

REFEREED JOURNAL OF IIA | ISSN-0019-4913

2019 AUGUST | VOLUME 84 | ISSUE 08 | ₹ 100





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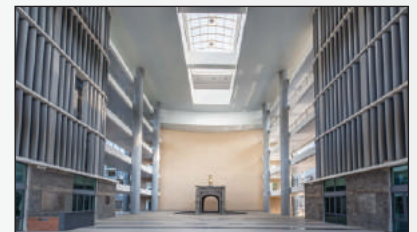
ISSN-0019-4913

REGISTERED UNDER SOCIETIES REGISTRATION ACT, XXI OF 1860

JOURNAL OF THE INDIAN INSTITUTE OF ARCHITECTS

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Printed & Published by **Ar Anand Palaye** on behalf of **The Indian Institute of Architects** and printed by **Foto Copy Design Studio**, M-2, Sai Vihar, 22, Mint Back Road, Fort, Mumbai 400 001 and Published at **The Indian Institute of Architects**, Prospect Chambers Annexe, 5th Floor, Dr D N Road, Fort, Mumbai - 400 001.

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Ar. Anand Palaye

EDITORIAL

Dear Fellow Architects and readers

In our continuing effort to provide varied information to our readers about architectural happenings in our country, we present the following papers and articles which will be of interest to our readers.

Veer Surendra Sai Airport at Jharsuguda (Odisha), named after a well-known freedom fighter, can be easily considered as an example of successful efforts for providing sustainable infrastructure across India that will contribute to the region's overall development in a sustainable manner. **Ar. Kanav Khosla** has presented their design for this compact and energy efficient airport terminal building that also provides glimpses of historical heritage.

In the ongoing process of urbanization in our nation, formation of cities has far reaching effects on its residents and their lives. **Prof. (Ar.) Jit K. Gupta** and **Ar. Anoop Sharma** in their paper on how a Compact city as an option can offer a viable solution for achieving the goal of sustainability in urbanisation.

All buildings consume energy for various purposes and need for adequate lighting is a major component responsible for a building's energy consumption detail. **Ar. Dhanashree Gugale** in her paper on Daylighting in an Office Building explores ways to optimize energy consumption through use of daylight in design process.

Rivers in India are an important factor in our culture and river Ganga and its legendary Ghats at Benaras have a unique situation and position. **Prof. Nishita Tadkodkar** presents a detailed study on the cultural and spatial intertwining of Ganga Ghats at Benaras.

Presently use of computational tools is at a very high level in the field of architectural design process and especially in evaluating a building's performance at design stage. **Ar. Mukta Deshpande** and **Dr. Ar. Abraham George** in their paper on Analysis of existing methods of building performance and optimisation provide a comprehensive insight into these tools.

Typically, an administrative building is a face of the authority and it has a distinct bearing on the society by way of its image and it also influences how common people perceive the functioning of the government machinery through these buildings. **Dr. Parag Narkhede** and **Ms. Shivani Bhandari** present detailed case studies on various design aspects of an administrative building.

We are sure our readers will enjoy these papers and articles.

Ar. Anand Palaye

Chairman - Publication Board & Executive Editor, JIIA



Ar. Divya Kush

PRESIDENT'S MESSAGE

Dear Fellow Architects,

Warm Greetings,

Friends, as you all know that our country is faced with various natural disasters across the states on a regular basic year after year. Our Central and State Governments and a number of other social organisations did their best to mitigate the hardship faced by the people and also had taken preventive measures. It gives immense sense of satisfaction that various Chapters and Centres of IIA as well as a number of Individuals from our fraternity have been making a significant contribution in this common endeavour. The initiatives taken by members of the IIA Kerala Chapter are particularly noteworthy and worth being followed.

I am also happy to inform you that, we have received a record no. of 517 valid entries for the IIA Awards 2018. The 1st stage Jury was held at IES College of Architecture, Bandra, Mumbai. The Jury consisting of eminent architects went through an elaborate process of evaluation for shortlisting 84 entries for the consideration at the 2nd and final stage of Jury to be held from 2nd to 4th October, 2019 at Trivandrum followed by grand Award Ceremony in the evening of 4th October, 2019.

Another important event of The Arcasia Forum 20, 40th Arcasia Council Meeting and 50th Anniversary celebration are scheduled to be held in Dhaka, Bangladesh from 3rd-7th November, 2019 and the theme of the Forum is "Architecture in Changing Landscapes" and with the sub themes of Technology, Culture, Environment, Economy and Pedagogy. It will be a pleasure to see our members attending these events in large numbers.

This issue of the Journal has articles & research papers by authors on important subjects like airports in smaller cities that will help growth of infrastructure, issues related to ongoing urbanization and compact cities as possible solution, optimization of day light use in modern office buildings, analyzing the intricate relation of Ganga Ghat, analytical comparison of computational tools for building design performance and impact of administrative buildings and so on.

I am sure, as always, the papers & articles in this issue will prove to be very interesting & informative for the readers.

A handwritten signature in black ink that reads "Divyakush". The signature is fluid and cursive, with a long vertical stroke at the end.

Ar. Divya Kush
President,

The Indian Institute of Architects



Day 0 :
02nd Oct 2019

Venue 1 :

9:30 AM - 12:30 PM - Closed door Jury on exhibition
12:30 PM - 1:30 PM - Lunch Break
1:30 PM - 4:00 PM - Jury Continues

6:30 PM - Inauguration of the Event
7:10 PM - Introduction of TAAC
Dinner and Fellowship

Day 1 :
03rd Oct 2019

Venue 1 :

8 AM - Registration starts
9:30 AM - Inauguration of the exhibition of the shortlisted entreis
10 AM - Screening of the short listed entries of national short film competition
12 PM - Keynote on the theme TAAC
1:45 PM - Lunch break
1:45 PM - 3 PM - panel discussion
5:30 PM - Lawn evening
6:30 PM - Culturals and Networking
7:30 PM - Dinner and fellowship
9:30 PM - Music band

Venue 2 :

8 AM - Registration starts
9 AM - 4 PM - Jury presentation starts at
 Screen 1
 Screen 2
 Screen 3
4 PM - Tea and lunch will be served at the venue

Day 2 :
04th Oct 2019

Venue 1 :

9 AM - Key Note 1
11:30 AM - 11:45 AM - Tea Break
11:45 AM - 1:15 PM - Key Note 2
1:15 PM - 2:00 PM - Lunch
2 PM - 3:30 PM - Key Note 3

3:30 PM - 5:30 PM - Beach Event and Tea
6 PM - 9 PM - Award Night and Culturals
9:30 PM - DJ starts

For further details, kindly Email us on iiatvm@gmail.com



Department of Science & Technology
Govt. of India



IUSSTF
Indo-US Science and Technology Forum



Building Energy Efficiency Higher & Advanced Network (BHAVAN) Fellowships

Recognizing that climate change, clean and efficient energy and environmental protection are among the biggest challenges facing India and the United States; cooperation between our countries is critical in tackling these issues. In order to address the need for human resource development and capacity building in these frontier areas, the Department of Science and Technology, Govt. of India and the Indo-U.S. Science and Technology Forum (IUSSTF) have partnered to launch the **Building Energy Efficiency Higher & Advanced Network (BHAVAN)** Fellowships with an aim to nurture contact between students and scientists of science and technology from India and the US.

Eligibility

For Student Internships

- Indian citizens currently pursuing Ph.D. / M.Tech. / M.S. (Research) / M.Arch. in Science, Engineering, Technology or Architecture at a recognized institution of higher education and learning in India.
- Age:** Upto 32 years as on 31 December 2019.
- Areas:** Building Energy Efficiency / Built Environment / Habitat Energy Efficiency.

For Fellowships

- Indian citizens having Ph.D. / M.Tech. / M.S. (Research) / M.Arch. in Science, Engineering, Technology or Architecture in the specific area of Building Energy Efficiency / Built Environment / Habitat Energy Efficiency. Relaxation in qualifications could be made for individuals with proven and considerable research background and experience who are part of a recognized institution of higher education and learning in India.
- Applicants must be pursuing independent research on extra-mural / industry-supported research projects and should have credentials expected of an established researcher.

- Age:** Upto 40 years as on 31 December 2019.
- Employment:** A regular position in a public-funded R&D Laboratory / S&T institution / recognized academic institute (University / College) in India.

Objectives

- To provide opportunity to best and brightest Indian students and scientists to gain exposure and access to world class research facilities in U.S. academia and labs.
- To promote research and capacity building in the frontline area of Building Energy Efficiency.
- To pave way for the next generation scientists and technologists from India to interact with American peers, thus helping to build long-term R&D linkages and collaborations in this domain.

Fellowship/Internship includes

- Monthly Stipend
- Contingency Allowance
- Return Airfare
- Health Insurance

Duration

- Internship:** Minimum 3 months and upto 6 months
- Fellowships:** Minimum 3 months and upto 12 months

Submission Deadline: 30 November 2019

For program information contact:

Indo-U.S. Science and Technology Forum

Fulbright House, 12, Hailey Road, New Delhi - 110001, E-mail: energy.fellowship@indoustf.org

For Proposal Guidelines and Format please visit: www.iusstf.org

Veer Surendra Sai, Jharsuguda Airport - Odisha



Ar. Kanav Khosla - Email : kanavkhosla@gmail.com

Ar. Kanav Khosla, has a Bachelor in Architecture degree from M.I.E.T., Nagpur University in 1998 and has done his Masters in Urban Design from Oxford Brookes University U.K. His Principle objective is to focus on the requirements and desires of the clients through continuous collaboration and interaction. Ar. Kanav Khosla has been practicing under the style of the firm AVINASH KHOSLA AND ASSOCIATES, established since 1968, and have a pan India presence with an experience of more than 51 years in this field. He has a holistic approach to Architectural Design and Construction services combining the abilities of a variety of Professionals and Specialists into a Co-ordinated Team. Grounded in Modern Building construction technologies, the Firm also possesses expertise and has produced architecture reflective of the distinctive Contemporary Architecture for many projects.

The Airport at Jharsuguda, inaugurated by the Worthy Prime Minister of India on the 22nd of September 2018 is the SECOND AIRPORT TERMINAL BUILDING IN THE STATE OF ODISHA.

Popularly known as the Powerhouse of Odisha because of the large number of power plants located nearby, Jharsuguda Airport serves this fast emerging economic hub of the State.

This airfield was used way back during World War II by the RAF and other Allied Forces to counter Indian Freedom Fighters led by Shri. Subhash Chandra Bose. After India gained Independence from Allied Forces, the airfield was abandoned. A feasibility study was carried out by AAI to revive Jharsuguda

Airport, which, by then was occasionally used by general aviation aircrafts and decision was made to upgrade it for commercial operations. Odisha Government signed a memorandum of understanding (MoU) with the Airport Authority of India for development of the State's second Airport at Jharsuguda in Odisha.

Named after the well-known freedom fighter VEER SURENDRA SAI, Jharsuguda Airport covers an area of 1027.54 Acres. The Airport Infrastructure has been developed for all weather operations. The development works include The Terminal Building, A.T.C. Tower, Fire Station and ancillary works.



Simple Straight Line Façade



Murals Displaying Rich Heritage Of The State

The Terminal Building is an R.C.C. composite structure equipped with state of art passenger facilities. Terminal building at Jharsuguda is a two level building primarily comprising domestic departures and arrivals at the lower level along with services and offices at the upper level. The approach to the building is through a 16 m wide dual carriage road from the main highway about 2 km away from the Terminal Building. Profiled into a vault sloping towards the Air Side, the Terminal Building stands elevated over the surrounding, otherwise undulating terrain and is visible from afar as the beacon of the new development.

Commissioned by the Airports Authority of India, the Architect has planned and furnished the building to provide maximum passenger comfort and to facilitate efficient functioning within a limited budget and time schedule. Approached through a large canopy space on the city side, the Terminal provides a comfortable alighting area for Departing and Arriving passengers in the harsh climate. The large and continuous passenger concourse gives way to the Security Hold and the Arrivals Baggage claim halls.

The interior of the building exhibits local handicrafts and artworks of the state highlighting the rich ethos and culture of the region. The city side is aesthetically landscaped with lush green areas connecting passengers to nature.



Continuous Passenger Concourse



Extended Canopy Around The Terminal

The Terminal Building has been developed as sustainable multi-level structure with extended porticos and projections all around to reduce thermal gain. High performance glass has been used in the building to reduce solar exposure. The roofing system of the building has been designed as a Multi-layer Galvalume sheet roofing over a portal frame structure to reduce heat gain inside the structure and increase efficiency of the air conditioning services incorporated inside thus increase comfort levels of the passengers and staff inside.

All internal electrification and lighting has been designed with LED panels to conserve energy. Air-conditioning has been centralised through a common location for all buildings. The Terminal has been compartmentalised and segregated for efficient air-conditioning and to reduce air leakages.

Water resources can be conserved by use of conventional gravitational water supply systems in place of hydro-pneumatic which reduce pressure on piping systems and reduce water wastage. Grey Water treatment systems along with reuse of recycled water has been implemented on site along with rain water harvesting provisions.

A simple yet elegant structure, Jharsuguda Airport is an attempt to humanise an otherwise energy guzzling building by use of Green and sustainable materials like fly ash bricks, high tensile steel, and Aluminium Composite Panel Cladding systems to make the building sustainable and energy efficient by design.



Profiled Roof Sloping To Airside



Reflective Façade With Highlighted Entrance

Compact City as an Option for Making Indian Cities Smart and Sustainable



Prof. (Ar.) Jit K. Gupta - Email : jit.kumar1944@gmail.com

Prof. (Ar.) Jit K. Gupta, Chairperson, Chandigarh Chapter, IGBC has an experience of five decades in architecture, architectural education, urban and policy planning. He is the former Chairman for Board of Studies (BOS), Architecture, Punjab Technical University; V.P. of Indian Institute of Architects; Member of BOS, Architecture for Punjab University, Indraprastha University and Manav Rachna University. Part of the Co-opted Member Working Group of the Planning Commission of India for the ninth five-year plan, he has authored more than 250 technical papers for global conferences and has delivered lectures/orations in universities in Detroit, Ohio, Switzerland and at SAARC (Kathmandu and Bhutan).

Ar. Anoop Kumar Sharma - Email : anoop.sharma@smvdu.ac.in

Ar. Anoop K. Sharma, is serving as Professor (Asstt.) at School of Architecture & Landscape Design, Shri Mata Vaishno Devi University, Katra (Jammu & Kashmir), since 2009. He is a graduate of NIT-Hamirpur from 2003 batch. Presently, he is actively engaged in his research endeavors aimed at enriching the Built Environment.



ABSTRACT: *Paper searches for appropriate solutions and options to make Indian cities more sustainable, productive, livable and least consumers of energy and resources. In search for appropriate solutions and options, paper objectively looks at the prevailing pattern of urbanization, city planning and development in India; road blocks hampering the sustainability and livability in urban centers; options for making Indian cities promoters of environment and ecology through planning compact cities; adopting mixed land use, minimizing urban sprawl and increasing densities.*

KEYWORDS: *Compact cities, mixed land use, urban sprawl, density.*

I. INTRODUCTION

Cities have existed in the past and they shall continue to exist in future also. Cities are known to be definers of history and scripter of the journey of growth and development of mankind. Cities are places where large number of people live and work. They are hubs of governance, commerce and transportation. Cities are known to be places of concentration, consolidation and dominance besides promoters of economy, generators of wealth and providers of higher order of infrastructure and services. Known for concentration, cities have emerged as centers of innovations, excellence and achievements. Nations and communities depend upon cities to usher an era of quality living and prosperity. With globalization and liberalization dictating the economies, urbanization is known to usher an era of considerable economic and social transformations, putting cities at the centre stage of economic growth and development. Cities enjoy distinct advantages of economies of scale in their operation and management. Due to large concentration of the economic activities, cities are known to be drivers of development and reducers of poverty. Higher levels of literacy and education, better healthcare, greater access to social



services and enhanced opportunities for cultural and political participation are the hallmark of urbanization and urban living. However, despite distinct advantages, cities are places where inequality is found to be norm/rule rather than exception with millions of urban residents living in slums/sub-standard conditions. Cities are also known for their dualities and contradictions where poverty and prosperity compete, where skyscrapers and slums are seen to rub shoulders, where

unplanned and haphazard development have emerged as the order of the day, where informal sector do not find place in city growth and development and where majority of residents are excluded from the planning process and provision of basic services and amenities. Cities are also known to be promoters of inequality and exclusion besides global warming. Rapid and unplanned urban growth threatens sustainable development and perpetuates adverse quality of life when policies are not implemented to ensure that the benefits of city life are equitably shared with people and communities. Unplanned or inadequately managed expansion also leads to urban sprawl, pollution, and environmental degradation, together with unsustainable production and consumption patterns. Because of large consumers of energy and non-renewable resources, cities are responsible and known to be promoters of climate change and global warming. Considering the role of cities in promoting sustainable, economic and social development besides environmental protection of communities and nations, it becomes critical that a new urban agenda is immediately defined and put in place for integrating all the facets of urban development to promote sustainability and livability in urban settlements. New urban agenda is required to effectively address the emerging threats and challenges and take advantage of the opportunities offered by urbanization to make it more sustainable, productive, effective, efficient and equitable.

II. INDIAN URBANIZATION

Indian urbanization, beginning with Indus Valley, has history spanning over 4500 years when cities and towns were largely associated with the seats of administration, capital and trading centers. Context however underwent a qualitative and quantitative change under the impact of industrialization with the arrival of the Europeans in India; large number of adversities and geo-political factors including famine and plague; epidemic; agricultural depression; two global wars; massive migration propelled by partition of country, planning new urban centers, rapid industrialization, green revolution, better basic healthcare, education and entertainment services and amenities; increased mobility, expanded transportation network, better employment opportunities, rapid technological advances and ever increasing trade and commerce, in the post independence period which led to increased footfall in cities. However, Indian urbanization suffers from the malaise of being subsistence in nature, generally propelled by push factor involving poor migrants moving from rural areas to urban environment for better economic options and employment opportunities, adversely impacting quality of life in the urban spaces. Indian urbanization is distinctly characterized by polarization and concentration of the population, economic activities and services in the metropolitan centers while small towns continue to stagnate. Indian urbanization, globally known for its peculiarities, has been called slow, massive and sometimes disguised by the World Bank. Despite level of urbanization

standing at 31.1% in 2011, India as a nation holds the distinction of being the second largest urban system in the world after China.

Year 2007 is considered a watershed in the global demographic history, when for the first time global urban population exceeded the global rural population and the world population has remained predominantly urban thereafter. Year 2011 will be remembered in the demographic history of India for two distinct landmark developments involving; urban India adding more people (91 million) than Rural India (90million) and for the largest growth in the number of towns placed at 2774 (from 5161 to 7935), putting India on the fast track of urbanization.

In the Indian context, next four decades are likely to witness enormous growth in terms of number of urban centers, their size and population. It is estimated that number of urban residents will grow to 590 million in 2030 and 800 million by 2050 when Indian population will be 1.4 billion and 1.6 billion. India is projected to take over China in 2036, becoming the largest populated country globally. Estimates made in World Urbanization Prospects – The 2014 Revision Report of Department of Economic and Social Affairs, United Nations, 'India by 2030 will have 7 cities with population exceeding 10 million and 2 cities of population above 5 million. By 2050 AD, number of Metro Cities will go beyond 100 and 10 million plus cities will be 9 with Delhi becoming second most populated agglomeration in the world after Tokyo city'. In the given context, urban centers are likely to emerge as major settlements, housing large proportion of Indian population besides making sizeable contribution to the national (75% in 2031) and global economy. Urban India would be the major propeller of economy, generator of employment and scripter of the future growth and development story of India. To make this a distinct reality, cities will require a new order of growth agenda and large investment and efforts from all stakeholders to meet the greatest challenges of providing adequate shelter, healthcare, education, mobility, water sanitation and poverty, pollution, exclusion and quality of life in urban India. With urban population reaching 590 million in 2030, greatest challenge before urban planners, architects and policy makers would be, how to harmonize the growth and development of urban India and make it rational.

Growth of cities is largely dictated by urban planning, development and management processes. Uncontrolled and haphazard pattern of urban expansion is considered wasteful both in terms of land, energy consumption and greenhouse gas emissions. Accordingly, it will be appropriate to look at the prevailing planning, development and management practices in India, identify roadblocks and redefine new order of urban planning and development options to make cities smart, green, more humane, equitable, just, efficient, productive, sustainable and providers of assured quality of life to all urban residents including poorest of the poor.

III. PLANNING FOR COMPACT CITIES

Cities have been globally recognized to be major catalyst for promoting global warming and climate change, being largest consumers of fossil fuel based energy and generators of green house gas emissions. Cities, are known to consume 60 to 80 per cent global energy, and generate 70 per cent human-induced greenhouse gas emissions, primarily through built environment and transportation. However, cities offer numerous opportunities and options to develop, mitigation and adaptation strategies to deal with climate change and sustainability especially through urban planning and design process by rationalizing land use pattern, adopting innovative design solutions, prescribing optimum densities and creating green travel options which minimizes car ownership and promote walking, cycling and public transport.

Unfortunately, all our urban planning tools and planning strategies have been leveraged to promote rapid expansion and sprawl of cities, both in population and area. Majority of the Master plans prepared for promoting the planned development of the urban areas have used the mechanism of providing series of ring roads and bye-passes around the existing cities to create additional urban areas and promote faster movement of vehicles. Focus has always been planning for vehicle rather than people and promoting decentralization of population and activities. This has led to uncontrolled expansion and urban sprawl in physical terms leading to increased distances between places of living and working and entertainment besides accessing basic amenities and services used by urban inhabitants. Accordingly, urban areas are witnessing increased number of vehicular trips and trip length leading to building more roads, encouraging more car travel and creating more air pollution, making cities expand outward. Studies have revealed that urban dispersal is known to cause 20 to 50 per cent higher air pollution than compact development. In addition, urban sprawl has proved to be

economically inefficient, especially in the provision, operation and maintenance of services and infrastructure because of larger length ,breadth and depth of urban services network. Urban sprawl is also known to be large consumer of agricultural land. India, with only 2.4% of the global land and home to 16.7% of the global population, is already highly land stressed. As the negative environmental, economic and social effects of urban sprawl become increasingly visible through traffic congestion, social isolation and the continual loss of valuable land on the urban fringe, it becomes clear that continuing this pattern of development into the future will be highly unsustainable. Accordingly, urban planning must focus on making cities least consumers of land and resources by making them look inward. All urban policies and planning tools which make cities look outwards and promote urban sprawl have to be replaced to make cities look inward and more compact.

Existing urban planning practices based on the principles of low density development, automobile dependency and single-use development are known to be promoters of urban sprawl and economic, social and environmental unsustainability. This outlines the need for change the way urban areas are being planned and designed to make them more sustainable. The Compact city hypothesis, introduced as an alternative to urban sprawl, focuses on optimizing the use of urban land, limiting the peripheral expansion, intensification of activities, increasing densities, minimizing mechanized transportation, minimizing car ownership and redeveloping underused or abandoned sites. The compact city model will help in promoting efficient use of existing land resources and infrastructure, as well as reducing automobile usage and promoting public transportation, which becomes more viable at higher urban densities.

Compact city, as a concept, has gained global acceptance among planners and urban designers because of its distinct

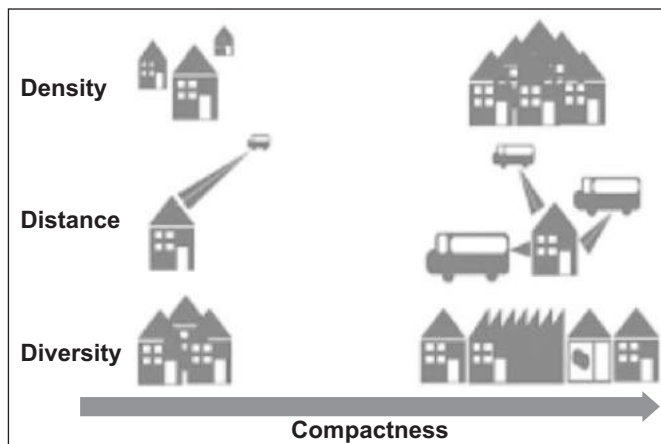
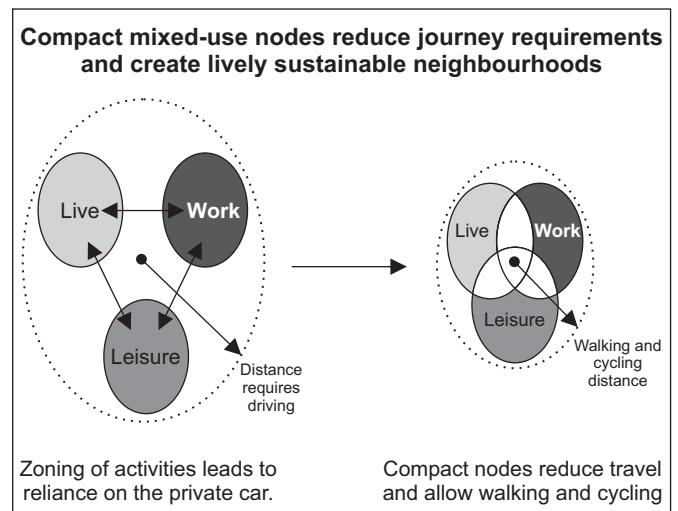


Fig. 1 - Illustration of the terms Density, Distance and Diversity as applied in the compact cities model



advantages. Compact cities are known to create urban settlements which are human centric with relatively high densities, using mixed land-uses with considerable design quality. These cities are known to be oriented towards high degree of public transport accessibility with focus on walking and cycling as preferred mode of travel. Compact cities are known to be anti-thesis and antidote to excessive urban sprawl, mono-functional suburban housing, and peri-urban development besides promoters of the sustainable development within the urban environment. As per, Burton, 2002, compact city is distinguished by three essentials identified as : a high-density city, a mixed-use city, and an intensified city , in which first two are related to the form of the compact city, while the third focuses on the process of making the city more compact. The third point remains most critical because there are few opportunities for a compact city to be created from scratch (Williams et. al., 1996:83). Objective of creating compact cities can only be achieved through a process of making existing cities more dense by creating building at higher densities and mixing of compatible urban uses. Mixed-use development traditionally reduces travel times by locating businesses among residential areas in close proximity, making more people to walk or cycle to work, while reducing the distance travelled to conduct daily activities in comparison to single-use dominated cities. Mixed-use development has the distinct advantage of promoting economic sustainability for local businesses, as they are located within close proximity of a greater number of people, therefore increasing 'foot-traffic' and improving social equity through decreasing the need to own an automobile to access many of the destinations required by local residents. Options for mixed-use development could be a horizontal (where individual developments of different uses sit side-by-side) or vertical (a variety of use within the individual building) mix of uses within the same development.

In addition to mixed land use, planning of compact cities will be largely guided by principle of optimizing the land resource by using land on the principle of 24x7; where number of public amenities and services will be provided on multiple use basis; where the open areas provided with institutions will also be available to communities for their daily use and where institutions will be used on multiple basis. Planning of compact cities will need new order of land use pattern where the area under traffic and transportation will be reduced due to minimization of mechanized travel, planning norms for amenities and services shall be rationalized and plotted development shall be replaced by mixed-use flatted development to achieve higher densities and promote compactness. Building bye-laws and development controls will have to be re-defined to permit more built-up area using minimum land. City shape and pattern of growth will also undergo qualitative change to achieve higher operational

efficiencies and minimize urban sprawl. In nutshell, a new regime, order and pattern of urban planning, urban development and urban legislation shall be required to be put in place to achieve compactness of cities.

Considering enormous environmental concern cities have, compact cities offer distinct advantages as promoters of sustainability because of shorter distances to be travelled, reduced number of vehicles on the roads and lower energy consumption. These cities are also known for their livability and quality of life due to less pollution and lesser number of vehicles on the roads. Compactness also makes cities more inclusive by making them people centric. In addition, they offer urban environments which is operationally efficient because of having high degree of utilization of urban infrastructure and services. Dense development also makes cities highly land and resource efficient. Compact city also enables promoting a culture of shared economy, where individual ownership of goods and services is transferred across the neighborhood and communities. Compactness also makes city safe against crime and promoters of more social interaction, making cities socially more vibrant. Because of less car-oriented, these cities are more community oriented and offer distinct social advantages as neighbors know each other more, and there is high degree of human interaction and exchange. Because of high correlations between compactness and productivity, agglomeration effects are key for growth for innovation. Compact cities with green public transport, offer major health benefits by making people more active, healthy and productive as they walk and cycle more.

IV. CHALLENGES OF A COMPACT CITY

Compact city, despite numerous advantages, offer distinct challenges to planners, architects and administrators to make them sustainable These challenges can be enumerated in terms of issues related to affordability, environment, traffic and transportation and heat island. Many cities that have successfully become more compact have also seen a considerable increase in real estate prices making them



unaffordable for majority of urban residents. Accordingly, it will be critical for cities to think and plan for housing affordability and making cities inclusive while promoting compactness. Compact city policies also need to consider its impact on environment due to urban heat island effect. In order to create ambient temperature, city will also have to create large green spaces to minimize adverse impact of compactness on the pattern adopted by Singapore. However, green spaces, unless managed properly, may lead to higher temperatures in more compact, dense, urban environment.

Transport will be another issue requiring focused attention. While minimizing dependence on the personal vehicles, adequate opportunities will have to be created and made operational for seamless mobility in the city through an efficient and smart public transport system in order to make the concept workable and sustainable. This will also include providing attractive and safe options for pedestrians and cycling within the city. Traffic and transportation planning will have to be done with care and caution making communities as active partners. However, there cannot be a straight jacket option for achieving compactness in urban settlements. It has to be city specific, depending upon social, physical, environmental and economic fabric of the city. It will be rational on the part of city authorities to conduct a comprehensive socio-economic survey, identify areas which are vacant, derelict, unused, abandoned, underused, misused and abused within the urban limits and take up their development based on well defined planning and development norms in order to optimize their use and integrate them with the city development process. Buildings, which are not built to their optimum capacity, will also have to be leveraged with owners made to undertake construction up to prescribed height consuming total permitted floor area ratio.

Singapore has already developed a master plan for the city, containing development options for all available land parcels/properties under plotted development to be converted into flatted development. There are many cities in India, which are already hyper dense. Such cities will have to expand into their hinterlands ideally along rapid rail corridors with key elements of compact urban growth attached, In case of cities where the existing urban footprint of the city allows for urban growth, at least for the foreseeable future, it will be appropriate to accommodate most of the urban growth within the existing city. However, green field cities offer numerous options to make them compact. Researchers globally remain skeptical about the benefits and acceptability of the compact city, questioning whether such an approach could be feasible and acceptable because of restriction it imposes on the individual choices over the location and size of their dwellings, which has been the major cause of sub-urbanization and decentralization of most cities in the developed world.

V. CONCLUSION

Cities and towns remain critical in charting and scripting the India's development trajectory. Structural transformation of the Indian economy, sustaining high rates of economic growth and realization of India's economic potential will largely be contingent on the efficacy and efficiency of urban settlements and rationalization of the process of urbanization. Well-managed, urbanization is known to fosters social and economic advancement and improved quality of life. However, urban India is facing greater challenges than ever in terms of growing number of urban residents living in informal settlements, inadequate urban services, climate change; exclusion and rising inequality and poverty; rising insecurity; growing migration, rising global carbon emission. The current models of urbanization and urban planning are highly unsustainable. Majority of Indian cities lack planning, capacity and preparedness to manage effectively the challenges associated with rapid and massive urbanization. Accordingly, a new agenda is required to be scripted and defined to effectively address these challenges and take advantage of the opportunities offered by urbanization. The new urban agenda should promote human settlements that are environmentally sustainable; socially inclusive and economically productive. Compact city, as a model of urban intensification, offers enormous opportunities to make cities more sustainable. Accordingly, appropriate urban planning, development and management framework needs to be evolved and made operational to make compact city model a distinct reality.

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Optimising Daylight in an Office Building for Moderate Climate of Pune



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ABSTRACT : Daylight has been an immortal source of light. Currently, this source is not used optimally and is commonly supplemented by artificial light. The illumination levels are a big contributing factor towards indoor comfort. To optimize daylight in a building, it must be oriented according to solar design. Shading, orientation, window openings are the major contributors in energy efficient building. This paper deals with the quantitative analysis of daylight through different types of openings and fenestrations used in an office building. The study is for the moderate climate of Pune. The paper also helps to understand passive design strategies like building orientation, courtyard effect, building shape, building envelope, shading devices, etc. The analysis is done by generating simulations on software for different WWR (Window Wall Ratio), window sizes and type of glass. The strategies and guidelines for optimizing daylight in an office building are given based on the findings and results generated. Finally which type of office building design and fenestration is best suitable and can give daylight optimization without glare for a given climate is concluded.

INDEX TERMS : Daylight, energy efficient, illumination level, light shelf, office building, overhang, shading.

1. INTRODUCTION

In India among all the building typologies, energy consumption is maximum in commercial buildings. The energy is mainly utilized for lighting the interiors and cooling the building. Lighting and cooling the building again generates heat inside and around the building which in turn increase cooling load. A study shows that about 20-40% energy is consumed for lighting out of the total electricity required for a building.

Harvesting daylight can significantly reduce electricity consumption in a building. However it also require to counter balance the heat gain or heat loss, glare, variation, etc. Many offices use light photo sensors which take advantage of daylight and dimming light so that no more light is produced than necessary. This can improve productivity of an employee and make him comfortable and efficient.

As the cost of energy increases, efforts are made to minimize energy consumption. This can be done by- utilization of daylight in design practice. It is very comfortable to work in natural light than artificial light but excessive daylight can even create glare problem for users.

2. REVIEW OF LITERATURE

A building envelope protects the building from the external environment. This envelope includes roof, external façade,

projections, etc. which act as thermal shell and decides the temperature intake inside the building. In moderate climate there is not much variation in average yearly temperature as the temperature do not reach the extreme levels. The design in such climatic zone can be flexible enough and efforts should be made to reduce heat gain and maintain thermal comfort level.

Shading, building orientation, windows, openings and their sizes are the major contributors in making the building energy efficient.

The daylight penetration inside the room in a working space is an important factor as it influences users ability to have outdoor view and the design of electrical lighting system. For this the daylight should cover maximum room depth by maintaining required lighting levels. According to one of the developed methods, if the depth of the space increases and is more than three times the ceiling height, the daylight factor (DF) in deeper parts of the room might decrease below 1%. [9]

The recommended illumination levels on a working plane in an office is 300-750 lux.

Illumination levels for different task are recommended to be achieved either by day lighting or artificial lighting or a combination of both. [10]

Table 1 : IES standard illumination and for different office spaces

Space	IES Standard illumination (lux)	MS 1525 recommendation (lux)
General offices	500	300-400
Computer room	500	300-400
Conference room	750	300-400
Executive office	500	300-400
Filing room	300	200
Print room	300	300-400

Optimization of daylight mainly depends on passive solar heat gain elements, position and orientation of building and percentage of glazing. Passive building design methods mainly include

- Orientation
- Building shape
- Ratio of wall to window
- Envelopes and Shading devices

All perimeter parts of buildings lying within 6 m of the facade, or twice the ceiling height, are classified as passive, while rest of the other zones are considered non-passive (Fig. 1).

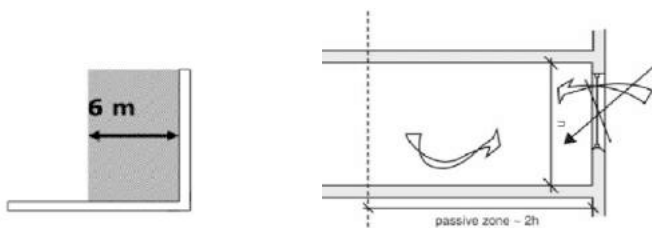


Fig. 1 - Parts of building that can be naturally lit and ventilated are called passive zones [6]

Strategies for maintaining thermal comfort and energy efficiency in a building have to be incorporated at design stage. One of these could be passively design envelopes which actively meet heating and cooling needs of building. Building envelope provide thermal division between indoor and outdoor as well as play an important role in determining how effectively natural light can be utilized in a building.

The research is about which type of window opening and their percentage are best suitable for office building to achieve optimization of daylight in moderate climate (of Pune).

3. METHODOLOGY

Steps :

- 1) Comparison of different types of window openings considering their sizes, projections, shading devices, etc (grid of the building block will be same in each case) in IT office building.
- 2) Designing and orienting them in suitable direction during daytime for two months and analyzing with the help of simulations (May and December)
- 3) Considering WWR same in all the cases maintaining a suitable sill level .8m .
- 4) Observing outputs of different simulations
- 5) Concluding the results and observations

Case studies :

1. KPIT, Pune (window with shading fins)
2. TCS, Chennai (ribbon window)
3. Infosys, Pocheram (window with shading fins and light shelf)

4. UNIT DESIGN FOR SIMULATIONS

4.1 Building Shape

To check which type of shape /form is suitable for office building in moderate climate of Pune, three different forms are considered viz. circle, square and rectangle. The floor plate area is maintained same in all the cases. Daylight simulations are carried out annually orienting the buildings in N-S direction and keeping WWR ratio 40%.

Table 2 : Daylight simulations for different building forms

Form	Circular	Square	Rectangle
Plan			
Day-light simulation			

It is found that the illumination level is more in rectangular form than circular or square form.

4.2 Window Openings

An office building of floor plate 50m x 24m and height 4.2m with central core area is considered as a base module. Same grid is maintained to carry out daylight simulations in seven cases for different window openings. The building block is oriented in N-S direction and openings are provided on same faces. The results are analyzed using Design Builder as simulation software. The WWR is same in all the cases i.e 40% (as per ECBC code). The wall, floor and ceiling reflectance is

kept constant in all the cases. The sill height is maintained at 0.8m. The cases have been simulated for the month of May (summer) and December (winter) and are generated for clear sky conditions. The target task illuminance is set to 300lux. In simulation model the windows are specified with aluminum framing with a single glazed unit having a glass of transmittance value 0.62 the readings are analyzed for lux level 20 to 1000.

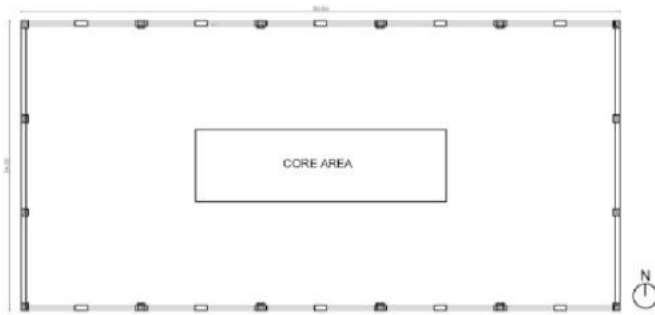


Fig. 2 - Office building floor plan considered for simulations

Table 3 : Types of window considered for simulation

Cases	Window type
Case 1	Box Window
Case 2	Window with overhang
Case 3	Ribbon window with overhang
Case 4	Ribbon window with column spacing
Case 5	Window with light shelf
Case 6	Window with shading fins
Case 7	Window with shading fins and light shelf

4.2.1 Case 1 Box Window

It is observed that for every 1m distance from window the illumination level gradually decreases. In the month of May and December a sufficient amount of daylight can penetrate only upto 3m from the window line. The rest of the office area will have to depend on artificial light.

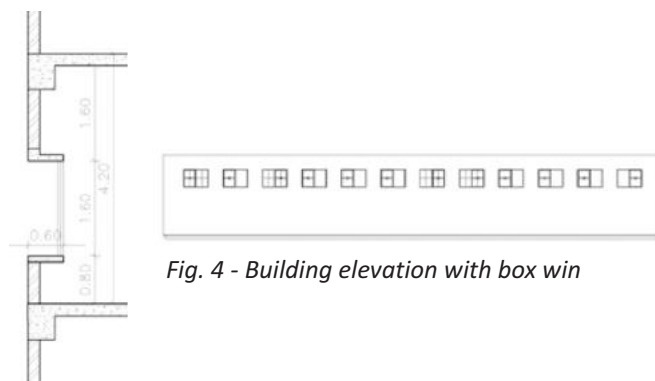
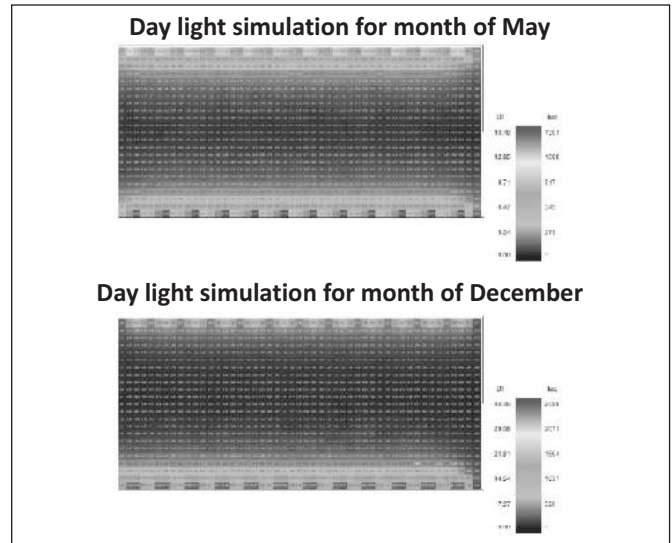


Fig. 3 - Section of Box window

Fig. 4 - Building elevation with box win

Table 4 : Day light simulation for box window



4.2.2 Case 2 Box Window with Overhang

There is a decrease in illumination level for every 1m from the window line. The illumination level is slightly more than case 1. Maximum illumination of 900lux is achieved at 1m distance from the window. In both months about 300lux level is achieved upto 4m distance from the window.

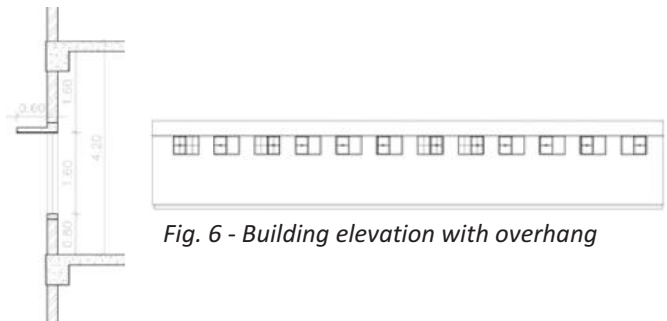
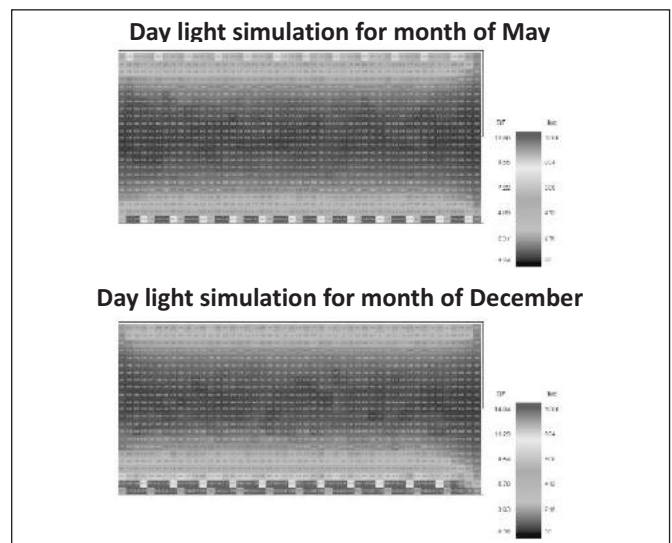


Fig. 5 - Section of Overhang window

Fig. 6 - Building elevation with overhang

Table 5 : Day light simulation for box window with overhang



4.2.3 Case 3 Ribbon Window with Overhang

In this case it is observed that about 300lux is achieved up to 5m from the window for both the months and gradually decreases at the center. The illumination levels are quite more in this case than Case 2. As the opening size increases the illumination level increases.

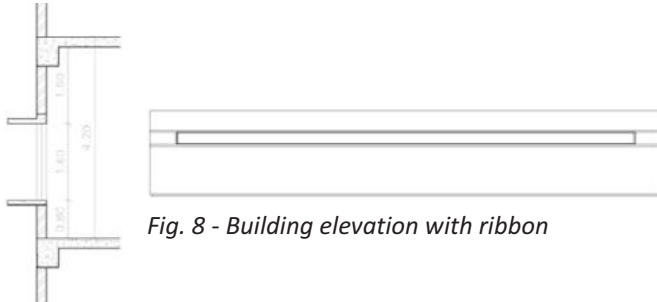
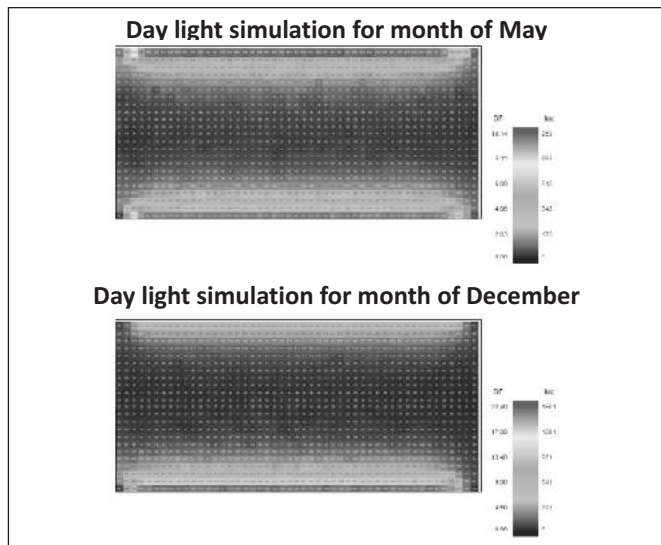


Fig. 8 - Building elevation with ribbon

Fig. 7 - Section of ribbon window with overhang

Table 6 : Day light simulation for ribbon window with overhang



4.2.4 Case 4 Ribbon Window with Column Spacing

In this case it is observed that daylight optimization is more than the earlier cases. Here the columns act as shading device for the ribbon windows and hence more diffused light can penetrate. About 300lux is achieved up to 6m in both months.

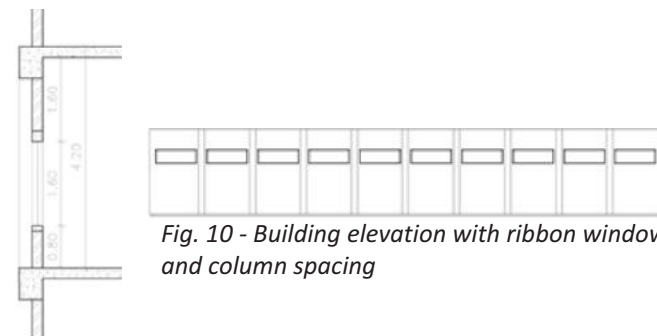
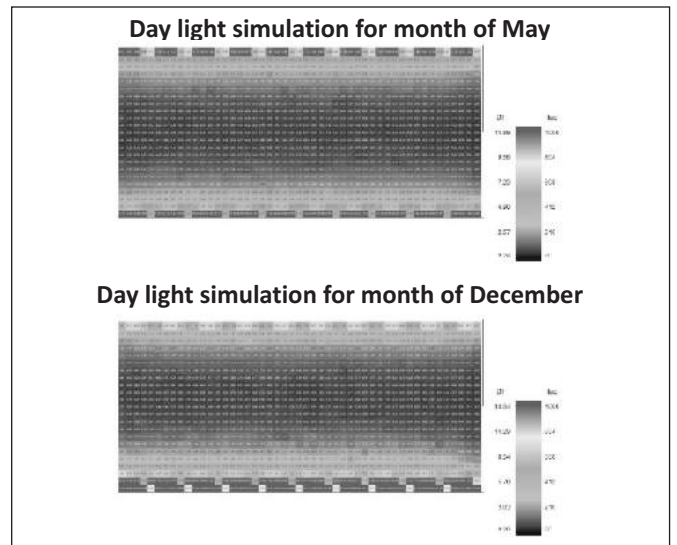


Fig. 10 - Building elevation with ribbon window and column spacing

Fig. 9 - Section of ribbon window with column spacing

Table 7 : Day light simulation for ribbon window with column spacing



4.2.5 Case 5 Box Window with Light Shelf

In this case the daylight penetration is less than case 4. The use of light shelf do not increase the light levels in this case. Daylight penetration is about 300lux upto 4m in the month of May while it is 400 lux upto 4m only from south side in the month of December.

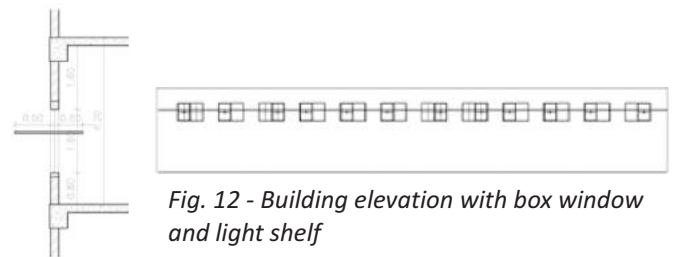
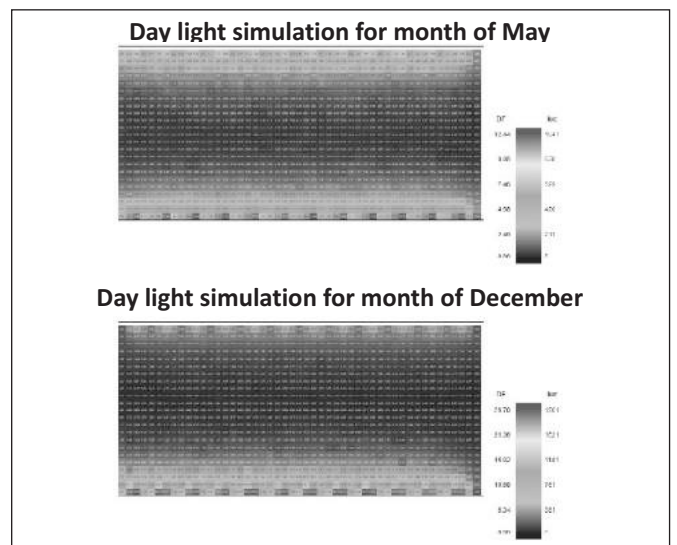


Fig. 12 - Building elevation with box window and light shelf

Fig. 11 - Section of box window with light shelf

Table 8 : Day light simulation for box window with light shelf



4.2.6 Case 6 Window with Shading Fins

In this case the illumination levels are maximum than the above cases. About 300 lux is achieved up to 6-7m. The shading fins allow more diffused light to penetrate inside the room.

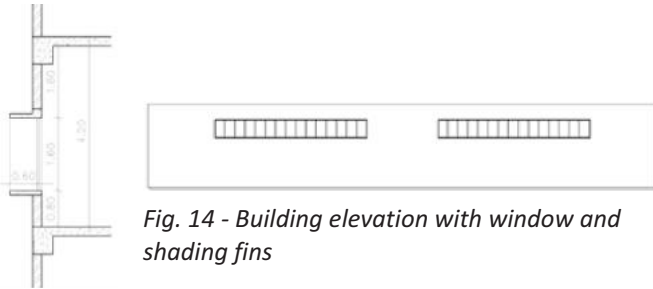
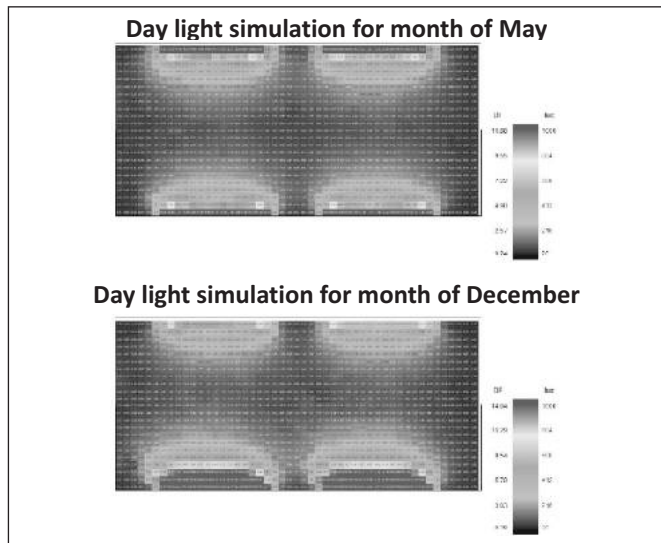


Fig. 14 - Building elevation with window and shading fins

Fig. 13 - Section of window with shading fin

Table 9 : Day light simulation for window with shading fins



4.2.7 Case 7 Window with Shading Fins and Light Shelf

In this case the illumination levels are similar to case 6. About 300 lux is achieved up to 6-7m. The addition of light shelf do not increase daylight penetration in the room. It only diffuses the light near window and provides shading in the lower part near the window.

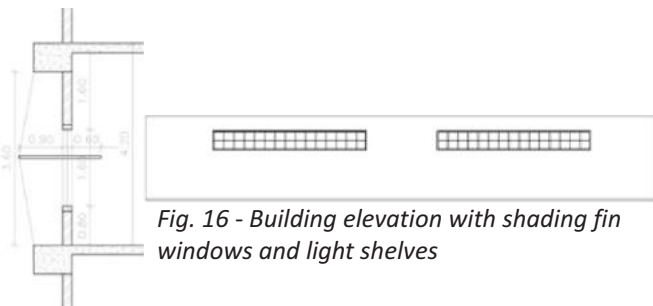
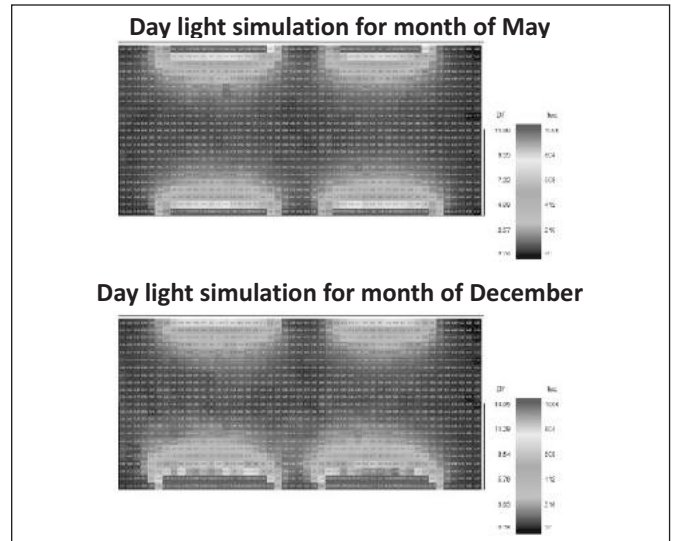


Fig. 16 - Building elevation with shading fin windows and light shelves

Fig. 15 - Section of window with shading fins and light shelf

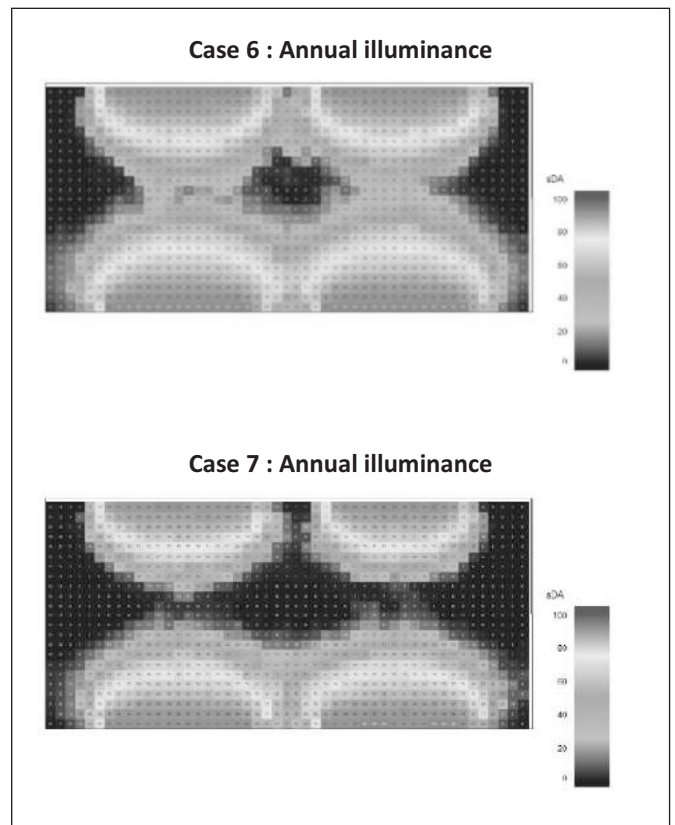
Table 10 : Day light simulation for window with shading fins and light shelf



The illumination levels in case 6 and case 7 are maximum than case 1 to case 5, hence annual day light simulations are carried out to find out which case is most appropriate.

4.2.8 Annual Result for Case 6 and Case 7

Table 11 : Annual illuminance for window with shading fins (only) and window with shading fins and light shelf



The annual daylight simulations show that in case 6 the daylight penetration is more deep and reaches till the center of the room. About 300lux is achieved at the center.

5. RESULTS

Table 12 : Illumination in month of May and December for different types of window.

Cases	Window type	Illumination in month of May (>300lux)	Illuminance in month of Dec. (>300lux)
Case 1	Box Window	42%	29%
Case 2	Window with overhang	50%	50%
Case 3	Ribbon window with overhang	50%	29%
Case 4	Ribbon window with column spacing	55%	55%
Case 5	Window with light shelf	45%	33%
Case 6	Window with shading fins	56%	61%
Case 7	Window with shading fins and light shelf	48%	58%

6. MEASURES TO CONTROL GLARE

Following are the measures which can be adopted to control glare in an office building :

The reflected glare from the extremely bright exterior surfaces like large paving or sand area, parked cars, can be visually uncomfortable. The view of these surfaces must be limited or protected.

A light-color shade can be used for interiors to minimize heat gain.

Fine screens which reduce illumination and glare can be used for shading the window to maintain an exterior view without any obstruction. Louvers or screens that operate upward from the window sill can also be used.

7. CONCLUSION

Every building component has potential for saving energy hence it must be chosen properly. The illumination levels are more in rectangular form office building for moderate climate of Pune. The increase in wall window ratio (WWR) increases daylight penetration but also rises the heat levels in the building. Hence low WWR is recommended i.e <40%. Double skin glazing with low U-value should be used. Day light

enhancement system such as light shelves do not improve daylight levels (in Pune) significantly but shades the lower part of the window and thereby reducing cooling loads in summer. The shading fins can be used to increase the amount of daylight in an office.

Acknowledgment

The authors wish to thank Ar. Prasad Kulkarni, Ar. Medha Deshmukh and Siddharth Chuttar for their guidance in the research work.

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Ghats of Varanasi - A Cultural Landscape



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ABSTRACT : Sites where Community's relationship with landscape over a substantial period of time in terms of the evolving values, beliefs and hence its attitude towards it being a key factor in establishing its identity are often referred to as cultural landscapes.

At the edge of the sacred city of Benaras lie the ghats, the stone built steps bordering the holy waters of the river Ganga. A Ghat is a common site in India but nowhere else in the subcontinent have continuous ghat steps been constructed over such a long distance as in Benaras. The steps are remarkably versatile constructions adapting to the highly variable water levels, as well as to the sacred and profane functions. Built forms such as the Ghats comprising of steps, landings lined by temples and other public buildings, pavilions, kunds (tanks), Streets and plazas and religious practices mutually constitute the cultural landscape.

This cultural landscape is layered and kinetic, and responsive to the river's flow.

Rarely has any river gathered in itself so much meaning and reverence as the Ganga has over three millennia in the Indian subcontinent. At Varanasi, where the Ganga reverses its flow northwards, the ghats describe a crescent sweep in a 6.8 km stretch. They date back to 14th century although they were extensively renovated and extended in the last three centuries to allow access to the holy Ganga from the temples and shrines of this ancient city. Cultural practices are spatial in that they are defined by places; built forms and practices mutually constitute the cultural landscape, each impacting the other.

1.0 Introduction

Varanasi also known as Benaras or kashi is a City on the banks of river Ganga in the Uttarpradesh state of North India. Varanasi grew as an important industrial centre, famous for its muslin and silk fabrics, perfumes, ivory works, and sculpture. Buddha is believed to have founded Buddhism here around 528 BCE when he gave his first sermon. Religious importance of Varanasi grew in the 8th century, when Adi Shankaracharya established the worship of Shiva as an official sect of Varanasi.

Varanasi experienced a cultural revival in the 16th century under Mughal Emperor Akbar who patronized the city and built two large temples dedicated to Shiva and Vishnu. Much of Varanasi was built during the 18th century by Maratha and Brahmin kings.

Varanasi has been a cultural centre of North India for several thousand years] and is closely associated with the Ganges. Hindus believe that death in the city will bring salvation, making it a major centre for pilgrimage. The city is known worldwide for its many Ghats, embankments made in steps of stone slabs along the river bank where pilgrims perform ritual ablutions. Of particular note are the Dashashwamedh Ghat, the Panchganga Ghat, the Manikarnika Ghat and the Harishchandra Ghat, the last two being where Hindus cremate

their dead and the Hindu genealogy registers at Varanasi are kept here.

2.0 Ghats of Benaras-Design language

The Ghats are a thin sliver of public space, ranging in width from 50'-500' on the Ganga between its confluence with Assi Nala and Varuna River. The open spaces mediate between the city and the river; temples, historic palaces and mansions, and new residential and commercial buildings stretch out creating



Fig. 1 - The design language with the lower floors solid and upper floors porous to resist the thrust of the river when it floods.



Fig. 2 - Flats surfaces of steps and landings articulated into volumes through niches and aedicules

an impressive skyline. The design language consists of prototypical forms - bastions, balconies, aedicules, portals, pavilions and platforms—in different sizes and materials, and in many combinations. The historic architecture responds to the changing water levels of the Ganga -the upper floors are porous with windows, balconies, and galleries for viewing the river while the lower floors of palaces are built solidly without openings, and with octagonal or circular towers to resist the thrust of rising waters when the Ganga floods. The formal grammar unites the vertical historic facades of riverfront buildings with the horizontal surfaces of steps and landings. The towers are aligned with square, rectangular, octagonal, and circular platforms built over well foundations that divide the steps to the river into bays. Octagonal platforms (marhi) built to strengthen the steps can be hollow or solid. Trees also have circular and rectangular platforms built at their base for shrines, and landings are dotted with movable wooden platforms used for a variety of activities.

The flat surfaces of steps and landings are articulated into volumes through niches and aedicules whose forms are shared with temple architecture. For example, the walls of Panchkroshi Temple consists of hundreds of niches that represent shrines visited by pilgrims on the panchkroshi yatra



Fig. 3 - Worship of Lingam on the Assi Ghat at Varanasi



Fig. 4 - Ganga Aarti at Dashwamedha Ghat

circumambulatory journey around Varanasi Besides receding niches, temple walls are also articulated by projecting aedicules; the ghats similarly have freestanding shrines, occasionally embedded in walls. Make shift places are created from lean-tos built from bamboo and jute/canvas housing lingas, aghoris (holy men), or snacks sellers. Thus a volume is created with the use of found materials on the planar surface of steps and landings.

2.1 8 Main ghats of Varanasi and their functions

Assi ghat –Ganga meets the river Assi located at the extreme southern end of the city. Assi ghat is an important ghat for the hindu, hindus bathe there before worshipping lord Shiva in the form of huge lingam under pipal tree.

Chet Singh ghat is of historical importance, site of 18th century battle between Maharaja Chet Singh who ruled Varanasi and British. Darbangha ghat is a photogenic favourite and most visually appealing and architecturally impressive ghats, built in early 1900 by royal family of Bihar. Dashwmedha ghat is the heart of action, top attraction in Varanasi, oldest and holiest of Varanasi ghats, it is the ghat where famous ganga aarti is performed every evening. According to Hindu mythology, lord Brahma created the ghat to welcome lord Shiva. Man mandir

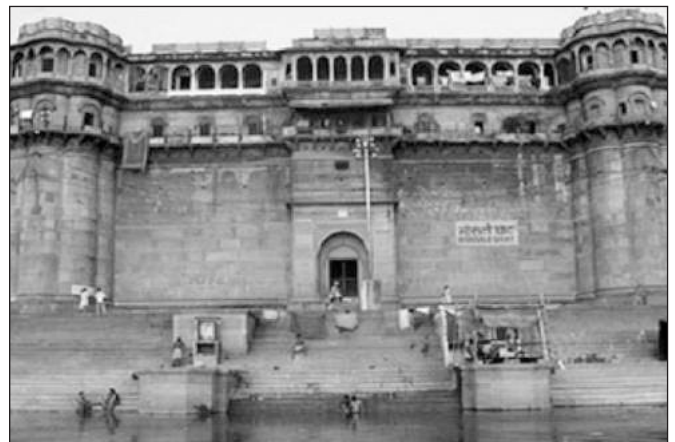


Fig. 5 - Spectacular bhonsle ghat - substantial stone building with small windows



Fig. 6 - Manikarnika Ghat - the burning ghat



Fig. 8 - Ganga Aarti at Dashwamedha Ghat

ghat, very old Varanasi ghat, is notable for its exquisite Rajput Architecture. Scindia ghat picturesque and peaceful place, with none of the grimness of nearby Manikarnika ghat (the burning ghat). Bhonsle ghat distinctive looking Bhonsle ghat built in 1780 by Maratha king Bhonsle of Nagpur. Substantial stone building with small artistic windows. Manikarnika ghat most confronting manikarnika ghat also known as burning ghats the place where majority of dead bodies are cremated in Varanasi. Hindus believe it will hibernate them from the cycle of death and rebirth.

The ghats are an urban mise-en-scene where not only the drama of everyday life but also death and celebration of life plays out. Aarti, i.e. daily felicitation to the Ganga and cremation occur on the riverfront, most spectacularly at Dashashwamedh and Manikarnika Ghats, attracting large crowds.

In life and death processes considered to be polluting in Hinduism, fire and water are purifying agents, and they are part of both events. Ganga is venerated with fire (as are other gods and goddesses) and on the ghats, the faithful worship at dawn the rising sun. On ancient water bodies such as Lolarka Kund on Assi Ghat, it is believed that life symbolically begins

when sunrays strike water. Fire is the agent of destruction—mortal remains of a Hindu are cremated on the riverbank, in the belief that Ganga will purify the pollution associated with death.

3.0 Death and Manikarnika ghat

Manikarnika Ghat is instantly recognizable by its smoking fires, soot-covered buildings, and stacks of wood piled on boats and landings. As the center of the three-mile long sweep of the ghat stretch, it has the sacred kund (tank) believed to have been dug by Lord Vishnu and the cremation ground, symbolic of the universe burning at the end of time. It is the abode of Lord Shiva who presides over mahashamshan, the great cremation ground. Here Shiva is known as Tarakeshwar, the one who whispers the tarak mantra in the ears of the dying. Although Shiva is the reigning deity of this ghat, Vishnu shares the place as attested by his footprints and Manikarnika Kund, the site of his austerities. The myth describing the co-existence of both gods is allegorical of the Hindu belief that creation is preceded by destruction. Manikarnika Ghat distills all of Varanasi's sacred energies in its waters of creation and fires of destruction. It is the place where people surrender their bodies and become one with Shiva.



Fig. 7 - Steps to river Ganga facilitating Bathing in the River Ganga to cleanse oneself, top of the Marhis are used as seating spaces. Built forms and practices constitute the cultural landscape mutually impacting each other



Fig. 9 - Early morning rituals at Assi ghat

It was the first embankment to be clad in stone in the thirteenth century although its temples were built in the late eighteenth or early nineteenth century. At the river edge are many square platforms, solid and well as hollow with niches where lingas are washed by the Ganga, with poles with canvas strung above them as shade structures. The visual order is layered and complex with temple spires, flat roofed pavilions, aedicular shrines, and platforms built on the sloping embankment. Some people die in hospices on the ghats, others are brought from the city and nearby villages, and their bodies carried on bamboo poles on the shoulders of mourners. After being washed in the Ganga, the cremation ritual commences—the eldest son circumambulates the body five times and puts the fire taken from the doms into the mouth. Midway through the burning, the skull is broken with a wooden pole in the ritual, kapalkriya for the soul to escape. As the fires die down, the son breaks a clay water pot and walks away without turning back. The ashes are gathered from the funeral pyre and immersed into the Ganga.

4.0 Life and Dashwamedha Ghat

The largest and most popular of celebrations occurs every evening at Dashashwamedh Ghat drawing large crowd of visitors. Aarti to Ganga is a performance for about thirty minutes at dusk by a local organization called Ganga Sewa Nidhi. Fire is the key element here as well but unlike Manikarnika Ghat where it is a conflagration consuming the body, here it is an oblation offered to the Ganga as a visible reminder of how life begins. Dashashwamedh Ghat is a popular ghat - one of the main roads of Varanasi bifurcates on either side of a large produce market and turns into steps leading down to the river's edge. It is named after the sacrifice of twelve horses performed by the creator of universe, Brahma. The archetypal act was repeated by rulers, most notably by the second century dynasty of Bara Shiva Nagas. It is believed that by bathing at this ghat, one reaps the benefit of this ancient sacrificial act performed by gods and kings. Its design grammar is similar to other ghats--the edge is activated by hollow and solid octagonal platforms, plus there are semi-fixed platforms on landings that are hubs of activities. Niches containing Ganga and Shiva deities activate the vertical plane.

As dusk falls, activities cease and for a brief period the ghat is transformed into a spectacle. Two groups of young male performers prepare the wooden platforms in two stretches for the aarti ceremony. The platforms become stage sets for a choreographed event performed in unison. This involves invoking the presence of Ganga and venerating her prowess by singing her glories. Sounds of conchs, drums, and bells accompany the song sung by accomplished singers and blared over loudspeakers. Peacock feathers and fly whisks sweep the air; incense and camphor in brass pots are waved in circular motions as if the performer is inscribing a mandala is space

with his gesture. Lastly fire in tiered brass lamps are offered to the Ganga with uplifted arms. Then the performers prostrate themselves before the iconic (statue) and phenomenal (river) forms of the Ganga, paying her obeisance. Gestures, posture and clothing dramatize their actions.

5.0 The cultural landscape-Built forms and practices mutually constitute the cultural landscape.

The ghats (steps and landings) on the Ganga River in Varanasi, India are a vernacular landscape defined by situated events, natural—flooding and changing flow of the Ganga—and cultural including ritual activities and performances that sustain public life.

The formal and spatial language of the ghats is activated in everyday spatial practices bringing vitality to the riverfront. The design vocabulary of the ghats is similar everywhere yet the landscapes as constituted by events are different and carry profound meanings about the role of Ganga in sustaining life, removing pollution, and promising liberation from the cycle of death and life.

According to Michel De Certeau, cultural practices are spatial in that they are defined by places; built forms and practices mutually constitute the cultural landscape, each impacting the other. Steps and landings, pavilions, platforms, shrines, and niches become behavior settings, loci of activities that are congruent with formal language of the ghats. Steps to the river facilitate bathing and other rituals centered on the holy waters and washing clothes, while those above the landings are used as sitting spaces to watch public life. The top of marhis seats groups in a circle suggested by the octagonal shape; the interior of hollow ones could be changing rooms or a shop. Movable platforms are used for rituals, massages, selling trinkets and religious paraphernalia.

The patterns of ritual and recreational activities have a diurnal rhythm tied with interaction with the river - bathing and worshipping the sun at dawn and early morning, washing and cleaning in late mornings and afternoons, leisure activities in the evenings, and waving of lamps (aarti) to Ganga at dusk.

The ghats are an urban mise-en-scene where not only the drama of everyday life but also death and celebration of life plays out.

6.0 Conclusion

It is widely acknowledged that Varanasi Ghats embody cultural heritage but less understood are the various ways in its material and intangible forms are intertwined. Historic monuments built in the last three centuries are the focus of current preservation efforts, although most are in private use, and do not contribute to the public realm. The steps, landings, and their structures as an enacted landscape of a rich and

vibrant public life, have been ignored so far (Dar 2005). This vernacular landscape is shaped by spatial practices that keep ancient traditions alive and vigorous. It is always in flux, its temporality a function of the Ganga's seasonal flow and the rhythm of rituals and festivals determined by planetary motion. The kinetic aspect necessitates rethinking the existing monument-centric preservation practice.

The scope of conservation should expand to include managing public spaces of the ghats so that they are not encroached by private interests, regulating practices that pollute the Ganga, and promoting arts and crafts. New structures should be based upon the traditional design grammar; instead of being fixed and rigid, they should be deployable so that they can adapt to kinetic urbanism. Local crafts such as bamboo umbrellas, wooden boats, clay pottery, and making candle wick and flower garlands should be promoted and incentivized through subsidies. Cultural events such as Subh-e-Banaras and evening aartis at many ghats should be supplemented with organized exhibitions of arts and crafts, and music and dance festivals celebrating the Banaras Gharana (school). More specifically the historic monuments should be integrated into the public realm; visual aids should be designed for way-finding; narrative surfaces should be designated for folk-art; and deployable structures should be built for vending kiosks and visitor facilities.

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Analysis of Existing Methods of Building Performance and Optimisation



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ABSTRACT : *The designer today is equipped with the strength of artificial intelligence. There are ongoing research studies to integrate this science to achieve solutions to the design problems. The task of the designer is to address all the existing and possible forces and create an optimum solution. These existing and possible forces and their permutations and combinations weave a complex fabric of design problems. The argument of this study is, it is an achievable target for the designer if the designer is equipped with a robust decision support system.*

In this research, methods of building performance and optimisation are analysed and compared to establish the need of automating the process of designing; to achieve an optimised and precise volume/form as a design solution, from the population of solutions

KEYWORDS : *Building performance optimisation methods.*

I. INTRODUCTION

In the earlier studies on simulation in built form, Schon argued that "Research should focus on computer environments that enhance the designer's capacity to capture, store, manipulate, manage and reflect on what he sees" [1]. The studies in this domain focused on the development of the models or the machines for designing[2]. These models help the designer as a tool; so that the design decision remains the designer's domain.[3]. Based on the model of Schon[1], the interaction between the designer and its representation on a computer is expressed with the analytical models of design by Oxman. These analytical models of design represented by Rivka Oxman, explain the interaction of the designer with his design representations[4]. The importance of these models of design is that they mark the developmental stages in the theory of computational design.

The compound model by Oxman [4] is a representation of the future implementation of the idea of computational design that is based on integrated processes, including; the formation, generation, evaluation, and performance. Further studies show the development of computational design tools

to achieve optimization through the building performance simulation (BPS) and building information modeling (BIM).

In the BIM and simulation environment, the information linked to the drawings included its three-dimensional virtual model along with its attributes. These environments perform as a decision support system. Further experimentation show the development of the machine intelligence based on algorithms for the generation of design solutions.

This paper investigates methods of building performance optimization at two different levels. The primary level investigates the BPS (building performance simulation for optimization) methods. The second level includes experimentation on a case situated in the regional context. These experiments test the conventional BPS methods based on the parameters viz; controls, handles, and complexity in the exchange of information. The key findings show that there is a need to reduce the complexity of information exchange. Which may be through the integration of various processes and bringing them on the same platform; and; further to automate the intermediate processes. The research concludes with the proposal of a hypothetical model to bridge the

identified gap by integrating the information model and machine intelligence model.

1.1 Investigation of the BPS Methods through literature

M-I Conventional process of designing based on the theory of climatology

The analysis of for the conventional method is based on a theory proposed by Koenigsberger[5], [6] and expressed as diagram below :

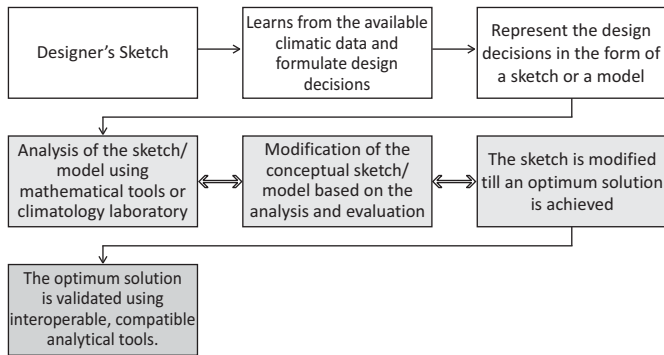


Fig. 1 : MI-Process flow chart based on the theory of climatology

The intermediate processes indicated with two-way arrows consume more time and involve more efforts. These methods are based on the principle of interoperability of operations which leads to complexity and information loss, require more time and human efforts (see comparison table 9 for more clarification)

M-II Conventional process of designing in BIM environment

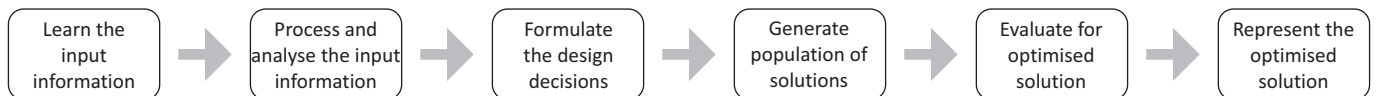
A sample case is modeled in the BIM environment to analyse the process of designing in a BIM environment. The process is dependent on the designer's sketch. It is not capable of generating a sketch in the BIM domain. The design decisions are based on the climate analysis simulated in the BIM domain. The information format is the designer's sketch which is imported from AutoCAD i.e. other compatible domain or can be modeled in the BIM domain. It is further analysed into BIM analysis modeling environment. The analytical findings formulate the design decisions. The model is further exposed to a back and forth process of optimisation. Sketch-analyse-modify sketch till an optimum solution is achieved. It is advantageous as the solution achieved can further be linked to the other processes of optimisation. The back and forth process is dependent on the repetitions and iterations and has an experimental and exploratory nature. It lacks a scientific logic for experimentation and exploration. Further, it leads to the investment of a greater time. Although the iterative processes are performed on the same platform, it requires complex computation. This process lacks the intelligence to produce solutions based on the input information.

M-III Advanced process of designing with algorithms / parametrics

This method is analysed based on the secondary data available on Ladybug+Honeybee plugin[7] website for Rhino+Grasshopper[6] modeling environment. This method follows the algorithmic or parametric method of designing. This method has a logical construct which is programmable and formulated with the help of algorithms. The algorithms create solutions that are based on the input parameters. The initial sketch/model of the designer is the primary input information. With this input, a three-dimensional form is created using algorithms. The input parameters are controllable using programmable/mathematical logic. Therefore, it gives the designer flexibility of exploration through programming which is a scientific approach. All the other parameters are related and dependent on the input parameters. Hence, every change/modification in the input parameter automatically reflects on all the other parameters and finally on the outcome. This method consists of implicit processes that are automated and show an effective reduction in the involvement of human efforts in the iterations. Moreover, it reduces the complexity of computation. The M-III involves automation of iterative and complex computation which is an advancement of the previous methods. This method has the potential to create a solution based on the algorithm. Moreover, the requirement of the interoperable platform is eliminated. The designer can integrate all required functions in a program of various algorithms. This method has integrated tools, e.g. Ladybug and Honeybee for climate responsive design, Octopus solver for multi-objective optimisation, and Galapagos evolutionary solver for generation of a population of solutions, etc. that can support the design decisions.

M-IV Process of designing using CARBSE tool

This process works on a method of suggesting appropriate design principles for the given climatic condition. It provides analytical charts and prescriptions to support the design decisions. The solution is in the form of a three-dimensional geometry that suggests and prescribes the design decisions. It is comparable to a diagrammatic expression of a climateresponsive form based on Euclidean geometry. The support engine produces charts, graphs, and tables for the designer. This method is advantageous in terms of producing a solution as a prescription for the given climatic condition. This method requires a cross-platform exchange and iterative processing. Automation is observed into analytical findings and prescriptions to support the design decisions. The linear process of designing of all these methods can be expressed with the help of linear process diagram as,



1.2 Comparative analysis of BPS through experimentation

The second level investigation includes experimentation on a sample case in a given context. The aim is to test the efficiency of the BPS methods to create an optimised 3-dimensional geometry. This solution should act as a threshold and provide decision support for building performance. The design decisions are the effect of the cause which is the climate. The outcome is the prediction based on the input information. This prediction is dependent on the nature of intelligence of the adopted method to find a solution.

The aim of the experimentation includes testing these methods for; human efforts involved to find a solution, human

control over the process of designing, required time, the complexity of calculation, and, the complexity of computation.

Fig. 2 provides a comprehensive overview of all the processes which emphasizes the research gap and proposes the conceptual method to bridge the gap. The thematic coding is explained in table 7;

- A colour code is assigned to every primary process, and it is further reflected in other secondary processes
- The requirement of cross-platform exchange of information is indicated using
- Automated/parametric processes are indicated using

Table 1 : Explanation of the code of the linear process diagram

The code	The explanation of code	The code	The explanation of code
D	The designer	SA	The learning of the climate analysis
S	The learning from scientific theories of climatology	SP	The formulation of design principles
R	The representation drawing : sketch/model	----->	Linear one-way process
A	The process of analysis of the conceptual sketch/model, i.e. evaluation	----->	Hidden internal process
Fo	The outcome	----->	Back and forth iterative process

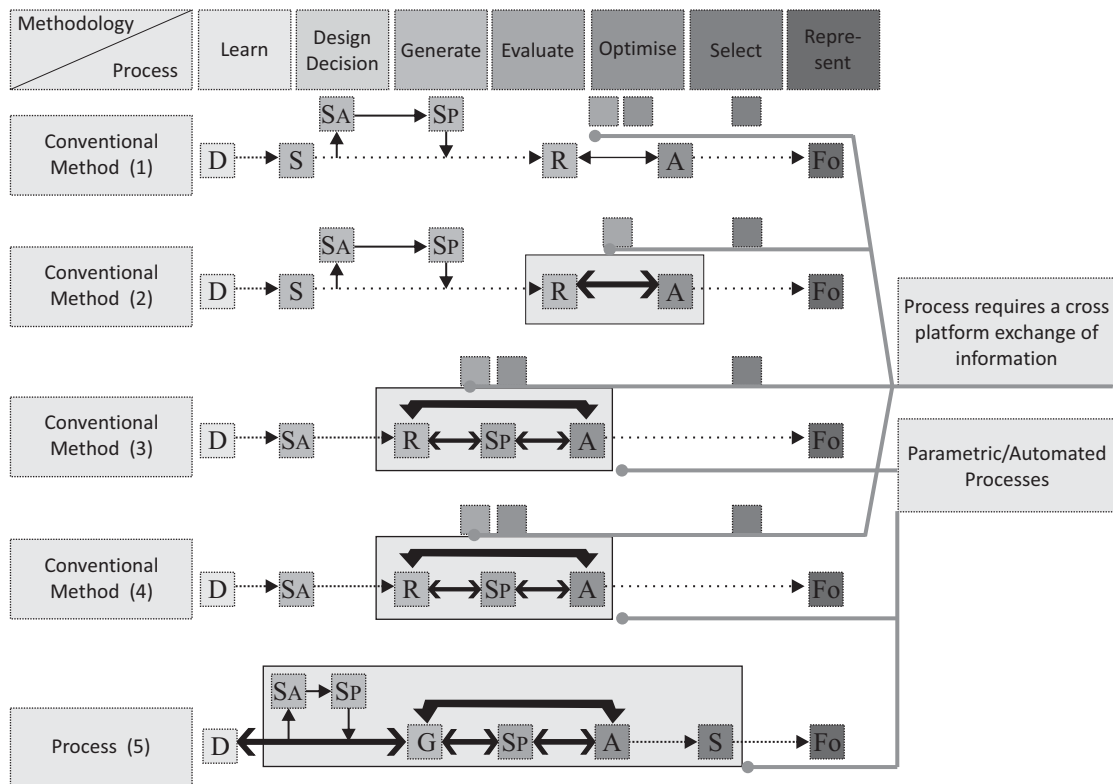


Fig. 2 : Results of experimentation expressed as a linear process diagram

Inference

Fig. 2 shows that the implicit iterative processes should be integrated and automated and bear intelligence of learning, generation, optimisation, and representation. Hence the argument states that the computational model of designing should be intelligent to create optimised form of 3-dimensional geometry as output with minimum human efforts for information input. It is identified from the above experimentation that, with every developmental stage of method I through IV, the complexity of computation increases

and requires a substantial amount of exchange of cross-platform information. Which further requires repetition of modeling, i.e. iteration in the virtual environments of several platforms of computation working in parallel. It requires an investment of time to a greater extent. Further, it requires skilled resources specific to the computer domains which increase the complexity of the design process.

To achieve the desired outcome, it is necessary to formulate an alternative method.

Table 8 : Results of experimentation

	Parameters of information processing	M-I	M-II	M-III	M-IV	Variance
1	Extent of human efforts	5	3	2	2	2.00
2	Extent of time required	5	3	3	3	1.00
3	Other domain support	4	3	2	1	1.67
4	Requirement of Physical set-up	4	3	3	3	0.25
5	Requirement of human resource	5	3	2	1	2.92
6	Requirement of complex computation	4	3	2	2	0.92
7	Requirement of complex calculation	5	1	1	1	3.67
8	Extent of human efforts to process and collate the information	5	4	1	3	4.25
9	Extent of human efforts to support the design decisions	3	3	1	3	1.00
10	Extent of human efforts to process the information to create a population of solutions	5	5	1	5	4.00
11	Extent of input efforts	5	4	2	5	2.00
12	Readability of outcome geometry	3	4	5	2	1.67
13	Compatibility of outcome geometry with other domains	2	3	5	2	2.00
	Average score of Methods based on the parameters	0.26	0.36	0.58	0.57	

The comparison of two functions of variance and average score as explained in table 9 shows that P7, P8, and P10 show

the highest variance (Fig. 3). M-III score highest in average of all parameters as compared to M-I and M-II and M-III (Fig 4).

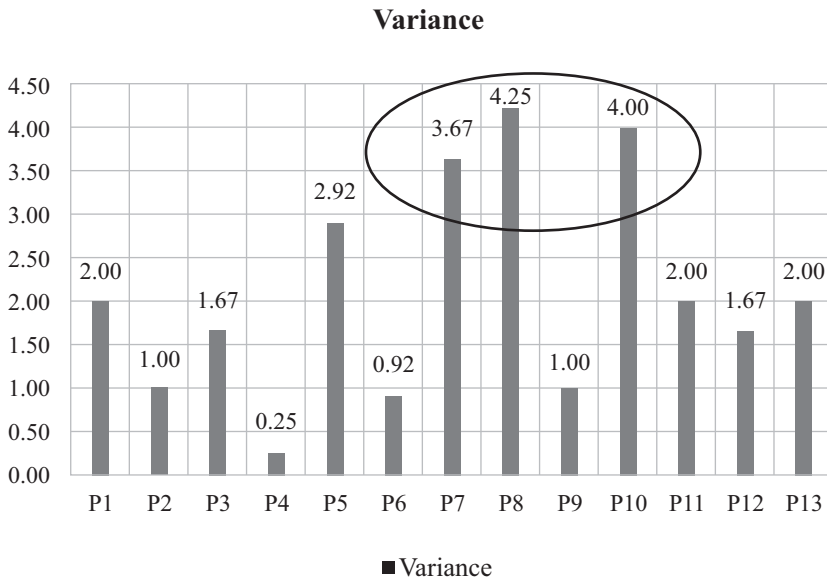


Fig. 3 : Selection of parameters of variance

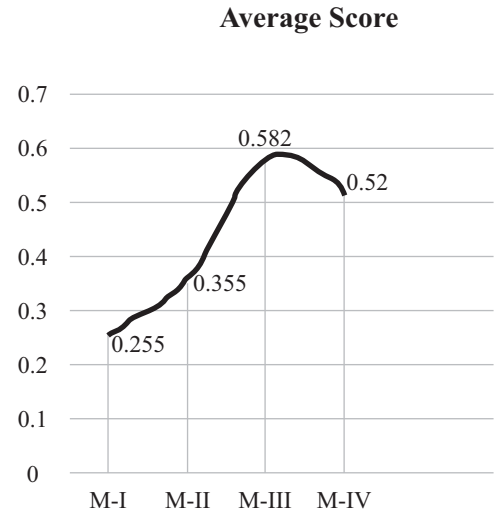


Fig. 4 : Comparative analysis of average score of methods

From the comparative analysis, this research states that there should be an effort to design an alternative method/model of designing to address to the following requirements;

- i. The ultimate control should be with the designer
- ii. A single input by the designer should create a population of output/solutions.
- iii. The solution should be based on the scientific theory.
- iv. Reduce the complexity of the process of designing and computation,
- v. The model should be able to handle multiple levels of complexity.
- vi. Interface for input should be the least complex
- vii. The time required for computation should be minimum
- viii. The solutions should be readable in terms of two-dimensional and three dimensional drawings.

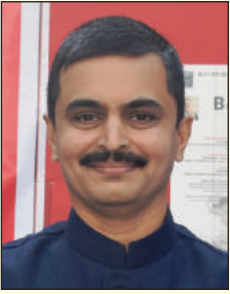
1.3 Future scope

Future studies may add controlling the wind and humidity as well. This model focuses on developing a process-oriented model of designing; the further studies may develop a material oriented model of designing.

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Study of Form and Function of an Administrative Building



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Ms. Shivani Bhandari is Final year student of BKPS College of Architecture, Pune. She is working on various Architectural and Interior Design projects. The paper is based upon her research work for planning of administrative buildings



ABSTRACT: *The administrative building is public building which has some important considerations to be taken into account as it acts as representative asset of the city. It is medium of communication for the respective organization or authority. These buildings have considerable value as its architecture plays an important role in defining the identity of the society at state, district or country level. But at the same time these buildings should facilitate visitors the required comfort and ease within activities. Hence, paper is based upon the study of the form and function of public administrative buildings. This is to understand the role of the administrative architecture governing the image of the authority while achieving better functionality. It involves the study of influential factors carried out through analysis done from various medium scale admin building and their findings. This is evaluated to decide or conclude on the significance of the identified factors. These findings can be helpful in designing the administrative buildings by understanding the level of importance these various factors hold. It can contribute to the future or present modifications in administrative buildings.*

KEYWORDS: *Administrative building, organizational structure, identity of government, form & function.*

I. INTRODUCTION

Like any other forms of the architecture, administrative buildings carry a wide range of the design vocabulary and this design vocabulary include the factors such as location, form, functionality, circulation, etc. These are vital to be studied because they govern the organizational structure of the building and define the character of the building based upon their necessity of consideration. These factors are important as they help us to understand how to provide interconnection between spaces and functions of the building providing comfort to the visitors and staff through organizational structure while also promoting the building as icon of the city through character defining elements. The above study is carried out through identification of the factors from literatures and articles and the same factors are analysed for various existing administrative building. The analysis shows how they are implemented within buildings and how much significance is given while designing these admin buildings.

The comparative analysis for the case studies states how the considered factors vary in terms of context, materials used and form of the buildings in each case. Conclusion states on the importance and significance of the factors and how they evolved as per changing time and need of the administrative buildings.

CASE 1 : THE DISTRICT COLLECTOR OFFICE

It is the 'Collector Office' building of the city which is an administrative headquarter of the district. It is constructed in 2017 which is located in the hot dry climatic zone. Collector office is designed on the existing site, which was meant to replace the cluster of number of small and old structures.

Location - It is located at the major junction of the highways in the core of the city and surrounding of it has number of such administrative buildings. Placement of the building signifies its presence as it has good visibility from all the sides.



Fig. 1 : View from the entrance



Fig. 2 : View from the exterior



Fig. 3 : Landscaped open spaces

Organizational Structure

1. Functionality - It is five storied building accommodating all the departments in two wings A and B, wing C which is fifth floor along with the three storied separate parking building with grand central plaza connecting the all three. Functional planning of the building is based upon the interconnectivity of all the departments with the consideration of large number of visitors. Service areas are planned in each wing. All wings are connected by bridges and skywalks. Open spaces and sitting areas are designed as buffer to cater to visitors.

2. Circulation - The office building has sufficient number of staircase and lifts. The passages are wide and naturally ventilated. For the horizontal movement on the upper floors skywalks are designed. Open spaces, courtyards, intermediate sittings cater as pause points.



Fig. 4 : Location Map

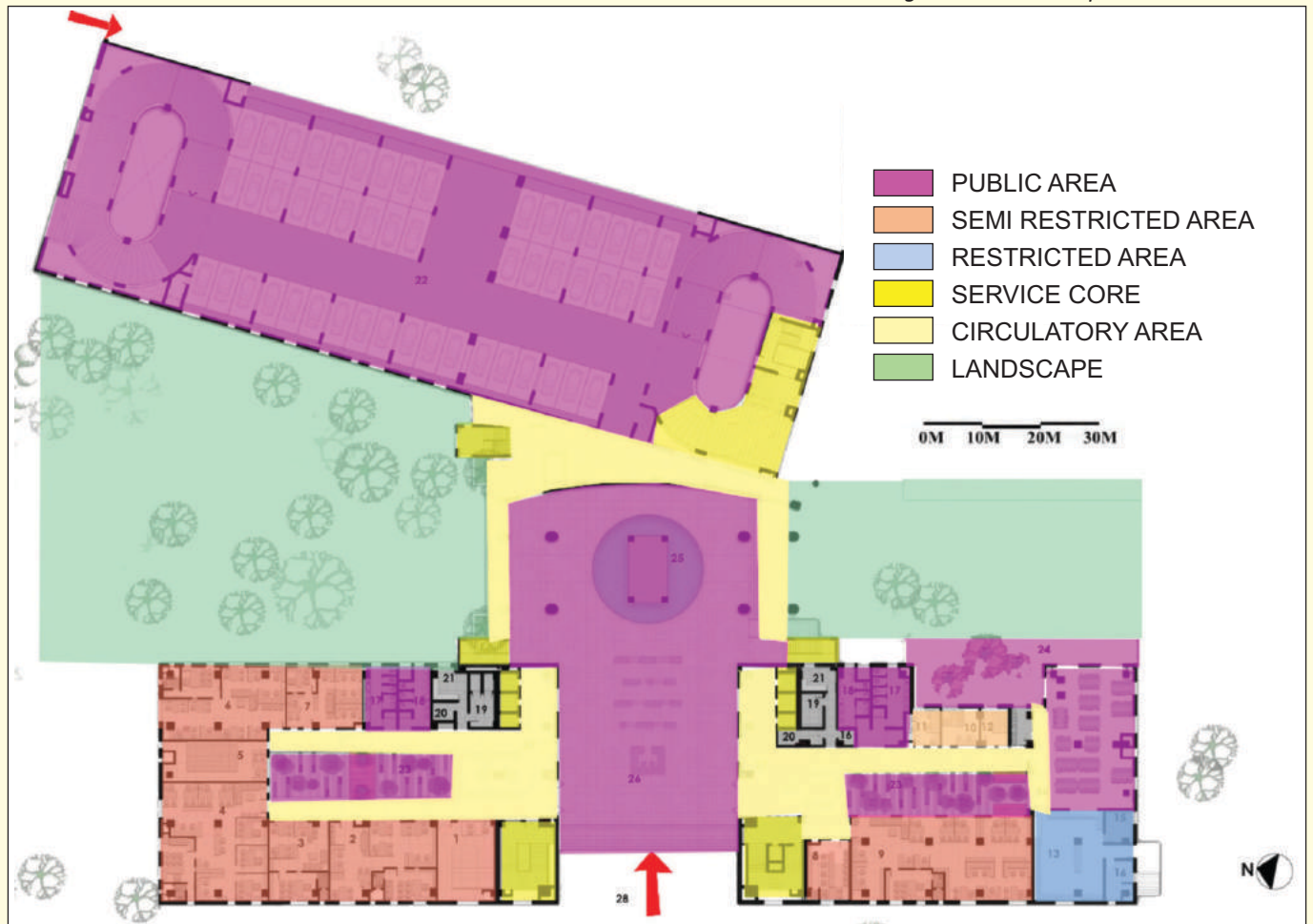


Fig. 5 : Zoning plan

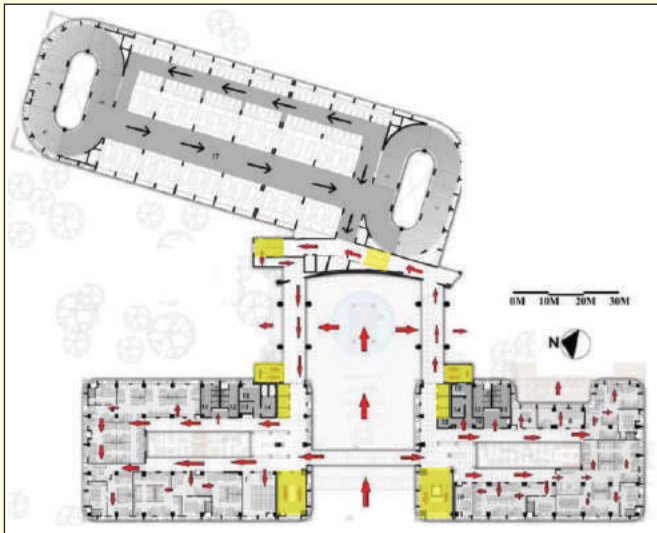


Fig. 6 : Horizontal movement pattern in plan

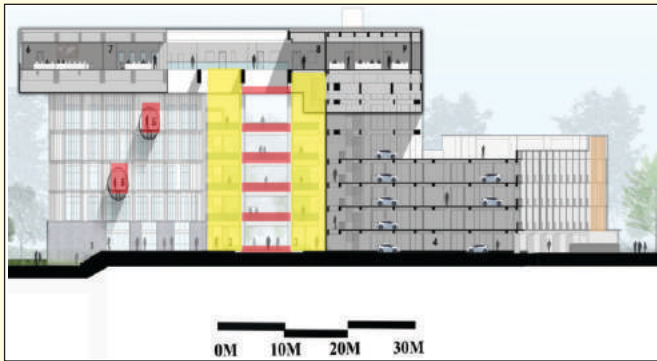


Fig. 7 : Vertical movement pattern in section



Fig. 8 : Monumental open spaces

3. Spaces - The building has grand welcoming plaza provided with the roof at the topmost floor. It has heritage structure erected in the center of the plaza. This is of the monumental scale designed with the water body and the passages of the wings, skywalks overlook this plaza. Envisioned with grandness building is better ventilated and better lit with natural light.

Character Defining Elements

1. Form and Style - The building is designed with the consideration of urban context. Its contemporary form is

achieved with advanced techniques and material and elements like skywalks, louvered façade, etc. The use of old stone from existing building and due importance given to the old porch holding national emblem above it retains the memory of old collector office.

2. Materials - The materials used are both traditional and modern materials. Stone masonry used at the ground floor forms the strong visual base. Above it, the office building rises with the vertical fins, made of galvanized iron creating tropical skin on the façade and responding to the context and tropical climate of the city. The opaque sunroof on last floor helps the natural light enter inside.

CASE 2 : ZILLA PARISHAD BUILDING

Location - It is located in the urban area having tropical climate in the core of the city which accommodates all the public welfare departments along with conference halls, auditorium, assembly hall. Surrounding of the building is consist of commercial and institutional buildings. Though it is located at junction of the roads, primary entrance to the site is not clearly visible.



Fig. 9 : Exterior view

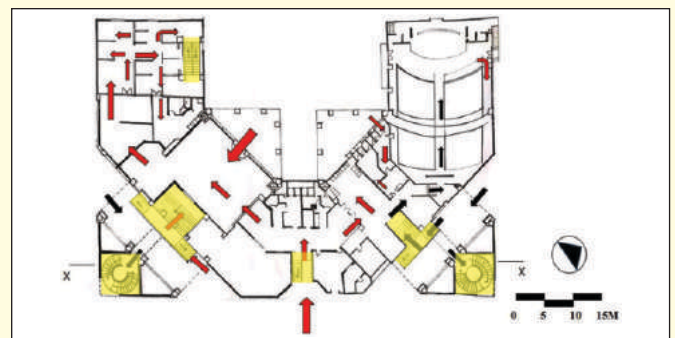


Fig. 10 : Horizontal movement pattern

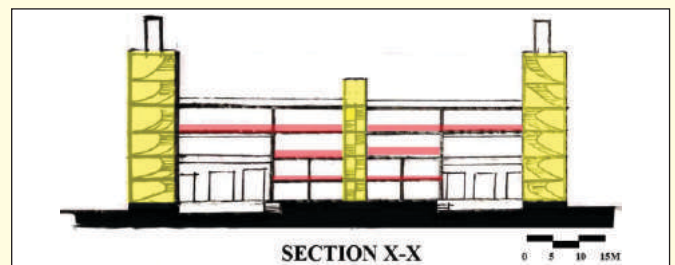


Fig. 11 : Vertical movement pattern

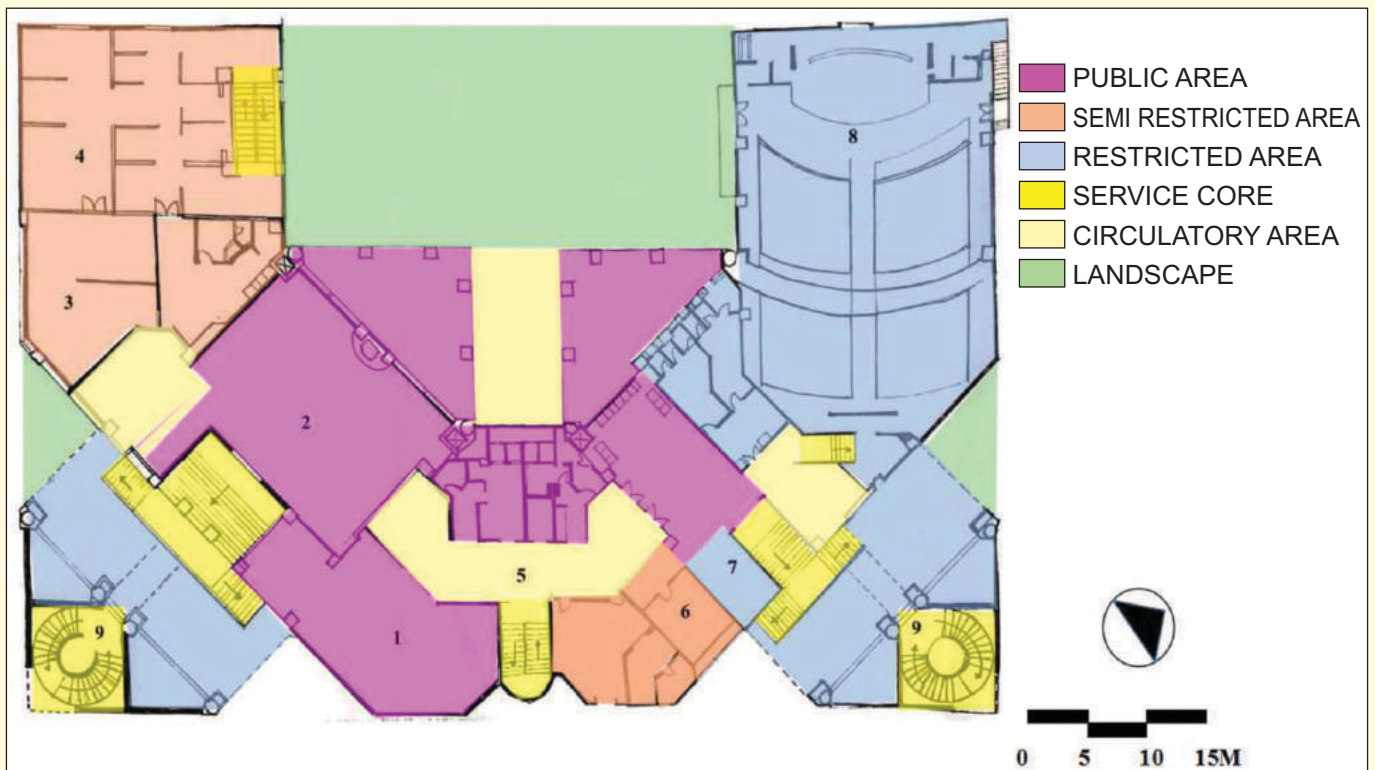


Fig. 12 : Zoning diagram

Organizational Structure

1. Functionality - It is basement+ 6 storied building. The segregation of the spaces as per functions in this building is worked out by segregating functions as per the need of privacy. The separation of the formal activities and public activities is achieved by providing all the public welfare departments on lower floors and all the offices and conference rooms on upper floors. Separate cores as means of access are provided for visitors and staff.

2. Circulation - The circulation pattern is symmetrical for both the wings because of its symmetrical shape. Separate staircases are provided for the staff and public. Lifts have access only for the floors from 3rd floor onwards. So vertical movement become difficult for disabled people. Width of the passages is less and insufficient amount of natural light is in the cores.

3. Spaces - The building is designed as U shape and symmetrical in form. The U shape provides privacy to the central space from three sides. The entrance is stepped and grandeur. Double height interior spaces such as waiting foyer signify the grandness. The voids are created within building by providing inbuilt terraces on fourth floor.

Character Defining Elements

1. Form and Style - The form of the building is symmetrical and unique as upper floors are elevated by columns. Voids are created inbuilt form providing whole building as a single unit. There is lack of natural light and ventilation inside of the building. Variation in heights and colours define the function of the spaces. The two towers coming up from the corner symbolizes power.

2. Materials - The materials used is concrete and glass. Glass is used in the towers of staircases and for the windows. Materials help to relate the building façade to the surrounding buildings in terms of context and aesthetics.



Fig. 13 : Stepped entrance and foyer



Fig. 14 : Service core on the corner



Fig. 15 : View from the open space

CASE 3 : MUNICIPAL CORPORATION BUILDING (BERI, 2009)

Location - The site is located in the suburban area. The site given was having narrow access road dividing the tight odd shaped plot area. Hence the internal road of access is widened including frontal arrival space in the road right of the way.

Organizational Structure

1. Functionality - It is two storied building with lower level having entries on either side for public and central entrance for the senior staff. Proximity to all the functions and spaces is equal and which is maintained by providing all the offices along central lobby. All important offices are provided on the upper floor for private formal activities. Small courtyards in each wing functions as a buffer zones.

2. Circulation - The movement of staff and general public is segregated by providing different means of access. Lifts, staircases, services are easily accessible.



Fig. 16 : Front view of the building

3. Spaces - The spaces within the building are compact. The wings are consist of 'L' shaped clerical staff area joined by a curved supervisory staff area and a green central courtyards. Main entrance is flanked and conveys a welcome gesture. Jetting out stepped auditorium at second level serves as a porch.

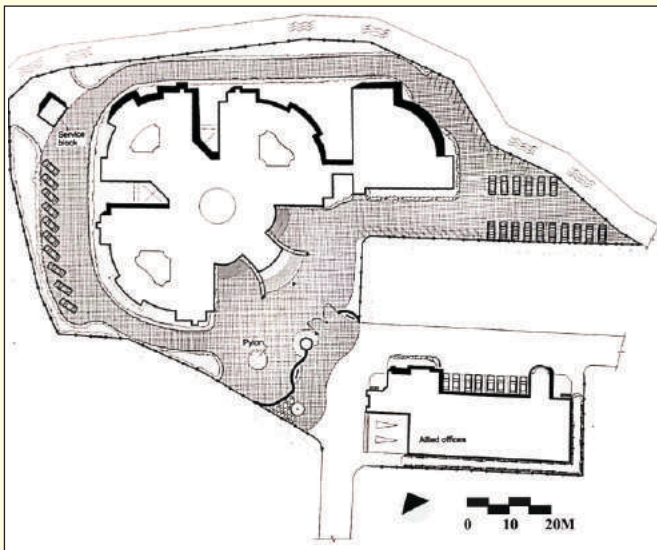


Fig. 17 : Site plan

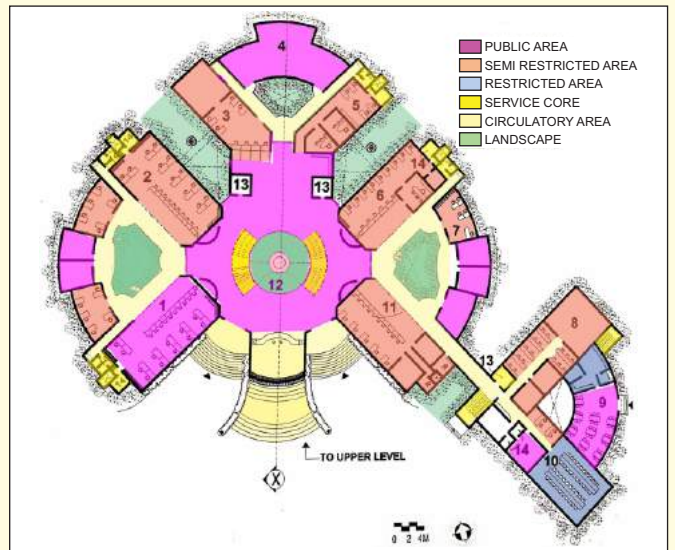


Fig. 18 : Zoning diagram

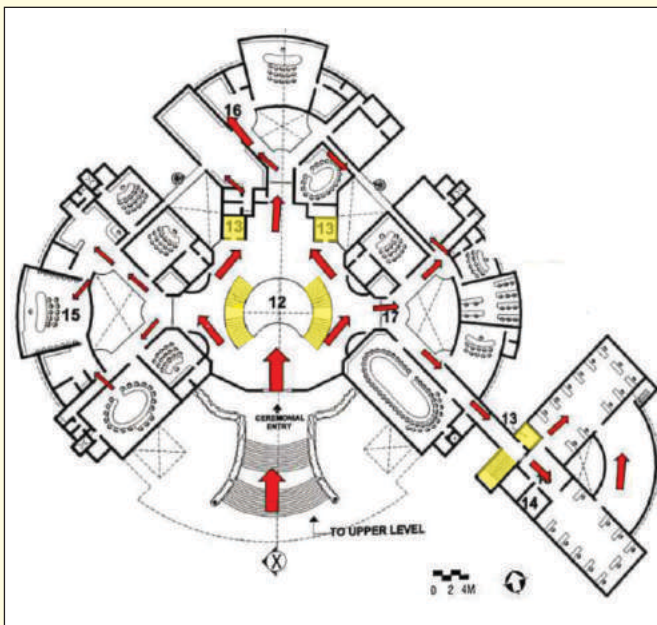


Fig. 20 : Horizontal movement pattern



Fig. 19 : Aerial view

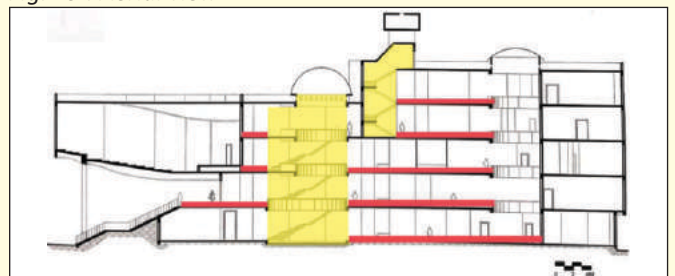


Fig. 21 : Vertical movement pattern

Table 1 : Comparative analysis

Factors	Subfactors	Case 1	Case 2	Case 3
Organizational structure	Functionality	All the service areas, public spaces are functionally located.	Strong interconnectivity	Proximity to each functional space is equal
	Circulation	Sufficient and naturally ventilated circulatory areas are provided.	Lack of natural light in cores No provision of universal access	Sufficient amount of light and ventilation. Provision of universal access
	Spaces	Double height spaces and monumental scale Buffer zones or pause points are created at appropriate locations.	Double height space only at entrance, intermediate scale Intermediate buffer zones are not sufficient.	No double height spaces or monumental scale Small scale buffer zones are created.
Character defining elements	Form and Style	Contemporary rigid form	Variation in form i.e. use of linear, curved and chamfered edges	Curvilinear form
	Materials	Concrete, stone, galvanized iron, glass.	Concrete, glass	Bricks-exposed brickwork

Character Defining Elements

1. **Form and Style** - The form of the main building is compact. The curvilinear façade softens the building. The curvilinear forms and rectaguloid elements create balance within the form.

2. **Materials** - The material to be used is brickwork. Exposed brick work relates the old terms in context of traditional material.

Inference

As the administrative buildings accommodates all the public departments along with some restricted zones, the public and formal activities are segregated by designing separate access for public and staff and important persons but interconnection of these spaces and functions should be strong and easy for the visitor's comfort. Also the admin buildings need not to always follow traditional form, style or materials. They can be defined by relating their functions and spaces. Monumentality and power can be signified with scale, form, use of modern technology for construction. Because now days, context of the urban or suburban areas, economy also play major role in overall designing process.

Conclusion

Organizational structure of the building is the factor which has major consideration in the administrative architecture where as form, aesthetics have become relatively secondary factors. But the evolution in the design of admin building is defined through use of advanced technologies and materials and better correlation within functions and spaces of the buildings.



Fig. 22 : Floating form over green area

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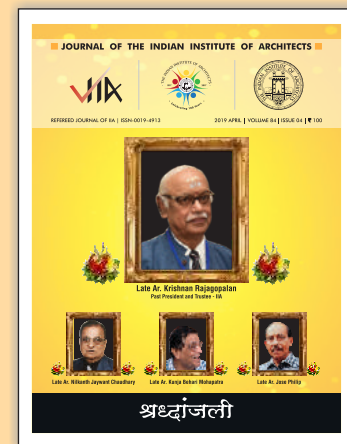
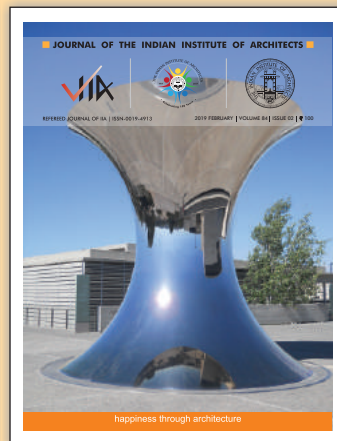
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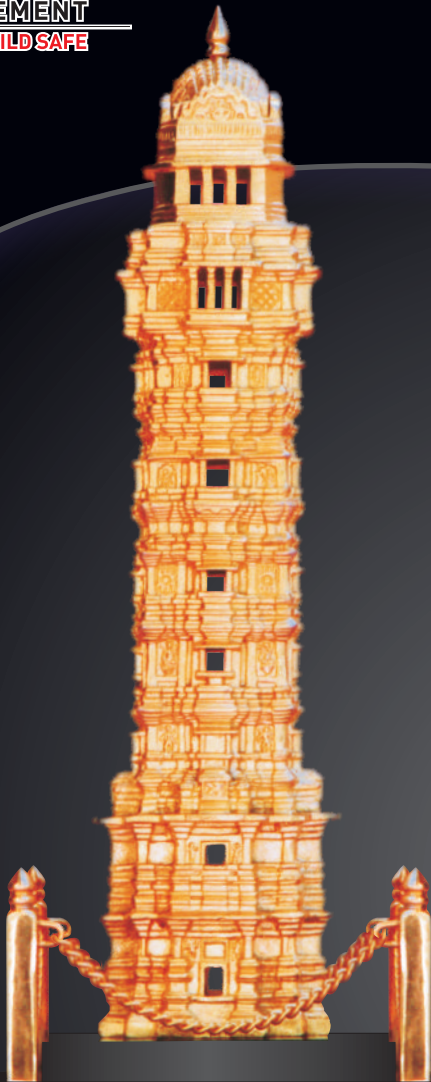
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