its name from the ***Kadu Malleshwara*** Temple("A whiff of *Malleswaram* | | Citizen Matters, Bengaluru," n.d.). It is well known for its religious institutions, educational institutions and culinary experience. It is a neighbourhood also known for its markets during the festival season which is one of the oldest in Bangalore and its continuous tree umbrage that creates a very different micro-climate for the neighbourhood when compared to the surrounding neighbourhoods making it a very suitable area for the residing population. Once a completely residential neighbourhood has now lost its original essence and has become a major connecting route for people moving from the city centre to other parts of Bangalore due to the great connectivity with the railway line and the metro in the neighbourhood. The flowchart below shows the major complexities identified in the neighbourhood and images to support the same.

Fig 6: Images showing *Malleswaram* Market.

6. MAJOR COMPLEXITIES IDENTIFIED IN THE NEIGHBOURBOOD

Fig 7: Map showing the major activity points of the neighbourhood.

A detailed activity mapping of the present day scenario (as shown in Fig 7.) gives an idea about the movement pattern of people in *Malleswaram*. The recent addition of a metro connectivity has increased the congestion along the most active street of the neighbourhood namely, *Sampige road* and *Margosa road*. The street flooded already due to the existing flower market being moved out of its allotted space in lieu of a redevelopment project of the market area started in the year 2014 is yet another major issue to be addressed. These issues have been charted out in Fig 8. Which clearly shows the major complexities. Increasing density in the neighbourhood has resulted in the transformation of the low-rise residential neighbourhood into a high-rise mixed use neighbourhood brought into place at the cost of the natural environment of the neighbourhood. The decadal change of the neighbourhood includes the loss of the natural tree cover, receding underground water table which have resulted in the drastically changing micro-climate of the neighbourhood.

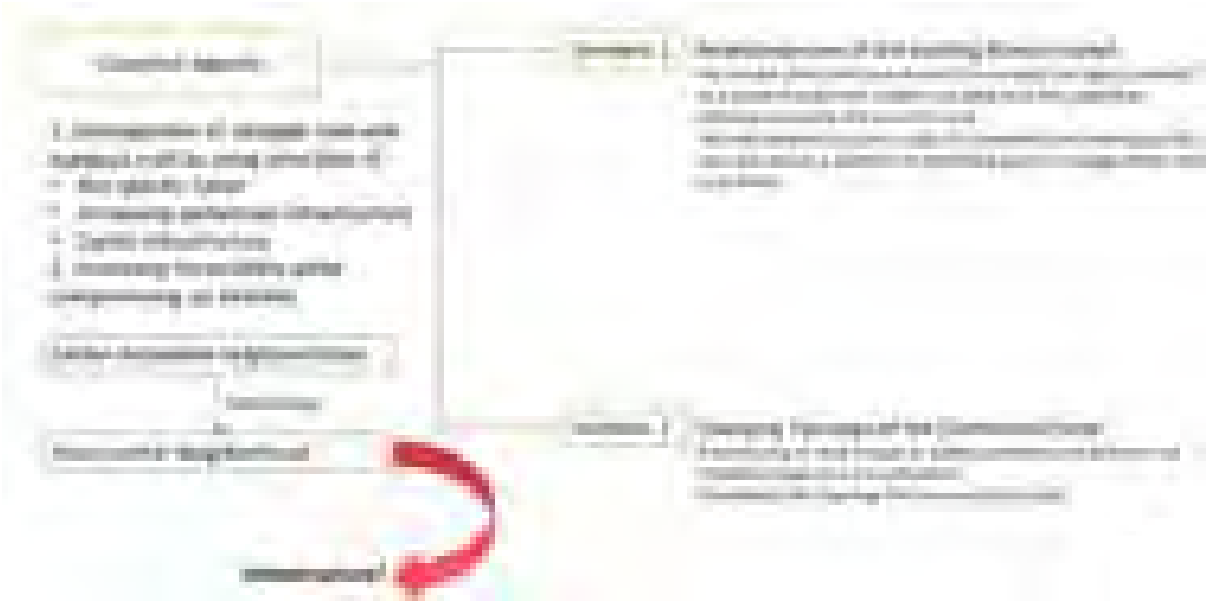


Fig 8. Major complexities & possible project outline.

7. CONCLUSIONS:

The paper highlights the need for incorporating the neighbourhood concept as a basis for the planning of cities. The neighbourhood planned should cater to the wide range of needs of the different kinds of people that might use the neighbourhood. Such a neighbourhood design would result in a people-friendly neighbourhood which is attractive, safe, accessible, walkable, authentic to its time period, familiar, well connected to other parts of the city and informative at the same time which would instill a sense of ownership and belongingness towards their surrounding and encourage better interaction of the people with their living environment.

REFERENCES:

12 Things That Make A Neighborhood Truly Great. (n.d.). Retrieved January 15, 2020, from https://www.forbes.com/sites/trulia/2014/11/29/12-things-that-make-a-neighborhood-truly-great/#105d522e35f6

A whiff of *Malleswaram* | | Citizen Matters, Bengaluru. (n.d.). Retrieved January 16, 2020, from http://bengaluru.citizenmatters.in/273-*Malleswaram*-guide-273

Banerjee, Tridib, Baer, W. C. (1984). Beyond the Neighborhood Unit: Residential Environments and Public Policy. Retrieved December 31, 2019, from https://books.google.co.in/books?hl=en&lr=&id=GJnuBwAAQBAJ&oi=fnd&pg=PA1&dq=Banerjee,+T.+Baer,+W.+1984+'Chapter+1:+Introduction'+in+Beyond+the+Neighborhood+Unit:+Residential+Environments+and+Public+Policy,+Plenum+Press,+New+York,+1984,&ots=pwJ9mahrPo&sig=

CONSENSUS | meaning in the Cambridge English Dictionary. (n.d.). Retrieved January 15, 2020, from https://dictionary.cambridge.org/dictionary/english/neighbourhood

Johnson, D. L. (2002). Origin of the Neighbourhood Unit. *Planning Perspectives*, *17*(3), 227–245. https://doi.org/10.1080/02665430210129306

Lawhon, L. L. (2014). Neighborhood Unit. In *Encyclopedia of Quality of Life and Well-Being Research* (pp. 4335–4337). https://doi.org/10.1007/978-94-007-0753-5_3335

Maitra, A K. (1993). Managing Urban Environment in India-Workshop on Role of Cities. *Volume II-Times*

Research Foundation Kolkata, 45–48.

Maitra, Asesh Kumar. (2000). *Urban Environment in Crisis*. New Age International.

'*Malleswaram* retains the Bangalore of yore.' (n.d.). Retrieved January 16, 2020, from https://www.dnaindia.com/bangalore/report-*Malleswaram*-retains-the-bangalore-of-yore-1673441

Mumford, L. (1954). The Neighborhood and the Neighborhood Unit. *Town Planning Review*, *24*(4), 256. https://doi.org/10.3828/tpr.24.4.d4r60h470713003w

Perry, C. A. (1929). the Neighborhood unit-a scheme of arrangement for the family-life community, regional survey of New York and its environments. *Neighborhood and Community Planning, Committee of Regional Plan of New York and Its Environs*, *8*, 30.

Preston, J., & Rajé, F. (2007). Accessibility, mobility and transport-related social exclusion. *Journal of Transport Geography*, *15*(3), 151–160. https://doi.org/10.1016/j.jtrangeo.2006.05.002

radburn.jpg (800×1074). (n.d.). Retrieved January 15, 2020, from http://pedshed.net/blog/wp-content/uploads/2006/12/radburn.jpg

Vidyarthi, S. (2010). Inappropriately Appropriated or Innovatively Indigenized?: Neighborhood Unit Concept in Post-independence India. *Journal of Planning History*, *9*(4), 260–276. https://doi.org/10.1177/1538513210384457

Wheeler, S., & Org, E. (2001). *UC Berkeley IURD Working Paper Series Title Livable Communities: Creating Safe and Livable Neighborhoods, Towns, and Regions in California Permalink Publication Date*. Retrieved from https://escholarship.org/uc/item/8xf2d6jg

Zhang, L., Zhou, S., & Kwan, M. P. (2019). A comparative analysis of the impacts of objective versus subjective neighborhood environment on physical, mental, and social health. *Health and Place*, *59*. https://doi.org/10.1016/j.healthplace.2019.102170

How much development is too much in today's world?

Himadri Das and **Benjamin Mathews John** argue for the need of an ecological and inclusive approach to re-imagining cities

Peter Calthorpe first codified the concept of Transit Oriented Development (TOD) during the late '80s in the USA as a solution to urban sprawl caused by car-centric American cities. According to Calthorpe, TODs are: Mixed-use communities within an average of 2,000-feet (600 mts.) walking distance between a transit stop and a core commercial area. In the American context, TOD emerged from the need to contain urban sprawl.

In recent years, TOD has become a buzz-word in the development of Indian cities. The saleability of the concept in projects has been in the form of high Floor Space Index (FSI). TOD makes for a financially feasible development model, accepted by politicians, bureaucrats and policy makers. On ground implementation of TOD has seen limited success due to several variables. These variables include understanding site context, market demand, land-use mix, accessibility to transit, appetite for development, affordability of transit and right institutional mix enabling integrated development.

The Brundtland Commission report titled Our Common Future (1991) was the first to coin the term 'Sustainable Development' and cautioned governments to focus on conserving the environment for future generations rather than destroying it. In India, the Post Neo-Liberal state is deeply entrenched in the Climate Change agenda, in order to resolve the conflict between development and protection of the environment. This article will attempt to address the eternal question of 'How much Development is too much Development?' set against the present context to address the lack of understanding of local as well as global contexts, to appreciate the real 'carrying capacities' of cities before applying blanket policies like TOD. 'Carrying capacities' are not related to availability of amenities, infrastructure or type of urban fabric but the terrain or geography and the communities that inhabit the city. This underlines a need for an ecological and inclusive approach to re-imaging cities.

Learnings from TOD cities in the global south

The case studies show that cities face several roadblocks in their path to implementing TOD. Curitiba was conceived as a transit city through the structuring of higher densities along its NE-SW corridor. Studies have shown that structural corridors are not consistently supported by densities in all parts of the city. A study in the Journal for Urban Planning and Development shows up to 80% of the commuters using the Bus Rapid Transport System (BRTS) are thought to have origin points far off from the transit routes. Similarly, the development plan in the city of Bogota focusses on combining transit and public housing. A study done by Roberto Cervero at the Society for Transport in 2011, found that lower income households lived near transit routes. Over the years, the subsequent administrations have removed policy restrictions on developers. This has incentivised high income housing closer to transit in order to capitalise on increased market value of land. Do transit triggered land markets, which are pushing the poor to the periphery, justify the claims of an inclusive city?

Among the Asian cities, Tokyo in Japan is the quintessential rail-transit city says Taras Grescoe in his book The Straphangers. The railway system in Japan is largely privatised. The private companies not only developed the railways, but also built satellite towns around them. The fact that there are a handful of private companies that fund, construct and manage this entire complex system raises questions of the lack of equity and choice for citizens. Large mega-sized, mono-use urban areas connected efficiently with railway networks, work well only when the economy is upbeat, but what happens during a crisis?

Do transit triggered land markets, which are pushing the poor to the periphery, justify the claims of an inclusive city?

Hong Kong and Singapore have created transit cities by implementing very strict policy regimes. While the efficacy of the policies has been proven from a transit perspective, do these policies help in creating an equitable and affordable housing scenario? Hong Kong has about 21.3% of its total land allocated for urban use. As a result, there is a huge demand for developable land, which is bought at auctions by developers and rail transit companies. There is a high level of inequity in terms of affordability of living space. The Hong-Kong TOD policy, which is hailed as a success, is part of this larger bouquet of policies that restrict use of land for urban development. So, while such a policy protects the fragile forests and slopes on the islands of Hong Kong, the residents must pay a heavy price through high rents and high costs of real estate.

Low Rise-High Density: What should India's TOD approach be?

In the Indian context, where master plans themselves have an implementation ratio of 10%-12% due to weak monitoring and enforcement frameworks, the efficacy of complex TOD related guidelines is yet to be established.

The most prolific adaptation of TOD is through inclusion in Statutory Master Plan Documents. Delhi, Ahmedabad and Naya Raipur do this by including it within their Master Plans. The second approach to implementing TOD is through central level programmes, such as 'Smart City'. Such an approach has been adopted in Bhubhaneshwar, Jaipur and Kochi. The third approach is that of a PPP agreement. It was implemented by Hyderabad, which entered into a PPP agreement with a private entity, which in this case was Hyderabad Metro Rail Limited (HMRL). The last approach is using TOD through state level investment programmes or responding to a metro rail policy, something the city of Bengaluru is following.

In Indian cities, communities tend to share expensive real estate to bear the cost of rentals. Across the country, communities are also culturally pre-disposed to a strong relationship with the earth. Due to higher household sizes, which translate to higher people densities, Indian cities can achieve comparable density through low rise-high density as high-rise/high density development.

Case of 5 FSI and Suburban Rail in Bengaluru

The historic settlement of Yelahanka dates to the 12th century A.D. Janaki Nair in her book The Promise of a Metropolis identifies the settlement of Yelahanka as a precursor to Kempe Gowda's Pete (an area in the city with roads laid out in cardinal directions) in Bengaluru in 1537. The settlement of Yelahanka was home to communities involved in many livelihoods. Weaving was one of the most important, due to its proximity to major silk markets like Doddaballapur and Devanahalli to the north and Ramnagaram to the west. Even today, one can see these weavers in Yelahanka Old Town preserving this traditional livelihood.

Yelahanka is also the origin point of the Hebbal Valley and lake system, a site of rich biodiversity. The Yelahanka Lake – at a size of 22 ha. – is one of the largest lakes in north Bengaluru. Upstream, it is linked to the Puttenahalli Lake and the Herohalli Lake, while

GAGANA SHYALE

SAROJNI NARAHARI

Left: **Silk Weaving still continues at Yelahanka Old Town today**
Right: **Residential typology of Yelahanka Old Town- showing a strong response to the street**

KUSUMA. LAVANYA. SNEHA. SUNIL. NAGARJUNA

Changing Terrain of Yelahanka

downstream it flows into the Jakkur Lake before finding its way to the Hebbal Lake System further south. Historically, the natural water systems not only provided access to fresh water and fertile topsoil for agriculture, but also provide a strategic defense mechanism for the settlements in the region including that of Yelahanka.

With the coming of the British, railway lines were laid, which led to splintering of the settlements. The British also used techniques like growing Eucalyptus to drain the marshy land and make it suitable for development. At the end of the 19th century, Bengaluru experienced the bubonic plague. This resulted in far-reaching changes in the evolution of the city. The City Improvement Trust Board (CITB) was formed and new areas were developed like Malleshwaram to the north and Basavangudi to the south of the Pete. Post this period, the degradation of the water systems and lakes were accelerated. The value of the water bodies changed from life-giving and sustenance to that of recreation and aesthetics. The city started receiving piped water for drinking. The inter-dependency between the settlement and its water bodies was disrupted. Today, Yelahanka is strategically located close to the Bengaluru International Airport Limited (BIAL) at Devanahalli. During the last decade, Yelahanka has developed as an institutional area with several schools, colleges and a burgeoning residential apartment market.

In 2018, responding to a crisis of excessive traffic congestion, the Karnataka government announced a package of INR 1600 Crores to develop a suburban rail network in Bengaluru to support the metro and bus networks that are already in place. One of the key objectives was to connect the BIAL at Devanahalli to the main railway station at the centre of the city. This connection would pass through Yelahanka. In order to finance this massive investment, it was also proposed that all railway lands within Bengaluru would be allowed a premium FSI of 5.0 and value would be captured from developers using this FSI. Yelahanka has large tracts of railway land and is a beneficiary of this policy. The total area of land available under the railways at Yelahanka is more than 100 ha.

The envisaged development, if realised, would be up to twice that of Manyata Tech Park, which is a large job centre in North Bengaluru that employs more than five hundred thousand people and has contributed to the traffic congestion problem in the surrounding area. The question of allowing high FSI onto the site and consequently impacting the ecology and communities residing there begs to be asked. Development of this magnitude is not only a threat to the biodiversity and demography of the area; it could be catastrophic from the perspective of limited water resources. A study

When places with a delicate balance of ecology and community are bombarded with the onslaught of infrastructure, native or local processes and practices get impacted

was conducted by students of M. Arch (Urban Design) at the BMS School of Architecture, Yelahanka, Bengaluru, to understand the impact of such a development on the area of Yelahanka. The drawings and data collected by students help to illustrate this argument in detail.

When places with a delicate balance of ecology and community are bombarded with the onslaught of infrastructure, native or local processes and practices get impacted and replaced by an exploitative model. This causes perpetuation of unsustainable practices resulting in irreversible damage to the ecosystem. In order to counter the flow of such practices, an assessment of carrying capacity needs to be undertaken. The assessment can be categorised under the following triad of parameters, namely: Nature, Culture and People.

Nature, or ecology includes those aspects that are a function of terrain or geography like water source, fertile topsoil, existence of biodiversity in flora and fauna. These aspects are provided by nature but in limited quantities. The thumb-rule indicators that would help

KUSUMA. LAVANYA. SNEHA. SUNIL. NAGARJUNA

Splintering of the old settlement of Yelahanka during the Colonial period

guide us would be availability and health of fresh drinking water (from surface or underground sources), extent and types of vegetation cover in the area, number of native species comprising the vegetation cover and amount and range of food grains that are grown in the area.

Culture includes those aspects that are customs, rituals, knowledge-systems, art-forms, which are made from human experience of the place. Culture also includes seasonal variations of crop patterns or human activities, seasonal calendar of rituals and customs, availability of local building materials and mineral resources, development of architecture and the arts.

The thumb-rule indicators that would be critical to consider would be presence of knowledge systems about habitat including forests and settlements, traditional practices of agriculture and building given the type of terrain, the tangible and intangible culture that developed over the years, art-forms which would be a repository of this ancient wisdom, knowledge of managing climate crisis such as droughts or floods that are passed on from oral traditions.

People includes those aspects that are related to communities that inhabit the area for generations or even those who migrated to the area recently. It is about their livelihoods and occupation, change in demography and family structures, ambitions and aspirations.

The thumb-rule indicators that would help us study these facets of communities would be levels of poverty or affluence, the trends of migration of communities and change in their occupations over the years, the resilience of communities to weather through crisis be it health related or economic, health status of women, children, elders and other vulnerable stakeholders.

The Yelahanka study gives evidence that it's vital to have a nuanced approach to development, one that considers the impact on ecology and inclusiveness.

How much development is too much development?

It is evident from a UN Habitat database that densities in Asian and African context are more than double of European cities and almost ten times that of land rich, developed countries such as the United States and Australia. That essentially translates to a higher number of people living in a per square kilometre area.

KUSUMA, LAVANYA, SNEHA, SUNIL, NAGARJUNA

Yelahanka today

PEOPLE-CULTURE-NATURE framework

CIRCULAR GRAPHIC FOR CULTURE-HTTPS://WWW.RELOCATEMAGAZINE.COM/
CIRCULAR GRAPHIC FOR PEOPLE-HTTPS://WWW.GOOGLE.COM/
CIRCULAR GRAPHIC FOR NATURE - HTTPS://WWW.NATURE.ORG/EN-US/ABOUT-US/WHERE-WE-WORK/INDIA/
INFOGRAPHICS TAKEN FROM THENOUNPROJECT.COM

Within the Asian context, Indian cities experience higher migration from rural areas. This results in further pushing up densities of inhabitants. Planning, more often than not, tends to be about accommodating densities, rather than preparations for the future. In such a context, people densities and not built-up densities, should be linked to provision of affordable housing, provision of adequate social amenities and access to physical infrastructure and open spaces. TOD policies need to be reworked to ensure checks and balances that address these exigencies.

The outbreak of COVID-19 has impacted the entire world, countries are struggling to ensure social-distancing norms in densely populated cities. However, in the developing countries there is an additional burden of ensuring the most vulnerable groups survive unemployment and hunger during large-scale lockdowns.

During the pandemic, we have also witnessed nature reclaiming its rightful place in our cities. Examples are seen in the form of the clean Yamuna water in Delhi or the renewed flow in the Arkavathy at Bengaluru.

This proves that rampant urbanisation has been impacting the terrain and people adversely. We have been largely ignorant of such underlying conflicts because the focus has always been about a fast-growing economy at all costs.

So how do we return to a sustainable balance of economy with ecology and equity?

We have talked far too long about cities as engines of economic growth, but cities also exist because of the terrain or geography they sit on and the people who inhabit them. The conversation needs to shift from the primacy of economy over ecology and equity to a trialogue, which will calibrate the impact of economy on ecology and equity as a pre-condition.

For this, an assessment of carrying capacity needs to be done based on context of geography and its people. This can be done by preparing TOD zone suitability mapping by layering and giving weightages to both ecological and equity parameters (terrain/availability of land, density of vegetation, ground water levels, bio diversity, vulnerable groups, migrations, livelihoods and aspirations of people) and transit parameters (mass transit networks, ridership, jobs around transit etc).

Acknowledgement: This article is an outcome of the work done by 3rd semester, Masters in Urban Design students of BMS School of Architecture, Yelahanka. We acknowledge the hard work and contributions by Shikha, Dhruva, Vanitha, Roja, Sarojini, Mahima, Kusuma, Sunil, Parichita, Madhuri, Lavanya, Hemanth, Sneha and Shilpa from the 2017-2019 batch, M. Arch UD, BMSSA, Yelahanka.