Design for All
Institute of India

— Knowledge Partner —

Design for All

'Design for All' Journal,
November 2021 Vol-16 No-11 ISSN:2582-8304

Image from Article "Possibilities of Architectural Modelling with Lac"

Guest Editor: Prof. (Dr.) Mandeep Singh
Head Industrial Department & Professor Architecture Department
School of Planning and Architecture, New Delhi

ISSN: **2582-8304**

November 2021 Vol-16 No-11

Table of contents

Note from the Guest Editor
Design for all at building level

1. Re-imagining ageing: the role of mixed-use spaces in fostering healthy ageing.....8
Ar. Parul Nayar, Prof. (Dr.) Mandeep Singh

2. Material Oriented Design Approach: A Paradigm shift in Form Generation:.....34
Ar. Gunjan Jain, Dr. Shuvojit Sarkar

3. Case study of GRIHA rated institutional buildings
Examining green building features and building energy systems to facilitate of GRIHA rated projects to facilitate design for all:.....61
Ar. Priyanka Kochhar, Prof (Dr.) Mandeep Singh

Design for all at urban level

4. Karol Bagh & Western Extension: the other new Delhi;.....81
Ar. Vandini Mehta, Prof. (Dr.) Mandeep Singh

5. Role of Form-Based Codes as Determinants in Reclaiming Threshold Spaces: A Case Study of Walled City of Vadodara:.....102
Prof. Advaita Jalan, Prof. (Dr.) Mandeep Singh

6. Assessing the Impact of Horizontal Surfaces on User Perception of Outdoor Comfort in High-rise Group Housing:.....128
Ar. Kamini Singh, Prof. (Dr.) Mandeep Singh

Design for all through educational and policy level interventions

7. Compliance to Compassion: A pedagogy using emotional engagement and other techniques for teaching accessible design to architecture students:.....148
Ar. Raja Singh, Prof. (Dr.) Anil Dewan

GUEST EDITOR:

***Prof. (Dr.) Mandeep Singh** is presently Head Industrial Design Department and has been Head Architecture (2014-15 & 18-19), Dean of Studies (2015-17), Head Urban Design (2011-14) Head Industrial Design (2005-10), apart from being a full-time faculty at the School of Planning and Architecture, New Delhi since 1986.*

In addition to teaching, guiding design and research projects for 35 years, Prof. Singh is currently serving in several committees set up by the Government of India. He is a Member of Delhi Urban Arts Commission, Advisor to Association of Indian Universities (AIU), Advisor to Competition Commission of India (CCI), Member of Project Steering Committee (PSC) for 'Developing Energy Efficient Building Material Directory', Bureau of Energy Efficiency, Professional Advisor for National War Memorial, Ministry of Defence, Advisor and Member, Governing Council, NID Haryana, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Jury Member in the Committee for National War Museum, Ministry of Defence, and Member of Expert Committee for selection of tableaux for Republic Day Parade, Ministry of Defence.

He has been consultant, advisor and peer reviewer to many public and private sector organisations, notable being World Bank, CPWD, Shri Mata Vaishno Devi Shrine Board, Reliance Infrastructure, Ministry of Defence for National War Memorial

Competition, Competition Commission of India, Basmati Export Development Foundation, Golchha Organization (Nepal), Bureau of Police Research and Development (BPRD) for creating identity of Police Station and conducting architectural competition among others.

Prof. Singh has vast experience in guiding PhD scholars, and numerous publications to his credit.

ISSN: **2582-8304**

Guest Editor's note

Professor Mandeep Singh (PhD)
Head of Department, Industrial Design,
Email: m.singh@spa.ac.in
School of Planning and Architecture, New Delhi

Given the large interest of scholars to publish in this important journal, we received a huge number of papers for consideration. While six papers were published in the September 2021 edition, seven have been published in the November 2021 edition.

Everyone at SPA Delhi, including students and faculty of ten graduate and two undergraduate departments of Architecture, Design, Planning, Landscape and Management among others, work on different aspects of 'Design for All'. The theme is embedded in the style of thinking, teaching, and learning across board.

This volume and compendium of papers provides views of young faculty and scholars on design for all at the building level, urban scale and at the policy level. All scholars and authors are associated with SPA Delhi, which is the knowledge partner with Design for All Institute of India for this peer reviewed edition of the journal.

The first three papers reflect upon various issues around design for all at the building level. Ar. Priyanka Kochhar has documented building envelope and energy system design strategies implemented by two government GRIHA rated institutional buildings in New Delhi. Both projects are in the composite climate

zone and provide useful insights into the prevalent sustainability linked practices in the Indian construction sector.

Ar. Parul Nayar has proposed five parameters to provide unique architectural design solutions required for the successful functioning of a mixed-use facility for senior living. The parameters have been used to study and analyze the Parkside Retirement Homes in Bangalore and House of Generations in Denmark. Recommendations of the analysis, which may be used by architects at large have been integrated in the design of a potential senior living facility, as a part of an undergraduate thesis project. Ar. Gunjan Jain investigates futuristic material-oriented design approach in generating forms. The paper concludes with a discussion on the potential and challenges of the material-oriented design approach along with the possibility of taking it up on a large scale.

The second set of three papers focus on issues around design for all at the urban level. Ar. Vandini Mehta has investigated specific urban histories of Karol Bagh-Western Extensions and Imperial New Delhi, to re-examine and historicise the ways in which inequity is created and maintained in our cities even today. Prof. Advaita Jalan focuses on the role of form-based codes as determinants in reclaiming threshold spaces and concludes that form-based codes play a critical role in arriving at context-specific response to reclaim threshold spaces within the walled city of Vadodara. Kamini Singh investigates the impact of the outdoor surfaces' materials, accessibility and thermal properties on the user choice and selection for performing outdoor activities in high-rise residential environment of Greater Noida. The paper concludes that user preference for outdoor residential spaces is closely determined by the thermal comfort and accessibility;

however there is a pattern with respect to age, gender and activity level of each user group.

The last paper suggests educational level interventions to facilitate design for all. Ar. Raja Singh discusses the pedagogy and other techniques for teaching accessible design to architecture students. Using emotionally charged pedagogical exercises, the author has been able to sensitize students of architecture towards Universally Accessible Design, which is reflected and validated through an anonymous and optional survey.

These papers have been checked for plagiarism and have gone through a peer review process. Prof. (Dr.) Anil Dewan, Head, Department of Architecture, Prof. (Dr.) Sewa Ram, PhD Coordinator and Head, Department of Transport Planning and Prof. (Dr.) Ashok Kumar, Dean (Academics) have been part of the peer review committee.

As the Guest Editor, I am grateful to Prof. (Dr.) P.S.N. Rao, Director SPA Delhi for accepting the proposition for SPA Delhi to be the knowledge partner on this issue of the journal. I appreciate inputs provided by Ms. Aditi Singh and Ms. Priyanka Kochhar, PhD scholars at SPA Delhi towards compilation of this edition.

Professor Mandeep Singh (PhD)

Head of Department, Industrial Design,

Email: m.singh@spa.ac.in

Ar. Parul Nayar

Ar. Parul Nayar holds a Bachelor of Architecture from the School of Planning and Architecture, New Delhi. Her current interest in the field of inclusivity in architecture and designing experience 'for all' has focused her research on exploring mixed-use facilities as the future of senior living developments. Her other area of interest lies in understanding the design of temporal landscapes in cities and their consequent spatial transformations. She loves to explore, experiment, evolve and always aims to design a balance of experience, functionality and aesthetics.

Prof. Dr. Mandeep Singh

Prof. (Dr.) Mandeep Singh is presently Head Industrial Design Department and has been Head Architecture (2014-15 & 18-19), Dean of Studies (2015-17), Head Urban Design (2011-14) Head Industrial Design (2005-10), apart from being a full-time faculty at the School of Planning and Architecture, New Delhi since 1986. In addition to teaching, guiding design and research projects for 35 years, Prof. Singh is currently serving in several committees set up by the Government of India. He is a Member of Delhi Urban Arts Commission, Advisor to Association of Indian Universities (AIU), Advisor to Competition Commission of India (CCI), Member of Project Steering Committee (PSC) for 'Developing Energy Efficient Building Material Directory', Bureau of Energy Efficiency, Professional Advisor for National War Memorial, Ministry of Defence, Advisor and Member, Governing Council, NID Haryana, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Jury Member in the Committee for National War Museum, Ministry of Defence, and Member of Expert Committee for selection of tableaux for Republic Day Parade, Ministry of Defence.

He has been consultant, advisor and peer reviewer to many public and private sector organisations, notable being World Bank, CPWD, Shri Mata Vaishno Devi Shrine Board, Reliance Infrastructure, Ministry of Defence for National War Memorial Competition, Competition Commission of India, Basmati Export Development Foundation, Golchha Organization (Nepal), Bureau of Police Research and Development (BPRD) for creating identity of Police Station and conducting architectural competition among others.

Prof. Singh has vast experience in guiding PhD scholars, and numerous publications to his credit.

ISSN: **2582-8304**

Re-Imagining Ageing: The Role Of Mixed-Use Spaces In Fostering Healthy Ageing

1. Ar. Parul Nayar 2. Prof. Dr. Mandeep Singh

Abstract

Mixed-use development in senior living facilities is gaining acceptance to accommodate the transforming needs of older people, and to foster healthy ageing. This research explores the role of integrating senior living communities to various public functions as the key to address social, economic, and psychological challenges faced by the elderly. Specifically, the study evaluates five parameters including - (i) the role of creative placemaking, (ii) public-private interface, (iii) safety through functional intermixing, (iv) sensory experience of nature and explores the possibilities of a (v) barrier-free design, to provide unique architectural design solutions required for the successful functioning of a mixed-use facility for senior living. The above-mentioned parameters, derived from review of literature have been used to study and analyze the Parkside Retirement Homes in Bangalore and House of Generations in Denmark. The two case studies have been selected based on their location, code compliance and functional intermix. Findings of the analysis have been integrated in the design of a potential senior living facility, as a part of an undergraduate thesis project. The paper concludes by providing recommendations on spatial organization and design features that may be incorporated in the development of this nature. In doing so, this study informs the design decisions of various architects and authorities like DDA who are planning for such facilities in near future.

Keywords: **Built environment, Community, Active ageing, Inclusive**

Introduction

Population ageing is a complex phenomenon that is highly influenced by the built environment (Black and Jester, 2020)The built environment includes various objective and perceived characteristics of the physical context in which people spend their time("(PDF) The effect of the physical environment on mental wellbeing | Rachel Cooper - Academia.edu," n.d.)Older adults interact the most with the built environment based on their lifestyles and physical capabilities. This environment plays a crucial role in their ageing process as it not only enables them to carry out their daily activities but also enhances their long-term health and well-being by nurturing an inclusive habitat that caters to their changing needs("CDC - Healthy Places - Healthy Aging and the Built Environment," 2017).

India is witnessing a generational change ("Enabling a new senior care ecosystem," 2021) The increase in life expectancy due to advancements in technology and healthcare infrastructure is leading to considerable population ageing. The Longitudinal Ageing Study in India (LASI) India Report points out that people aged 60 and above account for 8.6% of the total Indian population and are projected to further rise to 19.5% by 2050. This considerable increase in the ageing population is leading to a rise in demand for senior living facilities in India ("Enabling a new senior care ecosystem," 2021)Earlier these facilities were designed as isolated spaces located at the outskirts of the cities, but now within the socio-cultural context of the 21st century, a new spatial category has emerged which breaks away from the traditional

notions of these facilities being imagined as isolated gated communities. Now, the design of these facilities is being envisaged as mixed-use spaces encompassing a diversity of functions and features to foster healthy ageing. The seniors of today are seeking these innovative design models because they allow them to stay connected with society, aid intergenerational interaction and yet ensure safety (News, n.d.).

Institutions like the World Health Organization prescribe a framework to promote age-friendly environments, with a particular focus on the concept of "active-ageing", highlighting the importance of inclusive, accessible environments for the elderly and the possibilities of creation of opportunities for them by mixing functions (Aneshensel et al., 2007) However, there is a lack of data addressing the details of designing these mixed-use environments. Hence, it is imperative to research and understand the specific design features that may be incorporated to design a facility of this nature.

Mixed-use senior living in india- the growing trend

Senior living facilities are residential hubs designed on a "campus-style", having independent units, various other recreational and medical facilities. There has been a major emphasis in the past few years on the needs of the senior population with a focus on their wellness, which includes active community involvement, companionship, independence and better healthcare infrastructure ("Mixed-Use Developments in Senior Living | Senior Living Development," 2019)In short, the changing desires and lifestyle are fuelling the transformation in the development of such facilities and hence, the concept of mixed-use spaces have stepped in. These communities are situated within the city centers

and offer facilities that are open to both the residents and the surrounding community. Their ability to offer a variety of options to the elderly, combined with their flexibility, make them a growing market in the current scenario (Schiavone, 2019)As a result, this new trend encourages active living and also contributes to enhancing social connectivity, interaction, and safety due to its spatial proximity.

Social Engagement

The presence of various amenities that are essentially shared by all forms the foundation for the creation of a "community within a community". Functions like foodcourts, working zones, retail spaces allow for intergenerational interaction to occur ("Neighbourhood Supports for Active Ageing in Urban India - Deepti Adlakha, Murali Krishna, Ryan Woolrych, Geraint Ellis, 2020," n.d.)The key idea lies in designing an active sense of place which is harnessed by making use of the spaces in-between the various functions. These spaces or voids form the binding medium that invites people ("Placemaking and the art of Mixed Use | Dialogue 32," n.d.) By allowing for multiple activities and functions to co-exist at one place, mixed-use housing developments also create opportunities to work. Some seniors prefer to volunteer during their free time at local facilities or others provide free consultancy, their presence also leads to providing off-hours business for retailers and restaurants (Shaw, 2017) Therefore, these facilities create local job opportunities, stimulate the economy and also have a positive impact on overall senior lifestyle by providing higher levels of socialization and diversity in terms of the experiences they offer.

In such a situation, the interface determines the levels of interaction. The distinction between private (residential) and

public (commercial) spaces is defined by the arrangement of various functions (Narvaez and Penn, 2016)which can enable a transition to public street life through private buildings by addressing the interface(Narvaez and Penn, 2016) Moreover, processes by which the mixing of uses takes place is important, such as diversity, conservation and regeneration(Aldous,1992; Törmä, 2011) Common interface typologies are- Accessible/inaccessible, direct/setback, Opaque/transparent, car/pedestrian (Dovey and Wood, n.d.)

Enabling Environment

Another important feature of mixed-use senior living developments is their ability to enable an environment that allows for these functions to occur. Safety is one of the most crucial aspects that impact the elderly. All spaces for the baby boomer generation must provide a sense of security, as well as psychological and physical comfort (Chen, n.d.)Jacobs argued that urban spaces, should be designed with broader aspects of urban form, mixed land uses; and that there must be "eyes on the street", those belonging to "natural owners" of the street(Rosenberg, 1994). Jacob asserts that the seniors tend to feel confident to be within urban areas when they are not isolated from contact with the larger urban realm. The design of the physical environment can promote nature or informal surveillance. If people perceive that they are being observed, even if they are not being observed, it might arouse a sense of apprehension within them(Cozens et al., 2005). Different types of surveillance include natural (e.g. Looking through windows to outdoor spaces) formal or organized (e.g. patrols by police) and mechanical surveillance strategies(Larimian et al., 2013). Other ways of ensuring security include access control. It focuses on ensuring

safety and reducing crimes by denying access to potential spaces of threat. Informal/natural (e.g. spatial definition), formal/organized (e.g. manned security) and mechanical (e.g. locks)strategies (Cozens et al., 2005)might be adopted for the same.

Outdoor spaces and interaction with nature is also considered as an important quality of life aspect of senior living facilities(Rodiek, 2006)Various studies have demonstrated the healing effect of nature which can further aid in improving the cognitive functions of senior citizens.Designing outdoor spaces, and possibilities of interaction with nature often forms the core of the design of mixed-use space and hence becomes beneficial for the baby boomer generation ("Designing biophilia in senior living communites," 2018)According to Clare Cooper Marcus when being exposed to nature and outdoor spaces senior citizens experience a "relief from physical symptoms" or at least the relief from awareness of those symptoms. The is the key for long-term illnesses such as dementia as being constantly reminded of one's disability can have negative impacts such as depression or anger. The second type of healing is stress reduction. Dealing with any medical condition can be emotionally and physically draining for the patient as well as the family members and staff. Hence, nature and outdoor spaces aid in diverting the mind and providing a temporary relief from the same.

Access to all

Lastly, accessibility for all has been recognized as a basic necessity for mixed-use spaces, thus making them ideal to be clubbed with senior living facilities. The foundation lies in designing an environment that can be understood, physically accessed and used

by everyone irrespective of age, gender, situation, or ability (Pioneer, n.d.)For this various design features like wider corridors, grab bars, handrails, adjustable counters and ramps are provided to improve ease of use, comfort and ensure independence to all.

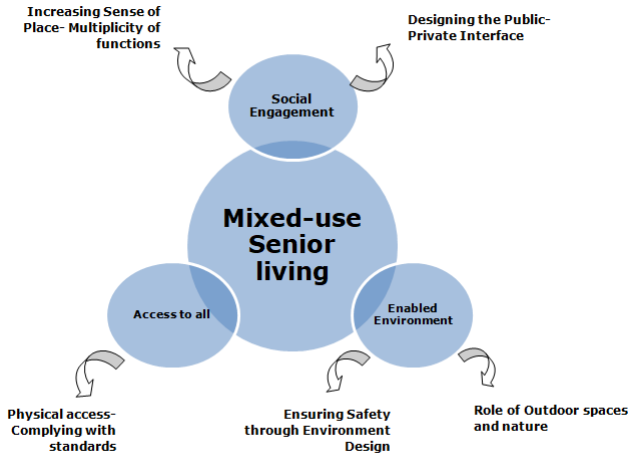


Figure 1- Factors enabling effective functioning of mixed-use senior facility
Source – Author

Based on the literature review, it can be inferred that Social engagement, Enabled environment and Access to all spaces form the pillars of effective functioning of mixed-use senior living spaces with the multiplicity of functions, the interface typology, safety levels, proximity to outdoor spaces and physical accessibility determining the spatial configurations and forming the backbone of the entire system.

The next stagefocuses on analyzing two case examples based on the parameters derived to understand the range ofdesign features that can be used to achieve the same.

Case examples

The following case examples have been selected to understand the exact design features that can enable effective functioning

1) ***Parkside Retirement Homes, Bangalore***
2) ***House of Generations, Denmark***

They have been selected based on their location, code compliance and functional intermix.

Parkside Retirement Homes, Bangalore

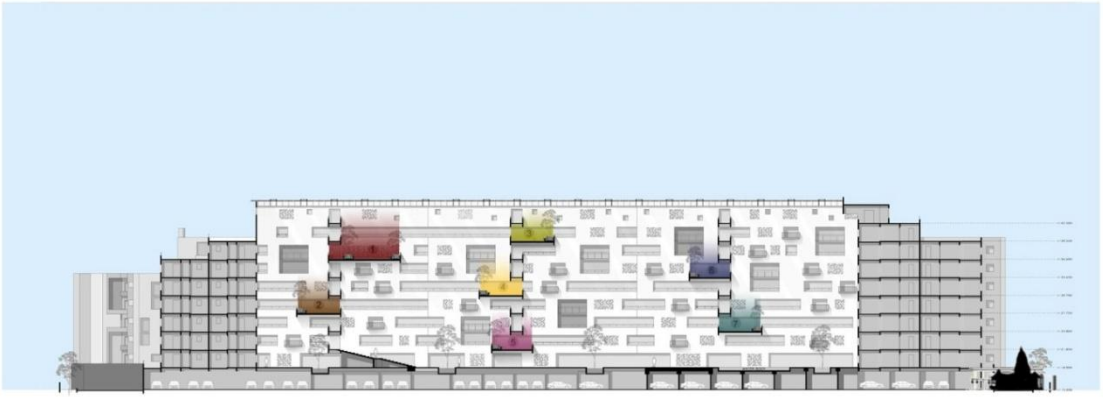
- **Architect: Mindspace**
- **Year of Completion: 2018**
- **Site area: 278709 sqm**
- **Occupancy:156 units**
- **Building height: G+8 floors**
- **User Group: 60+**

Picture 1- Parkside Retirement Home
Source- Archdaily

a) Use of Creative Placemaking

The sense of place is achieved by the volumetric disposition and play of facade. It is the first point that engages the visitor and pushes them to move inside. Once the user enters, light and shadow play a vital role in establishing the connection along with presence of various functions like reading areas, small gathering spaces which provide opportunities for interaction with the residents.

b) The Public-Private Interface



Picture 2- Section through Parkside Retirement Home showing recreation spaces
Source-Archdaily

The podium level is entirely public housing all the amenities required. This is the only point till where the visitors are allowed. The recreation zone for the residents is split into various functions scattered at multiple levels maintaining visual connection with the public space below.

c) Safety

The entire circulation is around a courtyard, which ensures a constant 'eyes on the public areas'.A manned entry/exit gate has been designed to monitor security of the residents. Electronic surveillance is installed in all common areas with 'Call-Points' in all units.

d) Role of Nature & Outdoor Spaces

Picture 3- Open spaces within the facility
Source- Archdaily

The design is based around a courtyard with various waterbodies introduced to create a calming effect. The presence of skylight allows penetration of daylight at all times. The voids in facades have been strategically designed to create break out spaces that allow for interaction at a smaller scale. Furthermore, the terrace has been designed as an active outdoor social space with planters and seaters for comfort of the senior residents.

e) Universal accessibility features in design

Picture 4- Universal accessibility features in design
Source- Mindspace architects

Built in seaters have been designed in all circulation spaces at regular intervals for the residents. Also, the layouts of the units have been designed to reduce barriers like doors and ensure visibility and ease of access to all spaces. The design also adheres to the American Disability Act for design guidelines.

House of Generations, Denmark

- **Architect: ERIK Arkitekter**
- **Year of Completion: 2020**
- **Site area: 25,000 sqm**
- **Occupancy: 314 units**
- **Building height: G+7 floors**
- **User Group: All age group**

Picture 5- View of House of Generations
Source-https://www.rum.as/projekter/english-project-2

a) Use of Creative Place-making

Sense of place is established through the multiplicity of functions that the development offers ranging commercial, office and recreational opportunities thereby improving diversity and attracting a wider user base to the space. The space intentionally mixes the generations by making use of the gaps in between the buildings and activating them with functions. It houses spaces for

all ranging from units for the elderly, including units for individuals with physical disabilities and units for individuals with acquired brain injuries, along with units for youth/students, families and daycare spaces for smaller children("Meeting," 2018)

b) The Public-Private Interface

Picture 6- A typical floor plan depicts the relationship between dwelling units (white) to their semi-private circulation spaces within each "house" (dark green), which links to the semi-public common spaces adjacent to each "house" (light green). Outdoor public spaces are indicated in brown.
Source- Archdaily

Main public and common spaces are located at the ground level which are accessible to the neighborhood community. These include the café, outdoor spaces, daycare centre daycare centre, and a theatre("Meeting," 2018). At every floor, the individual houses spill out to semi-private spaces that foster interaction. These spaces are visually connected to the spaces below but are not physically accessible by the public.

c) Safety

Designed as a gated community for ensure security of spaces. Common spaces/ public functions are located at the ground level with residential spaces designed above to ensure "eyes on street"

d) Role of Nature and Outdoor spaces

Picture 7- Outdoor spaces in House of Generations
Source- https://www.rum.as/projekter/english-project-2

The design involves a variety of small breakout spaces few of which are accessible to public and the rest are private. The idea is to ensure design of both inward and outward looking spaces. The presence of water adjacent to the development adds calm and tranquility to the busy environment. Furthermore, residential units have been designed to harness the waterfrontview.

e) Universal accessibility features in design

A sensitive approach to materiality, color, and differentiation of each threshold aids inway finding. The concept of 'borrowed space' has been adopted while designing individual units. This is preferred for residents dealing with dementia as the main focus is to avoidsegregation through the use of doors/walls("Meeting," 2018)

Design

The design features observed in the case examples were further used in design of an undergraduate thesis project aimed at designing a "Mixed-use senior living facility in Delhi, India"

a) Use of Creative Place-making

Illustration 1- 3D View showing the multiplicity of functions and there inter-relationship
Source- Author

The design incorporates multiple functions ranging from commercial, residential, recreational and community, that foster 'a sense of place' and invite more people to stay. The strategic location of connector functions like the community hall and eateries invite more people to visit the development and interact with the senior residents.

Illustration 2- Public spaces in the design
Source- Author

b) The Public-Private Interface

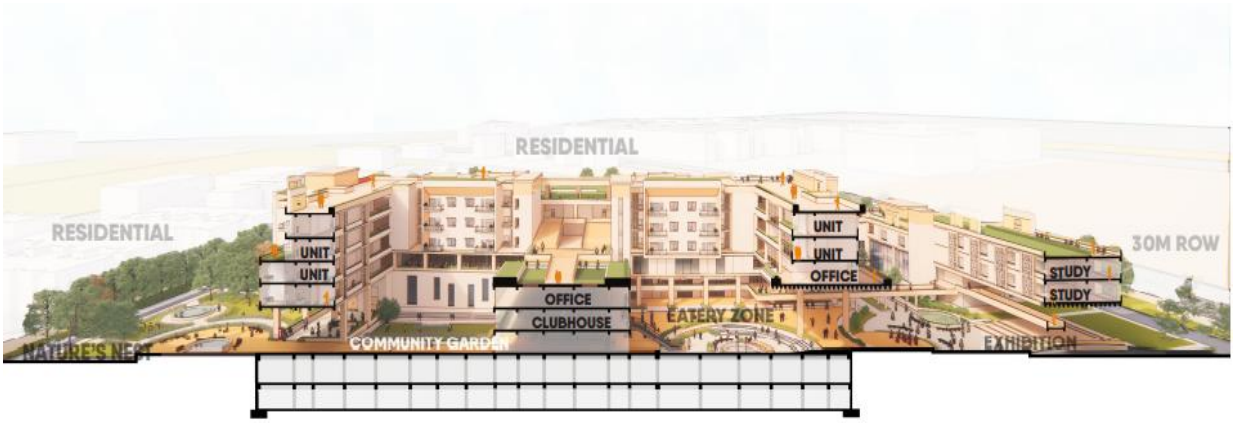


Illustration 3- Sectional Perspective depicting the interface and co-relation between functions

Source- Author

The residential spaces have been located above the public zone thereby promoting natural surveillance in public spaces at all times. The private zones are inaccessible to the public due to access control technology installed in vertical circulation areas. Recreation spaces have been broken into individual functions and scattered throughout the development to promote chance encounters. These spaces therefore function as the binding medium between the public and the private.

c) Safety

The design deploys strategies of natural surveillance followed by rfid technology for access control. Security points have been designed at multiple entrances with security stations at upper levels.

d) Role of Nature and Outdoor spaces

Illustration 4- Landscape strategy and design
Source- Author

The activity levels on site were understood and in order to promote interactions, the public realm has been proposed at two levels. Thus, the nature of experience transitions an active hub to a calm and serene zone called the nature's nest, providing options for multiple interactions. Various water features have been designed in the open spaces to add calmness and promote healing. Built in planters have been designed in all circulation spaces to aid in navigation.

a) Universal accessibility features in design

SUMMARY MATRIX

Parameters	Parkside Retirement Homes, Bangalore	House of Generations, Denmark	Enliven: Mixed-use Senior living community, Delhi (Thesis project)
Use of Creative Place-making	• Play of facade • Multiple recreation spaces • Drama with light and shadow	• Multiple functions for all age groups • Activating gaps between buildings with public functions	• Multiple functions for all age groups • Use of connector functions- Community hall, Eateries
The Public-Private Interface	• Ground level entirely public. • Private units designed above • Visual connection between all spaces	• Ground level designed as entirely public • Private units designed above • Circulation zones designed as small interactive spaces • Visual	• Ground level entirely public. • Private units designed above • Use of RFID technology for access control • Recreation spaces as common functions between public &

		connection between all spaces	**private**
Safety	• **Circulation around the main courtyard.** • **Constant natural surveillance**	• **Gated community** • **Constant natural surveillance through "eyes on street"**	• **Gated community with access control in private areas** • **Natural surveillance through mix of functions)residentialabove public spaces)** • **Security stations at all levels**
Role of nature &outdoor spaces	• **Water features designed for calming effect** • **Skylight to allow daylight penetration** • **Terrace as a social**	• **Multiple outdoor breakout spaces** • **Residential units designed to harness views of the water**	• **Water features designed for calming effect** • **Public realm proposed at two levels** • **Differentiating between public & private through**

	space		**transition in user experience from one edge to the other (active to calm)** • **Built in planters in circulation spaces**
Universal accessibility features in design	• **Built in seaters in design** • **Reduction of physical barriers in unit planing**	• **Differences in materials, colours & textures**	• **Grab bars** • **Anti skid flooring** • **Built in seaters** • **Call buttons in living units** • **Ramps and railings** • **Differences in materials, colours & textures**

Grab bars in washrooms, anti-skid flooring, user friendly fittings for comfortable usage,periodically spaced built in seaters in corridors, emergency alarms and call buttons within each residence, ramps and railings for support in negotiating between levels, spacious elevators, ability to accommodate stretchers in case of an emergency, visual aid through change in colours and textures for easy navigation are few of the features that have been designed.

Conclusion

As India is experiencing a major generational change, the provision for healthy and active ageing is imperative. The term mixed use senior living facility suggests that the space should be inclusive and accessible to all and hence, should be perceived as a part of the urban design. Furthermore, the residential spaces for the senior living community are perceived safer when clubbed with public functions. Not only does this mix foster inter-generational interaction but also creates opportunities for working. This is ac SUMMARY MATRIX ıultiplicity of functions, designing the ınterface, ensurıng safety through built environment design, promoting use of outdoor spaces and adding features that ensure universal accessibility.

Some of the features as inferred from the case examples and design exercise are-

- **Including multiple functions like commercial, community, residential and integrating them both horizontally and vertically to promote chance encounters and ensure natural surveillance at all times.**
- **Using recreation facilities like play zones, cards room, common theatre areas as "connector functions" to establish community building.**

- **Defining zones that are completely public to the zones that are entirely private by using technologies like RFID, visual barriers like screens, landscape design to enable access control.**
- **Introducing water features, outdoor green interactive spaces in design to promote healing effect fostering healthy ageing.**
- **Terraces can be envisaged as an active social space overlooking the public realm.**
- **Design of seating spaces at regular intervals (fixed/flexible)**
- **Designing anchor features to invite people to stay. Eg. Eateries, restaurants, temporary food kiosks.**
- **Designing terraces and courts of interactions as breakout spaces of various activities scattered around levels to create interactive 'pockets' in design.**

Therefore, all of these features play acrucial role in shaping the character of the development, as they all work together to affect the manner in which a space is used and perceived. Based on the context of the development, some factors might have a considerable impact than the other, but the resulting experience and outcomes would be a combination of all of these.

References

- ***Aneshensel, C.S., Wight, R.G., Miller-Martinez, D., Botticello, A.L., Karlamangla, A.S., Seeman, T.E., 2007. Urban Neighborhoods and Depressive Symptoms Among Older Adults. J. Gerontol. Ser. B 62, S52–S59. https://doi.org/10.1093/geronb/62.1.S52***
- ***Black, K., Jester, D.J., 2020. Examining Older Adults' Perspectives on the Built Environment and Correlates of Healthy Aging in an American Age-Friendly Community. Int. J. Environ. Res. Public. Health 17, 7056. https://doi.org/10.3390/ijerph17197056***
- ***CDC - Healthy Places - Healthy Aging and the Built Environment [WWW Document], 2017. URL https://www.cdc.gov/healthyplaces/healthtopics/healthyaging.htm (accessed 8.6.21).***
- ***Chen, K., n.d. SUSTAINABLE DESIGN FOR THE ELDERLY: SENIOR HOUSING DESIGN GUIDELINES 58.***
- ***Cozens, P., Saville, G., Hillier, D., 2005. Crime Prevention through Environmental Design (CPTED): A Review and Modern Bibliography. Prop. Manag. 23, 328–356. https://doi.org/10.1108/02637470510631483***
- ***Designing biophilia in senior living communites, 2018. . Colo. Real Estate J. URL https://crej.com/news/designing-biophilia-in-senior-living-communites/ (accessed 1.22.21).***
- ***Enabling a new senior care ecosystem: India needs holistic regulatory framework [WWW Document], 2021. . Times India Blog. URL https://timesofindia.indiatimes.com/blogs/voices/enabling-a-new-senior-care-ecosystem-india-needs-holistic-regulatory-framework/ (accessed 8.6.21).***
- ***Larimian, T., Zarabadi, Z.S.S., Sadeghi, A., 2013. Developing a fuzzy AHP model to evaluate environmental sustainability from the perspective of Secured by Design scheme—A case study. Sustain. Cities Soc. 7, 25–36. https://doi.org/10.1016/j.scs.2012.10.001***
- ***Meeting: Generations House, 2018. . H O M E. URL https://housingourmatureelders.wordpress.com/2018/08/31/meeting-generations-house/ (accessed 8.10.21).***
- ***Mixed-Use Developments in Senior Living | Senior Living Development [WWW Document], 2019. . LCS Dev. URL***

https://www.senior-living-development.com/senior-living-mixed-use-developments/ (accessed 8.6.21).

- ***Narvaez, L., Penn, A., 2016. The Architecture of Mixed Uses. J. Space Syntax 7, 107–136.***
- ***Neighbourhood Supports for Active Ageing in Urban India - Deepti Adlakha, Murali Krishna, Ryan Woolrych, Geraint Ellis, 2020 [WWW Document], n.d. URL https://journals.sagepub.com/doi/full/10.1177/097133362 0937497 (accessed 8.8.21).***
- ***News, S.H., n.d. Strategies for Mixed-Use Development in Senior Living [WWW Document]. URL https://resources.seniorhousingnews.com/strategies-for-mixed-use-development-in-senior-living (accessed 8.8.21).***
- ***(PDF) The effect of the physical environment on mental wellbeing | Rachel Cooper - Academia.edu [WWW Document], n.d. URL https://www.academia.edu/471564/The_effect_of_the_physical_environment_on_mental_wellbeing (accessed 8.14.21).***
- ***Pioneer, T., n.d. Barrier-free design: Making environment accessible to the disabled [WWW Document]. The Pioneer. URL https://www.dailypioneer.com/2013/state-editions/barrier-free-design-making-environment-accessible-to-the-disabled.html (accessed 8.8.21).***
- ***Placemaking and the art of Mixed Use | Dialogue 32 [WWW Document], n.d. . Gensler. URL https://www.gensler.com/publications/dialogue/32/placemaking-and-the-art-of-mixed-use (accessed 8.7.21).***
- ***Rodiek, S., 2006. A Missing Link: Can Enhanced Outdoor Space Improve Seniors Housing? Sr. Hous. Care J. Volume 14, 3–19.***
- ***Rosenberg, E., 1994. Public and Private: Rereading Jane Jacobs. Landsc. J. 13, 139–144.***
- ***Schiavone, L., 2019. Exploring Senior Living Partnerships in Mixed-Use Development — Love & Company. URL https://loveandcompany.com/2019/08/exploring-senior-living-partnerships-in-mixed-use-development/ (accessed 8.6.21).***

- ***Shaw, J., 2017. Seniors Housing Draws Customers to Mixed-Use Centers. REBusinessOnline. URL https://rebusinessonline.com/seniors-housing-draws-customers-to-mixed-use-centers/ (accessed 8.7.21).***

***Ar. Gunjan Jain** completed her B.Arch from G.G.S.I.P.U New Delhi in 2003 and Masters in Planning with specialization in Environment from School of Planning and Architecture,New Delhi in 2005.*

She has 16 years of experience, wherein she has worked on projects in association with CPCB, GTZ, MoEF, HUDCO, DDA, SPA Delhi (institutional projects) and well known private firms in Delhi. She has also been actively involved in teaching since 2010 as a visiting faculty at SPA Delhi and architectural colleges under IP University.

She is presently working as an Assistant Professor(on contract) in the Department of Architecture, SPA New Delhi and is also pursuing her PhD research in the field of energy efficiency in the built environment from the same department.

Dr. Shuvojit Sarkar ***completed his graduation in architecture from TVB,School of Habitat Studies,G.G.S.I.P.U New Delhi in 2002 and Post Graduation in Planning with specialization in Environment from School of Planning and Architecture,New Delhi in 2005. He completed his Doctoral Research in the year 2019 from Jadavpur University.***

He has almost 17 years of experience in research and academics.He has worked on various funded research projects in SPA,Delhi apart from institutional consultancy projects.

He is presently engaged as an Associate Professor in the Department of Architecture, SPA New Delhi. His fields of research and interest include Sustainability, Environmantal Stewardship and AI.

ISSN: **2582-8304**

Material Oriented Design Approach
A Paradigm shift in Form Generation

Ar. Gunjan Jain[1]*
[1]*Assistant Professor,
School of Planning and Architecture, New Delhi

Dr. Shuvojit Sarkar[2]*
[2]*Associate Professor,
School of Planning and Architecture, New Delhi

Abstract

The study investigates futuristic material-oriented design approach in generating forms, wherein the form generating process is informed by the combination of material properties and its behaviour, keeping in mind its impact on the environment. It is an alternative to the present-day form oriented design approach, wherein the material aspect is often taken up after the form generation, within the limitations of the known traditional construction techniques. The need of the study originates from the fact that the nature inspired material-oriented design approach could be the potential need of the hour for a more holistic sustainable architecture and to address the global emergency of climate change.

The current experimental practices involving the concepts of 'material ecology' and 'material morphology' along with their design process and implementation have been explored by reviewing and critically analysing the works of Ar. Neri Oxman and Ar. Achim Menges. An effort has been made in the study to evaluate the pros and cons of implementation of both the concepts in the form generation process, so that the architects and designers can take a more informed decision. The study relies on secondary case examples as very few works have been attempted globally on this

emerging concept.

The detail study of the works on this concept reiterates that built form generation through this approach addresses the complex interrelation between materiality, form, structure and space, the related processes of production and assembly, and; the varying degree of performance effects that emanate from the interaction with environmental influences and social/cultural forces. The construction of built forms is no longer limited to collections of discrete parts with homogeneous properties. They rather resemble organs that can be computationally 'grown', additively 'manufactured' and biologically 'augmented' to create heterogeneous and multifunctional objects.

The potential and challenges of the material-oriented design approach along with the possibility of taking it up on a large scale in the near future has also been discussed.

Keywords: ***Material Informed Design, Material Ecology, Material Morphology, Sustainable Architecture.***

Introduction

The rapid growth of the building and construction sector is contributing significantly to human induced climate change. Buildings and construction together account for 36% of global final energy use and 39% of energy-related CO_2 emissions. The energy intensity per square meter of the global buildings sector needs to improve on an average by 30% by 2030 (compared to 2015) to be on track to meet global climate ambitions set forth in the Paris Agreement (UNEP Global Status Report,2017). Countries, party to the Paris agreement, are making every possible effort for reducing the carbon footprint of the building and construction sector. Lot of

efforts have been made in reducing the operational energy through building envelope optimization and regulatory measures such as introduction of energy codes. Improvements in technology of processing, manufacturing and assembly of building materials are also being undertaken. However, the ecological soundness of modern day design approach in form generation, especially inspired and governed by the chronicles of industrial revolution, needs to be relooked into, which is often neglected in literature and currently seen architectural practices.

In this paper, emerging concept of nature responsive and nature inspired material oriented design approach has been reviewed and critically analyzed to see its potential as a possible alternate way to make the modern design approach more environment sensitive and sustainable along with respecting both human and functional value of architecture (Asefi et.al,2016). The short comings of the current methodsare evaluated according to ever-changing userrequirements and with respect to the environment.The available technology in terms of material andfabrication techniques has been taken into consideration as an invaluable opportunity in the development of theproposedstrategy.

Design approach with materials and methods-a historical perspective

The foundation ofbasic frameworkfortheemergence and initial establishmentofdifferent architectural theories was laid during 'TheRenaissance'andflourished especially after the advent of industrial revolution. The attention towards the incorporation and adaptation of the industrialization processes and methods in building construction industry led to amajor paradigm shiftinarchitecturaldesign.Thediscovery and inventions of new

materials, construction methods and large number of industrial products and production technology, coupled with the population explosion, propelled the progress of modern architecture to a whole new league. Progresses in science and advent of new possibilities; overwhelmed the architectural fraternity so much, that they started to deviate from the classical architectural principles and adapted to the new 'trends' in design which were often results of various experiments. These new and rapid developments led into separation of architectural and engineering processes. Development in engineering and technology, especially propelled by advancement in computer science related to design and analysis of form and structure, opened new avenues towards free form architecture and gave a whole new dimension to construction of complex geometry forms.

With the unprecedented scale of urbanization and tremendous building growth across the world, in the modern architecture, design processes are based on the principles of industrial revolution imbibing values of mass production which has led into separation of form, analysis and fabrication.

However, in vernacular architecture it's the holistic understanding of the traditional materials, their behavior and assembly difficulties that led architects into design and fabrication which helped it to further evolve as an integrated process (Asefi, 2016).

The need for anewenvironmental-sensitive designapproach- material oriented design

"Climate change is not a problem of the future, it's here and now and affecting very region in the world" said Dr. Friederike Otto from the University of Oxford, and one of the many authors on the

UN's Intergovernmental Panel on Climate Change (IPCC) report.

The most recent IPCC report, August, 2021, underlies the urgency of taking action at global level to halt climate change and deal with its unstoppable effects. The report warns that without immediate rapid and large scale reductions in greenhouse gas emissions, it will be impossible to limit warming close to 1.5^{o} C or even 2^{o}C.

The global climate emergency is prompting architects to embrace new sustainable design and construction strategies to counteract the effect of widespread building activity on the environment. This is paving way for a pressing need of an imminent change in architectural design approaches too. It is leading to emergence of approaches like Bionics or Biomimetics, Biomimcry, Biophillia etc. in the domain of architecture. Though at present, they are often dealt in a superficial and cosmetic manner.

The ecological failure of the modern design, is leading to a shift to materiality in the design culture (Oxman et.al, 2014). Material-based design approach is in general trusted upon to achieve a more sustainable design approach. In this approach the processes of form-generation are informed by the combination of material properties and environmental constraints (Oxman, 2012). Advancements in technology has provided new possibilities for material experimentation and exploration in various stages of architectural design processes.

Material-oriented design approach explores the way in which material behavior and properties can be utilized to its full potential from the very inception of the design processes to make resulting architecture more sustainable, truly holistic and

encompassing. Unlike prevalent design practices of architectural form generation, material-based design emphasizes the integration of design and fabrication processes inspired from various phenomena existing in nature. Nature's way of design shows that infinite iterations in forms are possible through optimal resource utilization. Figure 1a and b. illustrates the process of design in the material-based approach in comparison with the current design practices in architecture.

In current design practices, architects design forms and then seek help of engineers and various consultants for environmental, structural, services analysis and; when the form is finalized, the construction experts start the fabrication processes. This approach to design is often quite inefficient as it results in consumption of a lot of resources to achieve the desired architectural form.

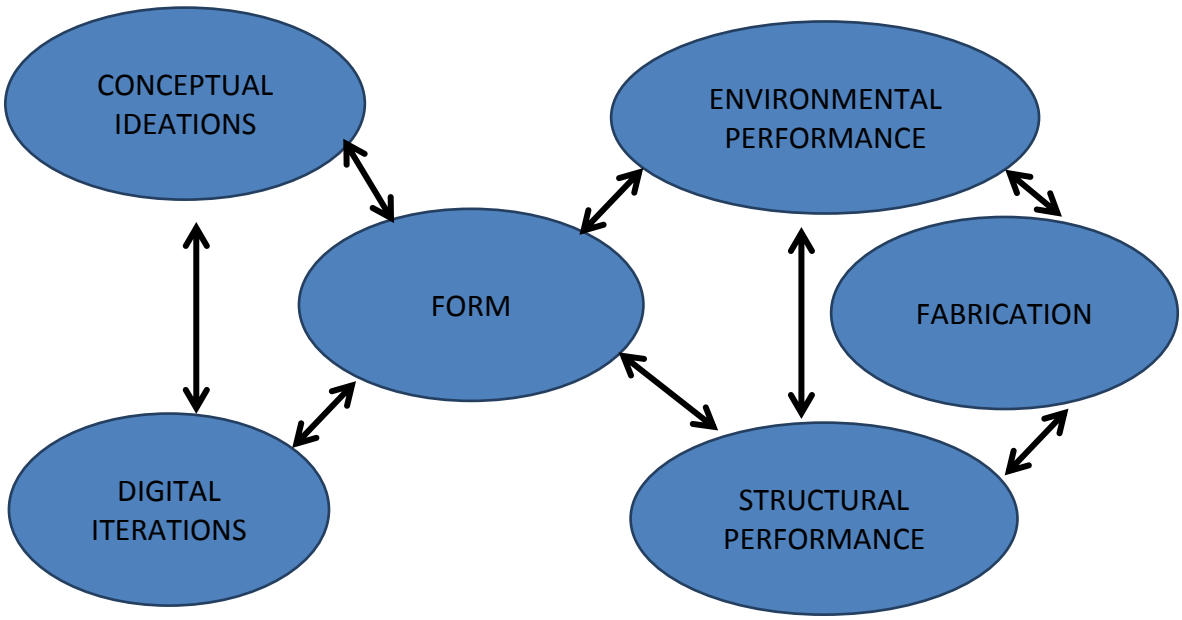


Fig1a.Present Prevalent Practice
Source: Author

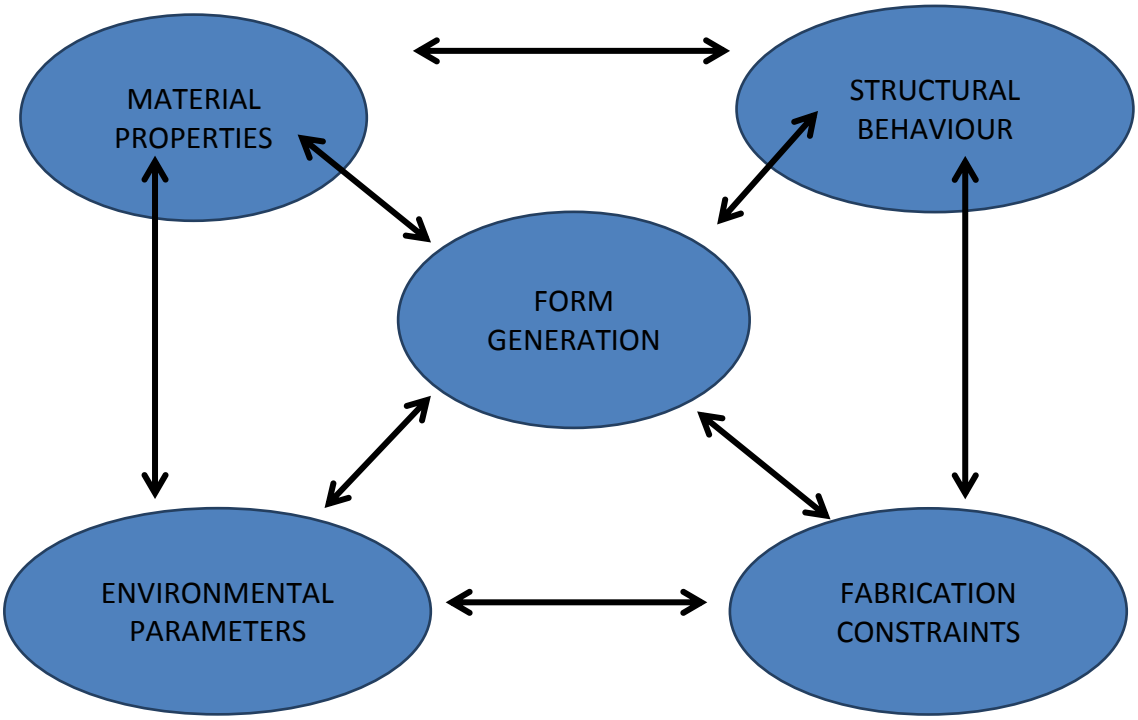


Fig1b.Material Oriented Design Practices
Source: Author

In material-oriented design approach inspired by nature, form generation is driven by primarily with the motive of maximizing performances with minimal resources (Oxman, 2012). In this method, analysis and computation of material behavior and properties is done at an early stage of the design to tap the potential of the material in terms of structural and morphological properties, increasing efficiency and reinforcing performances of the form and the resultant design. Analysis plays a vital role during the entire morphogenetic process, not only in firmly establishing and assessing the suitability criteria related to the structural and environmental capacity, but also in revealing the system's material and geometric behavioral tendencies (Menges 2007).

Material oriented design practice is characterized by the dominance of material over shape and incorporation of material

properties, structural behavior and environmental parameters to inform the distribution of matter to generate form. In current design practices, virtual shape- defining parameters are typically prioritized over physical material and fabrication constraints, which are often considered only in hindsight, following a geometric-centric design approach (Oxman,2011; Menges,2011).

Recent advances particularly in the upcoming field of direct digital production are enabling a shift from the popular geometric-centric design practice (Oxman, 2011). Such approach to design is an outcome of the easy availability of computational design, digital fabrication, additive manufacturing and also progresses in material engineering. Computing the distribution of matter as a function of structural and environmental performance, is not only to control substance variation defined as per a given boundary, but better still, utilizing such method for generation of form itself (Oxman, 2010). Thus material computation does open up endless form generation possibilities inspired by nature. Figure 2 illustrates the main goals of material based design.

Most designers employ bio-mimicryas a method to incorporate the aspect of sustainability in whattheyhavedesigned (Baumeister, 2007). Despite The availability of nature as an inspirational source to design, translation of biological knowledge to a human design setting has stayed at a very superficial levels inceit is mostly done by mimicking formor certain mechanical aspects of an organism (Zari, 2007). Material-oriented design approach takes bio-inspiration and bio-mimicry to the next level where it seeks to mimic nature's way of not only to build but also design.

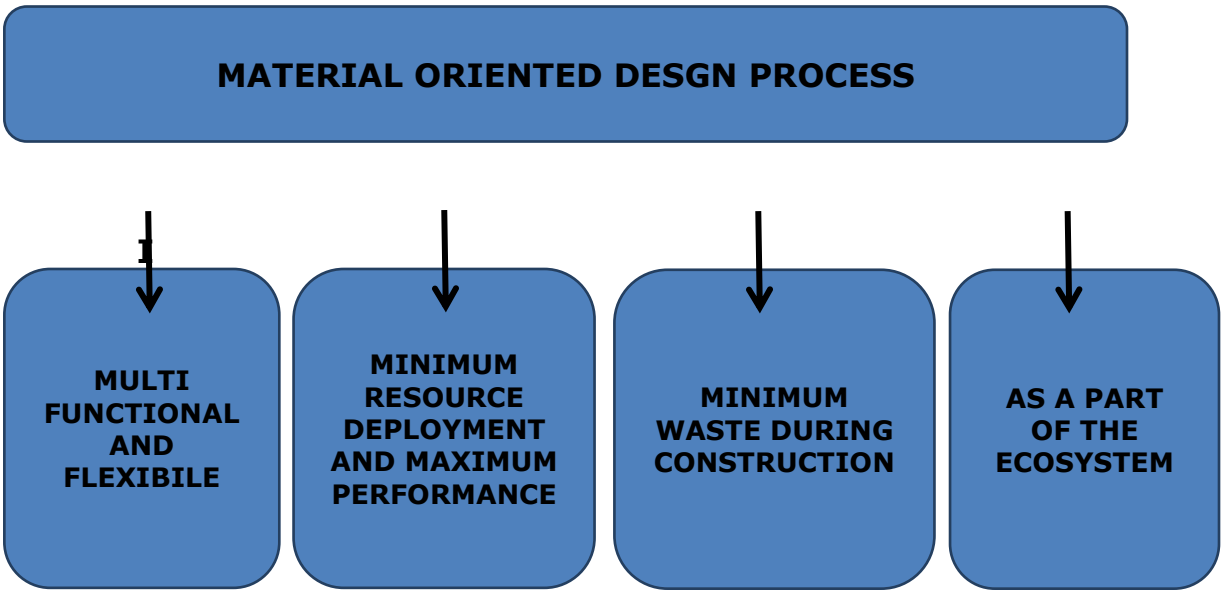


Fig2.Material Oriented Design Outcomes

Source: Author (Adapted from Asefi et.al, 2016)

Although many other forms ofbio-inspired designs have also been explored and widely used by researchers and professionals in the field of sustainable architecture (Reed,2006;Royo et.al,2015),material-baseddesignapproachis more likely to accomplish sustainability through fundamental changes in design strategies as it is more holistic and starts from the inception. Thisapproach holds promise as a true shift from conventional design methods to an approach in which form generation is based on natural principles that allow it to successfully function. However the widespread and practical application of material-oriented designapproach to design architectural form as a design method remains experimental till date.

Evaluating existing material oriented designstrategies - a comparative analysis

In this section, the researches in the field of material-oriented design in architectural domain by Prof. Neri Oxman and Prof.

Achim Menges have been critically examined and the similarities and differences between their design approaches are highlighted.

Prof.Neri Oxman conducts research at the intersection of computational design, digital fabrication, material science and synthetic biology. She frequently uses the term 'material ecology' to best define her research work. On the other hand, Prof. Achim Menges research primarily focuses on the development of integral design processes at the intersection of morphogenetic design computation, biomimetic engineering and computer aided manufacturing. His research aims to demystify the morphological complexity of material constituents used in design of architectural forms. In this paper his work in the field of material-based design will be referred as 'material morphology' to be categorically distinguished from 'material ecology'. The comparison of the set wo design practices is based on the strategies that they implement in the development of their design and research projects.

Some of the similarities in the design practices followed by architects Oxman and Megnes are that they seek the integration of material behavior and design computation. They are inspired by the inherent guiding principles behind nature as active agents of form-generation. Both the design practices aim to study, understand and compute material behavior at microscopic and macroscopic level to be able to generate forms. The difference being that material morphology practiced by Menges unfolds performative complexity through morphology, the assembling method is through the process of construction and the forms may or may not be multifunctional. Whereas the material ecology practiced by Oxman tend to create new material and behaviour

through assembling method and seamless design by use of anisotropic materials.

The piece-of-art displayed in CentrePompidou Paris, 2012 (Plate 1) is an example in which Achim Megnes uses wood as responsive skin material by rediscovering new performances in wood structure by means of computational design. In this project inherent hygroscopic properties of wood as well as differentiation of wood structure in radial and tangential sections are employed to design an innate climate responsive piece of art with no need for any technical equipment or energy. This hygroscopic skin reacts to different levels of humidity and canbe employed as passive solution for ventilation inbuildingskin.

Plate.1 : Hygroscope – Meteorosensitive Morphology Morphogenetic Design Experiment, Permanent Collection, Centre Pompidou, Paris, 2012.
(Source: http://www.achimmenges. net)

Monocoque project (Plate 2) undertaken by Neri Oxman entails experimenting with a structural skin that combines structural, environmental and physical performances of the skin by adjustingits various physical performances like thickness, pattern density, stiffness, flexibility and translucency to load,curvature and skin pressured are as respectively

(Oxman,2012). In this project by understanding and exploiting material properties creatively, the skin is able to perform multiple functions. The white soft material by letting light through thereby addresses the transparency and luminosity aspect, while the black stiffmaterial lends the required structural strength to the skin in question. It should be noted that multi functionality which is the primary aim of the project, draws its inspiration from nature and is one of the main principles that Prof. Oxman follows in herdesignprojects.

Plate 2: Monocoque – Structural Skin, 3D Print Museum of Modern Art, NY, 2007,
(Source: https://mediatedmatter.com)

Functional anisotropic materials displaying their gradients on multiple length scales and locations are ever present in natural systems (Oxman et. al, 2012).Prof. Oxman's desire to design heterogeneous forms into one single part in orderto accomplish multi functionality within the structure and also moving away from assembly of parts by means of digital anisotropy is clearly reflected through her designs.

In one of the Prof. Oxman's experimental projects; a large scale continuous and multi-dimensional structure- 'The Aguahoja' (Plate 3 and 4), the structural pattern that unfolds is inspired by nature, an insect wing or leaf venation structure as one may like to interpret, and its final shape outcome demonstrates

controlled folding into arobust and light weight cantilever beam configuration (Berkebile,2007).Through the application of additive manufacturing techniques, the different material properties created out of carrying chemical concentration of materials was employed to generate a structure that surprisingly and seamlessly transmitted from beam to mesh at such a large scale.

Plate 3: The Aguahoja-Project, Hierarchically structured Chitosan made – Structural Skin on display, MIT, Mediated Matter Lab, Media Lobby2018 (Source: https://www.creativeapplications.net, https://mediatedmattergroup.com/)

Plate 4: Hierarchically structured Chitosan properties – Structural Skin (Source: https://www.creativeapplications.net)

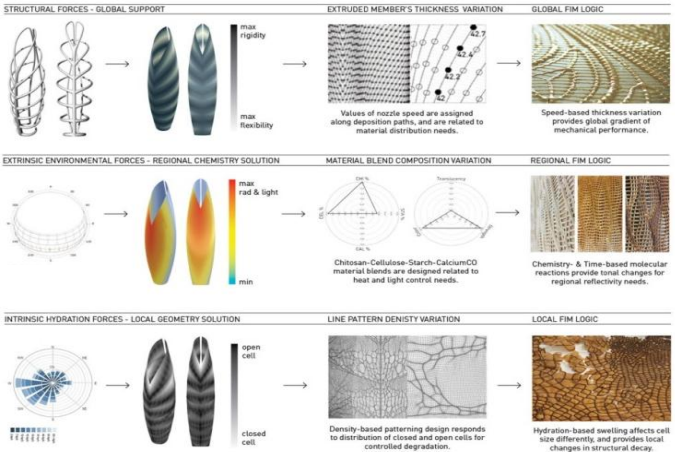


Plate 4: The Aguahoja-Project, Property of the structural skin and its performance under various forces

(Source: https://mediatedmatter.com)

In comparison to Oxman's projects, that are primarily additive processes and with incremental growth idea majority of the times, Megnes's is mostly assembly in fabrication while benefiting from digital fabrication in his projects that he employs. The structure of a temporary research pavilion designed and constructed in 2010 in the Institute for Computational Design (ICD) and the Institute of Building Structures and Structural Design (ITKE), is made out of plain plywood (Plate 5). In this project the elasticity characteristics of timber in its equilibrium state is engaged to derive the complex physical form of the structure.

Plate 5: The Pavilion (various views) – Stuttgart University, 2010

(Source: http://www.achimmenges. net)

One of the salient features of this pavilion is the implementation of architectural aesthetic features integrated with material behavior and environmental constraints to achieve a highly

efficient architectural form with one single material. Even though the design process was an extremely challenging, complicated and intricate task, the result was a form which was quite simple and efficient. Integrating architectural forms with material and structural behavior as well as environmental constraints as a fundamental principle in material-based design approach is an intricate and complex task that has been successfully achieved in this project. The torus shape of the pavilion as well as the light penetration through the skin of the pavilion is combined with the curved entrance of the pavilion to create a dynamic and an exciting architectural space.

Prof. Oxman seeks to design forms which change not only the design processes but also fabrication processes in order to achieve forms that are highly efficient both structurally and unctionally. In this approach, she also seeks to construct forms that are not only fabricated but also grow. Prof. Oxman's desire to explore a non-assembly method of construction, primarily geared towards seeking growth in form-generation, becomes apparent in the project of Silk Pavilion (Plate 6 and 7). In this project digital fabrication was used to set up the main structure of the pavilion while silk worms filled inthe gaps over a period of time. The process of form generation in whichdigital technologies and nature are employed to create a desired form is called by Prof. Oxman anature inspired-design.

Plate 6: Silk pavilion-MIT Media Lab, 2012-2018
(Source: https://mediatedmatter.com)

Plate 7: Silk pavilion-MIT Media Lab, 2012-2018
(Source: https://mediatedmatter.com)

Comparing two design practices highlights that materiality as a driving agent of form-generation process opensup endless design possibilities just like the way nature provides diverse, efficient, adaptable forms out of limited number of fibers and cells. As a whole, Megnes's design practice ismost likely to be easily assimilated in current architectural practices due to its eco-friendliness, the similarity of forms to current architecture which makes it more relatable. On theother hand, Oxman's design practice might leadto fundamental changes in the future

of not just design processes but also the form of architectural buildings and inherent quality of material as a driver of form. This has been clearly shown through the material-based design approach examples discussed here.

The implementation of material-oriented designapproach- the potential

Many designers and architects select bio mimicry or other bio-inspired design approachesto enhance the sustainability of what they have created (Zari,2007)and the outcomes do witness small yet significant improvements. On the other hand, material-oriented design approach seeks to pick up particular characteristics both in micro and macro scales through the larger understanding of the materiality in nature and strive to translate it into a usable human design options in addition to possible implication of analysis right from the inception of the project and carries it through.

The other bio-inspired design approaches might just simply entail replicating nature's ecosystem and not just forms and organisms. In this strategy, architects may not be able to produce a satisfactory design addressing all the important issues unless they have a sound scientific understanding and collaboration of the entire process of design. With the limited understanding of materials in design computation and digital fabrication, itis quite possible that the translation of such knowledge into a human design setting may lead to unsuccessful designs. On the other hand, the material-oriented design approach can result in innovative building technologies and materials since itnot just studies materials superficially but also

explores the properties of materials.

While other bio-inspired design approaches mainly aim to respond to particular predetermined built environment and design problems, material-based design outcome can lead into thoughtful design solutions through studying material behavior and properties in both micro and macro scale and accordingly manipulating its properties. Ecosystem mimicry means that a far more in-depth understanding of ecology guides the design of a built mass that is able to participate in the major biogeochemical material cycles of the planet (hydrological, carbon, nitrogen etc.)in are inforcing rather than damaging way(Charest,2007).

Material-based design approach can be seen as a sourcefor possible innovation and even a regenerative and uniquebuilt environment. This approach if imbibed can go way beyondsustainingcurrentconditionstoarestorativeonetoguidethrou ghintegrationwithsurroundingenvironment andbecoming part ofnature'secosystem. In fact, the greatest advantage of thisapproachisthepotentialpositiveeffectitcanhaveonthesurroundin genvironmentandevencounteracting the current drawbacks of modern design to a great extent.

While modern design was primarily based on the basic premise and values of mass production, whereas material based design approach is promoted basedon primarily the values of sustainability raised by the ecological failure of modern architecture. Inspite of modern architecture in which form follows function, in this approach form follows material behavior and properties.

Material-based design may be sought to attain and address ecological, social, cultural, aesthetical aspects successfully so that the new built forms don't fall into the same trap of modern architecture. It is often argued that studying natural systems and the way nature designs may open away towards strengthening architectural design strategies by addressing human values while the form is generated. Studying nature's design strategies shows that each form is representative of unique and very special needs. For example body structure and behavior of Namib Desert beetles known as Fog stand beetles is a highly efficient response to the harsh arid climate of the desert as a water vapor harvesting technique (Guadaremma et.al,2014) while protecting the beetles from surrounding environment. By studying nature, it becomes clear that different forms generated by nature are responsive to unique needs and the irresponsive is highly effective and efficient.

Architecture is a response to various needs and values of human beings,therefore it is only natural and obvious to implicate human criteria in conjunction with material and structural behavior and also environmental constraints at the early stage of design processes. This design strategy which considers both material properties and function and the form of the building in a mutual interaction is able to respond to many human and environmental needs and values while embracing the nuances of technologies.

It allows the architect the quintessential freedom to manipulate the design not just supported by technical, material, structural and environmental aspects but mainly through a close reference with aesthetical, social, cultural necessities. The recommended material-based designstrategy in Figure 3 begins by an emphasis

on how human needs, expectations andvalues (social and culture) can be implicated in the design process along with existing project constraints while achieving a sustainable architectural design while emphasizing the domain of materiality. The variables of structure, environment, social and fabrication constraints are also considered while form generation in this design process. Hence, it is the architect who finally guides form generation and develops it till finding an efficient response to architectural and environmental values and requirements. Additive manufacturing does hold good promise for large scale design and building fabrication especially in this era of globalization.

The implementation of material-oriented designapproach- the challenges

It needs to be mentioned that it is hardly expected that the material-oriented design approach becomes popular any time soon in near future due to the fact that the form generation during this approach employs highly advanced and complicated knowledge and sophisticated technologies. Nevertheless, the ever-changing architectural requirements, evolving technologies and world's emerging environmental problems may make this design strategy a necessity and even an indispensible part in the future of architectural design and construction.

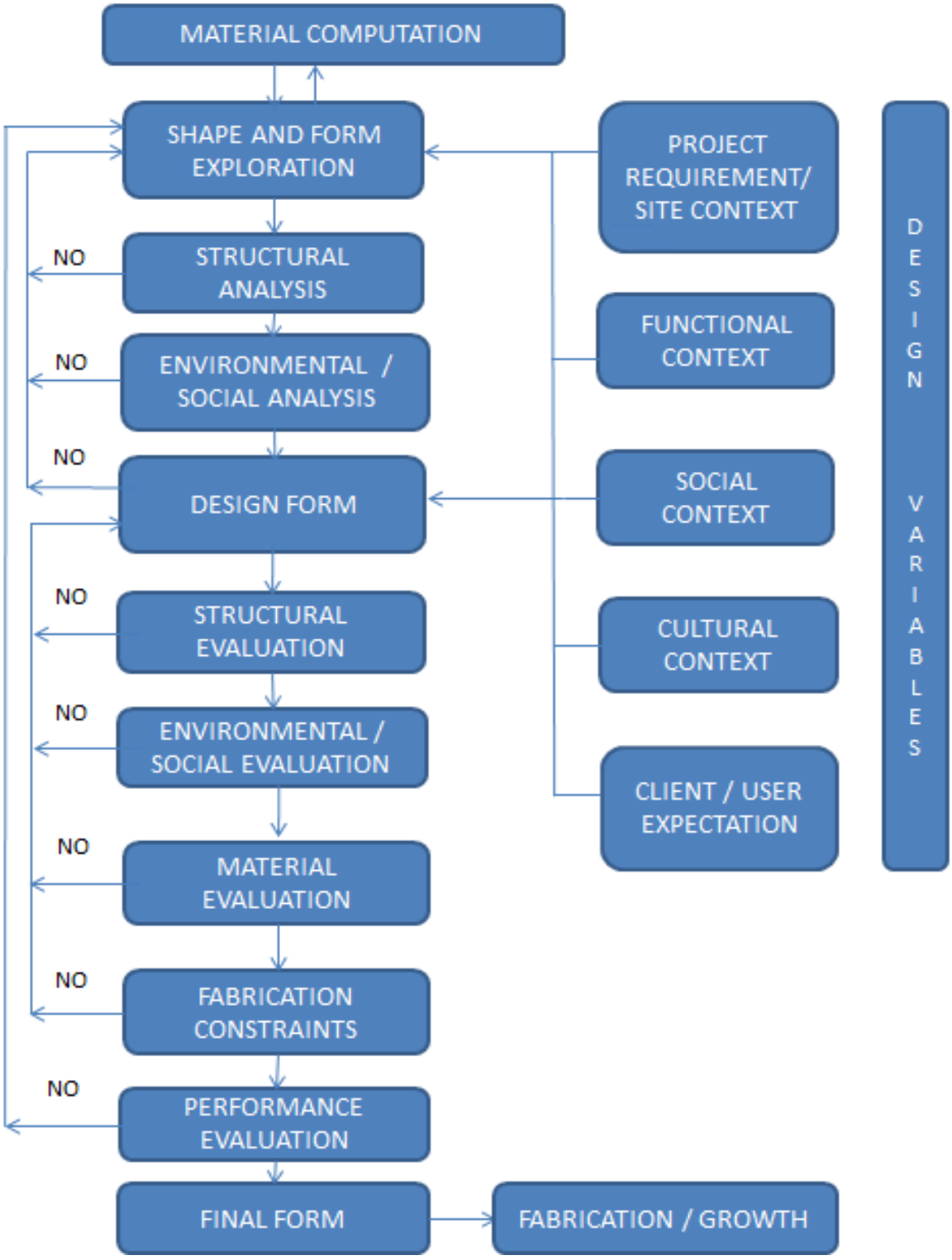


Fig3.Recommended Material Oriented Design Approach to overcome the Challenges in Form Generation

Source: Author (adapted from Asefi et.al,2016)

The complexity of this approach is primarily due to the involvement of many parameters that are barely considered in any simple architectural design strategies such as material morphology and material ecology. It is quite clear that it will not be possible to design and construct entire building through material-based design approach in the immediate future, due to many undefined parameters and technical issues that need to be addressed, including the way different parts of building such as electrical and mechanical equipment are incorporated in the design. However, one does hope for implementation of this approach, as the various technical issues are addressed in due course of time.

Conclusion & way forward

Material-based design approach has the potential to become an inherent part of the eco-system and revolutionize the approach and generation of architectural forms. The proposed approach can be considered as an efficient strategy for the design of kinetic architecture. It eliminates the need for joint connections to a large extent and helps in accomplishing energy efficient design with little need to rely on external energy and technology during manufacturing phase. Another great potential of material-based design approach is generating passive multi-functional building skins which makes it a part of the surrounding eco-system and thereby reducing the energy consumption during the operational phase. As a whole, material-based design approach holds immense promise as the initial step towards the future sustainable architectural design practices. However, how it addresses the issue of social acceptability, technology adaptability and economic viability on a mass scale in the near future would be interesting to see. But one may argue that in this

era of globalization this may not be such an issue considering the immense environmental benefits it has and with the present level of awareness.

References

1. ***Oxman,N.,Material-BasedDesignComputation,ADReader,MakingandPrototypingArchitecture, (2012).***
2. ***Sennet, R., The Craftsman, Yale UniversityPress, (2008).***
3. ***Oxman,N.,Ortiz,C.,Gramazio,F.,Kohler,M.,Material Ecology, Computer-Aided Design,Elsevier,60:1–2,(2014).***
4. ***Menges, A., Computational MorphogenesisIntegralFormGenerationandMaterializationProcesses,Em'body'ingVirtualArchitecture:The Third International Conference of theArabSocietyforComputerAidedArchitecturalDesign (ASCAAD 2007), Alexandria, Egypt,pp.725, (2007)***
5. ***Oxman, N.,Material Ecology: UnitingPrinciples of Engineering and Nature SarahWright,SPECTRUM,MassachusettsInstituteofTechnology, (2011).***
6. ***Oxman,N.,Material-basedDesignComputation.Ph.D.thesis,MIT,(2010).***
7. ***Baumeister,D.,EvolutionoftheLife'sPrinciplesButterflyDiagram,personalcommunication,(2007).***
8. ***Pedersen Zari, M., Biomimetic ApproachestoArchitectural DesignforIncreasedSustainability, presented at the SustainableBuilding (SB07) Regional SustainableBuildingConference,Auckland,NewZealand,(2007)***
9. ***Reed,B.,ShiftingourMentalModel-"Sustainability" to Regeneration, RethinkingSustainable Construction 2006: NextGenerationGreenBuildings,Sarasota,Florida, (2006).***
10. ***DuroRoyo,J.,MogasSoldevila,L.,Oxman,N., Flow-Based Fabrication: An IntegratedComputationalWorkflowforDesignandDigitalAdditiv***

eManufacturingofMultifunctionalHeterogeneouslyStructuredObjects,Elsevier

, Computer-Aided Design Journal, SpecialIssue on Geometric and Physical ModelingforAdditiveManufacturing,(2015).

11. ***Oxman, N., Tsai, E., Firstenberg, M., DigitalAnisotropy:AVariableElasticityRapidPrototyping Platform, Virtual and PhysicalPrototyping,Volume7,Issue4,2012***
12. ***Berkebile,B.,MasterSpeakerAddress,LivingFutureConference,Seattle,WA,(2007).***
13. ***Charest,S., EcosystemPrinciple Research,personalcommunication,May,(2007).***
14. ***Guadarrama-Cetina,J.,Mongruel,A.,Medici,M.-G., Baquero, E., Parker, A.R., Milimouk-Melnytchuk, I., Gonz´alez-Vi˜nas, W., andBeysens, D., Dew condensation on desertbeetle skin, The European Physical JournalE, 37(109), (2014).***
15. ***UNEP Global Status Report, (2017)***
16. ***Asefi,M.,Afzali,Z., Environmentally Sustainable Architecture: Material –Based Technological Design Approach, Current World Environment Journal,Volume11,Issue 1,2016***
17. ***http://www.achimmenges.net***
18. ***https://www. matter.media.mit.edu***
19. ***https://www.creativeapplications.net***

***Ar. Priyanka Kochhar** is currently a research scholar pursuing her PhD from the School of Planning and Architecture (SPA), New Delhi. She is an architect by qualification from SPA, New Delhi, has a Masters' degree in Environmental Conservation from the University of Greenwich, London, and has several publications to her credit. She brings with her over 15 years of experience in business strategy, sustainability education and advocacy, credentialing, building certification, green building policies, and strategic partnerships. She worked for ten tears at The Energy and Resources Institute (TERI), and spearheaded the GRIHA programme, which was the first indigenous green building rating system of India, adopted subsequently by the Government of India. She went on to join the Green Business Certification Institute (GBCI) where she led the EDGE programme in India (an innovation of IFC, a member of the World Bank Group) and various education programmes of the United Stated Green Building Council (USGBC).*

She served on the Board of UNEP Sustainable Building Climate Initiative (SBCI) and its Advocacy Committee as the youngest member and was the first Rockefellar Young LEADer.

Prof. (Dr.) Mandeep Singh is ***presently Head Industrial Design Department and has been Head Architecture (2014-15 & 18-19), Dean of Studies (2015-17), Head Urban Design (2011-14) Head Industrial Design (2005-10), apart from being a full-time faculty at the School of Planning and Architecture, New Delhi since 1986.***

In addition to teaching, guiding design and research projects for 35 years, Prof. Singh is currently serving in several committees set up by the Government of India. He is a Member of Delhi Urban Arts Commission, Advisor to Association of Indian Universities (AIU), Advisor to Competition Commission of India (CCI), Member of Project Steering Committee (PSC) for 'Developing Energy Efficient Building Material Directory', Bureau of Energy Efficiency, Professional Advisor for National War Memorial, Ministry of Defence, Advisor and Member, Governing Council, NID Haryana, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Jury Member in the Committee for National War Museum, Ministry of Defence, and Member of Expert Committee for selection of tableaux for Republic Day Parade, Ministry of Defence.

He has been consultant, advisor and peer reviewer to many public and private sector organisations, notable being World Bank, CPWD, Shri Mata Vaishno Devi Shrine Board, Reliance

Infrastructure, Ministry of Defence for National War Memorial Competition, Competition Commission of India, Basmati Export Development Foundation, Golchha Organization (Nepal), Bureau of Police Research and Development (BPRD) for creating identity of Police Station and conducting architectural competition among others. Prof. Singh has vast experience in guiding PhD scholars, and numerous publications to his credit.

ISSN: **2582-8304**

Case study of GRIHA rated institutional buildings

Examining green building features and building energy systems to facilitate of GRIHA rated projects to facilitate design for all.

Ar. Priyanka Kochhar[a] , Prof. Dr. Mandeep Singh[b]
[a] Ph.D. Scholar (Full-Time), Architecture Department,
School of Planning and Architecture, New Delhi
[b] Professor, Department of Architecture and
Head, Department of Industrial Design,
School of Planning and Architecture, New Delhi.

Corresponding Author:
Ms. Priyanka Kochhar
Email: Priyanka.kochhar@gmail.com
Mobile: 9711642241
Author Declaration: This research paper has not been published before.

Abstract

Case studies serve as an important education tool for students and practitioners, and allow for future project planning, and data collection ahead of time. This paper documents building envelope and energy system design strategies implemented by two government GRIHA rated institutional buildings in New Delhi. Project details include building specifications (building size, level of performance as per GRIHA rating, year of construction and occupancy, and cost of the project), and green building features (architectural design, building materials (envelope and interiors), and building energy systems (visual, thermal, and other systems).

Both projects are in the composite climate zone and provide useful insights into the prevalent sustainability linked practices in the Indian construction sector.

KEYWORDS: *Case studies, GRIHA rating, institutional projects*

1. Introduction

GRIHA (Green Rating for Integrated Habitat Assessment) rating framework is an evaluation tool for measuring and rating a building's environmental performance. It facilitates design and evaluates a project through its life cycle including pre-construction, building planning and construction, and operation and maintenance stages. In addition to reducing the greenhouse gas emissions from buildings, GRIHA helps projects to optimise electricity consumption while meeting comfort requirements, reduce dependence on fossil fuel-based electricity and reduce stress on natural resources. Other benefits of GRIHA rated buildings include direct health benefits like reduced air and water pollution.

GRIHA rated building case studies are instrumental in providing information for enhanced understanding, increasing the body of knowledge, and disseminating information on design strategies around resource efficiency in the built environment. They often outline new solutions to meet various building and energy codes, which students and architects may attempt to understand and advance for their own academic or real-life projects. While several case study publications by the Central Public Works Department (CPWD)[1]-an authority within the Ministry of Housing and Urban

[1]https://cpwd.gov.in/Publication/Solar_Power_Booket_Seminar.pdf;https://cpwd.gov.in/Publication/Architectural_Footprints_of_CPWD.pdf;https://cpwd.gov.in/Publication/Architectural_Footprint_10_Sep.pdf; https://cpwd.gov.in/Publication/IGDBooklet.pdf

Affairs, Government of India, GRIHA Council[2] and United Nations Environment Program (UNEP)[3] provide information on the design approach, highlight overall strategies for GRIHA compliance and provide guidance for projects in India- detailed specifications, and examples to help learn and facilitate code compliance is not available. Popular media articles repeatedly publish and highlight the same buildings, which accentuates the need to dissimilate information about green building projects that have not been documented so far.

1.1 Case study selection

Data collection for this research has been covered under the ambit of the Memorandum of Understanding signed between the School of Planning and Architecture, New Delhi and CPWD in2019. Considering that CPWD endorsed GRIHA rating in 2009, it is important to formally publish the achievements in terms of enhanced building performance assessed through GRIHA rating in the decade after its adoption, i.e. between 2009 and 2019. Selection of case study buildings is based on the following parameters:

- ***Minimum 4 or 5 Star GRIHA rated (or provisionally rated) and comply with relevant and applicable Indian codes and standards in composite climate zone.***
- ***Building use to be institutional and project to be operational (day use).***
- ***40% (or more) of the building to be air conditioned.***

[2]https://www.grihaindia.org/case-study; http://www.pace-d.com/wp-content/uploads/2016/08/GRIHA-and- Green-Buildings-in-India-%E2%80%93-GRIHA-Council.pdf

[3]file:///C:/Users/User/Downloads/-State%20of%20Play%20for%20Sustainable%20Buildings%20in%20India- 2010994.pdf

- ***Built up area to be more than 20,000sqm (i.e., project eligible for seeking environmental clearance).***

As per list of GRIHA rated projects available on the GRIHA website (accessed in August 2020), there are 155 GRIHA pre-certified/ provisionally certified/ certified CPWD projects in India. 17 of these CPWD projects (institutional and residential) are in Delhi NCR, 14 of which are institutional projects complying with various formats of GRIHA including GRIHA, GRIHA EB (existing building), GRIHA LD (large development), SVA (simple, versatile, affordable) GRIHA and TERI GRIHA (GRIHA v1 2007).

Four projects that meet the above-mentioned criteria are shortlisted below:

- ***Indira Paryavaran Bhawan (IPB), Jor Bagh (5-Star GRIHA Provisional Rating)***
- ***Lecture Theatre and Lab Complex at IIT Delhi, New Delhi (4-Star GRIHA Provisional Rating)***
- ***Punjab National Bank Head Office, Dwarka (5-Star GRIHA Provisional Rating)***
- ***Supreme Court Extension, Pragati Maidan (5-Star GRIHA Provisional Rating)***

Since the Indira Paryavaran Bhawan at Jor Bagh has been documented extensively, the details of this project have been excluded from this paper. Furthermore, the Supreme Court Extension project comprises five buildings (including residential) and is not a single building like other projects, and hence it was also excluded from the final case study selection. To maintain anonymity of the projects, shortlisted case studies have been named 'Project 1' and 'Project 2' for description in this paper.

2.Case studypresentation

The following process has been adopted for data collection.

- ***Review of primary documents (for construction and operation) including final agreement between CPWD and contractor, final bill under CPWD agreement and tendered Bill of Quantities from CPWD.***
- ***Preparation of questionnaires for green building consultants.***
- ***Interviews and discussion with concerned CPWD officials.***

Broad categories under which the specification and cost data has been collected are as follows:

1.General project details

2.Envelope ○ **Wall** ○ **Fenestration** ○ **Roof**	**4.Heating, ventilation, and air conditioning** ○ **Total tonnage** ○ **HVAC design parameters** ○ **Type and cost of HVAC system**
3.Internal lighting ○ **Connected lighting load** ○ **Type and cost of lamp, fixtures, and ballasts** ○ **Lighting controls**	**5.Electrical system** ○ **Total connected load** ○ **Type and cost of transformer** ○ **Capacity and cost of DG sets** ○ **Building management system (BMS)**

Building	**Built-up Area**	**Total Project Cost**	**Date Completed**	**Salient Features**

Project 1	**45,761m^2** **• G+4** **• 1 basement**	**Rs.115cr (Rs. 25,130/sqm)** **• Civil: (87.47%)** **100.6cr** **• Elec.: (291%)** **3.35cr**	**2015**	**• GRIHA 4 Star (provisional)** **• North-South orientation** **• WWR= 23.5%** **• Daylight integration** **• Strong shading strategy** **• EPI: 59.06kWhr/m2/annum** **• 5MWp solar system on campus** **• CFL and T5 fixtures** **• Flyash based material**
Project 2	**76,188m^2** **• G+5** **• 3 basements**	**Rs.405cr (Rs. 53,160/sqm)** **• Civil: (33.82%)** **137cr** **• Elec.: (16.29%)** **66cr**	**2017**	**• GRIHA 5 Star (provisional)** **• WWR= 35.4%** **• Daylight integration** **• EPI: 43.5kWhr/m2/annum** **• 202KWp rooftop solar PV** **• LED fixtures+ sensors** **• Pervious paving** **• Flyash based material**

***Table 1*: Key information about the case studies; Source: Compiled by Priyanka Kochhar**

2.1Project 1

The first case study comprises a multi-storey (B+G+5) building with composite structure of RCC and structural steel. It encompasses lecture halls with 500, 300, 150, 60 and 30 seating capacities, laboratories for physics, chemistry, biology, applied mechanical, computers, humanities, and design studio along with an auditorium with 500 seats, and conference rooms. The building is divided in 5 blocks, A, B, C, D & E by construction/ seismic expansion joints and has been designed to accommodate students.

The whole building is on raft foundation of RCC and designed as compact building to save energy. It is centrally air conditioned

and meets GRIHA 4 Star compliance on energy and other standards. Select features of the building are as follows:

- **RCC framed structure with shear walls**
- **Cavity walls and double-glazed glass**
- **Aluminium doors and windows**
- **External dry cladding in sandstone**
- **Fire resistant structural glazing and aluminium composite panel**
- **Vitrified tile in labs, kota stone in corridor and granite in foyer**
- **Acoustic treatment of lecture halls**
- **Fire alarms, sprinklers, and wet risers**
- **Adequate number of lifts in three blocks**
- **Centrally air-conditioned classrooms and labs**
- **Smart classrooms with projectors and audio video facilities**

Image 1: Project 1, New Delhi; Source: Priyanka Kochhar, assisted by Kanika Trivedi

Block A comprising central foyer and entry area has a double height (10.75m) opening. This block is circular in shape and the

RCC structure has circular beams that are curved in plan along with circular columns (10.75m height).

Block B is circular in shape and comprises the lecture halls. Due to the long spans of lecture halls (24.3mx21.15m), structural steel plate girders that rest on shear walls have been provided. Built up sections of structural steel are used as primary and secondary (beams) members. Primary members (plate girders) are supported by RCC shear walls. It consists of 3 lecture halls of 300 capacity on the ground floor, 4 lecture theatres of 150 capacity and student lounge on the first floor, 4 lecture theatres of 150 capacity and student lounge on the second floor, 4 lecture theatres of 150 capacity and 3 classrooms of 60 capacity on the third floor, and 9 classrooms of 60 capacity and 9 classrooms with 30 capacity on the fourth floor.

Block C is the laboratory block which is an RCC structure in rectangular shape (45.08mx17.65m). the height of each floor is 4.2m, where the main structural members are beams and columns. There are 5 laboratories on each floor.

Block D has a composite structure of structural steel and RCC. Due to the long span (42.04mx20.74m), height (8.54m) and circular shaped auditoriums, built up sections of structural steel have been provided as primary and secondary members. Plate girders are supported by shear walls. It comprises an auditorium of 500 capacity on the ground floor (up to mezzanine floor roof slab), an auditorium of 500 capacity on first floor (up to second floor roof slab) and 2 laboratories on the third floor.

Block E consists of ramp area in between C&B blocks and B&D blocks.

2.1.1 Building specifications

Built on a 19,690sq m site inside the 320 acres IIT Delhi campus, the Lecture Theatre and Lab Complex has been designed to accommodate a floating occupancy of 2200 students and faculty. It has a total built up area of 45,761sqm out of which about 40% is air conditioned. Building envelope U-values (W/m2K) were as follows: Wall (thick stone cladding+230mm flyash brick+115mm flyash brick+plaster): 0.766; Window (i.e. glazing in air conditioned area): 1.9 with VLT of 0.39 and SHGC of 0.28; Roof assembly (RCC slab with 50mm fibre glass wool +150mm brick coba): 0.596.

The building design ensures daylight to 51.6% of occupied areas and artificial lighting is provided using T5 lamps with electronic ballasts and CFLs. The LPD achieved is better than requirements of the Energy Conservation Building Code (ECBC) requirements. The HVAC systems have been designed to maintain a room temperature of 24 ± 1°C. The total cooling load is 550TR, where 3x275 TR variable air volume with water loop chiller system (2 working+1 standby) have been used. The total load of electrical systems is 1271kW, and an integrated building management system is also provided.

2.1.2 Green features of the building

Building material

- ***Brick work for walls: The outer walls of the building comprise a cavity wall made of 230mmflyash brick and 115mm flyash brick clad with thick stone on the external side and plaster on the internal side, resulting in U -value of 0.766 W/m2K (ECBC 2007 requirement: 0.44 W/m2K).***

- ***Wood and PVC work for fenestrations: 24 mm thick double glazed hermetically sealed windows are provided in the North West/ South West sides of the building. Sun louvers are also provided to reduce the cooling load. Glazing U-value for air conditioned area: 1.9 W/m2 °K and for common/ non air conditioned area is 5 W/m2 °K.Glazing Solar Heat Gain Coefficient (SHGC) for air conditioned area is 0.28 and for common/ non air conditioned area is 0.43. Glazing Solar Coefficient for conditioned area is 0.32 and that for common/non-conditioned area is 0.49. the total window to wall ratio is 23.5%. To meet the GRIHA rating requirement the visual light transmittance (VLT) is 0.39.***
- ***Roof: The roof assembly has been provided with reinforced cement concrete slab, with 50mm fibre glasswool insulation and 150mm brick coba.***

Building energy systems

- ***Indoor lighting and control sensors: The lighting system of this building is designed with T5 lamps with electronic ballasts and CFLs to achieve Lighting Power Density (LPD) of : 1.5 W/ ft2 for Lecture Theatre/Classroom; 1.0 W/ ft2 for Equipment Room and 0.5 W/ ft2 for Miscellaneous Areas, and meet ECBC 2007 recommended levels in all spaces.***
- ***HVAC: 40% of the building superstructure is air conditioned and designed for central cooling. The air conditioning load is estimated to be 550 TR for which 3x275 TR variable air volume with water loop chiller system (2 working+1 standby) have been installed.***
- ***Electrical: The total electrical load of the building is 1271kW. Two diesel generator sets (500kVA+750kVA) are***

used for emergency purposes or during power failure. There are three 2000KVA dry type transformer and one 1000kVAtransformers provided on site. Further, UPS power (100kVA) and integrated building management system has been provided.

2.2 Project 2

The second case study project is built on a plot size of approximately 5acres. Designed for about 1650 employees, it covers a built-up area of 76,188m2 across six floors and three basements. About 70% of the superstructure is air conditioned. While it was designed as a net-zero building, the final project has received GRIHA 5 Star (provisional) rating.

Image 2: Project 2, New Delhi; Source: Priyanka Kochhar, assisted by Kanika Trivedi

2.2.1 Building specifications

The building is composed around the central axis that emerges from the metro station through the park into the centre of the site. Bridged floors across the axis are created at ground and top levels for corporate floor, café and multipurpose halls. The opening up of the entire centre of the building breaks down the

scale of the large building into smaller elements. There is a six-storey high circular glazed cylinder at the end of the axis that accommodates the PNB gallery, VIP lounges and special conference rooms. Opening of the centre create a strong venturi effect that draws the south-west winds into the atrium, making natural cooling effective for several months through the year.

2.2.2 Green features of the building

Building material

- ***Brick work for walls: The outer walls of the building are double wall units with extruded polystyrene as insulation in between. The outer walls are made of 200mm AAC (Autoclaved Aerated Concrete) block and the inner walls of 100mm AAC block. 30mm extruded polystyrene is provided between the outer and inner walls, resulting in U -value of 0.39 W/m2K (ECBC 2007 requirement: 0.44 W/m2K).***
- ***Wood and PVC work for fenestrations: All windows in the building are Un-plasticised Poly Vinyl Chloride (UPVC) windows with double glazed units. To meet the GRIHA rating requirement of heat load reduction, the U-value of external window assembly is 1.48 W/m2K (ECBC 2007 requirement: 3.3 W/m2K). The visual light transmittance (VLT) is 0.49. With a Solar Heat Gain Coefficient (SHGC) of 0.22 of double glazing and appropriate shading design, achieved SHGC of fenestration is 0.23.***
- ***Roof: The building has a unique roof design. The roof plane is broken into four panels, comprising two lower side panels that reflect the slightly tilted geometry of the building plan below, and two raised panels that cover the atrium. The roof assembly has been provided with 250mm reinforced cement concrete slab, with 75mm XPS***

insulation and tiles finish to achieve U value of roof assembly is 0.31 W/m2K (ECBC 2007 requirement is 0.41).

Building energy systems

- ***Indoor lighting and control sensors: The lighting system of this building is designed with LEDs and sensor controls, to achieve Lighting Power Density (LPD) of 0.60W/ft2 for office floors and meet ECBC 2007 recommended levels in all spaces. Daylight sensors (lux level sensors) and occupancy (motion) sensors have been installed in the building.***
- ***HVAC: 69% of the building superstructure is air conditioned and designed for central cooling. The air conditioning load is estimated to be 660 TR for which three water cooled chillers (2 working + 1 standby) of 375 TR each and one 100 TR chiller have been installed.***
- ***Electrical: The total electrical load of the building is 2195kW. Electricity is sourced from BSES Rajdhani Power Limited. Diesel generator sets are used for emergency purposes or during power failure. 200kWp solar rooftop plant has also been installed. There are three 1000KVA dry type transformer and four DG sets with rating 2x1000kVA (gas based), 500kVA (diesel based) and 380kVA (diesel based) capacity. Further, UPS power has been provided to support critical service such as emergency lighting, power points for workstations, security system and building automation system and server room. An integrated building management system to control and monitor the building's mechanical and electrical equipment such as AHUs, TFAs, chillers and electrical system has also been provided.***

3. Discussion

GRIHA is based on nationally accepted energy and environmental principles that assesses a building out of thirty-four criteria, and awards points on a scale of hundred. The criteria are divided into 'applicable' and 'selectively applicable' categories, where certain criteria and sub-criteria of 'applicable' category are mandatory for the project to achieve GRIHA rating.

Table 2 below summarises key GRIHA criteria to optimise electricity consumption while meeting comfort requirements. GRIHA facilitates implementation of relevant codes such as the Energy Conservation Building Code (ECBC), National Building Code (NBC), and Special Publication (SP) 41 of Indian Standard (IS) for resource efficiency through design that results in abatement of carbon emissions from the built environment.

Table 2: GRIHA (2007) criteria 13 & 14 incorporating relevant codes and standards; Source: GRIHA Manual Volume 1: Introduction to National Rating System, adapted by Priyanka Kochhar

Criteria	Description	Points	Applicability	Relevant codes and standards incorporated
Criterion 13	***Optimize building design to reduce conventional energy demand***	***8***	***Mandatory***	***ECBC 2017*** ***NBC 2005 Part 8/ Section 1-3*** ***SP-41 – 1987 Section 2, Part 7***
Criterion 14	***Optimize energy performance of building within specified comfort limits***	***16***	***Partly mandatory***	***SP-41 – 1987 Section 2, Part 7*** ***ECBC 2017*** ***NBC 2005 Part 8/ Section 1-3***

GRIHA rated projects described above follow mandatory provisions ECBC for air-conditioned buildings. The projects also meet the prescriptive shading norms of ECBC, provide daylight, avoid over design of artificial lighting, and reduce energy performance index from GRIHA benchmark by 10-30%. Summary of building envelope specifications of the two case study buildings is provided in Table 3 below. Both projects meet various GRIHA and ECBC requirements.

Table 3: Case study building envelope specifications; Source: Compiled by Priyanka Kochhar

Envelope	Wall	Glazing	Roof
	• Thick stone cladding+ 230mm flyash brick+ 115mm flyash brick+ Plaster • U-value: 0.766 W/m2 K	• U-value of glazing for air conditioned area: 1.9 W/m2 °K • VLT: 0.39 • SHGC: 0.28	• RCC slab+50mm fibre glasswool+ 150mm brick coba • U value of roof assembly: 0.596 W/m2 K
	• 200mm AAC Block + 30mm rockwool+ 100mmm AAC Block • U -value 0.39 W/m2K	• U-value of external window assembly: 1.48 W/m2K • VLT: 0.49 • SHGC: 0.22	• RCC slab+ 75mm XPS+ tiles • U value of roof assembly: 0.31 W/m2K

Details of building energy systems including lighting, air conditioning and electrical systems are provided for both projects in Table 4 below.

	Lighting	Heating, Ventilation & Air Conditioning	Electrical Systems
Project 1	• Daylight integration (76.6%occupied areas daylit) • LEDs • Daylight/lux level sensors • Occupancy/motion sensors • LPD: Better than ECBC requirement •7% of total energy demand	• Room temperature of 26 ± 1°C • 69% superstructure air conditioned • Cooling load: 660TR 1. 3x375 TR water cooled chillers (2 working+1 standby) •84% of total energy demand	• Total load: 2195kW • Transformers: 3x1000kVA dry type • DG sets: 4 (2x1000kVA gas based+ 1x500kVA diesel based+ 1x380kVA diesel based) • UPS • Integrated building management system
Project 2	• Daylight integration (51.6%occupied areas daylit) • T5 lamps with electronic ballasts • CFLs • LPD: Better than ECBC requirement •25% of total energy demand	• Room temperature of 24 ± 1°C • 40% superstructure air conditioned • Cooling load: 550TR 1. 3x275 TR variable air volume with water loop chiller system (2 working+1 standby) •16% of total energy demand	• Total load: 1271kW • Transformer: 1000kVA +3x2000kVA • DG sets: 500kVA+750kVA+ •UPS: 100kVA • Integrated building management system

Table 4: Case study building energy system details; Source: Compiled by Priyanka Kochhar

4. Conclusion

Descriptive case studies of GRIHA rated institutional projects highlighting design strategies to optimise electricity consumption while meeting comfort requirements are valuable contribution to academic literature on resource efficiency in the built environment. The above case studies which help link envelop and energy system design to ECBC and GRIHA compliance are especially useful to students and practitioners for knowledge enhancement and future project planning. Additionally, published case studies provide information that lead to advances in research and improve level of resource optimisation achieved in buildings.

5. References

https://cpwd.gov.in/Publication/Work_Manual_2019_20032019.pdf

Project Report on 'Review and Revision of CPWD Documents to Include Energy Efficiency Parameters and Capacity Building of Professionals'; New Delhi: The Energy and Resources Institute. p.p : 53 [Project code 2011HH11]

https://cpwd.gov.in/Publication/Green_rating_manual_april_2019.pdf https://doe.gov.in/sites/default/files/GFR2017_0.pdf

ISSN: **2582-8304**

Ar. Vandini Mehta

Architect, PhD Scholar, Independent Urban Researcher

Education:

- ***2018-Present*** ***PhD Scholar, School of Planning and Architecture, New Delhi,***
- ***2005*** ***M.S. Arch, University of California, Berkeley: Specialisation: Environmental Design in Developing Countries***
- ***1997*** ***Dip. Arch., School of Architecture, CEPT, Ahmedabad, India; Exchange Study, RMIT, Melbourne, 1994***

Professional Practice:

- ***2007-Present*** ***Principal Architect & Founder, Studio VanRO, New Delhi2007- Present***
- ***2017-2019*** ***Consultant Architect, Hindustan Zinc Ltd., CSR Project, Udaipur***
- ***2013-2014*** ***Consultant Planner,CURE (Centre for Regional Excellence), New Delhi***
- ***2005-2007*** ***Project Manager and Project Architect, MAP, New York City***
- ***2000-2003*** ***Architect, McBride and Associates Architects, New York City***

Academic:

- ***2009-Present*** ***Visiting Faculty, Dept of Urban Design and Architecture, SPA, New Delhi***

- ***2014-2015 Visiting Faculty, Urban Design Program, Sushant School of Architecture, Gurgaon, NCR***
- ***2014 Visiting faculty, RICS (Royal Institute of Chartered Surveyors) Amity University, NOIDA***

Selected Publications and Conferences:

- ***Co-edited Book: The STRUCTURE: Works of Mahendra Raj. Edited by Vandini Mehta, Rohit Raj Mehndiratta, Ariel Huber. Published by Park Books, Zurich, 2016; Book Events held at India, europe, USA. March-Oct 2016***
- ***7ICCH, "An Engineer in the Middle East", Lisbon, Portugal July 2021***
- ***RC21 ISA, "Village Urbanism: Infiltrating spaces of Delhi's unplanned expansion", Delhi, 2019***
- ***Aquimemoria 5, "Heritage in Crisis: The Case of Delhi", Salvador, Brazil. Nov 2017.***
- ***RGS-IBG Conference: "Infiltrating Urbanism: the case of Aya Nagar" Exeter, UK, Sept 2015***
- ***AAG: "Urban Coversions: FarmHouse developments in the city of Delhi", San Francisco, USA. Apr 2007***
- ***IASTE Conference: "Imaging the (un)real: Space in Bollywood Films", Bangkok, Thailand. Dec 2006***

***Prof. (Dr.) Mandeep Singh** is presently Head Industrial Design Department and has been Head Architecture (2014-15 & 18-19), Dean of Studies (2015-17), Head Urban Design (2011-14) Head Industrial Design (2005-10), apart from being a full-time faculty at the School of Planning and Architecture, New Delhi since 1986.*

In addition to teaching, guiding design and research projects for 35 years, Prof. Singh is currently serving in several committees set up by the Government of India. He is a Member of Delhi Urban Arts Commission, Advisor to Association of Indian Universities (AIU), Advisor to Competition Commission of India (CCI), Member of Project Steering Committee (PSC) for 'Developing Energy Efficient Building Material Directory', Bureau of Energy Efficiency, Professional Advisor for National War Memorial, Ministry of Defence, Advisor and Member, Governing Council, NID Haryana, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Jury Member in the Committee for National War Museum, Ministry of Defence, and Member of Expert Committee for selection of tableaux for Republic Day Parade, Ministry of Defence.

He has been consultant, advisor and peer reviewer to many public and private sector organisations, notable being World Bank, CPWD, Shri Mata Vaishno Devi Shrine Board, Reliance Infrastructure, Ministry of Defence for National War Memorial

Competition, Competition Commission of India, Basmati Export Development Foundation, Golchha Organization (Nepal), Bureau of Police Research and Development (BPRD) for creating identity of Police Station and conducting architectural competition among others.

Prof. Singh has vast experience in guiding PhD scholars, and numerous publications to his credit.

ISSN: **2582-8304**

Karol Bagh & Western Extension: the other new Delhi

Ar. Vandini Mehta
PhD Scholar, Visiting Faculty, Urban Design Dept, School of Planning and Architecture, N Delhi

Prof. Dr Mandeep Singh
Head Industrial Design, Professor of Architecture, School of Planning and Architecture, N Delhi

Abstract

Karol Bagh is a vibrant residential neighbourhood of Delhi, thronging with businesses, wholesale markets, warehouses, hotels and great street food. Delhites know it as a refugee colony which got populated post-partition and first time visitors will be daunted by its chaotic and overcrowded streets and bazaars. It is, however, interesting to note that Karol Bagh and Western Extension was developed at the same time as the Imperial Capital of 'New' Delhi was being planned and built.Setup as an "Improvement Scheme" by the DIT (Delhi Improvement Trust) to respond to the overcrowding of the walled city of Delhi in the early 1900s with contemporaneous ideologies of 'improvement' and 'planning', this area's development tells a story quite contrary to the making of the grand Imperial Delhi -built for the British and Europeans. One of the *other* New Delhi- built for its local native population. Unravelling the gap between intention and execution, this paper raise two questions: First, how did categorisation of land become a means of controlling it? Second, what are the techniques of governance that facilitate the spatial production of difference and inequity. This paper engages in a critical reading, and decoding of archival records, communication and data from the that time period as evidence for analysing intent vis-a-vis

execution. This methodology is used to uncover how ideologies can justify completely inverse priorities and spatial outcomes as in the case of Karol Bagh-Western Extensions and Imperial New Delhi- both built in the same time period and in adjacent areas. Investigating such specific urban histories, I believe, will help re-examine and historicise the ways in which inequity is created and maintained in our cities even today.

Keywords: ***Urban History, Delhi, Colonial Ideology, Improvements, Karol Bagh-Western Extension***

Introduction

> ***'The major metropolis in almost every newly-industrialising nation is not a single unified city, but in fact, two quite different cities, physically juxtaposed but architecturally and socially distinct…(these) dual cities have usually been a legacy from the colonial past…'***[4]

In the years after 1911, Delhi saw a frenzy of building activity and growth. The decision of shifting of the British Imperial Capital from Calcutta to Delhi and Delhi also emerging as an important railway junction were two key reasons for this. In a matter of just 50 years, the population of the city doubled to 3,47,592 in 1931[5], with a steep rise particularly at the turn of the century. The city attracted labour for the building of the new Capital and the many new converging railway lines made it a commercial hub. Traders, merchants, administrators and industrialists migrated toDelhias it grew in political and commercial importance. These migrations created new geographies for the colonised - characterised by the

[4] ***Janet Abu-Loghod, Tale of two Cities: The origins of Modern Cairo, 1965***
[5] ***Delhi Gazetteer, 1912***

manner they lived and worked, by the amount of land they occupied and by the density of occupation.

Karol Bagh-Western Extension was one such urban landscape planned as an extension to the already congested city of Shahjahanabad, to accommodate the expected growth the city was bound to attract as a Capital. But unlike the grandiose plans for New Delhi, it was planned and executed with a constant worry of strain on funds- despite an active urban municipality and collection of heavy taxes and octroi by the colonial government for over a century. The narrative of lack of funds to provide even basic services to this rapidly expanding city of the natives contrasted acutely with the detailed plans and budget allocations for a city that was going to be inhabited almost exclusively by British and Europeans and a handful of their princely Indian allies. The *planned* population density of Karol Bagh was over 100 people per acre vs that of New Delhi of under 3 per acre.

The two themes used to present this argument through archival evidence are- First the control of land that was achieved through a mix of outright annexation, re-categorization of land titles and tenures and creating laws to acquisition for public purpose. And secondly, how colonial narrative of seeming benevolence through 'improving' the natives and the Improvement Trusts were techniques of governance that produced a landscape of difference and inequity.

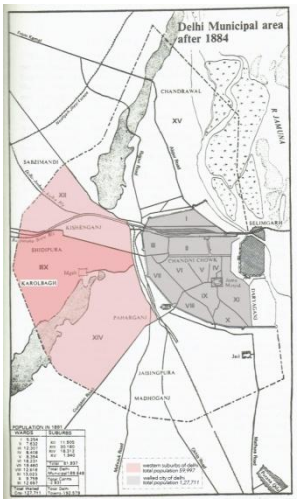
Control through suburban Lands

The early 1900s revealed a rise in land value around cities in all larger cities across India (like Calcutta, Bombay and Chennai) and the British colonisers realised the potential of this latent value that could be capitalised. Even though the suburban population

had been growing at a faster rate and was already 60,000 -half of the walled city- in 1884, it was ignored by the Government till 1908. The majority of this land on the suburbs of Delhi was under British possession after the 1857 Revolt, and they did not consider it of importance for over a century of rule in the region since 1803. Despite several efforts and statements by officers like the Delhi Commissioner of Delhi who in 1874 said,

> **"Some of the finest properties to be found anywhere, properties which could be immensely prized in any European Capital and which are capable not only of being made a great source of *future profit*, but the *improvement* of which will vastly increase the *comfort and health of people* in Delhi and its neighbourhood and add to the attractions of the city which so many travellers visit from all parts of the world."[6] (emphasis mine)**

These words are an early precursor to legislations that would get formalised only 4 decades later. The description of the lands outside the city of Delhi, infused with the beauty and nostalgia of its rustic landscape, the ideas of 'improvement' and 'the comfort and health of people in Delhi', obscures the intentions of 'future profit'.



These suburban lands outside Delhi were called the Crown or *Nazul* Lands. They originally belonged to the Mughal rulers, annexed by the British in 1803 and after the Revolt of

Figure: Western suburbs of Delhi. Delhi Municipal Area after 18847
Source: Author, edited Archival Map

[6] ***Delhi Commisioner 1874, quoted by Hume, A.P., in Report on the Relief of Congestion in Delhi, Simla, Government of India Press, 1938***
[7] ***in Narayani Gupta, Delhi Between Two Empires 1803-193, Oxford University Press, 1981, pg 160***

1857 became 'Crown property'. For ease of control, it was declared that Crown lands that fall within Delhi Municipal limits would subsequently all be called Nazul[8]. In 1874 when the population of the city was just over a lakh and a half, these lands did not have much value[9] and their management handed over to the Municipal Committee. In 1874 the municipal collections in revenue or rents from these Nazul lands was a meagre Rs10,600 annually[10], even though we see in this 1884 map, the area covered was quite large.

By the turn of the century, in the next 30 years, things changed dramatically. The government realised the need to capitalise on the potential profits from these vast tracts of Nazul lands which were found to be in a messy administrative state. There were multiple ownerships, irregularities in leases and rents, *maufis* and encroachments, none or incomplete maps and plans. Having learnt from other Provinces that unoccupied sites near larger towns tend to increase greatly in value and it was 'inadvisable to give powers of such lands to municipal councils', Deputy Commissioner Delhi, Mr Humphrey, commissioned a survey of the crown lands under Mr R B Whitehead.[11]

Almost all records had been destroyed in the 1857 Revolt and when in 1908 Mr R.B. Whitehead was commissioned to take stock

---

[8] Land outside Municipal limits under other State departments like Railways or Irrigation etc were called Government land and those not administered by any state Departments were called Rural Nazul. Whitehead, R.B., Report on the Administration of the Delhi Crown Lands, 1908, Delhi Archives

[9] Hume, op.cit.

[10] Hume, op cit.

This had grown to Rs 4 lakhs from just leasing of land in 1931. (Kataria, Dinesh. Planning Shahjahanabad: 1910s-1930s, Social Scientist, Vol 47July Aug 2019)

[11] Whitehead, R.B., Report on the Administration of the Delhi Crown Lands, 1908, Delhi Archives

of the Crown lands, the Report had to be pieced together from incomplete records found with local *Patwaris* and whatever was still available in the North Western Province offices. While these messy records were blamed on the mismanagement of the Municipality, something which was repeated in many reports and official communication over the decades to follow, it is useful to investigate the multiple tenancies and ownerships on these lands that were given the blanket category of 'Nazul' and claimed as Crown property after the Revolt.

Multiple ownerships, encroachments and 'squatters'

After the Revolt of 1857 or what was called the Mutiny by the British, Delhi was cleaned out of all its population by the British to teach the mutineers a lesson. They were dispossessed off their properties and only those who could prove their allegiance to the British were allowed to re-enter the walled city[12]. In addition one-third of the city was cleared up of its built structures, particularly around the Fort which was now occupied by the military. Many people who managed to escape settled on the western suburbs of the city where the Grand Trunk Road as a major artery on the West towards Kabul and the NW Province already had settlements, markets like the Subzi Mandiand *serias*[13].

Before the British arrived in Delhi, the Moghul rulers had given the lands outside the medieval city to their main allies- like the Nawabs of Jhajjar, Loharu and Rajas of Ballabhgarh and Kishengarh. On these estates there were many villages with their *abadi*[14], agricultural, forest, grazing and other lands (including lands under the control of mosques and shrines, *waqf*). Officially,

---

[12] Gupta, N; 1981
[13] Serai is rest house or lodge for travellers
[14] Abadi is the main village habitation

entire surrounding village lands of Jahan Numa and Khandrat Kalan were assigned to the King of Delhi in 1803, but after the 1857 Revolt they were confiscated and taken under the ownership of theCrown, and when handed to the municipality for administration in 1874 they were called Nazul.

These uniform categories assigned to them administratively, however, were not necessarily a ground reality. Besides the historic diversity tenures of land, and land categories, there were also settlements that had come up post the Revolt, for British military needs. Troops had been posted at various places within the walls and outside the City to maintain order. Outside the city these were located in Jahan Numah, near the old Idgah towards the western side of the City. Locatedin a desolate spot on the ridge the Cantonment Magistrate, Major Trevelyan (not be confused with Mr C E Trevelyan[15]) found it was necessary to form a market and invited shopkeepers for the daily needs of the soldiers. They were allowed plots to settle on 'Government waste land' to the east of Pahari Dhiraj.[16]"It is certain that the colony will remain here forever. Incase the Sadar Bazar is removed from this place or if a road is made through it,no compensation will be paid. No one will be allowed to sell shop to anyone else."[17]Whitehead's Report on the Administration of the Crown Lands in 1908 refers to these people who were officially allotted

[15] In 1931 C E Trevelyan, Secretary to the Resident of Delhi, who later became Governor of Madras, sold plots for the Government in an area that was then known as Travelyangung. Hume, AP, 1935

[16] Whitehead, R.B., Report on the Administration of the Delhi Crown Lands, 1908, Delhi Archives, pg 16

Major Treveyan issued a proclamation on September 29th, 1858, translated from urdu/ Persian states the, Government to permit building of pakka or kachcha shops on the land of Sadar Bazar, which is close to Pahari Dhiraj outside the Lahori Gate, on plots 15 feet by 30 feet for Rs 5 for single and Rs 10 for double plots with a rent of one Anna per 100 sq ft.

[17] Proclamation of Major Trevalyan in September 1858, quoted in Whitehead (1908), ibid.

land and paid rents for 50 years supporting the British Troops - as 'Major Trevelyan's *squatters*'- taking away in a swift sweep of the word 'squatter'- their right on land.

Records of settlements created by British officers like Trevelyangung and Major Trevelyan's 'squatters', including pre-British land ownerships, show a history of land ownership in the Nazul lands was complicated not only by the pre-British arrangements but even after it fell into British control, that were recorded and executed through the various 'Settlement Reports'. For instance Whitehead mentions that the Settlement Report of 1864 shows the Government to be the owner of all lands in Jahan Numah and Khandrat Kalan[18], which was not clearly so. It was an assertion- not a fact- as is evident in 1876 when Mr Leslie Smith, Assistant Commissioner's enquiry of rural and urban Delhi by the Settlement Department in connection with the *maufi* tenures states,

> **"It is directed that the propriety right of the Government should be asserted in each case, and recorded in the Settlement papers, that a suitable rent should be fixed and incases where Government right is not accepted the holder should be ejected."[19]**

Whitehead's report also mentions that, "A large amount of landed property in this neighbourhood was sold by the Deputy Commissioner after the Mutiny, but many purchasers had subsequently added enormously to their holdings by encroachment. The occupants of Khandrat were mostly squatters and had no good title to land."[20] Khandrat Kalan was later the

---

[18] Whitehead, 1908; ibid. pg 10
[19] (emphasis mine)
[20] Whitehead, 1908; ibid. pg 17

area on which New Delhi was built. While it was already clear that disputes and titles of land were a messy affair, increase in land value and the possible lost income by the Imperial Government was at the heart of this assertion on lands. By 1902, the value of land in the western suburbs had gone up by 400% in Sadar Bazar, 400% in Paharganj and 300% in Sabzi Mandi[21].

Even though Khandrat Kalan is talked of as waste lands with the ruins of older Delhis, in a comment in their Report on the quality of the land chosen for New Delhi states, "(the proposed site) consists of good land most of which is in continual use for agricultural purposes…The committee has twice seen the ground under a smiling expanse of crops and feel the confidence in the good quality of the solid for the purpose of gardens, parks and arboriculture generally."[22]

Surveying and recording of land can be very powerful means of control. The messy land records in India that we often encounter even today, (particularly around cities) have an interesting history in such contradictory and authoritative polices of the British colonisers though framed under seemingly liberal ideology and land laws. This section attempted to unravel parts of the Nazul land category that was used in multiple ways to claim authority and later ownership rights on land which had a very diverse mix of histories, uses and ownerships, particularly those that later become the western extensions and the new Capital.

---

[21] Whitehead,1908; ibid. pg 32

[22] ***Swinton, Brodie and Lutyens, Final Report of the Delhi Town Planning Committee, July 1913***

'Improvements', land acquisition and profit-making

The Improvement Trust came to Delhi quite late despite many calls by British officers and Indians too. After more than 2-3 decades of being introduced in other parts of the country where they turned out to be expensive given the constant fund shortage that was projected even though over 3 million Sterling Pounds were annually taken away in profits from India[23]

Originally the Western Extension was part of the Imperial Capital Project. But later the Secretary of State sanctioned it to be treated as separate and managed locally. It would be administered by Delhi Municipality under a separate account head. As land values rose, certain kinds of Improvement projects were found to make good profits (see table below), and sharing that with the Municipality would reduce the gains of the Imperial Government. Taking it a step further it was decided to take all Nazul lands, revenues and Improvement schemes away from the Municipality and in 1925 these were given to the Deputy Commissioner, blaming the Municipality for its incompetent management so far. The truth was that no agency had done any improvements in the Nazul areas and this was acknowledged even in Whitehead's Report[24]. Despite the Chief Commissioner's proposal to provide water supply and drainage to the Western Extension, nothing had been done till 1931. A sub-committee in 1931, considering expansion proposals noted that Karol Bagh or Western Extension is yet unfortunately devoid of water supply or drainage. The Chief Commissioner is quoted in Hume's report that the "melancholy history of the Western Extension colonies created by the

[23] ***Tharoor Shashi, An era of Darkness, Aleph Press, 2017***
[24] ***Whitehead, 1908***

government in 1913 and still lacking the most ordinary amenities of life."[25]

ROAD	Grant from Govt. upto 1936	Income received by Govt. upto 1936	Profit
Burn Bastion	1,22,000	8,06,155	6,84,155
Garstin Bastion	2,50,000	5,82,083	3,32,083
Jhandewala	47,404	1,27,199	79,795
Idgah	1,13,279	27,529	-85,750
Idgah Extension	7,200	-	-7,200
Mundhewala	2,46,032	13,611	-2,32,361
Total	7,85,915	15,56,657	7,70,722

Figure: Government Profits from Improvement Schemes upto 1936, Hume Report, 1936

The tussle between the Government and the Municipality continued for over a decade more until a Bombay Court judgement that stated in another case that, "while legally a municipality could not compel Government as estate owner to supply particular services, neither could the Government compel the Municipality to provide the necessary money." Based on this the Government agreed that in the case of Western Extensions it would incur the cost of basic services, but capped it to a maximum of 10 lakh. This, however, was only adequate for the existing inhabited area of Western Extension and another 13 lakh was required for the new additions.

[25] ***Hume, 1935; pg 10***

On the other hand, large scale acquisition of land was an immediate priority for the building of the New Capital. Considering the need to connect the new Capital in the South to the Civil Lines in the North with appropriate roads, one of the main problems highlighted was the need to cross the current suburbs of Paharganj with a population of more than 15000 which was considered too large to displace without discontent and more importantly very large costs. It was clear that these were inhabited by poor classes and also space for expansion of the old city had to be in the west of the city. An acquisition policy was drawn out - cheap acquisition of land and then control on future acquisitions to reduce cost of the project.

For this all land was classified and assessed based on its future market value. Class I and II for official buildings and residence were classified unproductive land and Class III and IV meant for the Zamindars, and rich Indian classes was considered 'productive'. Craddock proposed the latter two classes be sold at Rs 300 and Rs 2500 per acre. One month later Beadon had increased this to 1000 and 10,000 per acre respectively![26] The Western Extensions that were originally made for the poor classes was later marked for Class III and IV for receipt of higher returns.

Land acquisition and development costs in the New Capital area were however not compromised or justified by profits earned. Some of the expenses incurred only in the first three years of its planning between 1911-1914 were: Rs 47 lakhs on the cost of acquisition and 1.7 lakhs in the salaries paid for this work.[27] The expense of the entire work for New Delhi was estimated at a

---

[26] **Kataria, Dinesh. *Planning Shahjahanabad: 1910s-1930s,* Social Scientist, Vol 47July Aug 2019, pg70**

[27] ***Proceedings of the Imperial Delhi Committee, September 1914, pg 7***

whooping 5 million pound sterling, in this report of 1914 with only the annual establishment (administrative) expenses being Rs 9 lakh.[28]

The New Capital was built unencumbered by meagre discussions of profits or investment constraints. Instead a ten square mile area was built with generous 300 feet wide roads lined with wide green avenues. The romantic imagery of being built amidst 'ancient ruins' (while actually displacing many living villages and agricultural lands), with every detail planned with precision like water supply with multiple alternative sources, a water-borne sewerage system, even an elaborate arboriculture plan for forests and gardens generously watered by bypassing the needs of the many in the old city and its extensions. It was a city meant for 20,000 people only, with no room for the poor, not eve the Indian clerks employed in this new city They were left to their means to find room in the already congested Old City.[29] Despite the congestion of the Old City and to keep its polluted, unsanitary population and space at bay large open, green, buffer areas were planned between the two cities for adequate segregation on the south side and the railways acquired land on the immediate west of the wall.

With such a generous budget one would have imagined at least some would be diverted to making the inhabitants and growing migrants population needed to run an already congested city. After two decades, in 1935, A.P. Hume was commissioned to Report on the Congestion of Delhi. That showed an immediate excess population of 1,00,000 people and probable increase of 133,000 in the next 15 years. It recommended possibility of

[28] ibid. pg 20
[29] Legg, Stephen, 2007; Quoted by Kataria, 2019

housing and shops for 41000 in the 416 acres available on vacant government land and further acquisition of 1100 acres for the 106,000 people (a planned density of 100/ acre). It also highlighted the importance of addressing the slum clearance and re-accommodation problem to ameliorate insanitary conditions. This Report finally led to the formation of the Delhi Improvement Trust only in 1936.[30] Unfortunately, the solutions and work done by the Trust remained piecemeal and far from adequate. As these archival records have shown projects were considered and chosen and executed when their financial success was possible, not really for improvement of the 'lives of the people of Delhi'.

Conclusion

Ideas of improvement that came 40 years too late even after recorded warnings from British officers for the urgent need to decongesting the city, planning new neighbourhoods for its poor and resettling slums dwellers, that were not paid heed to until they made financially profitable sense to the Imperial Government. It is often said how we have strong institutions even today because of the legacy of British rule, but if we look carefully at the archival records presented in this paper, the lapses and the starkly different treatment of natives and Europeans reveal an urban space that is the ironic opposite of its stated benevolent intentions- of improving the lives of its people. The reality however on unravelling this history of the tussle between the Imperial Government and Municipality, land acquisition and annexation through seemingly liberal laws and in the interest of creating value, had quite the opposite impact. Narratives of helping the natives and improving their lives were but

[30] ***Origins of the Trust, in the Administration Report of the Delhi Improvement Trust for years 1937-1939, Finance Dept. File 1(31), 1940, NAI***

euphemisms of capitalising on land value through its acquisition and control.

Karol Bagh and Western Extension even today are an overcrowded under-serviced area with some hidden examples of housing and commercial enclaves of rich art deco and colonial architecture of the middle and upper class that belie its surrounding. But that is not because of the burden of population influx post-partition as many know, nor only due to the mismanagement or lack of funds of the post-independence administration. It is due to the historic disinterest in providing for the poor classes since the last 100 years and the policies and ideologies instituted then, that continue today in our independent nation still ill-equipped to provide for the poor but very capable to create large-budget and mega-scale designs to support the upper classes in the name of public good. Can we learn from such histories and face the drawbacks of the lingering colonial patterns, that maintaining the 'difference' between the powerful and the poor even today, so we may be able to truly *Design for All?*

Bibliography

Abu-lughod, Janet. Tale of Two Cities: The Origins of Modern, Comparative Studies in Society and History, Vol 7, No.4: 429-457, Jul 1965

Datta, Partho. Planning the City: Urbanisation and Reform in Calcutta: 1800-1940, Columbia University Press, 2012

Gupta, Narayani. Delhi Between Two Empires: 1803-1931: Society, Government and Urban Growth, Oxford University Press, Delhi. 1981.

Hosagrahar, Jyoti. Indigenous Modernities: Negotiating Architecture and Urbanism, Routledge, New York. 2005.

Kataria, Dinesh. Planning Shahjahanabad: 1910s-1930s, Social Scientist, Vol 47July Aug 2019.

King Anthony. Colonial Urban Development, Routledge & KeganPaul, London. 1976

Legg, Stephen. Spaces of Colonialism, Spaces of Colonialism, Blackwell Publishing. 2007.

Metcalf, Thomas R. Ideologies of the Raj. Cambridge University Press, 1995

Oldenburg, V.T. 2014. The Making of Colonial Lucknow, 1856-1877. Princeton: Princeton University Press.

Spodek, Howard. City Planning in India under British Rule, Economic & Political Weekly, Vol 48:53-61, Jan 2013

Archival Records

- ***Administration Report of the Delhi Improvement Trust for years 1937-1939, Finance Dept. File 1(31), 1940, National Archives of India, online***

- ***Delhi Gazetteers 1883-84, 1912-13, Arya Press***

- ***Final Report of the Delhi Town Planning Committee, July 1913***

- ***Hume, A.P., in Report on the Relief of Congestion in Delhi, Simla, Government of India Press, 1935, Delhi Archives***

- ***Proceedings of the Imperial Delhi Committee, September, 1914***

- ***Proceedings, Legislative Assembly Question Delhi Municipality Proposed Improvement and Congestion problem, Dept. Education, Health & Lands, File 53-82, 1936, NAI***

- ***Whitehead, R.B., Report on the Administration of the Delhi Crown Lands, 1908, Delhi, Delhi Archives***

Prof. Advaita Jalan

She is currently, pursuing PhD in Urban Design (part-time) from Urban Design Department, SPA, New Delhi. Has M.A. Urban Design from University of Central England, Birmingham, UK (now known as Birmingham City University) and Diploma in Architecture (at par with degree) from D.C. Patel School of Architecture, APIED, Vallabh Vidyanagar. Currently, associated with School of Environmental Design and Architecture, Navrachana University, Vadodara as an Associate Professor. She is a passionate urban designer with over 10 years of professional and over 8 years of academic experience. Has worked for public sector such as Nottingham and Birmingham City Council, UK along with private sector, Brown & Keener, USA. Her work primarily focused on regeneration, master-planning, design guidelines formulation, and conservation-based projects. Her strength lies in the assimilation of her international professional expertise and research oriented academic experience. She holds keen interest in questions of city, built environment and a firm believer of research-based practice. She is profoundly, interested in exploring the possibilities of application of various paradigms of urban design codes to improve quality of built environment.

Prof. (Dr.) Mandeep Singh

He holds PhD, Master of Urban Design and B.Arch. from SPA, New Delhi. He is currently Head Industrial Design (second tenure), Professor of Architecture, SPA New Delhi, Member Delhi Urban Art Commission (2021-24) and Governing Council Member (2017-20) NID Haryana. Was former Dean (2015-17) and has held position of Head Architecture (2017-19, 2014-15) Head Urban Design (2011-14) Industrial Design (2005-10). He is full time faculty in SPA Delhi since 1986. In addition to teaching since last 34 years and guiding many design and research projects, he has designed many buildings, Urban Design, and Industrial Design projects. He won many design awards notable being part of team member which won First Prize of Urban Design of GGSIPU University, first prize of HUDCO competition of low-cost housing etc. He has been consultant, advisor and peer reviewer to many public and private sector, notable being World Bank, NDMA (on Architecture curriculum), CPWD (Rajghat, C Hexagon), Shri Mata Vaishno Devi Shrine Board, Reliance Infrastructure, advisor to Ministry of Defense for National War Memorial Competition, Selection and suggestion committee of Republic Day Tableaux (2019-21), Competition Commission of India, Basmati Export Development

Foundation, Golchha Organization (Nepal) are among few notable ones. He was also associated by Bureau of Police Research and Development (BPRD) for creating identity of Police Station and conducting architectural competition. He has also written many papers for National and International Conferences. In addition to six PhD scholars he is guiding, four of the scholars guided by him have been awarded PhD.

ISSN: **2582-8304**

Role of Form-Based Codes as Determinants in Reclaiming Threshold Spaces: A Case Study of Walled City of Vadodara

Prof. Advaita Jalan[a] and Prof. Dr. Mandeep Singh[b]

[a] PhD Scholar (Part-Time), Urban Design Department, School of Planning and Architecture, New Delhi, and Associate Professor (Full-time), School of Environmental Design and Architecture, Navrachana University, Vadodara.

[b] Head, Department of Industrial Design, School of Planning and Architecture, New Delhi.

Abstract:

Since 1980's there has been boost in Indian economy, shift in the planning mechanism and tools employed in development and re-development of urban form within cities. This has significantly influenced the manner in which sites within old city cores are redeveloped. This transformed the inherent DNA of the built and the unbuilt spaces of urban forms. This paper will focus on how the shift in the paradigm of utilization of threshold spaces occurred due to mushrooming of new building typologies within the city cores. For the study purpose all the interface spaces forming the edge between the built and the unbuilt such as, plinths, steps, otlas, verandahs, gate, etc. have been defined as threshold spaces. The traditional urban form extended an opportunity for its users to conduct variety of multifunctional activities within mentioned threshold spaces. The manner in which these spaces were used was essentially based on the user's perception, context, and necessity. The hierarchy was established according to its purpose and adjoining building use. Hence, when new building typologies such as apartments, commercial buildings replaced the traditional built forms, the ground floors got

substituted with stilt parking, and streets got redefined to accommodate vehicles. The study of walled city of Vadodara is undertaken in two parts: critical review of existing building byelaws stated within the Gujarat Development Control Regulation and empirical on-site observations, and primary survey. The American model of Form-Based Codes which was introduced in 1980's as an alternative to development regulation, is now being published at national level as Form-Based Codes Policy Workbook in partnership of Smart City Mission and MHUA, India and being tested for various kinds of projects such as the commercial - station redevelopment of Indian Railways.

Based on overall findings, this paper will conclude establishing the critical role of form-based codes in arriving to context-specific response to reclaim threshold spaces within the walled city of Vadodara.

Keywords: ***Form-Based Codes, Threshold Spaces, Reclaiming, Building Typology***

Introduction:

Formal public spaces such as chowks, streets, or semi-private spaces such otlas, verandahs, steps outside the house, other such spaces at the interface of private and public realm are all integral part of the built form. "This transition space has a strong physical presence in several aspects of human life in India and is equally significant for its metaphysical implications. The most intriguing aspect of these spaces is the quality that allows large variations in scale. From very small domestic threshold to large ghats on the riverbanks, one can see enormous diversity in the creation of transition realms" (Jain, 2002, p. 14). These spaces are typically vibrant, versatile, accessible, and distinctive in nature. The function of the built form at the edge of public realm or transition

spaces largely contribute to the nature of activities occurring within them. All such spaces which generate an opportunity for people to come together for casual conversations, leisure, play, work, read, simply sit, and watch passerby, etc. can be considered as "Social Spaces."

Here, the intend of the study is to focus on the transition spaces which fall within the threshold of public realm (sidewalk and street) and private realm (house, shops, commercial development). For the purpose of this study elements such as otlas (raised platform), steps, plinths, verandahs, and gates at the interface of traditional and non-traditional built form and the street or sidewalk will be considered as the threshold spaces. Vadodara is one of the major cities of the western state of India, Gujarat. For the study purpose only the walled city area of Vadodara city, has been considered.

Shift in the Planning Paradigm:

The composition of built and unbuilt spaces is an evolving phenomenon and hence it is important to get an insight of the reasons which played a vital role in transforming the urban form of these historic cores of Indian cities. Economy is always at the core of any kind of change which occurs within a country. Hence, the boost in Indian economy in 1980's turned out to be one of the key players in bringing in reforms in planning approaches and in the structuring of the urban authorities. It also laid the foundation for institutionalizing the idea of urban authority and formulating reforms in the legacy of colonial approaches. "More importantly, in addition to diverse players who modified the neighborhoods through incremental adaptations, the state officials often employed the planning idea selectively, transforming the spatial form of Indian cities in critical ways" (Kumar , Vidyarthi, &

Prakash , 2021, p. 172). This approach was reflected in the redevelopment across all parts of the cities including the ones where more sensitive and context responsive solutions were required such as the historic cores within cities. New building types such as apartments, commercial complexes, retails shops, etc started mushrooming wherever land was available within the city including the old city cores which were already dense.

Aim:

The aim here is to critically analyze the reasons for loss of threshold spaces within the old city cores and establishing the relevance of Form-Based Codes in order to reclaim threshold spaces within new development.

Research Framework:

This paper is part of an ongoing PhD research work focusing on the Form-Based Codes and the Walled City of Vadodara, Gujarat. Specifically for the purpose of this paper the research has been carried out in following two stages:

***Stage 1:* Primarily consists of literature review to understand the threshold spaces and the determinants shaping it.**

***Stage 2: Is* derived from on-site observational study of the Walled City of Vadodara.**

The pre-requisite for selection of threshold spaces is based on following parameters:

a. **Buildings from 1800-1900 have been selected in order to understand elements and attributes of threshold spaces which were part of built form in this period**

b. New development from 1980's onwards i.e., forty years period

Analysis is drawn from the theoretical premise set by the literature review and primary study carried out of on-site observations.

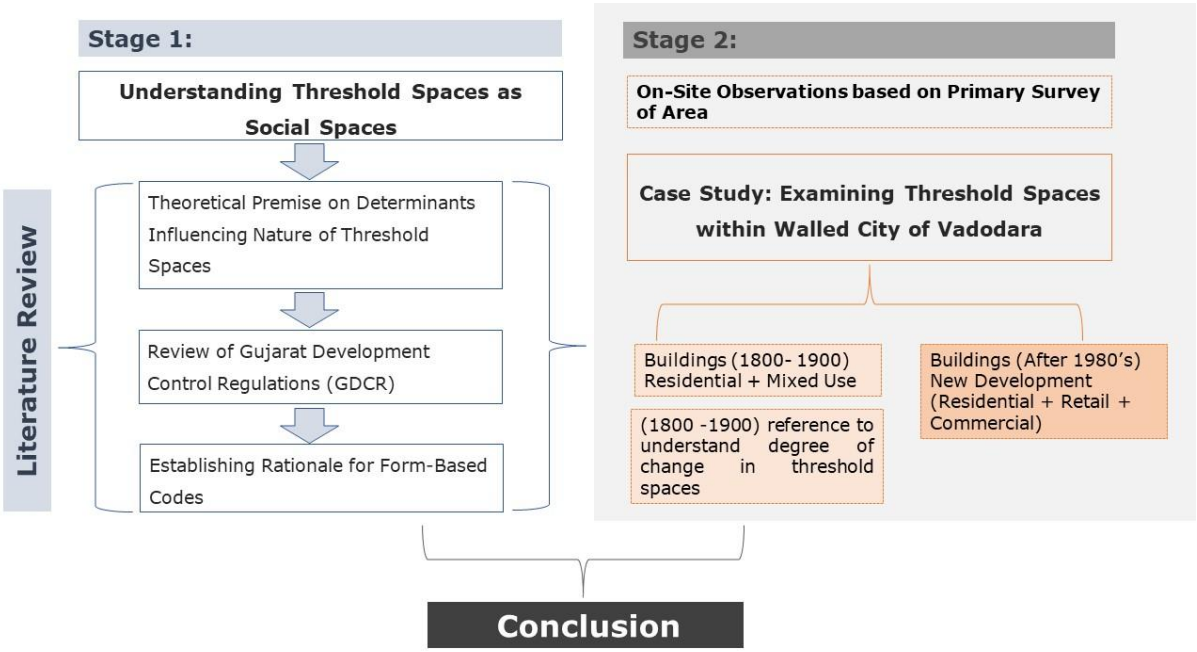


Figure 1: Illustrating Research Framework to give an overview of the method undertaken to conduct this study.

Scope and Limitation:

This paper will only focus on last forty years around i.e., 1980's onwards and not on the period prior to that. The earlier period-built form is used only for reference to measure change. The study only examines the non-listed structures prevalent in the study area. Internal residential streets and the only residential and mixed use (commercial+ residential) use have been examined.

Introduction to the Study Area – Walled City of Vadodara:

Vadodara is located in Gujarat in the western state of India. Historically, it was one of the princely states of India which was

known for its progressive approaches to education, society, art and architecture. It has long established history, embellished with rich architectural and cultural heritage. The walled city of Vadodara was established in 1511 AD by Khalil Khan, son of Sultan Mahmud Begada. At that time, it was also known as Daulatabad – the walled city. Later in 1734 AD Marathas took over and since then Gaekwads ruled the State of Baroda till the independence of India in 1947.

The walled city is divided into four quadrants which are divided by four cardinal axes and marked by four gates at the end of cardinal axes and one at the center. The urban fabric is closely knit with traditional house forms such as pol housing with common parallel walls, havelis, wadas with large courtyards and khadkis forming cul-de-sac cluster of houses. Public building types such as religious places, institutions, community places, etc. are also part of the urban composition. Architectural elements such as intrinsically carved fenestrations, columns, brackets, steps, plinths, otlas, verandahs and gates are inherent elements of architectural vocabulary profoundly seen in the traditional built form. These elements formed a repetitive pattern in the streetscape, by either projecting beyond the building line or creating intricately carved out semi-covered spaces within the building façades. Each house has a unique identity which is demarcated entrances and threshold elements.

Old derelict buildings, demolished building sites or the redevelopment of the houses for upgradation of lifestyle gave way for the developers to propose new building types and uses within this close-knit fabric. Hence, when new building types started mushrooming in this area the pattern of continuity of threshold elements, entrances and street line began disappearing.

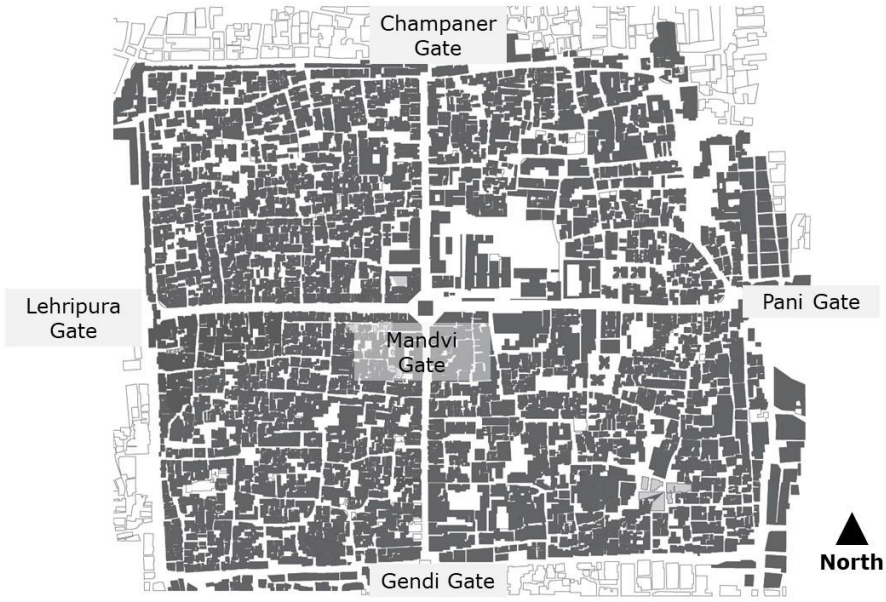


Figure 2: Figure ground generated by author based on google earth aerial map indicating recent scenario of the walled city of Vadodara.

Stage 1: Literature Review:

Understanding the Threshold Spaces as Social Spaces:

The term threshold can be defined as, "A design feature that emphasis where two parts of a building meet" (Cowan, 2005 , p. 395). Meaning the edge at the interface or at the transition of different types of spaces or built forms. In this case steps, otlas, verandahs and plinths are considered as elements defining threshold spaces. Typically, these have interface with either street, sidewalk, or other built form. Usually, the streets become an extension to these threshold spaces accommodating the spill over from the semi-public space to public realm. Another peculiarity of otlas and steps is that even a passerby could take a pause and sit for a while and proceed, as these are at the interface of private and public realm. The verandahs, and otlas were designed keeping in mind the local climatic conditions. These spaces can be covered, semi-covered or completely open. The buildings within the walled city are back of the pavement with insignificant to zero setback from the street edge. Elevated plinths

or otlas not only gave protection in case of floods but also formed an important feature of privacy as it raised the ground floor level from the adjoining street.

"Public space is, by definition, space used by those who do not individually control it" (Habraken, 2000, p. 158). Whereas the threshold spaces delineate territorial boundary between private and public space and hence create a sense of ownership alongwith security for its users. Socializing is seen as an important function and an integral part of human life and of the society as well. Threshold spaces give an opportunity to its users to interact with other people and still being able to restrict the entry of unwanted acquaintances within the house. "Entering the public realm from private space is a fundamental right: the door to public space is always open, and there must always be a public space we can move out to. In doing so, one is till on "home turf": public space is communally shared among those from similarly included territories'' (Habraken, 2000, p. 158).

Traditionally, threshold spaces in Indian context also carries a symbolic interpretation and demarcation of public & private spaces. Rituals and beliefs are demonstrated through colorful rangolis, red swastika, and traditional torans are used to decorate and customize these spaces.

Plinths, otlas and steps outside shops were and are still used for displaying products and for luring potential shoppers to shop. Typically, these spaces are overlooking the streets due which they tend to provide active surveillance on streets throughout the day. Thereby, reducing the possibility of any kind of anti-social activities occurring and hence making streets safe for all.

Determinants influencing the nature of threshold spaces:

Following are the determinants that influence the threshold spaces:

1. ***Use***
2. ***Socio-Cultural Values***
3. **Control and Regulatory Mechanism**

1. **Use: Can be defined as "The aspect of use refers to the human activities that give rise to and are accommodated by particular elements of the built environment" (Kropf, 2017, p. 22). In case of Vadodara this will be observed in the built forms with residential use and mixed-use with shops at ground level and residence above. These are the primary building uses taken up for this study. "Use is therefore fundamental to understanding the structure and character of places. We understand built form at a primary level in relation to its use" (Kropf, 2017, p. 22). Each building type varies in its design based on the functions it houses and, on the requirements, associated with it. The type of activities occurring on the threshold spaces will also differ with the varying building uses.**

2. **Socio-Cultural Values: These values are DNA of our built environment at large. The societal and cultural values determine the order of built form, characteristics of spatial organization and representation of symbolic values which is represented in the kind of threshold spaces. "The human activities that create and make use of the built environment necessarily take place within a wider context of social, political and economic activities" (Kropf, 2017, p. 25). Intricately carved motifs also carry symbolic association and are an integral part of the communities and belief system they carry. For example,**

presence of God's idol at the entrance of a Hindu house as a protector against evil, is believed to be a symbol for auspiciousness and well-being of the family by the house-owners.

3. **Control and Regulatory Mechanism: These two terminologies are on purpose being congregated together to ascertain a connection between these terms and the mutuality they hold. "Control is a socially established relationship between a person or group and a particular object or area of land, often in the form of ownership" (Kropf, 2017, p. 25). Whereas the regulatory mechanism determines the character of the built form based on what is mentioned within the building byelaws norms based on what is considered to be acceptable by the respective planning authority.**

Components of Regulatory Mechanisms:

As the primary study area is the walled city of Vadodara the following building regulations are reviewed to comprehend the impact on the disappearance of threshold spaces in the new typologies.

Following regulations have been reviewed:

1. ***General Development Control Regulations 2006 (Vadodara Urban Development Authority) (GDCR)***
2. ***Comprehensive General Development Control Regulations 2017 (Urban Development and Urban Housing Department – Government of Gujarat)***

GDCR 2006				
Threshold influencing Parameters				**Inferences**
Access to building to be provided not less than 3m and shall have clear access to such building.	**Projections on setbacks such as steps shall not be permitted on setbacks, streets, or roads.**	**Plinth of minimum height of 0.45 m to be provided.**	**Parking generic parking requirement used for this area. Based on % of maximum permissible F.S.I.**	**Access, projections, plinths, and parking are regulated. No specific mention about any other architectural standards.**
Comprehensive GDCR 2017				
Threshold influencing Parameters				**Inferences**
Permissible Building Uses based on the road widths	**Permissible ground coverage on building units' area in sqm**	**Onsite parking requirement f residential building, wi areas more than 100 sqm. For non-residential use less than 60 sqm parking not required. All othe had to provide parking as per the norms.**	**Setback of 3 m from the central line.**	**Lack of control over the continuity of street line and the character of the built form at ground floor. Prominence given to parking as an essential aspect of newer developments – generic guidance.**

Table 1: Analytical review of building byelaws as one of the determinants influencing threshold spaces in apartments, houses and mixed-use building uses.

Stage 2: Approach for On-site Observations:

Photographic documentation of threshold spaces from all the four quadrants of the city has been captured. The intention is to give an overview of the present scenario of the continuity of these

elements in the existing buildings and the shift in the new building types. Series of photographs have been taken covering cross section of residential building types.

Key:

Identifies varying kinds of threshold spaces in following building types which is a manifestation of composition of plinths, otlas, steps, gates and jalis, grill, parking, stilt parking, entrances, etc.

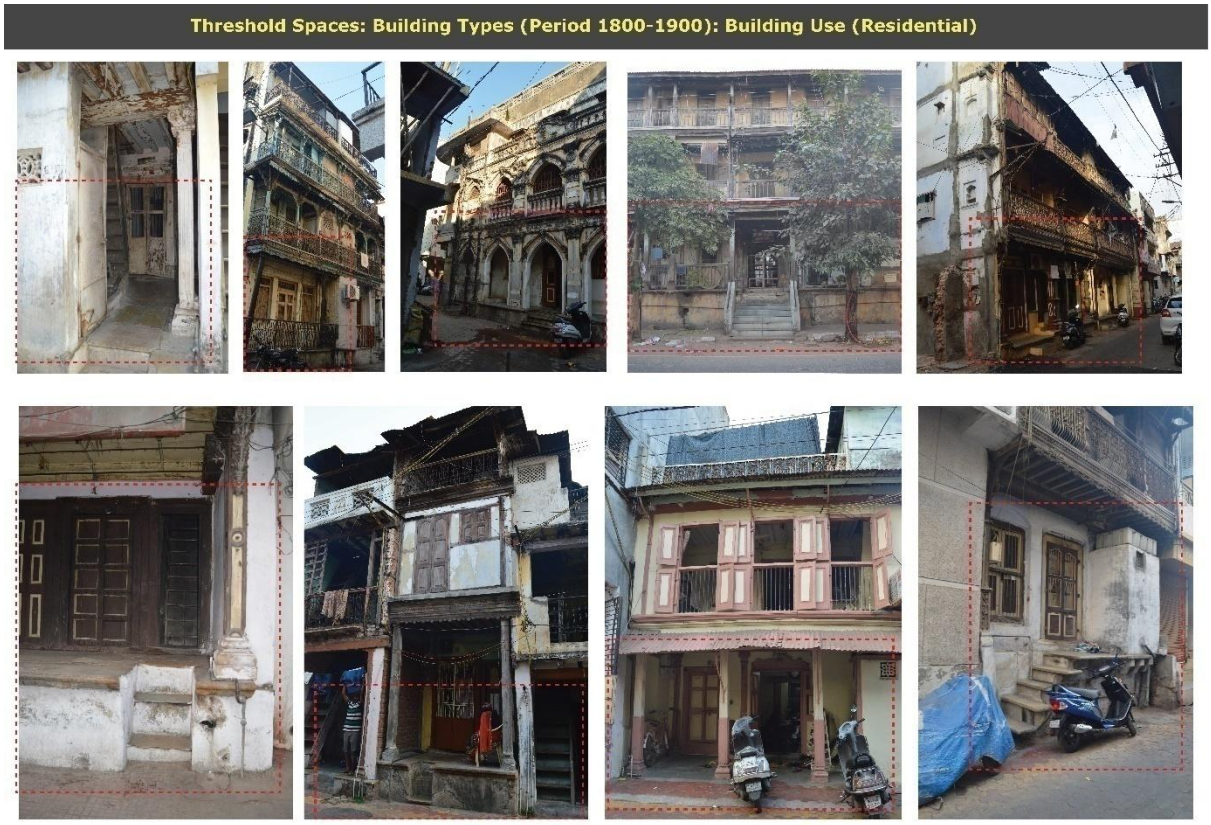


Figure 4: Traditional house forms (1800-1900) indicates robust nature, manifestation of architectural expression

Building Use: Residential (1800 -1900)		
Element of Threshold Space	**Determining factors**	**Overall Observations**
Otlas, steps, verandah, raised level, semi-covered entrances flanked by projecting balconies, chajjas	▪ **Scale** ▪ **Proportion** ▪ **Material** ▪ **Symbolic Value Motifs**	▪ **Establishment of hierarchy of spaces** ▪ **Privacy is achieved due to depth of otlas** ▪ **Response to contextual order**

Figure 5: Mixed-use traditional built forms (1800-1900) indicates robust nature, manifestation of architectural expression.

Building Use: Mixed-Use with retail at ground floor & residential above (1800 -1900)		
Element of Threshold Space	**Determining factors**	**Overall Observations**
Raised plinths, steps, projecting weather sheds, recessed entrances to shops, Shutters for shops	▪ Scale ▪ Proportion ▪ Material ▪ Space to display	▪ Well demarcated retail spaces ▪ Flexibility of space ▪ Response to contextual order

Figure 6: New development (1980 onwards) indicates the of ground floor and the associated uses with it.

Inferences:

Building Use: Residential & Mixed-Use (1980 onwards)			
Building Types	**Replacement of Threshold Spaces**	**Determining factors**	**Overall Observations**
▪ Apartment ▪ Mixed-Use (ground floor retail and residential above) ▪ Semi-detached house	▪ Parking ▪ Stilt Parking ▪ Jalis ▪ Gates ▪ Shutters ▪ Steps to access basement	▪ Regulations ▪ Parking ▪ Higher density ▪ More number of users per plot	Introduction of following functions at ground level: ▪ stilt parking ▪ Parking on streets ▪ Gated parking ▪ Setbacks Shops

Major transformation has occurred in this area in last twenty-five to thirty years. Hence, keeping that into account above mentioned regulatory timeline has been considered. Planning tools had to accommodate the changing trends and the surge of modernization leading to vehicle-oriented streets to accommodate increasing demand of off-street and on-street parking spaces. From the real-estate perspective too residential schemes (apartments) or multi-family units without parking did not turn out to be beneficial. Even in the case of house owners rebuilding the house to meet the needs of increase in family size or as part of the upgradation of lifestyle, there too parking was given priority and was being accommodated at ground level or on the streets or in chowks. Not only were the threshold spaces replaced by parking but the public spaces such as chowks also got packed with vehicles instead of being used for other social purposes. It is only at the times of

festivals that the vehicles get moved out of chowks and the celebration takes priority.

The facades of the building turned out to be less articulated and mediocre in character due to absence of threshold spaces. In these new typologies closed, private spaces dominated the streetscene. The threshold spaces got replaced with closed jalis or metal grill verandahs or closed room with entrances onto the street. Steps directly leading to the foyer inside the house. The commercial development on the main streets also lost those spaces where they could extend out their display; the idea of conducting retail got modified too. Closed introvert air-conditioned showroom type retails stores got higher preference over the traditional open shops with the activities extending out with the items being displayed beyond the steps, onto the plinths or the sidewalks. The relevance of transitional social spaces has almost completely got replaced by vehicles. Shift from human-centric to vehicle-oriented spaces has modified the street character.

"New development should enrich the qualities of existing urban places" (Davies , Llewelyn;, 2000, p. 14). Somehow this statement of the new development within an existing urban setting is supposed to enhance the distinctive character of the place and reflect in its built and unbuilt spaces does not hold true in case of the walled city of Vadodara.

The relevance between the activities, socio-cultural significance, and the way the built form was configured does not matter much now. The control of regulatory mechanism has predominantly prescribed the nature of spaces at the interface of private and public realm.

Establishing the Rationale of Form Based Codes:

Form-Based Codes (FBC) came into use as an alternative to conventional zoning and regulatory system. After examining the limitations of conventional planning tools to control what gets developed and how it responds to the public realm FBC seemed to be bridging the gap between planning, urban design, and architecture. It has an integrated approach towards social, cultural, economic, and environmental concerns. This comprehensive approach provides a platform for the local authority to achieve coherent and predictable built form. It was initiated in 1980 but in 1981 first development code for Seaside, Florida, was formulated by Duany Plater-Zyberk in U.S.A.

"FBCs are holistic, addressing both private and public space design to create a whole place, including buildings, streets, sidewalks, parks, and parking. They regulate private development for the impact it has on the public realm" (Parolek, Parolek, & Crawford, 2008, p. 11).

Inclusive Process of FBC:

Other advantages of FBC are the inclusion of communities in form of public participation which becomes bases for inclusiveness in the process. Also, unlike urban design or any other guidelines FBC would hold statutory status leading to its mandatory acceptance by all and has potential for its integration within the exiting regulatory system too.

FBC for Indian Cities:

Now Indian Government has also acknowledged the use of FBC within Indian cities. A Form-Based Codes Policy Workbook is

published by Ministry of Housing and Urban Affairs, Government of India, Smart City Mission in collaboration with WRI India – Ross Center. "The current planning process in Indian cities emphasizes rigid land-use, zoning and development controls that fails to recognize the unique urban fabric, fine-grained mix of uses, potentials and constraints of different areas or neighborhoods within the city needing area-specific solutions and interventions" (MoHUA and WRI India - Ross Center, 2021, p. 5). Recently, there has been proposals of FBC being specifically used for Commercial Development within Station Railway Land Redevelopment Project in India. This project has been undertaken by Indian Railway Stations Development Corporation Limited. This also, presents an exceptional possibility of tailoring FBC structure for formulating and implementing it on case-by-case basis.

Application of FBC for Threshold Spaces:

As discussed earlier that in case of walled city of Vadodara, it is evident from the inferences drawn from the literature review and site observations that threshold spaces at ground floor level which are at an interface of the buildings and the street edge necessitates to be articulated and regulated. It is significant to determine which components to include in order to formulate context responsive codes.

The foremost part of FBC's is the flexibility and compatibility in its approach which can be attained by identifying appropriate structure for it. Such as:

A. Elements of FBC

B. Organizing Principles of FBC

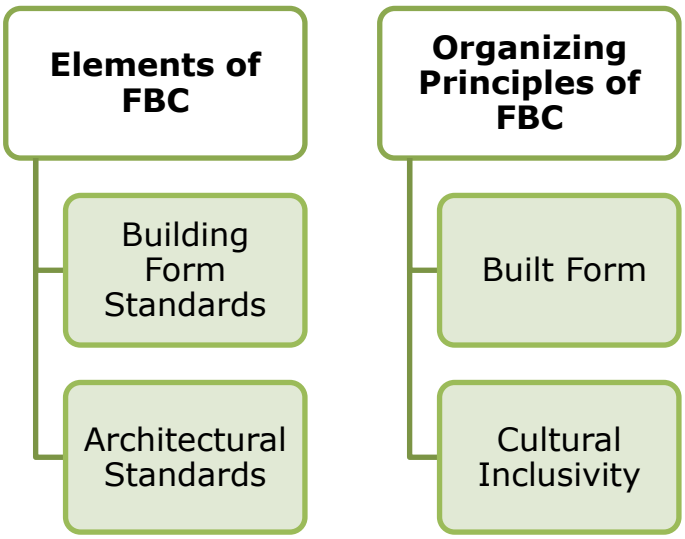


Figure 7: Potential structure for formulation of FBC for reclaiming threshold spaces as social spaces within walled City of Vadodara.

Elements of FBC:

These are also known as specifications which are chosen based on the type of context and development anticipated. Some of them are supposed to be mandatory and few are optional. Here the focus is on ones which are specific to place:

- ***Regulating Plan***
- ***Public Space / Street Standards***
- ***Building Form Standards: "Regulations controlling the configuration, features, and functions of buildings that define and shape the public realm" (MoHUA and WRI India - Ross Center, 2021, p. 13).***
- ***Architectural Standards: "Regulations controlling external architectural materials and quality" (MoHUA and WRI India - Ross Center, 2021, p. 13).***
- ***Administration***
- ***Definitions***

Organizing Principles of FBC:

"The organizing principles act as guiding elements that define planning and implementation of FBCs" (MoHUA and WRI India - Ross Center, 2021, p. 13). Based on the concern of reclaiming the elements of threshold spaces following principles can be used:

Among various principles mentioned under this design component the highlighted ones are most relevant in this scenario:

- ***Building placement***
- ***Building form & parking***
- ***Allowed land uses***
- ***Frontage types***
- ***Block standards***

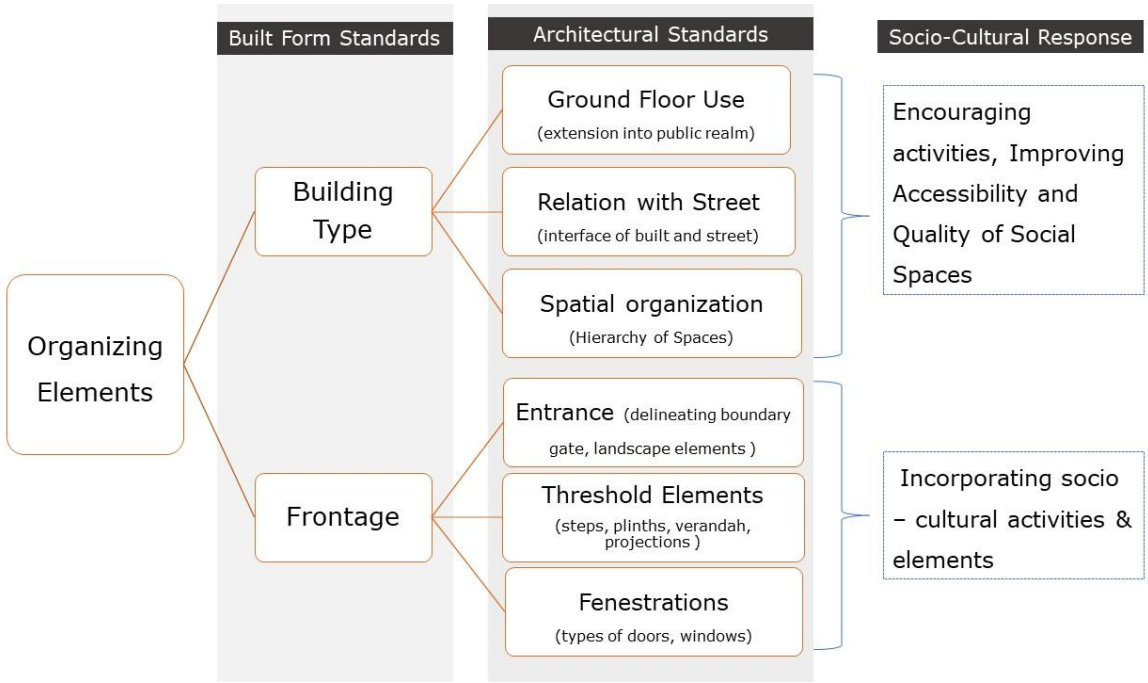


Figure 8: Inter-relationship diagram indicating the design principles to be considered for formulating FBC for reclaiming threshold spaces

Conclusion:

"The code is developed by using a combination of built form and street elements. The built form elements i.e. chajjas, balconies, bay windows, front porches, balconies, etc. may extend over the build-to-line (the distance between the property line and the building façade) or at times, the street elements i.e. footpaths, trees, landscaping help determine the nature of activities. The combination of the two elements leads to the development of a contextually rich urban form" (MoHUA and WRI India - Ross Center, 2021, p. 23).

It is apparent from the above stated arguments that FBC can be one of the most appropriate approaches to be adopted in order to address micro level concerns such as regulating and articulating elements of built form such as threshold spaces based on its contextual setting. It also provides a platform for incorporating the theoretical premise determining the threshold spaces such as Use, Socio-Cultural Values, Control and Regulatory Mechanism. It can be well integrated within the built and unbuilt spaces to make them meaningful to the respective communities.

Hence, it can be concluded that Form-Based Codes not only can be used to reclaim threshold spaces within newer developments but also to create more inclusive and accessible social spaces within historic contexts.

References:

Cowan, R. (2005). The Dictionary of Urbanism . Norflok: Streetwise Press .

Davies , Llewelyn;. (2000). Urban Design Compendium. London: English Partnerships and The Housing Corporation.

Habraken, N. (2000). The Structure of the Ordinary - Form and Control in the Built Environment . (J. Teicher, Ed.) Cambridge : The MIT Press .

Jain, K. (2002). Thematic Space in Indian Architecture. Ahmedabad: AADI Centre & India Research Press.

Kropf, K. (2017). The Handbook of Urban Morphology . Sussex : John Wiley & Sons Ltd .

Kumar , A., Vidyarthi, S., & Prakash , P. (2021). City Planning In India, 1947-2017. Abingdon, Oxon : Routledge - Taylor & Francis Group .

MoHUA and WRI India - Ross Center. (2021, n.d. n.d.). https://smartnet.niua.org/sites/default/files/resources/2-form-based-codes-policy-workbook.pdf. New Delhi : Ministry of Housing And Urban Affairs (MoHUA), Smart City and WRI India - Ross Center Retrieved from https://smartnet.niua.org: https://smartnet.niua.org/sites/default/files/resources/2-form-based-codes-policy-workbook.pdf

Parolek, D. G., Parolek, K., & Crawford, P. C. (2008). Form-Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers . Hoboken: John Wiley & Sons .

Urban Development And Urban Housing Department, Government of Gujarat. (2017). Comprehensive General Development Control Regulations - 2017 (These regulations shall apply to the entire Gujarat state as classified categories in the notification). Gandhinagar: Urban Development And Urban Housing Department, Government of Gujarat .

Vadodara Urban Development Authority . (2006). General Development Control Regulations - 2006 (These regulations are part of the Second Revised Development Plan 2006 Submitted

under section 16 of the act). Vadodara : Vadodara Urban Development Authority .

Bibliography:

Baroda Municipal Corporation . (1975). A basic plan for Baroda - A Perspective For Growth And Structure - Volume One - A Perspective for Growth . Baroda : Baroda Municipal Corporation .

John, P. (Ed.). (2016). Baroda Know Your Roots - Connecting People To The Banyan City . Ahmedabad : Bennett, Coleman & Co. Ltd.

Kamini Singh

PhD Research Scholar

Department of Urban Design

School of Planning and Architecture, New Delhi

Email: Kamini196phd18@spa.ac.in

Kamini Singh is a Part-time PhD Research Scholar in Department of Urban Design, School of Planning and Architecture New Delhi. She is employed as Assistant Professor of Architecture at Apeejay School of Architecture and Planning, Greater Noida. She has more than 9 years of professional experience in academics, research and architectural practice.

Prof. Dr. Mandeep Singh

Head of the Department

Department of Industrial Design

School of Planning and Architecture, New Delhi

Email: Mandeepspa@gmail.com

Professor Mandeep Singh has about 40 years of professional experience including 35 years into academics. His work portfolio has a diverse range from Industrial Architecture, Urban Design, and Research consultancy. He is former Dean and Head of Department of Architecture, Urban Design, Industrial Design. Presently, He is Professor of Architecture and Head of Industrial Design at the School of Planning and Architecture, New Delhi.

ISSN: **2582-8304**

Assessing the Impact of Horizontal Surfaces on User Perception of Outdoor Comfort in High-rise Group Housing

Ar. Kamini Singh[1], Dr. Mandeep Singh[2]

[1]PhD Scholar, Department of Urban Design, School of Planning and Architecture, New Delhi, India Email: Kamini196phd18@spa.ac.in

[2]Head of the Department, Department of Industrial Design, School of Planning and Architecture, New Delhi, India Email: Mandeepspa@gmail.com

Abstract: Covid-19 Pandemic and associated restrictions have posed several challenges on our everyday living environment with an increasing gap between private and public realm. The feeling of being cooped up within the indoor residential environments have increased the value of surrounding outdoor spaces as a relief to the associated mental and physical stress. In case of high rise group housing societies the common spaces, shared parks, plazas, pathways and parking areas have emerged as s paces for physical activity, recreation, and social interaction. The spatial characteristics of the common areas are being looked at as felicitator for multi-use opportunities. It is crucial to enable these private-public spaces to be comfortable and accessible for all where the physical quality of horizontal surfaces are critical for activity in outdoor environments. This paper investigates the impact of the outdoor surfaces materials, accessibility and thermal properties on the user choice and selection for performing outdoor activities in high-rise residential environment of Greater Noida. A close link between the surface properties and user spatial preference was established by documenting the materials and form aspect ratio, measuring surface temperatures in sun and shade, mapping user activity pattern for 4 intervals, and then analysing the data thus obtained with respect to solar and wind orientation of active versus non active spaces. It was understood

that the user preference for outdoor residential spaces are closely determined by the thermal comfort and accessibility, however there is a pattern with respect to age, gender and activity level of each user group. The accessibility of a space plays a crucial role for people with special needs such as senior citizen, people accompanying pram and wheel chairs etc. To ensure the wide range of user with varied physical abilities in a public space the appropriate mix in spatial qualities has been found to be desirable.

Keywords - ***Urban Design, micro-climate, high-rise Housing, urban climatology, urban surfaces***

Introduction

A pregnant lady walks gently in the walking track assisted by her partner from racking young bicyclers. A group of mid-aged men spread wide over the parks talks so loudly that catches attention of people watching the scene from their balcony on 7th floor. Several groups of senior-citizen lady occupy almost all the benches in the park, while gossiping in low voice. Among the many basic needs of people is that for recreation, including relaxation and socializing. People are not meant to work constantly; nor are they meant to live alone. Ideally these different needs — to escape from the pressures of work, to feel part of a community, to be around and possibly interact with others — can all be met in the same place. When people are drawn to public spaces they can perform multiple roles for others as well as for themselves (Efroymson, Ha, & Ha, 2009). In the wake of pandemic situation, regularly visiting an urban public spaces is not an option. The neighbourhood parks have come to resort, for engaging with people and nature. The age group of 18- 60 years (college students and working population) who seldom visited their neighbourhood parks due to their social life associated with

their institutions and workplaces are also seen in the parks. Craving out a small time for outdoor activity has become possible due to proximity of parks and the flexibility associated with work from home culture.

"One of the most important initiatives in urban places worldwide is the integration of more parks and green spaces with trees and plants that can dampen noise levels, filter pollution, absorb carbon dioxide and produce oxygen, absorb rainwater, reduce run-off, and provide shade. These spaces also encourage physical activity, and may help address worrisome health issues such as the rising level of child obesity." (Ryan 2006) The parks have been crucial not only for environment, but for mental and physical well-being of citizen. In case high-rise housing societies the connection with the earth at the ground level is established only when the user walks down to the common areas of the society. This need act as a driver to explore how these shared open spaces can become inclusive, empathetic and accessible for all.

Spatial Empathy and Comfort

"Intricacy is related to the variety of reasons for which people come to neighbourhood parks. Even the same person comes for different reasons at different times; sometimes to sit tiredly, sometimes to play or to watch a game, sometimes to read or work, sometimes to show off, sometimes to fall in love, sometimes to keep an appointment, sometimes to savour the hustle of the city from a retreat, sometimes in the hope of finding acquaintances, sometimes to get closer to a bit of nature, sometimes to keep a child occupied, sometimes simply to see what offers, and almost always to be entertained by the sight of other people." (Jacobs, 1989) The humanistic perspective of

looking at the role of public spaces initiated a dialogue on the value of empathizing with the varied user group in public spaces as a crucial element of successful public spaces. The idea of 'empathy' in urban spaces have been looked through various lenses, and 'it is possible to set a merger in motion, a special consonance that connects the 'me' to the ambiance. We can therefore feel that a certain place is friendly or that a certain space rejects us; that a majestic construction intimidates us with its arrogance; that a park packed with people is either happy or, on the contrary, frightening.' (Duarte & Pinheiro, 2016)

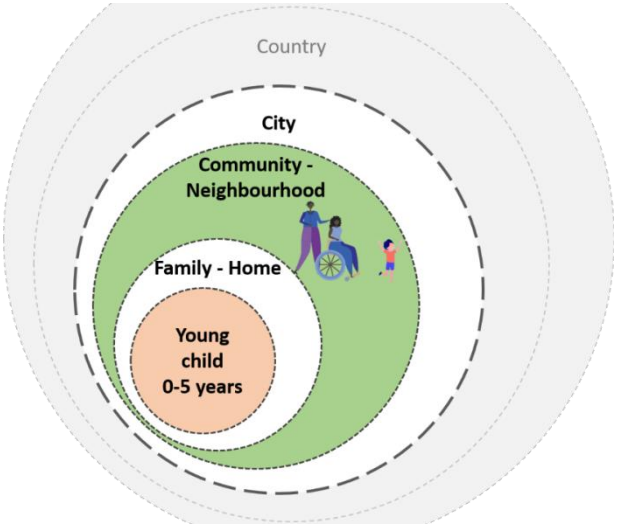


Figure 2: Neighbourhood as a Spatial and Social Entity, Source: Elisabeth Belpaire (National Workshop on Accessible Cities)

The public spaces in case of residential societies goes beyond the parks and plazas, and any space that is open and accessible to all can be a place for social activity. Social activity occurs in this in-between interstitial space (for example, the front porch) as this space has an ambiguous character where we negotiate both 'publicity' and 'privacy'. (Dovey & Woods, 2015) In the case of a residence and its premise, there are different levels of transitions occurring. The wall separates the inside and the outside, clearly defining the private and the public, whereas a transition of space happens at the gate, as it bridges the public and private realms. Therefore, this interface is both where we welcome and exclude

strangers and is essentially double, separating and connecting levels of a socio-spatial hierarchy – part/whole, individual/collective, self/society (Ivenson 2006 cited in (Dovey & Woods, 2015)). A public spaces should be safe, relaxing, with opportunities to stop and linger, for example, with good quality, comfortable and preferably moveable formal seating, informal seating opportunities (on steps, kerbs and walls), toilet facilities, soft landscaping and careful consideration given to microclimate (places to sit in the sun, and to shelter from the wind and the rain).. (Carmona, 2003)

Comfort can be thought of as the balance between relaxation and stimulation. The study conducted by William H Whyte on Plazas of Manhattan in 1970s, affirms that presence of sun, wind, shade, trees, water and how much accessible they are for public (e.g. can you touch them, take a bath etc.) is an elemental point of a good urban space (Whyte, 1980). This was one of the first studies that looked at human comfort as a determinant of successful public space. The study has been a milestone in framing principles for sociable public spaces such as adding value to the provision of ample amount of comfortable and 'sittable' spaces. His research proves that variety in use is widely regarded as one of the prerequisites for a successful urban space. He tried to find out how activity patterns interrelate with the physical dimensions of urban spaces. (Efroymson, Ha, & Ha, 2009) His work indicates how an inclusion, accessibility and comfort can bring in more people to public spaces and add to the overall experience of the public space."Thermal comfort is that condition of mind which expresses satisfaction with the thermal environment. Because there are large variations, both physiologically and psychologically, from person to person, it is difficult to satisfy everyone in a space." (ASHRAE, 2017). Thermal comfort plays a

crucial role in selection of outdoor space for activity. While the rage of thermal comfort experienced depends on the age, gender, clothing and activity level of the user. In high density - roof details, material, urban surface albedo, surface emissivity, shade and diffused lighting, day length, aerodynamic roughness of surfaces, interaction between street and the air above roof level are determinant of human comfort at street level. (Givoni, 1998). Hence, the study expects to find an overlap between the idea of comfort and accessibility in public spaces with reference to its horizontal surfaces. The study specifically examines the surface material characteristics along with dependent variables such as location, orientation, aspect ratio or enclosure.

Spatial Context:

The site selected for the study is located in the urban periphery of Delhi NCR. It is a high rise group Housing Society, in Greater Noida. The site is surrounded by green-fields, under construction sites, urban village and high rise housing with a great variety if landscape elements as spaces ( )

- **Urban Density = 5000 people per sq km**
- **Site Density = 490 people per Ha**
- **Plot Area = 11.30 acre**
- **Ground Coverage = 23%**
- **FAR = 200**
- **Building height = 42 meter**
- **Building type = tower**
- **Large trees on the periphery, small trees in central park due to basement below.**

Figure 3: The urban form of selected group housing, Source: Author

1. **Tot-lot with swings**
2. **Open air theatre with clock tower**
3. **Gazebo/ Pergola/ pavilion**
4. **Central axis with fountains**
5. **Lawn**
6. **Basketball cum tennis court**
7. **Seat walls with tree court**
8. **Swimming pool**
9. **Pathways with surface parking (along site boundary and buildings)**
10. **Temple**

Figure 4: The Site Plan showing key activity zones

Identification of Parameters

The key parameter being assessed here are the horizontal surfaces in outdoor spaces. The properties of surfaces that influence comfort and accessibility are the kind of paving materials, their maintenance, and the horizontal and vertical connection across levels. Apart from surfaces spatial enclosure, orientation (Solar & wind) and the amount of light also influence the overall sense of comfort experienced by the user. Further, how the user perform activities, at what time of the day and for what duration helped us to evaluate the actual influence of the key parameter.

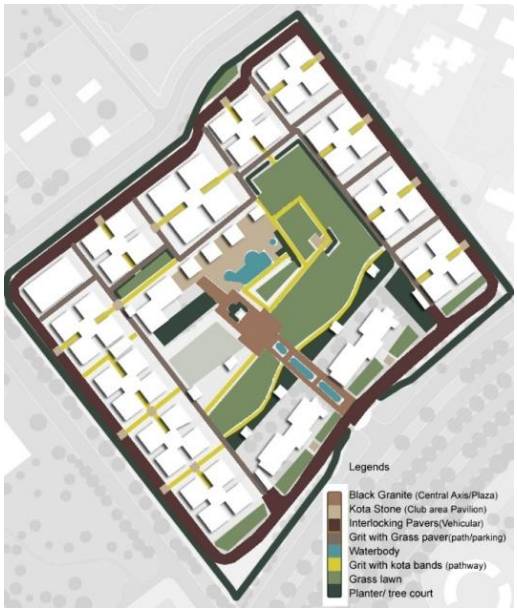
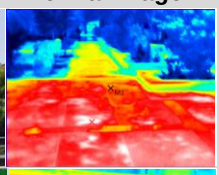
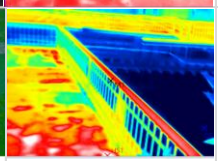
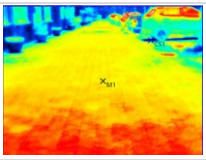
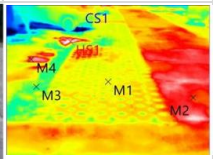
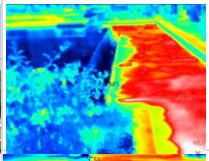
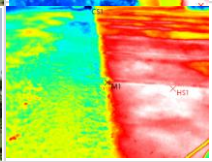
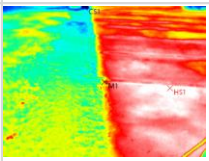
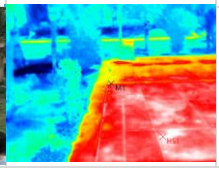


Figure 5: Site plan showing key horizontal surfaces and materials

Urban Surfaces: The surfaces are crucial to ensure that the public realm is accessible to all without compromising their dignity. The provision of 'visual cues' to the change in spatial context by additional design elements (such as landscape, curbs, barriers, lights, furniture) and alternative pavement and texture/material at intersection and crosswalks.

This also ensure a clear segregation of pedestrian and vehicular domain. The universal design norms suggest that surface material should be stable, firm, smooth and slip resistant. The use of contrasting or bordering materials, bollards also helps to demarcate the vehicular and pedestrian area. The reflective and absorptive properties of surface material impact the thermal and visual comfort, while the texture and level of surfaces influence the ease of movement and accessibility. The thermal properties of surfaces determine the thermal comfort in the immediate environment. The map below shows the horizontal surface materials on site (). Table 2, presents a comparative analysis of the materials used in outdoor horizontal surfaces are compared on the basis of their location, thermal properties, and texture.

Table 2: Comparison of Surface material properties of outdoor Urban Surfaces (summer)

Material		Location	Site Image	Thermal Image	Temperature (Sun) ◦C	Temperature (Shade) ◦C	Texture
Black Granite		Central Axis & Plaza			56	36	Polished
Kota Stone		Club area & pavilion			54	46	Honed
Interlocking paving		Vehicular Path in periphery			48	38	Rough
Grass paver		Parking area			42	33	Rough / natural
Waterbody		Pool and Fountain			31	36	Natural
Grit paving with kota bands		Pathway			52	45	Rough
Grass lawn		Lawn			45	32	Natural
Planter & Tree court		Park edges			36	33	Natural

Enclosure: The spatial enclosure crucial to the experience and activities in a public space. In thermal comfort studies the aspect ratio is used which is defined as the ratio between the heights of the adjacent building to the width of open space. The Canyons are 2D cross-section, with dimensionless ratio i.e. H/W. It is relevant for evaluating radiation access, shade and trapping, wind effects,

thermal comfort and the dispersion of vehicle pollutants. Literature suggests that users' preference of urban space enclosure is an inverted U-shape relationship (Carmona, 2003). Extreme high values of enclosure evoke claustrophobia and confinement, while extreme low values of enclosure evoke discomfort because of lack of psychological shelter. The preferred values of enclosure exist in between the two. (Alkhresheh, 2007) The high rise built form surrounding a central park in the selected case study creates a large range of spatial enclosure (Figure 6). It was observed that each user group find comfort in different amount of enclosure. E.g. the Children age 3- 14 years tend to prefer spaces with lower degree of enclosure as opposed to adult women.

Figure 6: Building Height Map

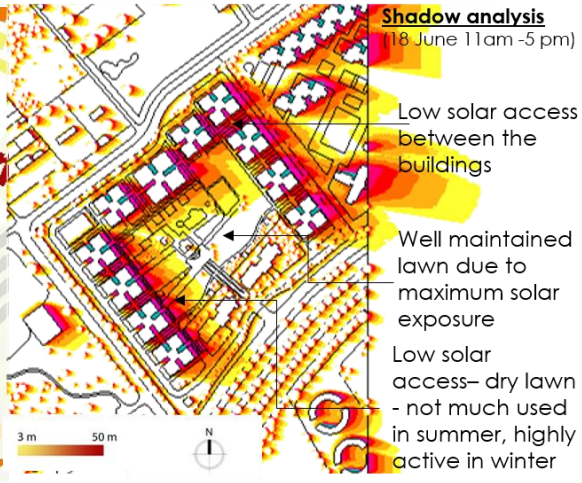


Figure 7 : Shadow Analysis Map

Orientation: Orientation of buildings with respect to sun and wind have direct influence on thermal comfort. The height of the building and solar orientation create varied shadow pattern throughout the day. Presence of direct solar radiations create 'hot spots' supported by indirect reflected radiations from the surface materials. (Figure 6) In the case of rectilinear building forms, faster winds at higher altitudes are drawn down to the ground-level (downwash) and becomes turbulent. The 'corner effect'

causes greater wind velocities. The narrow gap between two buildings causes accelerated winds through a channel (Venturi effect). This have direct impact on spot level wind conditions and contribute to the spot level thermal comfort experience. The wind flow pattern at 11 am and at 3 pm during summer month have been shown in the map below. (Figure 8)

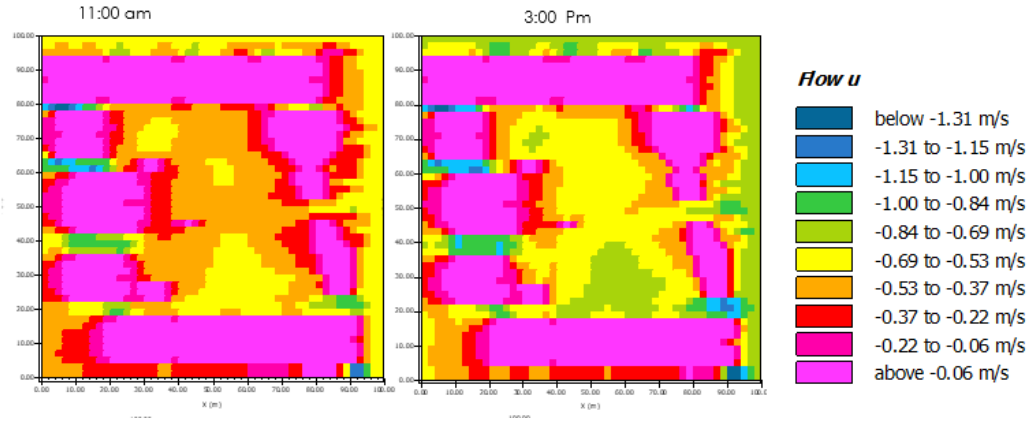


Figure 8: Wind Analysis Map using Autodesk Flow Design Software

User Profile: The profile of residents range from people employed in IT companies, Educational Institutions, Business and Industry owners. Most of them have migrated from nearby small towns and villages. Some of the families have migrated from Delhi NCR after retirement and next generation is studying or working. Based on the general profile of users in the outdoor spaces the following categories were identified.

a. 0 to 3 Year old children (accompanied by parent/ caretakers) (10%)

b. 4 to 18 Years (Children/teenagers) (50%)

c. 18 to 60 Years (Adults) (25%)

d. 60 + Senior Citizen (15 %)

Activity: The following activity components were observed in the outdoor spaces –

a. ***Passive Engagement*** *– Sitting, Sitting with a child/ pram / wheelchair, standing, Standing with a child/ pram/ wheelchair, Lying Down, Walking alone with a purpose*

b. ***Active Engagement*** *– Cycling, Exercising, Taking pictures/videos, Playing, Walking with pram/child/ wheelchair*

The distribution of activities across the outdoor spaces is as per the maps below. Active recreation is shown as circles whereas passive recreation is represented as triangle. The map is color-coded showing age and gender categories. The activities were recorded for 4 time slots -

a. ***Morning: 5 am to 9 am,*** ***b. Afternoon: 9 am to 4 pm,***

c. Evening: 4 pm to 7 pm & ***d. Night: 7 to 11 pm respectively.***

Figure 9: Activity Mapping: Morning

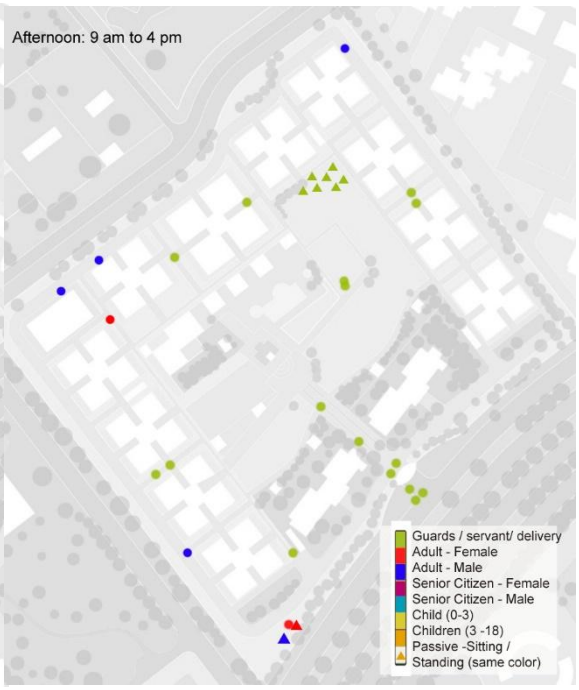


Figure 10: Activity Mapping: Afternoon

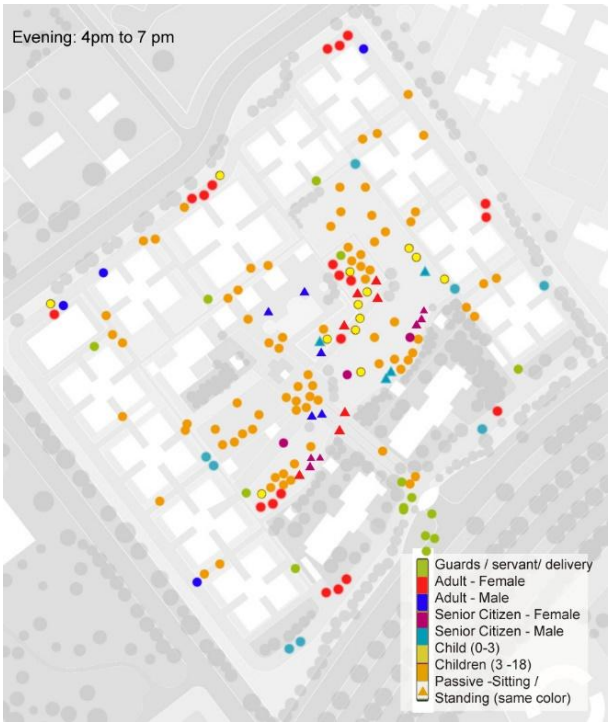


Figure 11: Activity Mapping: Evening

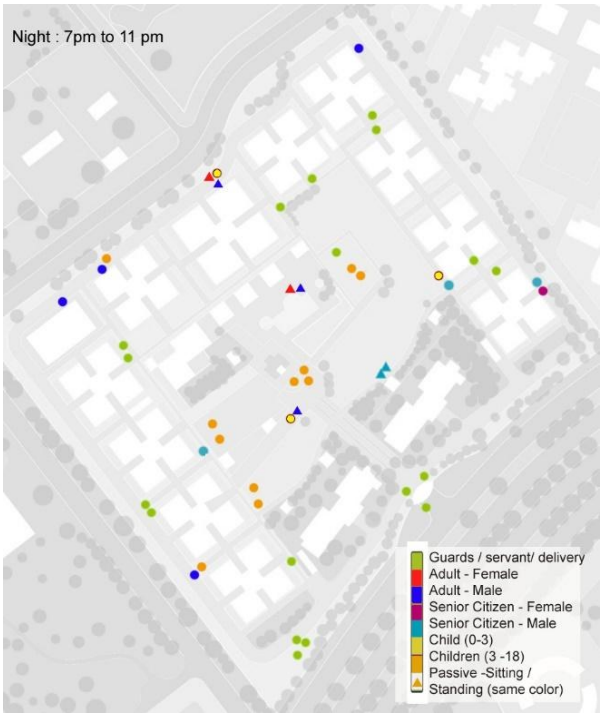


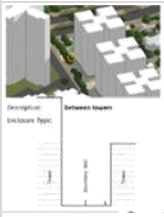
Figure 12: Activity Mapping: Night

Results

The data obtained for the selected parameters - surface material properties, enclosure, orientation, user profile and corresponding

activities were analysed to see the overlaps. This guided to understand a possible interrelation between the aspects of comfort, activity and accessibility (Table 3).

Table 3: Summation of selected parameters to identify possible co-relation

Space	Location	Material	Enclosure	Aspect	Orientation (Shade hours)				Human Activity & User Group (hours)			
	Map	Surface	Section	H/W	6_9	9_16	16-19	19_23	6_9	9_16	16_19	19_23
Park		Grass Lawn and pathway with grit paving & Kota bands		0.28					d	c	a/b /c/d	c
Plaza		Black Polished Granite stone and Kota Stone with Sandstone		0.28					e	e	b	b/c
Pathway & Parking		Exposed Grit paving with kota bands and grass pavers (to deliniate parking)		13 to 4					d/c	c	c	c/d
Parking & Vehicular Road		Interlocking pavers with grass pavers (to deliniate parking)		13 to 4					d	c	b/c	c
Transition Space		Exposed Grit paving with kota bands and Kota Stone transitional plaza		15 to 10					c	c	c	c
			Age group		0 to 3	3 to 18	18 to 60	60 +	Nil			
			Age Category		a	b	c	d	e			
			Amount of Shade		High	Med	low	Very low	Nil			
			Activity Intensity		High	Med	low	Very low	Nil			
			Legend (Color)									

Conclusion

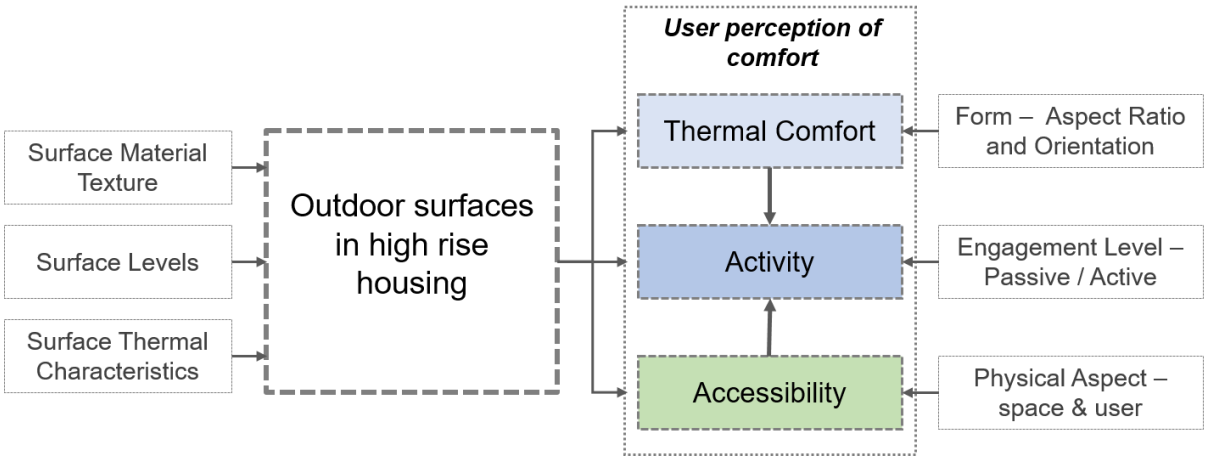


Figure 13: Proposed Relation between Thermal Comfort, Activity and Accessibility

The outdoor surfaces in high-rise housing were found to be crucial in user perception of comfort in outdoor spaces. The activity mapping gave a clear picture on user and activity distribution across spaces in selected group housing society. The key takeaways from the study include –

- ***The activities with greater physical engagement e.g. running, playing, cycling and brisk walking were done in hard paved spaces only (vehicular path & granite paved axis and plaza).***
- ***The senior citizen have strongest preferences. They move and recreate in a fixed pattern everyday – the activity, the speed of walk, the route for walking and bench for sitting etc.***
- ***The adult women were identified in groups and in locations with a greater degree of enclosure***
- ***Opposed to the above, children prefer less enclosure, and spaces with levels. The plaza and stepped court was always occupied by young children only. The children also prefer to regularly change their activities and prefer to explore new materials, locations, textures and spaces.***

- ***The thermal comfort plays greater importance for middle aged and senior citizen in order to select the spaces – for example the amount of sunlight, wind, views all help them build the choice of space.***
- ***The residential space selected was quite accessible for all, yet the continuous pathways of grit along the periphery of park were specifically preferred by people with special needs i.e. pregnant ladies, people with pram/ wheelchair and senior citizens. These were the spaces where lesser number of children were running and cycling, and vehicular movement was restricted. Hence, these were considered to be 'safe' for slow walkers.***

It could be further concluded that there is strong ability of adaptation into play in selection of spaces for everyday outdoor activities. People naturally tend to develop preferences based on their physical abilities, activity level and thermal comfort.

References

Alkhresheh, M. (2007). Enclosure as a function of Height to width ratio and scale. Florida: DIssertation, University of Florida.

ASHRAE. (2017). Thermal Environmental Conditions for Human Occupancy Standard 55: 2017. Atlanta: ASHRAE.

Burte, H. (2008). Space for Engagement: The Indian Artplace and a Habitational Approach to Architecture. Calcutta: Seagull Books.

Carmona, M. (2003). Urban Spaces-Public Places: The Dimensions of Urban Design. Oxford: Architectural Press.

Dovey, K., & Woods, S. (2015). 'Public/private urban interfaces: type, adaptation, assemblage. Journal of urbanism, 1 -16.

Duarte, C. R., & Pinheiro, E. (2016). Spatial empathy and urban experience: a case study in a public place from Rio de Jenario. Proceedings of 3rd International Congress on Ambiances (pp. 611 - 616). Volos, Greece: HAL.

Efroymson, D., Ha, T. T., & Ha, P. T. (2009). Public Spaces: How They Humanize Cities. Dhaka: HealthBridge - WBB Trust.

Givoni, B. (1998). Climate Considerations in Building and Urban Design. NYC: John Wiley & Sons, Inc.

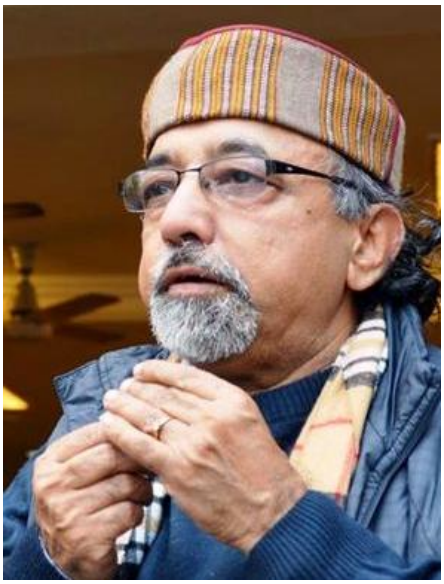
Huss, S. (2016). Measuring human experience of public spaces: A methodology in the making, concious cities. Concious Cities, https://www.ccities.org/measuring-human-experiences-of-public-spaces-a-methodology-in-the-making/.

Jacobs, J. (1989). The Death and Life of Great American Cities (Ed 1 ed.). Vintage Books.

Whyte, W. H. (1980). The Social Life of Small Urban Spaces. New York NY: Project for Public Spaces.

Ar. Raja Singh, ***M.Arch (Energy Efficient and Sustainable Architecture, NIT Trichy)***
Senior Manager, Environment Design and Security, ISAC India &Research Scholar, School of Planning and Architecture
Research Interests: Ventilation, Architectural Pedagogy.
Email: rajaphd@spa.ac.in Mobile: +91 9888312502

Raja Singh is a research scholar in the area of Natural ventilation and its role in Airborne Infection Control. He is also currently the Senior Manager- Environmental Design and Security at Information Sharing and Analysis Centre, A Section 8 Company Advocating Security in the Built Environment. During masters at NIT Trichy he researched on the relation between fire spread and natural ventilation. He has been a speaker for CPWD and an invited reviewer for the journal 'Indoor and Built Environment' He is very actively involved in Urban Civic Issues and works with various stakeholders for the same.



Prof. Dr. Anil Dewan, ***Ph.D., M.BEM (SPA-Delhi), Professor (Arch), School of Planning and Architecture,***

Research Interest: Hospital Architecture, Architectural Pedagogy, Professional Practice, and Accessible Design.
Email: a.dewan@spa.ac.in Mobile: +91 9868120869

Prof. Dr Anil Dewan is a senior professor in the Department of Architecture at the School of Planning and Architecture, New Delhi. He has been very active in the area of healthcare architecture and has been part of innumerable Hospital Design Projects. He has taught not only in various architecture design studios but also to various Hospital Administrators including the ones at AIIMS, New Delhi. He has been part of many committees in the World Health Organisation. He is a distinguished fellow at the Institute of Hospital Engineering. He has recently conducted an online teacher's training program in the Emerging Areas in Hospital Planning, Design, Construction and Facilities Management.

ISSN: **2582-8304**

Compliance to Compassion: A pedagogy using emotional engagement and other techniques for teaching accessible design to architecture students.

Authors: Raja Singh and Anil Dewan

Raja Singh is the Corresponding Author. The work has been done for this paper at the Department of Architecture, School of Planning and Architecture, New Delhi.

Abstract

Universal Accessible Design in some form is included in the curriculum of all Architecture colleges. This subject is of importance not only from the point of view of compliance, but also for actually providing for the interaction of the Persons with Disabilities with the built environment. A special elective course was framed for architecture students on this subject called 'Universally Accessible Design' in an architecture college. The focus of the elective was to create a shift in the minds of the students by emotionally charged pedagogical exercises.

The basis of these exercises was the premise that students will make a conscious effort to include Universal Accessibility interventions into the design if they meet and are sensitised towards the experiences of the Persons with disabilities. Along with this, students were made to undergo simulation exercises by themselves using wheelchairs and walking sticks. This was accompanied by case studies and lectures by a disability practitioner. At the end, students were asked to provide a feedback in the form of an anonymous and optional survey. All

students agreed to the importance of such special electives for learning Universally Accessible Design. 87.5% stated that the elective has sensitised them towardsthe people with Disabilities.

Keywords:

Architectural Pedagogy, Universal Accessibility, Teaching-Learning Method, Hands-on Exercises, Design for Persons with Disability.

Introduction:

This paper aims to present, describe and validate a pedagogy which has been developed for teaching accessible design to students of architecture. In the curriculum, and the design studios, inclusion of accessibility features is a common practice. This current practice is based on the instruction methods where there is discussion centered on two major issues: Firstly, the measurements of spaces and other inclusions in the sphere of accessibility and Secondly, an approach at intervention at the level of material and technology enhancement. This paradigm has not only detached the emotional value of the subject, but has also reduced it to just other criteria which have to be met in the design of buildings.

A balanced approach between the above mentioned materialistic (or realistic, as some may argue) and the emotional development was attempted in this elective course. It was based on a premise that once charged with an emotional provocation, sensitization will be the natural step to follow. Once sensitised, students will experience a shift in the perspective towards universally accessible design.

The idea of Compliance to Compassion stems from the idea that there will be a change in perspective of the students. Earlier, where Universal Accessibility, might just occur to be a Compliance requirement for the students will now become a Compassion driven. This self-driven learning will be inculcated by the architecture and they will implement it in their designs.

A methodology around this premise was developed and the students were made to go through a semester of this elective. Many studies done by various practitioners were analysed and their important learnings were incorporated in developing this methodology. (Ergenoglu, 2013)("Creating Accessible Learning Environments | Center for Teaching | Vanderbilt University,") At the end, students were made to provide a survey based experiential feedback which has been shared in this paper.

Methodology:

This paper illustrates the important methodology of teaching Accessible Design to architecture students. The paper looks at the following main points:

1. ***Sensitisation by meeting Persons with Disabilities.***
2. ***Simulation Exercise for a Hands on experience.***
   - ***i) The Walking Stick Exercise***
   - ***ii) The Wheelchair Exercise***
3. ***Visit to Tactile Gallery.***
4. ***Lecture by Disability Law Advocate.***
5. ***Case study of a model Accessible Building.***
6. ***Studio: Integrating Interventions into Design.***

Figure 14: The scheme of the methodology used in the Elective for Architecture Students.

Sensitisation by meeting Persons with Disabilities.

To teach about visual impairment, with a set of specifications about braille signage, technology enhancements and barrier free movement, an attempt was made to subject the students to the experience of a person with visual impairment. A person with visual impairment was made to lead the class on one particular day where he shared his experience of navigating the built environment. This enabled the creation of frame of reference where students were provided with a memory of a person who has shared his experience of navigating and interacting with the built environment. This also brought in a great deal of normalising

of this situation, which otherwise lead to a certain stigma, ignorance or a simple lack of exposure. These students, who may have briefly seen a person with visual impairment, had spent a greater amount of time with the sole intention of only addressing them. In a question asked by a student in this class regarding the creation of interactive spaces to include the visually impaired, it was noticed that the answer provided was architecturally non satisfying as there was no interaction possible for the person in the realm of visual or spatial appeal. The only area left to create a pleasurable experience for the blind in such an interactive space was the use of sound as a tool for navigation, ambience enhancement and entertainment. The concept of shoreline, which is a training methodology of people with visual impairment, was made clear to the students very quickly by a short demo by the person explaining his experience.

In another case, a person on a wheelchair shared anecdotes from his life about how he had to request the building agency to refurbish his living apartment which he was allotted as part of his military service. He had to make arrangements for his wheelchair to enter through doors. The shelves of the kitchen to be lower, and the toilet to have sufficient grab bars for easy access. In another anecdote, in his subtle way he explained his desire to attend a conference which was not very keen on having a person on a wheelchair. He explained in a jovial way the manner in which he managed to navigate his way through the conference and feel at par with the world in the matters of entertainment and a social life. Without drawing a single line, he sensitised the students about design for the disabled with a conversation which most students will not forget in their life.

Simulation Exercises for Hands on Experience.

In the Simulation exercises, the intention was to actually create an experiential analysis for the students. They were for a short time exposed to the experience of a person with a disability. The simulation exercises were done in following two ways:

The Walking Stick Exercise:

In this a student volunteered to be blindfolded. A cloth was tied around the eyes. The student was then made to rotate at one place and then taken to an unknown place in the college campus. This was done to prevent any memory of the original space from providing a visual memory clue to the student. At this new location, the student was handed over a walking stick which is used by persons with visual impairment. The student was then asked to navigate the way out of the space into a known place of the campus (a landmark like the college main entrance or the canteen). Some students were around the volunteer to prevent the student from any peril. They were however, not allowed to assist the student to navigate by providing any verbal clues.

This was repeated for other students. On interviewing the students who had opted to volunteer, it was found that they had somewhat a hard time and could get a small fragment of the experience of a person with visual impairment who has to navigate his way every moment of time in his/her life.

The Wheelchair exercise:

A wheelchair is a very essential aid for the person who is unable to use his feet or legs for locomotion due to old age, temporary medical condition or permanent disability. It has a chair which has two wheels attached to it. The person using a wheelchair can use

the rim to move the wheels. This wheelchair requires a certain turning radius and movement width in the built environment.

Being wheel driven, it becomes a challenge on the staircase. Hence, there is a requirement of proper widths at entrances, pathways and docking spaces. There is also a need for ramps where a wheelchair user can use the wheelchair to climb. Lifts are also a very adequate way to climbing floors in a building. The lifts should have adequate interventions including appropriate movement space in the lift car for the wheelchair user.

Figure 15: Students performing the Wheelchair Simulation Exercise.

Students took turns to use a wheelchair on a variety of spaces including lifts, public footpaths, bus stops, building corridors and classrooms. A special exercise was done to make students push themselves up a ramp independently. The student who had used

the ramp on a wheelchair, along with his classmates was then made to calculate the ramp gradient ratio of the ramp just used. It was found that ramps with a prescribed ratio of 1:12 were also a challenge to climb by the students even after they could take the support of the handrails. On interviewing, the students spoke about their realisation of the appropriate provision of slope in a ramp.

Visit to Tactile Gallery

The National Museum at New Delhi is at the forefront of innovation in museum related improvements. It had recently introduced a new gallery called the 'Anubhav' Gallery. ("National Museum, New Delhi,")The purpose of this was to create exhibits for the persons with visual impairment. Contrary to the exhibits and specimens in the museum which visitors can't touch, the Anubhav gallery was different. It was a model where persons with visual impairment could actually touch the specimens and feel the size, scale, texture, the form and the features of the specimen. The specimens had a signage carrying information in Braille, apart from being placed on stands which were just about the average standing human height. The people were encouraged to touch and feel the specimens which ranged from warrior sword handles, Harrappan seal copies, sculptures and tactile paintings. Tactile paintings displayed were developed by Indian Institute of Technology, Delhi. These paintings were made for the visually impaired. The various impressions on the painting were in the form of embossed dots on a canvas like hard medium. These dots varied according to the colour and design and their combination, when felt together was able to communicate the figure that was drawn on the "painting"

Figure 16: A tactile painting displayed as an exhibit in the Anubhav Gallery of the National Museum.

Even the pathway leading to the gallery has a rough texture so that it could act like a navigational aid to the visually impaired. The overall arrangement of the gallery was such that the visually impaired could enjoy the experience of the art that was "displayed" This action of the provision of such a gallery specially for the visually impaired highlights the commitment of the museum to the United Nations Convention on the Rights of Persons with Disabilities(United Nations, 2006) which states that the persons with disabilities have a right to participate in the community activity and be able to enjoy art just like any other

person. This is also a great effort to promote the fundamental Right to Equality in the country.

Lecture by a Disability Law Advocate

In order to make the students aware of the bye laws, rules and the code requirements, a prominent judicial activist, advocate and disability rights practitioner("Centre for Accessibility in Built Environment (CABE) Foundation, India: About Us,") was invited to address the students on the way various rights of the persons with disabilities were fought for in the court of law. He shared the United Nations Convention on the Rights of Persons with disabilities, Human rights, their Indian Ratifications, the Disability Act and various other case judgements. It was an important session where again, by highlighting the difficulties faced by persons with disabilities were highlighted in the courts in India which led to the governmental actions in this area. Students were taught about the importance of the law and how it could affect their chances of intervention in the built environment, giving them the vocabulary needed to put forward their case to their jurors and future clients.

Case study of a model Accessible Building

In New Delhi, there are a few buildings which serve as a model design for Universal Accessibility. But as a case study example, the most common and useful example could be the latest large scale addition to Delhi's Infrastructure, i.e. the Delhi Metro Network.("DMRC: Facilities for differently abled passengers," n.d.) All the stations in the Delhi Metro network are Universally Accessible. The students after their emotional charged, motivating sessions had to be also shown good examples of Universally Accessible Design in the Built Environment. For this they were taken to the Delhi Metro Station at ITO, New Delhi where they

went with a wheelchair and observed the interventions. They took visual clues, did photographic documentation and did some measurements of key spaces and features.

Studio: Integrating Interventions into Design

When the above steps were completed, the students were asked to bring an old plan from their previous semester's work and enhance it by including built environment interventions for the persons with disabilities. The students first overlaid tracing sheets over their old designs and made changes by adding Universal Accessibility Interventions. This was an intensive exercise where the students could actually see the difference in the design before and after the interventions. There was special care taken to make sure they could make minimal structural changes to the design in order to integrate the changes. In some cases, changes required radical structural changes which were added appropriately.

Discussion and Conclusion

Submissions

The semester concluded with the students submitting various innovative submissions during the semester. One such submission was to watch a video on architecture for the Persons with disabilities and present the innovations in this field in the form of a small one page description. In another such classwork assignment, the students were made to sketch a wheelchair along with the measurements to scale. This wheelchair was brought and placed on the teacher's table in the class and the students sketched it and measured it like an art class specimen. This drilled in the size of the basic element of Accessible design for each of the class students. There were other such innovative submissions that were made by the students.

The Survey

In an additional class, the students who were present were made to take a small survey where they were asked to provide a feedback to the semester based class. The responses of the 16 students who took the elective are recorded in the Table 1 provided below.

Question	Response
Do you think this elective has sensitised you towards the people with Disabilities?	87.5% students were positive. Out of those positive, 78.57% has an absolute affirmation
Do you think this approach of having Persons with Disabilities come to the class and share their experiences helps you visual their problems in the built environment better?	81.25% students were positive. Out of those positive, 84.61% has an absolute affirmation
Do you think the simulation exercise where you were made to sit in a wheelchair and move about increased your awareness about the problems faced by the persons on wheelchairs?	81.25% students were positive. Out of those positive, 92.00% has an absolute affirmation
Do you think the practical visit to the metro station (a model accessible building) has been an important exercise in making you actually visualize and experience a space which is friendly for the persons with disability?	87.5% students were positive. Out of those positive, 85.71% has an absolute affirmation
Has your participation in this elective: 'Universally Accessible Design' enabled you to look at Accessible Design from a view which is	87.5% students were positive. Out of those positive,

based on Compassion rather than just compliance of the rules?	**85.71% has an absolute affirmation**
How important do you think are special electives like these (on Universal Accessibility) in making you skilled and aware of the aspects of Universally Accessible Design	**100% students were positive.** **Out of those positive, 81.25% Strongly Agreed.**
Do you think all the students of Architecture Schools should be made to undergo a semester-long class on Universally Accessible Design as you have undergone?	**100% students were positive.** **Out of those positive, 81.25% has an absolute affirmation**

Table 4: The Survey Questions with the responses of the students.

Results

The students provided an affirmative and positive response to all the questions asked. In the question about the importance of the electives in Architecture schools on Universal Accessibility, there was a unanimous affirmation by the students who responded to the survey. The aim of sensitizing the students was also achieved as the students gave a 87.5 percent positive response to the question which had asked about whether they were sensitised about Universal Accessibility or not.

Conclusion

To conclude, it would be right to state the Universal Accessible Design is a much needed skill which architecture students are already exposed to. This study has also highlighted the importance of introducing an elective for the same in Architecture colleges for the students in their formative years of Architecture education. It is also evident that the students had a positive

emotional sensitisation in this elective which will be a lifelong learning. They are also going to use this skill in each of their design not only as a compliance requirement but as a compassion driven duty.

Acknowledgements

Thanks to Prof. Dr. P.S.N. Rao, the Director of SPA Delhi for the motivation and for lending the wheelchairs of his office for the exercises, Adv. Subhash Chandra Vashishth for his expert class on law on Disability laws, Dr. Ranjana Mittal, HOD (Arch) for her support and active encouragement, especially for facilitating the Persons of Disabilities to provide their experience to the students of the elective. Dr. Mahavir, Dean (Academics) for facilitating and his unwavering support. Special thanks to Mr. Shyam Kishore, Trainer at Association for the blind, Delhi and Commandant Arvind Dutt Abdali, DIG, Border Security force for taking time out to share their experiences with the class. Thanks to the students who opted for the elective for their support. Special thanks to Dr. Gurkirpal Singh for his free hand in letting me experiment with developing teaching ideas.

References:

Centre for Accessibility in Built Environment (CABE) Foundation, India: About Us. (n.d.). Retrieved April 18, 2020, from https://cabeindia.blogspot.com/p/about-us_6.html

Creating Accessible Learning Environments | Center for Teaching | Vanderbilt University. (n.d.). Retrieved April 18, 2020, from https://cft.vanderbilt.edu/guides-sub-pages/creating-accessible-learning-environments/

DMRC: Facilities for differently abled passengers. (n.d.). Retrieved April 18, 2020, from http://www.delhimetrorail.com/differentlyable.aspx

Ergenoglu, A. S. (2013). Accessibility Awareness among Architecture Students: Design Thinking Evaluations in Yildiz Technical University. Procedia - Social and Behavioral Sciences, 89, 312–317. https://doi.org/10.1016/j.sbspro.2013.08.852

National Museum, New Delhi. (n.d.). Retrieved April 18, 2020, from http://nationalmuseumindia.gov.in/departments-tactile-gallery.asp?lk=dp12

United Nations. (2006). The UN Convention on the Rights of Persons with Disabilities. Retrieved from https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html

ISSN: **2582-8304**

Letter from the Chairman's Desk By Sunil Bhatia PhD

One day I was cooking and realized that every step after one another was following subconsciously that my mother was doing. I was happy that I followed the instinct of primitive people who were governed by their natural instinct of observation. What we call ourselves modern people are nothing but the real foundation was laid by our ancestors who were highly vigilant and unlike other animals highly observant. When I scanned my kitchen I found that raw food items have their own history, utensils for cooking process carry long history and better serving vessels have another level of history.

When someone offered an item for eating I never experienced and completely unknown to me, I shiver with fear and my mind probes by questioning before eating " Should I take ? Is it not poisonous?" Sometimes I eat trusting the person who has offered. I admire the strength of primitive people who dared to test things suitable for mankind. We have a choice of foods from the long list of edible items prepared by primitive people. I can imagine cereals that are grass varieties but finding salt and spices and its suitable role in cooking is a real mental exercise.

Mother was cooking food before washing every items for removal of foreign elements around it ,that may spoil cooked food or may prove harmeful after consumption, cutting for removal of

unwanted part or hard area for even cooking, followed by traditional techniques of boiling or frying or baking after adding the salt and spices for salty preparation or sweet preparation with sugar or jaggery or lots of almonds or cashew nuts or raisins. Her hands were trained with her long experience to such a level that actions appear subconsciously and do every step effortlessly. She cooked with the perfection that makes our mouth tasteful. In other words our taste buds are customized to what she offered us since birth and rest buds are lying passive. I am vegetarian and when I found a small child eating animal food and relishing it, disturbed and next moment I realized the active taste buds are responsible and the offering of staple foods is specific culture based.

I was wondering who thought of cooked foods and the process of cooking. It is the assembly of small steps arranged and devised with perfections for meeting human needs for living. There is no other option of cutting. Cutting vegetables increases the surface area that helps in even cooking in less time. Wherever softness was required either remove the unwanted or hard area by cutting or dressing or soak for some time or boil or steam. Boiling or steaming has come into human life much later and was learned after acquiring fire management. Roasting is natural and simply putting the items close to fire does it. Boiling or steaming is a well-thought process. I can understand cutting has come naturally in our life because of the size of the mouth that decides the size of bites. What could harm our body or hard for eating by crushing with teeth and may prove fatal, we remove it before eating. Another thing is that our mouth also decides the size of the quantity we can consume. If someone shows some kind of cleverness or greediness or ignorance, they may face the problem

of being unable to chew and body resists accepting large size and sometimes proves fatal by blocking food pipe or breathing pipe. When I looked at my kitchen I realized how many tools and devices are designed by humans for cooking that makes perfect art. Cooking is a completely man-designed process where simply arranged various events of nature and intervention of human efforts are suitable for meeting purpose. 'Is it taste buds that guide us or our human anatomy forces us to devise different methods for consumption that are naturally available to us? No other animals on the planet do cooking except humans.' Another force maybe people were trying in an attempt to meet the body requirement. Hunting was a high failure exercise and fulfilling human body demand for living was only meeting with what prey was eating. I do not know about animals but I experienced a deficiency or over-eating of something that disturbs my body and signals some problem. It reduces my efficiency and fails even for performing my daily routine for living. Primitive people's habits are still reflected in tribes that are away from modern civilizations. They may appear stout but victims of deficiencies and mental faculties are not open to what we enjoy. These people's methods may be different but cooking is done before consumption and it is the universal practice. I observed that in every part of the world in every civilization people make bread in round shape and it is a universal design of making flatbread or dough.

There are various established theories of cultivation and no perfect answer that can satisfy the reason for shifting from hunting to cultivation. The majorities of people are focusing on the uncertainty of food, the reason for shifting focus on cultivation and believe women force was the reason for establishing agriculture. They assume women are nature and know nature as

well knows of caring of nature without disturbing. Some say that some people in the group were weak by any means and could not participate in mass hunting for food, there was no concept of sharing of food or no means of transporting dead animals for the weak was responsible or the design of agriculture . They were left with the option of either die of hunger or devised foods available close vicinity and satisfy hunger with minimum physical effort. The design of cultivation has taken mankind to the next level from hunting to focusing on agriculture. Once the food problem was almost solved and minimized the death of starvation, then human effort shifted for growth of thought. The animal never came out of the struggle of hunger and lives with all vigilance on what to eat and what not and there is still the possibility that it may die with hunger. There is no question of thinking above moment to moment survival or growth of thought for better security.

The design of cultivation might have begun with limited identification of natural food available in local regions. Nature produces as the season comes and mostly attracts the living beings by color or shape, that helps in the spread of seed for better survival of their own and not to die growing clusters close to existing grown trees/plants . Pollination is existing in nature and bees are responsible for it. Birds and other animals were attracted to harmless seeds of a particular type of grass wheat that needs less water, changes golden color after maturity and another grass of rice variety in shallow areas was available for consumption in abundance in nature . There was no human effort in cultivation and it was nature's effort of producing in its own way. Nature of encroachment on other shares is basic nature for living and man did the same with other living beings. The growth of many folds was witnessed in yield by human intervention and well thought efforts. The real interesting part is man was

governed by his own greed. That greed made him safe by storing as much grain for the elimination of uncertainty of availability of foods. As the season comes it grows wherever leftover of previous grains was available and humans were satisfying their hunger seasonally. Nature lost its strength after a few natural growths of grass and leftover seeds were the majority of times taken as food by birds. Lowering of yield was worrisome, wished to counter with his greed and succeeded with design that later proved as agriculture. Natural green grown grass with its own efforts was the food of wild animals and it was destroyed before it reached maturity. To protect from birds they started hiding seeds with soil and later took the concept of ploughing. Need for water for the growth of grass helped in designing irrigation. To protect the standing crops from wild animals designed fencing or tricks of fooling by designing the various scarer by using sound or by making human heads with the painting on pitcher hanging on fixing the sticks as the man stands by spreading hands. That design helped in scaring the birds to come close to fields for seeds. Nature's role is limited to guiding our ancestors and observing that earth was failing and diminishing power of producing what previously produced. It is the human effort that not only helped in restoring the strength of producing the same but produces better. Design of tools and agriculture support as manure, chemical fertilizers came with due course of time and it was a natural effort because the man was governed with greed and wished to live longer. The strength of a man in social life was measured by area of land and how many animals he had. This focus shifted with the design of currency and a new commercial world generated laid on greed with extreme intensity. It is the greatest tool designed by man for encroaching others territory. I have used the word greed but in a real sense, it is the encroachment on others' spheres for making safety circles wide

for living longer without fear of being killed by other animals as food. All living beings work in dual ways. One is to make it safe for longevity and the other is to meet the requirements of the present. He never lives in the past. The future is uncertain and the present is scary and needs priority attention for living. These two factors are responsible for the growth of humans where animals are aware of safety but limited to survival instinct and no effort for supporting this instinct and other is meeting the present requirement for living and still based on others shares. He wished to encroach others but fear of not knowing to meet the challenges of powerful animals makes him scared but uses all-natural means of grinning, hooting, and other natural ways. If they succeed in snatching food from others, otherwise live that moment with hunger. Other side man worked to make himself more powerful what nature has given by designing the various tools. The greatest weapon that has come to hand made him all-powerful that is the art of fire management. Earlier we used killing by inflicting pain or twisting the weakest body part or instant death can be achieved without giving opportunity to prey attack humans by using natural available tools.

The natural safety net available to man was to climb on the tree and stay safe out of reach of animals or live in the cave. The real effort started when humans used mammoth animal's bones to imitate the design of a cave by arranging many bones in such a way it should have hollow spaces as caves for living for safety. Use of mud houses came much later and baked brick after fire management. It is natural that wherever humans settled after a few days even grass died out and lost its presence. I have witnessed the design of pathways in forests that come to existence either humans travelled frequently or forest fire. Forest fire is initiated either by the friction of trees because of wind that

helps in creating a spark and dry grass in the ground catches fire or a bird holds the firing straw from the distance in her beck and drops it in dry grass or strike of lightning. This phenomenon is required for maintaining balance in forests but human points it is a great loss. This observation by primitive people helped in learning the art of fire management and women selected the dry tinder for the fire and carried the fire with dry grass from a distance.

I am still surprised how the idea of making bread has come into the minds of people and how this assembly of different actions is learnt by humans for making chapati/ flatbread. Who was forced to either cook indirect heat or use some barrier of the plate for cooking in indirect heat? Who was impounded for grinding, kneading, rolling pin or use of hands for the round shape of dough /flatbread, putting in the right controlled temperature for proper cooking and finally applying butter or clarified butter to maintain moisture of cooked food for a long time for the original taste, otherwise it becomes so hard for chewing .Those who designed were real designers and I feel like to stand and salute them for their great contributions. It is my theory that crushing of grain by teeth allows for thinking turned into powder by some means and the idea of impounding using a long heavy log that can be manually lifted after placing grain in a pot surfaced. Mouth has saliva that helps in turning crushed dough for proper slipping into food pipe made dough by adding controlled water. Real surprise came from the design of the bed and rolling pin for flattens bread. I can understand the heating of dough shape by rolling with hand for cooking but flatten bread is still a mystery and needs further investigation. It is a complete man made design which did not use the observation of nature. It is a well thought out experimental design and may be first that is not natural but

pops up in mind of design for better living. Another actions of change of side of flatten bread for proper cooking from all side or use of ladle for disturbing the shallow frying/boiling or covering with some plate for faster evenly pressure cooking is completely man made design and helps in indicating that somewhere in mind some perfection of moving next better level was surfacing in these actions. Pressure cooking later led to modern time for design of steam Engine by James Watt.

No modern designers so far have invented new techniques of cooking apart from roasting, boiling and frying and we are still using the same in present times. We experimented by combining two or more techniques of cooking and the result of different duration of use of frying and boiling gave us the concept of gravy. I think by this experiment our minds were grown for designing experimentally not accidently but well thought design. I don't know at first they designed various types of vessels for cooking or thought of the design process and to do practically need such equipment. One thing is confirmed, whatever they designed they did all sorts of practical and upgraded to such a level where no scope of improvement was left. The basic design of rolling pin, mortar pestle, vessels and cutlery and many more remains the same design after so many centuries and witnessed being made with better material. The origin of serving vessels might have come from problems faced in eating. Prey lying on the ground has dust in the touching portion and is not fit for consumption. If it is on grass every portion can be eaten. They found some barrier is required and it may be grass or leaves spread on ground for placing prey for optimum use as food. Later this concept of plates and cutlery was designed for lowering the use of the human part in proper eating management.

The degree of refinements in cooking was a sign of progress in civilizations and grains acquired the status of staple food for the majority of humans in different parts of the world. Shifting from animal food to agriculture food was a major change and it is best suited for the human digestion system. Lowering of uncertainty of availability of hunting animal food to a certain level of assured foods from cultivations is remarkable progress in stabilizing human and their thoughts. This process of design of cultivation has lowered the capability of physical strength but more developed the mental strength. Baked in direct heat or use of indirect heat with no oil or with oil creates variation in the preparation of dough or flatbread. The oil extraction technique is amazing and how someone thought of oil from tiny mustard seeds and that to use for cooking. I can understand the use of butter or clarified butter because it is dairy product.

This special issue of November 2021 Vol-16 No-11 is the continuation of September 2021 Vol-16 No-9 special issyue of Guest Editor Prof Mandeep Singh of School of planning and Archtect, New Dehi, India. I have observed a great quality in Prof Mandeep that he is good human, very humble and academic inclination is high.

Lambert Academic publication for celebration of 150th special issue by publishing a book by compiling editorials "Design For All, Drivers of Design" translated in eight different languages from ENGLISH into French, German, Italian, Russian, Dutch and Portuguese. Kindly click the following link for book. "Morebooks", one of the largest online bookstores. Here's the link to it:

https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1

With Regards

Enjoy reading, be happy, and work for the betterment of society.

Dr. Sunil Bhatia

Design For All Institute of India

www.designforall.in

dr_subha@yahoo.com

Tel 91-11-27853470®

ISSN: **2582-8304**

Forthcoming Issues

Africa Origin Designer year 2021
December 2021 Vol-16 No-12

Ricardo Gomes, IDSA

Professor Ricardo Gomes has been a faculty member in the School of Design at San Francisco State University for over 29 years. He was the Chair of the DAI Department from 2002-2012.

Prof. Gomes coordinates the Design Center for Global Needs and the Shapira Design Archive Project in the School of Design (DES).

This non-profit international research and development center is dedicated to promoting responsive design thinking methods and solutions to local, regional and global issues such as: inclusive/universal design, health care, the aging, community development, social innovation and sustainability of the built environment.

Prof. Gomes was awarded the 2020 Faculty Award for Excellence in

Service Learning, from the Institute for Civic and Community Engagement, SFSU; and the IDSA 2020 Education Award presented in recognition of significant, distinguished, and long-term contributions of faculty to the field of industrial design academia

Prof. Gomes is on the Board of Directors of the Institute for Human Centered Design in Boston. He is also a member of the Industrial Designers Society of America; and Trustee of the Beta Beta Chapter, Epsilon Pi Tau International Honor Society for Technology in the School of Design, SFSU. Prof. Gomes was a Fulbright Research Scholar from 1984-1986 at the University of Nairobi, Kenya. He conducted post-graduate research and product development of a container system for mobile health care delivery in East Africa from 1982 – 1987. In 1986, he was Program Coordinator of Design Projects in Developing Countries, Les Ateliers, Ecole nationale supérieure de création industrielle (ENSCI) in Paris, France where he directed student liaison projects with European international development agencies.

For over 30 years, Prof. Gomes has conducted keynote speeches, presentations, symposiums and workshops at universities and international conferences throughout Africa, Asia, Europe, Latin America and the U.S. In addition, he has served on juries related to Inclusive Design; Universal Design; Design for Social Responsibility; Sustainability; and Equity for BIPoC in the Built Environment.

Prof. Gomes received his MFA in Industrial Design for Low-Income Economies from the University of California, Los Angeles (Design of a Container System for Mobile Health Care Delivery in East Africa). He received an M.A. in Architectural Building Technology from School of Architecture and Urban Planning at UCLA (Analysis of Alternative Building Materials and Construction Systems for Small-scale Industries in the Cape Verde Islands, West Africa); and a BFA in Industrial Design from Massachusetts College of Art (Design of

an Adaptive Structural Environment for Severely Disabled and Developmentally Challenged Children).

January2022 Vol-17 No-1

Jesús Hernández Galán, PhD

Director de Accesibilidad e Innovación

Doctor in Engineering with cum laude honors, with more than 30 years' experience working in the field of accessibility. From 1990 to 2000, I was as an accessibility consultant specializing in protected natural areas. On 2000, I was appointed General Director and CEO of accessibility consultant company, Via Libre, until 2003 when I became Director of Universal Accessibility and Innovation Directorate at Fundacion ONCE to present. I am currently vice president of the European Network of Accessible Tourism (ENAT), president of the technical standardization committee 170 for Universal Accessibility and Design for All, and a trustee of three foundations working in accessibility. I have also been a jury member of the following awards: Access City Awardsfrom its first edition to present, Queen Letizia Awards, Fundación Universia Innovation Awards and OTIS Accessibility Awards. Additionally, I have been Project Leader of several standardization working groups about accessibility such as European Commission Mandate 420, Accessibility Requirements for Public Procurement and ISO 21902 Accessible Tourism. Moreover, I have been dissertation director and a member of the

examination committee for more than ten doctoral dissertations, co-author of over 80 research papers and publications, and have travelled to more than 30 countries to participate at conferences a guest speaker. I have also received additional training at some of the most prestigious universities such as Polytechnic University of Madrid, Stanford University, London School of Economics and IESE

Colleen Kelly Starkloff, Founder

Starkloff Disability Institute

Colleen Kelly Starkloff is co-founder, with her husband Max, of the Starkloff Disability Institute. During the 1970's, she co-founded Paraquad, Inc. in St. Louis in conjunction with Max.

Ms. Starkloff has worked in the field of disability rights since 1973. She has extensive experience educating and training the disabled and non-disabled communities on issues related to employment of people with disabilities, independent living; developing new program initiatives; and coordinating activities that promoted the successful implementation of the Americans with Disabilities Act (ADA). She served two terms as the United States Organizer of the Japan/USA Conference of Persons with Disabilities. In 1999, she joined a citizens' advocacy group responsible for the establishment of the Affordable Housing Commission in the City of St. Louis, which oversees a $5M Affordable Housing Trust Fund. She ensured that housing created

by the Trust Fund must include Universal Design features. She served as Founding Chair of the Commission. She is the creator and Organizer of 6 national Universal Design Summits which train architects, designers and builders on uses and benefits of Universal Design in home and community design.

In 2005 she introduced Disability Studies into the curriculum at Maryville University and also taught a course on Universal Design in 2010. From 2005-2010 she collaborated with the Missouri History Museum to create a 1,000 square foot exhibit focused on Disability History. Titled "The Americans with Disabilities Act: Twenty Years Later", this exhibit remained open and free to the public for 19 months. An estimated 163,000 visitors saw this exhibit. In 2011 she established the Max Starkloff Speaker Series, to educate the public on the need to create a world that welcomes all people with disabilities. In 2011 she was presented a Doctor of Humane Letters by Fontbonne University. In 2013 she began consulting and training on issues related to employment of people with disabilities in mainstream, competitive jobs. In 2014 she was responsible for organizing advocacy efforts in Missouri to encourage Senate ratification of the Convention on the Rights of Persons with Disabilities.

In 2016 she began a new venture, "Colleen Starkloff Talks Disability", as a public speaker on disability issues. A university Commencement Speaker, and general speaker, Ms. Starkloff is sought after to speak nationwide on a variety of subjects related to employment of people with disabilities, disability history, the Disability Rights Movement, Independent Living and the emancipation of all people with disability. A 1993 graduate of Coro's Women in Leadership Program, she has won numerous awards for her work in the Field of Disability. She is also a St. Louis "Woman of Achievement" for 2017. (Watch the award ceremony here.) She was awarded an Inspire Award by the

BiState Development Agency in 2018. In 2019, she received the Saint Louis University Alumni Merit Award for the Doisy College of Health Sciences.

Her life story is captured in Max Starkloff and the Fight for Disability Rights, a biography about her late husband. The book is available in print, at the Missouri History Museum and as an ebook through Amazon.com; An audible book can be downloaded at Audible.com.

March 2021 Vol-17 No-3

Dr. Christopher Lee

I have a Ph.D. in Education with a specialization in Instructional Design, a Masters of Fine Arts in Writing and Poetics (MFA) and a Masters in Education (M.Ed). My research interests center on Universal Design for Learning. I love to write and teach. Whenever teaching I learn a little more about what Universal Design for Learning means and how much students enthusiastically embrace its principles. My philosophy of education centers around the learner. As an instructor, I am much like a coach and so, strive to listen to what students are saying and then facilitate their learning as much as possible. As an administrator, I listen to students, staff and everyone I work with to learn more about Universal Design and how I can be a part of helping to make life better for all. I love technology and the doors it opens for everyone. I love hiking, reading, writing, weight lifting, and most of all, being with my family.

New Books

it is available on **www.morebooks.de** one of the largest online bookstores. Here's the link to it:
https://www.morebooks.de/store/gb/book/design-for-all/isbn/978-613-9-83306-1

The Ultimate Resource for Aging in Place With Dignity and Grace!

Are you looking for housing options that are safer and more accommodating for independently aging in place? Do you want to enjoy comfort, accessibility, safety and peace of mind – despite your disabilities, limitations and health challenges? The help you need is available in the Universal Design Toolkit: Time-saving ideas, resources, solutions, and guidance for making homes accessible.

This is the ultimate resource for individuals and professionals who want to save time, money and energy when designing, building, remodeling or downsizing a home. The Universal Design Toolkit will help you take the steps to design homes for your clients or yourself while eliminating the costly trial and error challenges you'd inevitably encounter if faced with this learning curve on your own.

Rosemarie Rossetti, Ph.D., teamed with her husband Mark Leder in creating this unique Toolkit. They bring ten years of research, design and building expertise by serving as the general contractors for their home, the Universal Design Living Laboratory– which is the highest rated universal design home in North America.

Within the Toolkit's 200 richly illustrated pages, you'll find: Insights that distinguish *essential* products, services and resources from the *unnecessary*.

Proven, realistic tips for finding the right home.

Home features you need to look for. Nothing is assumed or left out.

Handy home checklists and assessments.

Interview questions to help you hire industry professionals with knowledge and experience.

Photographs that provide a frame of reference to inspire, clarify and illuminate features andbenefits.

Valuable resources to save you time, money and energy.

Helpful sources of funding.

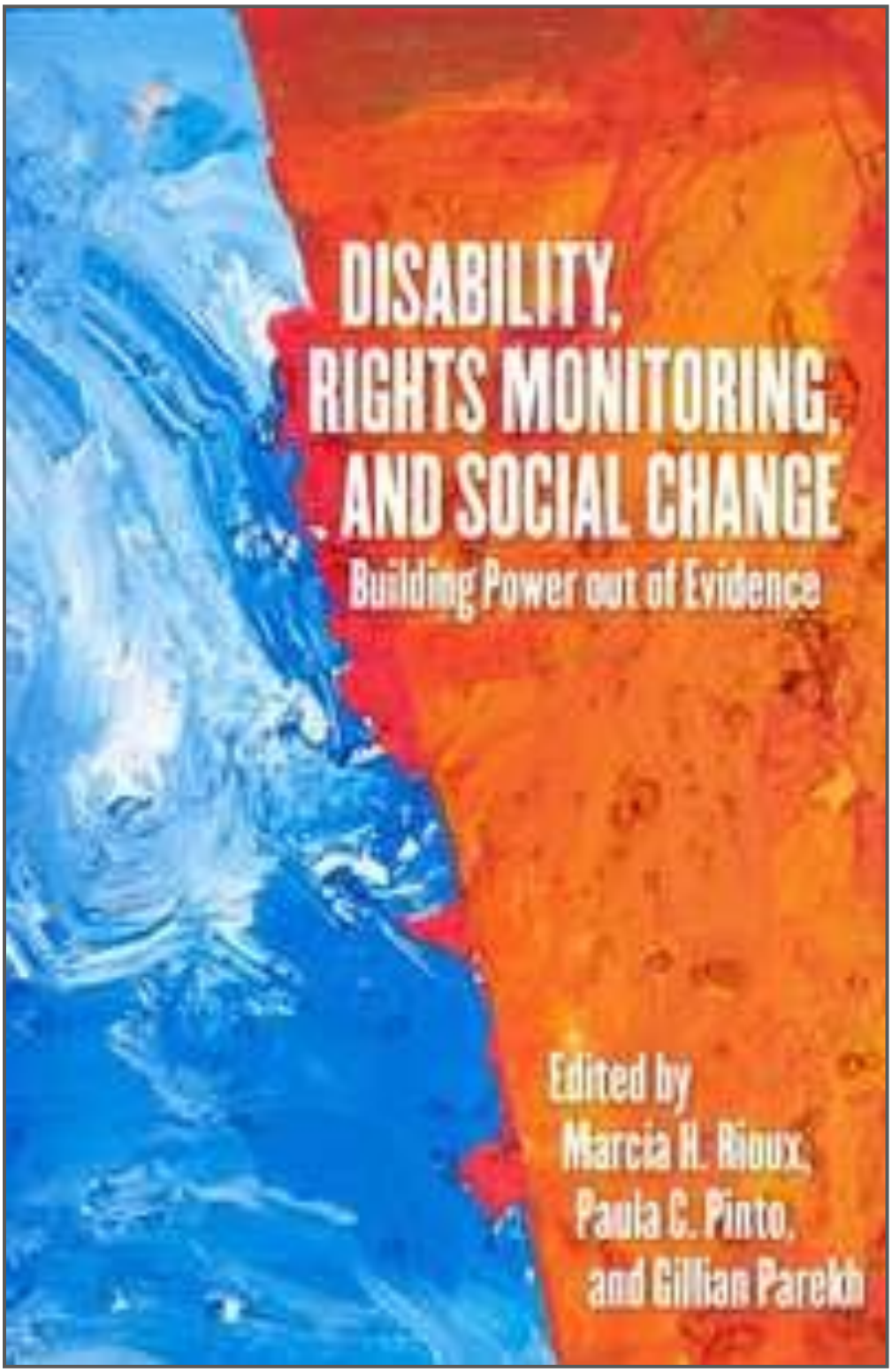
Space planning dimensions for access using assistive devices such as wheelchairs andwalkers.

And so much more!

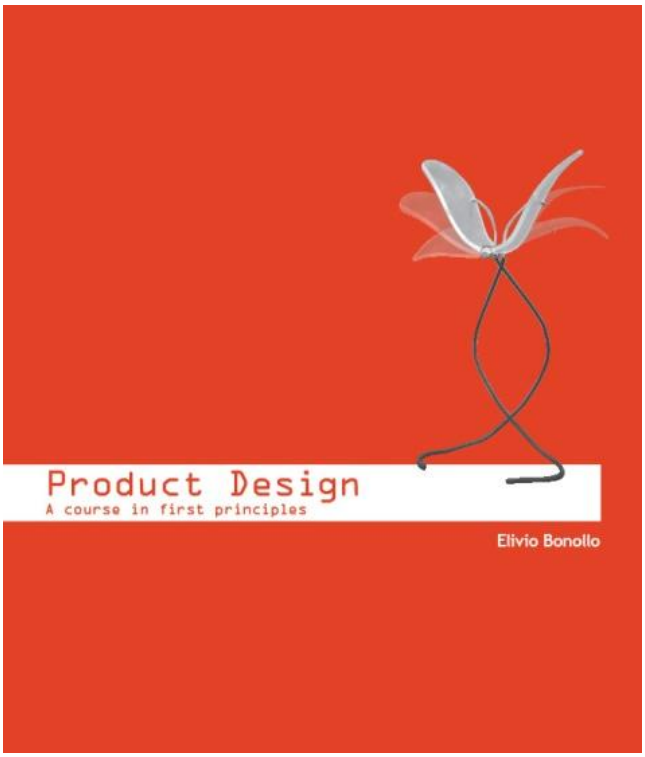
If you want useful, dependable advice and easy to implement ideas from respected experts who know the ropes, you'll love Rossetti and Leder's perspective. As a speaker, author and consultant who uses a wheelchair, Rossetti has helped hundreds of people design their ideal homes. Now her comprehensive Toolkit is available to help and support you!

Get the Universal Design Toolkit now to start your project!

Disability, Rights Monitoring and Social Change:

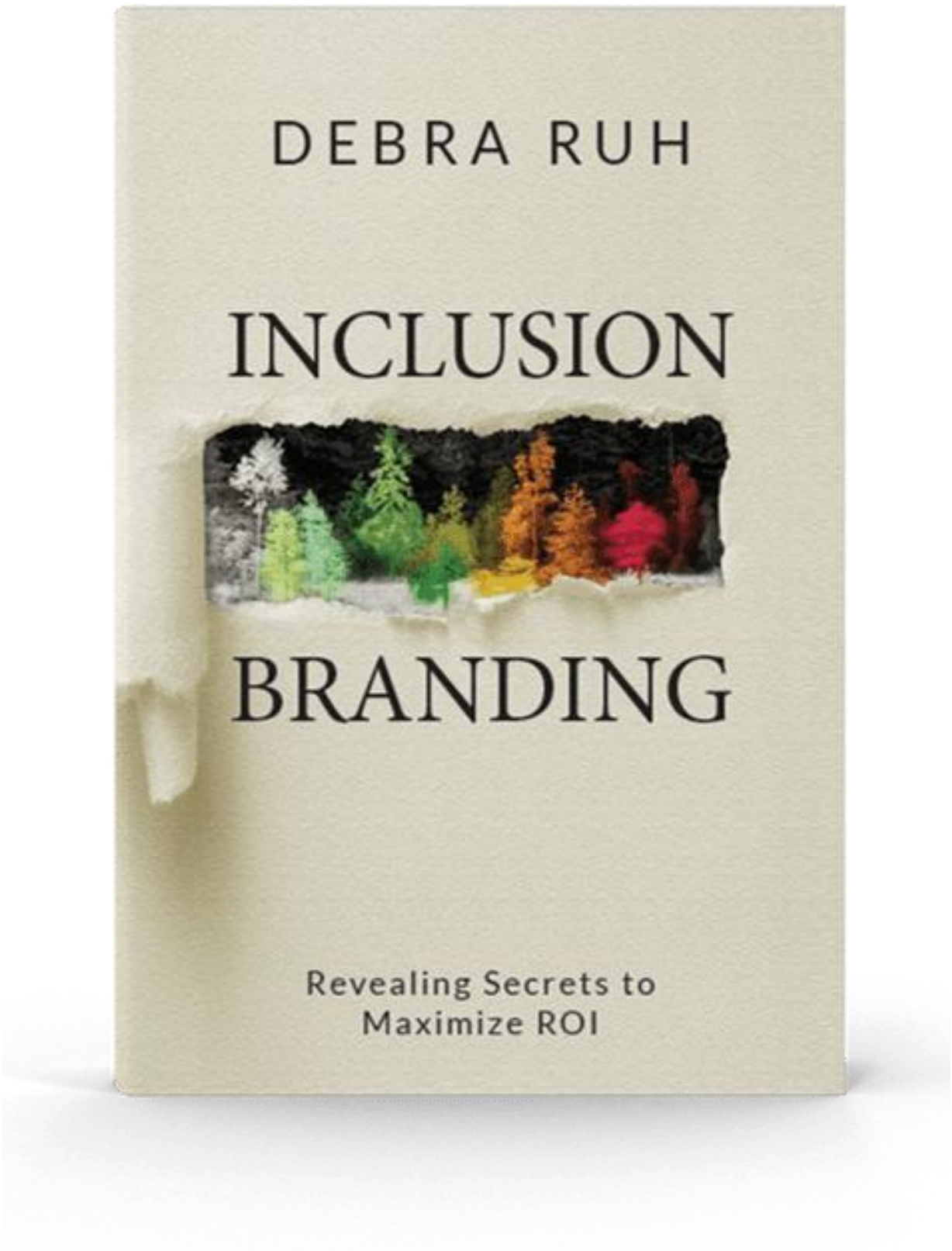


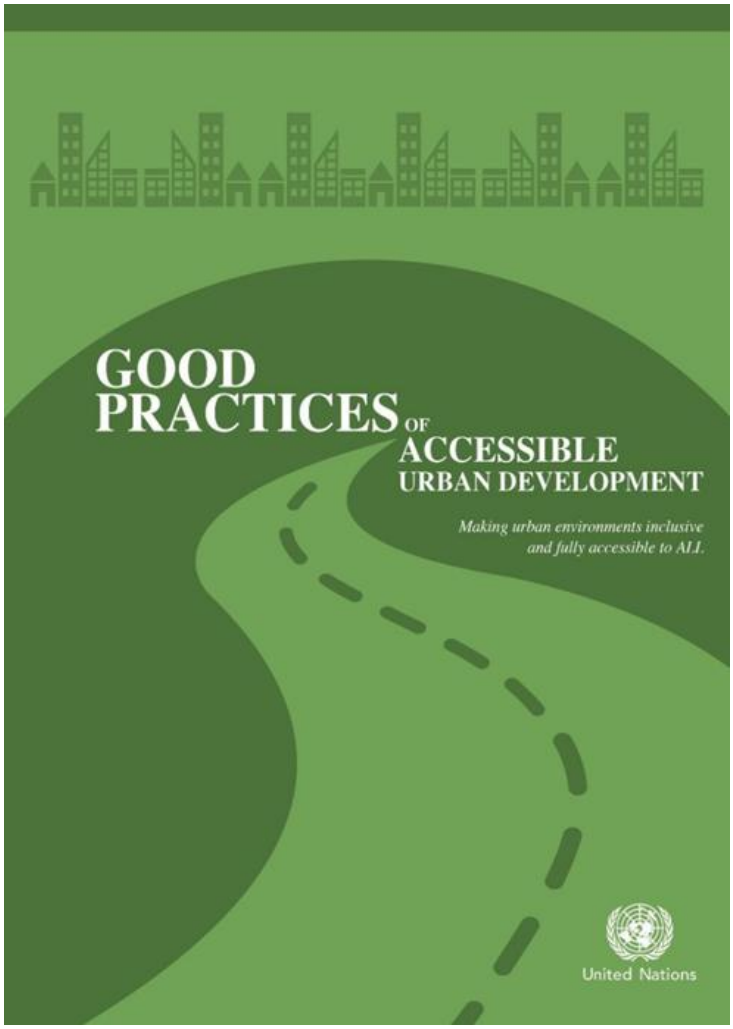
New Update: ELIVIO BONOLLO (2015/16) PRODUCT DESIGN: A COURSE IN FIRST PRINCIPLES



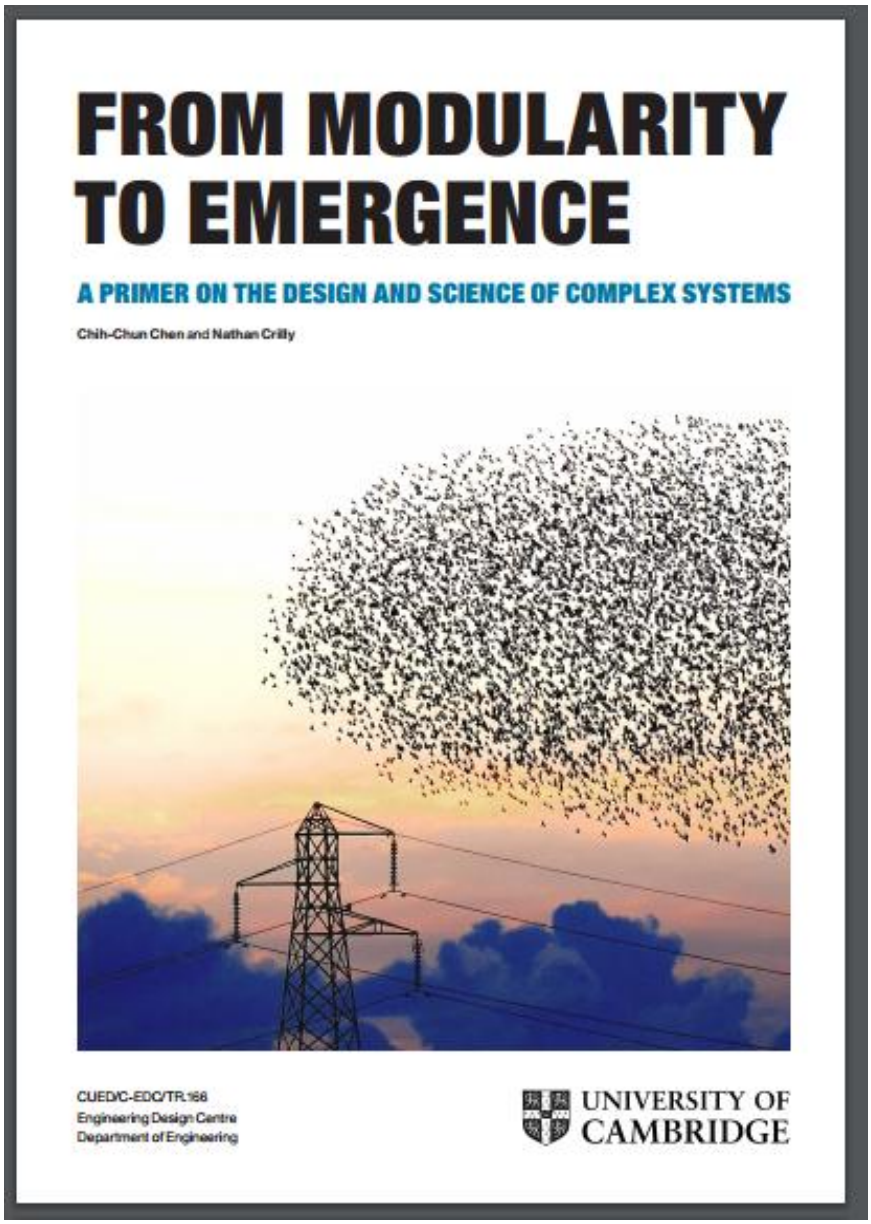
Available as a paperback (320 pages), in black and white and full colour versions (book reviewed in Design and Technology Education: An International Journal 17.3, and on amazon.com).
The 2018, eBook edition is available in mobi (Kindle) and ePub (iBook) file versions on the amazonand other worldwide networks; includingon the following websites:
ePubversion:www.booktopia.com.au
https://www.booktopia.com.au/ebooks/product-design-elivio-bonollo/prod9781784562946.html
mobi (Kindle versions):www.amazon.in
https://www.amazon.in/Product-Design-Course-First-Principles-ebook/dp/B07FNV2F4L/ref=sr_1_1?ie=UTF8&qid=1532999395&sr=8-1&keywords=Product+Design%3A+A+course+in+first+principles
www.amazon.com
http://www.amazon.com/Product-Design-course-first-principles/dp/1784562939/ref=sr_1_sc_1?ie=UTF8&qid=1456434322&sr=8-1-spell&keywords=Bonollo+Product+Design%3A+A+course+infirst+principles
www.amazon.com.au
https://www.amazon.com.au/Product-Design-Course-First-Principles-ebook/dp/B07FNV2F4L/ref=sr_1_fkmr0_1?ie=UTF8&qid=1532497383&sr=8-1-fkmr0&keywords=Product+Design+a+course+in+first+principles
READING HINTS: ePub files can be read with the iBook app on Apple MacBook/iPad devices; ePub files can also be read on Desktops PCs, Laptops and Surface devices using readers such as the Microsoft *freda*ePub reader. The Kindle (mobi file) reader isflexible and suitable for reading the eBook on PCs; Kobo readers can also be used to read ePub files on MacBook and iPad. All formats are very interactive with very good navigation.

ISSN: **2582-8304**





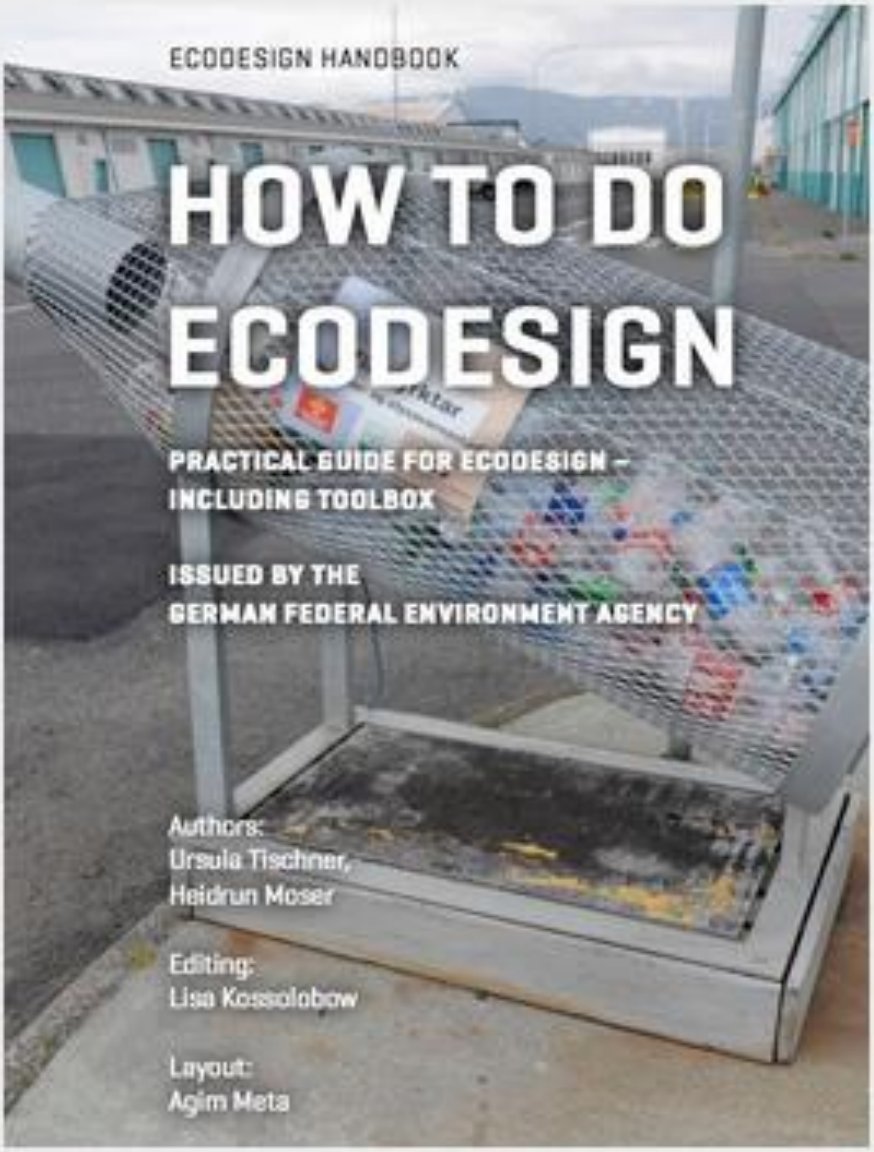
In light of the forthcoming United Nations Conference on Housing and Sustainable Urban Development (HABITAT III) and the imminent launch of the New Urban Agenda, DESA in collaboration with the Essl Foundation (Zero Project) and others have prepared a new publication entitled: "Good practices of accessible urban development".
The publication provides case studies of innovative practices and policies in housing and built environments, as well as transportation, public spaces and public services, including information and communication technology (ICT) based services. The publication concludes with strategies and innovations for promoting accessible urban development.
The advance unedited text is available at:http://www.un.org/disabilities/documents/desa/good_practices_urban_dev.pdf



Dr Chih-Chun Chen and Dr Nathan Crilly of the Cambridge University Engineering Design Centre Design Practice Group have released a free, downloadable book, _A Primer on the Design and Science of Complex Systems_.
This project is funded by the UK Engineering and Physical Sciences Research Council (EP/K008196/1).
The book is available at URL: http://complexityprimer.eng.cam.ac.uk

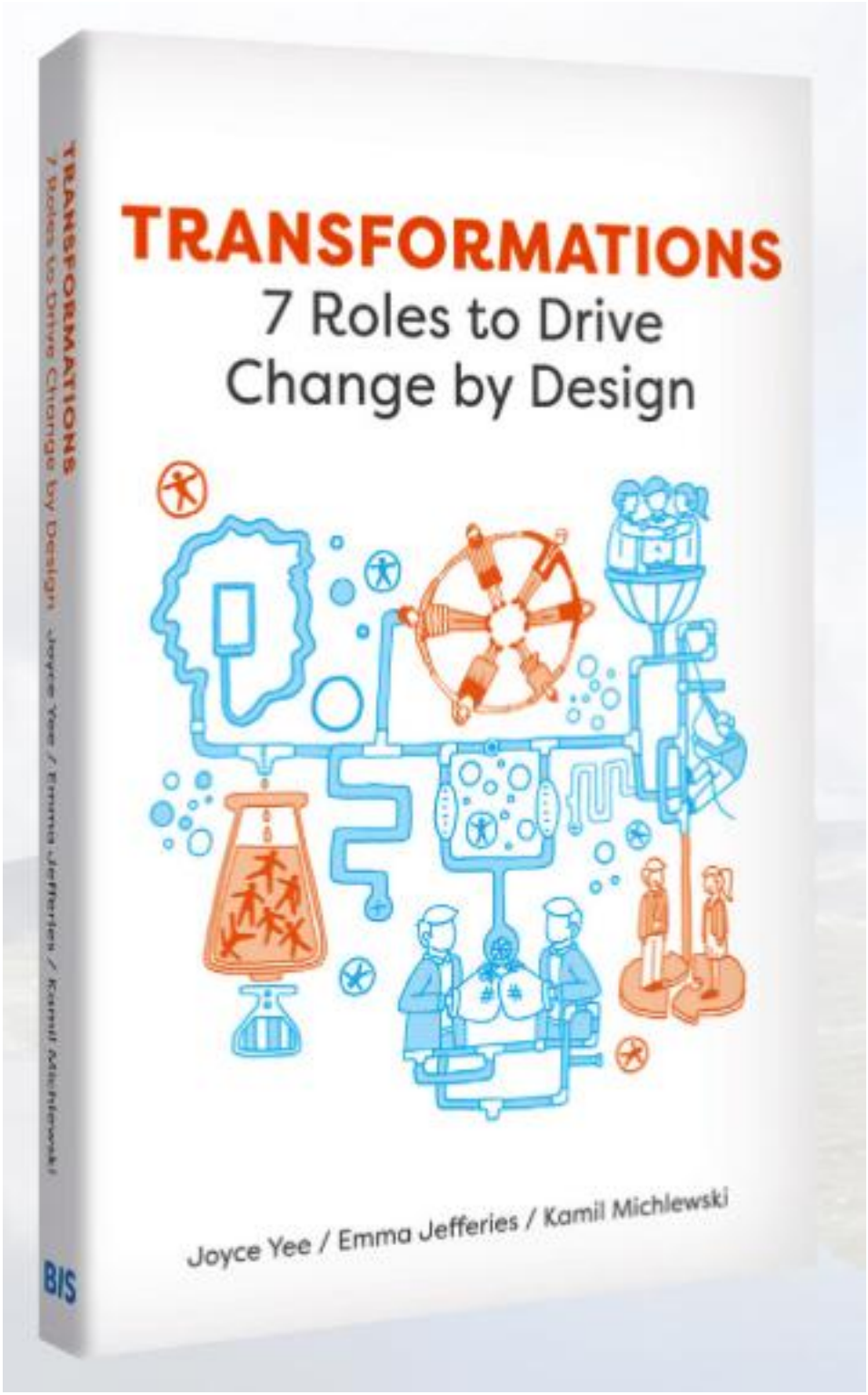
Changing Paradigms: Designing for a Sustainable Future

New iBook / ebook:
HOW TO DO ECODESIGN

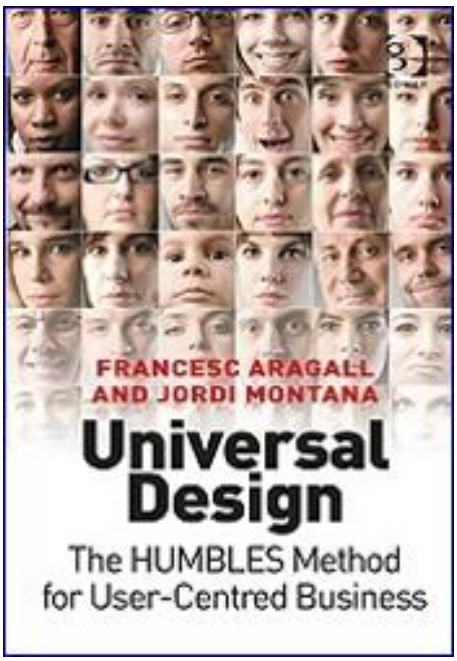


Practical Guide for Ecodesign – Including a Toolbox
Author: Ursula Tischner

ISSN: **2582-8304**



Universal Design: The HUMBLES Method for User-Centred Business



"Universal Design: The HUMBLES Method for User-Centred Business", writtenbyFrancescAragall and JordiMontañaandpublishedbyGower, providesaninnovativemethod to supportbusinesseswishing to increase the number of satisfiedusersand clients andenhancetheirreputationbyadaptingtheirproductsandservices to the diversity of their actual andpotentialcustomers, takingintoaccounttheirneeds, wishesandexpectations.

The HUMBLES method (© Aragall) consists of a progressive, seven-phaseapproach for implementing Design for All within a business. Byincorporating the user'spoint of view, itenablescompanies to evaluatetheirbusinessstrategies in order to improveprovideanimproved, morecustomer-orientedexperience, andtherebygain a competitiveadvantage in the marketplace. As well as a comprehensiveguide to the method, the bookprovidescasestudies of multinationalbusinesswhichhavesuccessfullyincorporated Design for All intotheirworkingpractices.

According to SandroRossell, President of FC Barcelona, who in company withotherleadingbusiness professionals endorsed the publication, it is "requiredreading for thosewhowish to understandhow universal design is the onlyway to connect a brand to the widest possible public, increasing client loyaltyandenhancing company prestige". To purchase the book, visiteither the **Design for All Foundation website**

ISSN: **2582-8304**

Appeal

ISSN: **2582-8304**

News

1.

Study of Design needs practical lab sessions

While stakeholders are continuing education in the field, they are waiting for offline classes to begin in earnest

Representative Image. (Getty Images)

Today, a hybrid format of teaching-learning is being hailed as the future of education. However, in the case of courses such as Design, which requires regular lab sessions and practical hands-on training, students and teachers are waiting to restart offline classes.

Praveen Nahar, director, National Institute of Design, Ahmedabad, says, "Over the course of the pandemic, the institute adopted a hybrid mode with remote facilitation leveraging learner's own context, remote access to institutional resources and more.

Whenever the situation was better, we also provided optional access to workshops/studios/labs."

Aditi Srivastava, president, Pearl Academy, New Delhi, explains, "With a shift to the hybrid concept, the aim was to ensure that students do not miss out on experiential learning. Many practical concepts, such as drafting a pattern, were taught through online classes. If students did not understand anything, they were supported with recordings of live lectures as well."

The last eighteen months have reshaped the way various Design modules were taught, says Manisha Mohan, dean, School of Design, University of Petroleum and Energy Studies (UPES), Dehradun. "The initial time went in guiding students and teachers to get comfortable with online classes. We also used Coursera to help students with additional material," she adds.

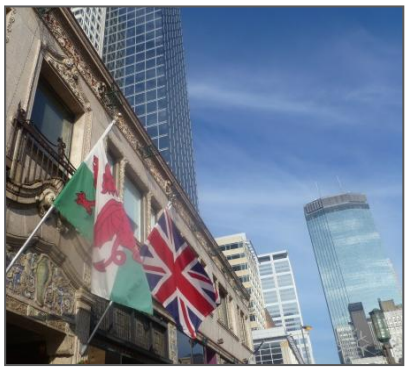
Dealing with challenges

Nahar says that the shift has been a challenge for both teachers and learners. "The hybrid concept pushed us to re-exam our pedagogy and develop new assignments/teaching methodologies within the constraints. Innovative use of technology led to increased levels of re-skilling for all," he says.

A big issue was to provide students with adequate practice material at home, says Srivastava. "During the lockdowns, even online delivery of relevant raw material had not been possible. Thus, we sent tool kits to each of our student's homes to enable them to continue practical learning," she says.

(Courtesy: Times of India)

Programme and Events



UD 2021

A! Aalto University

FIFTH INTERNATIONAL CONFERENCE ON UNIVERSAL DESIGN

June 9 - 11 2021 at Aalto University, Espoo

GET READY TO CELEBRATE GREAT DESIGN!

As restrictions start to ease across Australia we can't wait to celebrate the very best in design and innovation with our 2021 Good Design Award Winners. Booked for Fri 17 September at The Star in Sydney, this year's Good Design Awards Ceremony will be one you don't want to miss!

We think our design community deserves an extra special celebration this year, so save the date and get your entries in!

ENTER GOOD DESIGN AWARDS

ISSN: **2582-8304**

berkeley prize

BERKELEY PRIZE 2022 LAUNCHES IN ONE MONTH

This year's topic:

DESIGN GUIDED BY CLIENTS' NEEDS:

Applying Social Factors Research to Architecture

A NEW QUESTION ON THE SOCIAL ART OF ARCHITECTURE AND A NEW OPPORTUNITY TO CONSIDER THE WHY OF DESIGN

AS ALWAYS, THE POTENTIAL FOR UNDERGRADUATE STUDENTS TO WIN CASH PRIZES IN THE ANNUAL ESSAY COMPETITION

AND, FOR THE SECOND YEAR, A CHANCE FOR PRIZE SEMIFINALISTS TO RAISE MONEY AND RECEIVE A STIPEND TO PARTICIPATE IN A LOCAL COMMUNITY SERVICE PROJECT RELATED TO THE TOPIC

IT ALL STARTS ON SEPTEMBER 15

TELL FRIENDS, STUDENTS AND FACULTY - FORWARD WIDELY

ISSN: **2582-8304**

Job Openings

ISSN: **2582-8304**

Contact *Design for All Institute of India*

Advertising:
To advertise in digital Newsletter
advertisement@designforall.in
Acceptance of advertisement does not mean our endorsement of the products or services by the Design for All Institute of India
News and Views:
Regarding new products or events or seminars/conferences/ workshops.
News@designforall.in
Feedback: Readers are requested to express their views about our newsletter to the Editor
Feedback@designforall.in

Forthcoming Events and Programs:
Editor@designforall.in
The views expressed in the signed articles do not necessarily reflect the official views of the Design for All Institute of India.

Special Correspondent:
Ms. Nemisha Sharma,
Mumbai, India
Nemisha98@gmail.com
Address for Correspondence:
13, Lodhi Institutional Area,
Lodhi Road, New Delhi-110 003India.

This journal is published monthly for free for benefits for readers, by Design for All Institute of India,/ 70 Sector-18 Rohini, Delhi-110089 (INDIA) and publisher name Dr. Sunil Kumar Bhatia, address A/2/70 Sector-18 Rohini, Delhi-110089 Tel: +91-11-27853470 ,E-Mail: dr_subha@yahoo.com

This publication is completely free .We do not charge anything for published items in this journal from contributors .

Disclaimer:

Web site: www.designforall.in

Special request should be addressed to
Dr_subha@yahoo.com

ISSN : *2582-8304*
(Cover Design: Ar. Priyanka Kochhar)