

**A critical analysis of Bengali modern and traditional architecture using the  
“Deep Beauty” framework**

by

M. M. Lekhon Alam

B. Arch., Khulna University, Khulna, Bangladesh, 2014

A THESIS

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Architecture  
College of Architecture, Planning, and Design

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

2018

Approved by:

Major Professor  
Gary Coates

# **Copyright**

© M. M. Lekhon Alam 2018.

## **Abstract**

The connection and relationship between nature and architecture is one which triggers the evaluation of many criticisms and questions as well as solutions. There is a new approach to design that was introduced several years ago called biophilic design, which requires contemporary designers to look at the natural processes found in nature for inspiration. In this study Bengal architecture, both vernacular and modern is described as a unique example of biomimicry and phenomenological design that could work as a solution for some other countries as well. Bengal architecture is the architecture of Wind, Water, and Clay.

For this research, the focus is on the modern and traditional architecture of Bangladesh, a country with a rich cultural background. Before 1947, Bangladesh was a part of the British Empire, and in 1971, Bangladesh got independence from Pakistan in the Bangladesh Liberation War. Throughout history, Bangladesh has seen many transformations with respect to its architecture. The predominant history of Bangladesh culture has been shaped by Hinduism, Buddhism and at last by the introduction of Islam. All of these influences have shaped its cultural and traditional behavior and unfolded a different type of architectural style which is at root both native and vernacular. In Bangladesh, architecture is basic to human survival, and it is the reflection of the people's habits, climate, culture, and tradition, and perhaps this is the only real example of Deltaic Architecture in the world. In this thesis, Bengal architecture is analyzed through Professor Gary Coates' "Deep Beauty" framework.

This report introduces Bengal architecture to the world from the very early stages to modern days through some case studies of exemplary buildings. In order to provide better architectural solutions for the future, it is essential that we look back at examples that have passed

the test of time and search for the inherent qualities of traditional regional architecture. With this purpose, the report focuses on some traditional and Modern buildings: a critical analysis of the indigenous deltaic architecture of Bangladesh is presented in order to learn how it meets the criteria of Deep Beauty, for the creation of a sustainable architecture that works technologically, culturally and humanly. Three modern buildings from Bangladesh have been selected which have a profound link with the Deltaic Architecture: the National Assembly Building by American architect Louis Kahn, the Faculty of Fine Arts Building by Bangladeshi architect Muzharul Islam, and the METI Handmade School by German architects Anna Heringer and Eike Roswag. All the case studies have been critically analyzed through “Kelbaugh’s five points of a Critical Regionalism” as well as the “Deep Beauty” Framework. The results from these analyses demonstrate the inherent power and the enduring relevance of regional architecture which is deeply beautiful and inherently sustainable.

**[Key Words:** Deltaic Architecture, “Deep Beauty” framework, Critical Regionalism, Sustainability, Contextual, Modernism, The Delta]



# Table of Contents

List of Figures .....	ix
List of Tables .....	xv
Acknowledgements .....	xvi
Dedication .....	xvii
MS Arch Report Structure .....	xviii
Chapter 1 - Introduction .....	1
Significance .....	1
The Deep Beauty Framework for Architectural Design .....	5
Functional Level .....	7
Typological Level .....	9
Archetypal Level .....	11
Chapter 2 - Architecture of Bangladesh .....	13
Location .....	13
Historical Context .....	14
Geographical Influence .....	15
Climatic Influence .....	17
What is Deltaic Architecture? .....	19
The Delta and Architecture .....	21
Deltaic Architecture and Its Morphologies .....	24
The Architecture of the Delta .....	26
Functional Level .....	28
The Orientation of the Building .....	28
Building Materials and Construction Techniques: .....	30
Family Structure .....	30
Social Setup .....	31
Comfort .....	31
Typological Level .....	32
The sense of History, Community, and Place .....	32
Building Type .....	34

Biophilic Design .....	38
Archetypal Level.....	39
The Orientation of Space: .....	39
Geometry, Proportion, and Number: .....	40
Spatial Polarities in Natural Settings .....	41
Chapter 3 - Louis I Kahn and the start of Bengali Modernism.....	42
National Assembly Building, Dhaka, Bangladesh.....	42
An example of Critical Regionalism.....	44
The Sense of Place .....	45
Kahn Creates a Bengal Style of Modern Architecture.....	46
Materials .....	46
A Climate Responsive Bengali Modern Architecture .....	47
The Sense of Nature.....	48
A distinct ecosystem: a land-water relationship .....	49
Deltaic Landscape: A landscape of land and water .....	50
The Sense of History & the Sense of Craft.....	51
Historical link of National Assembly Building in Dhaka, Bangladesh .....	52
“Representing the Delta”—Unique architectural features of National Assembly Building.....	53
Philosophy and Bengal Morphology .....	54
Implementation of Deltaic Concept and Philosophy: “DIG and BUILD” .....	54
The Sense of Limits .....	57
National Assembly Building: A Place within a Place .....	57
Contextual Peripheral Vision of the National Assembly Building.....	60
Bengali Modernism and the Significance of the National Assembly Building, Dhaka.....	62
Chapter 4 - Study Methods .....	63
Selecting.....	63
Rubric for Analysis.....	64
Tools for Analysis.....	65
Chapter 5 - Analysis of the Selected Design Projects.....	67
Project Selection .....	67

Faculty of Fine Arts, University of Dhaka, Bangladesh .....	67
An Example of Critical Regionalism .....	68
The Sense of Place .....	68
The Sense of Nature .....	69
The Sense of History .....	70
The Sense of Craft .....	70
The Sense of Limits .....	71
01. Faculty of Fine Arts Building, University of Dhaka, Bangladesh .....	72
Functional Level .....	81
<i>The Orientation of the Building:</i> .....	81
<i>Building Materials and Construction</i> .....	82
<i>Social Structure</i> .....	83
<i>Social Setup</i> .....	83
<i>Comfort</i> .....	86
Typological Level .....	93
<i>Sense of History, Community, and Place</i> .....	94
<i>Building Type</i> .....	95
<i>Layout</i> .....	95
<i>Biophilic Design</i> .....	100
Archetypal Level .....	103
<i>Orientation in Space</i> .....	103
<i>Geometry, Proportion, and Number</i> .....	104
<i>Geometry</i> .....	105
<i>Spatial Polarities in natural Settings:</i> .....	116
Project Selection .....	126
METI Handmade School in Rudrapur, Dinajpur, Bangladesh .....	127
An Example of Critical Regionalism .....	135
The Sense of Place (The Genius Loci) .....	136
The Sense of Nature (Protect and preserve ecosystems) .....	136
The Sense of History (A good point of departure when designing building) .....	136
The Sense of Craft (Traditional expression): .....	137

The Sense of Limits (Human-scale in the built environment).....	137
Functional Level .....	138
<i>The Orientation of the Building</i> .....	139
<i>Building Materials and Construction</i> .....	141
<i>Social Structure</i> .....	151
<i>Social Setup</i> .....	152
<i>Comfort</i> .....	153
Typological Level .....	163
<i>The sense of History, Community, and Place</i> .....	164
<i>Building Type</i> .....	166
<i>Layout</i> .....	167
<i>Biophilic Design</i> .....	172
Archetypal Level.....	174
<i>Orientation in Space</i> .....	174
<i>Geometry, Proportion, and Number</i> .....	175
<i>Spatial Polarities in Natural Settings</i> .....	183
Chapter 6 - Conclusion .....	193
Findings .....	193
Future Direction .....	193
Limitations .....	193
References.....	194

## List of Figures

Figure 1-1 A traditional Bengal household .....	2
Figure 1-2 Traditional Space Sequences of Bengal Architecture .....	3
Figure 2-1 Location of Bangladesh .....	13
Figure 2-2 The ancient border-line of Bengal .....	14
Figure 2-3 Bangladesh the biggest river Delta .....	16
Figure 2-4 Main rivers of Bangladesh .....	16
Figure 2-5 Two geo-cultural matrices of Delta .....	20
Figure 2-6 The Ganges and the Development of Eastern Matrix of Delta .....	21
Figure 2-7 The true Nature of Delta; A pure chemistry of Land and Water .....	21
Figure 2-8 Paradigmatic figures: A man with the plough and a man with the net .....	22
Figure 2-9 ** “Jor Bangla” Temple; Terra-Cotta Works of Delta .....	23
Figure 2-10 Kantajew Temple, Bangladesh: Clay Works, Terra-Cotta Work .....	23
Figure 2-11 Rustic Bengali Hut, 1874 .....	24
Figure 2-12 Plan of a “Bengali Hut” .....	25
Figure 2-13 Section of a Bengali Hut .....	25
Figure 2-14 A hut with a thatched roof and permeable mud facades .....	25
Figure 2-15 A Bengal Household (the unit of production); An Invisible Pavilion of Delta. ....	26
Figure 2-16 A Traditional Bangladeshi Household .....	27
Figure 2-17 Basic thinking behind the building orientation. ....	29
Figure 2-18 The Bamboo-woven hut on stilts .....	33
Figure 2-19 Thatch hut on an earth platform .....	34
Figure 2-20 Use of Brick in Delta, “ <i>Jorbangla Mosque.</i> ” .....	34
Figure 2-21 A Bengal Household (the unit of production) .....	35
Figure 2-22 A section of Bengal Household (space sequences of the Delta) .....	35
Figure 2-23 Plan of a traditional house form in rural Bangladesh .....	36
Figure 2-24 Space morphologies of a Bangladesh’s traditional rural house .....	37
Figure 3-1 Predominant materials are the concrete and red brick .....	46
Figure 3-2 Climatic Response: National Assembly Building .....	47
Figure 3-3 Present days: Natural Settings of Louis I Kahn’s National Assembly building .....	49

Figure 3-4 Old image of National Assembly Building .....	49
Figure 3-5 Deltaic Landscape of National Assembly Building, Dhaka .....	50
Figure 3-6 Replication of the Delta .....	53
Figure 3-7 “DIG and BUILD”— the generic image of the Delta.....	54
Figure 3-8 A Section of Deltaic Landscapes .....	55
Figure 3-9 Household Building Process in Delta .....	55
Figure 3-10 National Assembly Building, Dhaka: floating essence in the water .....	56
Figure 3-11 Plan of the National Assembly Building .....	58
Figure 3-12 Form Analysis of the Assembly House.....	59
Figure 3-13 Street image of old Dhaka city.....	60
Figure 3-14 Morphological transformation at National Assembly Buildings .....	60
Figure 5-1 Location and Orientation of Faculty of Fine arts, Dhaka .....	72
Figure 5-2 Site context plan for the Faculty of Fine Arts Building by Muzharul Islam.....	73
Figure 5-3 Ground Floor Layout Plan .....	74
Figure 5-4 First Floor Layout Plan .....	75
Figure 5-5 Blow up Plan: (Ground Floor Plan) .....	76
Figure 5-6 Ground Floor Plan of Faculty of Fine Arts, Dhaka .....	77
Figure 5-7 Inner Courtyard view from ground floor .....	78
Figure 5-8 Entrance, East façade of the Building .....	79
Figure 5-9 First floor’s east side semi-outdoor .....	79
Figure 5-10 Semi-outdoor corridor on the south .....	79
Figure 5-11 South Facing Semi-outdoors and North Facing Windows .....	81
Figure 5-13 Children are attending “painting competition” in the corridor .....	84
Figure 5-12 Outer yard; place for cultural gathering and exhibitions .....	84
Figure 5-14 Faculty of Fine Arts, University of Dhaka; Center of Gravity of Social Life .....	85
Figure 5-15 Plans Showing Section Line AA’ .....	86
Figure 5-16 Section AA’; Ventilation through courtyards (anonymous) .....	87
Figure 5-17 Linear Mass Section .....	87
Figure 5-18 Curved Mass Section .....	88
Figure 5-19 South Elevation of the Building .....	88
Figure 5-20 East Elevation of the Building .....	89

Figure 5-21 “ <i>Jalees</i> ” (lattices) and “ <i>Beras</i> ” (perforated screen) .....	90
Figure 5-22 The terracotta screens made from traditional clay provide a degree of privacy .....	90
Figure 5-23 Children’s painting competition in the shaded corridor .....	90
Figure 5-24 Windows with solid wooden planks .....	90
Figure 5-25 two openings on opposite walls .....	91
Figure 5-26 For Cross ventilation architect placed vents .....	92
Figure 5-27 Cross-ventilation .....	92
Figure 5-28 A section of Bengal household (space sequences of Delta).....	96
Figure 5-29 A section of Bengal Household (space sequences of Delta).....	97
Figure 5-30 A inner courtyard which follows the Christopher Alexander’s courtyard concept .	98
Figure 5-31 Inner courtyard of the Faculty of Fine Arts, the University of Dhaka.....	99
Figure 5-32 Linkage with different Courtyards: Side views from the building. ....	99
Figure 5-33 Inner courtyard features .....	100
Figure 5-34 Faculty of Fine Arts, (DU), Biophilic Design.....	102
Figure 5-35 Orientation in Space of Fine Arts Building, Dhaka .....	104
Figure 5-36 Different geometric shapes in the ground floor plan. ....	104
Figure 5-37 A typical Bengal household patterns and primary space sequences .....	105
Figure 5-38 Ground floor Plan: replication of Bengal household patterns and sequences .....	106
Figure 5-39 Geometric pattern of the Ground Floor Plan: rectangular & circular forms. ....	107
Figure 5-40 1 <sup>st</sup> floor plan of the building.....	108
Figure 5-41 Ground floor Plan: Circular forms analysis. ....	109
Figure 5-42 Geometric Pattern the south side of the front pavilion; (20 rectangle blocks).....	110
Figure 5-43 Geometric Analysis of the Ground Floor Plan .....	111
Figure 5-44 Blow Up A of Geometric Analysis .....	112
Figure 5-45 Blow Up B of Geometric Analysis .....	112
Figure 5-46 Blow Up C of Geometric Analysis .....	113
Figure 5-47 Blow Up D of Geometric Analysis .....	113
Figure 5-48 Geometric Analysis of the First Floor Plan.....	114
Figure 5-49 Blow Up E of Geometric Analysis.....	115
Figure 5-50 Blow Up F of Geometric Analysis.....	115
Figure 5-51 Ground Floor Plan: Prospect and Refuge.....	118

Figure 5-52 Upper Floor Plan; Prospect and Refuge.....	119
Figure 5-53 Upper floor corridor .....	120
Figure 5-54 Ground floor corridor .....	120
Figure 5-55 Continuous corridors and the outer courtyards .....	120
Figure 5-56 Classrooms and first floor: Interior refuge and prospect. ....	121
Figure 5-57 Ground floor Plan: Enticement .....	122
Figure 5-58 Path that turns .....	123
Figure 5-59 Terrace and verandahs; Peril .....	124
Figure 5-60 The Sculptural Stair: a sense of enticement and thrill .....	125
Figure 5-61 Architect Anna Heringer in Bangladesh .....	127
Figure 5-62 Location of METI Handmade School, Rudrapur, Bangladesh .....	128
Figure 5-63 Site Plan for METI Handmade School, Rudrapur, Bangladesh .....	129
Figure 5-64 Ground Floor Plan of METI School .....	130
Figure 5-65 Upper Floor Plan of METI School .....	131
Figure 5-66 Ground Floor Plan of METI School .....	132
Figure 5-67 The METI Handmade School, Rudrapur, Bangladesh .....	133
Figure 5-68 Protecting west facade from the hot summer sun. ....	134
Figure 5-69 Kids are enjoying in the upper-floor .....	134
Figure 5-70 The exterior facade is punctuated with colorful doors and drapes .....	134
Figure 5-71 Upper floor of the school .....	134
Figure 5-72 Organic patterns of “Caves”: Children’s activities .....	135
Figure 5-73 Organic “caves” pattern is on the west side and entrance from the east.....	139
Figure 5-74 Sun Path Diagram .....	139
Figure 5-75 A playful cave which is made of mud .....	140
Figure 5-76 Elevation Map of Bangladesh .....	143
Figure 5-77 Climate Data of Dinajpur, Bangladesh .....	144
Figure 5-78 Rural house (Mud House) near METI school in Rudrapur, Dinajpur .....	144
Figure 5-79 Rural traditional mud house near METI School, Rudrapur, Dinajpur.....	144
Figure 5-80 Bamboo and straw are used to slow down the erosion of the earth walls .....	146
Figure 5-81 Bamboo Framework (beams) of METI Handmade School .....	147
Figure 5-82 The dominating roof of this vernacular mud house in Rudrapur.....	147



Figure 5-83 SECTION: Replication of Bengal Architecture .....	148
Figure 5-84 METI School kids are learning to build, helping on site and so becoming a living part of the building .....	149
Figure 5-85 Foundation by hand .....	150
Figure 5-86 Use of Indigenous Methods: Cows are mixing loam, straw & little bit of water .	150
Figure 5-87 Bamboo construction is also done by local people .....	150
Figure 5-88 A formal classroom activities on the ground floor .....	152
Figure 5-89 Children are playing in the field, METI school .....	152
Figure 5-90 Tree Planting Program: A learning opportunity to get kids involved in the works	153
Figure 5-91 Kids are playing on the upper .....	153
Figure 5-92 Bamboo stair of METI school links ground floor to upper floor .....	153
Figure 5-93 A small verandah on the upper floor .....	154
Figure 5-94 Two floor Plans of The METI Handmade School, Bangladesh.....	155
Figure 5-95 Section AA': Interior spaces.....	156
Figure 5-96 Adequate Ventilation through windows, doors, and semi-outdoors .....	156
Figure 5-97 Upper Floor of the METI: Windows are made of bamboo.....	157
Figure 5-98 South Elevation of the building .....	157
Figure 5-99 North Elevation of the METI School . .....	158
Figure 5-100 During Summer Time .....	159
Figure 5-101 Bamboo and woven window shades .....	159
Figure 5-102 Interior view of a classroom.....	159
Figure 5-103 colorful saris are hanging from the ceiling. ....	160
Figure 5-104 Winter Time: Thermal Mass activities .....	161
Figure 5-105 East Elevation of the building .....	162
Figure 5-106 West Elevation of the Building .....	162
Figure 5-107 Three Basic parts of Bengal Mud (Mud Hut) house .....	165
Figure 5-108 The METI Handmade School .....	165
Figure 5-109 A Bengal Mud House's space sequences and architectural morphologies.....	168
Figure 5-110 METI School's Section AA': Replication of traditional Bengal Mud House .....	169
Figure 5-111 section of Bengal Household (space sequences of Delta) .....	170
Figure 5-112 Detached Out yard: Following the rural house pattern .....	171

Figure 5-113 Natural settings of the METI handmade school, Bangladesh .....	173
Figure 5-114 The METI School is located in the middle of nowhere in Bangladesh .....	175
Figure 5-115 Plan of a Bengal Hut (also discussed in chapter two).....	176
Figure 5-116 Geometric Analysis of the Ground Floor Plan: all rectangular forms. ....	176
Figure 5-117 Geometric Analysis of Upper Floor; all rectangular forms .....	177
Figure 5-118 Geometric pattern of METI School.....	177
Figure 5-119 South & North Elevation: Three different sized windows are randomly arranged	178
Figure 5-120 East Elevation: Three different size doors are randomly arranged on the east ....	178
Figure 5-121 West Elevation: Six different size windows are randomly arranged on the west. .	179
Figure 5-122 East & West elevation: Project is a horizontal development .....	180
Figure 5-123 Settlement patterns of Deltaic Bangladesh .....	182
Figure 5-124 Classification of Prospect and Refuge Space.....	183
Figure 5-125 Characteristics of a Deeply Rewarding Space .....	184
Figure 5-126 Bottom Floor Plan: Prospect and Refuge.....	185
Figure 5-127 Upper Floor Plan; Prospect and Refuge.....	186
Figure 5-128 Ground floor Classrooms: Interior Refuge .....	187
Figure 5-129 Raised Brick Semi-Covered Platform and Playground: Exterior Refuge and Exterior Prospect .....	187
Figure 5-130 Ground floor Classroom: Interior Prospect .....	188
Figure 5-131 Exterior refuge area on the upper floor of the METI School.....	188
Figure 5-132 Upper floor area: Interior Prospect .....	189
Figure 5-133 Bottom Floor Classrooms: Enticement (openings create a sense of mystery).....	189
Figure 5-134 Ground floor Plan: Enticement.....	190
Figure 5-135 Upper-floor Plan: Enticement.....	190
Figure 5-136 Stair and Enticement: (rapid change of views; turns and disappear) .....	191
Figure 5-137 Children are in the verandah; Peril .....	192
Figure 5-138 The Hanging Verandah of the METI School, Bangladesh .....	192

## List of Tables

Table 2-1 Average temperature of Saidpur city .....	17
Table 2-2 Average temperature of Saidpur city .....	18
Table 2-3 Average sunshine of Dhaka city .....	18
Table 2-4 Average precipitation of Chittagong .....	18
Table 4-1 Table Figure Rubric for Analysis .....	64

## **Acknowledgements**

First, I would like to thank the Almighty Allah for his infinite kindness and grace which has been bestowed upon me. I would also like to express my wholehearted thanks to my major advisor Professor Gary Coates for introducing me to new concepts, knowledge, and information which formed the basis of my work. His continuous guidance, comments, constructive criticism, and help enabled me to complete my academic endeavors. In addition, I am very grateful to Professor David Sachs and Professor Todd Gabbard for helping me to fix the outline of my research and providing valuable feedback.

I would like to express my gratitude to my sister, Shabnam Ferdous, and my brother-in-law, Ashfaqul Anwar Siraji for encouraging me in hard times and providing me with a peace of mind. Finally, I must express my profound gratitude to my parents, MD Zahangir Alam and Rabeya Alam, for their love, support, and continuous encouragement throughout my life and through the process of reaching and writing this thesis. This accomplishment wouldn't have been possible without them.

## **Dedication**

I dedicate this work to my parents, MD Zahangir Alam and Rabeya Alam. Their constant support and unconditional love have been essential during the course of my masters. I express my most profound gratitude and the highest level of appreciation for all the sacrifices they have made for me throughout my life.



## Chapter 1 - Introduction

The connections and relationships between nature and architecture are one which triggers the evaluation of many criticisms and questions as well as solutions. The architectural features of Bengal and the production of materials, structures, and design systems are modeled on biological entities and processes in Bangladesh. However, Bengal architecture is a unique example of phenomenological interpretation and is the architecture of **Wind, Water and Clay** (Haque, 1997).

### Significance

Bangladesh, officially the People's Republic of Bangladesh, is a country in South Asia. Dhaka is the capital city, and it shares land-borders with India and Myanmar. Although it is a smaller territory than Kansas, Bangladesh is the world's eighth most populous country. The Bangladesh population is approximately 163 million, an equivalent to 2.18% of the total world's population. In Bangladesh, thirty percent of the total population lives in urban areas, and by 2030 the percentage will be more than 40 percent (Shahriar Shams, 2014).

Bangladesh was ruled by the British colony from 1757 to 1947, and after that, it was a province of Pakistan until 1971. Consequently, the real existence of Bengal was always stimulated by movements in political and literary fields. However, the deltaic Bengal was always fortunate to maintain its own existence across different traditions, culture festivals and religious values (Haque, 1997).



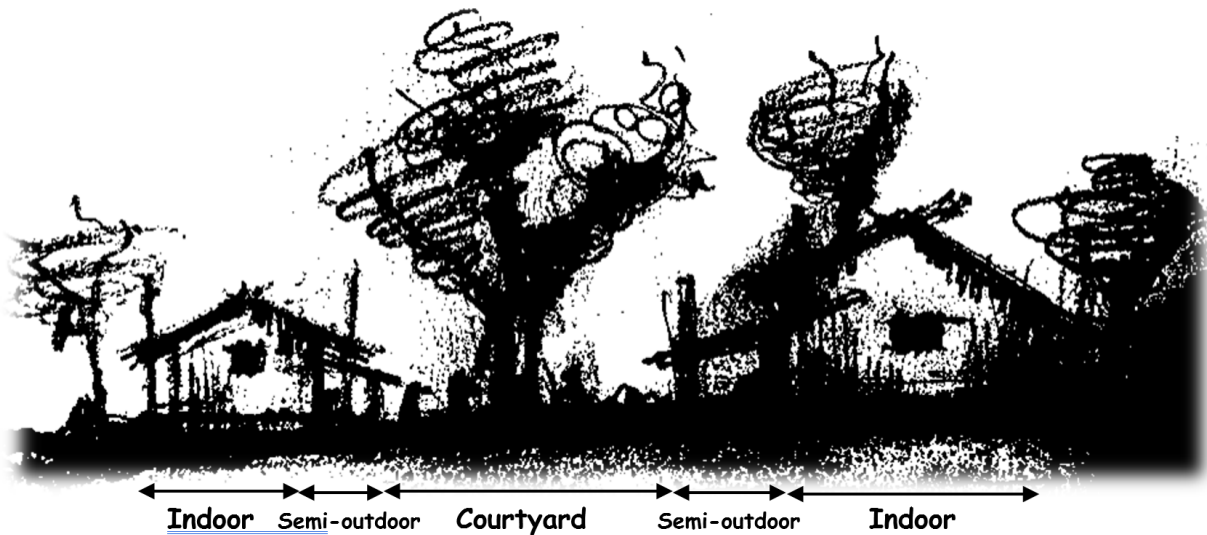
**Figure 1-1 A traditional Bengal household (News, 1874).**

The land of Bangladesh was developed gradually by some three hundred rivers. Furthermore, every aspect of life in Bangladesh is shaped by two primary things: a broad deltaic plain subject to frequent flooding and many rivers. It's a land of about only 1, 47,610 sq. /km, but you will find some notable geographical changes—which shape Bengal's architectural development as well. Bangladesh used to be a part of the mighty Mughal Empire, which was the period of Muslim architecture, and yet it was also a place of pilgrimage for Hindus and Buddhists. Furthermore, if you want to discover the fingerprint of Bengal architecture, you should go way back to its geographical development period. Furthermore, Bengal Architecture is so simple--formless, entirely excluded from concrete but still, it is an extraordinary example of purely organic and vernacular architecture. It is very easy to make dooryards (covered porches or semi-covered spaces) which are incredibly interactive to nature (Hosey, 2012). Building orientation, gardens,



and windows bear significant importance as those will give you an opportunity to interact with the environment. The architecture of Bengal is thousands of years old and has deep cultural roots (Kahn, 1994).

Instinctively, one may recognize architecture in the Delta as an architecture of Wind, Water, and Clay (Haque, 1997). People will never find these kinds of structures anywhere else in the world.



**Figure 1-2 Traditional Space Sequences of Bengal Architecture**

However, the present situation in Bangladesh is quite different. The increasing globalization and advancement in science and technology have caused the country to move away from traditional architecture. As a result, after the 1980s, the cities in Bangladesh modernized rapidly, resulting in vast changes to the fabric of cities. Currently, urban design trends in developing countries, including Bangladesh, are continuing to become more westernized in a pattern that is not appropriate for the region because of their inability to provide comfortable living

environments and public spaces. One can realize that the field is facing stagnation for lack of innovation and adherence to routine to the utmost. In Bangladesh, imitation of foreign styles in the name of innovation is running rampant, so much so that we are now in the risk of losing our extremely rich and unique architectural configurations which are significantly different from other cultures. In these circumstances, Bangladesh, like other countries all across the globe are seeking to create more sustainable buildings, towns, and cities. The use of the same building methods, materials, and styles globally, challenges every country's ability to achieve sustainable living (Eldemery, 2009). However, architects have a substantial role to play as they are the makers of social life and urban infrastructure. Fortunately, in Bangladesh, there are some excellent examples of extraordinary architectural works—the works which grow out of traditional roots, and which are molded by Bengali heritage and culture. Those buildings are timeless, authentic examples of regional architecture—"**The Fingerprint of Bengal Architecture**" (Hosey, 2012).

The analysis in this research is an attempt to learn from the past, understand the present and chart directions for design for a better future. R. Lewcock (1988) emphasizes this approach when he says:

“At any given time, the man-made world is inevitably the measure we use to determine the direction of change. Whatever we may think of it, the world around us provides the basis for decisions about the future. We are keenly aware of its deficiencies, but not always so aware of its strengths. From time to time it is wise to pause and consider whether what we might be losing when we change something. The corollary to this is to look back to see whether what we lost yesterday might, with little effort, be regained” (pp. v-vi).” (Lewcock, 1988)

## **The Deep Beauty Framework for Architectural Design**

“Deep Beauty” is well defined by Professor Gary J Coates, 2014. He says:

“Deep Beauty exists in a realm beyond mere aesthetics. Deep Beauty is rooted in an ecological ethos and a spiritual worldview. Deep Beauty respects and reveals the interconnectedness and unity of all life and the irreducible mystery within which everything exists. Deep Beauty heals and restores balance, harmony, and equanimity to both self and world. To create Deep Beauty in whatever we make and do is an act of love because only that which is loved is beautiful.” (Coates, 2014)

“LOVE” is the primary factor of conservation, in fact- the thriving development is encircled with love. It has a deep relationship with sustainability (Hosey, 2012). From the above statement, it is quite evident that Deep beauty indicates promotion of sustainability by embracing what people have always cared about most. Mostly, the shapes and the context of that architecture are required to be their prime form (Hosey, 2012). Sustainability is at its root the fulfillment of needs—very common daily needs. Aesthetics are fundamental to both culture and nature, and if sustainability refers to the graceful interaction between them, it must have a sensory dimension (Hosey, 2012). Furthermore, sustainability itself is a beauty, and a proper sustainable architecture should achieve timelessness.

I firmly believe design doesn't contain any universal forms or features since it is a response to the regional and contextual needs of the time (Hosey, 2012). However, most commonly, sustainability is generally associated exclusively with carbon emissions and energy efficiency. Criteria for quality design and environmental performance are not the same and so ‘great buildings’ are thought to be different from ‘green buildings’ (Hosey, 2012). A beautiful architecture will increase social security, and it will give eternal pleasure. Nevertheless, beauty is

a relative object since it depends on various elements and the primary catalyst of beauty is the Regionalism. Establishing contextual architectural elements for a less violent impact on the earth is the basis of sustainability which requires a regional approach to architecture. Lance Hosey, in his book "*Shape of Green*"; describes "Efficiency" with doing more with less which is a fundamental aspect of sustainability.

Sometimes designers ignore people's needs and their values. In fact, architecture's negligence towards people's culture and the local place triggers the development of the much unconventional design. Since architects sometimes ignore the existence of emotional experience and the physical pleasure of that very region, lack their buildings often a sense of connection with earth and place. Undoubtedly, the discovery of rooted architecture is perhaps the most important and least recognized need of the human soul (Hosey, 2012).

Therefore, it can be said that in order to make architecture sustainable, it is essential that it must also be deeply rooted in place and 'Deep Beauty' is a useful way to achieve this goal. The framework of deep beauty isn't just a theory; perhaps it is an exceptional tool for holistically measuring the degree of sustainability of architecture. This framework does not only talk about ecological science but also works as a chain that connects architectural functionality with regionalism as well as the archetypal, or universal aspects of architecture. In fact, it is a methodology which provides a comprehensive approach to think profoundly about the built environment. The framework is comprised of three interconnected levels of design: **functional, typological, and archetypal.**

## **Functional Level**

"The Functional Level includes design for all the pragmatic needs of the building's users. Truly functional buildings are also artfully integrated with their sites and respond simply and appropriately to the available sun, wind, and light. Such buildings, which are always no bigger than they need to be, are necessarily energy efficient and make maximum use of healthy and locally available building materials. Biomimicry, as a functionalist approach to biophilic design, is included in this level. Everything associated with the technological and functional aspects of ecologically and humanly sustainable design is included in this first, and necessary level of sustainable design." – (Coates, 2014)

The theory of regionalism leads to an architecture which is fundamentally site-specific and responsive to the native climate and traditions of the place where it is being constructed. In fact, a building is not only a structure, but it is also an interconnected ecological feature of a place. Furthermore, it produces the form of vernacular architecture which portrays a belief in the traditional interpretation of thoughts, forms, and style (Hosey, 2012). A building is a cultural phenomenon, and so its form and organization house depends on its cultural setting. The function of the building is more than a utilitarian idea and serves a higher purpose than only providing shelter. Since shelter is a secondary purpose of the building, its definite role is to create an environment that best suits the way of life of people. Nevertheless, the building acts as a social unit of space (Rapoport, 1969).

Consequently, it is quite evident that the circumstantial reacts to microclimate, and the immediate context. Sometimes a building's adaptation to the regional or the circumstantial can depend on its purpose in the community—perhaps its form is shaped by its position in a place. Biomimicry is a discipline that entails learning strategies and designs from nature that have proven to be successful for so many years. In the past, architects have taken inspiration from various acts

performed in nature and implemented them into works of architecture. Such architects who follow biomimicry believe that when designs are guided by nature, architecture becomes more life-like (Benyus, 2008). The Functional Level can be achieved by maintaining a strong sense of biomimicry. Examples of biomimicry can be seen in the design of building structures, forms, daylighting systems, natural ventilation strategies, sounds, colors and landscapes as well as urban design (Benyus, 2008)

Finally, the future of the city could lie in the right interpretation of our metaphors for sustainable design and the thoughtful graphics of an architect—and thus, we will be rewarded with some cities and houses that function as competent ecosystems. Nevertheless, biomimicry has the potential to lead the way towards sustainability.

## **Typological Level**

"The Typological Level involves the adaptation of bioregional building traditions and historically situated building types in the design of contemporary buildings that are capable of evoking a sense of connection with history, community, nature, and place. Rather than merely replicating historical forms, buildings functioning at this level enter critically into a conversation with the past in order to create something that is both familiar and yet somehow always fresh and new. At this level of design, culturally based meanings are continuously created, and deeply rooted building traditions are continually given new life. Buildings at this level also embody the principles of biophilic design, connecting building users to elemental nature and to the patterns, rhythms, and forms of the natural world, thereby fulfilling our intrinsic need to be connected to the regenerative processes of life."  
– (Coates, 2014)

Typologies deal on different levels: at the urban level, typologies deal with blocks, row or detached houses and at the building level, it can include residential houses, theaters, and industrial plants, etc. Classifying observations according to similar characteristics and recurring principles is an important component of the cognitive process. Humans perceive and communicate by forming standards and systemizing patterns. In this context, architectural typologies consider the different requirement profiles of building types and spatial systems. Examining typology involves a dialogue within history to discuss the generation of 'new' from the 'old.' Types are transformed over time due to changes in user requirements, scale, context, or other mechanisms (Pfeifer, 2007).

Hence it is crucial, from a global perspective, to find a way to incorporate the traditional design morphologies of a region into designs while keeping abreast of the global trends. However, sustainability demands more history-based and place-based forms—which includes regional style and traditional style (Hosey, 2012). Furthermore, the biological and ecological systems can serve

as inspiration for the design. The Functional Level of Deep Beauty can cater well for concepts like daylighting, reducing energy costs, use of local materials, and lower environmental impact. Subsequently, the next step is to design life-enriching, healing architecture that is nurturing and stimulates well-being. In other words, our way forward is a biophilic response (Cramer, 2008).

Biophilic design is a natural way of creating a human settlement which is also compatible with global trends. It always seeks to connect us to our innate need to affiliate with nature in the contemporary built environment. From the very beginning of our existence, we are biologically encoded to affiliate with natural features. All humans have their inborn intention to feel their soul within their green surroundings. An approach to creating a biophilic environment is to integrate plants, animals, and water into the built environment. Throughout the world in history, biophilic elements like domestic gardens, ponds, fountains, and garden courtyards are evident. In present-day buildings, aspects like green terraces, landscaped atria and aquariums contribute to bringing nature into the built environment. The biophilic design has an innate quality of healing people's mental and physical stresses (2012 Terrapin Bright Green LLC). Sometimes you may not notice that you have saved a lot of money through your physical and mental soundness (Louv, 2008). In the end, it was evident that the biophilic design has significant influences on human's life as it emphasizes people's adaptations to the natural world (Cramer, 2008). Lastly, it is quite apparent that design at the Typological Level could be achieved using biophilic design strategies.



## **Archetypal Level**

"The Archetypal Level involves the use of archetypal building elements, patterns, and forms that are most typically found in the world's sacred architecture. Buildings at this level speak in the natural language of space, which is rooted in the pre-verbal meanings of embodied experience: up and down, right and left, front and back, inside and outside, near and far, darkness and light, rough and smooth, warm and cool, the horizontal and vertical, the center and periphery. The archetypal and biologically rooted polarities of prospect and refuge, complexity and simplicity, enticement and peril are structured in ways that deepen and harmonize the apparent psychophysical opposites of lived experience. Often such buildings are shaped to higher levels of a formal order by use of the universal tradition of the qualitative number and sacred geometry. The archetypal level is the deepest layer of meaning and metaphoric signification in architecture. Buildings that reach this level lead user back through layers of consciousness and time from the outer surface of the waking mind to the depths of what Carl Jung calls the collective unconscious and beyond, to the edge of the luminous ground of being itself." (Coates, 2014).

We believe that nature, including humans, have the typical characteristics of structure and proportion that can be quantified through mathematics. Buildings that use archetypal elements from the world's sacred architecture possess greater levels of higher order by using sacred geometry and the qualitative number. In fact, every creation of man and nature are forms that can be observed through mathematical laws of geometry, symmetry, and similitude. The presence of biologically rooted polarities of prospect and refuge, complex order, enticement, and peril respond to our psychophysical opposites (Coates, 2014). Professor Coates also says that this level reveals the language of the space and also makes appropriate uses of the natural symbols of up and down, inside and outside, horizontal and vertical and so on (Harries, 1993). All shapes, lines, and surfaces are set in accordance with the proportions that are found in nature and exhibit perfect systems of beauty.

Based on an impartial foundation, detached from the personal tastes of a person, beauty is reached that is universal, general, and eternal (Ardalan, 1973). The natural symbols of light and dark refer to a light that changes according to the time of the day and year and moves us from light to darkness. Everything has different meaning and creates emotional experiences. Because of our primitive instincts, humans need sheltered spaces to protect themselves from climate and other threats. This characteristic is referred as 'refuge' by Jay Appleton (Appleton, 1996). Nevertheless, Appleton proposed "habitat Theory" and advanced the notion of "refuge-prospect". Humans have an inherent love for vast open spaces which he referred to as "prospect." The refuge areas allow people to see the outside threats and resources. A meaningful space is created when prospect and refuge are both present, and one can be seen from the other (Hildebrand, 2008). Moreover, Grant Hildebrand (2008) has identified five survival-advantageous characteristics: prospect and refuge; complex order; peril; and enticement (Hildebrand, 2008).

It is quite evident in many perspectives that science has a deep relationship with nature. Anyone can define nature through numbers, geometry, and proportion which is more appropriate and reduces things to just objects. Natural symbols can be felt by our body and mind. Therefore, a deeply beautiful design has natural language, inherent geometric formations. All timeless architectures have a sense of restriction which is universal.

## Chapter 2 - Architecture of Bangladesh

### Location

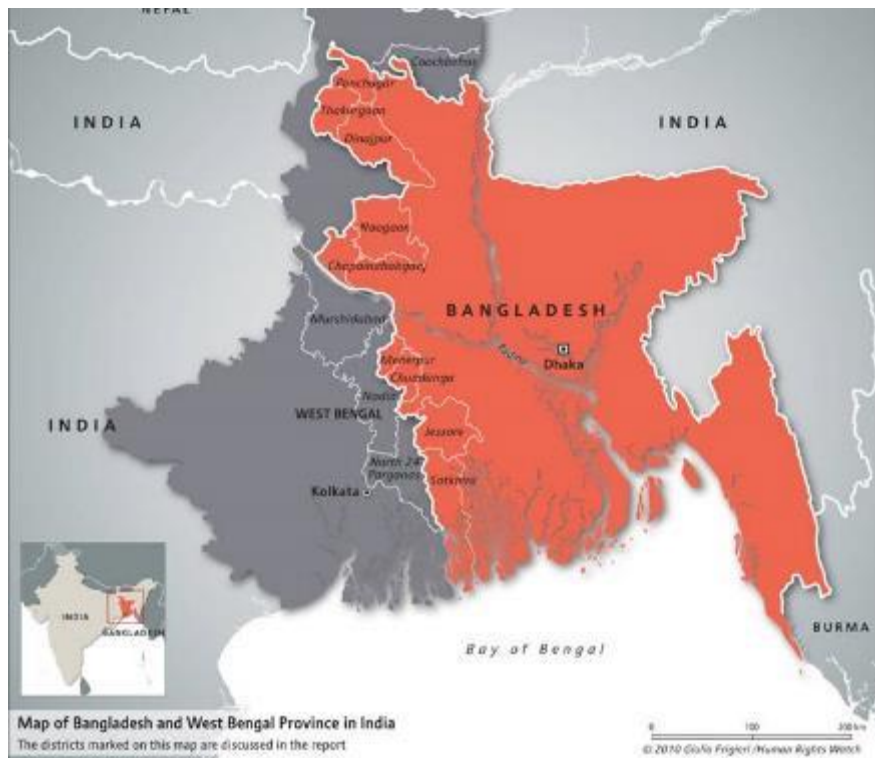
Bangladesh is located in the south of Asia and is a densely populated, low lying, mainly riverine country which shares more than 95% of its border with India and only around 5% with Myanmar. Bangladesh has a coastline of 580 km (360 mi) on the northern littoral of the Bay of Bengal. The country has an area of 147,610 square kilometers (56,990 sq. mi). Bangladesh is as big as **Iowa** (145,754 sq. km) yet its total population (166 million) ranks 8<sup>th</sup> in the world.



Figure 2-1 Location of Bangladesh (Maps, n.d.)

## Historical Context

Bangladesh may have only existed as an independent nation for 47 years, but its cultural roots go deep. Throughout its history, Bangladesh has been through political changes, with different rulers and has suffered different cultural invasions. Before 1947, Bangladesh was a part of British Empire. It was under the British rule for about 200 years, emerging as a part of Pakistan (called East Pakistan). In 1947 after breaking away and achieving independence from Pakistan, it became a separate country in 1971. As the result of the Bangladesh Liberation War. The history of the region is closely intertwined with the history of India and the history of Bengal. The history of Bengal includes modern-day Bangladesh and West Bengal in the eastern part of the Indian subcontinent—which is located at the apex of the Bay of Bengal, an area dominated by the fertile Ganges delta (Bengal, 2018).



**Figure 2-2 The ancient border-line of Bengal (Watch, 2018)**

(Presently, Deep Gray part is now in India, and the Brown Part is Bangladesh)

## Geographical Influence

The physical geography of Bangladesh is varied and has an area characterized by two distinctive features (Bangladesh, 2018):

1. A broad deltaic plain subject to frequent flooding, and
2. A small hilly region crossed by swiftly flowing rivers. (Bangladesh, 2018)

The majority of Bangladesh's elevations are only 33ft (10 meters) above sea level, and almost 80% of its land is in the lowland, the fertile Bangladeshi Plain. However, elevations decrease in the coastal south, where the terrain is generally at sea level. With such low elevations and numerous rivers, water—and concomitant flooding—is a predominant physical feature.

That's why Bangladesh is called the biggest river delta in the world. There are no real boundaries between the land and the river. Almost three hundred rivers and river channels cross Bangladesh, defining its geography and the people's way of life. Nevertheless, during the rainy season, almost 60% of its land remains under water in every year for about two months (Ahmed K. I., 2005). However, people survive in every year and regenerate their property again as if nothing had happened. Instinctively, one can understand that "Love" must empower them with courage and conviction. People in Bangladesh, love their country—they love their landscape's simplicity and have built an exceptional architectural style which is "**Deltaic Architecture.**" The style indicates a vast area's cultural and social identity which is extremely distinguishable and unique. However, its distinctiveness rests primarily on the deltaic condition of the region and its critical location in a wider geographical and cultural milieu (Haque, 1997).

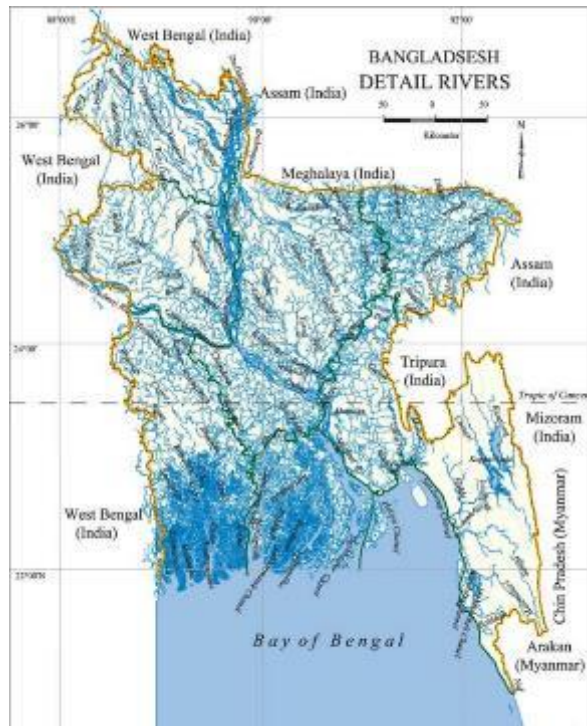


Figure 2-3 Bangladesh the biggest river Delta (Banglapedia, 2018)



Figure 2-4 Main rivers of Bangladesh (Banglapedia, 2018)

## Climatic Influence

### Bangladesh is neither a hot country nor a cold country:

Bangladesh is a tropical country whose climate is characterized by three distinct seasonal variations, especially with related to high temperatures, rainfall, and humidity. There are three distinct seasons in Bangladesh: a hot, humid summer from March to June; a cool, rainy monsoon season from June to October; and a cool, dry winter from October to March (Bangladesh Weather, 2018)

In Summary, Bangladesh has three distinct seasonal variations —

- **March to June -- A hot, humid summer:** Maximum Temperature ranges between 30°C and 40°C. **April** is the warmest month in most parts of the Bangladesh.
- **June to October -- A warm, rainy monsoon:** Monsoon is a season with dominant wind; occurs in the area of South and Southeast of Asia. Dominant Wind blows from the southwest between May and September and brings rain. It also brings more compact cloudiness, high humidity even during the day, frequent rains but also a decrease in temperature. In the monsoon season, Temperature drops to 30/32 °C (86/90 °F) during the day but remains high at night, about 25 °C (77 °F). (travel, n.d. )
- **October to March-- a cold, dry winter;** the average winter temperature for most of the country is about 50°F or 10°C. January is the coldest month.

Example: Average temperature of two cities (Saidpur & Dhaka) of Bangladesh has given below:

*Average temperatures - Saidpur*

Saidpur	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min (°C)	11	13	17	21	24	25	26	26	25	23	18	13
Max (°C)	23	26	31	33	32	32	32	32	31	31	29	25
Min (°F)	52	55	63	70	75	77	79	79	77	73	64	55
Max (°F)	73	79	88	91	90	90	90	90	88	88	84	77

**Table 2-1 Average temperature of Saidpur city (travel, n.d. )**



*Average temperatures - Dhaka*

<b>Dhaka</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Min (°C)	13	16	20	24	25	26	26	26	26	24	19	14
Max (°C)	25	28	32	34	33	32	31	32	32	32	30	26
Min (°F)	55	61	68	75	77	79	79	79	79	75	66	57
Max (°F)	77	82	90	93	91	90	88	90	90	90	86	79

**Table 2-2 Average temperature of Saidpur city (travel, n.d. )**

The temperature in Bangladesh is benign as it is neither so cold nor so hot. People can live without having any kinds of active heating and cooling systems, such as air conditioning (AC), heating, cooling, etc.

**Sunshine:**

The sun in Bangladesh regularly shines in the dry season, while in the monsoon season, from June to September, it is rarely seen. Here are the average daily sunshine hours in Dhaka:

*Sunshine - Dhaka*

<b>Dhaka</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Sun (hours)	9	8	7	6	5	3	2	2	3	6	8	9

**Table 2-3 Average sunshine of Dhaka city (travel, n.d. )**

**Rainfall:**

The monsoon climate is responsible for heavy rainfall in Bangladesh. However, the monsoon is felt less in the western region of Bangladesh where the annual rainfall is around 1650 mm (60/63 in). On the other hand, on the east coast (Bay of Bengal), the rains reach 2,900 mm (115 in) per year. Average precipitation of a coastal city, Chittagong, is given below.

*Average precipitation - Chittagong*

<b>Chittagong</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Year</b>
Prec. (mm)	5	25	55	140	305	600	735	540	265	190	70	15	<b>2940</b>
Prec.(in)	0.2	1	2.2	5.5	12	23.6	28.9	21.3	10.4	7.5	2.8	0.6	<b>115.7</b>
Days	0	2	3	7	12	18	22	20	16	9	3	0	<b>112</b>

**Table 2-4 Average precipitation of Chittagong (travel, n.d. )**



## **What is Deltaic Architecture?**

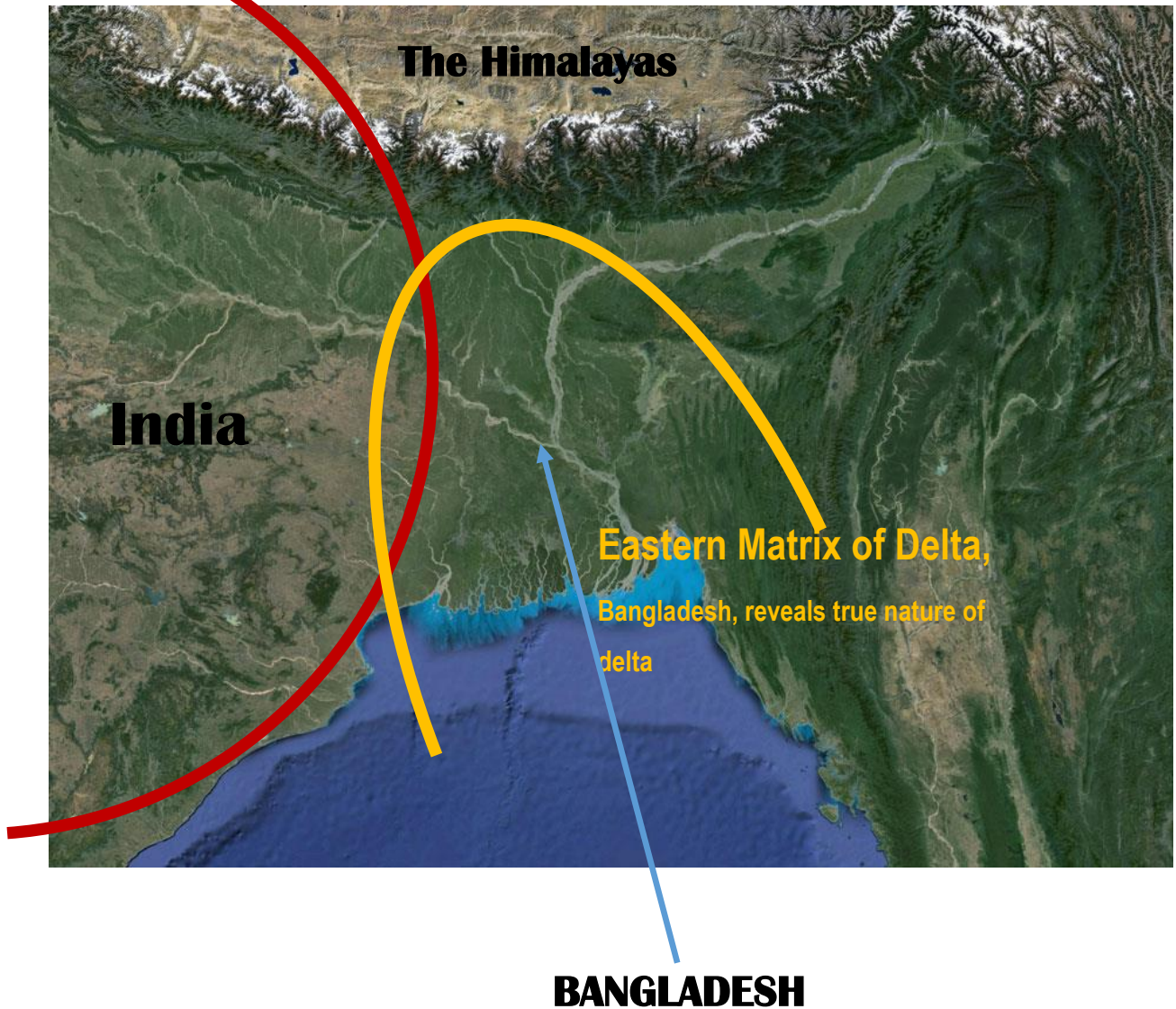
There is little difference between Bengal Architecture and Deltaic architecture (Haque, 1997), yet the subtle change is quite significant. I have already mentioned that the Bengal Architecture includes the architecture from modern-day Bangladesh, which is the Eastern Region of Bengal as well as the architecture from the West Bengal region of modern India.

Ganges-Brahmaputra Delta dominates most of Bangladesh's geography. Bangladesh, which is the eastern region of Bengal, is mostly a delta—a pure alchemy of land and water (Haque, 1997). In the Bay of Bengal, in the south, three of the world's most significant rivers, the Ganges, the Meghna, the Brahmaputra, discharge every year more than a billion tons of sediments and more water than all of Europe's rivers put together. About 700 water channels including tributaries flow through the country, constituting a waterway of some 15,000 mi in total length. The land in Bangladesh, in fact, is formed through silt brought by the rivers. Eventually, the whole country of Bangladesh lives with the ebb and flow of the water. Nothing but rivers have given the land an amorous nature and have characterized the region's climate, topography, ecology, and hydrology (Haque, 1997).

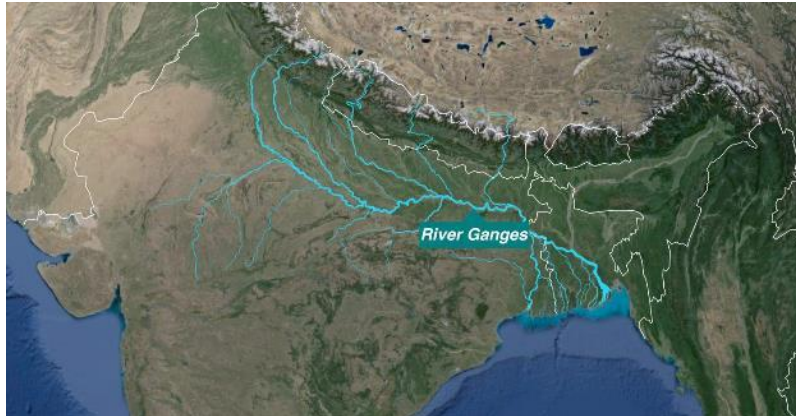
However, The Delta has two geo-cultural matrices; the Delta, a part of the eastern orbit, has been considered the most influential aspect of the Indian culture: On the one hand, a part of the western orbit which also expanded gradually towards Europe. It is called the “western matrix” which has given the culture a visible superstructure (Haque, 1997). On the other hand, Bangladesh belongs to the eastern matrix that reveals the true nature of the Delta—an ever-changing landscape. Therefore, we can say that; Bangladesh, the Delta, is a discrete bulge of the shoreline formed at the point where rivers (the Ganges, the Brahmaputra, the Meghna), enter the Bay of Bengal. The

bulge is formed because sediment is supplied more rapidly than it can be redistributed by basinal processes, such as waves and tides. (Ulty-files, Hasan, 1998).

**The Western Matrix of Delta**, which  
has given the culture a visible superstructure



**Figure 2-5 Two geo-cultural matrices of Delta (Earth, 2018)**



**Figure 2-6 The Ganges and the Development of Eastern Matrix of Delta (Rowlatt, 2016)**

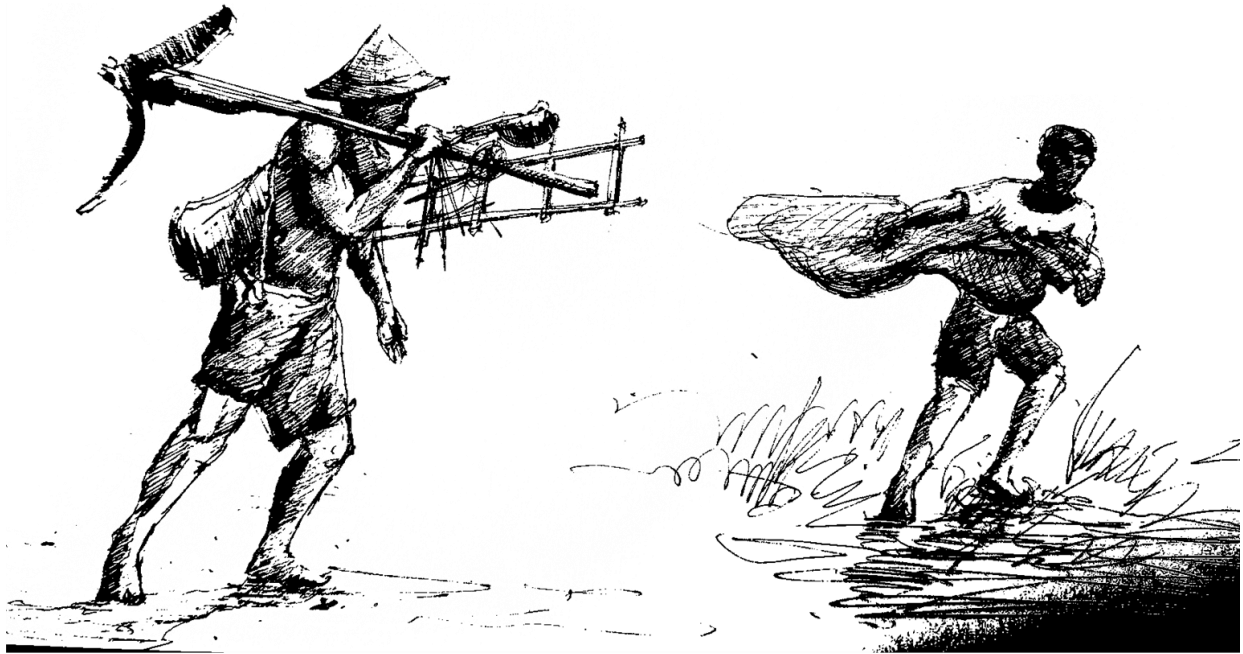


**Figure 2-7 The true Nature of Delta; A pure chemistry of Land and Water (Earth, 2018)**

### **The Delta and Architecture**

Bangladesh is the biggest river delta on Earth. The history of civilization in Bangladesh (the eastern matrix) is shaped by nothing but the predominance of water—a world of moistness, fecundity and lushness—where cosmological and valorized concepts are generated from riverine dynamics and agricultural rituals (Haque, 1997). More than three-quarters of Bangladeshis depend on agriculture and fishing, which are the country’s primary resources. In short, there are two cultures—Rice-culture and Fishing culture, and these are the basis of value-construction, of a

collective *ethos* and *mythos*, and of the articulation of self-Identity (Haque, 1997). Eventually, these life-sustaining activities have created two paradigmatic figures: -



**Figure 2-8 Paradigmatic figures: A man with the plough and a man with the net (Haque, 1997)**

1. ***The man with the plough*** – Farmers dig the soil. Then a plough is drawn by cows/water buffalo; thus, ploughing breaks up the soil and lastly farmers plant seedlings & ensure that the water level is equal. Eventually, they learned the use of bamboo, Bamboo-weaving, and wood construction from their ancestors.
2. ***The man with the net***—The Fishermen’s methods in Bangladesh are those of their ancestors—they make their own nets, dry them in the sun; everything is done by hand. They learned clay-molding from their ancestors.

The art of weaving is an integral architectural element of the Delta, and on the other hand, clay kneading has led to the art of pottery, and to the production of magnificent Terra-Cotta and brick buildings (Haque, 1997).



**Figure 2-9 \*\* “Jor Bangla” Temple; Terra-Cotta Works of Delta (Nayeem, n.d.)**

**\*\* Jor-Bangla**, also called *char-chala* or *yorubangala*, is a style of Hindu temple architecture that arose in Bengal. The style involves two structures that resemble the traditional village huts of the region, one that serves as a porch, in front of the other that serves as a shrine (**Fig- 2.:10**). (Jorbangla-temple, 2018)



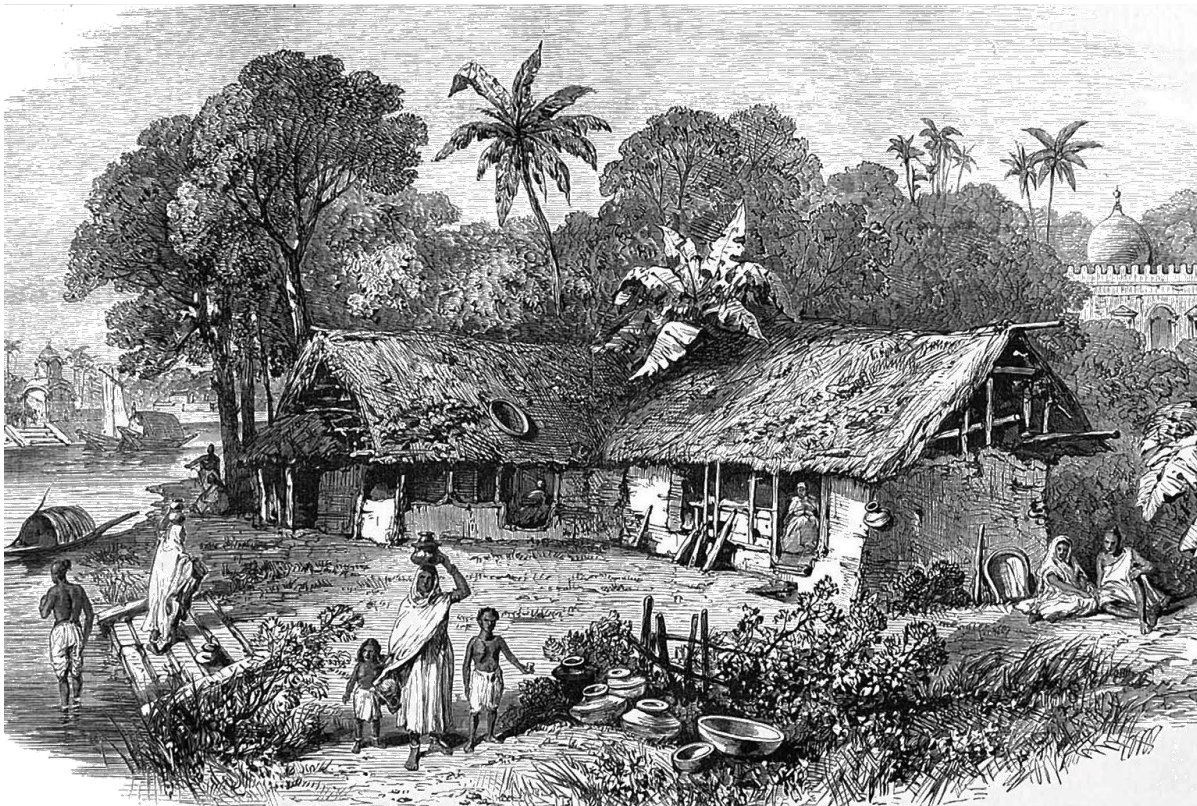
**Figure 2-10 Kantajew Temple, Bangladesh: Clay Works, Terra-Cotta Work (Advisor, n.d.)**



## Deltaic Architecture and Its Morphologies

### 1. Structural Pattern of Delta -- “Pavilion Structure”

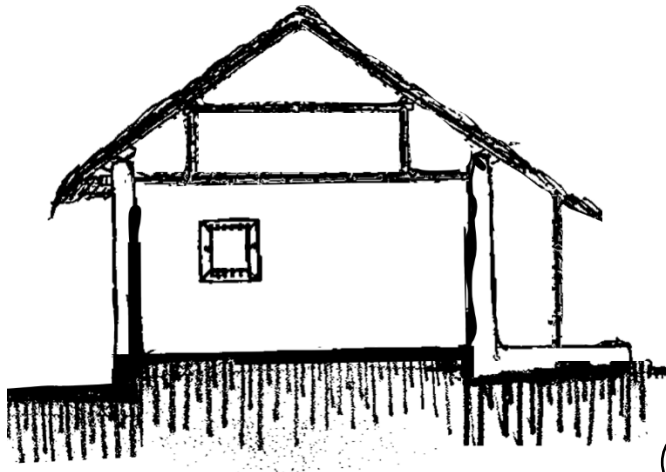
The Singular presence of the Pavilion Structure is the rustic “Bengali hut,” which is essentially a roof meant to thwart the intense sun and the torrential rain and the walls, which are permeable to the movement of air and placed well within the perimeter of the roof (Haque, 1997).



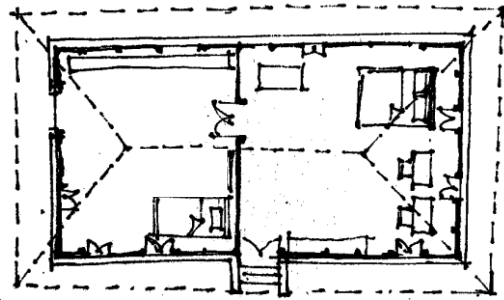
**Figure 2-11 Rustic Bengali Hut, 1874 (News, 1874)**

The hut is the basis of Bengal’s architectural ideas and concepts; nevertheless, these huts have features like verandahs, terraces, and semi-enclosures which create a dramatic relationship between inside & outside.

2. **Material** --- Mud, Wood, Bamboo, Thatch, etc.
3. **Construction Techniques** — Handmade



**Figure 2-13 Section of a Bengali Hut**



**Figure 2-12 Plan of a “Bengali Hut”**

The primary material found in the delta is clay, although wood, timber, thatch, and bamboo have also been used commonly as building materials.



**Figure 2-14 A hut with a thatched roof and permeable mud facades**

Until now, people of this region used the ubiquitous clay in order to build their house enclosures. However, these molded clay works were eventually shaped into forms like-burnt bricks and terra-cotta which were some of the very first steps in finding durability and solidity in deltaic architecture.

## The Architecture of the Delta

A "Hut" is a cell of Bengal architecture, and the Bengal's household is the morphological development of rustic huts and pavilions. The hut is also the basic unit of the universe of the Bengali peasant, which is also the basic structure to form a traditional Bengali household. Hence, the household is the unit of production; both tied intimately to the milieu formed by the hut and the *Uthan* (a court) and the wider paddy field (Haque, 1997).

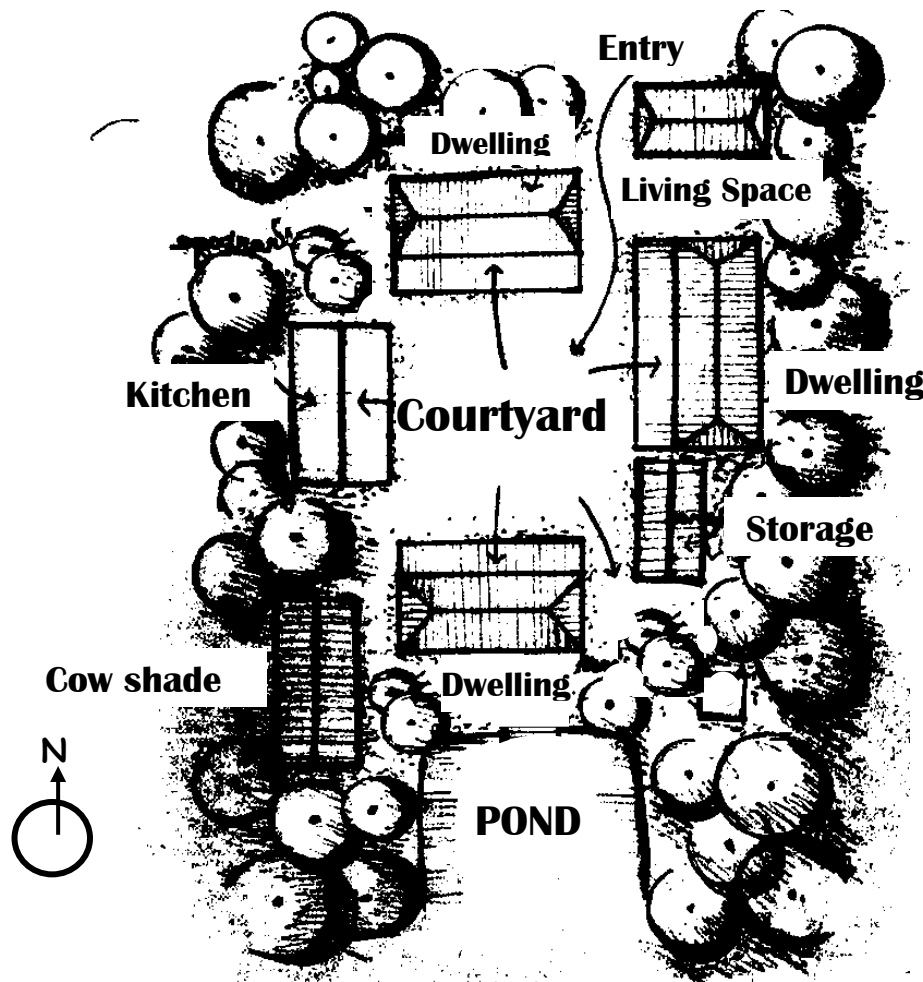


Figure 2-15 A Bengal Household (the unit of production); An Invisible Pavilion of Delta.

Here, the entire household is an invisible pavilion, yet one can feel its visible presence as well; nevertheless, it is a Bengal form of the expression of social equity, local ecology, and mythology.



## A Rural Traditional household of Bangladesh

The cell of Deltaic Architecture, “A hut,” is a small single-story mostly rectangular building of crude construction—serving as a temporary or permanent shelter for the people of this Delta. Gradually, they got the unit of production, “A **Deltaic Household**,” where the space sequences and circulation patterns were significantly different than in any other part of the world. Undoubtedly, this is because of its geographical situation and climate. It is a matter of great sorrow that while the issue of identity has been foremost in Deltaic Region’s (especially in Bangladesh) architecture yet the biggest Delta, the most profound site of identity-making, has been poorly addressed.

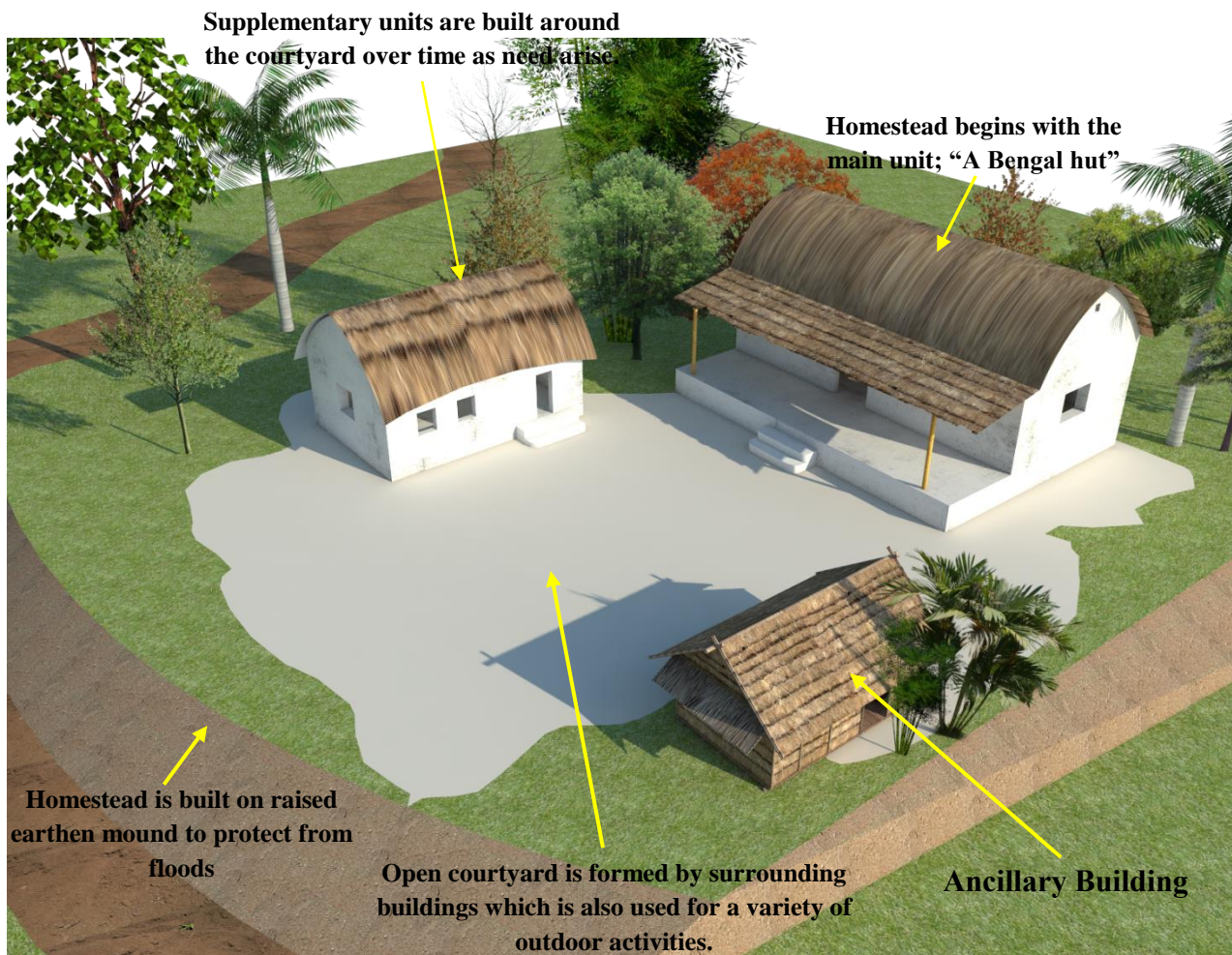


Figure 2-16 A Traditional Bangladeshi Household (Karim, 2015)

We have already understood the basic features of Bengal architecture and the space morphologies of the Delta. Undoubtedly, these are the examples of deeply beautiful architectures and are deeply rooted to its culture and heritage. However, in this study, I will discuss Deltaic architecture through Professor Gary Coates' "Deep Beauty" framework.

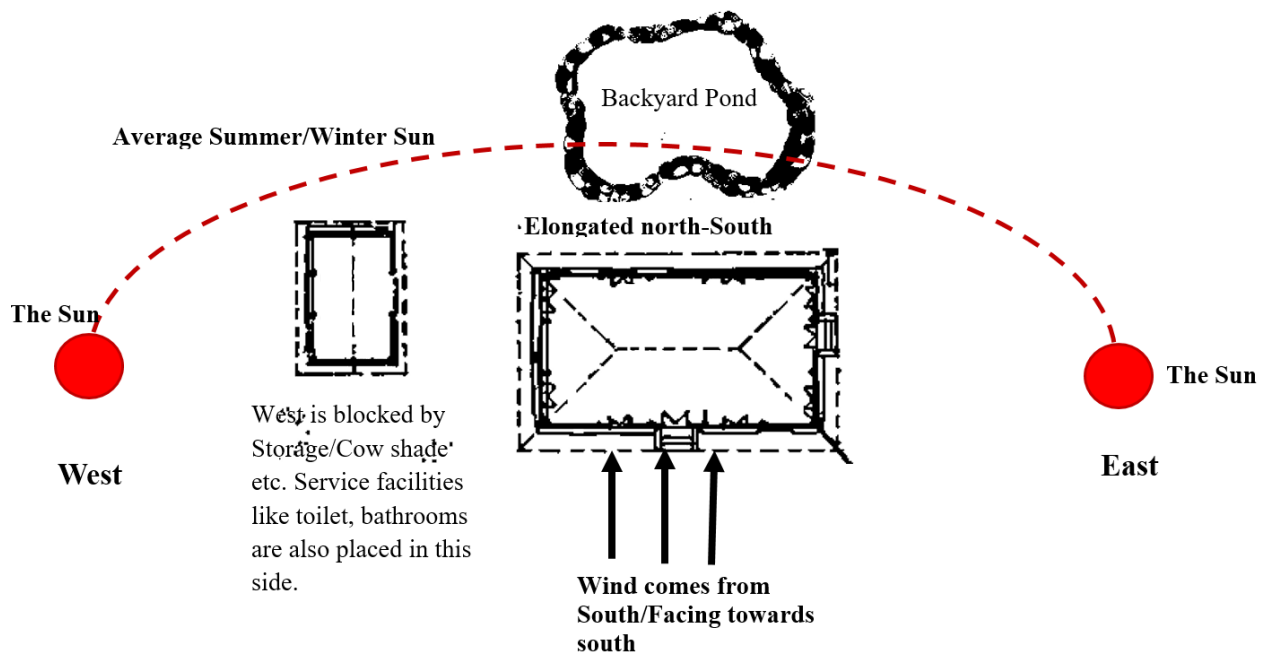
## **Functional Level**

### **The Orientation of the Building**

The relationship of sun, wind, and light with the building is usually considered while making of these traditional households. People always try to make these structures south facing as the wind comes from the southern hemisphere and the primary concern of the building process is to avoid the hot summer sun. Nevertheless, the orientation of these traditional buildings is deeply related to the climate. Characteristics of the hot-humid area are high summer day-time temperatures, high relative humidity, and little diurnal temperature variation. (Guide, 2016).

- **In Bangladesh – Orient along East and West, facing towards South.**

Bedrooms/Dwellings should be placed in the direction of the prevailing wind for proper natural ventilation. Kitchens should have cross ventilation. For this, eastern or the southeastern/western corner is the best for kitchens (Fig: 2.16). In some parts of the country, especially southern coastal areas, the pond is an essential part of the house and has manifold uses. Homestead ponds are used for multiple purposes including washing, bathing, watering livestock and irrigation for dyke or homestead vegetable production.



**Figure 2-17 Basic thinking behind the building orientation.**

In addition, many households excavate soil with which to raise the base of their homes in order to avoid flooding. As a result, many households in rural Bangladesh possess a small pond close to their homestead (Huda, 2009). Moreover, a house is surrounded by perennial trees giving protection from sun, storms, and cyclones and also offer a degree of privacy (Pond Aquaculture in Bangladesh, 2010).

### **Building Materials and Construction Techniques:**

- **Material:** mud, wood, bamboo, Thatch, etc. (all of these are purely organic and natural)
- **Construction techniques:** Entirely handmade.

### **Family Structure**

Due to the joint family system, the households in Bangladesh are large. Nationally, the average household size is 4.5 people per household, which is calculated by dividing the household population by total households (Arcgis, 2018). However, in rural areas, the family usually consists of grandparents, two couples, and their children. The culture of the region favored a joint family system in which three or more generations lived in the same house. After marriage, the son brought his wife home, and they both resided with his parents.

## **Social Setup**

Grandparents stay inside the house and help with household chores. Men are responsible for outdoor work while women usually remain inside as housewives. The trend of working women is slowly penetrating into the society as the economic situation is making it difficult to meet the expenses.

The architecture of the Delta is a part of the architecture of the Islamic world, as well as Indian Architecture before the advent of Islam in the sub-continent. Islam has influenced these traditional houses. The maximum build-out of a household has an inner court with surrounding verandahs, mainly used by women. In every household, there will be a separate room with a verandah named “*Boithak Khana*,” (Fig: 2.22) or Sitting Room, for outside people to come and socialize. The courtyard forms a social center of the house that promotes maximum interaction of family members and even interaction with the neighbors. It provides a natural setting, some furniture to sleep or relax and sitting areas for family discussions, all within the privacy and safety of the house. This courtyard is also a place where essential family functions, small cultural programs, and even religious formalities take place. Kitchens are oriented in such a way that women can easily maintain household activities from there (Hasan, 1985). The kitchen yard is linked up with the central courtyard with a privacy barrier to have more privacy for the female members (Hasan, 1985).

## **Comfort**

A Bengali household is an organic development and an example of vernacular architecture. The household also has influential semi-outdoor areas, shaded courtyards and well-ventilated

indoor areas having sufficient window openings for natural light. Therefore, these traditional deltaic households are comfortable places in which to live, in the sense that these homes are the examples of climatically adapted and have been built meticulously with local materials. These traditional Bengal houses have sufficient windows and doors. Therefore, wind passes through them quite easily. At the heart of household is the courtyard that protects the interior spaces from direct sunlight. In some regions of the sub-continent, the courtyards serve the purpose of being rainwater collectors. The functions of the spaces are flexible, and their usage is adapted according to the time of the day and the seasons. In summers, most of the time, people prefer to stay in verandahs or in the courtyard where the plantings provide fresh air. Sometimes a perennial tree is planted in the middle of the courtyard in order to protect residents from the hot summer sun. However, in the winters, people prefer courtyards during the day to gain maximum heat from the sun. All traditional Bangladeshi households have one or two separate kitchens (Fig: 2.16) to avoid hot air and smell, especially during the hot summers.

## **Typological Level**

### **The sense of History, Community, and Place**

These traditional houses are historically connected, have a strong sense of social equity and local placemaking. A clear understanding of the architectural development history of Bangladesh is made difficult by the problem of geography and politics. Hindu and Muslim architecture historically influenced the Delta (Hasan, 1985); nevertheless, the delta went through

the phase of early monumental architecture (Stupas, Temples, and Monasteries, basically was brick architecture) and then Islam came into this delta with horizontal and pavilion architectural features (like- mosques, pavilions, etc.). Gradually, the original idea of the pavilion was manifested in three primary forms. Such as—

- The Bamboo-woven huts on stilts
- Thatch huts on an earth platform
- The use of brick (Temples, Mosques, etc.)

Features like verandahs, courts, and terraces are all a part of the region's architectural history. The households of the Delta are nothing but courtyard developments that possess a sense of history and place. The deltaic courtyard interconnects multiple forms and functions (Fig: 2.16) instead of being located in the middle of a single structure (examples: Havelis of Pakistan, Courtyard houses of Pakistan).



**Figure 2-18 The Bamboo-woven hut on stilts**





**Figure 2-19 Thatch hut on an earth platform** (Advisor, n.d.)



**Figure 2-20 Use of Brick in Delta, “Jorbangla Mosque.”** (wikipedia, n.d.)

The influence of Delta was the quite extraordinary, leading to temples shaped as “Bengal Huts.”

These types of regional interpretations are the unique architectural features.

### **Building Type**

Traditional Houses in Bangladesh are basically based on courtyard housing typology. It mainly involves an open-to-sky court that is surrounded by semi-outdoor enclosures. This courtyard connects different functions together and creates a shared multipurpose space named

**“Uthan.”**



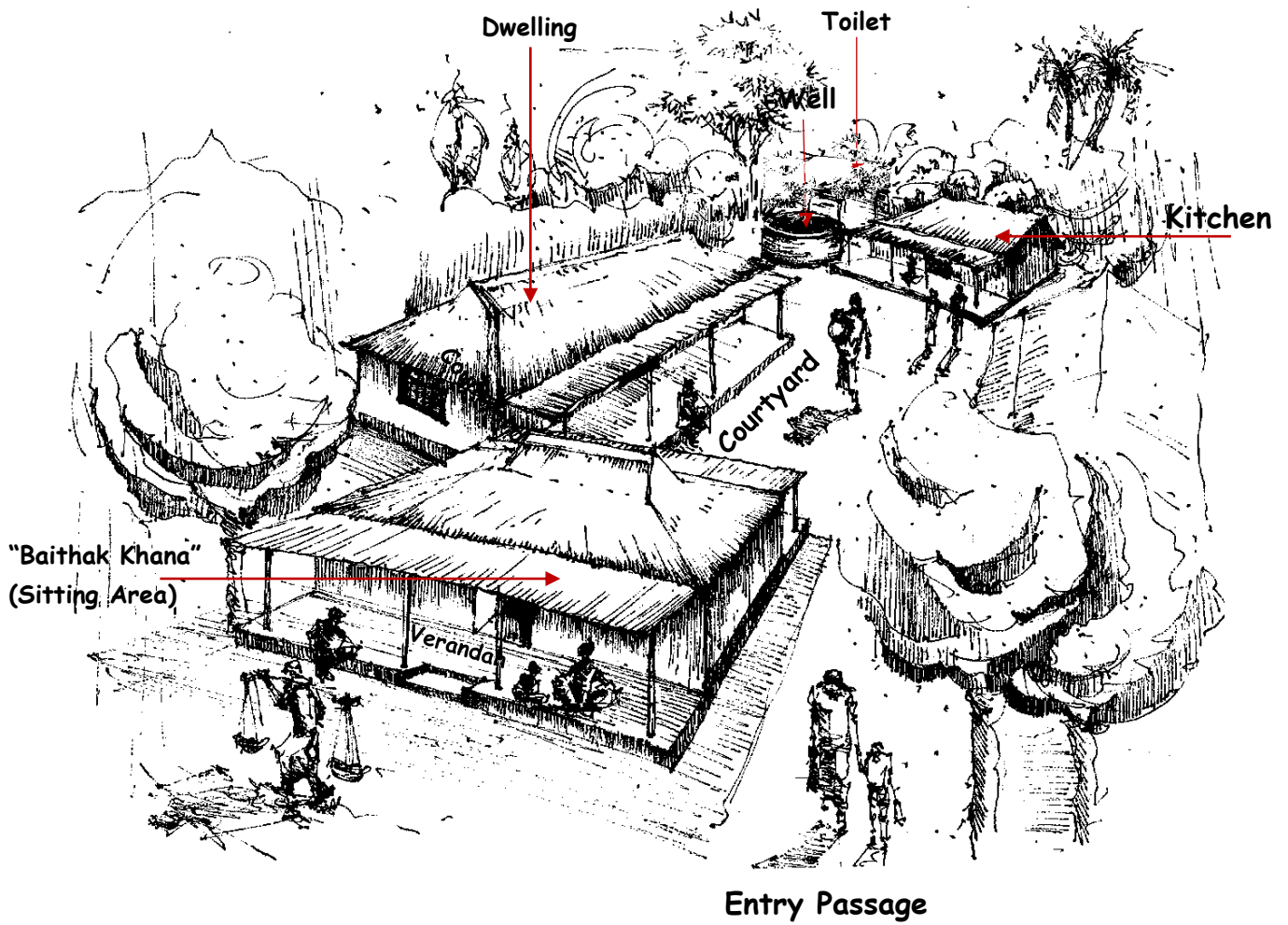


Figure 2-21 A Bengal Household (the unit of production)

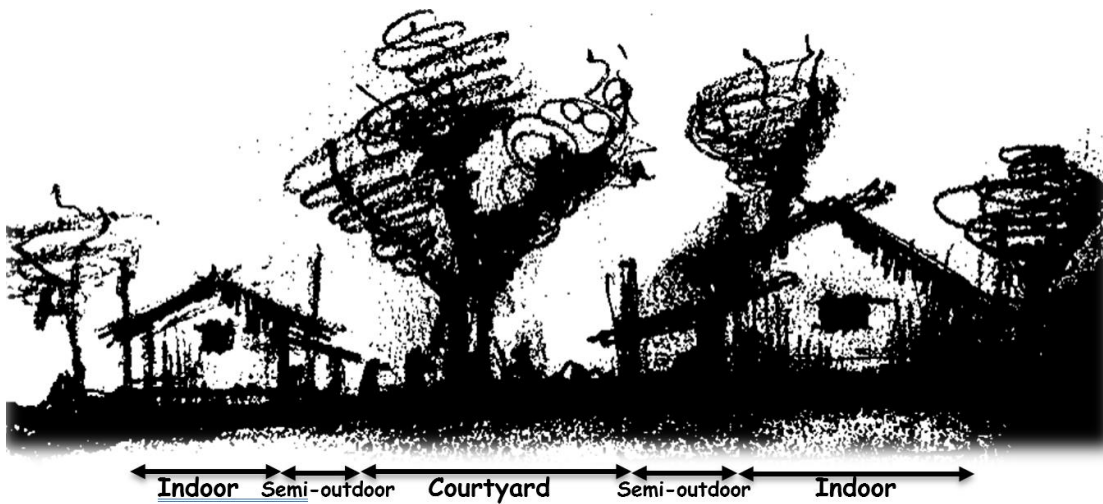


Figure 2-22 A section of Bengal Household (space sequences of the Delta)

The entrance of a typical Deltaic Household is through a simple pathway; it doesn't have any gate or marked doorway. The first room that faces the street is called the '*baithak*' (sitting area). '*Baithak*' is a male domain and serves as a transition between the public space and the private space (Bindia Thapar, 2004) "*Baithak*" is like a Living Room. In most cases, the main entrance should happen just beside the "*Baithak*" A typical household had two courtyards, the inner one for the women and children of the house and the outer one for the males. "Inner Houses" are the Dwelling units which work like bedrooms.

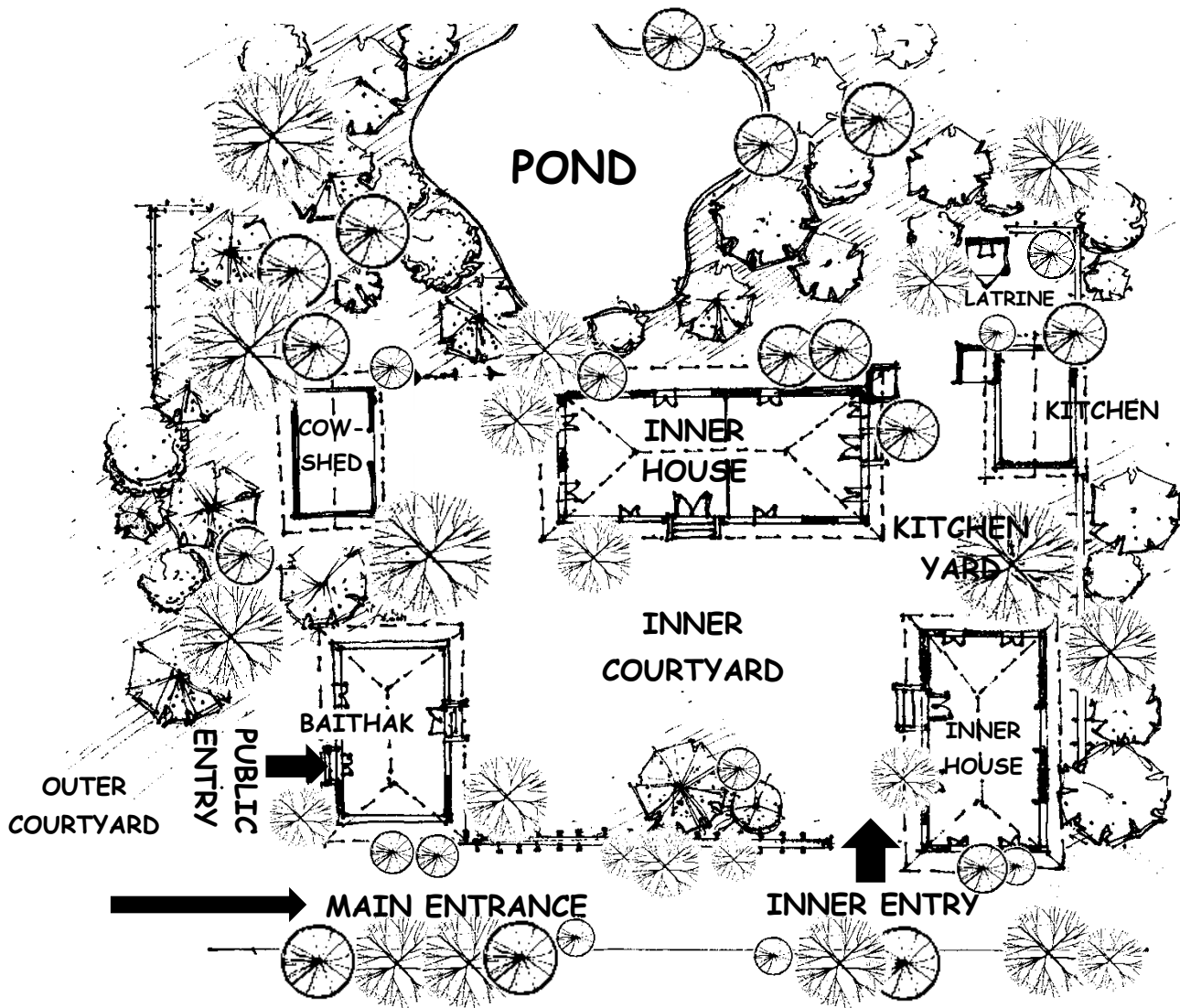
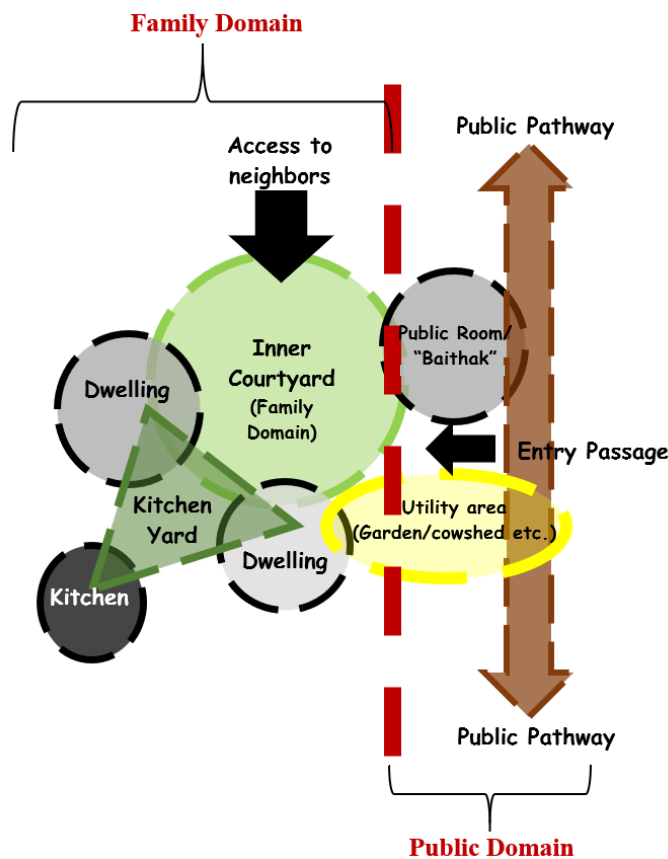


Figure 2-23 Plan of a traditional house form in rural Bangladesh (Hasan, 1985)

Some features like the inner court (Family domain), the outer court (Public domain), have an extra privacy barrier to have more privacy for the female members which are the result of both the Islamic and Hindu influences (Hasan, 1985).

In the house, all the units are organized in such a way that a privacy barrier separates the family area and formal area; especially for women's veiling customs which is kind of religious beliefs. There are separate service areas for both inner and outer house. All the units are single spaces except the main dwelling unit.



**Figure 2-24 Space morphologies of a Bangladesh's traditional rural house**

The main dwelling unit space is separated into two parts with a partition. One part is the parents' sleeping space, and the other half is used for sleeping spaces for grandmothers and daughters. The second half is also used for dining. The courtyard is mainly used as multipurpose space; activities like--outdoor living and Paddy thrashing, paddy drying, cloth drying, and so on,

take place in yards. Previously, the courtyard was mainly used for \*\*paddy thrashing by a cow (Hasan D. M., 1985). Therefore, again, it is quite evident that the deltaic household morphologies are also influenced by “Rice Culture” that I have already mentioned earlier.

\*\* *Paddy Threshing* is the process of loosening the edible part of paddy (rice) from the husks and straw to which it is attached.

## **Biophilic Design**

Biophilic design is a natural way of creating a human settlement which always seeks to fulfill our innate need to affiliate with nature in the built environment. Bangla’s traditional rural houses are the true examples of biophilic design. All humans have their inborn intention to be with nature and, in fact, they feel their soul within their green surroundings. Plants in the courtyards and a water feature like an adjacent pond bring nature into the house. The presence of earth is shown when plants or trees are rooted in the ground. The history of Bangladesh reflects these kinds of interpenetrations. The living spaces of our ancestors also used living spaces as their reflective mirror of daily lives—this Deltaic household is the production unit of Bengal Architecture (Haque, 1997).

Seasonal changes affect the aesthetic appeal of the courtyard. In winters, the plants wither, leaving a more barren landscape. When spring arrives, fresh flowers and green leaves showed up that are enjoyed all through summer until fall, when the plants began to change color, and fallen leaves fill up the courtyard floors (Reynolds, 2002).

Plants in courtyards influence all of our senses. Moreover, the traditional houses of Bangladesh have many aspects of biophilic design, like the use of local natural materials,

contextual interpretations, construction types, and so on. However, it is evident that people like to have around them natural archetypes or simulations of nature. We need shelters not only for physical safety but also for our mental peace and tranquility which can be achieved through designing a strong connection between architecture and nature. Architecture is often linked with order and balance as well as with natural rhythm (Hildebrand, 2008). Space which we may call “In-Between” space inside and outside—the semi-outdoor areas of the Delta (Fig. 2.23), creates an ambiguity between inside and outside. Nevertheless, the traditional house of Bangladesh is an example of Biophilia-- where plants provide shade and cool the air through transpiration; and in times of rain, plants help the earth to dry slowly, dispersing a strong aroma in the air for the senses. The water on the ground acts as a mirror, reflecting the sky and its surroundings and dispersing the sunlight to form patterns of light and dark (Reynolds, 2002).

## **Archetypal Level**

### **The Orientation of Space:**

In space, one’s location in relation to the cardinal directions is important for a person to understand where he or she is. The primary system of the orientation to the cardinal directions of north, south, east, west, and to the vertical axis constitutes the entire world (Ardalan, 1973).

The traditional house form evolved rather slowly through centuries under the influence of many factors working simultaneously -- the land, the culture, the climate, the available resources and so on. The basic form of a traditional rural 'Bengali House' is essentially a 'Shelter' that

responds to its climatic context and a 'Social unit of Space' with respect to its cultural context (Hasan, 1985). The organization of a traditional house in rural Bangladesh is primarily a response to the functional uses and activities of various spaces. In the traditional house of Bangladesh—buildings are organized around an open-to-sky court, which is surrounded by semi-outdoor areas with a unique space sequence of **“Indoor—Semi-outdoor—Courtyard—Semi-outdoor—Indoor”** (Fig: 2.23). The orientation of the traditional house in Bangladesh is an example of the simplicity of vernacular architecture. It is an organic style that is designed based on local needs, reflecting local traditions, and local availability of construction materials.

### **Geometry, Proportion, and Number:**

As I have already mentioned, a traditional house in Bangladesh is an example of simplicity and vernacular architecture.

- **Geometry:** Traditional houses have simple rectangle forms; rarely one can find any different geometry in Bengal households (Fig: 2.23). Although Deltaic Architecture has some distinguishable space sequences, morphologies and an inherent harmony of space, the architectural design process doesn't follow any strict geometric formation.
- **Proportion:** Traditional houses reflect “Human Scale.”

Deltaic architecture reflects horizontal development; Maximum traditional houses are one-story.

Schoenauer & Seeman (1962) have made an observation about the courtyard houses:

“It is obvious that in a large country like India one must encounter many regional differences in courtyard house building traditions. However, there is one characteristic which applies to the Indian builder in all regions: he has an excellent sense of proportion and is highly skilled, despite his simple tools, producing buildings with a distinctive dignity and beauty.” (Page: 43). (Schoenauer, 1962)

- **Number:**

Numbers in Islam are qualitative as well as quantitative. For example, in Islam, the number ‘4’ symbolizes the four directions, the four seasons, the four gateways to heaven (Ardalan, 1973) and the four rivers that flow in heaven. Although religious (especially, Islamic and Hindu) values and architectures influence the deltaic household patterns (Hasan, 1985) the style doesn’t reflect any significant numbers in the process of design. The traditional rural architecture of Bangladesh is an example of the phenomenological interpretation of context, culture, and climate.

### **Spatial Polarities in Natural Settings**

There are some preferences for different kinds of spaces. Kitchens are open and extend to the kitchen yard with open kitchen. Female members prefer to cook outside the kitchen in the fair days to avoid smoke and heat. In Bengali culture, women are the main persons responsible for maintaining households. Therefore, the placement of the kitchen is crucial, so that even in the working time a woman can monitor her household from the kitchen yard. These houses also have internal links to the house with the adjacent clan group (Hasan, 1985).

## Chapter 3 - Louis I Kahn and the start of Bengali Modernism

### National Assembly Building, Dhaka, Bangladesh

The development of Deltaic Architecture in Bangladesh was a complex phenomenon. Throughout its history, Bangladesh has seen many transformations concerning its architecture.

The beginnings can be traced back to the “*Pundranagar*” Civilization from the 3rd century BC to the 12th century AD. Between the 8th century and 12th century, the Buddhist dynasty known as the Pala Empire ruled Bengal. During that time, the majority of the population in Bengal were thought to be Buddhists. After that, the Hindu Sena dynasty came to power and Bengal civilization history had gone through the prevalence of Hinduism which is later transformed further by the arrival of Islam in the 13th century and continued for hundreds of year (History of Bangladesh, 2013). Lastly, Bengal was governed under the British rule \*\* (*East India Company rule: 1757-1858, and British Empire rule: 1858-1947*) for more than 200 years (The British period, c. 1700–1947). Eventually, Modern Bangladesh emerged as an independent nation in 1971 after breaking away and achieving independence from Pakistan in the Bangladesh Liberation War.

The “Bengali Renaissance” started earlier in the 19<sup>th</sup> century by the cultural and social dynamics of colonialism leading towards what came to be known as the “Bengali Renaissance” (Haque, 1997). During the Renaissance period, radical experiments, formations, and innovative creations had influenced Bengali Literature & arts; and yet they failed to make any morphological changes in Deltaic Architecture. The architecture of the Delta has a deep commitment to local culture; it is a combination of a scientific temperament with a spiritual tenor. The National Assembly Building at Dhaka, Bangladesh (1961-1982) by Kahn is yet to be fully appreciated and understood—it is an essence of the land and the building culture of Bangladesh. Undoubtedly, this



building is an epic work and the most influential landmark which has implications for the architectural language of the region. Robert McCarter, the author of the book *“Louis I Kahn,”* says, --"It is one of the twentieth century's greatest architectural monuments and is without question Kahn's magnum opus."

This chapter's study is significant as the Master Louis I Kahn has defined Bengal architecture through this building, and the project was a declaration to the world that the architecture of delta is different, unique and has its own architectural morphologies as well. Kahn's building is significant in this research because it is also an example of a regional approach to the architecture of place. Therefore, the project is the pride of the Bengali Modern Period. Famous Bangladeshi architect, urbanist and architectural historian, Dr. Kazi Khaleed Ashraf, in his book named *“Pundranagar to Sherebanglanagar: Architecture in Bangladesh”* says—

“Two architectural phenomena stand out as seminal expressions of the Bengali Modern Period: the Powerful creation by the American Architect Louis I Kahn of the National Assembly Building at Dhaka and the pioneering work of architect Muzharul Islam.”  
(Haque, 1997)

As my scholarly intention is to address the inherent power of Bengal architecture, the National Assembly Building will provide a basic understanding of the unique architectural features of the Delta. This building is also of international interest as it defines a nation's architectural identity globally. However, the building is an example of critical regionalism which is quite extraordinary for an example of monumental modern architecture. In the history of Deltaic architecture, the National Assembly building has a tremendous impact as the project introduced Bengal style of modern design.

## **An example of Critical Regionalism**

This chapter will illustrate the philosophical and conceptual features of the building and will explore how it meets the criteria of Kalbaugh's five points of critical regionalism. The National Assembly building is important because of its conceptual and philosophical aspects; in fact, the project created a Bengal Architectural Philosophy. Professor Kazi Khaleed Ashraf says:

“The beginning of the project was a biblical undertone. Kahn, in narrating his struggle, mentions that on the third day of dwelling on it (the assembly), he felt out of bed and conceived the idea that the assembly is of a transcendent nature. More intriguing into logically is the question he had posed earlier: how the buildings are to take their place on the land? This two-fold theme the transcendent nature of the assembly and the way buildings are to take their place on the land—becomes Kahn’s primary reflection on the project and the basis for the architecture. (Kahn, 1994).

Douglas S. Kelbaugh's Five Points of Critical Regionalism: It was an attempt of Professor Douglas S. Kelbaugh to define critical regionalism. He believes that a Critical Regionalism should have five characteristics or attitudes.

National Assembly building is an example of Critical Regionalism. A brief Analysis of National Assembly Building under Kelbaugh’s five points of Critical Regionalism has been prepared. Douglas Kelbaugh has given five basic points regarding Critical Regionalism—

1. Sense of Place
2. Sense of Nature
3. Sense of History
4. Sense of Craft
5. Sense of Limits

## **The Sense of Place**

(The Genius Loci)

The sense of place means the Genius Loci which means a prevailing character, atmosphere or essence of a place. Kelbaugh says—

“Critical Regionalism is a simpleminded or excessive importation from other places. Critical regionalism honors local climate, topography, building materials and building practices. It refers local authenticity to sophisticated imitation. This act of protection is also an act of resistance (p.186).” (Kelbaugh, 2007)

National Assembly Building, respects local climate & topography. The project also reflects traditional building practices, and it used indigenous materials. The building has historical authenticity and is an example of traditional deltaic architecture. Architect Louis I. Kahn explored various local aspects such as structural techniques, indigenous materials, local climate, and context. A brief explanation of this massive and epic project’s regarding its contextual approaches are given below—

### ***Kahn Creates a Bengal Style of Modern Architecture***

Louis Kahn was successful defining the new nation's architectural identity, and perhaps he even designed a specific way of being-in-the-world, to be precise, being in the Delta. For the Assembly building, he chose a red brick produced by a local factory. To complement this use of native methods, Kahn built the building on a human scale (Kahn, 1994). He believed that architecture was reflective of the art of making places, and that's exactly what is experienced by pedestrians who enter the building. High indoor streets were built with local materials while the glass windows utilize the latest technology to ensure a comfortable climate (Haque, 1997). Thus, Kahn only alters the factors incompatible with the needs of users as per the temperature and keeps with the use of the local environment and materials (Souza, 2010).

### ***Materials***

The predominant elements are the red brick and concrete exterior that give the overall image of the building (James-Chakraborty, 2013). Kahn also applied Bengal Ancient Structural methods: He used bamboo, wood and mud/brick to build this structure. However, it is a handmade building since Master Kahn didn't use any machines to build this large structure (Souza, 2010).



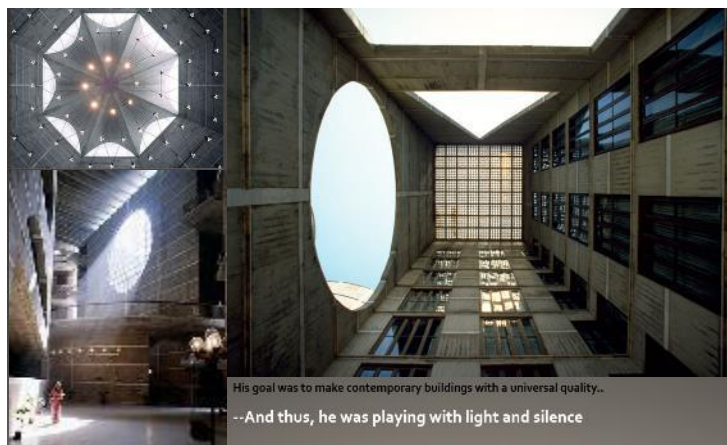
**Figure 3-1 Predominant materials are the concrete and red brick (Arquitectura, n.d.)**

Brick Construction is an ancient tradition of the region, the terracotta color brick building amidst deep green foliage and neighbored by a dank of water provides a perennial image of Bengali landscape (Kahn, 1994). Master Louis I Kahn used concrete which is basically the continuation of Bengali architectural history (see passage; Sense of History).

“The rapid spread of concrete to colonial India was far from a unique case of South Asian modernity. Vast tracts of what are now Bangladesh, India, and Pakistan remained rural and resolutely preindustrial, but key developments in astrophysics and quantum mechanics were occurring in Calcutta and Dhaka, the two largest cities in the as yet undivided province of Bengal.” (James-Chakraborty, 2013)

### *A Climate Responsive Bengali Modern Architecture*

One of the most important considerations Kahn took into account during the project design was providing protection from the sun and heavy rains and at the same time allowing the free circulation of air (Kahn, 1994). Instead of using colossal glass façades or large windows set in horizontal bands, Kahn created large geometric openings in the form of triangles, circles, arcs, and rectangles. These are exceptional and unique features of Kahn’s Modern architecture.



**Figure 3-2 Climatic Response: National Assembly Building** (National Assembly Building, 1987-1989 Cycle) (Souza, 2010)

In fact, he deliberately used geometric openings in order to minimize the disadvantages of the composition of a typical monumental building. Ultimately, he created some distinguishable archetypal forms and spaces characteristic of Bangladesh.

### **The Sense of Nature**

(Protect and preserve ecosystems)

Leonardo Da Vinci mentioned; “Human subtlety will never devise an invention more beautiful, more simple, or more direct than does nature.” (Kelbaugh, 2007)

In this point, Kelbaugh refers to “nature” as a good model for design because it holds the key to vitality, beauty, and sustainability. “Designers can learn from the incredible simplicity and sophistication of biological systems. Diversity, symbiosis, synergy, balance—these are a profound and inspiring message for all designer (p.186).” (Kelbaugh, 2007)

Architect Louis I Kahn learned from the context and replicated aspects of it in his design. The context of Bangladesh was explored in his design in many different spaces. When Kahn got the commission for the project in 1962, the site was basically a farmland to the northern outskirts of the old city. Presently, the project is situated in the middle of the Dhaka city—a burgeoning metropolis. Still, Kahn was successful in understanding the inherent Bengal geosystems; the incredible land-water relationship. In fact, he created a special relationship between the building and the cycle of nature, with light & shadow, with the rain and with the overwhelming presence of water (Kahn, 1994). He loved the simplicity of local culture, tradition, and people. He found and explored Bengal’s life-orienting rituals, myths, and religious devotions. He understood people’s interactive nature, bonding, and traditions.



**Figure 3-4 Old image of National Assembly Building: A farmland had been transformed by Master Louis I Kahn. (Kreis, 2013)**



**Figure 3-3 Present days: Natural Settings of Louis I Kahn's National Assembly building. (Souza, 2010)**

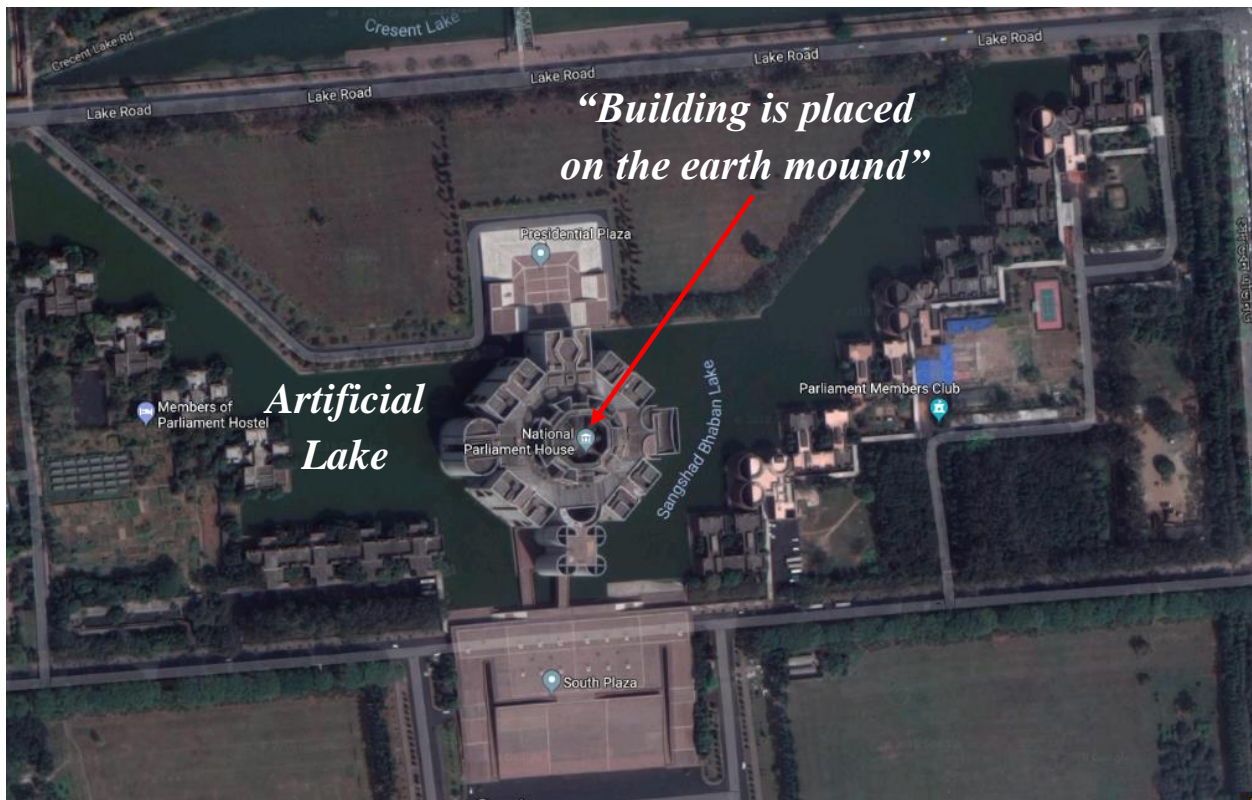
### *A distinct ecosystem: a land-water relationship*

Here, the sense of nature is adopted in different ways; Kahn took inspiration from the delta, followed contextual patterns and created an artificial ecosystem. Since Louis I Kahn maintained the same integral characteristics of the delta and explored the deltaic natural settings, the whole complex has created its own ecosystems.

Presently, Dhaka, The Capital City of Bangladesh, is the most densely populated city in the world which is now one of the worst cities for living in the world (Murphy, 2017). In the course of time, Dhaka has become one of the megacities of the world—as one might easily define its present city as a Concrete Jungle. Still, the only noticeable natural setting which is visible in the Dhaka city plan is the National Assembly Building and Its surrounding area. Kahn also designed semi-outdoor spaces, continuous corridors, large openings, punches, and windows to welcome nature into the building.

*Deltaic Landscape: A landscape of land and water*

Kahn followed the Delta and its space formations which inspired him to design a unique landscape and ecosystem. This study is a very brief explanation of National Assembly Building's interpretations of nature. The project is a milestone in the field of Bengali Modern Landscape architecture as well. The project has already created biological systems which are examples of diversity, symbiosis, synergy, and balance. In fact, Kahn created a landscape of land and water.



**Figure 3-5 Deltaic Landscape of National Assembly Building, Dhaka: A landscape which is artificially made but extremely contextual (Google Maps, 2018).**



## **The Sense of History & the Sense of Craft**

**“The sense of history provides a good point of departure when designing a building.”**

History should be respectfully studied for design principle. Douglas Kelbaugh says—“An architectural type that has stood the test of time, like the basilica or courtyard house, must be doing something right regarding responding to climate, social and cultural needs, traditional and economy (p. 188-189).” (Kelbaugh, 2007)

**“The Sense of Craft means the traditional expression of an architecture.”**

The construction of the building and the loss of craft is a part of a bigger economic web that is unfortunately beyond the control of the designer. Douglas S. Kelbaugh says, “The love of craft needs to be expressed in traditional ways, so long as it respects materials and their joinery.” High-tech architecture can be as carefully and elegantly detailed as earlier hand-crafted buildings. (*Patscenter, Princeton, N.J., by Richard Rogers Partnership/Kelbaugh & Lee*).

Architect Louis I Kahn tied implied the historical sense and the sense of craft together in his design. In fact, Kahn linked both features of a Critical Regionalism together quite magnificently: he picked the deltaic architectural type, explored it deeply and discovered the deltaic architectural craft. He also found traditional ways of constructing this mega project, respected contextual materials. Although the National Assembly Building is a prime example of Modern Architecture, its every architectural feature was carefully and elegantly detailed just like a hand-crafted building, since the handmade building concept is the historical essence of the Delta.

### *Historical link of National Assembly Building in Dhaka, Bangladesh*

The National Assembly Building in Dhaka is one of the great architectural landmarks in the world; it is located at Sher-e-Bangla Nagar in Bangladesh (Architravel, 2015). The building is also one of the largest Legislative complexes in the world, comprising 200 acres. Moreover, It is quite astonishing to find such an icon of modern architecture as an example of critical regionalism. One of the key features of generic modernist buildings is that they could be placed almost everywhere in the world, but the National Assembly Building was an exception. The philosophical intention of this building was to represent Bangladeshi culture and heritage and the history of the region. Eventually, by means of this masterpiece, Louis I Kahn, successfully marked the Bengali Modern period through his unique architectural perspectives and expression. Some features of National Assembly building are given below—

- Some features of the building are the minimal or no ornamentation, large openings, open plan and so on.
- Louis I Kahn used geometric forms like the square and circle, and triangle.
- The National Assembly Building's true structural expression and the predominance of the concrete offer a great tribute to the building, reasonably consistent with the functions that take place in the interior—all are the authentic examples of modern architecture.

However, historians believe that it is an exceptional example of modern architecture being transcribed as a part of Bengali vernacular architecture (Souza, 2010).

## ***“Representing the Delta”—Unique architectural features of National Assembly***

### ***Building***

Here, Kahn's key design philosophy optimizes the use of space while representing Bangladeshi heritage and culture (Haque, 1997). Nevertheless, the National assembly building is a unique interpretation of modern architecture where Kahn's architectural innovations have paved the way for "Bengali Modern Architecture": perhaps it is the first significant modern example of "Deltaic Architecture"—the architecture of wind, water, and clay.

### **Replication of Bengal rural house pattern**

Kahn had visited many places in Bangladesh before the design and construction of this masterpiece, and perhaps he wanted to build something which would reflect Bangladesh. He got the true essence of Deltaic Architecture, finding it in the rural areas of Delta where people live with the ebb and flow of the water.



**Figure 3-6 Replication of the Delta (discussed in chapter two) (Souza, 2010)**

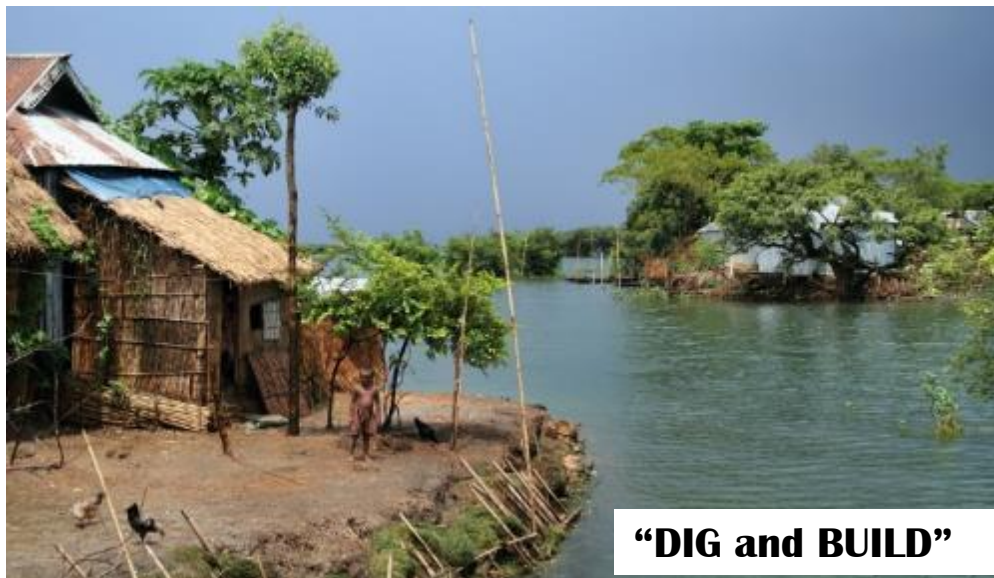
Kahn also observed some distinct structural development patterns in the Delta which were simple but somehow appropriate for this unique building.

## Philosophy and Bengal Morphology

- During Kahn's first trip to Bangladesh in 1963, he recognized the absolute essence of the relationship between **the land and building** (Ashraf K. K., 1994).
- He made a few sketches on a river cruise that recorded his impressions of the overwhelming **presence of water in the land** (Ashraf K. K., 1994).
- Kahn also conceptualized building in the delta as a "**Dig and Build**" process that results in an earth mound on which the building is placed, with the excavated pit becoming a pond. (Ashraf K. K., 1994).

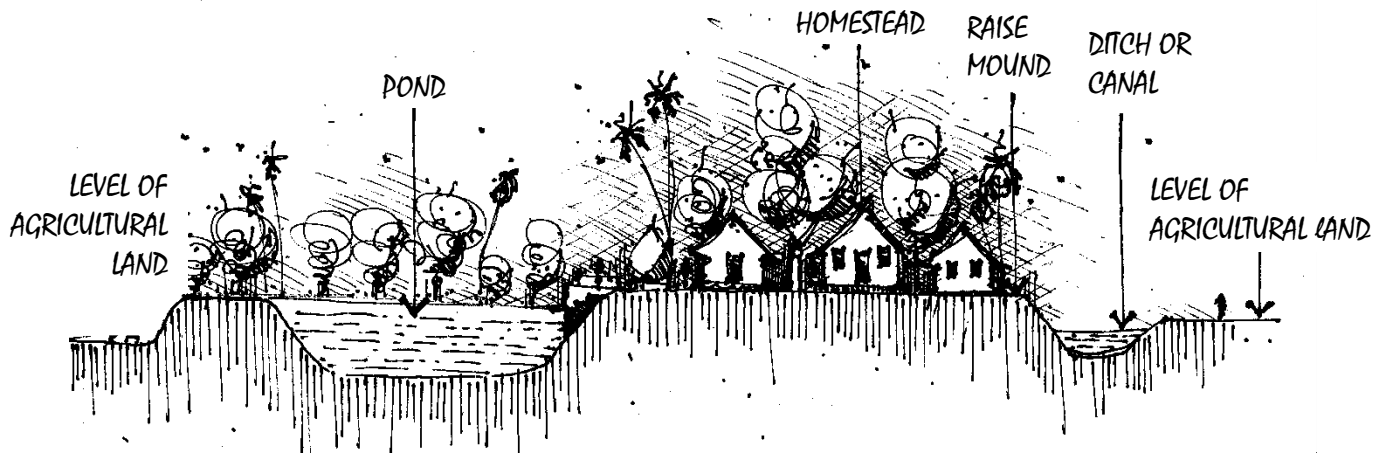
### *Implementation of Deltaic Concept and Philosophy: “DIG and BUILD”*

Kahn conceptualized the method “**Dig and Build**” (Kahn, 1994) which in times past was nothing but the survival approaches of this region’s people, where floods are so frequent and catastrophic.

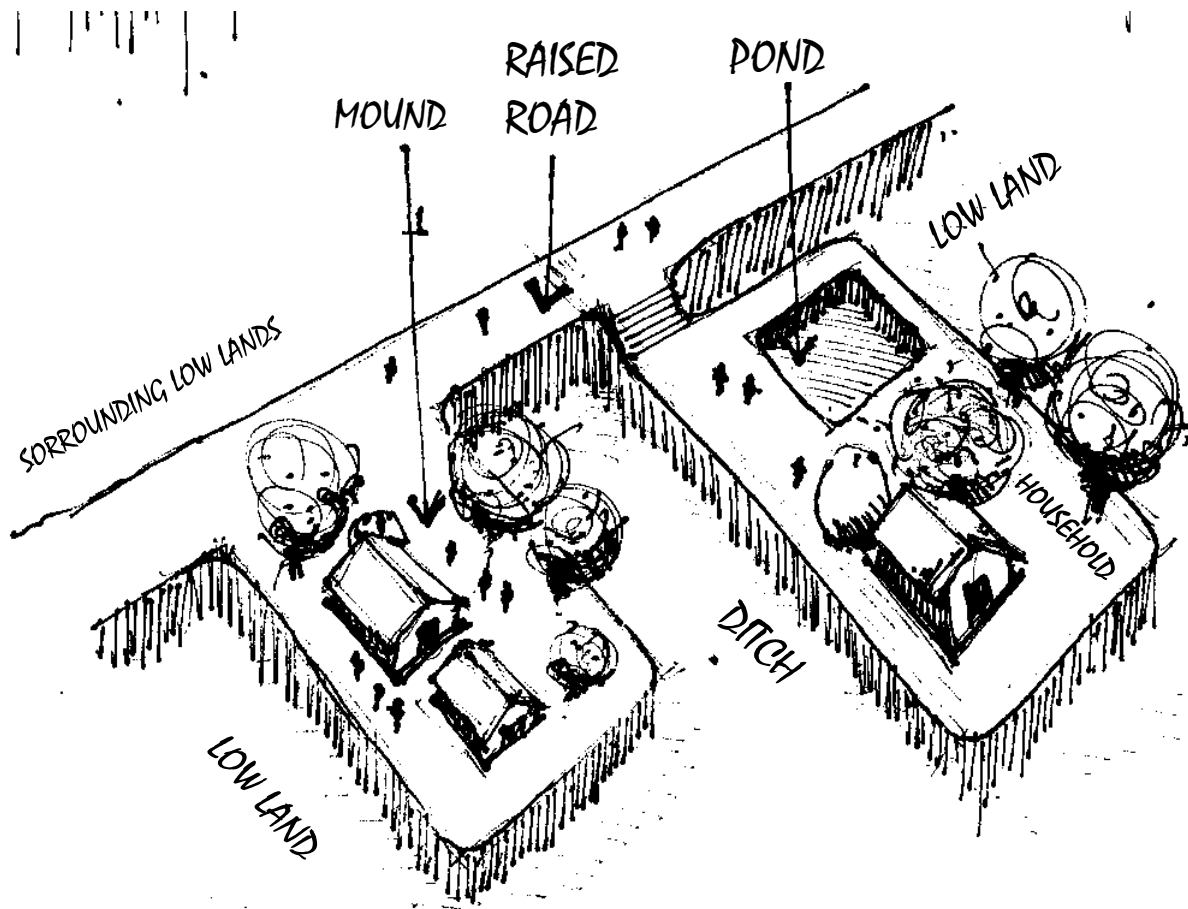


**Figure 3-7 “DIG and BUILD”— the generic image of the Delta** (Ariful, n.d.)

In the Delta, tidal water, especially during the monsoon, floods delta soils that normally remain underwater for 4–5 months each year. However, over 80% of Bangladesh is floodplains, situated at the end of the Ganges Delta with numerous tributaries flowing into the Bay of Bengal (Bussell, 2017).



**Figure 3-8 A Section of Deltaic Landscapes:** which must have influenced Louis I Kahn to develop his philosophical and conceptual thoughts for The National assembly Building, Bangladesh (Hasan, 1985).



**Figure 3-9 Household Building Process in Delta** (Hasan, 1985).

Firstly, people start to dig a pond (Fig 3.9), then they collect the pond soil and gather those in a selected building site. Gradually through the process, they raise the site and build a high platform manually. Since in the Delta, 70% of the total area is less than one meter above sea level, they still apply these indigenous building methods just like their ancestors.

Louis I Kahn conceptualized building in the delta as a "**Dig and Build**" (Kahn, 1994) process that results in an earth mound on which the building is placed, and the excavated pit becomes a pond. In fact, this is the basic and the most prominent feature of Bengal architecture. However, Kahn used the same techniques to build the National Assembly Building at Dhaka, Bangladesh.



**Figure 3-10 National Assembly Building, Dhaka: floating essence in the water** (Islam, n.d.)  
*One can realize that there are no real boundaries here between the Land and the River.*

This kind of conceptual approach to a modern building was extraordinary thinking. As a result, the edifice is located on raised earth surrounded by an enormous artificial lake and is connected to the land across the plaza north and the plaza south by raised roads. (Souza, 2010)

## **The Sense of Limits**

(Human-scale in the built environment)

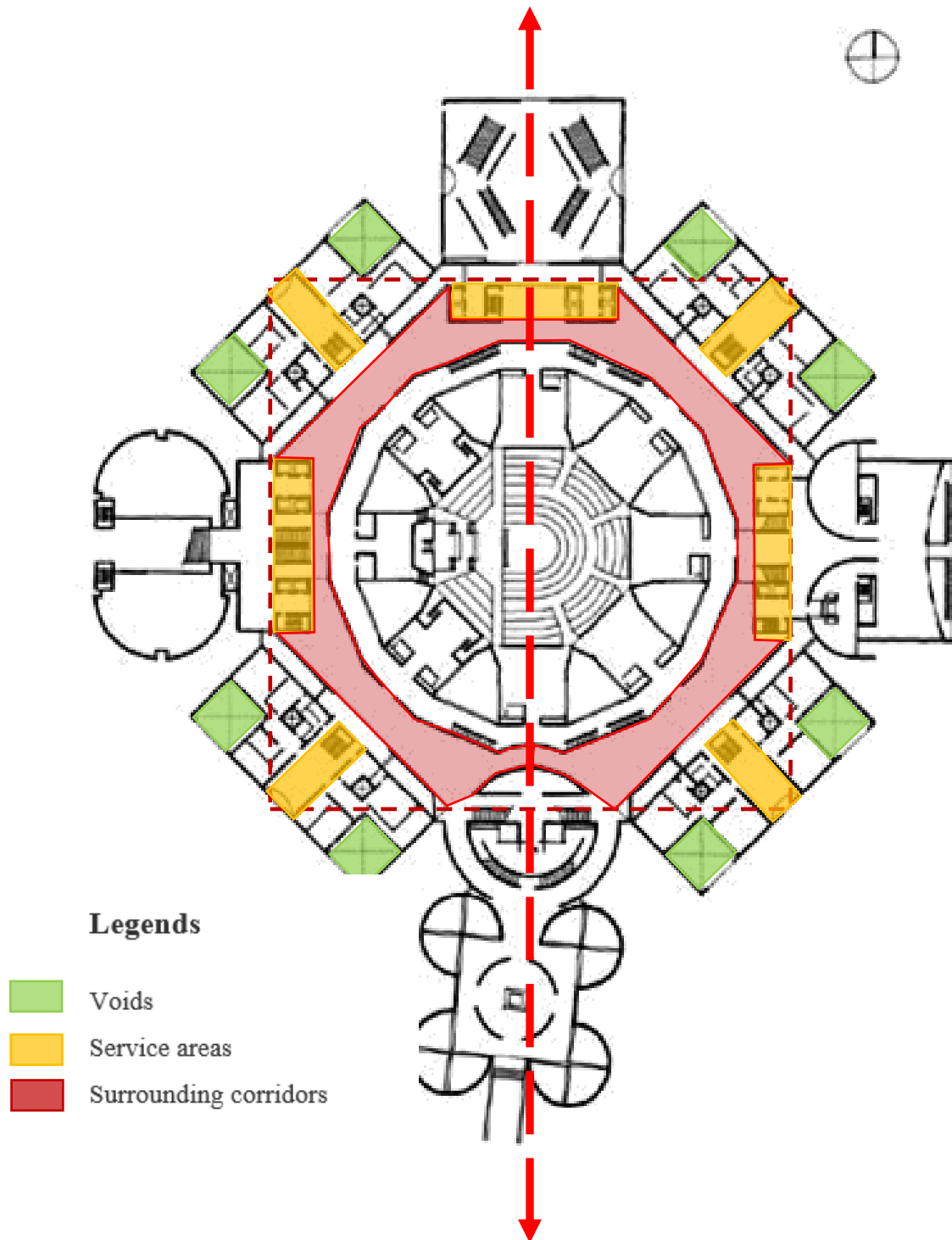
The point is well defined by Kelbaugh. —

“A sense of limits is about the need for finitude and for physical and temporal boundaries to frame and limit human places and activities. It is about the need for human scale in the built environment. It is also about the need for psychological boundaries – ones that make life more understandable and negotiable (p. 189).” (Kelbaugh, 2007)

### ***National Assembly Building: A Place within a Place***

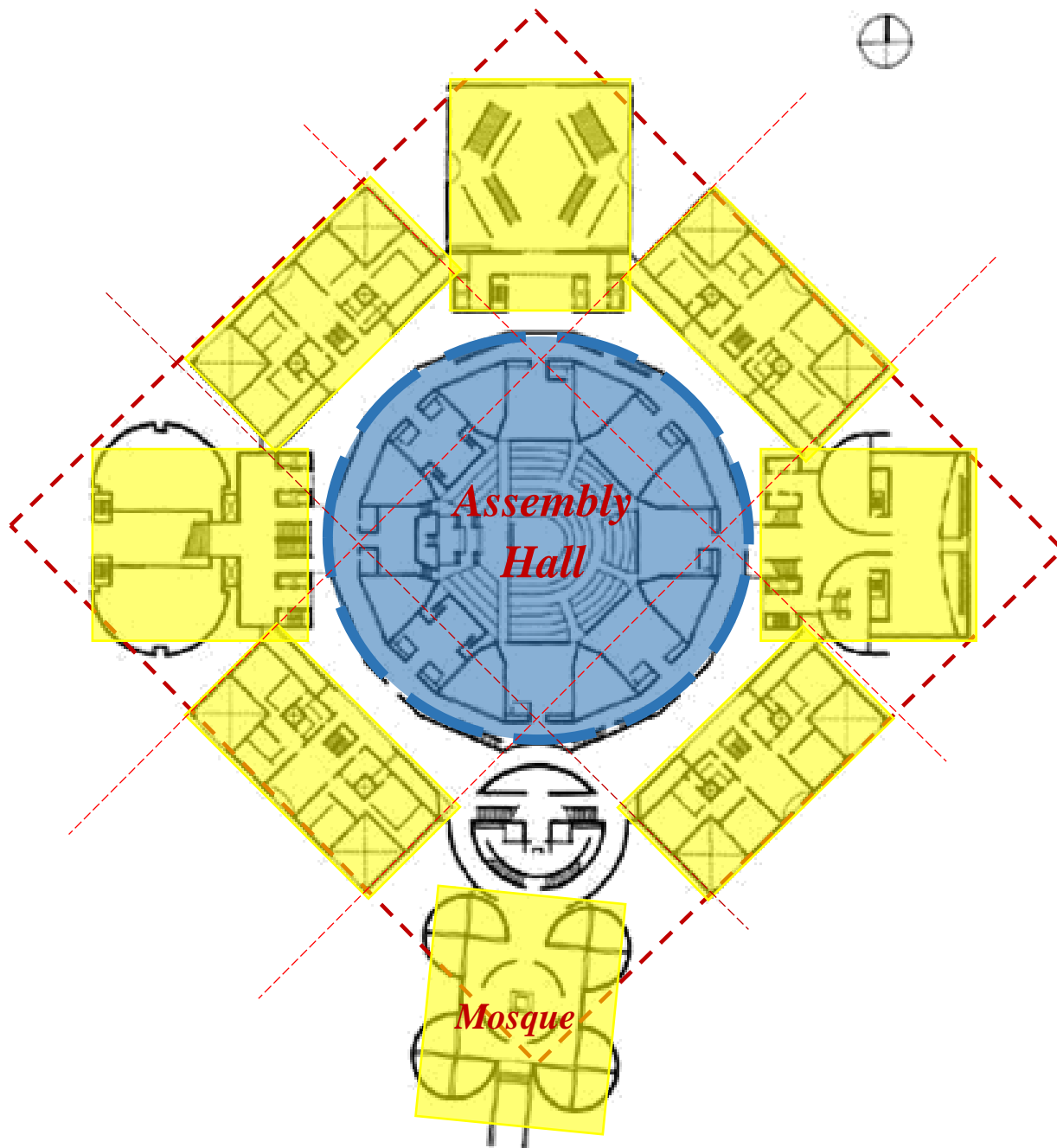
In this project, every functional area is well defined and has created physical boundaries to frame and limit human activities. Firstly, the building was conceptualized as a spiritual building (Kahn, 1994) that promotes Bengal’s culture and historical values. These approaches were also reflected in building design while he designed corridors, pathways, terraces, verandas, ramps, stairs, and openings and so on. Master Louis I Kahn deliberately marked physical boundaries for the users through different functions such as assembly hall, offices and the service areas. A very short and brief analysis of the National Assembly building is given below where the service and served areas, the surrounding corridors and the voids are marked to show the sense of limits of the project.

*Axis, symmetry, simple rectangle form*



**Figure 3-11 Plan of the National Assembly Building: service and served areas & the surrounding corridor and voids create the sense of limit. (Souza, 2010)**





**Figure 3-12 Form Analysis of the Assembly House: The National Assembly building is in fact a Nine-Grid Plan.** (Souza, 2010)

Master Louis I Kahn created a sense of limits in this Mega Project. Although it is a huge structure, one will find his/her own physical territory in the building.

### *Contextual Peripheral Vision of the National Assembly Building*

It is often a matter of surprise that one can't find a single column inside the building. In this Building every wall is a load-bearing wall, creating a fluidity of places and free-flowing spaces. In fact, Kahn took advantage of these qualities, reactivating peripheral vision, and introducing local perspective views. Probably, he was inspired by the context around Dhaka city (Old Dhaka) and also conceptualized his intuitive knowledge of Dhaka city in order to design interior spaces of this building. There are some similarities between the street images of Dhaka city and the interior circulation of the assembly building. However, there is some evidence that the cultural landscape of Bengal is abstracted in the National Assembly complex at Dhaka. (Huqelberry, 2010)



**Figure 3-13** Street image of old Dhaka city (Reynolds, 2016); Children playing in the narrow street (Wasif, 2010)



**Figure 3-14** Morphological transformation at National Assembly Buildings (Kahn N. , 2003)

Dhaka preserves its indigenous characteristics with all organic features and localities. It was totally a homogeneous morphological development which is characterized by a pattern of the typically narrow streets. It was developed in response to the intimate attitude of the people and the strong cultural features of this land. In fact, the streets of Dhaka are highly interactive community spaces that bear complex relationship among culture, context, and techniques. However, evolving morphologies and space sequences were similar to native Bengali architectural features. In fact, architectural features like ponds, waterways, trees, gardens and orchards have link with Mughal Dhaka (Ashraf K. K., 1994) which previously was a city of gardens and canals with pavilion-like dwellings, before in was ransacked by 'development' planning. (Ashraf K. K., 1994).

## **Bengali Modernism and the Significance of the National Assembly Building, Dhaka**

Louis I Kahn paved the way for Bengali modernism and perhaps unfolded a unique architectural approach which suggested that *sthaniyata* (contextualism) and Modernism are not incompatible (Kahn, 1994). This chapter is an attempt to elucidate a philosophical and conceptual understanding of Bengal Architecture. Therefore, research regarding the building's plan, sections elevations have not been included in this chapter. I have tried to justify this building's symbolic and programmatic aspects through the historical and cultural evidence of the architecture of the Delta. Nonetheless, it is quite evident that architecturally the National Assembly Building is a thoughtful essay on “**Designing in the Delta**”—offering a whole new architectural language for Bangladesh (Haque, 1997).

Kahn's regional interpretation in this building is so prolific that the building has become a symbolic monument to the government of Bangladesh. The National Assembly Building is different in the sense that it is modernist in principle, but it is an architecture which is deeply rooted in the context of Bengali vernacular architecture. Famous Bangladeshi architect, urbanist and architectural historian, Kazi Khaleed Ashraf writes, “The entrancement of Kahn's Ideas in the Modern Bengali Domain is not something strange; it was anticipated in the intellectual climate created by the nineteenth-century movement called the “Bengali Renaissance.”

This chapter presents the argument that the National Assembly Building at Dhaka is an authentic interpretation of critical regionalism and has illustrated the inherent power of being a single timeless structure that defines the nation's architectural identity. These findings will help to relate other case studies correctly through the “Deep Beauty” framework.

## Chapter 4 - Study Methods

### Selecting

Two different projects have been selected for this study. Those are—

1. **Fine Arts Institution, Dhaka** which is designed by architect Muzharul Islam.
2. **METI Handmade School in Rudrapur, Dinajpur, Bangladesh** – Designed by architect Anna Heringer who is a proponent and practitioner of sustainable architecture. *(The project received prestigious Aga Khan Award for Architecture, 2007)*

A brief and complete discussion about “Deep Beauty” framework and its three levels has been given in chapter one. An extensive literature review has already been mentioned in previous analysis and chapters. However, from those analyses, a rubric can be generated which will establish the criteria for the analysis. For this report, a “Rubrics for Analysis” has been produced with their own set of indicators which will also work as study methods.

## Rubric for Analysis

Functional Level	Typological Level	Archetypal Level
Orientation of Building	The sense of history, community, and place	Orientation in Space
Building Materials and Construction Methods	Building Type	Geometry, Proportion, and Numbers
Social Structure	Layout	Spatial polarities found in natural settings
Social Setup	Biophilic Design	Natural Symbols
Comfort		

**Table 4-1 Table Figure Rubric for Analysis (Qureshi, 2015)**

The two buildings selected for analysis are evaluated at all three levels of the Deep Beauty (Functional, Typological and Archetypal) Framework. These three levels have their own set of indicators which are examined individually.

At the level of Function, the analysis seeks to find out how these five buildings fit with their sites regarding climate, orientation, shape, and use of local materials. The analysis also judges how well the buildings respond to the needs of the social setup. Lastly, the passive strategies used for providing thermal comfort are identified and evaluated. (Qureshi, 2015)

At the Typological level, the traditional and the modern-day typologies are compared. A building program is the implicit or explicit statement of spatial requirements to be fulfilled within the constraints of available sites. Budgets and technologies are two principal variables which

usually define the building type (such as a one-family house, or thirty-unit apartment house, or a contemporary mosque or a cultural center). Those two variables also influence almost every intended activity such as eating, sleeping, working, socializing or parking the car. A program will also usually specify what kinds of spaces are to be provided for these activities, such as kitchen, dining room, bedroom, or garage, and how large these spaces must be (Hayden, Dolores, 2002). In this analysis, the building layout is studied in detail. The presence of a sense of history, place or community along with biophilia is explored. (Rabia Ahmed Qureshi, 2015)

At the Archetypal level requires finding the presence of the world's architecture and archetypal elements such as courtyards, semi-outdoors, and terraces and so on. The use of mathematics, nature, numbers, geometry and symbolic dimensions are assessed. The occurrence of archetypal spatial polarities, including complex order, prospect and refuge, enticement, and peril in the overall experience, are also explored.

### **Tools for Analysis**

The tools for study and analysis include drawings, sketches and photographs, literature review, interviews, personal experience and the use of a computer software program.

### **Photography and Drawings**

Many photographs and drawings of selected projects have been collected from various sources including the internet, books, journals, articles, and so on. Those photographs and plans are good enough for analysis as well as informative enough to produce explanatory sketches and diagrams.

## **Interviews**

The questions are based on the rubric mentioned earlier. For some projects, architect's lectures, conference speeches, their online interviews, and discussions have also been taken into consideration for the analysis.

## **Computer Software Program**

The software program 'Ecotect' is used to extract the climatic data and is further used to study the sun path diagrams. Other Software like Lumion, 3d Studio Max, Adobe Illustrator and Sketch-up are used for visualization and conceptual analysis.

## **Personal Experience**

The researcher belongs to a middle-class family and has lived in the city of Dhaka of Bangladesh for twenty-five years. He has also been a practicing architect for one year and has the opportunity to work on some residential projects in Dhaka. He is also a teacher at a public university in Bangladesh and has conducted some relevant research projects as well. From his personal experience, he is able to provide information regarding the current situation of modern design in Bangladesh and about the selected case study buildings.



## **Chapter 5 - Analysis of the Selected Design Projects**

### **Project Selection**

#### **Faculty of Fine Arts, University of Dhaka, Bangladesh**

I have selected this project as one of my research studies because of its deep relationship with Deltaic Architecture and Critical Regionalism. It's my scholarly intention to find the inherent power and the resistance to the global modernism of Bengal architecture through these case studies. However, conceptually, the project is also well associated with Louis I. Kahn's the National Assembly Building.

Louis I. Kahn established an example where modern architecture being deciphered as a part of Bengali Vernacular Architecture, following local context, culture, and climate. In the Faculty of Fine Arts, the University of Dhaka, architect Muzharul Islam explored the same things; he observed the Bengali household patterns, sequences and also followed the space morphologies of the Delta.

Through this project, architect Muzharul Islam explored Bengal's traditional architecture and paved the way for Bengali Modernism. Nevertheless, the project is also an instance of critical regionalism. The Faculty of Fine Arts is situated in the middle of Dhaka city: the context is very urban, and the building is a national landmark.

“Two architectural phenomena stand out as seminal expressions of the Bengali Modern Period: the Powerful creation by the American Architect Louis I Kahn of the National Assembly Building at Dhaka and the pioneering work of architect Muzharul Islam.”  
(Haque, 1997)

## **An Example of Critical Regionalism**

The Faculty of Fine arts, the University of Dhaka is an example of critical regionalism. A brief analysis of this building based on Kelbaugh's Five Points of Critical Regionalism has been prepared. Here, the study is very precise and has marked the fundamental aspects. However, all those points have been explained with diagrams and photos under the Deep Beauty Framework. The study is made so that the readers can relate to the characteristics of critical regionalism encompassed by the Deep Beauty Framework as well.

Douglas S. Kelbaugh's five points of Critical Regionalism: It was an attempt of Professor Douglas S. Kelbaugh to define critical regionalism. He believes that a Critical Regionalism should have five characteristics or attitudes.

### ***The Sense of Place***

(The Genius Loci)

This topophilia seeks to liberate the genius loci. It's a prevailing character, atmosphere or essence of a place. Kelbaugh says—

“Critical Regionalism is a simpleminded or excessive importation from other places. Critical regionalism honors local climate, topography, building materials and building practices. It refers local authenticity to sophisticated imitation. This act of protection is also an act of resistance (p. 186).” (Kelbaugh, 2007)

The Faculty of Fine Arts, Bangladesh, respects local climate & topography (Fig 5.24 and Fig 5.25), building materials and building practices. Nevertheless, the building has historical authenticity and is an example of traditional architecture.

### *The Sense of Nature*

(Protect and preserve ecosystems)

Leonardo Da Vinci mentioned; “Human subtlety will never diverse an invention more beautiful, more simple, or more direct than does nature.” (Kelbaugh, 2007)

In this point, Kelbaugh refers to “nature” as a good model for design because it holds the key to vitality, beauty, and sustainability. “Designers can learn from the incredible simplicity and sophistication of biological systems. Diversity, symbiosis, synergy, balance—these are a profound and inspiring message for all designers (p. 186).” (Kelbaugh, 2007)

Architect Muzharul Islam took inspiration from nature and context and replicated those into their design. The Building has incredible simplicity; nevertheless, the building is a part of natural ecosystems (Fig 5.18). The structure connects the natural environment and the socio-cultural context of the place.

Moreover, Architect Muzharul Islam was a true modernist, yet he felt the importance of regional approaches in modern design. He was inspired by nature and put nature at the core of his design. Undoubtedly, the project has a sense of nature.

### ***The Sense of History***

(A good point of departure when designing building)

History should be respectfully studied for design principle. Douglas Kelbaugh says—"An architectural type that has stood the test of time, like the basilica or courtyard house, must be doing something right regarding responding to climate, social, cultural needs, traditional and economy (p. 188)." (Kelbaugh, 2007)

Architect Muzharul Islam research Bengali household pattern and its space sequences and morphologies. In fact, Islam recognized Deltaic design vocabulary and syntax and had creatively transformed those to express and to accommodate new technical and programmatic forces. Professor Kelbaugh also says, "Traditional architecture can evolve as new scientific and technological developments." In this project, the Faculty of Fine Arts, the University of Dhaka—a traditional Bengali household pattern (primitive and rural) has been revived by architect Muzharul Islam who has in this way created a Bengal style of modern architecture.

### ***The Sense of Craft***

(Traditional expression):

The construction of the building and the loss of craft is a part of a bigger economic web that is unfortunately beyond the control of the designer. Kelbaugh says— "The love of craft needs to be expressed in traditional ways, so long as it respects materials and their joinery" (p. 189). High-tech architecture can be as carefully and elegantly detailed as earlier hand-crafted buildings. (*Patscenter, Princeton, N.J., by Richard Rogers Partnership/Kelbaugh & Lee*).

Architect Muzharul Islam always tended to use natural materials like brick, wood, mud, and so on. Another important material used in Bengal architecture, Terracotta, was introduced by Islam in this design. Nevertheless, some original features like “*Jalees*” (lattices) and “*Beras*” (perforated Screens) have also been transformed into this masterpiece and perhaps this contextual interpenetration has developed into an important part of Bengal style of modern architecture (Haque, 1997)

### ***The Sense of Limits***

(Human-scale in the built environment)

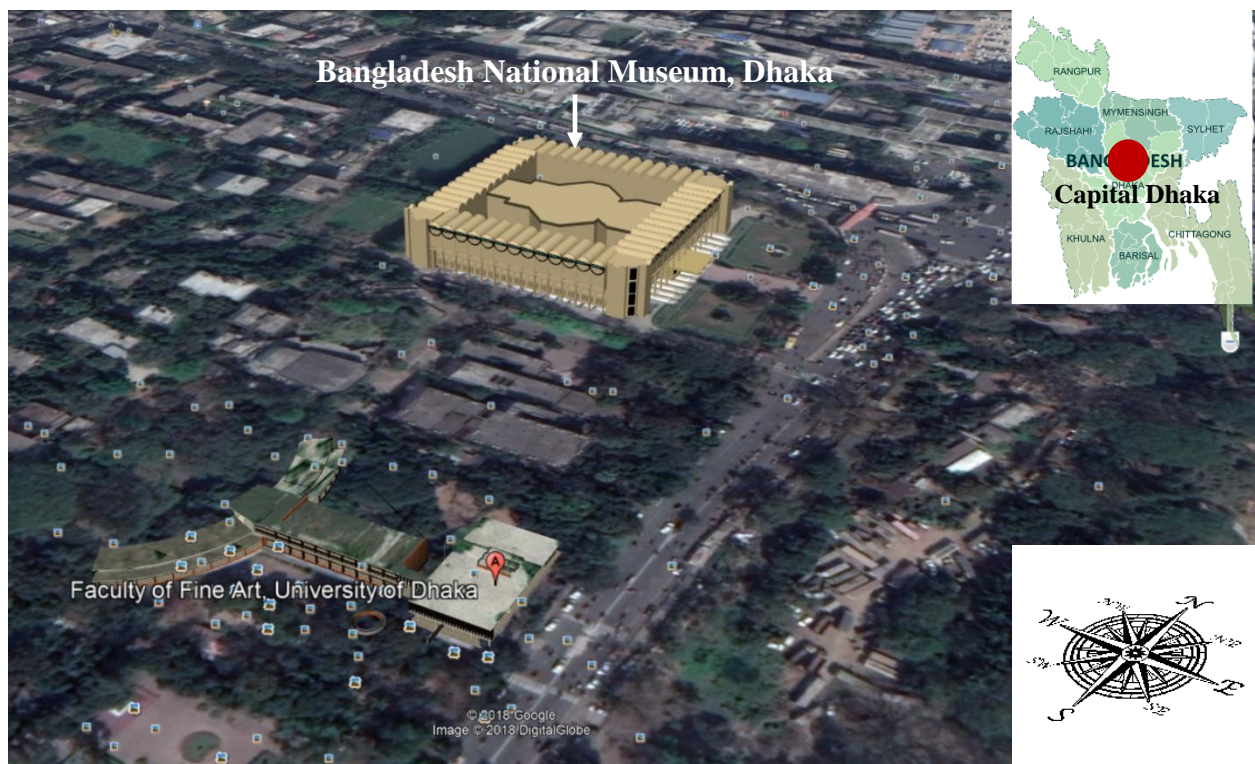
The point is well defined by Kelbaugh. —

“A sense of limits is about the need for finitude and for physical and temporal boundaries to frame and limit human places and activities. It is about the need for human scale in the built environment. It is also about the need for psychological boundaries – ones that make life more understandable and negotiable (p. 190).” (Kelbaugh, 2007)

In this project, every functional area is well defined by Islam and is defined by physical boundaries to frame and limit human places and activities (Fig 5.35, Fig 5.36). These approaches were also reflected in building design while he made human scale rooms and pavilions. The architect deliberately marked physical boundaries for the users through different functions such as classrooms, craft rooms, verandah, upper floor functional areas. These types of spaces and their uses *assist students* in developing their individual capabilities on different topics.

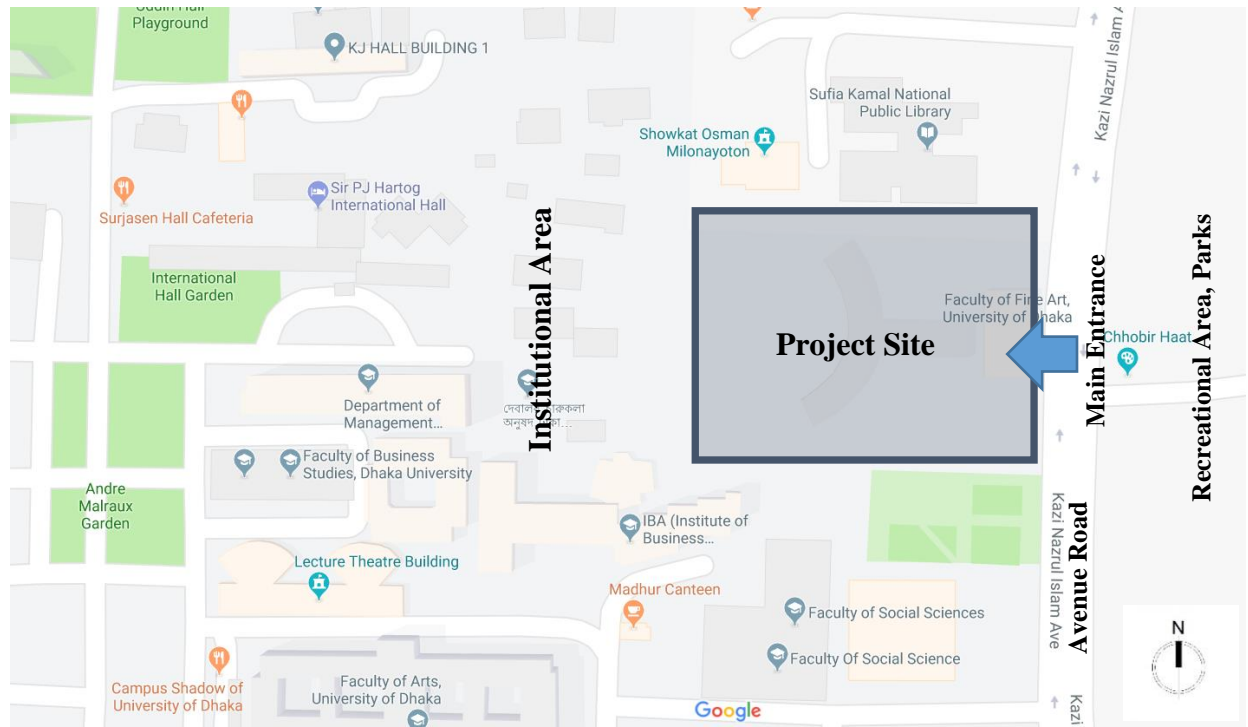
## 01. Faculty of Fine Arts Building, University of Dhaka, Bangladesh

Architect Muzharul Islam is the most prominent architect from Bangladesh. In fact, Bengali Modernism began with his design for the College of Arts and Crafts (presently, the Faculty of Fine Arts Building, University of Dhaka, 2008) by Architect Muzharul Islam. The Fine Arts Building, which was built from 1953-1955, was his first project and was, indeed, a revolutionary project for the future of Bengal architecture. Since 1956, the project has been situated in Shahbag, Dhaka, close to the Bangladesh National Museum. However, by this project, Architect Muzharul Islam broke the symbolic features of modern design and introduced regional interpretations. Thus, he created the identity of Bengal modern architecture.



**Figure 5-1 Location and Orientation of Faculty of Fine arts, Dhaka (Earth, 2018)**

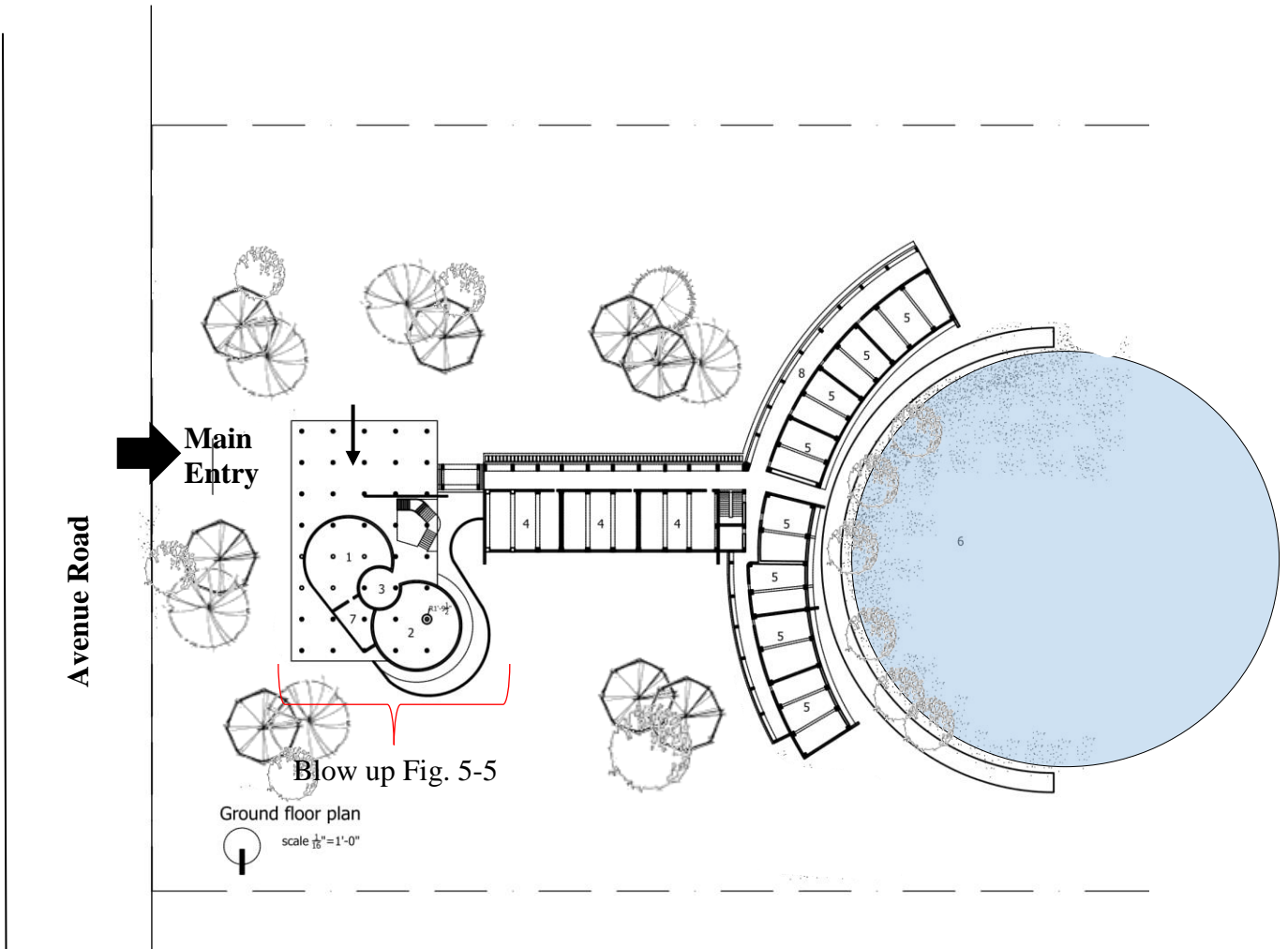
The Fine Arts building is surrounded by an impressive collection of gardens and tree-covered landscapes on the north, south and the west sides (Fig. 5.1). The main avenue road (Kazi Nazrul Islam Avenue) and the entrance are on the east side. Further down this avenue, another entrance is located for use by the students for their easy and frequent movement.



**Figure 5-2 Site context plan for the Faculty of Fine Arts Building by Muzharul Islam**

The Project is situated within a magnificent natural setting. On the campus of the University of Dhaka, Bangladesh. However, this particular area is the most famous public gathering place and is also the cultural and political hub of the country. There is a pond on the west side which is protected by lush green vegetations and perennial trees. The building is elongated along its east-west axis. The aim is to maximize exposure to the south and reduce exposure to the east and west. Architect Muzharul Islam was especially aware of Bengal architectural facts, and those unique morphologies were his primary considerations in order to establish an architectural

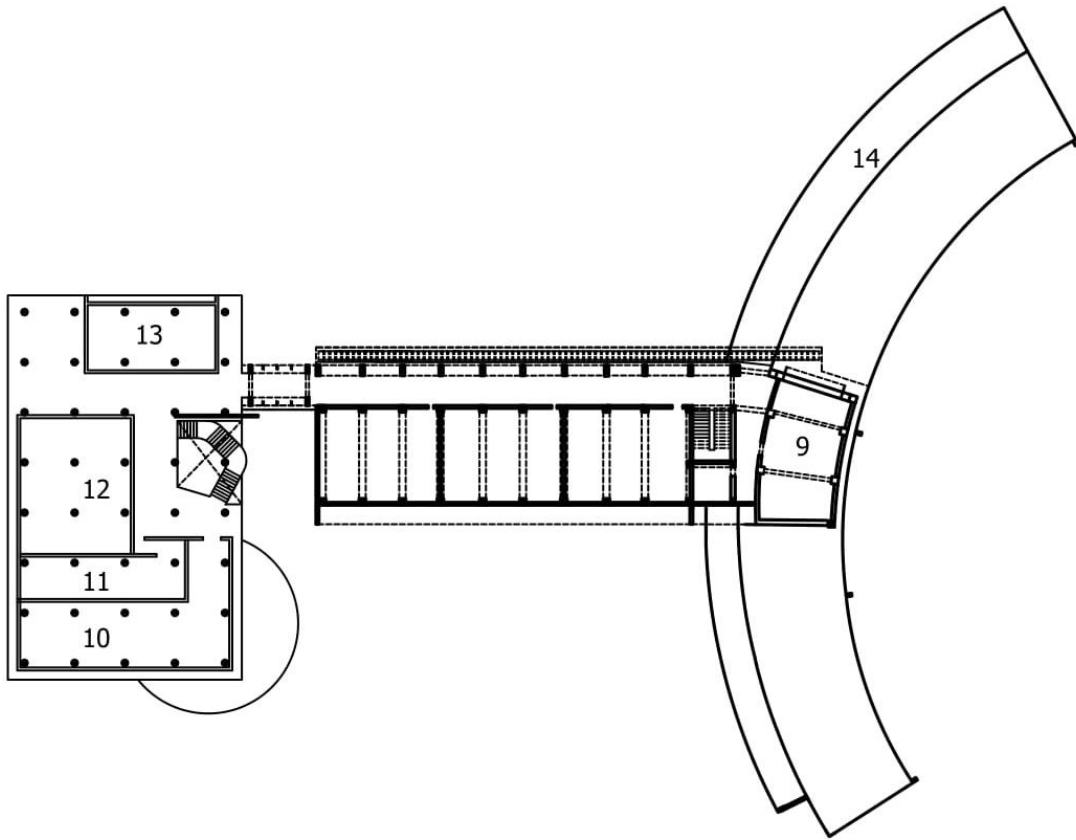
identity of Bangladesh. He placed traditional trees in courtyards and also influenced conventional semi-outdoor activities.



**Figure 5-3 Ground Floor Layout Plan (Anonymous)**

1. Library
2. Boys' common room
3. Toilet
4. Classroom
5. Craft room
6. Pond
7. Store
8. Verandah





## 1st floor plan

- 9. Study room
- 10. Exhibition
- 11. Office
- 12. Teachers' room
- 13. Girls' room
- 14. Terrace

**Figure 5-4 First Floor Layout Plan (Anonymous)**

Upon entering the front pavilion, one encounters a semi-outdoor space, and that serves the purpose of a public sitting/gathering area. Toward the north are a library and a Boys' Common room. There is also a courtyard which is quite traditional and has a perennial tree (genus is Plumeria) in the middle. The entrance pavilion and the inner courtyard are separated by screens (a perforated screen wall). One enters into the front pavilion, a magnificent structure that houses galleries on the ground floor and teachers' offices and common rooms on the first floor (Ashraf, 1998).

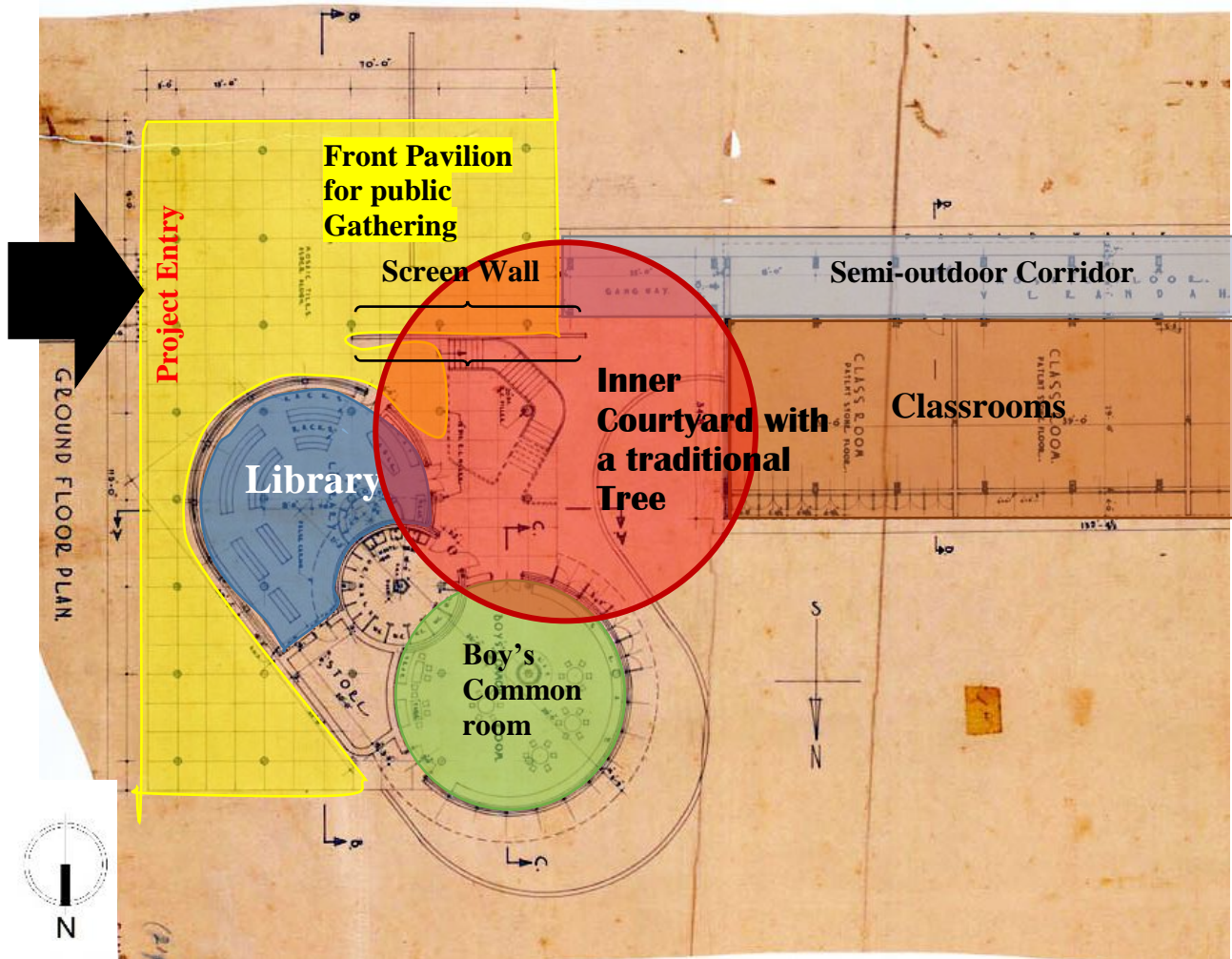
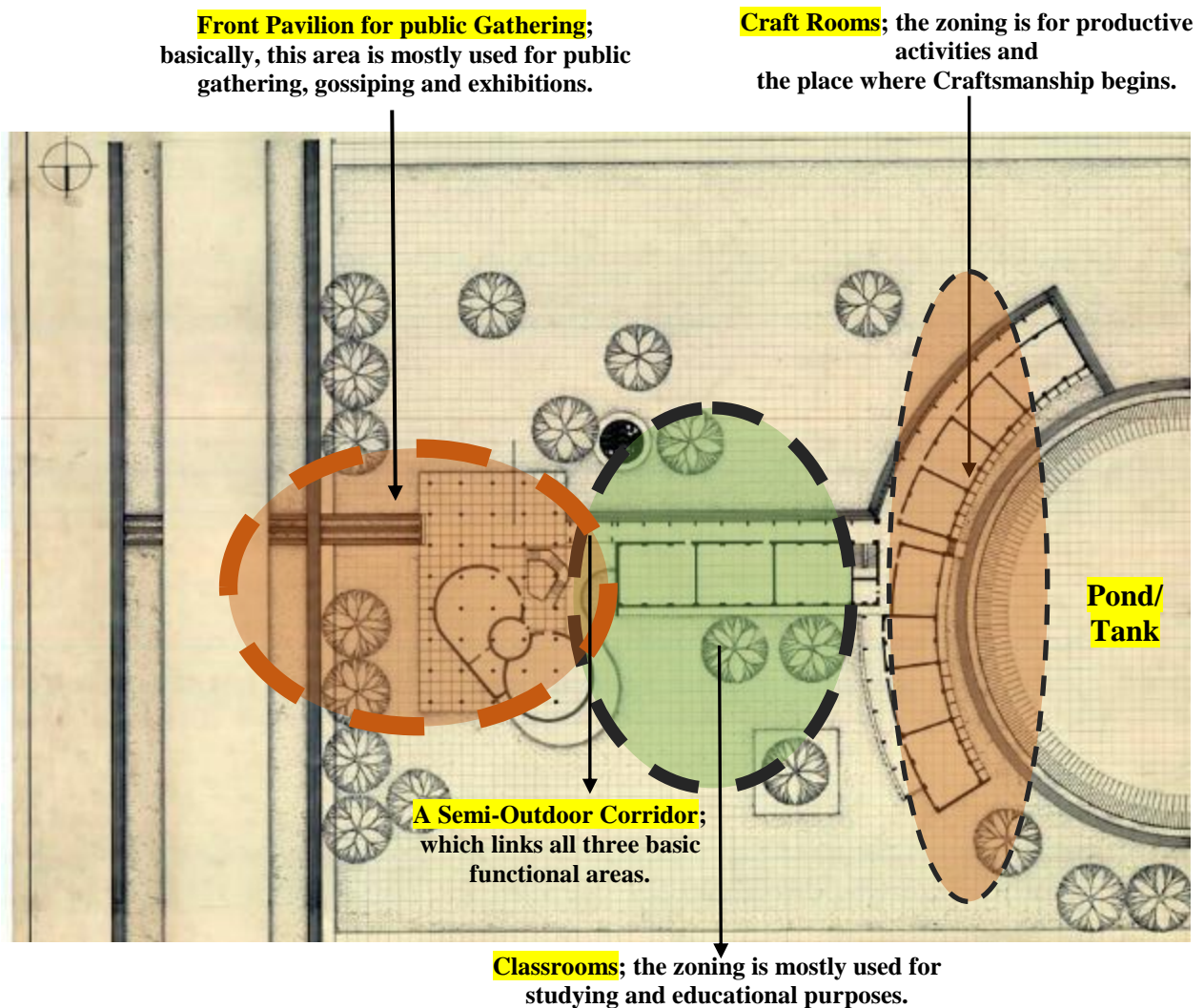


Figure 5-5 Blow up Plan; (Ground Floor Plan), (Archive, n.d.)

On the west side of the building, there is a circular pond (Fig. 5.3) which is located before the structure was built; it seems that Islam tried to respect this simple form of a natural setting and shaped the west façade of his building according to the pond's outline. The inner courtyard is smaller in size with a front pavilion on the east side and a semi-outdoor corridor on the north side that leads to the classrooms and craft rooms (Fig. 5.3). The south side of the inner courtyard is open, facing into the path of prevailing winds in order to facilitate natural ventilation. A semi-covered corridor links the public pavilion to three big classrooms, eight craft rooms and the round shaped pond.



**Figure 5-6 Ground Floor Plan of Faculty of Fine Arts, Dhaka (Archive, n.d.)**

A beautiful sculptural stair connects the two levels around a wonderful internal courtyard. From the inner courtyard (Fig. 5.6), the staircase leads into a covered outdoor space that is split into two functional areas, which are the common functional zone and the classrooms. The lower level (ground floor) is mostly **semi-covered\*\*\*** public areas which allow the structure to blend better with the surrounding vegetation. On the other hand, higher level (1<sup>st</sup> floor) is more private and mostly used for educational purposes and exhibitions. On the west side, there is a terrace that opens to the circular pond. The building has large continuous verandahs shading the inner walls and windows of studios and classrooms. On the first floor to the east, there are three more classrooms, a teachers' common room, a girls' room and an office. Famous historian Ashraf writes in *World Architecture, a critical mosaic, vol-8* "This building has achieved immediate iconic status in Dhaka as a work employing the Modernist vocabulary adapted to suit the local climate and context."

The beauty of this architecture is that it didn't follow the colonial style nor the traditional forms but created its own style and language. If you study this building carefully, however, you will find the replication of Bengal rural morphology and local culture (Ashraf, 1998).

*\*\*\* Semi-open or semi-covered spaces can be understood as transition spaces which, traditionally have been the places for social interaction and communication. They are shaded and thus cooler, interior semi-covered spaces which are the focus for all activity in homes and neighborhoods. Moreover, for the climate of the Indian subcontinent and inherent nature of intimacy in social space; render semi-open spaces is of prime importance (Architecture Asia, n.d.).*



Figure 5-7 Inner Courtyard view from ground floor. (Rossi, n.d.)





**Figure 5-8 Entrance, East façade of the Building** (Archive, n.d.)



**Figure 5-9 First floor's east side semi-outdoor** (Ashraf K. K., n.d.)



**Figure 5-10 Semi-outdoor corridor on the south.** (Archive, n.d.)

### **Functional Level of the “Deep Beauty” framework:**

The Functional Level of deep beauty deals with all the practical requirements of the building’s users (Coates, 2014). However, the theory of regionalism leads to the architecture being fundamentally site-specific and answering to the native climate and tradition of the place, where it is being constructed. Besides providing shelter, a house serves the purpose of a social unit of space (Rapoport, 1969). In fact, a home is not only a structure, but also it's an interconnected ecological feature of a place. Furthermore, it produces the form of vernacular architecture which portrays a belief in the traditional interpretation of thoughts, forms, and style (Hosey, 2012). Being suitable for the family structure and the social setup of its users is an important function.

Professor Coates says about the Functional level of Deep Beauty—

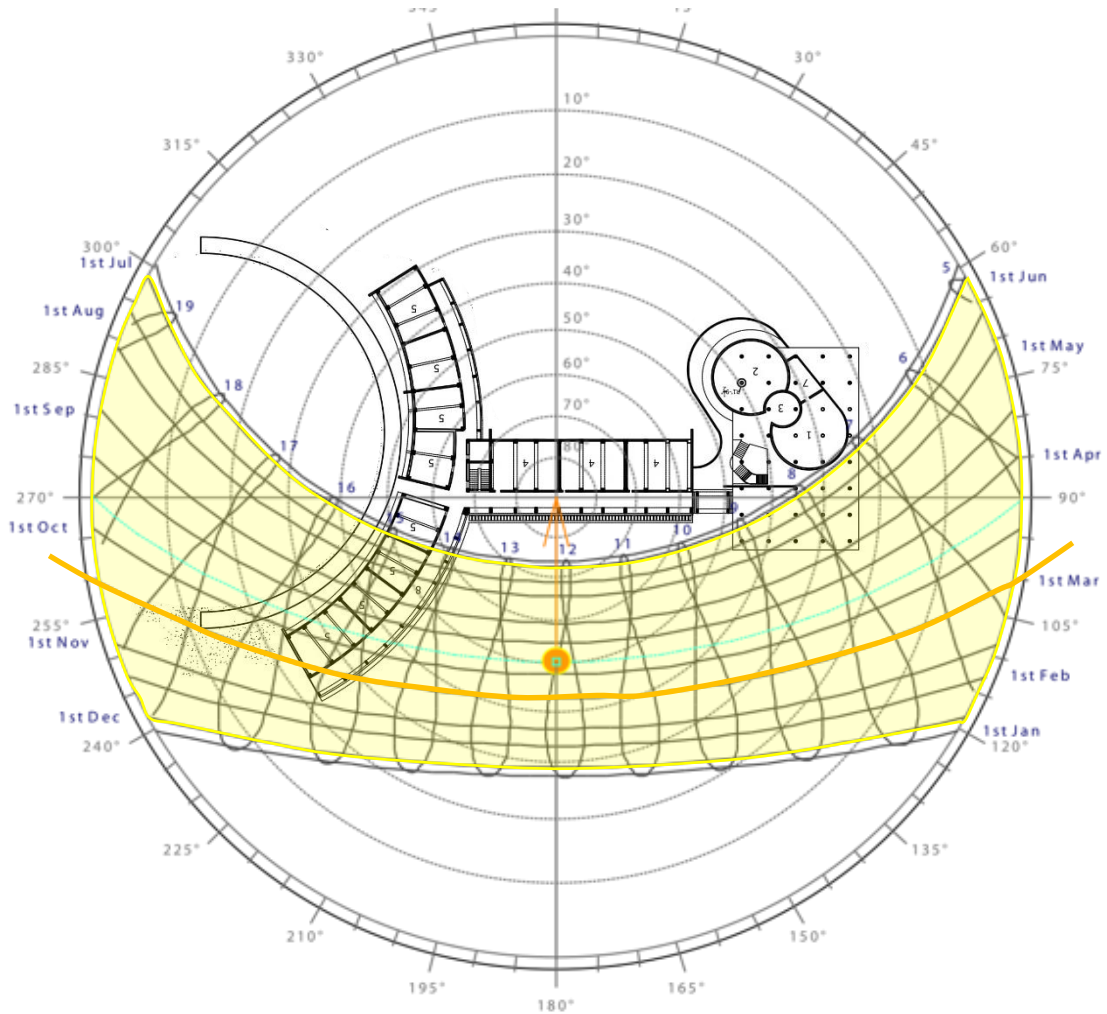
The Functional Level includes design for all the pragmatic needs of the building's users. Truly functional buildings are also artfully integrated with their sites and respond simply and appropriately to the available sun, wind, and light. Such buildings, which are always no bigger than they need to be, are necessarily energy efficient and make maximum use of healthy and locally available building materials. Biomimicry, as a functionalist approach to biophilic design, is included in this level. Everything associated with the technological and functional aspects of ecologically and humanly sustainable design is included in this first, and necessary level of sustainable design." – (Coates, 2014)

Furthermore, biomimicry is an approach that can provide functional solutions by taking inspiration from nature (Benyus, 2008). Building a house is a cultural phenomenon, and so the form and organization of a house depend on its cultural setting (Qureshi, 2015).

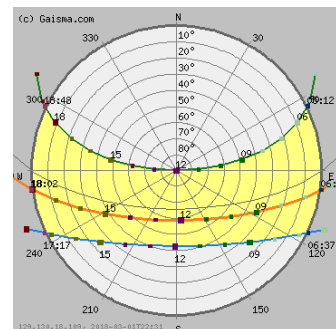
## Functional Level

### *The Orientation of the Building:*

The building is one that is mostly elongated along its east-west axis.



**Figure 5-11 South Facing Semi-outdoors and North Facing Windows (Alexander, 2014)**



Sun Path diagram of Bangladesh (Gaisma, 2018)

Most of the classrooms are located to the north, and Craft rooms are located on the west side of the Building. The maximum number of windows open to the northern side where there is the least amount of sun throughout the year. The semi-outdoor corridor and the courtyard are situated on the south side with maximum sunlight. Christopher Alexander and his colleagues highlight the importance of the south facing outdoors in their book *A Pattern Language*—

“People, use open space if it is sunny, and do not use it if it isn’t, in all but desert climates.”  
(p.514) (Alexander, 1977)

Orientation and the Placement of the outdoor spaces are fundamental and significant aspects of an enjoyable place. The survey conducted by Alexander proved that people with north-facing backyards did not use them at all and preferred the south facing front yards. Bengal morphological development is also dominated by a south facing shaded spaces, yards, courts, and verandahs. Architect Muzharul Islam discovered traditional Bengali space sequences and replicated those in designing the Fine Arts Building successfully. Moreover, this masterpiece is an excellent display of a harmonious integration of architecture and landscape. Nevertheless, Christopher Alexander also noted that south facing outdoor spaces must have sunny areas and will not work if they are covered with a band of shade (Alexander, 1977). In this Fine Arts Building, the two storey portion of the structure is elongated along its east-west axis in order to maximize exposure to the south courtyard and provide natural ventilation.

### ***Building Materials and Construction***

Historical development of Bengal Architecture is so ancient—many thousands of years old. People have always used one of the most vernacular materials which are "Brick" in order to build their structures. This handmade brick is such a beautiful element. However, Muzharul Islam



took "brick" as a primary design element: those were not only local, climate responsive and traditional but also beautiful and incredibly fascinating. The walls of the building are made of the traditional "Handmade Bricks" held together with lime mortar. In every design, Architect Muzharul Islam always tended to use natural materials like brick, wood, mud, and so on. Another important aspect of Bengal architecture, Terracotta, was introduced by Muzharul Islam in this design. Marvelous shading devices and pergola type brick details protect from driving rain, allow breezes and let one wonder at the wrath and beauty of our monsoon (Archive, n.d.).

### ***Social Structure***

The Fine Arts Faculty building is located in the Ramna area, part of the Dhaka University Campus. The Faculty (previously Government Institute of Arts and Crafts) was basically initiated by Shilpacharya Zainul Abedin, the eminent artists who helped establish the Institute of Arts and Crafts (now Faculty of Fine Arts) at Dhaka University (DU) in 1948. In 1952 the institute moved to a building at Segun Bagicha, and then in 1956, it moved to its own building (present-day FFAs' building) at Shahbag. Presently, the Faculty of Fine Arts is a public institutional building, a part of Dhaka University which is one of the best art schools in the south-east of Asia.

### ***Social Setup***

The Faculty of Fine Arts is the social and cultural hub of the University of Dhaka, and perhaps the area is the most prominent social and political center of the country. Traditional cultural activities, religious festivals, and even significant political protests are organized by the students of Dhaka University. However, students always prefer this Faculty of Fine Arts Building and its surrounding areas to perform and celebrate those cultural activities. A lotus pond and sitting area become the open heart of the whole institute. The ground on the south both is a mental relief

and a place to gather. This ground and the entire structure itself is transformed to host many activities, such as the Bengali New Year *'Pohela Boishakh'*, and numerous art classes and competitions for children (Archive, n.d.).



Figure 5-12 Outer yard; place for cultural gathering and exhibitions. (Archive, n.d.)



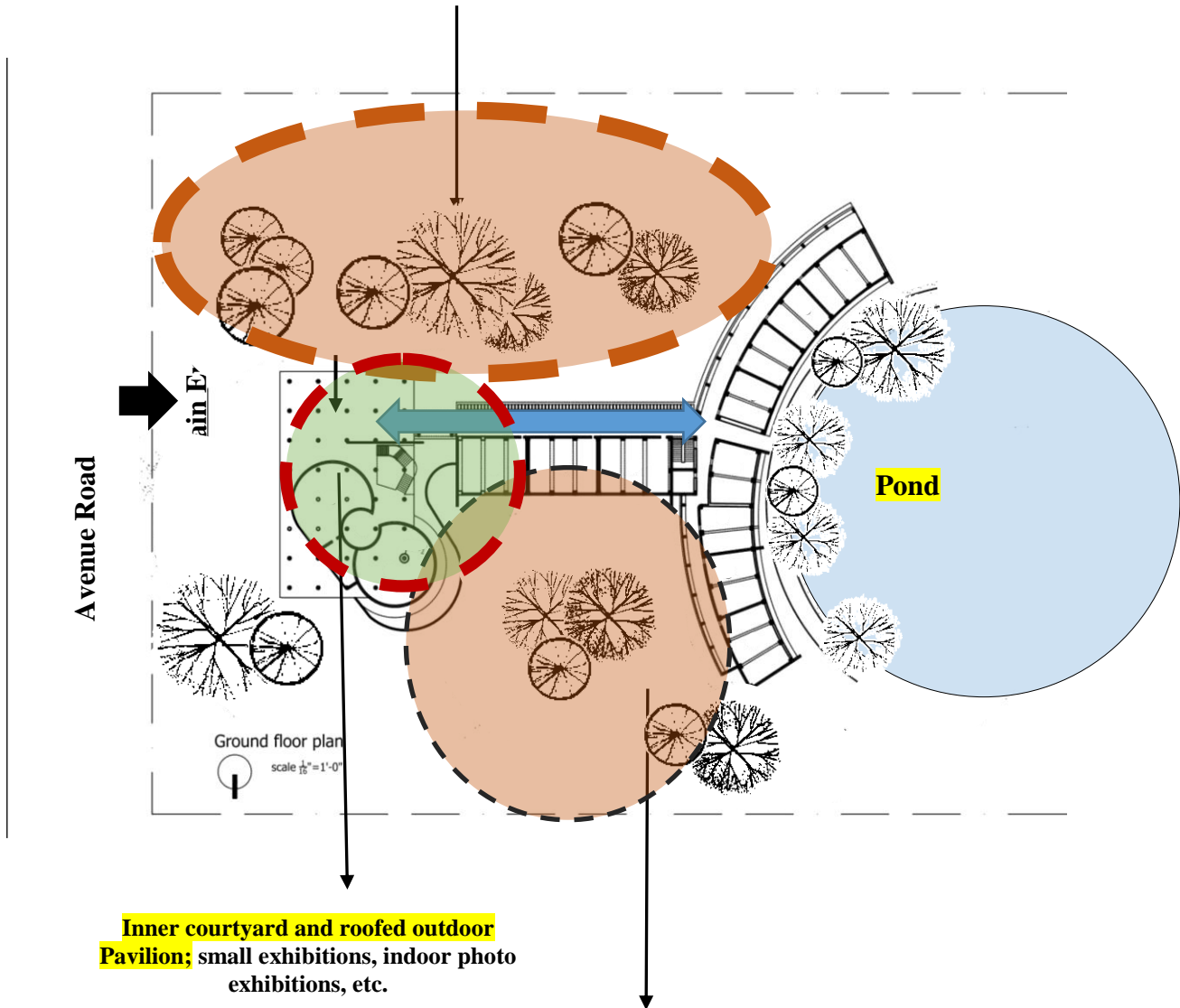
Figure 5-13 Children are attending “painting competition” in the corridor (Google Maps, 2018).

***“The design echoes the front yard and inner house scheme of rural Bangladesh”***  
(Archive, n.d.).

For *'Pohela Baishakh'* (1<sup>st</sup> day of Bengali New Year), a temporary stage is set in the center of the outer courtyard (front yard, area 02) around which comfortable seating arrangements are made (Fig. 5.18). The covered corridor functions are multipurpose. Due to its pleasant temperature, it is frequently used in the summer to relax and make drawings and paintings in. The verandahs and terraces are used to get sunlight and for adequate ventilation.

The inner courtyard and the terraces are used for many social events like musical evenings, exhibitions and students' competition (Fig. 5.13), and so on. Many people, other than the students of the Faculty of Fine Arts of Dhaka University (DU), use the building for social gatherings upon permission from the Faculty or from the University as well.

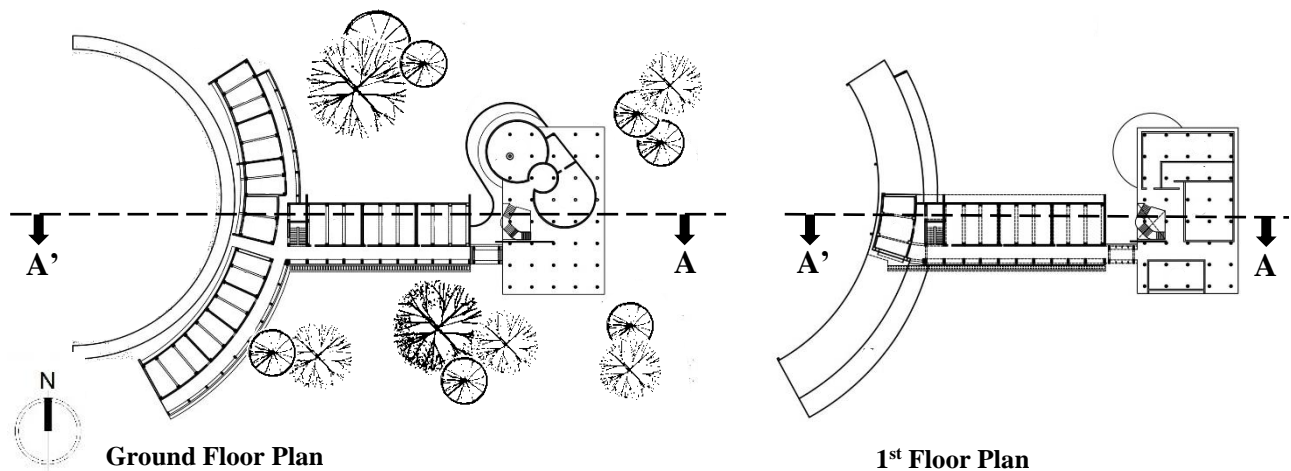
**Front yard area 01: A lotus pond and sitting area; this space is for a big public gathering like crafts exhibition, cultural program and so on...**



**Figure 5-14 Faculty of Fine Arts, University of Dhaka; Center of Gravity of Social Life, Semi-outdoor corridors, Sitting Circles, inner courtyard and outer courtyard.**

## *Comfort*

Architect Muzharul Islam in a single stroke of genius was able to guide architects in Bangladesh towards a Bengali modernism which would be rooted in its rich heritage and culture. During the summer season, the courtyards of the building, and also windows of rooms opening onto them, remain cool in the daytime and at night the terrace, and roofed corridors and verandahs allow the cool breezes to help remove heat from the building. In the winter season, the roof and the courtyards allow maximum exposure to the sun during the day and remain pleasant for the students and other people as well. There are no air conditioners but heaters have been installed inside—the building is ventilated naturally, and it supplies occupants with fresh air. There are only few ceiling fans in the indoor classrooms which are merely used by students during scorching summer days.



**Figure 5-15 Plans Showing Section Line AA'**

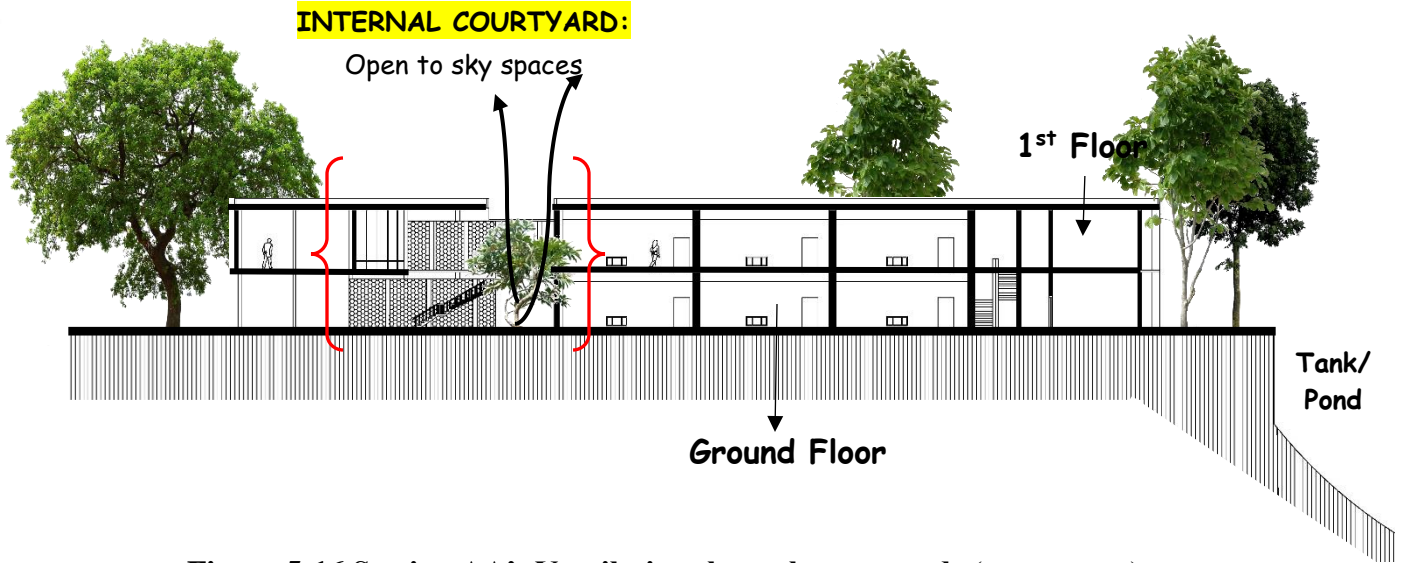


Figure 5-16 Section AA'; Ventilation through courtyards (anonymous)

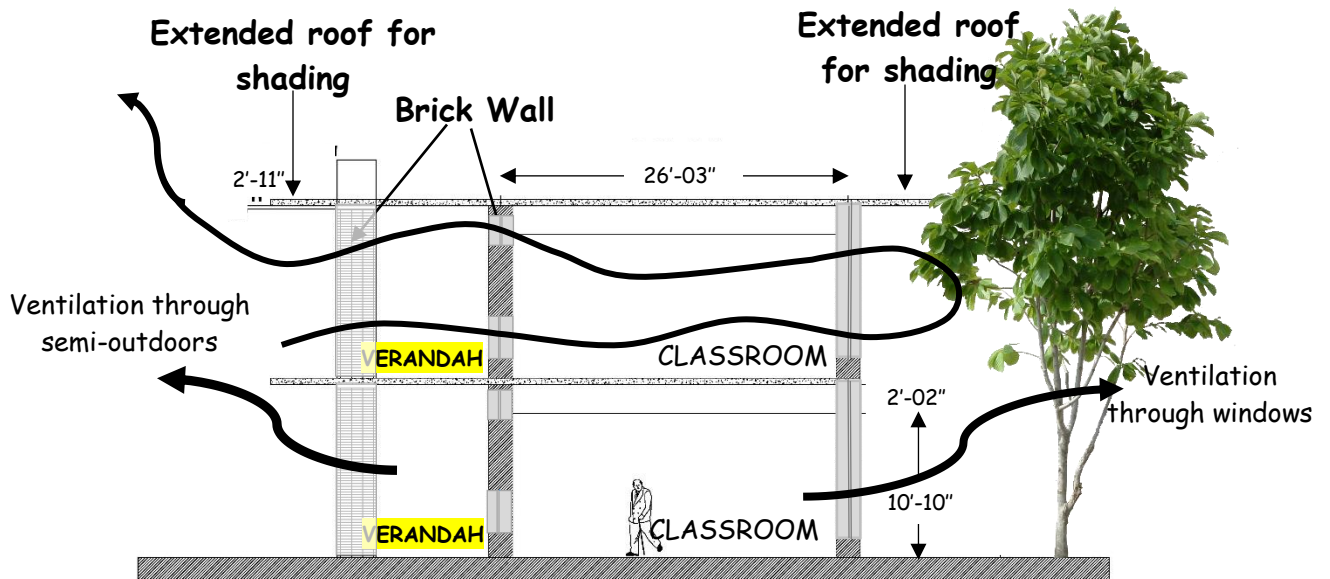
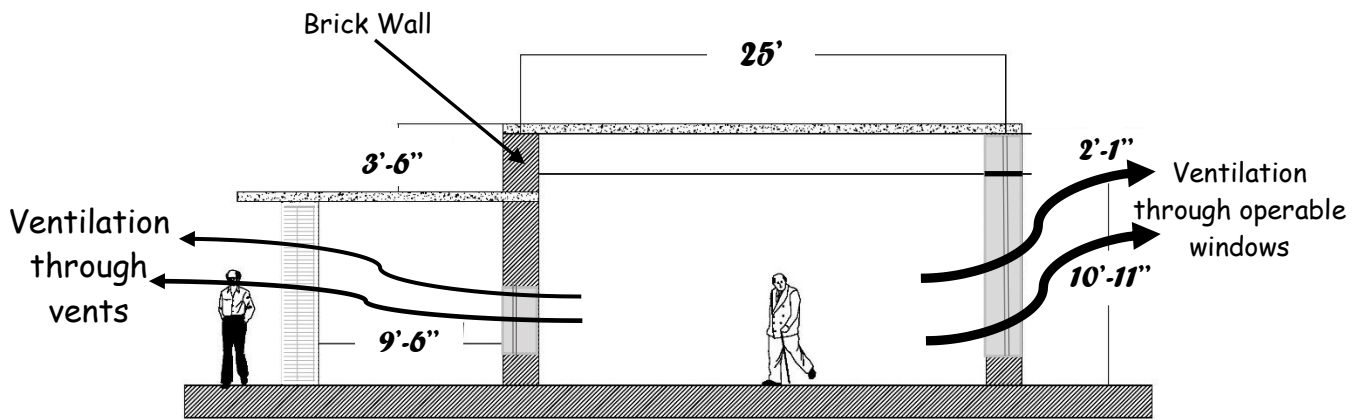


Figure 5-17 (Linear Mass Section) Adequate Ventilation through verandahs, semi-outdoors and corridors.



**Figure 5-18 (Curved Mass Section) Adequate Ventilation through verandahs, semi-outdoors and corridors (anonymous)**



**Figure 5-19 South Elevation of the Building:** Shaded corridors, Verandahs, Internal Courtyards all are south facing. (Archive, n.d.)



**Figure 5-20 East Elevation of the Building:** Architect deliberately designed the building and avoided hot summer sun on the east side. The building is elongated south to north. (Archive, n.d.)

Large continuous verandahs are rain and sun protected spaces, often separated with ‘*Jalees*’ (lattices) and ‘*Beras*’ (perforated screens) from the internal courtyard (Archive, n.d.). At the middle of the yard, there is a traditional tree named “*Kath Golap*” (White Plumeria) which allows the students to enjoy the breeze without having to face the scorching summer sun. Architect Islam deliberately placed semi-covered spaces which prevent glare and allow daylight and air to enter. His design scheme was significantly climate responsive (Ashraf K. K., 1998). The prevention of direct solar radiation keeps the interior spaces cool as well. Semi-outdoor corridors and verandahs are the transitional shaded spaces which connect a person to the outside with protection from extreme weather conditions. The terracotta screens made from traditional clay provide a degree of privacy. In winters to avoid heat loss through the openings, windows are closed with solid wooden planks.

The circular pond, a circular shaped water body in the outer yard cause evaporative cooling. The whole design setup allows the user to experience a light breeze with its gentle movements during the warm and humid time of the year.



**“Jalees” (lattices) and “Beras”  
(perforated screen)**



**Figure 5-22** The terracotta screens made from traditional clay provide a degree of privacy (Earth, 2015)



**Figure 5-21** “Jalees” (lattices) and “Beras” (perforated screen) (Archive, n.d.)



**Figure 5-23** Children’s painting competition in the shaded corridor (Hasan M. , 2017)



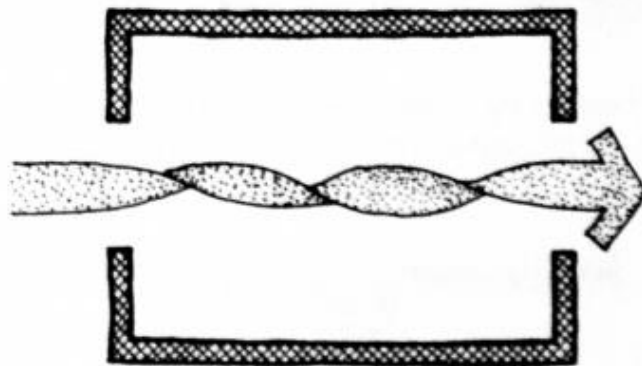
**Glass between  
wooden fins**

**Figure 5-24** Windows with solid wooden planks (Archive, n.d.)



“Cross-ventilation is a significant cooling strategy in warm climates because other than removing heat from the environment; it also creates a feeling of cooling by increasing the rate of evaporation of people.” (DeKay, 2013)

Architect Muzharul Islam followed both the method of cross-ventilation and stack effect principles (Fig. 5.17). In fact, he set an example of critical regionalism in architecture because he knew that comfort could only be ensured if the building follows contextual endeavors. We all know, **Critical Regionalism** is an approach to architecture that endeavors to counter the placelessness of much of the modern world but also rejects the fanciful individualism and decoration of postmodern architecture. Architect Muzharul Islam sought to provide a design rooted in the modern tradition but tied to geographical and cultural context. He also believed that an effective and appropriate regionalism is not merely regionalism in the sense of vernacular architecture, but that it should be a progressive approach to design that seeks to mediate between the global and the local architectural language. These approaches are quite similar to Critical Regionalism. Perhaps, his architectural interpretation will give us the best example of regional approaches. He is a true regionalist despite being an influential modernist as he always did see the world through local perspectives (Ashraf K. K., 1998).

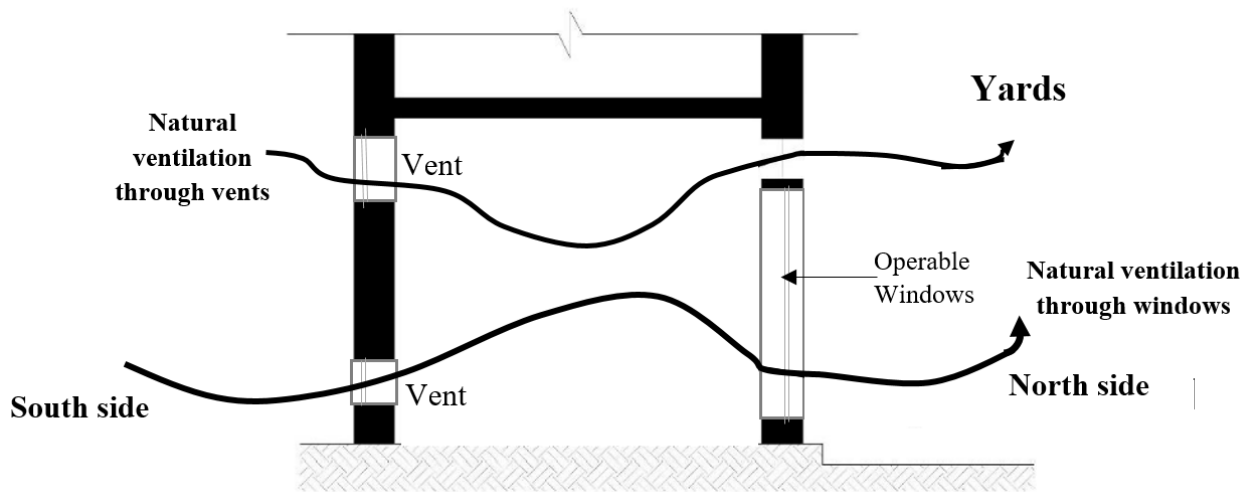


**Figure 5-25 two openings on opposite walls (DeKay, 2013)**

Windows or vents placed on opposite sides of the building give natural breezes a pathway through the structure. This is called cross-ventilation. Cross-ventilation is generally the most effective form of wind ventilation (DeKay, 2013). Architect Muzharul Islam deliberately used this cross-ventilation method.



**Figure 5-26** For Cross ventilation architect placed vents (Ganguly, 2015)



**Figure 5-27** Cross-ventilation

Basic ventilation techniques for indoor classrooms and craft rooms. Air reaches the surface and flows north and south.

Windows and vents with high ceilings in the classrooms and craft rooms create cross-ventilation (Fig. 5.25). Typically, this is a wind-driven effect in which air is drawn into the building on the high-pressure windward side and is drawn out of the building on the low-pressure leeward side (*Designing Buildings, 2018*). The exterior walls of the various rooms are mostly painted white in color to reflect the maximum radiation from the sun. On the other hand, brick masonry work is visible from the exterior of the building, since architect didn't put any paint on it. This is perhaps because of the historical influences as people used fair-faced brick walls to build ancient temples, mosques (discussed in chapter two). These thick handmade brick walls also work as thermal mass during winter. The architect also used wooden vertical louvers for proper ventilation and comfort.

### **Typological Level**

At this level, buildings possess a sense of history, community, nature, and place. By taking inspiration from the bioregional traditions and historical building types, architecture is created that is both new and familiar (Coates, 2014). Time-tested architectural types provide important lessons to reach high standards of excellence. Nature also provides lessons about sustainability and life-enriching design. Biophilic design in a built environment connects the users to nature through plants, animals, and water.

Professor Coates views the Typological level of Deep Beauty as:

"The Typological Level involves the adaptation of bioregional building traditions and historically situated building types in the design of contemporary buildings that are capable of evoking a sense of connection with history, community, nature, and place." (Coates, 2014)

Typology is regenerative so buildings can be of the same building type yet appear so different from each other (Polyzoides, 1992). Nature also provides lessons of sustainability and life-enriching design. Humans perceive and communicate by forming standards and systemizing patterns. In this context, architectural typologies consider the different requirement profiles of building types and spatial systems. Examining typology involves a dialogue within history to discuss the generation of ‘new’ from the ‘old.’

### *Sense of History, Community, and Place*

“The College of Arts and Crafts” (later named as the Institute of Fine Arts) announced the beginning of a Bengali modernism that deliberately stood away from both stigmatized colonial and hybridized traditional forms.” (Ashraf K. K., 1998)

Dhaka, the capital city of Bangladesh, once was called the Venice of the east—now this is one of the poorest countries in the world, and yet its history was different. Once it was a scenic beauty just beside a river called BuriGanga. Dhaka has a proud history of over 400 years and serves the whole southeast region of Asia through its social viability as well as through its strong regional connectivity. However, nobody could imagine Dhaka’s past glory and even many people have experienced the serendipity while they found Dhaka as a river-based city.

It is quite evident that aesthetics are fundamental to both culture and nature, and if sustainability refers to the graceful interaction between them, it must have a sensory dimension (Pallasma, 2013). Nevertheless, this sensory dimension of Bengal Architecture is its entirely unique land-water relationship and the poetic dilemma of indoor, semi-outdoor and outdoor spaces. During the 1940s and 1950s, Dhaka started to adopt bad examples of unresponsive and

non-contextual International Style. The architectural interpretation of this style was also deeply influenced by its colonial heritage (Ashraf K. K., 1998). However, Bengal architecture had a rich heritage of its own, which is so simple—proportionately and harmoniously developed.

Although Bengal's architectural characteristics and even its early traditional works were extremely rich in design features, a discontinuity has taken its toll, and soon Bengali architects were embracing the styles of their colonizer (Ashraf K. K., 1998). In that time, during the 1940s, Architect Muzharul Islam came with a candle in his hand and lighted the way towards a new revolution through this masterpiece. This project holds the pride to be known as the beginning of Bengali modernism (Ashraf K. K., 1998). "The project is deeply rooted in its rich heritage but "breaks away from the forms of both its colonial and traditional antecedents." (Archive, n.d.).

### ***Building Type***

The Faculty of Fine Arts Building is based on the traditional rural courtyard housing type of the region. The typical layout plan and space sequences of Bengal architecture have been transformed to meet the needs of this particular building and the community. Nevertheless, some original features like "*Jalees*" (lattices) and "*Beras*" (perforated Screens) have also been transformed into this masterpiece and perhaps this contextual interpenetration has developed the thresholds of Bengal style of modern architecture.

### ***Layout***

Christopher Alexander and his colleagues in the book the *A Pattern Language* also discuss the pattern of intimacy gradient. They say, "Unless the spaces in a building are arranged in a sequence which corresponds to their degrees of privateness, the visits made by strangers, friends, guests, clients, family, will always be a little awkward."

In this building, a definite gradient from formal spaces (classrooms/Craft rooms/office, etc.) to informal (exhibition area, courtyards, corridors, etc.) spaces can be observed (Fig. 5.29). The entrances lead to the front pavilion and the semi-outdoor passage that are more informal areas. Further into the building are the more intimate inner courtyards. Moving to the first floor, the level of privacy increases. However, the building is significant in the history of Bengal architecture because of its architectural layout and planning. The real success of this faculty building lies in the fact that it teaches art to artists, without the need for the presence of an instructor. Its layout and unique space sequences give students a chance to learn from nature.

Like other traditional houses of the Delta, the orientation of building in relation to sun and wind. And architect Muzharul Islam also replicated Bengal rural space sequences and designed influential shaded outdoor spaces. He strictly maintained the space sequences:

### “Indoor—Semi-outdoor—Outdoor.”

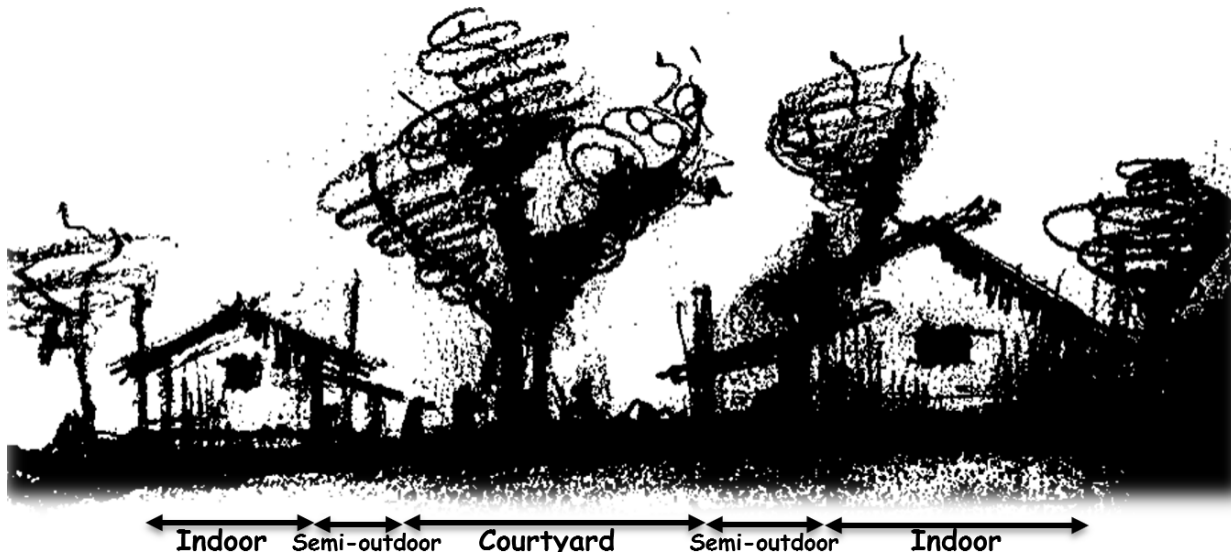


Figure 5-28 A section of Bengal household (space sequences of Delta).

Previously mentioned in chapter 02

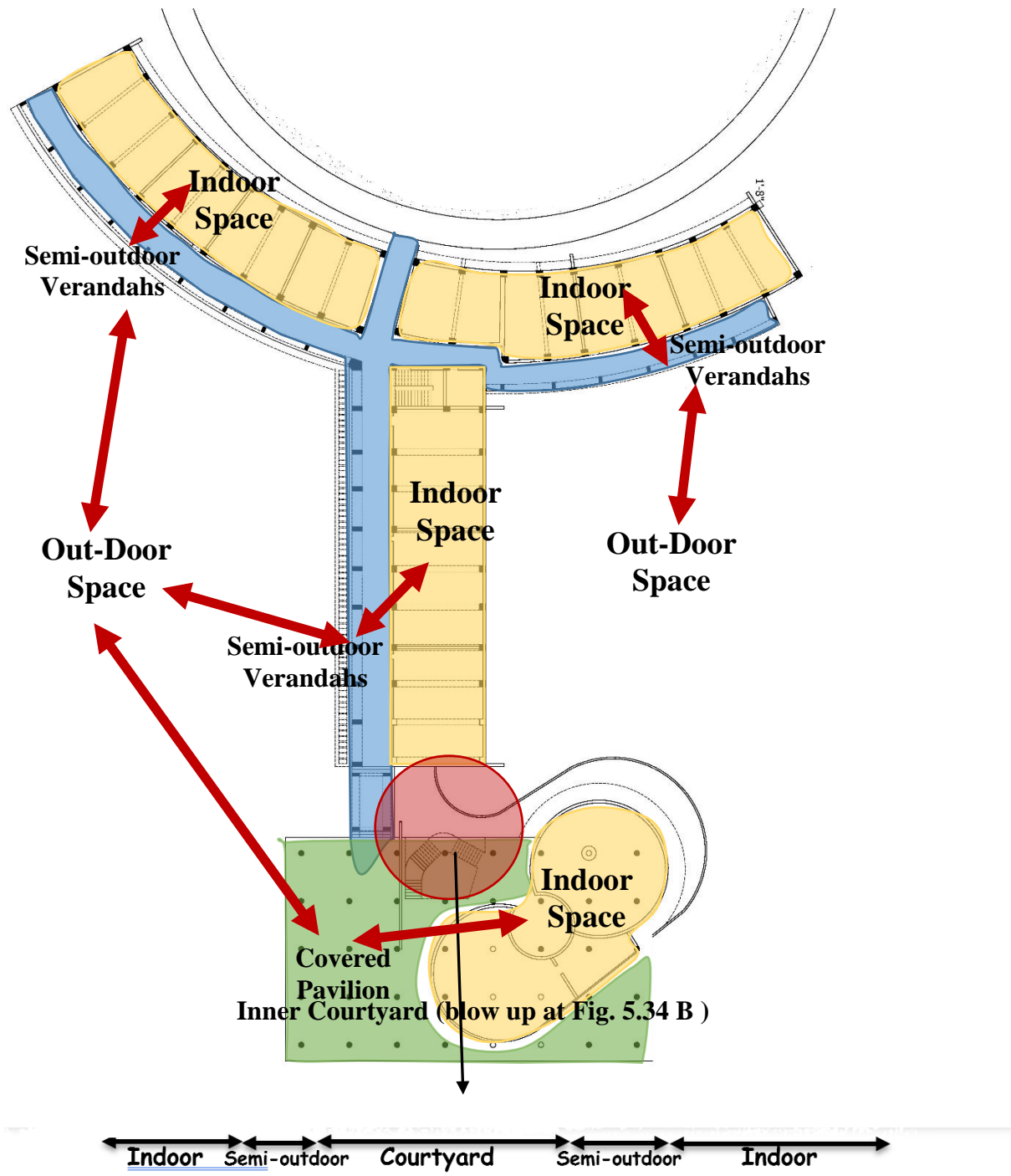


Figure 5-29 A section of Bengal Household (space sequences of Delta)

“Place every courtyard in such a way that there is a view out of it to some larger open spaces; place it so that at least two or three doors open from the building into it and so that the natural paths which connect these doors pass across the courtyard. And, at one edge, beside a door, make a roofed veranda or a porch, which is continuous with both the inside and the courtyard.”

(Alexander, 1977)

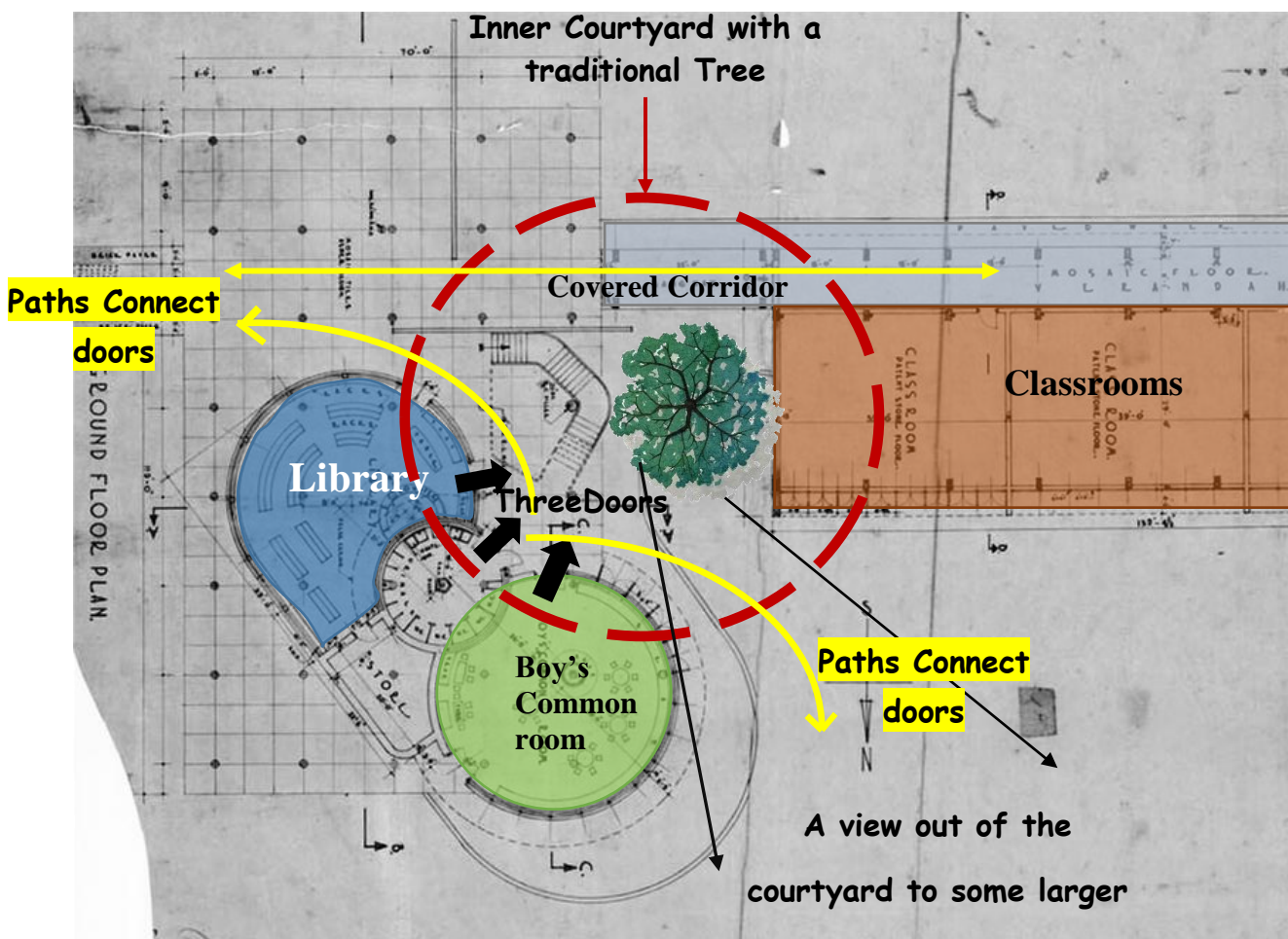


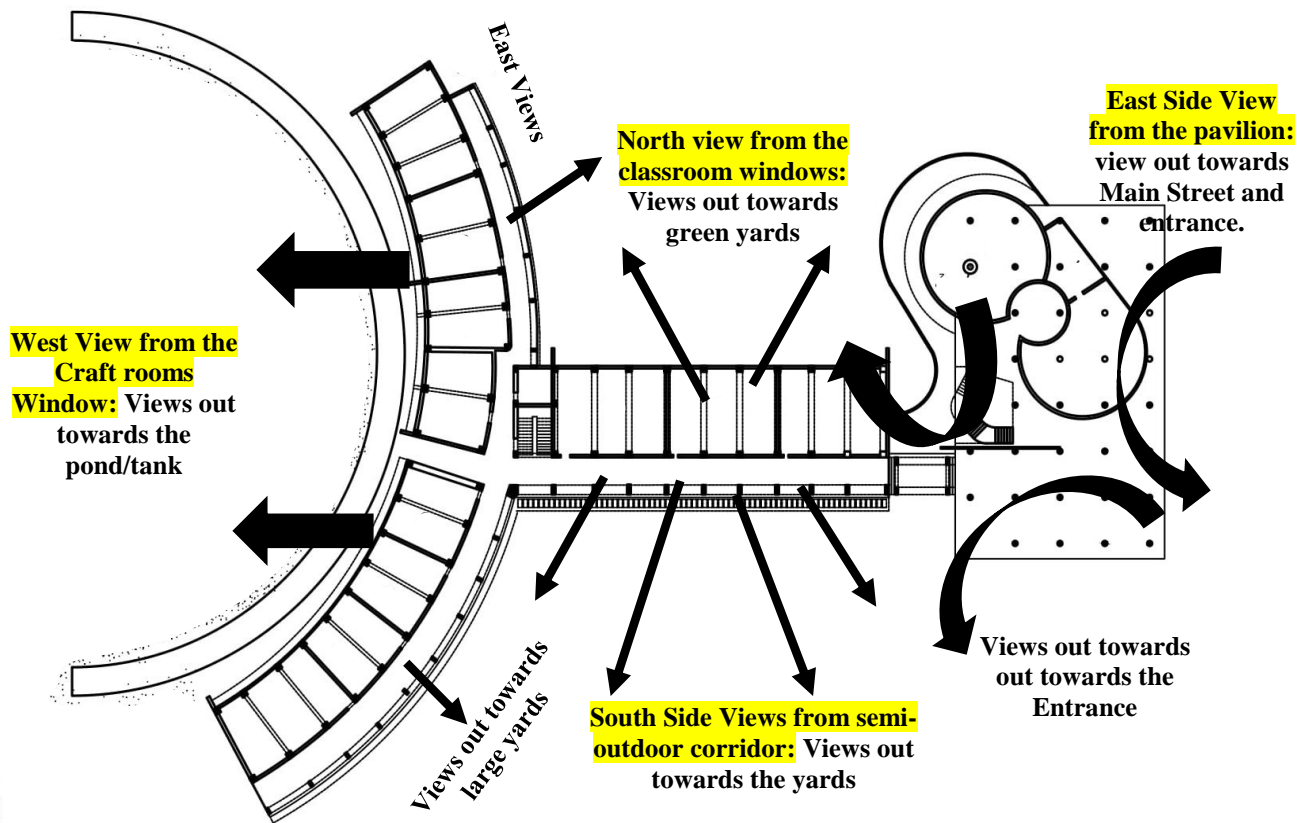
Figure 5-30 A inner courtyard which follows the Christopher Alexander's courtyard concept. (Archive, n.d.)





**Figure 5-31 Inner courtyard of the Faculty of Fine Arts, the University of Dhaka (Earth, 2018)**

Courtyards in modern buildings often become dead spaces because the distinction is made between the inside and the outside, an insufficient number of doors open into the courtyard, and the courtyards are cordoned off (Alexander, 1977). However, Visual & physical linkages with different courtyards and shared activities in the patios are crucial to creating lively and interactive spaces.



**Figure 5-32 Linkage with different Courtyards: Side views from the building.**

## ***Biophilic Design***

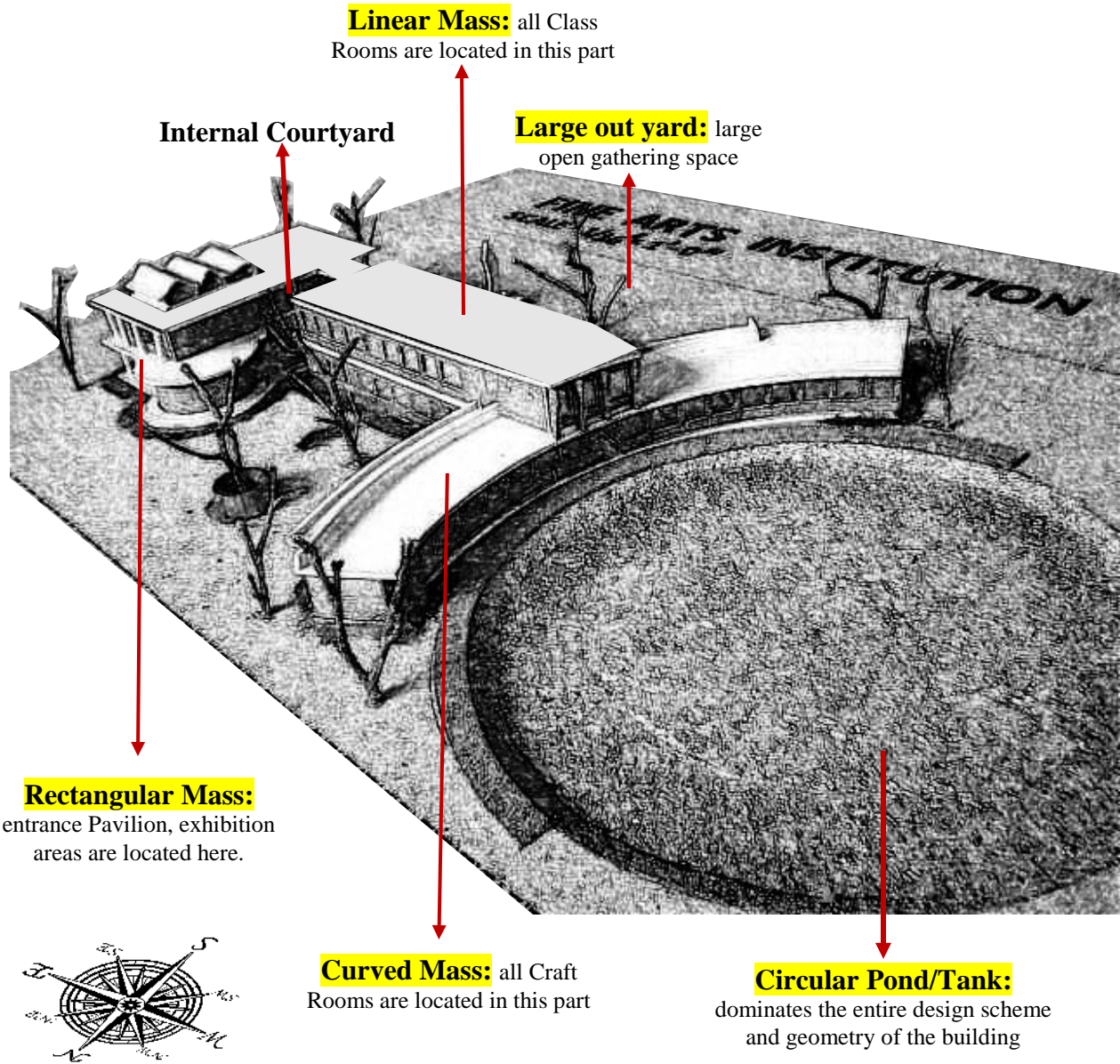
The most critical aspect of biophilia in architecture is to place nature at the core of design. Recently Professor Timothy Bentley has introduced these ideas in the field of urban design and architecture. However, about 50 years back Architect Muzharul Islam realized those concepts and also made substantial efforts to incorporate these philosophies into his designs. In fact, architect Islam was given a site which had numerous beautiful trees & he made it a point not to cut a single one of them (Ashraf K. K., 1998). His design started with finding the interplay of spaces within this beautiful array of trees, and the result is a beautiful free-flowing space continuously corresponding with the outside. He merged different elements of our traditional architecture such as forecourt, outhouse, screen, inner court but transformed them into a modern vocabulary (Archive, n.d.).

His design is incredibly climate responsive and spells out many spaces through which one could sense Dhaka's different seasons. Between sun and rain, between shade and room, between the inside and outside –he created a beautiful pavilion where a creative mind can wonder.



**Figure 5-33 Inner courtyard features (Earth, 2018).**

The Faculty of Fine Arts Building is home to many animals including birds, insects, and dogs. In fact, the architect designed resting places for birds in the courtyards. On the south, a small circular pool with a circular sitting area in the outhouse is a geometric form within which the lilies and the small fishes create an organic order. There is another big circular tank (a circular depression) named the “Lotus Pond” on the west side, which dominates the entire design scheme and geometry of the building. Eventually, the pond has become the open heart of the whole institute. Architect Islam didn’t even try to hamper or modify the shape of that pond; In fact, he followed the setting and respected every single aspect of nature. Now the pond has become a crucial part of the ecosystems as it is the home of hundreds of different species. Most of the Fine Arts Buildings, in this area have been intended in the scheme of a “*bagan bari*” (house in a garden (Archive, n.d.).



**Figure 5-34 Faculty of Fine Arts, (DU), Biophilic Design**  
 (Islam put nature at the core of design)

## *Archetypal Level*

Professor Gary J Coates has mentioned about the Archetypal Level of Deep Beauty that:

"The Archetypal Level involves the use of archetypal building elements, patterns, and forms that are most typically found in the world's sacred architecture. Buildings at this level speak in the natural language of space, which is rooted in the pre-verbal meanings of embodied experience: up and down, right and left, front and back, inside and outside, near and far, darkness and light, rough and smooth, warm and cool, the horizontal and vertical, the center and periphery." (Coates, 2014)

Buildings at this level use archetypal elements from the world's sacred architecture. Such buildings possess greater levels of higher order by using sacred geometry and the qualitative number. The presence of biologically rooted polarities of prospect and refuge, complex order, enticement and peril respond to our psychophysical opposites (Coates, 2014). Professor Coates also says that this level reveals the language of the space and also provides natural symbol of up and down, inside and outside, horizontal and vertical and so on (Harries, 1993). The level talks about numbers, geometry, space orientation, the proportion of the structure.

### *Orientation in Space*

The building is situated within the campus area of the University of Dhaka. From the roof of the Fine Arts building, the *Shishu* Park (the only public sector children's amusement park in Shahbag) is visible. Recently, on the east side, a museum named, The Museum of Independence has been constructed in the middle of the historical *Suhrawardy Udyan/Park* (formerly known as Ramna Race Course). On the north side, the Bangladesh National Museum is visible.





Figure 5-35 Orientation in Space of Fine Arts Building, Dhaka (Google Maps, 2018)

*Geometry, Proportion, and Number*

Architect Muzharul Islam discovered “**The Fingerprint of Bengal Architecture,**” with traditional rectangular and circular forms. He explored morphological characteristics of Deltaic houses and households. Nevertheless, geometry and proportion of this building came from native culture and context.

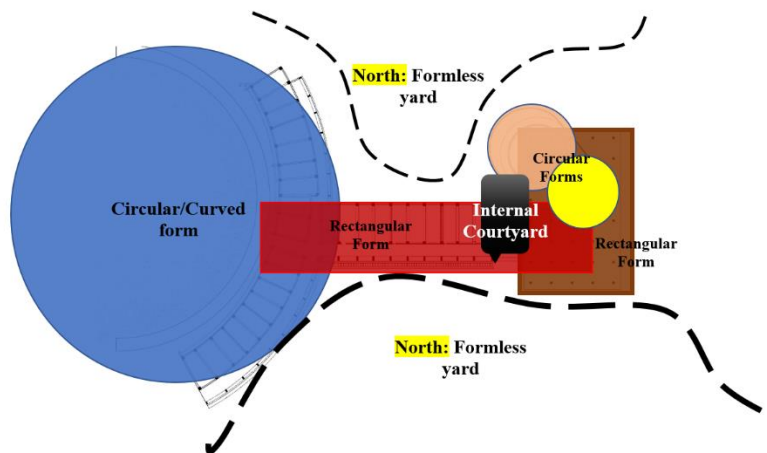


Figure 5-36 Different geometric shapes in the ground floor plan.

## Geometry

In the Delta, traditional houses have simple rectangle forms; rarely one can find any different geometry in Bengal households. Although Deltaic Architecture has some distinguishable space sequences (Fig 5.28), morphologies and an inherent harmony of space, the architectural design process doesn't follow any strict geometric formation.

As I have already mentioned, a traditional house in Bangladesh is an example of simplicity and vernacular architecture. Architect Muzharul Islam followed the Bengal household pattern and did real justice to the context which we may call critical regionalism.

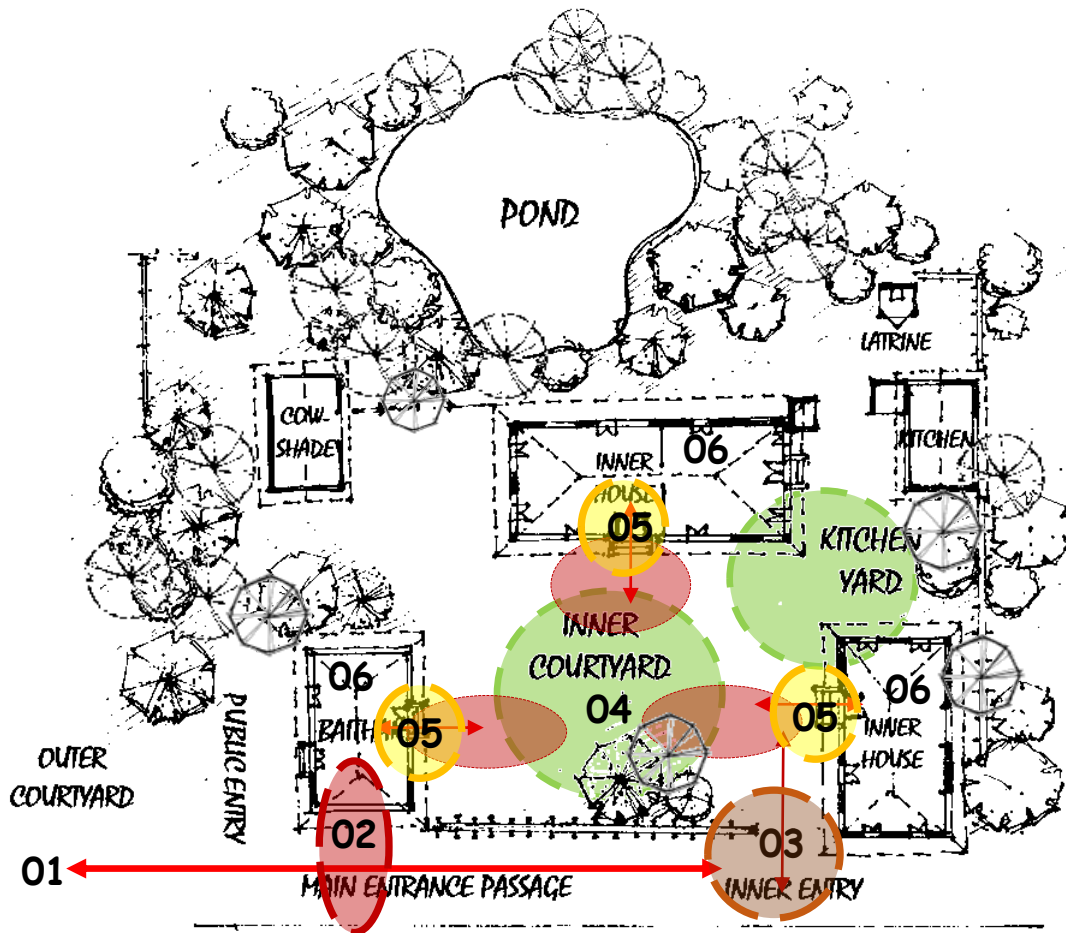
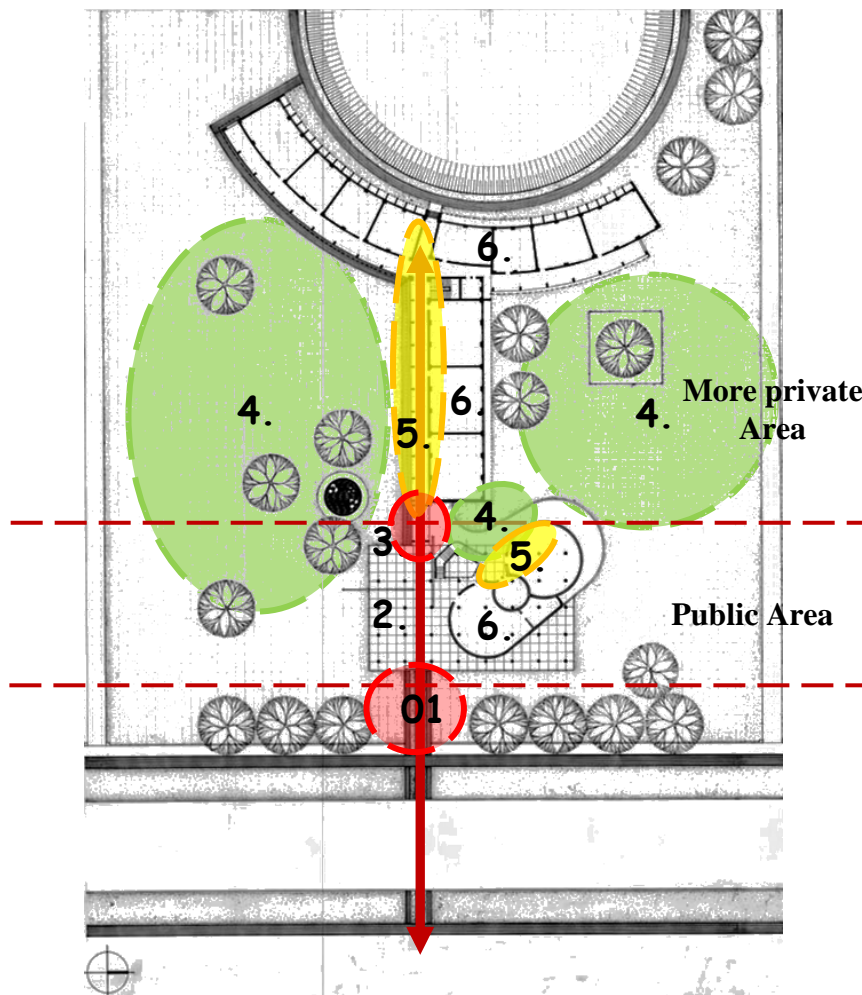


Figure 5-37 A typical Bengal household patterns and primary space sequences (Hasan D. M., 1985)

**A typical Bengal household's space sequence:**

1. Approach (entry)—2. “*Baithak*” (sitting area/living)—3. Private Entry—4. Inner Courtyard—5. Semi-covered/Shaded outdoor/semi-open spaces—6. Indoors (dwelling)

Architect Muzharul Islam maintained almost the same patterns and sequences.



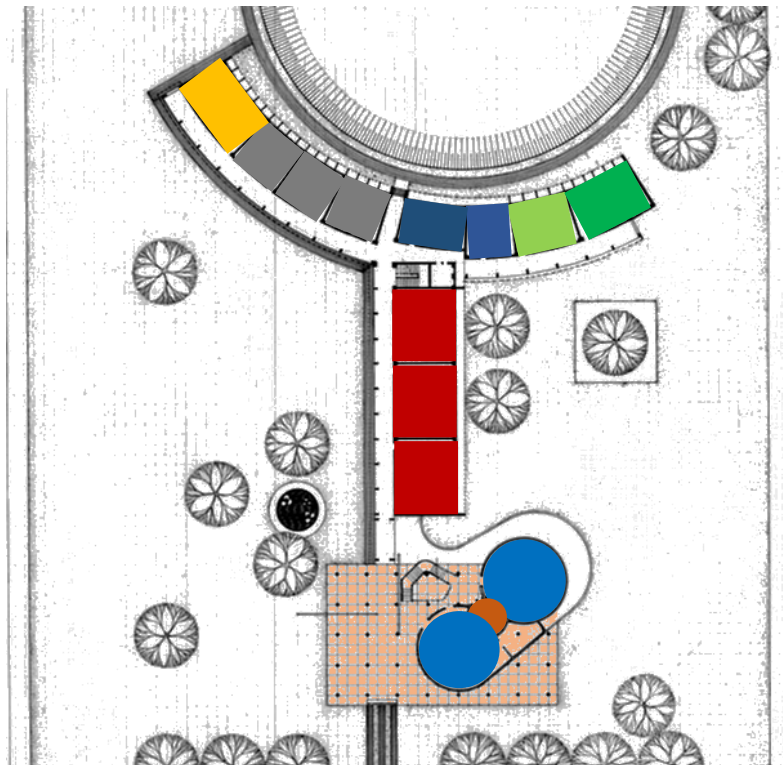
**Figure 5-38 Ground floor Plan: replication of Bengal household patterns and sequences**  
(Archive, n.d.)



The space sequences of the Faculty of Fine Arts Building follows the same pattern of a traditional Bengali household:

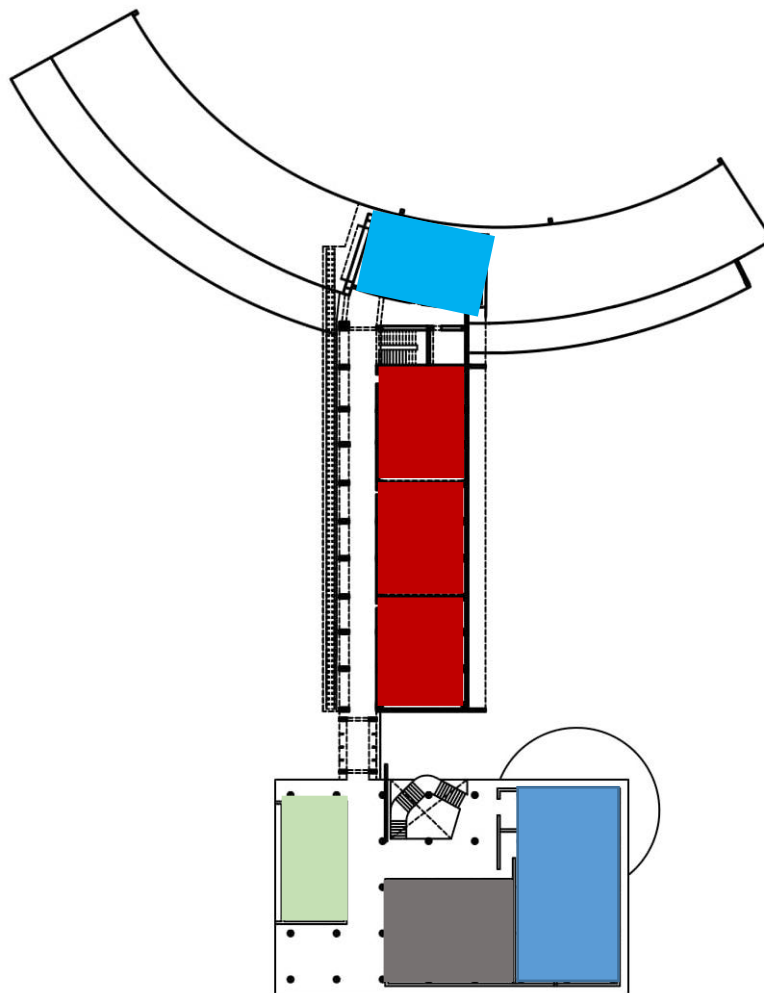
1. Approach (entry)—2. Basically, a public area (Essenes of the “*Baithak*”)—3. More private entry—4. Courtyards/yards—5. Semi-covered/Shaded outdoor/semi-open spaces—6. Indoor (classrooms, offices)

Now, it is quite evident that the project replicated the Bengali rural household patterns (Ashraf, Independence). However, it gained an immediate iconic status in Bangladesh. The project is a masterpiece employing the modernist vocabulary which was also adapted to suit the local climate and context (Ashraf K. K., 1998). Therefore, all internal functional areas like- classrooms, craft rooms, offices, common rooms, etc. are rectangular in shape, follow the Bengal architectural principle.



**Figure 5-39 Geometric pattern of the Ground Floor Plan: rectangular & circular forms.**  
(Archive, n.d.)

Although a circular mass is placed on the west side of the plan, all formal spaces like classrooms, craft rooms are rectangular in shape. However, approximately, eight different sized rectangles (eight different colors in Fig. 5.39) had been used by the architect. He also created three round shaped areas for the library, common room and toilet. However, in Bengal architecture, we find extensive use of rectangles, forming deltaic households that look quite organic and natural. In this project, architect Muzharul Islam took references from nature (respecting the outline of a pond) and also designed some organic shapes in the plan (Fig. 5.39).



**Figure 5-40 1<sup>st</sup> floor plan of the building**

The geometry of the Ground Floor Plan: all rectangular forms.

Circular form follows the outline of the pond on the west side.

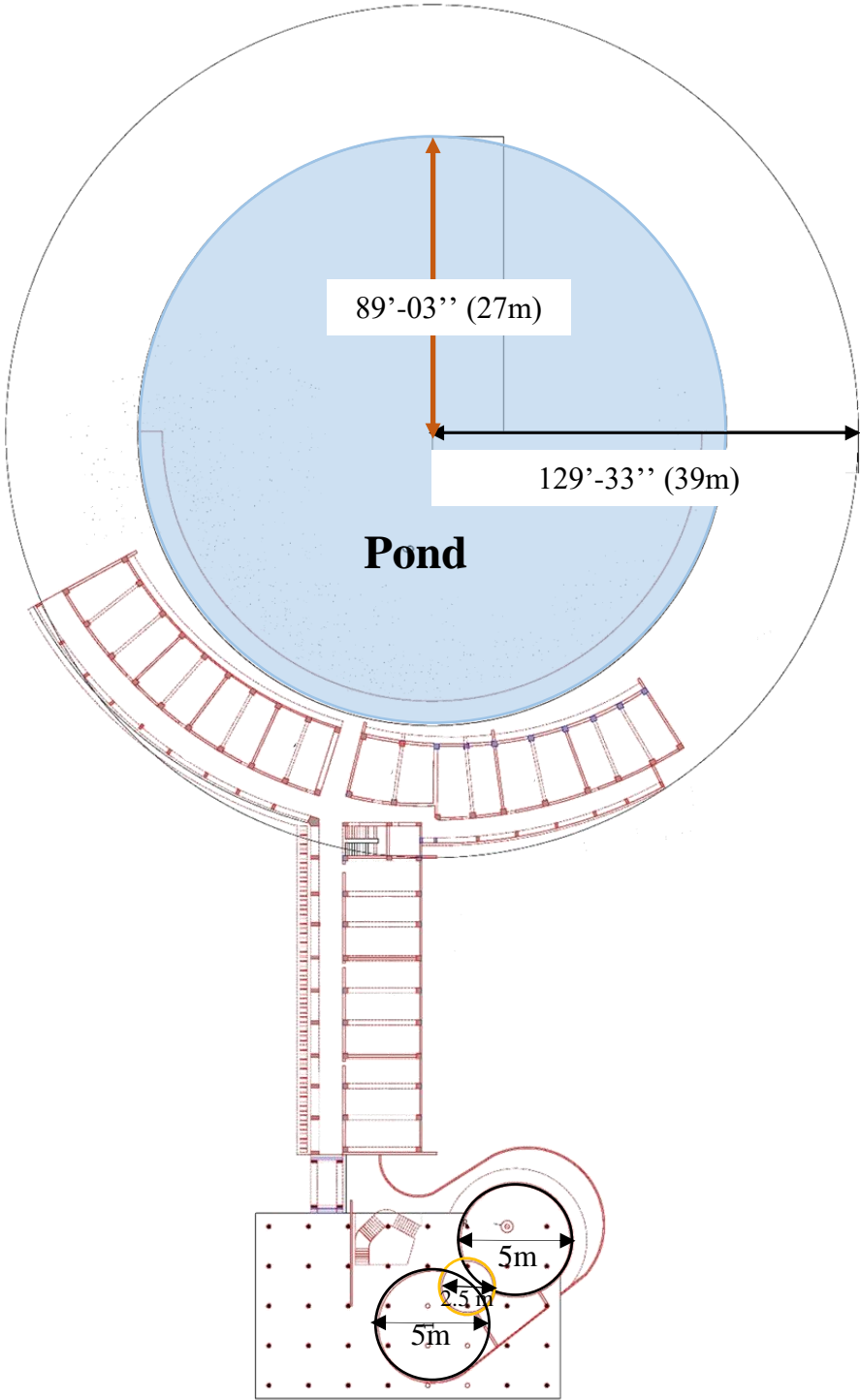


Figure 5-41 Ground floor Plan: Circular forms analysis.

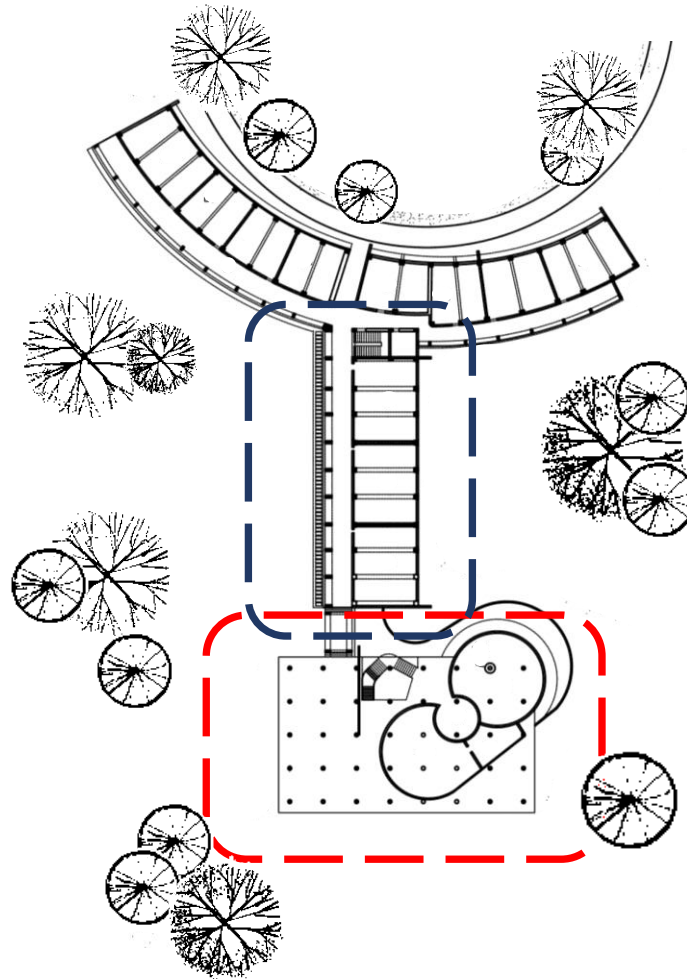
Bengal Architecture reflects “Human Scale.” Deltaic architecture reflects horizontal development; Maximum traditional houses are one-story. Again, architect Muzharul Islam followed the pattern; however, the faculty of fine arts institution is mostly a horizontal development.



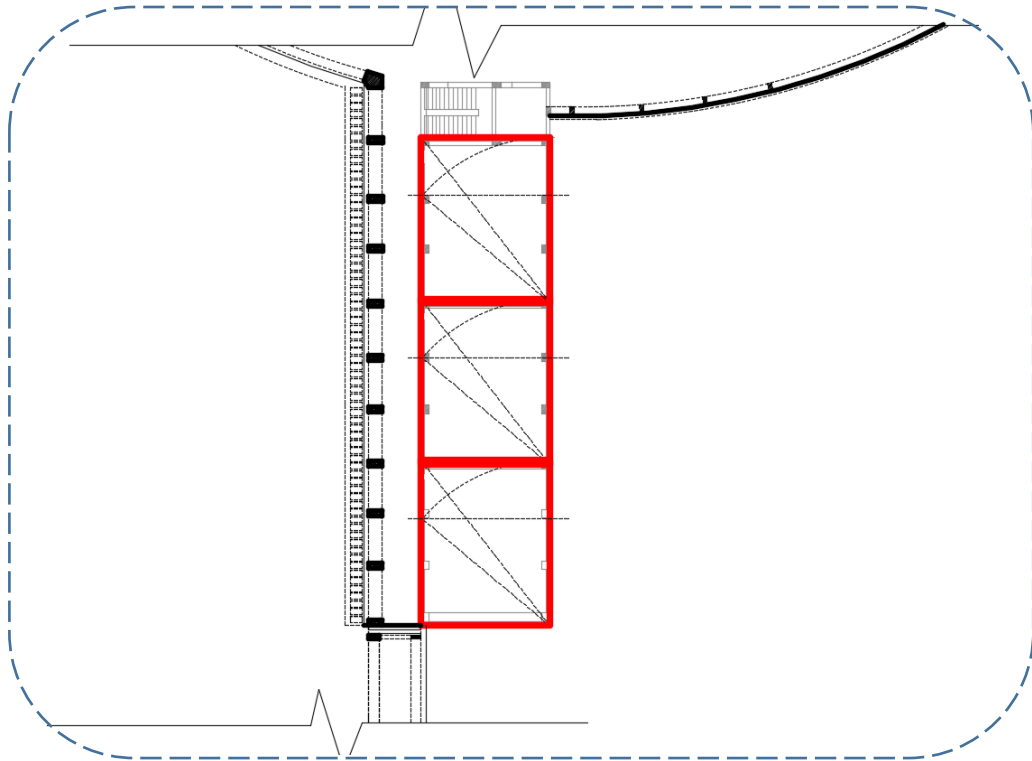
**Figure 5-42 Geometric Pattern the south side of the front pavilion; (20 rectangle blocks)**

The main design is formed by root-2 rectangles\*\* of different sizes and a circular form. The golden mean proportions have been used for the front pavilion. On the other hand, classrooms have the proportions of a root 2 rectangle, and the common room and library are circles. The second courtyard has a tree with proportions of a square. However, the craft rooms follow the natural outline of the pond as the circular mass was sapped deliberately by Islam according to the natural settings. Geometric analysis of the building has been given below—

\*\* A root rectangle is a rectangle in which the ratio of the longer side to the shorter is the square root of an integer, such as  $\sqrt{2}$ ,  $\sqrt{3}$ , etc. (Wikipedia,n.d.)

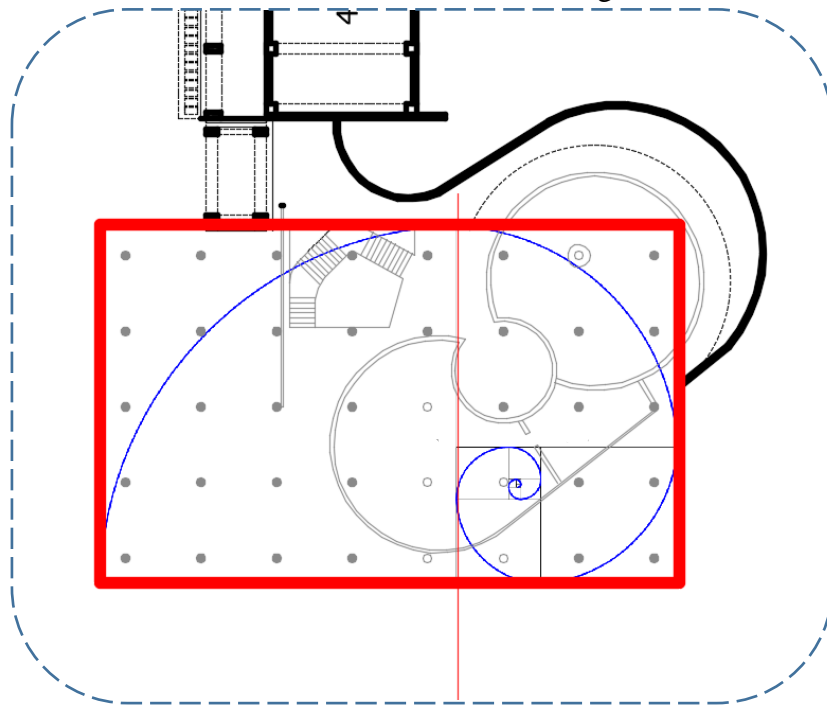


**Figure 5-43 Geometric Analysis of the Ground Floor Plan (anonymous)**



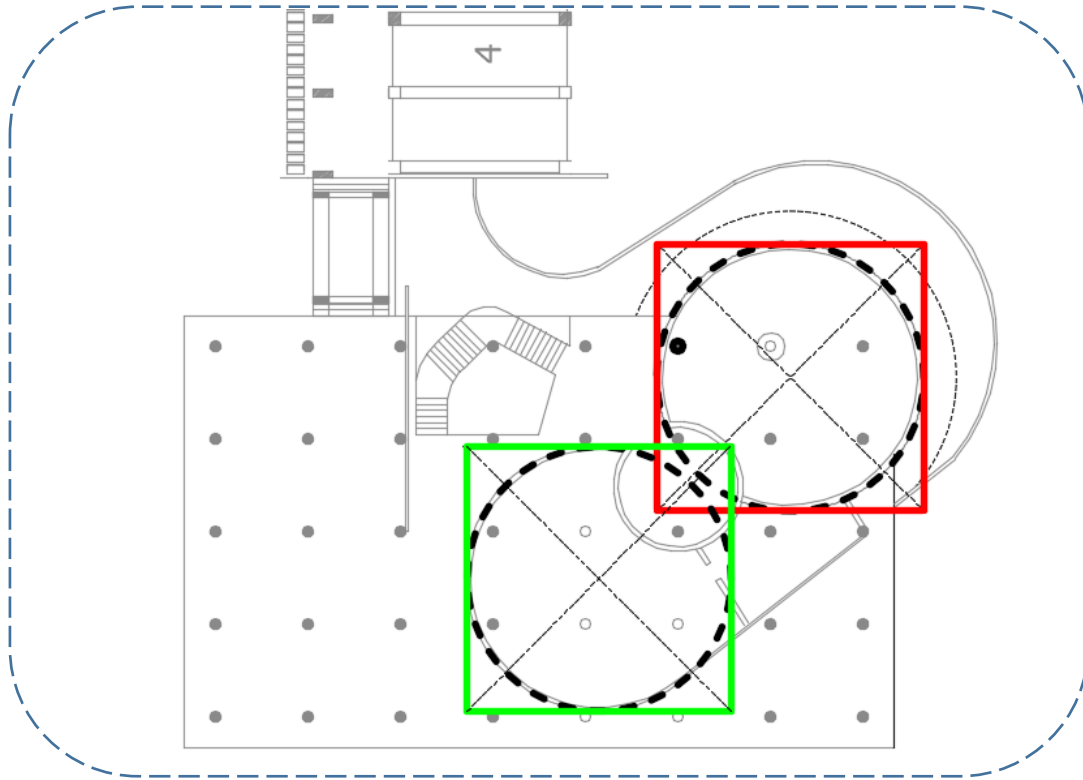
**Figure 5-44 Blow Up A of Geometric Analysis**

Classrooms are root-2 rectangles

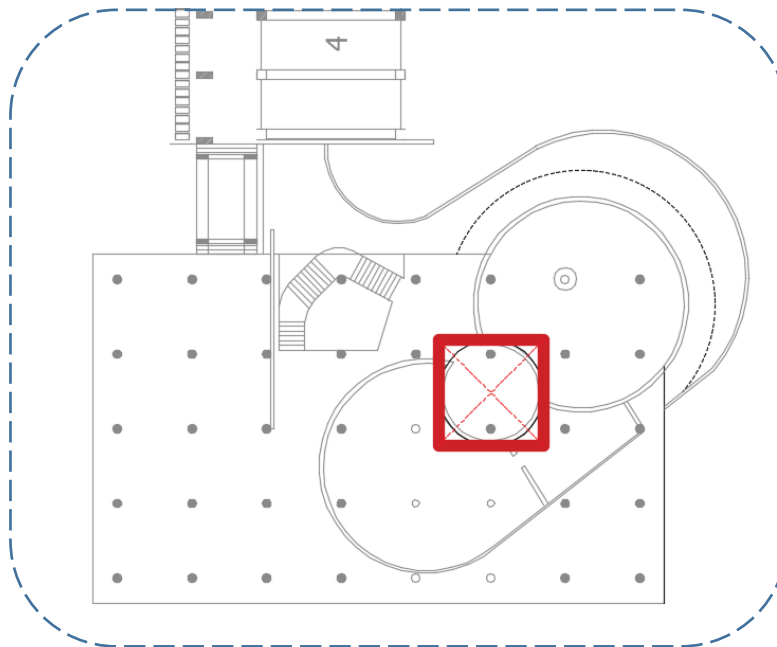


**Figure 5-45 Blow Up B of Geometric Analysis**

The entry pavilion is based on a golden mean section.

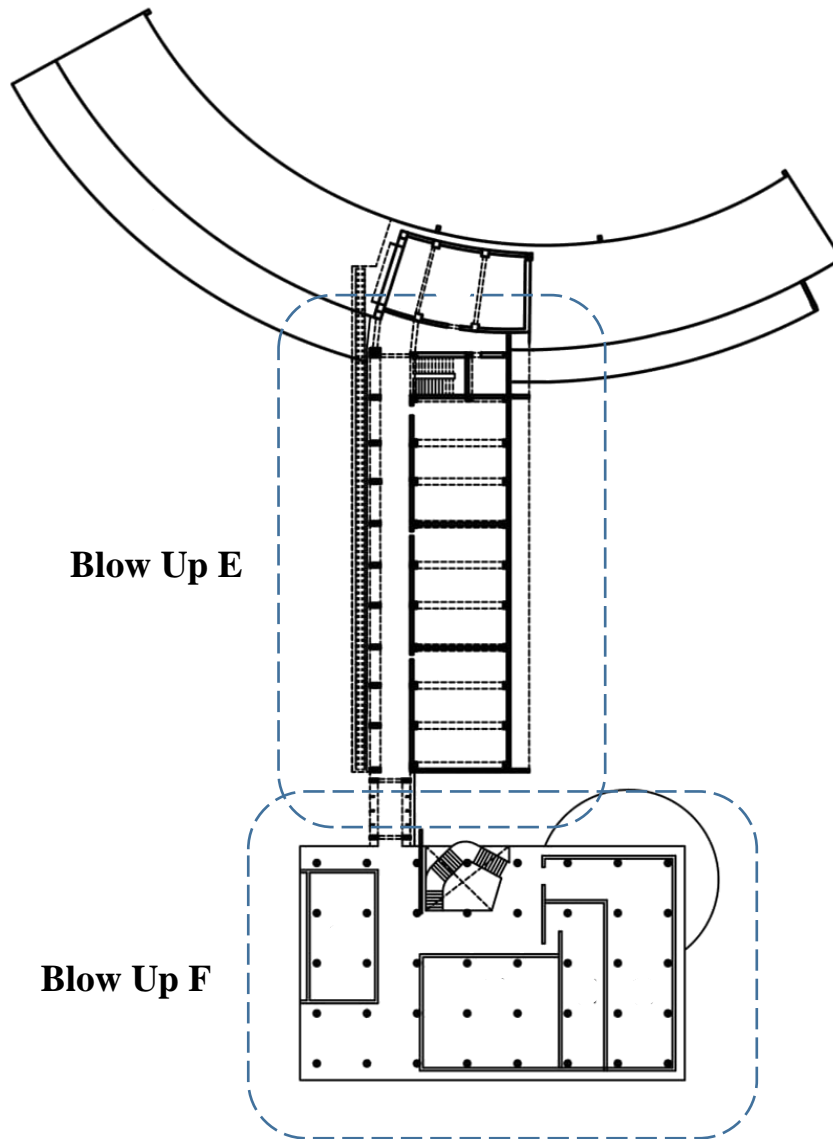


**Figure 5-46 Blow Up C of Geometric Analysis**



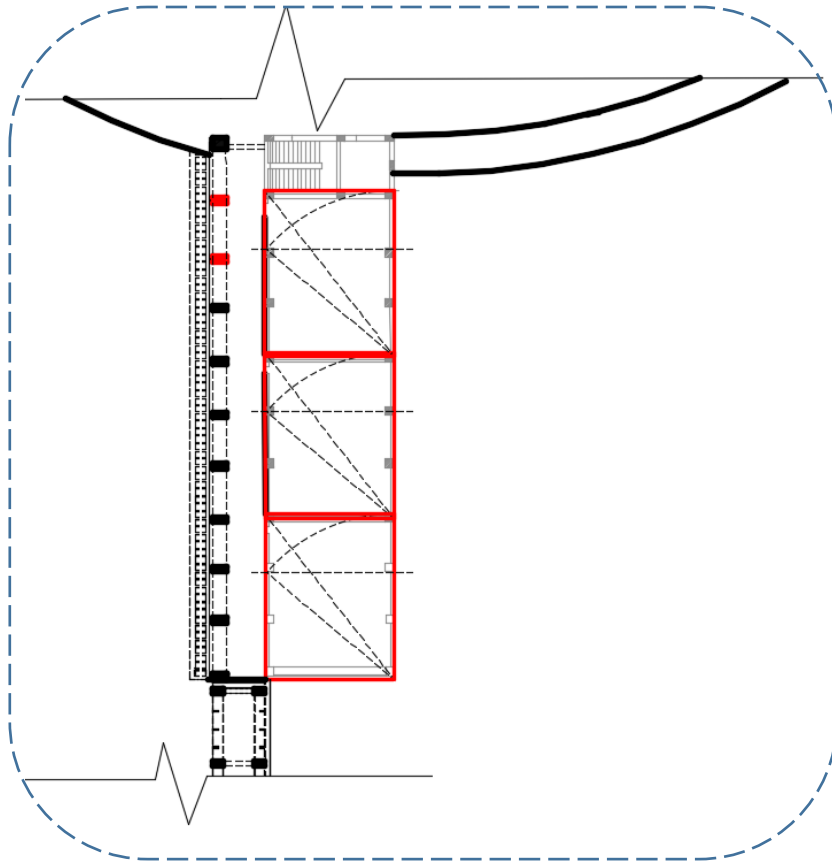
**Figure 5-47 Blow Up D of Geometric Analysis**

“Circle’s circumference consists of points equidistant from a fixed point (the center).”

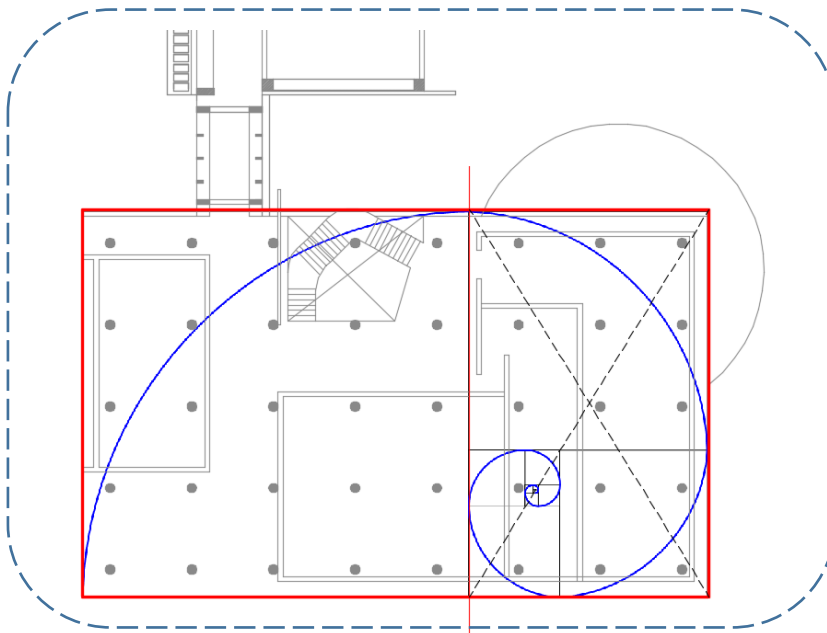


**Figure 5-48 Geometric Analysis of the First Floor Plan**





**Figure 5-49 Blow Up E of Geometric Analysis**



**Figure 5-50 Blow Up F of Geometric Analysis**

Numbers in Islam are qualitative as well as quantitative. For example, in Islam, the number '4' symbolizes the four directions, the four seasons, the four gateways to heaven (Ardalan, 1973) and the four rivers that flow in heaven. However, this building doesn't reflect any significant numbers in the process of design. Architect followed the morphological development patterns of the rural Bangladesh which have already mentioned above.

### ***Spatial Polarities in natural Settings:***

For this study, spaces have been divided into two groups such as exterior spaces and interior spaces where both space types have two prime zones within themselves. Those two zones are "Refuge" and "Prospect."

The characteristics of refuge are basically referred by Jay Appleton (Appleton, 1996). However, Appleton, in his "Habitat Theory," explained that the shelter spaces, which protect humans from extreme climates and threats, are the refuge spaces. On the other hand, the vast open space is called the "prospect"—the areas from where a person can see the outside threats and resources are the 'prospects.'

A meaningful space is created when prospect and refuge are both present, and one can be seen from the other (Hildebrand, 2008).

Refuge spaces are dark and narrow while 'prospect spaces are well-lit and spread out.





### **Exterior prospect and refuge spaces of the Faculty of Fine Arts:**

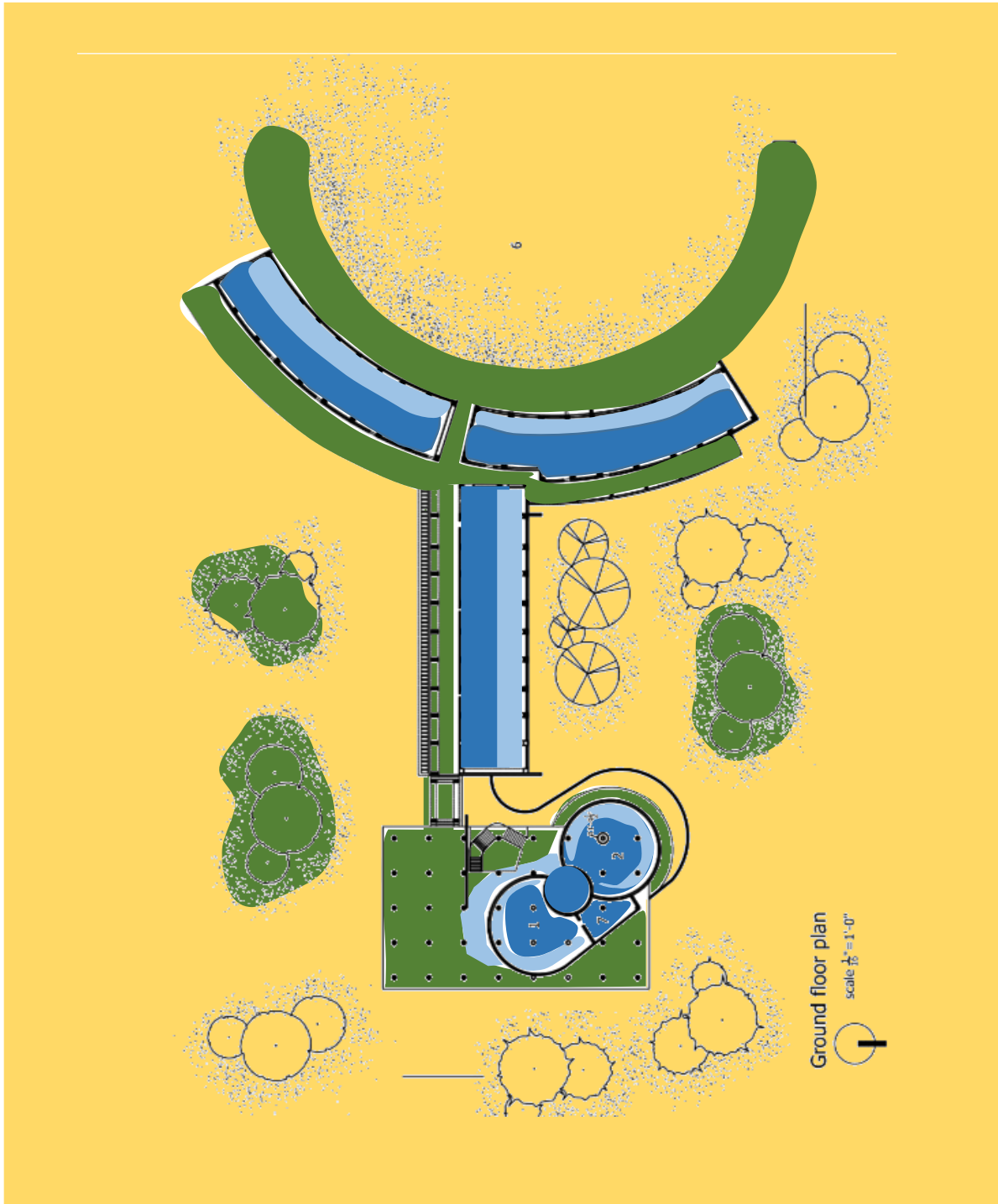
The outer courtyards of south and north side of the building and the inner courtyard are the exterior prospect spaces. There is a continuous corridor which is semi-covered and where shadow creates exterior refuge spaces. Other exterior refuge spaces are the front pavilion (square shape) and sculptural stair beside the inner courtyard. These are the exterior refuge spaces from where a person can see the yards and the outside threats and resources. There is also a shaded corridor on the 1st floor which is also the exterior prospect. The courtyards have trees which create shadows, and the exterior refuge spaces are created.

### **Interior Prospects and Refuges of the Faculty of Fine Arts:**

Usually, the interior prospects are defined as the well-lit and high-ceilinged spaces. One can find these types of places near the windows and doors; they give a feeling of vastness and immensity. An interior room can have both prospect and refuge as well (Appleton, 1996). Interior refuge spaces are dark, cozy and low-ceilinged whereas the interior prospects are well-lit and comfortable. For the Faculty of Fine Arts Building, most areas of the upper floor front pavilion are well lighted and naturally ventilated. From these spaces, students enjoy seeing the vastness of nature. Both the craft rooms and the classrooms, as well as all other functional areas, have interior prospect and refuge spaces.





**LEGEND:**

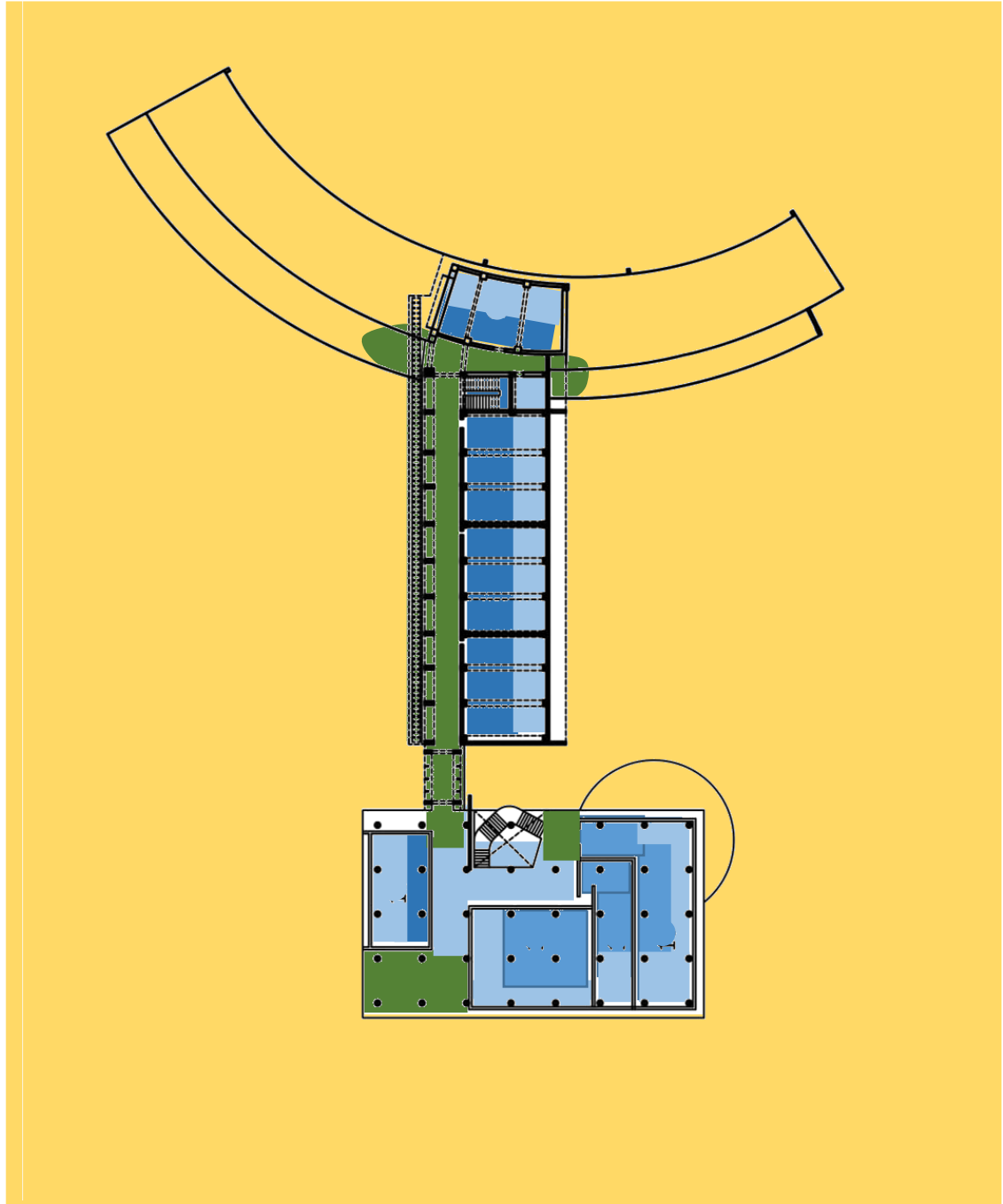
- |  |   |
|--|---|
|  Exterior Prospect Area |  Interior Prospect |
|  Exterior Refuge        |  Interior Refuge   |



**Figure 5-51 Ground Floor Plan: Prospect and Refuge**

**LEGEND:**

- |  |   |
|--|---|
|  Exterior Prospect Area |  Interior Prospect |
|  Exterior Refuge        |  Interior Refuge   |



**Figure 5-52 Upper Floor Plan; Prospect and Refuge**

The upper floor of the Faculty of fine arts is quite similar to the ground floor. The front pavilion has exterior prospect spaces as well. On the first floor, prospect and refuge are both present in all classrooms and students can also feel those spaces.



**Figure 5-54 Ground floor corridor (Ganguly, 2015)**



**Figure 5-53 Upper floor corridor (Archive, n.d.)**



**Figure 5-55 Continuous corridors and the outer courtyards: Exterior Refuge and Exterior Prospect (Hasan, 2017)**



**Figure 5-56 Classrooms (Maps, 2018), and first floor (Chowdhury, 2015): Interior refuge and prospect.**

Grant Hildebrand (2008) has identified five survival-advantageous characteristics: prospect and refuge; complex order; peril; and enticement.

The Faculty of Fine Arts Building followed the natural footmarks. All the factors like the linkage of classrooms and corridors, the inner courtyard, indigenous materials and even the window opening, vents are responsible for enticing an observer into exploring further. Primarily, the Building's space sequences which follow the Bengal rural household patterns have created a dilemma between nature and the structure. A pond on the west side of the building is quite serendipitous which suddenly appears to the visitors.



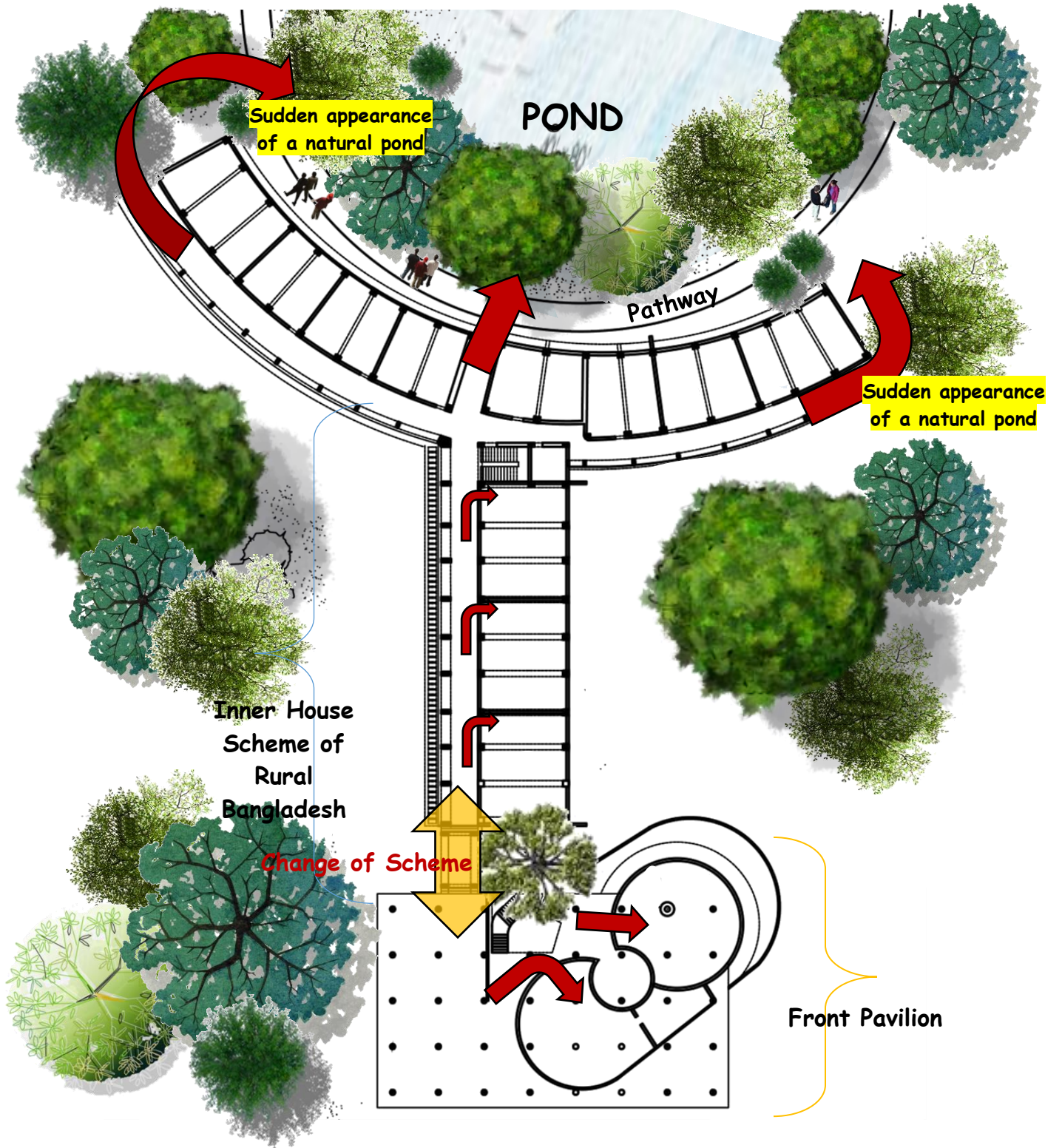


Figure 5-57 Ground floor Plan: Enticement (turns and disappears; a sudden change of views). The “*Bagan Bari*” (house in a garden) scheme creates enticement.



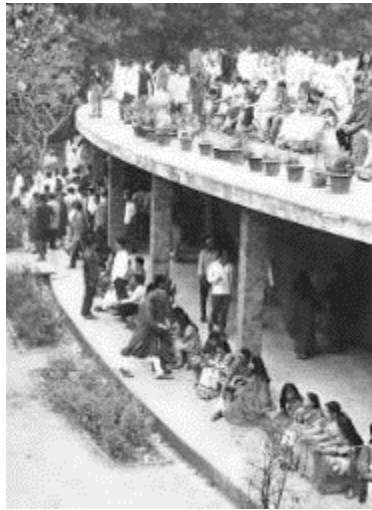


**Figure 5-58 Path that turns** (Arif, 2015)  
(Path that turns and provides a sudden change of views.)

In the geometric analysis, the study shows that the building has maintained a very simple order of Bengal rural household. These approaches significantly helped Islam to create the sense of mystery and enticement.

### **A perilous thrill to the users:**

The upper floor's terrace (on the circular mass) offers a thrill to the users. Students and visitors can enjoy the enjoy rains, the intrusion of birds and can feel the darkness at night. During the festival, people enjoy the thrilling and intimate views of surrounding yards.



**Figure 5-59 Terrace and verandahs; Peril** (Ahmed, 2007)

A beautiful sculptural stair connects the two levels around a wonderful internal courtyard (Archive, n.d.). This inner courtyard, the sculptural stair and the visual linkage between the ground floor and second floor have created the most interactive spaces. These areas create not only the sense of enticement but also offer a thrill to the users.



**Figure 5-60 The Sculptural Stair: a sense of enticement and thrill** (Archive, n.d.)

A very famous architect from Bangladesh and the professor of architecture at University of Hawaii, Kazi Ashraf writes, “The College of Arts and Crafts” (later named as the Institute of Fine Arts) announced the beginning of Bengali modernism that deliberately stood away from both stigmatized colonial and hybridized traditional forms.” (Ashraf K. K., 1998)

-----

Therefore, in the end, I can say that this is a real example of "**Deep Beauty**" and it was an incredibly powerful design. Nowadays, still, contemporary Bangladeshi architects tend to be motivated by this architecture. The project also shows how powerful an architecture can be that gives the identity to a nation's whole culture and context.

## **Project Selection**

### **METI Handmade School in Rudrapur, Dinajpur, Bangladesh**

I have selected this project as one of my research studies because of its deep relationship with Deltaic Architecture and Critical Regionalism. It's my scholarly intention to find the inherent power and appropriateness of Bengal architecture through these case studies. However, conceptually, the project is also well associated with Louis I Kahn's the National Assembly Building and Muzharul Islam's the Faculty of Fine Arts Building.

Louis I. Kahn established an example of modern architecture that grows out of an understanding of Bengali vernacular architecture, in its response to local context, culture, and climate. In the METI Handmade School, Bangladesh, architects Anna Heringer and Eike Roswag replicated the same things; they observed the architectural appearance of building forms and also followed the structural morphology and material qualities of the Delta. As in the case of the National Assembly Building at Dhaka, Bangladesh, the METI School is constructed by hand, not by any machine.

Kahn recognized the absolute essence of the relationship between the land and building in the Delta and did a national monument for Bangladesh. In the METI School, architect Heringer explored every single detail of the primitive Mud House of Bangladesh and was extremely inspired by those instances. Furthermore, Architect Muzharul Islam set a benchmark for Bengal architecture and paved the way for Bengali Modernism. German architect Anna Heringer took almost the same type of approaches, and she built an example of sustainable rural design. In addition, the project is also an instance of critical regionalism. Architect Muzharul Islam was

concerned about Bengal household pattern while in this project, Heringer revived a fundamental building technique (Mud House) of the Delta. The METI handmade project is situated in the remote village of Bangladesh; the context is very local and primitive.

### **METI Handmade School in Rudrapur, Dinajpur, Bangladesh**

The project is designed by proponents of sustainable design, German architect Anna Heringer and Eike Roswag (Design/ Concept: Anna Heringer & Technical Planning: Eike Roswag) and built together with the local villagers. It is one of their most notable buildings is METI Handmade School in Rudrapur, Bangladesh. (Heringer, n.d.)

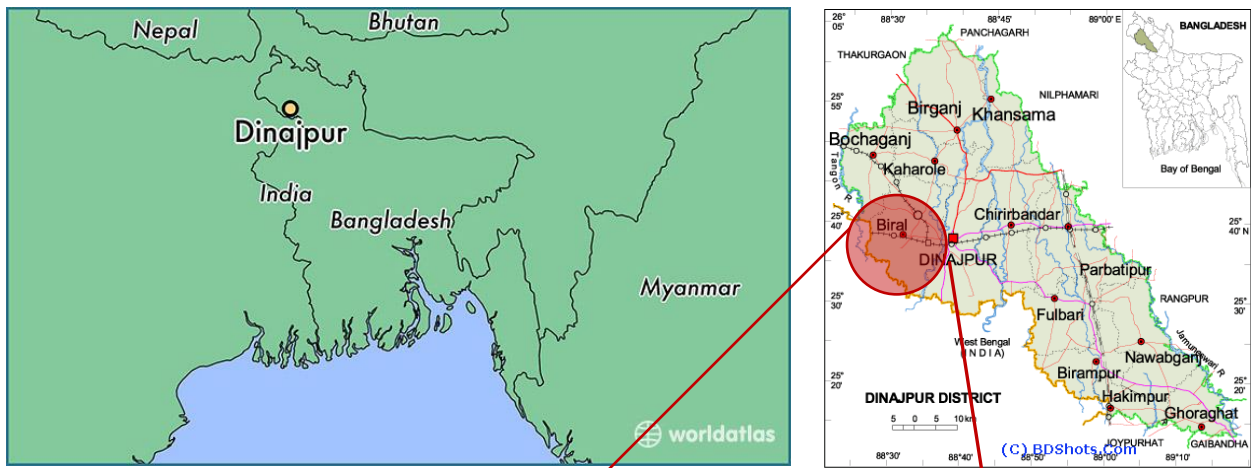


**Figure 5-61 Architect Anna Heringer in Bangladesh.** (Mori, 2018)  
(Heringer associated with Bengal's rural people, culture, environment and traditions)

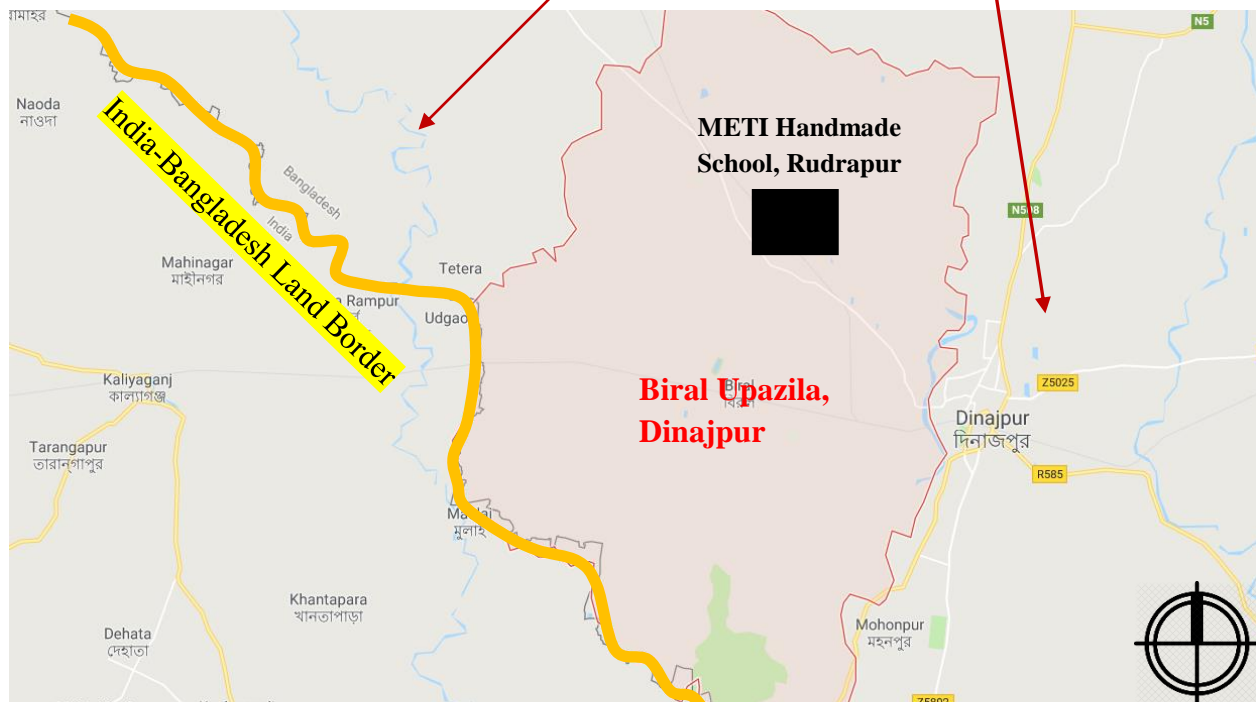
The structure is basically a primary school for 168 students which introduces new approaches for structural integrity and bio-climatically and regionally appropriate architecture. Use of local materials and local building techniques were so evident that the building has become

an example of a sustainable architecture for Bangladesh. Eventually, the project got the **Aga Khan Award for Architecture in 2007**. (Aga Khan Award for Architecture, 2007)

The award-winning METI handmade school is in the village of Rudrapur is located in Biral Upazila in the Dinajpur District. It is about ten hours by road from the capital, Dhaka. The project is situated in Northern Bangladesh, an area fairly close to the Indian border.

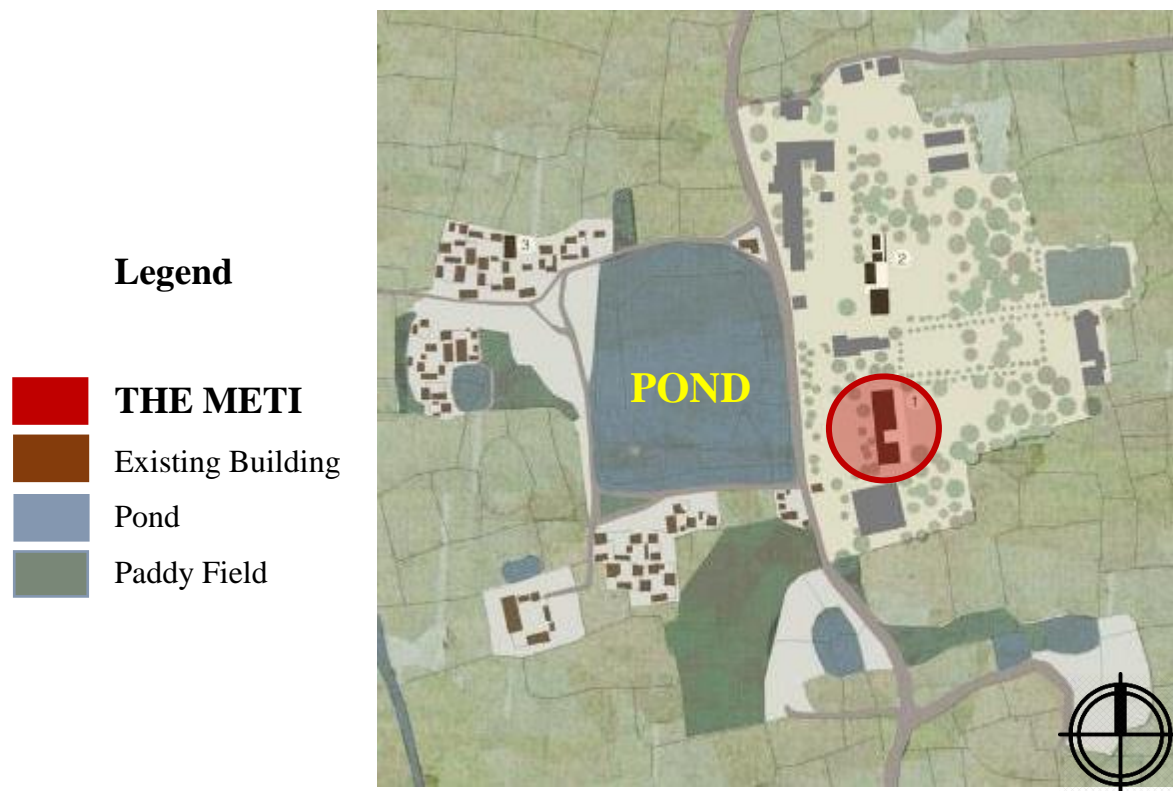


(Worldatlas, 2018)



**Figure 5-62 Location of METI Handmade School, Rudrapur, Bangladesh (Map, Google Map, 2018)**

The school is surrounded by an impressive collection of greeneries as the structure is in the middle of many rural households. The project is located in the compound of a Bangladeshi NGO, Dipshikha (meaning ‘Sparkle of Light’), that is dedicated to helping children in rural areas learn to read and write.

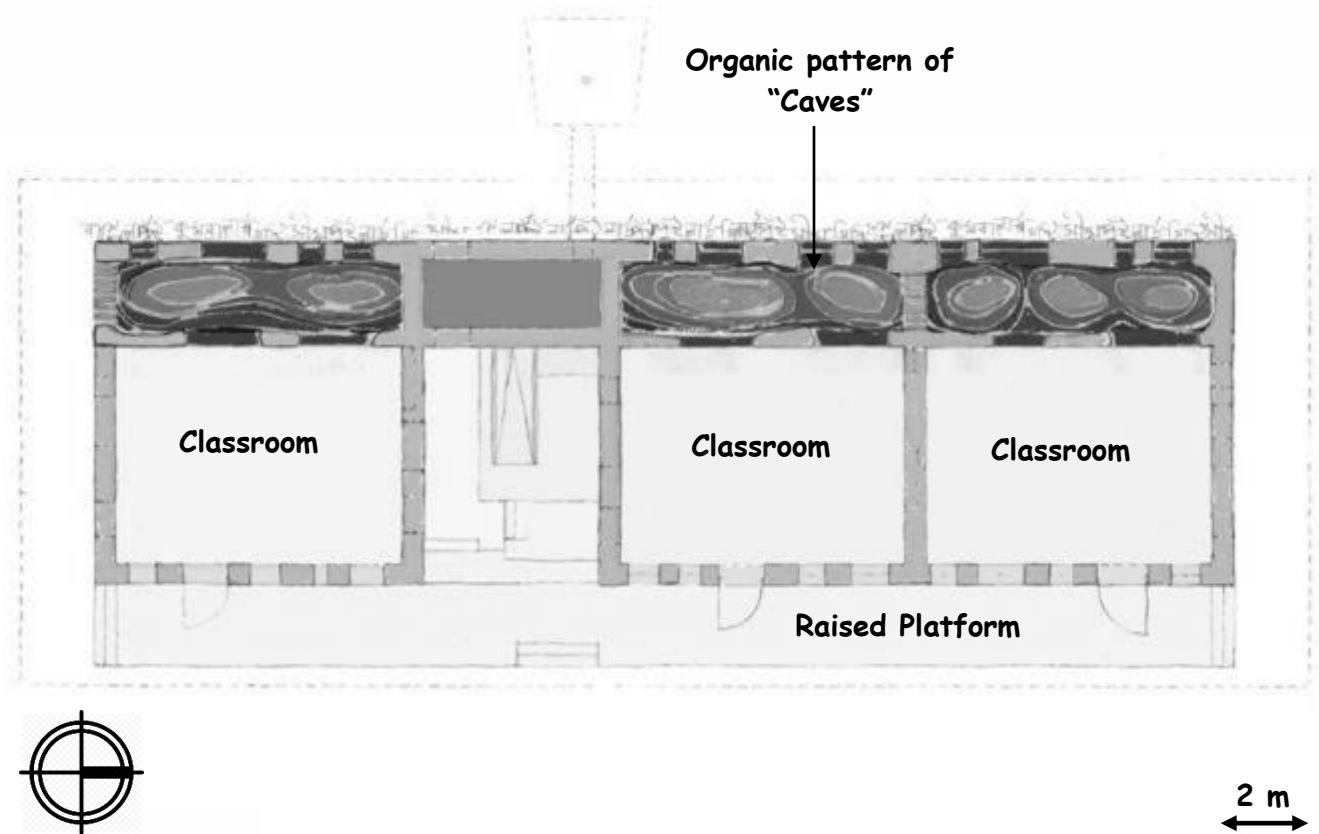


**Figure 5-63 Site Plan for METI Handmade School, Rudrapur, Bangladesh** (ArchDaily, 2010)

The school is situated within a magnificent natural setting; within the area of rural Bangladesh. The building is elongated along its east-west axis which is quite unusual. But the matter of fact, she took all necessary initiatives to avoid summer sun. Architect Anna Heringer

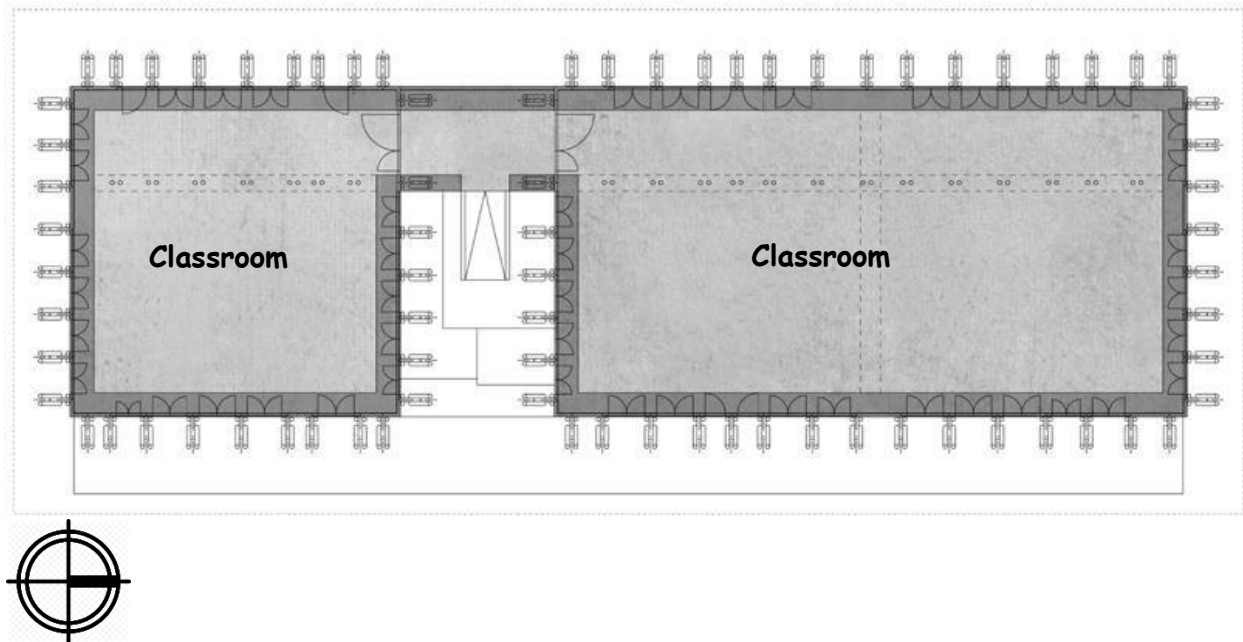
was especially aware of Bengal architectural realities, and those unique morphologies were her primary considerations.

"The final result (...) is a building that creates beautiful, meaningful and humane collective spaces for learning, so enriching the lives of the children it serves." [Jury of The Aga Khan Award for Architecture 10th Circle] (Heringer, n.d.)



**Figure 5-64 Ground Floor Plan of METI School (ArchSociety, 2008)**





**Figure 5-65 Upper Floor Plan of METI School (MoMA, n.d.)**

Architect Heringer's first move was to make a raised platform for the structure. For the foundation and verandahs, 83 m<sup>3</sup> masonry brickwork was done by local workers. Upon entering the school premises, is an earth paved and open-to-sky space. That serves the purpose of being a play area for the school children. Plan of this sustainable building (Lim, 2007) is in the shape of a rectangular: it has three classrooms made of thick earthen walls on the ground floor and a celebratory space on the upper level. The upper floor, in contrast, is a light and open space that encourages movement. A staircase is placed on the southern side of the building which is also made from bamboo and wood. However, the stair also serves to stiffen the structure. One enters onto the raised platform, a brick structure that houses classrooms and an organic pattern of 'caves' at the rear of the rooms on the ground floor and a bamboo-framed construction on the upper level.

West side of the building is protected by lush green vegetation

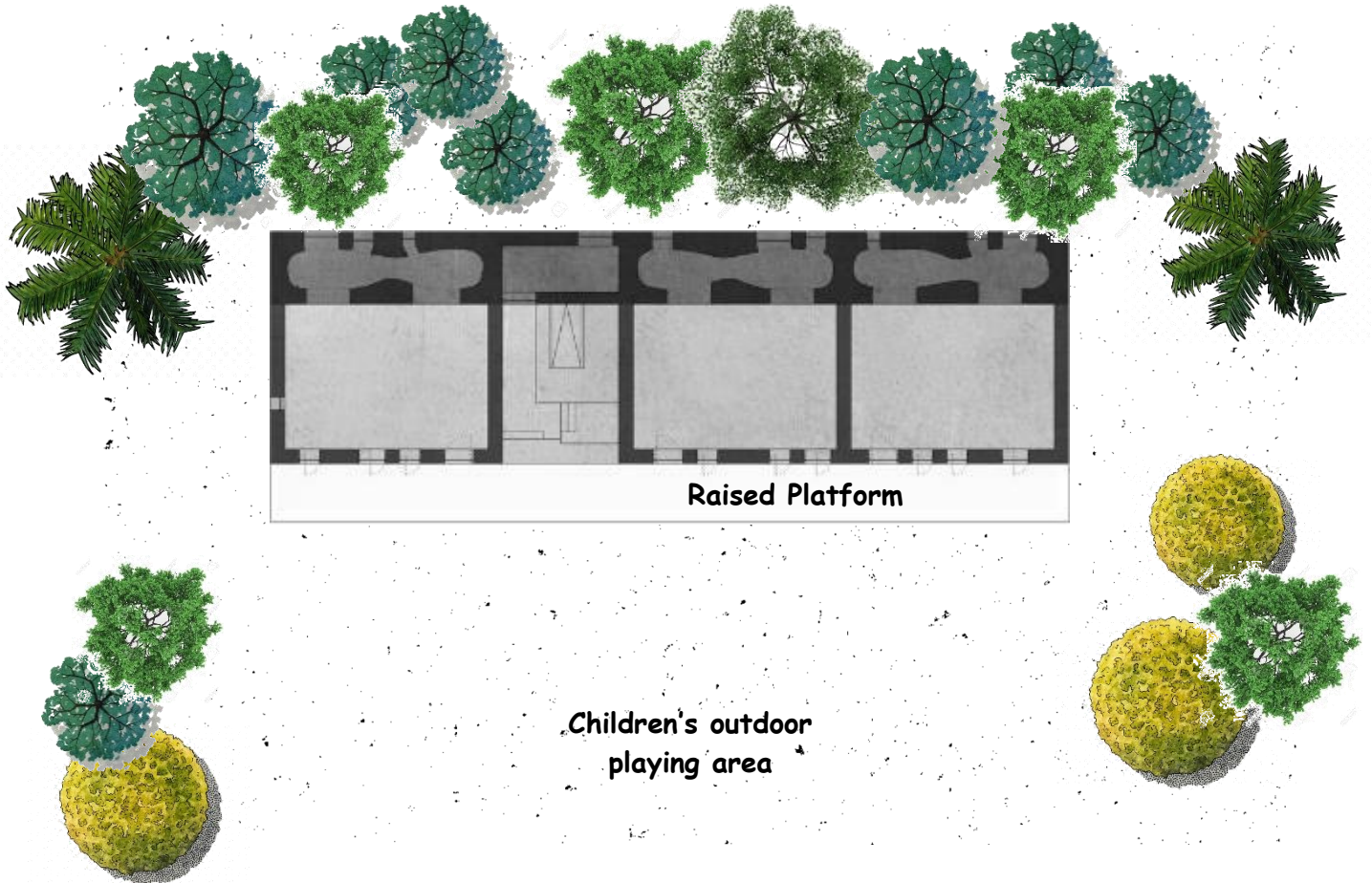


Figure 5-66 Ground Floor Plan of METI School (Tanvi Naik, 2017)



On the west side of the building, there is a big pond (Fig. 5.63) which is located before the structure was built. We all know that the ideal thermal massing of a building is one that is elongated along its east-west axis. The aim is to maximize exposure to the south and reduce exposure to the east and west. However, the METI Handmade School is an exception as the building is elongated along its north-south axis. Anna Heringer was completely aware of these facts, and hence she

planted trees on the west side, created lush tropical vegetation to protect from the hot summer sun. On the east side of the building, there is a big outdoor playground for the children. The north and south sides of the building are open, facing into the path of prevailing winds, making it easiest to ventilate. Heringer deliberately designed an organic pattern of ‘caves’ (Fig. 5.66) at the rear west of the rooms to have considerable thermal mass naturally. Thermal mass is very good at regulating indoor temperatures and keeping a more stable indoor temperature as outdoor temperatures fluctuate during the day (World, 2015). In contrast, the upper floor is an open and light space which encourages the movement of air and the celebratory movement of the children. The architect used bamboo walls for the fenestration providing picturesque views of its surroundings that boast of treetops and the village pond (Tanvi Naik, 2017). Heringer also used “*Saris*”,(a traditional female garment from the Indian subcontinent) on the ceiling as a colorful material which is quite unusual and surprising.

The beauty of this architecture is that it is deeply rooted in Bengali culture and heritage and also follows the contextual aspects of the Delta and promotes social equity. The METI Handmade School, Dinajpur is a significant example of sustainable architecture that replicates Bengal rural morphology (discussed briefly in chapter two) and local culture (Lim, 2007).



**Figure 5-67 The METI Handmade School, Rudrapur, Bangladesh** (ArchDaily, 2010)



**Figure 5-68 Protecting west facade from the hot summer sun.**

Trees are on the west side (Heringer, Sustainable Beauty, 2012)



**Figure 5-69 Kids are enjoying in the upper-floor** (inspiration, n.d.)



**Figure 5-70 The exterior facade is punctuated with colorful doors and drapes** (Hoerbst, n.d. )

The exterior wall has colorful doors and drapes which are randomly placed but left unfinished to demonstrate the community how it can be replicated later as well.



**Figure 5-71 Upper floor of the school** (Heringer, METI School, Bangladesh, n.d.)



**Figure 5-72 Organic patterns of “Caves”:** Children’s activities (Tanvi Naik, 2017)

### **An Example of Critical Regionalism**

METI Handmade School in Rudrapur, Bangladesh by Anna Heringer and Eike Roswag is an example of critical regionalism. A brief analysis of the METI School under Kelbaugh’s five points of Critical Regionalism is presented below. It should be noted that all those points have been explained with diagrams and photos under the Deep Beauty Framework. The study is made that the readers can relate characteristics of critical regionalism to the “Deep Beauty” Framework.

Douglas S. Kelbaugh's five points of Critical Regionalism: It was an attempt of Professor Douglas S. Kelbaugh to define critical regionalism. He believes that Critical Regionalism should be defined by five characteristics.

### ***The Sense of Place (The Genius Loci)***

The METI Handmade School in Bangladesh respects local climate & topography as well as local building materials and practices. The building has a sense of historical authenticity (Fig 5.107 & Fig. 5.109) and is an example of traditional Deltaic architecture. Architects Anna Heringer and Roswag explored various local aspects such as structure, indigenous materials, the users, location to build this building.

### ***The Sense of Nature (Protect and preserve ecosystems)***

Anna Heinger and Eike Roswag took inspiration from nature and context and replicated those into their design. The METI handmade school has incredible simplicity; In fact, a style marked by its austere geometric simplicity (Fig 5.118 & Fig. 5.119). Nevertheless, the building is a part of natural ecosystems and an example of sustainable architecture (Aag Khan Award for Architecture, 2007). The structure connects natural environment and the socio-cultural context of the place.

Moreover, Architect Anna Heringer sees nature as a Critical Regionalist. Therefore, she was inspired by nature at the organic level. She also admires nature and had added organic features to her project, the METI School.

### ***The Sense of History (A good point of departure when designing building)***

Architect Anna Heringer and Eike Roswag researched Deltaic architecture and its space sequences and morphologies. Furthermore, they recognized Deltaic design vocabulary and syntax



and creatively transformed those to express and to accommodate new technical and programmatic forces. Professor Kelbaugh also says, “Traditional architecture can evolve as new scientific and technological developments.” In this project, the METI Handmade School—a traditional architectural pattern (Mud House) has been revived by architect Heringer and architect Roswag (Fig. 5.109 and Fig. 5.110).

***The Sense of Craft (Traditional expression):***

For the METI (mud) Handmade School project, the hands-on connection was central to the architects’ vision, and they wanted technical developments of traditional Deltaic architecture to become part of local knowledge for application in future improvements (ASIA, 2015). Therefore, the architects involved local craftsmen, students, and teachers with this project, working in collaboration with European volunteers. However, The METI School is entirely a handmade architecture.

***The Sense of Limits (Human-scale in the built environment)***

In the METI, every functional area is well defined and creates physical boundaries to frame and limit human places and activities. METI School promotes children’s individual capabilities and interests. These approaches were also reflected in building design while she made human scale rooms and caves. Heringer understands that boundless architectural and urban spaces have less nearness, less presence. Therefore, Heringer deliberately marked physical boundaries for the users for different functions such as classrooms, caves, verandah, and upper floor recreational areas. These types of spaces and their uses assist students in developing their individual capabilities on different topics.

## Functional Level

The Functional Level of Deep Beauty deals with all the practical requirements of the building's users (Coates, 2014). However, the theory of regionalism leads to the architecture being fundamentally site-specific and answering to the native climate and tradition of the place, where it is being constructed. Besides providing shelter, a house serves the purpose of a social unit of space (Rapoport, 1969). In fact, a home is not only a structure, but also it's an interconnected ecological feature of a place. Furthermore, it produces the form of vernacular architecture which portrays a belief in the traditional interpretation of thoughts, forms, and style (Hosey, 2012). Being suitable for the social setup of its users is an important function.

Professor Coates says about the Functional level of Deep Beauty—

“Functional buildings merge well with their sites, respond to sun, wind, and light, are an optimum size, are energy efficient and make use of local building materials.” (Coates, 2014)

Furthermore, biomimicry is an approach that can provide functional solutions by taking inspiration from nature (Benyus, 2008). Building a house is a cultural phenomenon, and so the form and organization of a house depend on its cultural setting (Qureshi, 2015).



## The Orientation of the Building

The building is one that is elongated along its north-south axis.

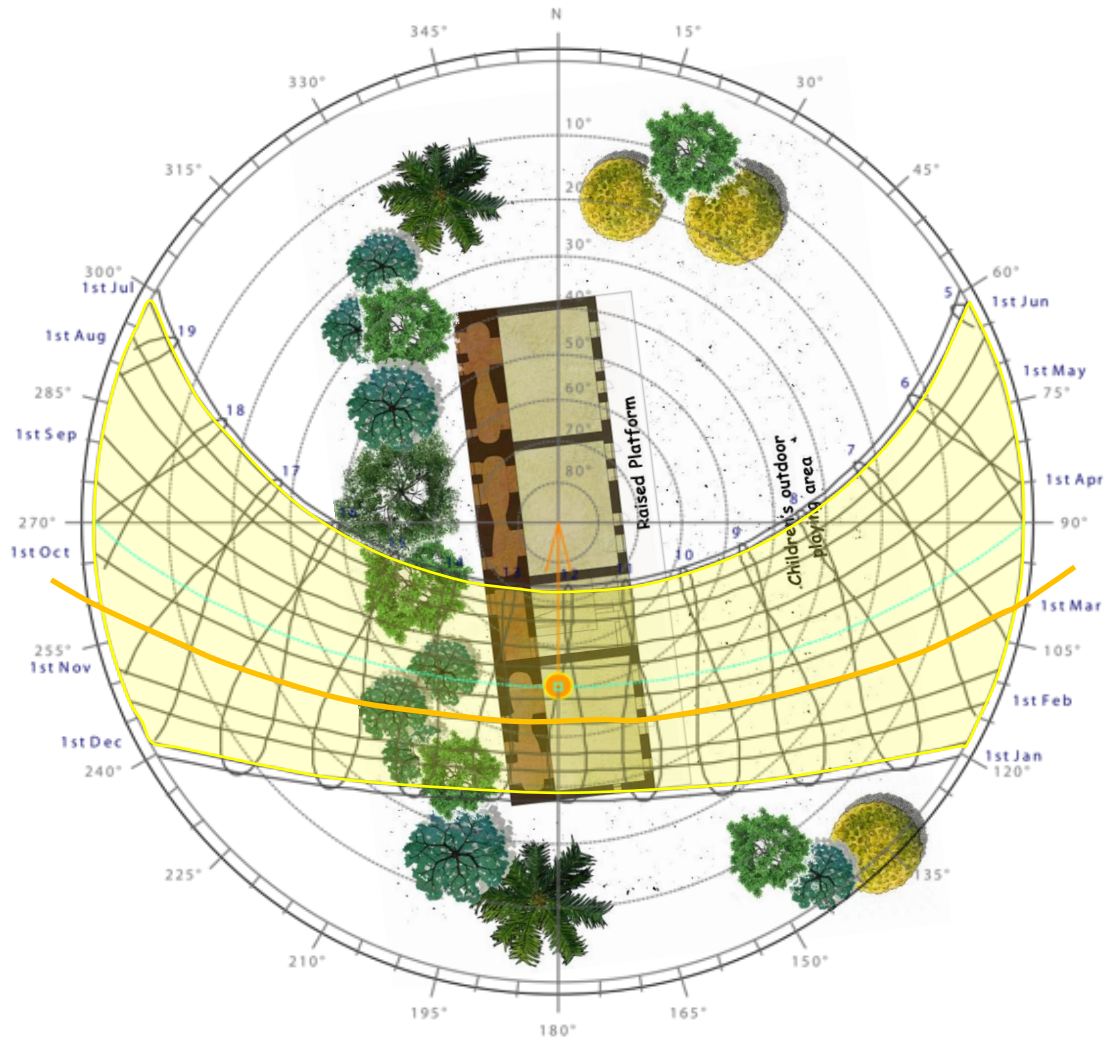


Figure 5-73 Organic “caves” pattern is on the west side and entrance from the east

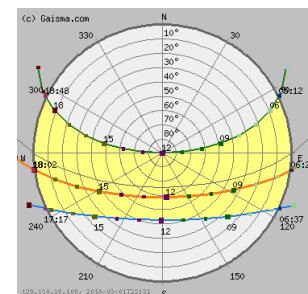


Figure 5-74 Sun Path Diagram (Gaisma, 2018)

Because of other essential site forces and for the site orientation, Heringer had to build a structure which is elongated along its north-south axis. She deliberately designed functional spaces in the building to avoid hot summer sun and also took necessary steps to ventilate every single space properly. The two levels of the building (the bottom floor and the upper floor) are entirely different in many respects, but the primary goal was to achieve climatic comfort and create interactive functional areas. The classrooms on the bottom floor with heavy mud walls have completely different feel than the light and airy upper level. On the west side of every classroom, there is a playful organic cave which refers how flexible earth can be in creating different types of spaces (World, 2015).



**Figure 5-75 A playful cave which is made of mud (World, 2015)**

However, the building uses only any passive cooling systems (basically, it uses only passive cooling natural ventilation). METI School is an extraordinary example of a naturally ventilated building. However, a letter was written by one of the students of the METI School to the Anna Heringer, and she was overwhelmed with joy to hear from him.

“Dear Anna-Didimoni, Hello, how are you? And what are you doing? I hope you are well. I am also well. Didimoni, we are very proud of you for making the building. I think no other building is as good as this building. It is very comfortable. In summer it is so cold, so it is very enjoyable. O.k., *didimoni*, next news...” [*Poritosh, a student of METI Handmade Student, Rudrapur, Bangladesh*] (Heringer, METI School, Bangladesh, n.d.).

Architect Anna Heringer & Roswag tried to minimize the unavoidable orientation problems of the building. She took some initiatives which are—

1. They planted trees on the west side of the building to protect hot summer sun (Fig. 5.66).
2. Using of “Mud” as a thermal mass on the west by creating organic caves (Fig 5.66).
3. On the bottom floor, classrooms have scattered small openings which provide enough daylight. The small size of the windows means that the thickness of the earth wall is enough to shade the openings. (World, 2015)

Heringer discovered Bangladeshi traditional space sequences and replicated those in designing the METI Handmade School. Moreover, this masterpiece is an excellent display of a harmonious integration of context and culture. In this METI Handmade School, two storey structure is constructed which aims to improve the quality of living in the rural areas of Bangladesh.

### ***Building Materials and Construction***

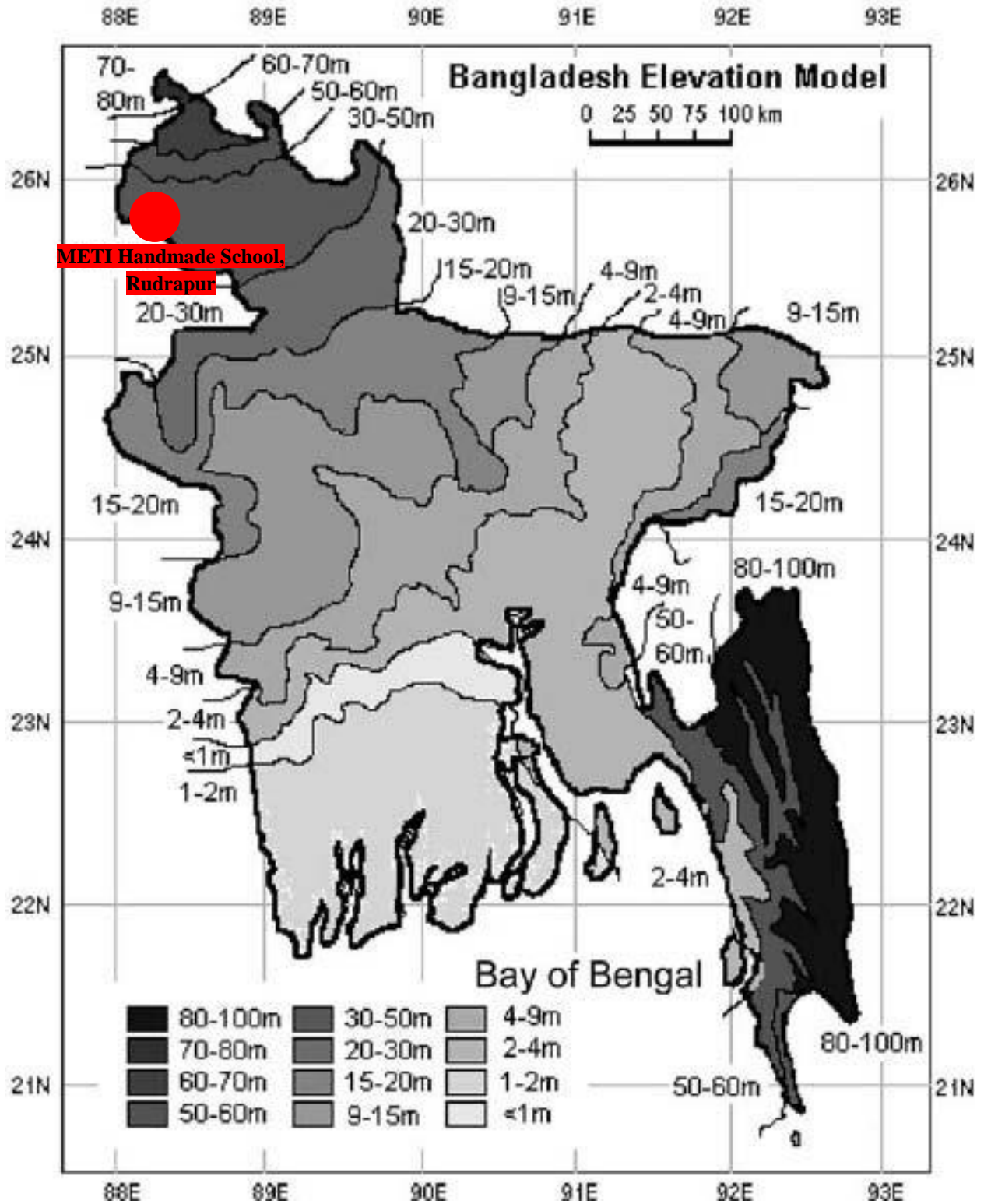
The METI Handmade School is an excellent example of rural Bengal Architecture. The “Mud House” is a primitive and traditional form of Deltaic architecture. This construction type is very common in villages and suburban areas of the Bangladesh where the lands are well above the flood level. Nevertheless, the areas should have less rainfall, lateritic soil and a dry climate. These

conditions are suitable for the construction of mud houses. This construction type has been used in this region for more than 200 years (Das, 2007). Rudrapur, the place where the METI School, is located lies in the north of the country (Fig. 5.76) where the mean height of land above sea level is more than 50 meters. Rudrapur is situated in high areas and is well above of sea level whereas around 80 percent of Bangladesh is less than 10 meters (33 feet) above sea level (Fig 5.76).

The hands-on connection was central to the architects' vision (ASIA, 2015). Heringer wanted to show the way of sustainability through technical improvements of the building where local knowledge and structural systems shape future development.

“Locally available expertise, skills, and materials are all a part of the school’s sustainability goals, while the architectural idiom and design departs remarkably from the regional typologies and construction techniques; result in a colorful, if confusing, collision of architectural styles, idioms and meanings drawn from the world over” (ASIA, 2015) (World, 2015).

Anna Heringer spent almost a year in Bangladesh in order to understand the rural culture and tradition. She saw villagers building their own homes and also recognized most of the houses in Rudrapur are mud houses. Nevertheless, the area has less rainfall, lateritic soil and a hot, wet and humid tropical climate (Fig 5.77).



Climate data for Dinajpur													[hide]
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	24 (76)	27 (80)	31 (87)	32 (89)	33 (91)	31 (88)	32 (90)	31 (88)	31 (87)	31 (87)	28 (83)	25 (77)	29 (85)
Average low °C (°F)	14 (58)	17 (63)	22 (72)	25 (77)	26 (79)	27 (81)	27 (81)	27 (81)	27 (80)	25 (77)	21 (69)	16 (61)	23 (73)
Average precipitation mm (inches)	8 (0.3)	20 (0.8)	58 (2.3)	117 (4.6)	267 (10.5)	358 (14.1)	399 (15.7)	318 (12.5)	257 (10.1)	163 (6.4)	30 (1.2)	5 (0.2)	1,979 (77.9)

**Figure 5-77 Climate Data of Dinajpur, Bangladesh** (Climate Data, Bangladesh, 2018)

Similarly, Rudrapur, a small village in Dinajpur district, has a tropical wet-dry climate. Therefore, Anna Heringer primarily used traditional materials like mud and bamboo and involved local craftsmen in building the METI Handmade school in Rudrapur in Northern Bangladesh.

### Why MUD:

As mentioned above, mud construction is very famous in areas having the abundance of alluvial soil. The climate in Rudrapur, Dinajpur is relatively dry.



**Figure 5-78 Rural house (Mud House) near METI school in Rudrapur, Dinajpur (ASIA, 2015)**



**Figure 5-79 Rural traditional mud house near METI School, Rudrapur, Dinajpur (ASIA, 2015)**

Anna Heringer observed that mud is one of the most easily accessible construction materials of that region. In addition, mud doesn't produce any waste once demolished and also has a minimal carbon footprint. Heringer liked the building methods because she knew that any kinds of actions which aim at reducing carbon emissions are incredibly beneficial to health as well. Furthermore, she was also aware of the facts that the mud construction erodes overtime and most of the buildings that she found in the area, are temporary houses. Therefore, the traditional mud buildings found in Bangladesh are far from optimal in this case (ASIA, 2015). Since Heringer had to build a permanent school structure for the children; she came up with an excellent solution to soil erosion problems. In this project, cob – a mixture of mud, clay, straw, and water – was used where the straw is laid lengthwise in a stretcher bond fashion and then knitted with straw arranged perpendicular to the stretcher bond (Lim, 2007).

The METI School is well-known for its approach to deal with the hot-humid tropical climates. Thick and heavy walls of The METI Handmade School have a larger thermal mass than traditional mud house in Bangladesh. In this project, the initiatives like mixing straw with mud, constructing thick mud wall, have made the structure more stable and durable and slow down to the erosion. Additionally, she used brick masonry foundation for stability which is a bit unlike the typical traditional mud house, although traditionally, bricks are the most commonly used construction materials of Bangladesh. The building sits on a 50 cm deep brick masonry foundation rendered with a facing cement plaster (Tanvi Naik, 2017).



**Figure 5-80 Bamboo and straw are used to slow down the erosion of the earth walls (World, 2015)**

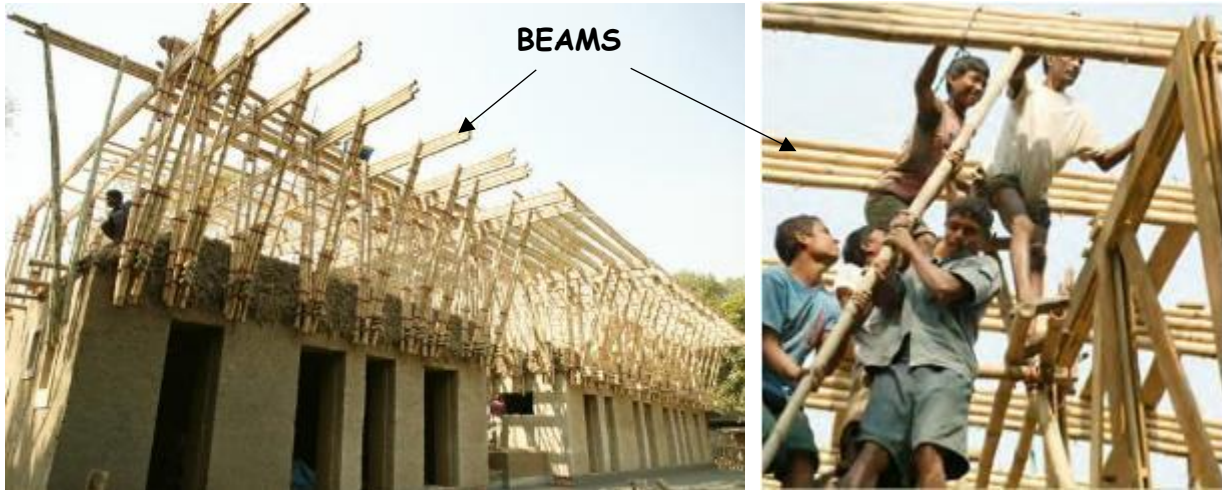
### **Why Bamboo & Straw:**

Most bamboo species are native to warm temperate and warm and moist tropical climates. In fact, the warm temperate, tropical climates of Bangladesh offer optimum conditions for most bamboo species. Because of the abundance of bamboo in Bangladesh and because of its durability, people still use bamboo as one of their main construction materials. Furthermore, evidence indicates that their ancestors also primarily used bamboo to build their houses, supporting structures as well as necessary tools for survival (discussed in chapter two).

“Perhaps the most surprising thing about bamboo - besides being an entirely natural, sustainable material with the tensile strength of steel that can grow up to 900 millimeters (3 feet) in just 24 hours - is that it's not more widely recognized as a fantastic construction material.” *[Elora Hardy's TED Talk]* (Goodwin, 2015)

This is why, Anna Heringer took these (Bamboo, Straw) natural vernacular materials and used them to build a handmade, sustainable architecture. Three layers of the bamboo post are tied together in order to use as floor beams, and at both ends, they are anchored into the mud wall with one meter by one-meter mud mass as a balustrade.

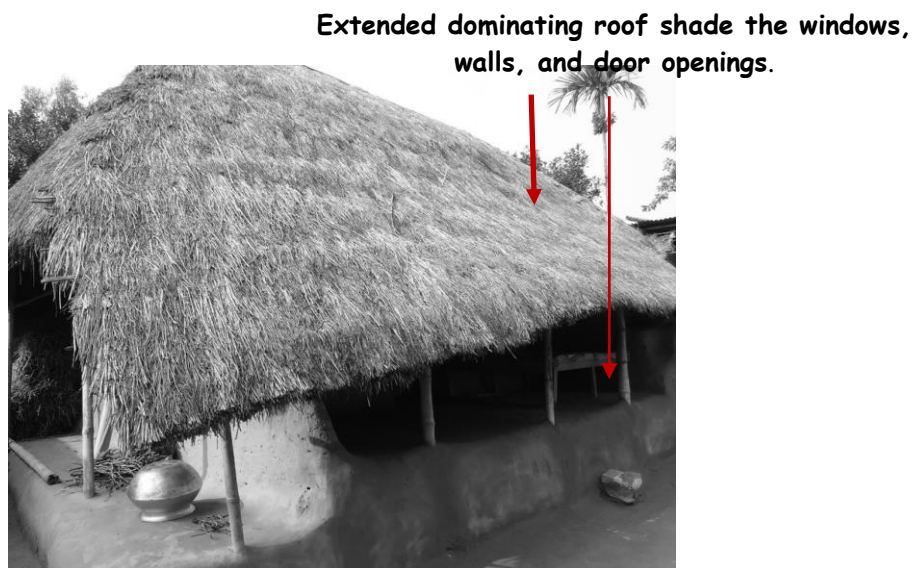




**Figure 5-81 Bamboo Framework (beams) of METI Handmade School (Lim, 2007)**

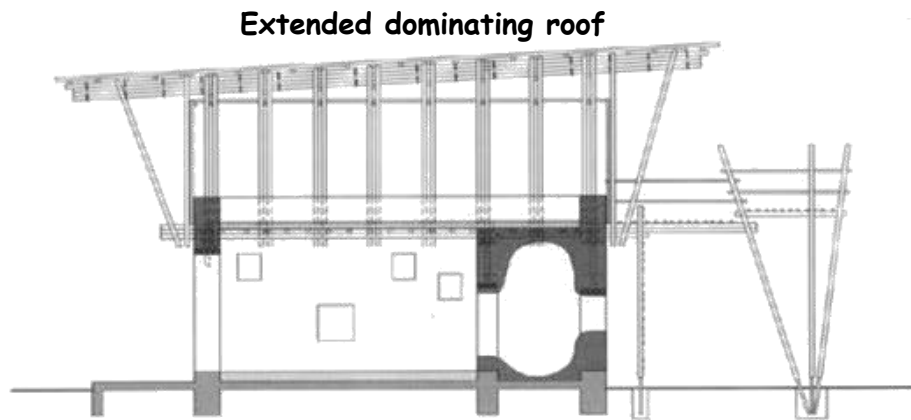
**From where did she get the influence??**

In Bangladesh, the roofs of traditional mud houses are built with straw. However, these kinds of roofs are vernacular materials which keep heat out of the house. Heringer also observed that these overhanging roofs also shade the windows, walls and door openings.



**Figure 5-82 The dominating roof of this vernacular mud house in Rudrapur (World, 2015)**  
 (Extended roof protects from the heat of the sun)

Architect Anna Heringer is a master; she observed every single detail of the Deltaic architecture, made a note on it and eventually, she unfolded the inherent power and resistance of regional architecture and built a handmade, sustainable building.



**Figure 5-83 SECTION: Replication of Bengal Architecture; (ArchDaily, 2010)**  
(Dominating extended roof of the METI School)

### **Construction Methods:**

METI School is a handmade structure which is made by hand, not by machine and typically, therefore, is of superior quality and sustainable architecture.

### **Construction process:**

According to principles of development work, the appreciation and use of the endogenous potential is the most sustainable solution, and this is also true for the use of local materials and resources (Lim, 2007).

1. The construction of METI Handmade School was a significant technical progression in the field of architecture where the focus was to replicate traditional design morphologies in contemporary architecture.
2. Architect Heringer researched on Deltaic households and traditional mud houses of Bangladesh and innovated by introducing a damp proof course for the METI School: she used a brick foundation and a mix of loam with straw for mud house construction. Loam is mixed with straw, which is a kind of reinforcement for the wall (Lim, 2007).



**Figure 5-84 METI School Kids are learning to build, helping on site and so becoming a living part of the building (Lim, 2007).**

However, children love their school; they want to stay in classrooms and also enjoy the pleasant weather. They had their hands in mud or clay before and helped to build their own METI School. Indeed, it's lovely to touch the mud wall, the organic caves, and the bamboo doors and windows. Juhani Pallasmaa says in an interview that –

*“As sight is the least embodied of our ways of perceiving the world – much more so than touch or smell or hearing which put us fully into space – it means the subject is increasingly isolated with respect to orientation in the world.”* (Pallasmaa, Rachel Hurst talks to Juhani Pallasmaa, 2011).

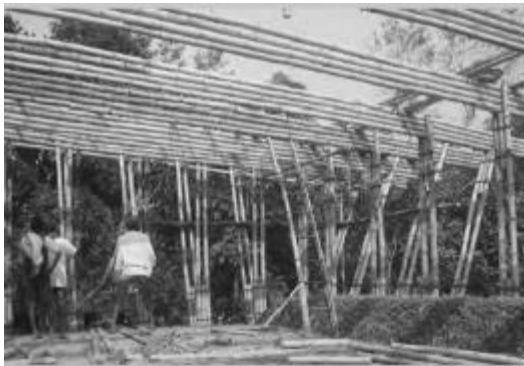
To create Deep Beauty in whatever we make and do is an act of love because only that which is loved is beautiful” (Coates, 2014).



**Figure 5-86 Use of Indigenous Methods: Cows are mixing loam, straw, and a little bit of water (Lim, 2007)**



**Figure 5-85 Foundation by hand (Lim, 2007)**



**Figure 5-87 Bamboo construction is also done by local people (Lim, 2007).**



In an interview in TED TALK, Architect Anna Heringer said—

“In terms of suitable building materials for my school, I didn't have to look far. They were right under my feet: mud, earth, dirt, clay, however, you call it ... and bamboo that was growing all around. Electricity in remote Bangladesh is rare, but we didn't need it. We had human energy, and the people were happy to have the work. Tools were an issue, too, but we had these guys, water buffalos. We had also tried a bit with cows, but interestingly, they were too intelligent. They were always stepping in the holes of the previous round. They wouldn't mix the mud, the straw—(laughter)” (TALK, 2017)

The project was a unique one for the people of Bangladesh, even for sustainable architecture where the complete structure was built by local people, craftsmen, and teachers. They worked with European volunteers, architects to construct this METI School. Anna Heringer used only 25 to 30 local workers in order to create this outstanding sustainable architecture.

### *Social Structure*

The local NGO (non-governmental organization) Dipshikha works in Bangladesh's rural area to develop people's lives and economic condition. In fact, the project was their attempt to establish a school which will instill in the children self-confidence and independence. Nevertheless, NGO aimed to strengthen rural children's sense of identity. They called architect Anna Heringer, and she took inspiration from the local context and climate and designed this wonderful example of sustainable architecture. The METI Handmade School is a primary school of 168 students, and they enjoy extra-curricular activities provided by school authorities. Undoubtedly, the METI School is a genuinely functional building. Professor Gary J Coates says—  
“Truly functional buildings are also artfully integrated with their sites and respond simply and appropriately to the available sun, wind and light” (Coates, 2014).

### *Social Setup*

The METI School performs both like an educational place for learning as well as a recreational area for the children. The school has a philosophy of “Learning with Joy,” and it works accordingly. Although METI is a rural educational building, the school has already become a recreational hub for many children of Rudrapur village. Moreover, students always prefer the school premises and its surrounding areas to perform and celebrate cultural and co-curricular activities. In fact, this was architect Anna Heringer’s idea to provide holistic education in an authentic and nurturing learning environment. Therefore, she explored the common building techniques of the Delta, had contributed in the field of sustainable architecture by employing contextual factors in design to bolster the regional identity (Lim, 2007). Both the play area on the east and the organic pattern of “caves” at the rear of the classrooms on the ground floor are the places to gather, play and interact with other children. Nevertheless, the entire structure itself transforms to host many educational activities, numerous art classes and sports competitions for children. Children between the ages of six to ten from lower-income families, mainly farmers, who earn less than Taka 60 a day are the main beneficiaries of this project (Lim, 2007).



**Figure 5-88** A formal classroom activities on the ground floor. (ArchDaily, 2010)



**Figure 5-89** Children are playing in the field, METI school (Hoerbst, n.d. )





**Figure 5-91 Kids are playing on the upper floor of the METI School.**

(Heringer, METI School, Bangladesh, n.d.)



**Figure 5-90 Tree Planting Program: A learning opportunity to get kids involved in the voluntary works**

(Heringer, METI School, Bangladesh, n.d.).

### *Comfort*

Heringer has built a building which is deeply rooted in Bengali culture and local context. Heringer believes sustainability is a synonym for beauty and comfort (Lim, 2007). The METI Handmade School is a work of sustaining ecological balance, strengthening cultural identity and supporting local economies—and the enduring comfort and beauty (Heringer, Sustainable Beauty, 2010). During the summer season, the classrooms of the building remain cool during the daytime because it has higher thermal mass due to thick mud wall and for direct contact with the ground. A beautiful bamboo stair has been placed almost in the middle of the building to link with the upper floor. The stair has been placed in a semi-covered space which allows the cool breeze to help remove heat from the building. There is a small verandah as well which is also made of bamboo and wood.



**Figure 5-92 Bamboo stair of METI school links ground floor to upper floor** (Lim, 2007)



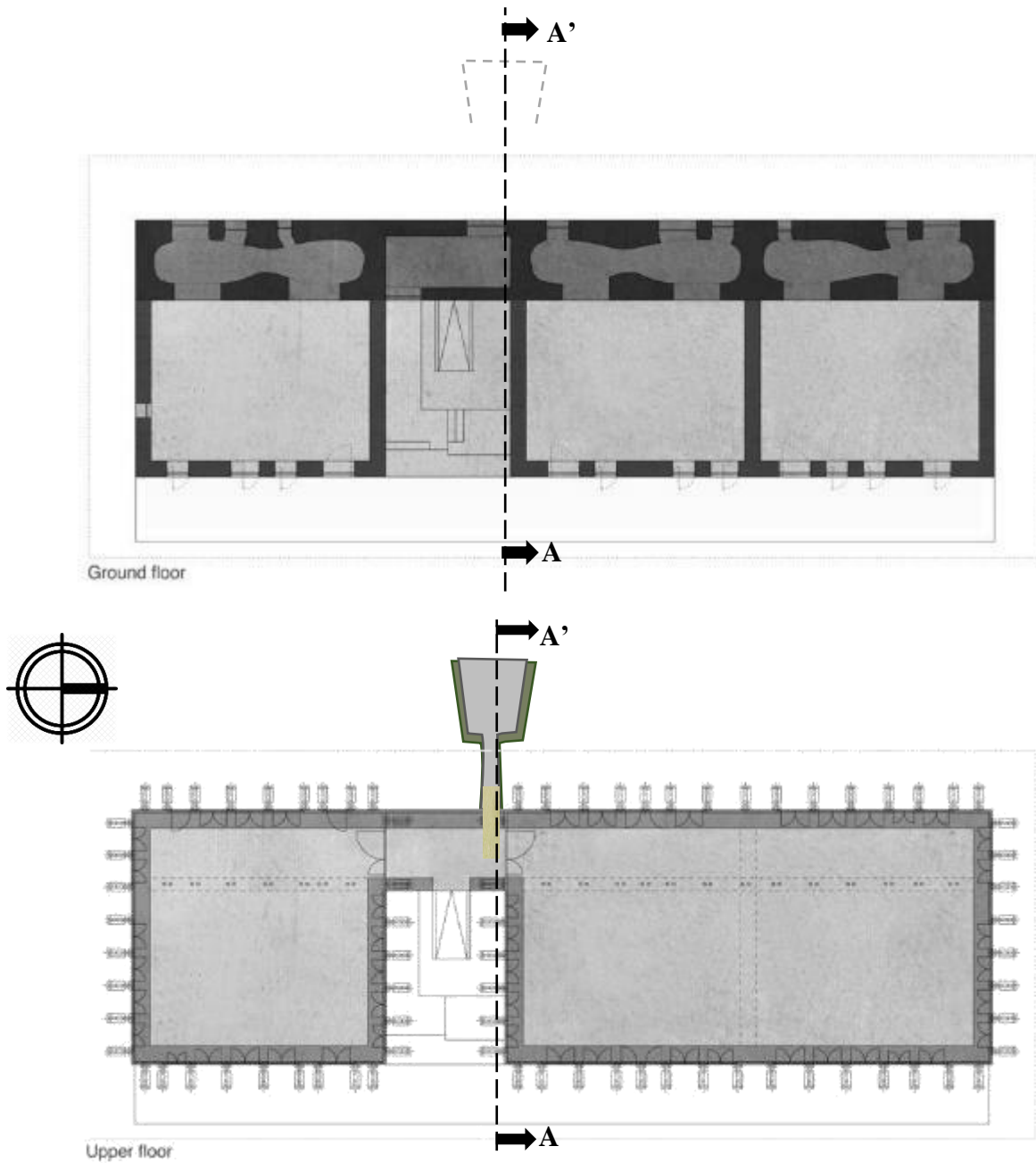
**Figure 5-93 A small verandah on the upper floor (Lim, 2007)**

In the winter season, the upper floor has maximum exposure to the sun during the day and remains pleasant for the students and other people as well. There are no air-conditioners or heaters have been installed inside—the building is ventilated naturally, and it supplies occupants with fresh air. The Rudrapur village didn't have any electricity facilities; In fact, in remote Bangladesh, electricity is rare. However, The METI School doesn't need electricity.

Since Heringer had planned on living without electricity, she searched for other ways to ensure comfortable environments for the METI School without the help of electricity. Eventually, she innovated different features and took all possible and necessary steps to confirm climatic comfort in the building



The sections of the METI Handmade School of Bangladesh are given below—



**Figure 5-94 Two floor Plans of The METI Handmade School, Bangladesh (Tanvi Naik, 2017).**

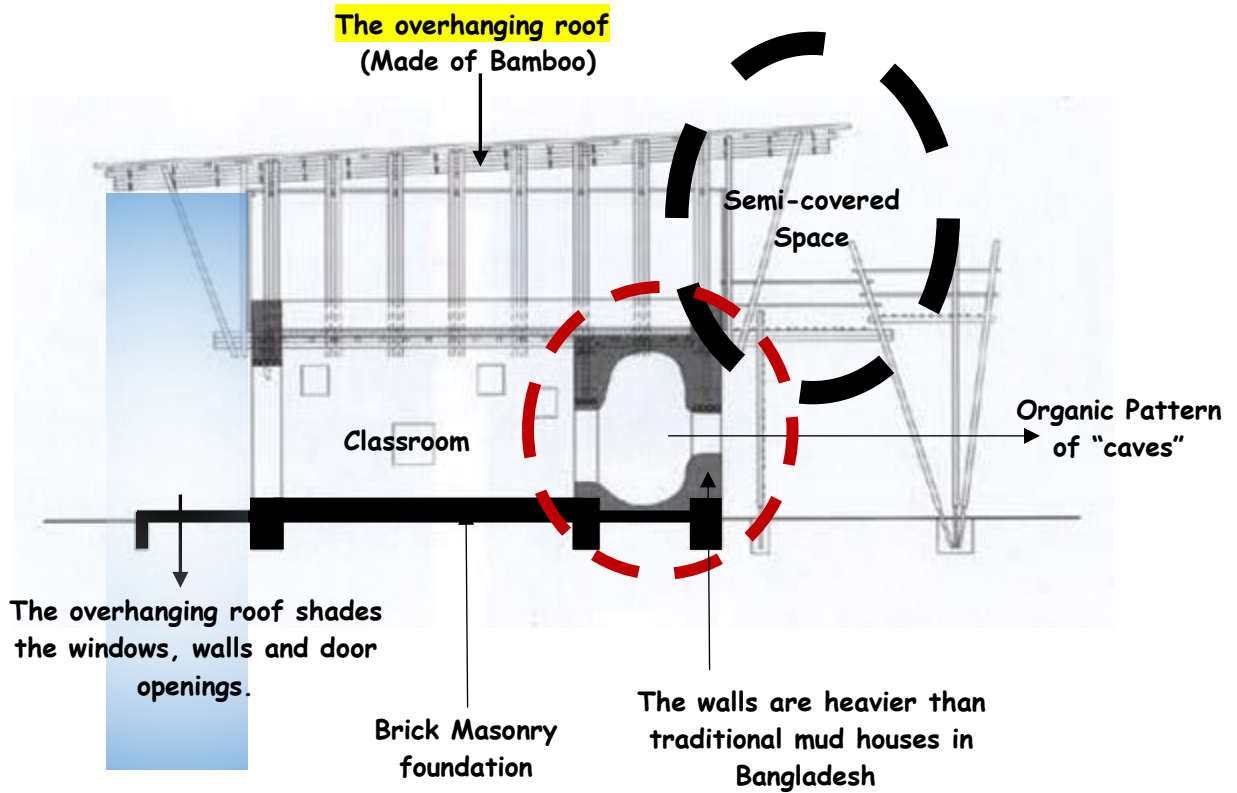


Figure 5-95 Section AA': Interior spaces (Heringer, METI School, Bangladesh, n.d.)

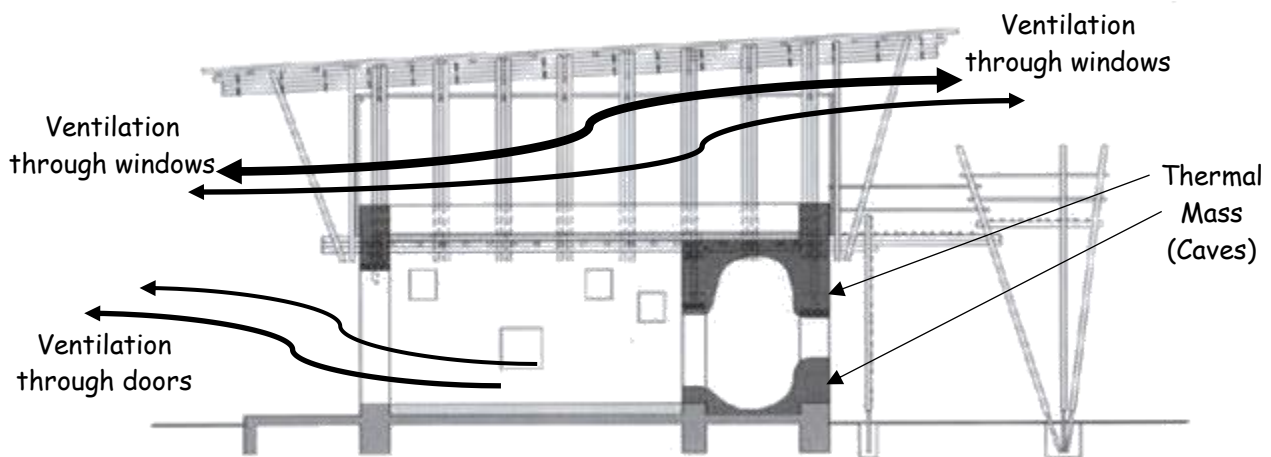


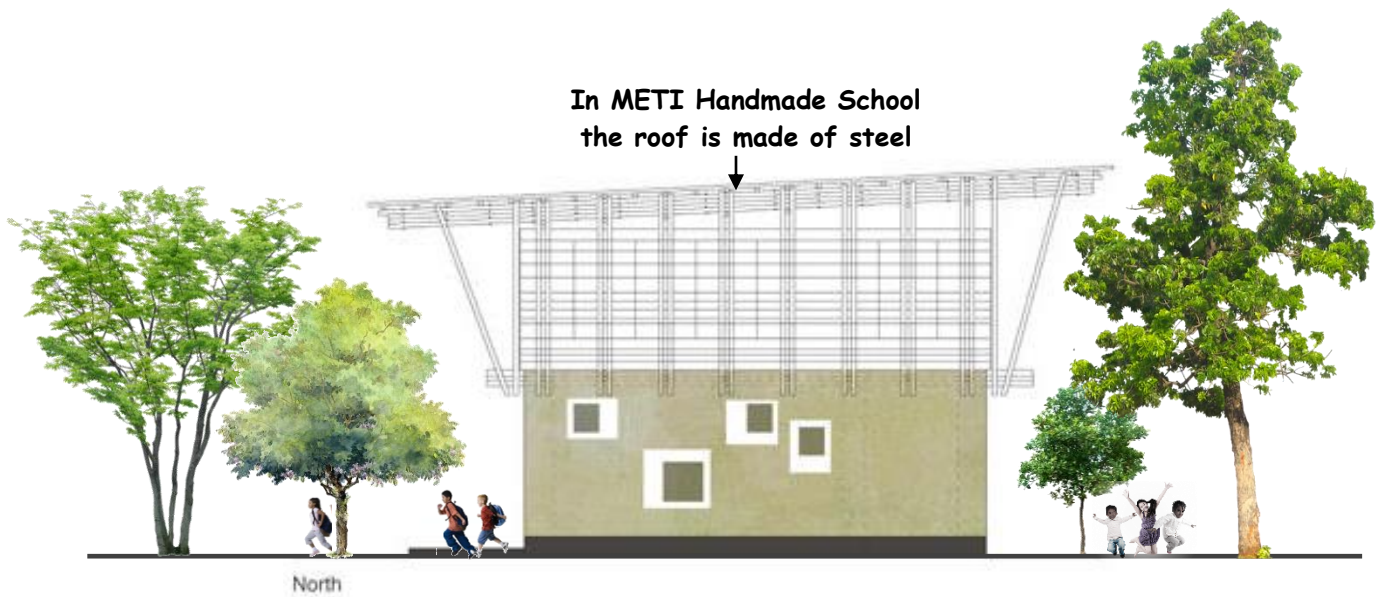
Figure 5-96 Adequate Ventilation through windows, doors, and semi-outdoors. (Heringer, METI School, Bangladesh, n.d.)



Figure 5-97 Upper Floor of the METI: Windows are made of bamboo (Lim, 2007).



Figure 5-98 South Elevation of the building: Smaller windows and more mass performed better than larger windows in a Hot-humid climate (ArchDaily, 2010)



**Figure 5-99 North Elevation of the METI School:** In contrast, upper-floor is an open and light space allowing fresh air movement (ArchDaily, 2010).

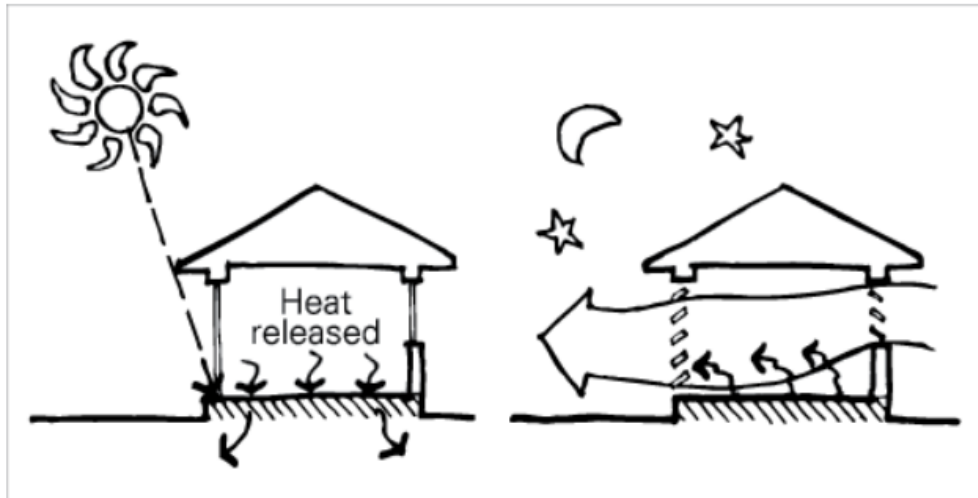
The school functions very well in the hot summer and is apparently very comfortable, temperature-wise, in the winter (Lim, 2007).

As summertime initiatives—

1. Anna Heringer used mud as the prime construction material for METI School. The METI School's mud walls are thicker and heavier than traditional mud houses in Bangladesh. Mud is said to have high thermal mass which has the ability to absorb and store heat energy. In fact, high-density material like mud requires a lot of heat energy to change the existing temperature. Thermal mass is particularly beneficial where there is a big difference between day and night outdoor temperatures (Reardon, 2013). Rudrapur, Dinajpur is such a place where large temperature differences occur between day and night outdoors. However, The METI School has thermal mass which means it is warmer inside at night and cooler inside during the day. The properties of the thermal mass store the solar energy received by the thick mud walls during the daytime then release the energy overnight. In



this way, the temperature swings can be significantly reduced. Thus, Heringer became successful in regulating METI's indoor temperatures through thermal mass and to keep a more stable and comfortable indoor temperature yet outdoor temperatures fluctuate during the day (World, 2015).



**Figure 5-100 During Summer Time (Thermal Mass)** (Reardon, 2013)



**Figure 5-102 Interior view of a classroom (METI School)** (ArchDaily, 2010)



**Figure 5-101 Bamboo and woven window shades** (Heringer, METI School, Bangladesh, n.d.)

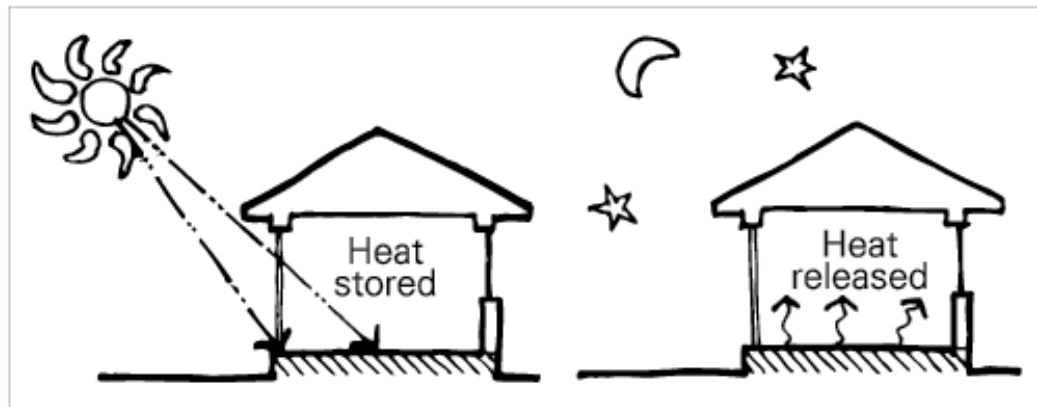
2. Upper- floor classrooms rely on cross ventilation. In fact, the floor is very airy with light bamboo construction. The slatted walls provide a stimulating environment for the students (Lim, 2007). To regulate the amount of air and sun entering the room, Heringer designed shades which are made of woven bamboo. Although air still flows in and out through the gaps of woven bamboo, the solar heat radiation can be blocked. The gaps also let in daylight, and even when most of the shades are closed there is enough daylight coming into the classroom (World, 2015). However, the primary purpose is to light the place naturally which is successfully achieved. It has just one generator for some halogen lamps to provide artificial light in the evening or at night.
  
3. A proper roof treatment: The roof of The METI handmade school is made of steel for the durability. But for the climatic comfort, there are colorful sari fabrics hanging below the ceiling (Fig 5.103). These have changed the whole interior space by adding color and creating a festive feeling. Moreover, the saris have climate benefits that it help to block the heat from the steel from radiating directly inside the classroom. There is also a ventilated gap between the steel and the saris, and as the air in this space heats up, it causes an updraft and ventilates the classroom below (World, 2015).



**Figure 5-103 colorful saris (A sari is a female garment from the Indian subcontinent) are hanging from the ceiling which has made the place more comfortable and peasant (World, 2015).**

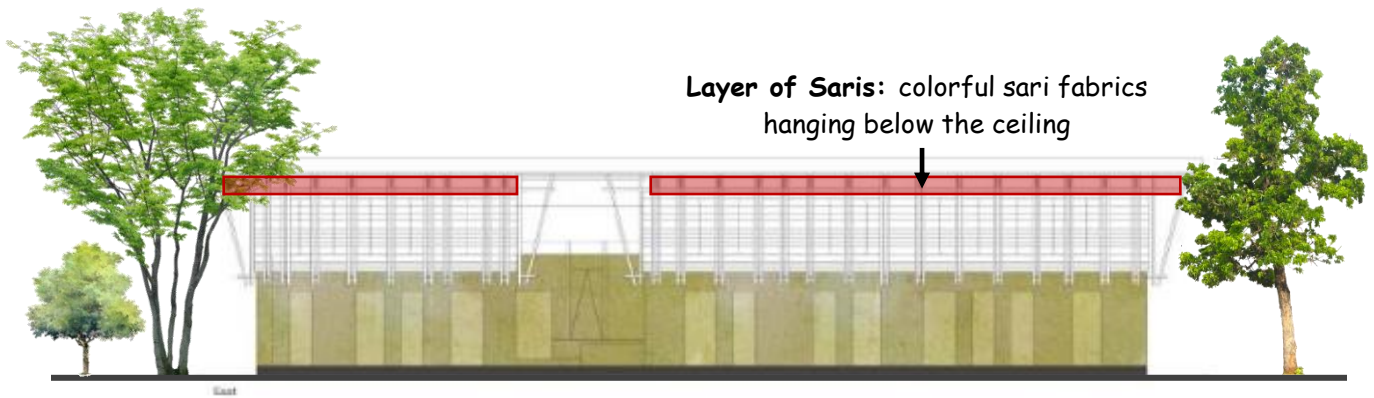
Winter time initiatives for the comfort—

1. In METI School, the ground floor classroom has a different feeling with thick mud walls. In winter, heavy thermal mass absorbs heat during the day from direct sunlight and also passes some into the ground as well. However, in the nighttime, thermal mass re-radiates that warmth back into the building (especially on the bottom floor of the METI) throughout the night. Thus, the METI handmade school stays comfortable throughout the year.

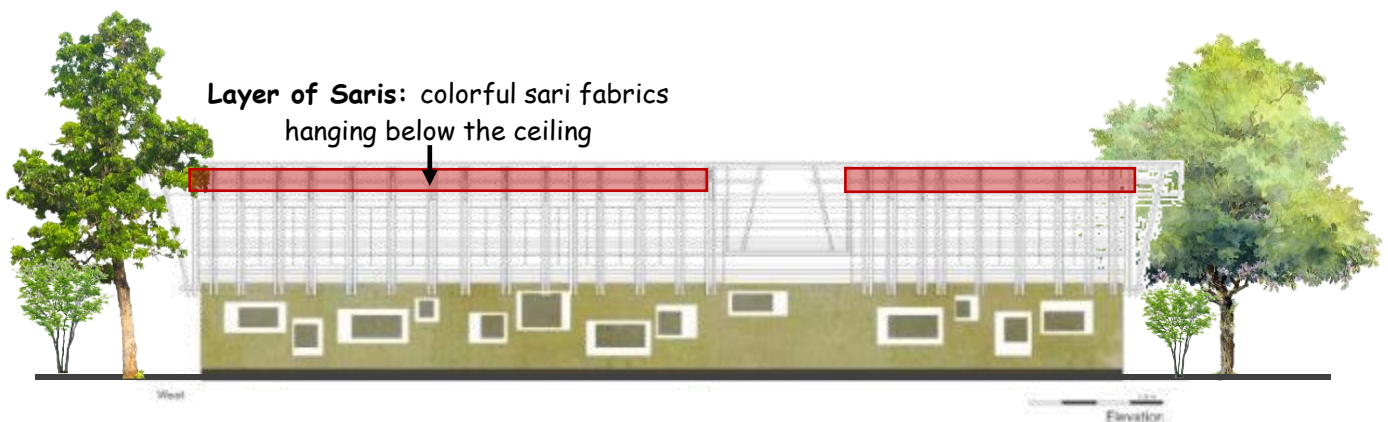


**Figure 5-104 Winter Time: Thermal Mass activities** (Reardon, 2013).

2. On the upper floor, they use more saris or colorful clothes to project cool air during the winter. Since sunlight still enters the room quite easily through the gaps of woven bamboo, the upper floor is also very comfortable, temperature-wise, in the winter as well (Lim, 2007). Moreover, Heringer tried to prevent the direct solar radiation which keeps the interior spaces cool.



**Figure 5-105 East Elevation of the building** (ArchDaily, 2010)



**Figure 5-106 West Elevation of the Building** (ArchDaily, 2010)

Heringer deliberately designed indoor and outdoor spaces which prevent glare and allowed daylight and air to enter. Her design scheme was significantly climate responsive. However, the prevention of direct solar radiation keeps the interior spaces cool. There are some semi-covered spaces and verandahs are the transitional shaded spaces which connect a person to the outside with protection from extreme weather conditions. The METI Handmade School blends in well with the local climate and society. Overall, snuggling comfortably into the surrounding flora and the color of the earth.



“Everyone in the village is very happy with the school. The adults think it is great that the children have a nice place to study. The children enjoy it because it is bright and cheerful.”

(Heringer, METI School, Bangladesh, n.d.)

## Typological Level

At this level, buildings possess a sense of history, community, nature, and place. By taking inspiration from the bioregional traditions and historical building types, architecture is created that is both new and familiar (Coates, 2014). Time-tested architectural types provide important lessons to reach high standards of excellence. Nature also provides lessons of sustainability and life-enriching design. Biophilic design in a built environment connects the users to nature through plants, animals, and water.

Professor Coates views the Typological level of Deep Beauty as—

"The Typological Level involves the adaptation of bioregional building traditions and historically situated building types in the design of contemporary buildings that are capable of evoking a sense of connection with history, community, nature, and place." (Coates, 2014)

Typology is regenerative so buildings can be of the same building type yet appear so different from each other (Polyzoides, 1992). Nature also provides lessons of sustainability and life-enriching design. Humans perceive and communicate by forming standards and systemizing patterns. In this context, architectural typologies consider the different requirement profiles of building types and spatial systems. Examining typology involves a dialogue within history to discuss the generation of 'new' from the 'old.'

### *The sense of History, Community, and Place*

The building is deeply rooted to Bengali tradition and culture. Architect Anna Heringer's conceptual thinking was---

“It is particularly important to improve the quality of living in the rural areas in order to counteract the continuing population migration to the cities. The primary potential for developing the building in the rural areas is the low cost of labor and locally available resources such as earth and bamboo.” --- Architect Anna Heringer (ArchDaily, 2010)

The METI Handmade School evolved out of the history of Bengal architecture (discussed in chapter 02) and from the context of the Delta. In every possible way, Heringer tried to follow local building tradition and social context. The METI School is an example of sustainable architecture which is profoundly rooted in community and place, has significant historical values. The project has emerged from in-depth knowledge of local building techniques and context. The distinguished Jury of Aga Khan Award for Architecture (10<sup>th</sup> Circle), clearly quoted that – the METI Handmade School by Anna Heringer & Eike Roswag, provide a fresh and hopeful architectural model for sustainable building globally."

Heringer is successful in highlighting the Deltaic tradition and architecture—

1. Heringer and Roswag selected the locally available materials like- mud and bamboo.
2. Architects had adopted “Mud-House,” a backward and primitive building technique, and their interpretations revealed a new paradigm of mud structure while benefiting the native people.



Dominating roof made of straw which is very light structure.

Heavy and thick mud wall having no openings

The Base: A mud raised platform

**Figure 5-107 Three Basic parts of Bengal Mud (Mud Hut) house: A primitive Village house of Bangladesh (Akhand, 2010)**



Light Bamboo Structure on the top of the building

Thick mud wall with some small openings

The base which is made of brick masonry work.

**Figure 5-108 The METI Handmade School (Lim, 2007).**

Although architect Heringer explored some new features in the building techniques, the basic three parts of a mud house were strictly maintained.

3. A handmade building & the involvement of the local community: The “handmade” approach was taken to employ architecture as a tool to boost the local economy, the cultural confidence as well as the ecological stability (Tanvi Naik, 2017). Architects used local craftsmen’s skill in order to establish a deltaic architectural image.

Finnish architect and former professor of architecture Juhani Pallasmaa has mentioned—  
It is quite evident that—aesthetics is fundamental to both culture and nature, and if sustainability refers to the graceful interaction between them, it must have a sensory dimension. (Pallasmaa, *The eyes of the skin: Architecture and the senses*, 2013). Therefore, it is quite evident that the METI handmade school is a sustainable architecture and has a deep sense of history, community, and place.

### ***Building Type***

The METI Handmade School, Rudrapur, is an instance of improving available local materials and techniques and implementing them in a new innovative way. The typical layout plan of a very primitive Bengal mud house (Mud Hut) has been transformed to meet the needs of a rural school and the community. The METI School is also an extraordinary example of an institutional building which is very native, contextual and sustainable developments. Nevertheless, the project encompasses all aspects of sustainability such as the use of local materials, building techniques, locations, the users, structure and the socio-economic context (Tanvi Naik, 2017); eventually is an example of deep beauty.

Professor Gary J Coates defines the typological level of “Deep Beauty” as—

“The Typological Level involves the adaptation of bioregional building traditions and historically situated building types in the design of contemporary buildings that are capable of evoking a sense of connection with history, community, nature, and place.” (Coates, 2014)

### *Layout*

Christopher Alexander and his colleagues in the book *A Pattern Language* also discuss the pattern of intimacy gradient. They say, “Unless the spaces in a building are arranged in a sequence which corresponds to their degrees of privateness, the visits made by strangers, friends, guests, clients, family, will always be a little awkward.” (pg. 610) (Alexander, 1977)

The METI School is a two-story building. There are three classrooms on the ground floor and two dividable classrooms on the upper floor of the building (floor area only 325 m<sup>2</sup>). The project doesn't have any main entrance gate or distinct entrance pathway. In fact, the METI School is located beside a playground and in the middle of a remote rural village of Bangladesh. The building has only two primary functions such as classrooms and children's recreational area. It has a raised brick platform which leads directly to the classes. A stair has been placed in a semi-outdoor space, almost in the middle of the building. Moving to the first floor, space becomes more informal and recreational. Undoubtedly, the building is significant throughout the world because of its architectural innovations, structural methods and for the socio-economic development of a region. The ultimate success of this building lies in the fact that it has unfolded entirely from local culture and context. The METI School is entirely handmade of local building materials. School building's layout also follows the architectural morphology of the Delta—

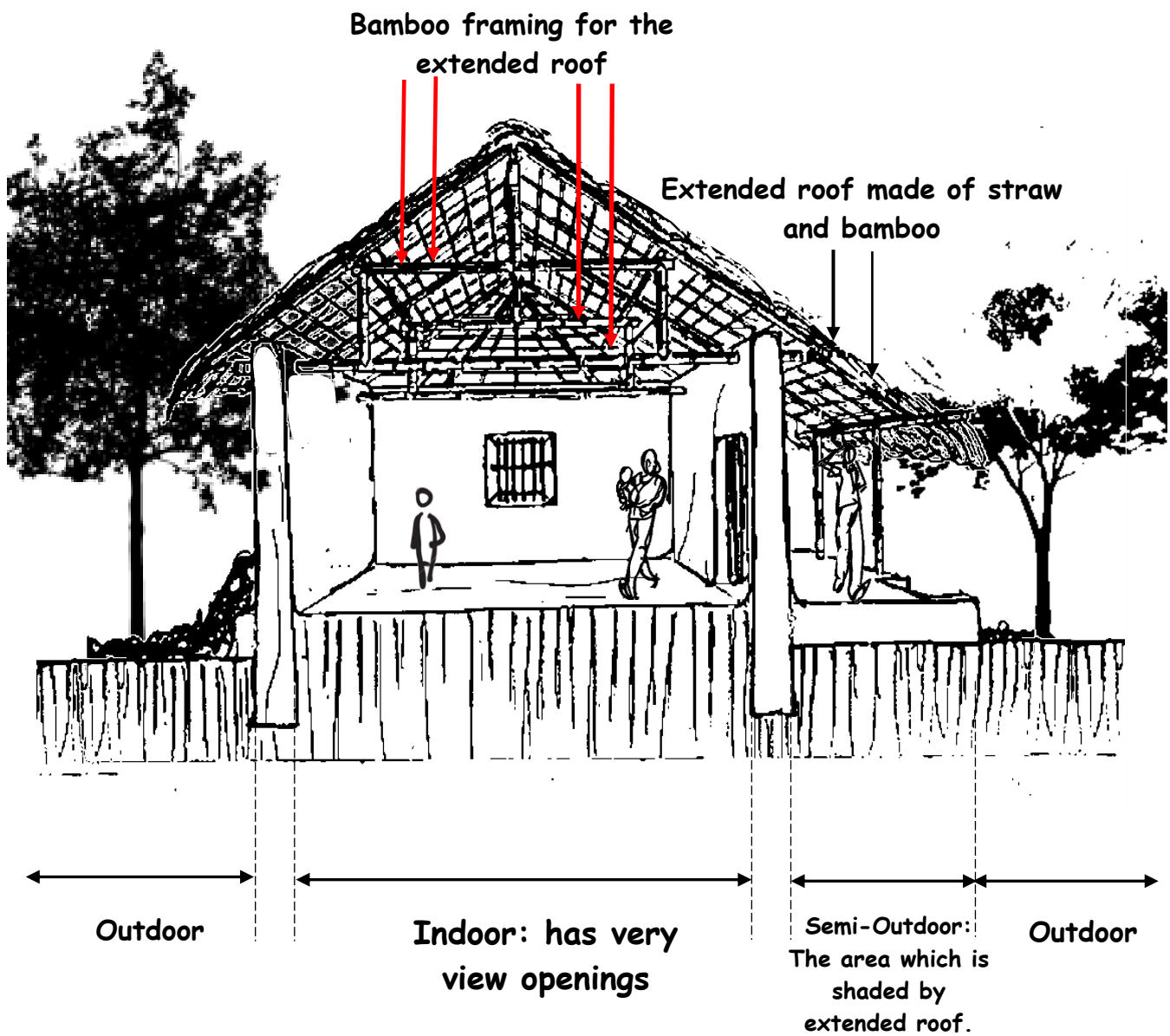


Figure 5-109 A Bengal Mud House's space sequences and architectural morphologies

(Hasan D. M., 1985)

Architect Anna Heringer also replicated Bengal rural space sequences and designed influential semi-outdoor spaces, outdoor and indoor spaces. She strictly maintained the space sequences of a Deltaic “Mud House”—

**“Indoor—Semi-outdoor—Outdoor.”**

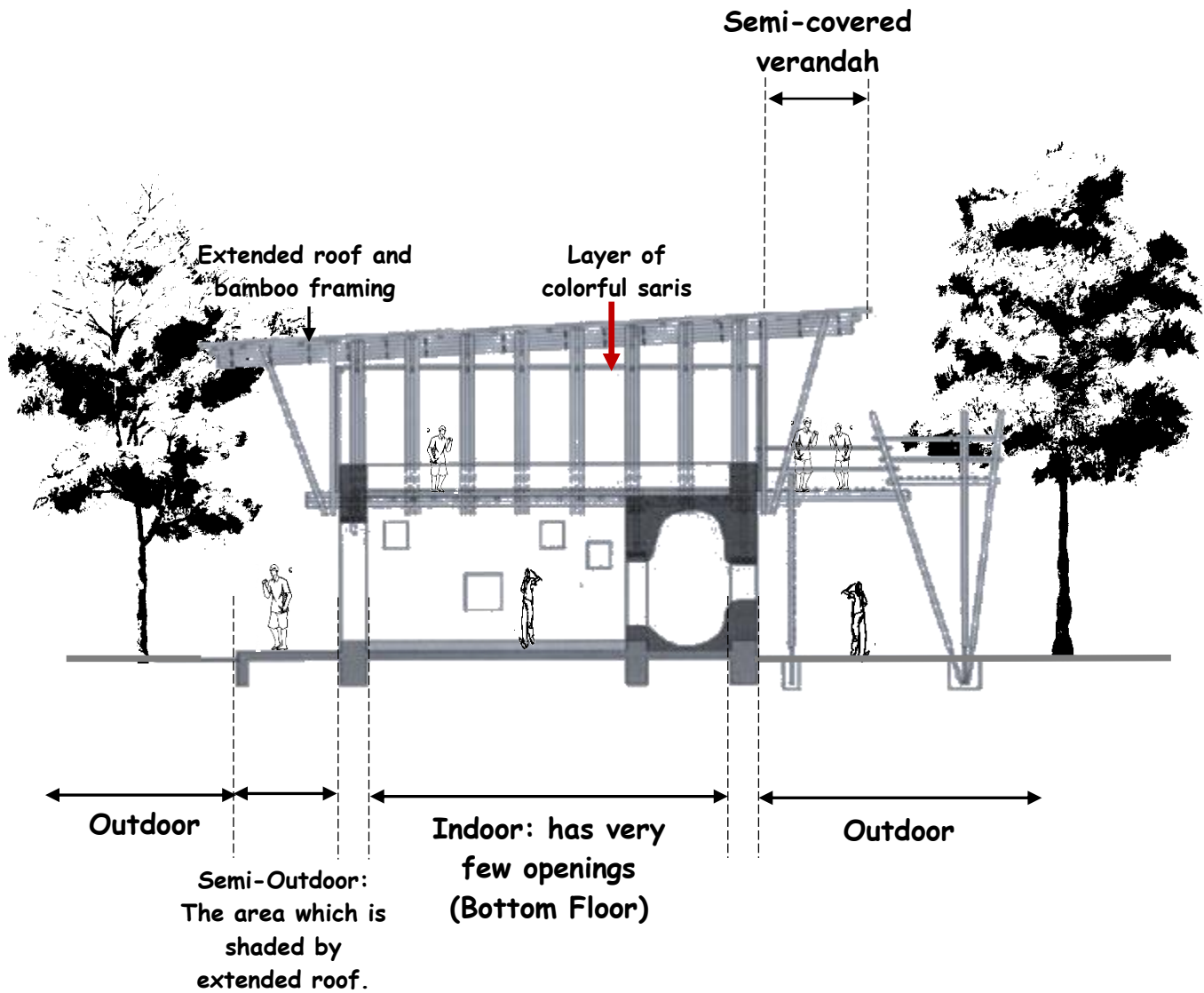
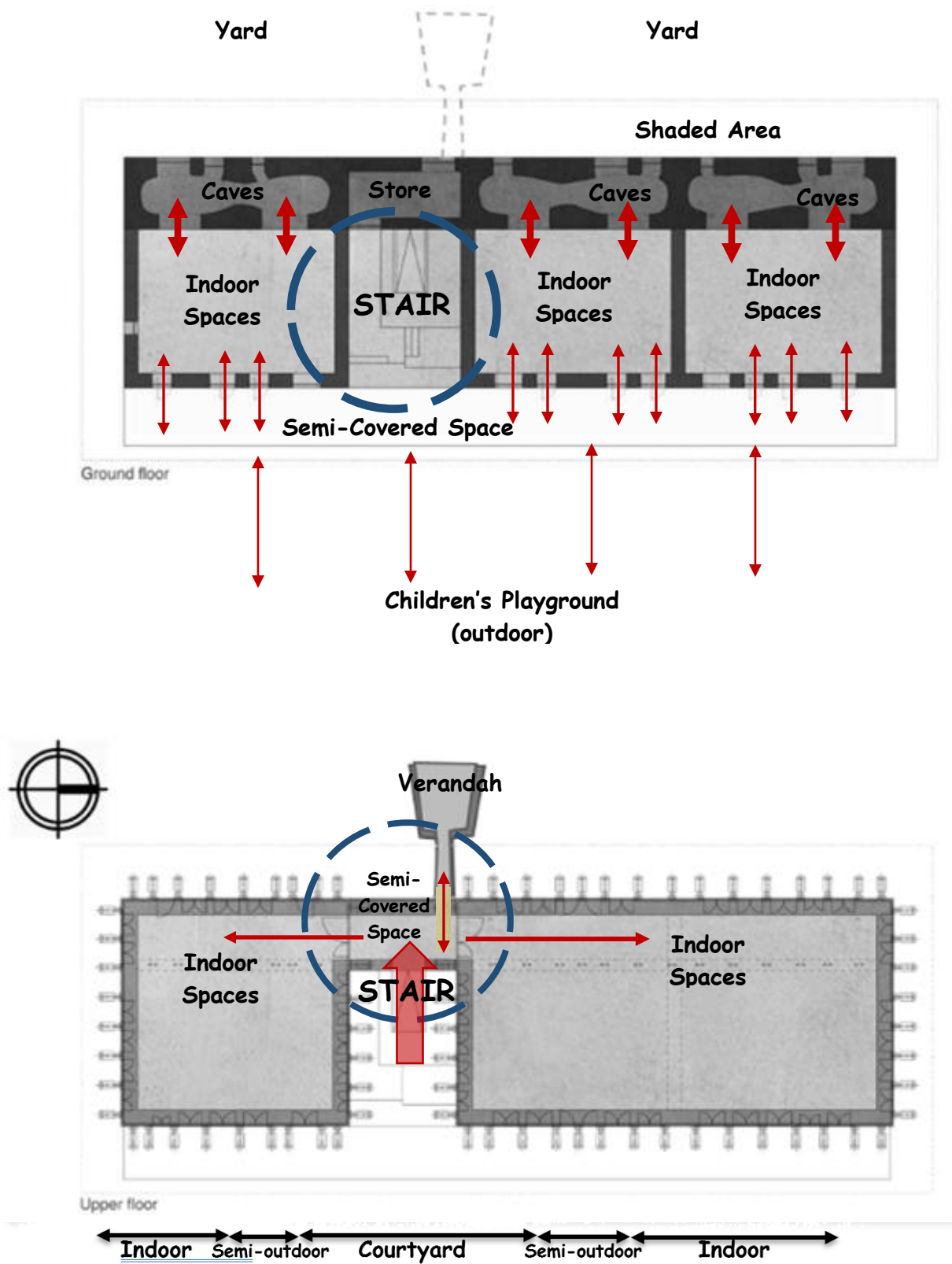


Figure 5-110 METI School's Section AA': Replication of traditional Bengal Mud House (ArchDaily, 2010)



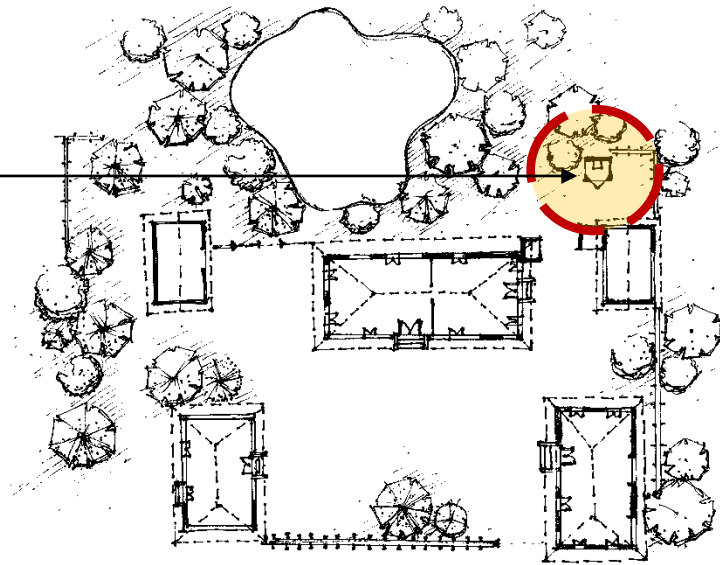
**Figure 5-111** Section of Bengal Household (space sequences of Delta), previously mentioned in chapter 02. (Tanvi Naik, 2017)



We can see that (Fig. 5.116), the bottom floor has three classrooms which are rectangular in shape made of thick earthen walls. Every class has their own access to outdoors to the east and to the organic shapes of “cave” to the west.

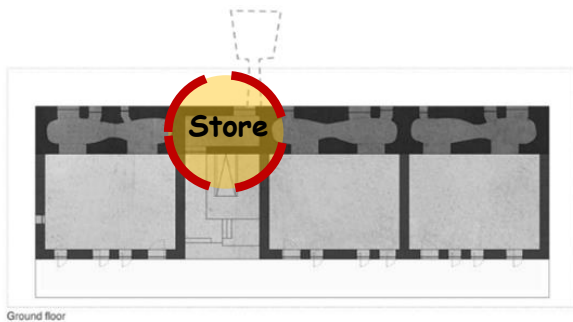
The fenestrations in the bamboo walls of the first floor provide picturesque views of the village pond through the treetops.

There are no attached toilet/bathroom in Bengal households.

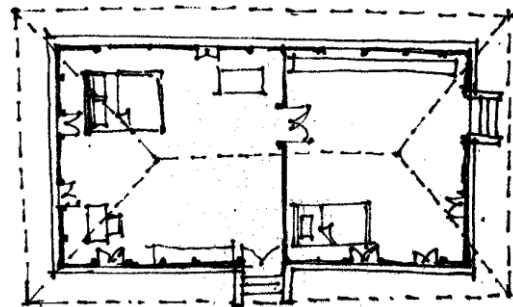


A typical household of Bangladesh

The METI handmade school also doesn't have any attached toilet



Ground floor Plan of the METI



Plan of a Bengal house

Figure 5-112 Detached Out yard: Following the rural house pattern (Hasan D. M., 1985)

Anna Heringer didn't design any attached toilet/bathroom in the building. Visual & physical linkage with different yards and shared activities in the semi-covered space are crucial to creating lively and interactive spaces.

### ***Biophilic Design***

The biophilic design relies on the concept of biophilia with sustainability (Duzenli, 2017). Biophilic Design is an innovative way of designing the places where we live, work, and learn (DESIGN, 2011). Recently Professor Timothy Bentley has introduced these ideas in the field of urban design and architecture. However, architect Anna Heringer is extremely concerned about sustainability. In an interview, she expresses her views:

**“ORIS (Q):** As a development learner what awareness did you acquire in Bangladesh?

**Heringer:** I learned that the most sustainable development approach is to use what exists locally, not to depend on external resources. To value the things, you have and to bring out the best of them”. (Heringer, Sustainable Beauty, 2012)

Heringer put nature at the core of her design, which is the most critical aspects of biophilia in architecture. Human beings are instinctively linked to all other living systems. However, Biophilia has conceptualized the relationship between nature and human and has given a theory which relies on sustainability as well (Duzenli, 2017). Her design started with finding the interplay of spaces and to give local people confidence in the use of traditional building methods and materials. Eventually, she revived primitive building styles of the Delta and explored fresh, innovative techniques in order to transform them into a modern vocabulary.

Heringer's design was incredibly climate responsive (discussed above), providing many spaces to interact with different seasons. Children can feel sun and rain, shade and shadow and light and dark from every single area of the METI School. The light and shadows created by the bamboo strips play on the earthen floor. She also created a beautiful pattern of organic "caves" where a creative mind can wonder. Learning with joy, team-based education, and utilization of nature are all elements of this METI school (MoMA, n.d.). The METI Handmade School, Rudrapur, Bangladesh, is also home to many animals including birds, insects, and dogs. The building has become the crucial part of the ecosystems as it is the home of hundreds of different species. In fact, architect Heringer was incredible when she integrated nature and natural process into this building, which is possible with the biophilic design approach (Duzenli, 2017). She also incorporated local people, context, climatic factors as well as socio-economic aspects into her design (Heringer, Sustainable Beauty, 2010). Lastly, it is quite evident that the METI handmade school, Bangladesh is not only an example of biophilic design but also a significant instance of sustainable architecture.



**Figure 5-113 Natural settings of the METI handmade school, Bangladesh (ASIA, 2015)**

## Archetypal Level

Professor Gary J Coates has described the Archetypal Level of Deep Beauty in these terms:

"The Archetypal Level involves the use of archetypal building elements, patterns, and forms that are most typically found in the world's sacred architecture. Buildings at this level speak in the natural language of space, which is rooted in the pre-verbal meanings of embodied experience: up and down, right and left, front and back, inside and outside, near and far, darkness and light, rough and smooth, warm and cool, the horizontal and vertical, the center and periphery." (Coates, 2014)

Buildings at this level use archetypal elements from the world's sacred architecture. Such buildings possess greater levels order by using sacred geometry and the qualitative number. The presence of biologically rooted polarities of prospect and refuge, complex order, enticement, and peril respond to our psychophysical opposites (Coates, 2014). Professor Coates also says that this level reveals the language of the space and also provides natural symbols of up and down, inside and outside, horizontal and vertical and so on (Harries, 1993). The level talks about numbers, geometry, space orientation, the proportion of the structure.

### *Orientation in Space*

The building is situated in a rural area of Bangladesh. The METI School's serene location is remote, submerging students and teachers in the natural green surroundings. On the east side, there is a big playground for the children. One can easily see the green paddy fields from the upper-floor of the building. However, the building really blends well with the local environment and social context of the region. The Building is a delight in the wilderness.



**Figure 5-114**The METI School is located in the middle of nowhere in Bangladesh (Map, 2018).

(Blow up)

***Geometry, Proportion, and Number***

Architect Anna Heringer discovered the morphological characteristics of the Deltaic mud house and households. Nevertheless, geometry and proportion of this METI School also came from the native “Mud House.”

## Geometry

A Simple Rectangle Form; rarely one can find any different geometry in Bengal households. Similarly, the primitive “Mud House” has some distinguishable space sequences and inherent harmony of spaces. The mud house pattern has its own construction methods, materials and equipment which are strictly followed by architect Anna Heringer and Eike Roswag.

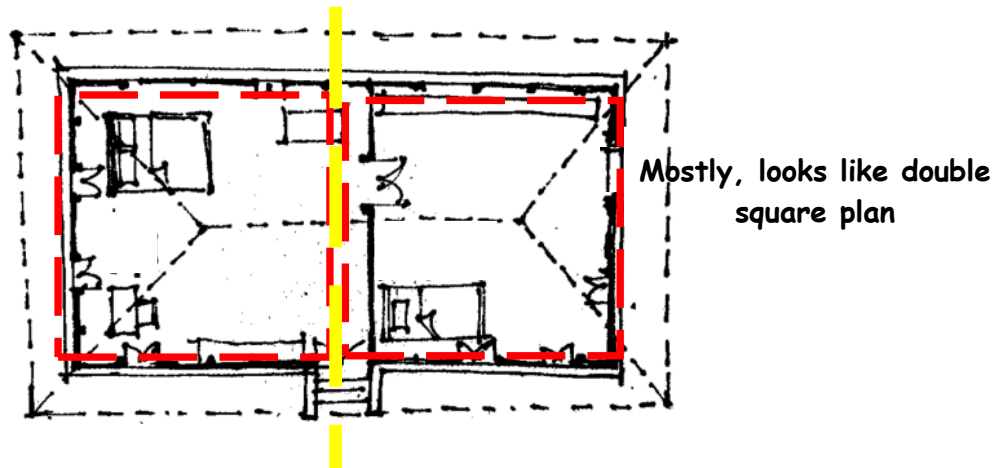


Figure 5-115 Plan of a Bengal Hut (also discussed in chapter two)

The primary material found in the delta is clay/mud, although Wood, Thatch, and Bamboo have also been used commonly as building materials. Heringer took the geometry from the Delta.

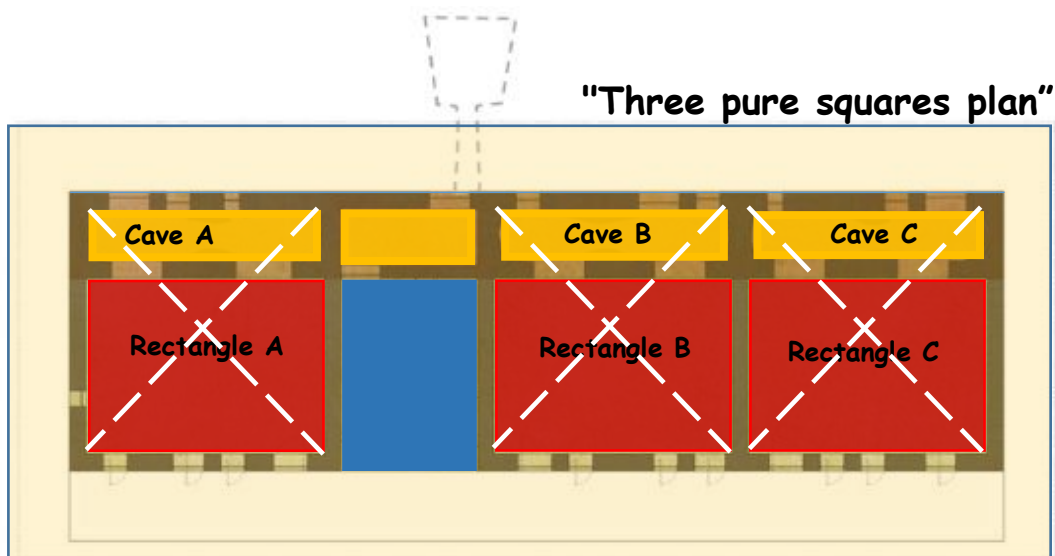
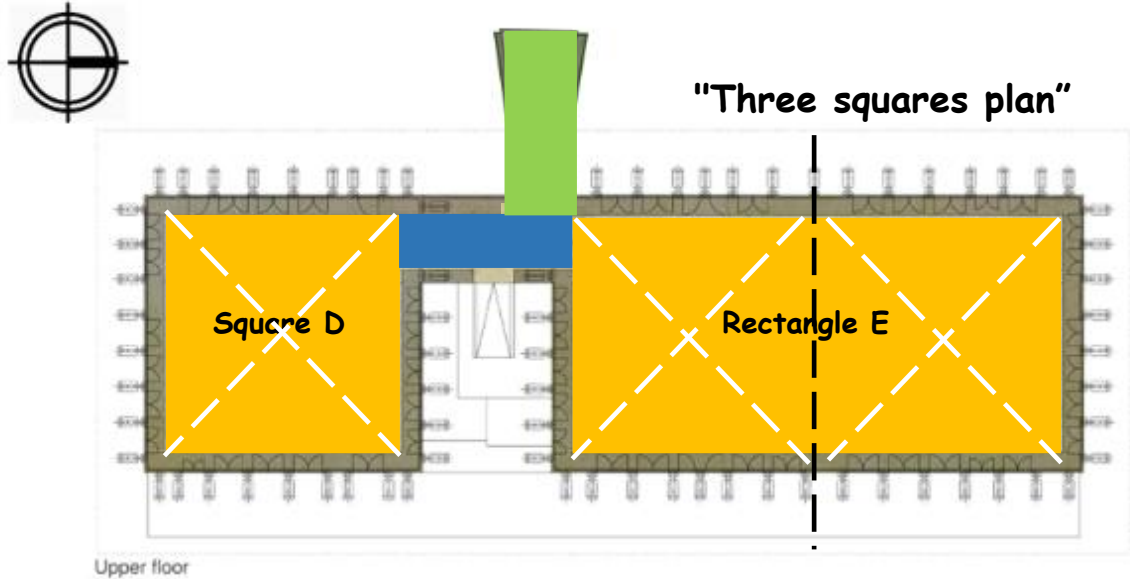


Figure 5-116 Geometric Analysis of the Ground Floor Plan: all rectangular forms.

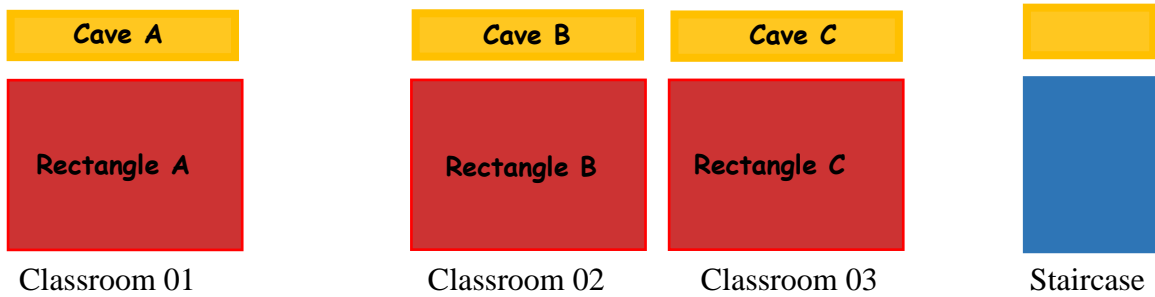




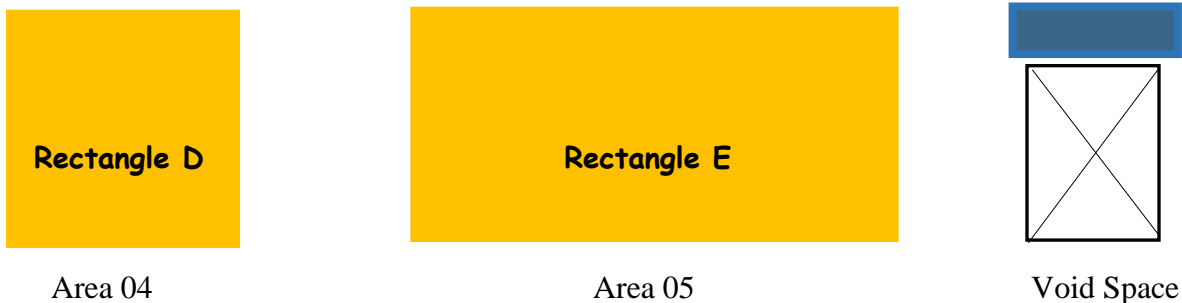
**Figure 5-117 Geometric Analysis of Upper Floor; all rectangular forms**

The square, traditionally, is the shape associated with the earth (Schneider, 1994). “Three announces wholeness and completion through an embracing synthesis. We feel its correctness and express it through our words and images. (p.41)” (Schneider, 1994)

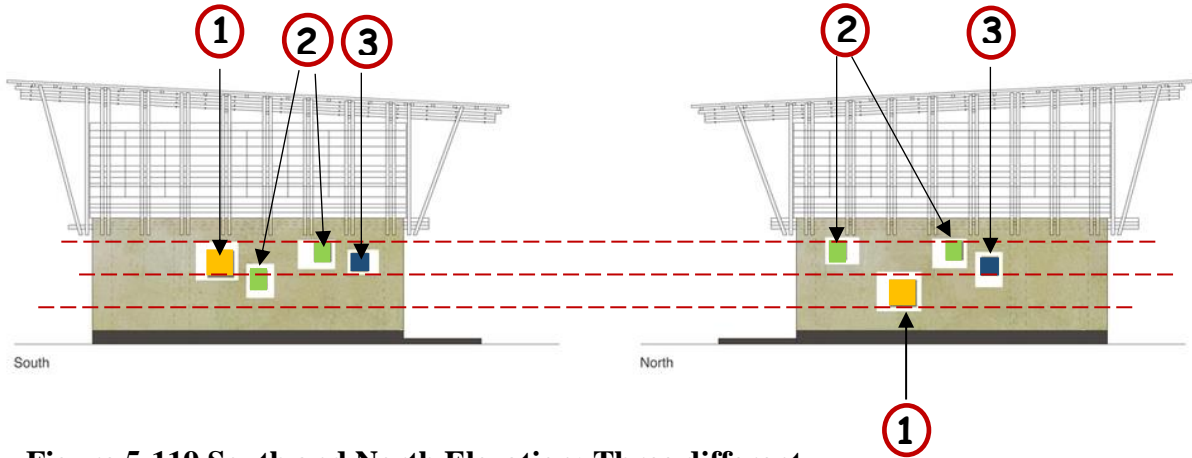
The Bottom Floor



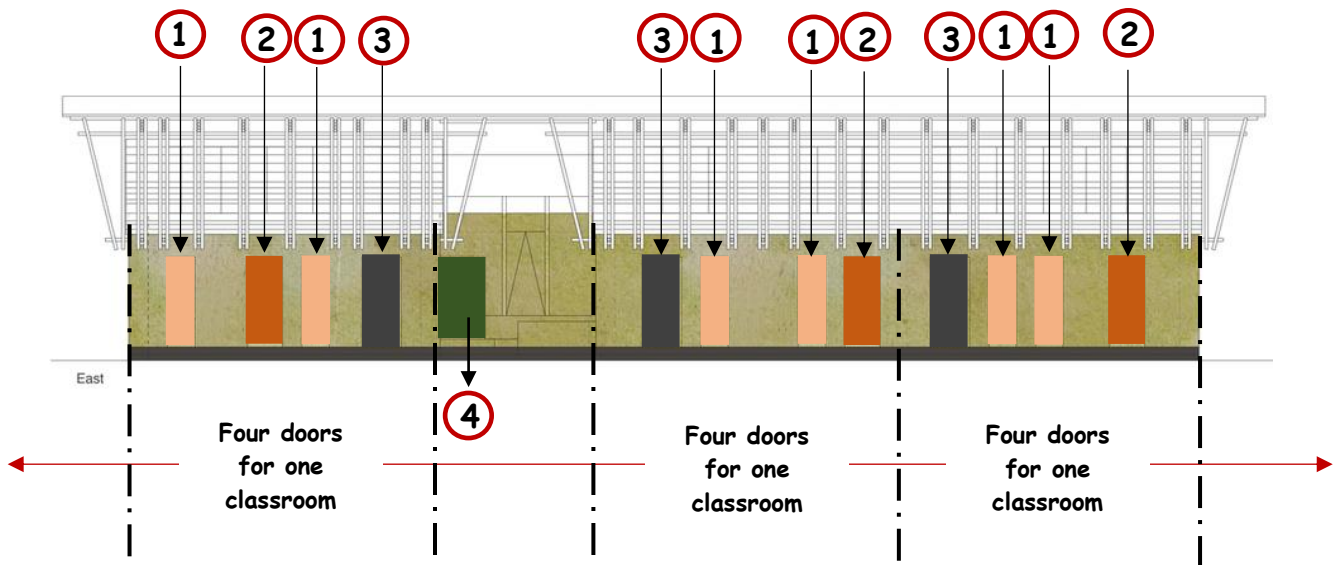
The Upper-Floor



**Figure 5-118 Geometric pattern of METI School** (she also used rectangles of some unspecified)



**Figure 5-119 South and North Elevation: Three different sized windows are randomly arranged (ArchDaily, 2010)**

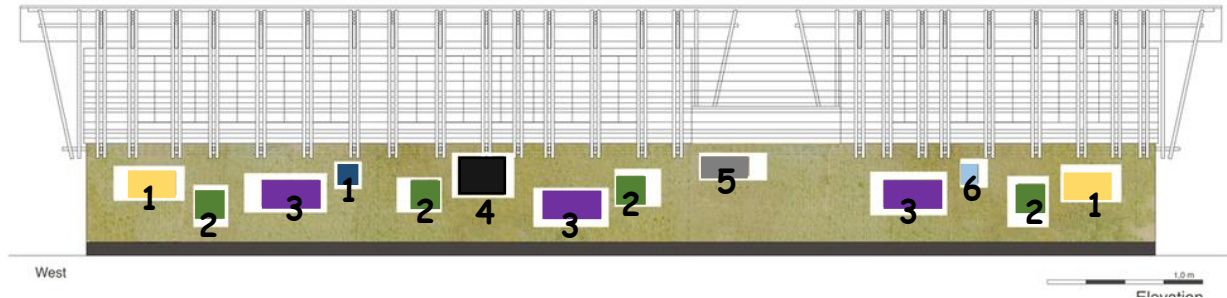


**Figure 5-120 East Elevation: Three different size doors are randomly arranged on the east side (ArchDaily, 2010).**

A straightforward approach to the plan: a rectangular plan with three squares. Probably, Heringer was more concerned about the geometric simplicity of the school and the context. Undoubtedly, this approach helps her to make a sophisticated beauty. That's why Buckminster Fuller says, "Simplicity is supreme Simplicity is the ultimate sophistication Beauty is therefore simplicity."



There are only two geometric forms in this building: 1. Rectangle & 2. Square and also 4 types of doors and around six types of windows are only on the ground floor.



**Figure 5-121 West Elevation: Six different size windows are randomly arranged on the west side.** (ArchDaily, 2010)

This is the overall elevation comprised of squares since each floor is comprised of squares (Fig. 5-118, Fig. 5.119).

There is a supreme relationship between earth and square as we organize space on the ground by the four cardinal directions of the compass and our body (Schneider, 1994). Michael S. Schneider writes:

"We divide the circle of the horizon around us into four quarters in front and back of us, to the left and right. The four-cornered cross in a circle has long been the astronomical symbol for planet Earth. Fourness indicates association with the stable, solid earth." (p.66) (Schneider, 1994)

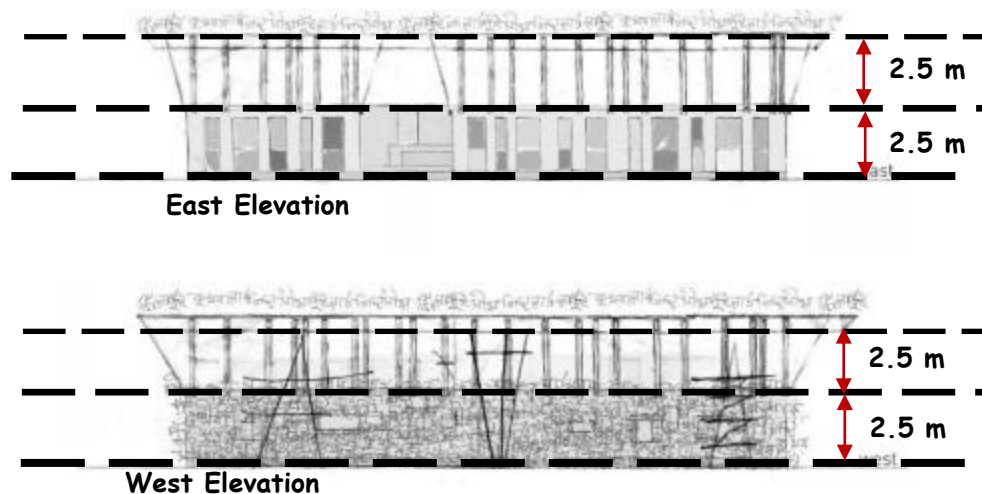
Heringer used three squares plan for the ground floor, as well as a similar approach, can be assumed from the upper floor plan which adds the feature of solidity and stability to the school. These are also related to earth. In Bangladesh, mud house is not a permanent structure, but somehow she tried to establish some permanent features of a mud house. From these geometric analyses, we can recognize that there is some hidden geometry in the building as well.

As I have already mentioned, a traditional mud house in Bangladesh is an example of simplicity and vernacular architecture. Architects Anna Heringer and Roswag followed the ingenious primitive geometry of the Delta and did real justice to the context which we may call critical regionalism (Satisfy Kelbaugh's 5 points of Critical Regionalism). However, the project gained an immediate iconic status throughout the world.

“The proportion of the internal spaces is well handled, receiving an enthusiastic response from the users. Compared to most of the houses that the villagers live in, this is luxury, with natural light and natural ventilation.” (Lim, 2007)

## Proportion

Bengal Architecture reflects “Human Scale.” Deltaic architecture reflects horizontal development; Maximum traditional houses are one-story. Architect Anna Heringer followed the pattern; in the building overall and in the intimate scale of caves and classrooms as well. The METI School is mostly a horizontal development just as is the case for typical Bengal mud architecture.



**Figure 5-122 East & West elevation: Project is a horizontal development** (ArchDaily, 2010)

We can understand from these geometric analyses that, Deltaic architecture has a healthy relationship with the earth. The average height of Bengal rural house is only around 9-12 feet (2.5-3.5m). Floor-to-ceiling height of the METI School is also 2.5 meters.

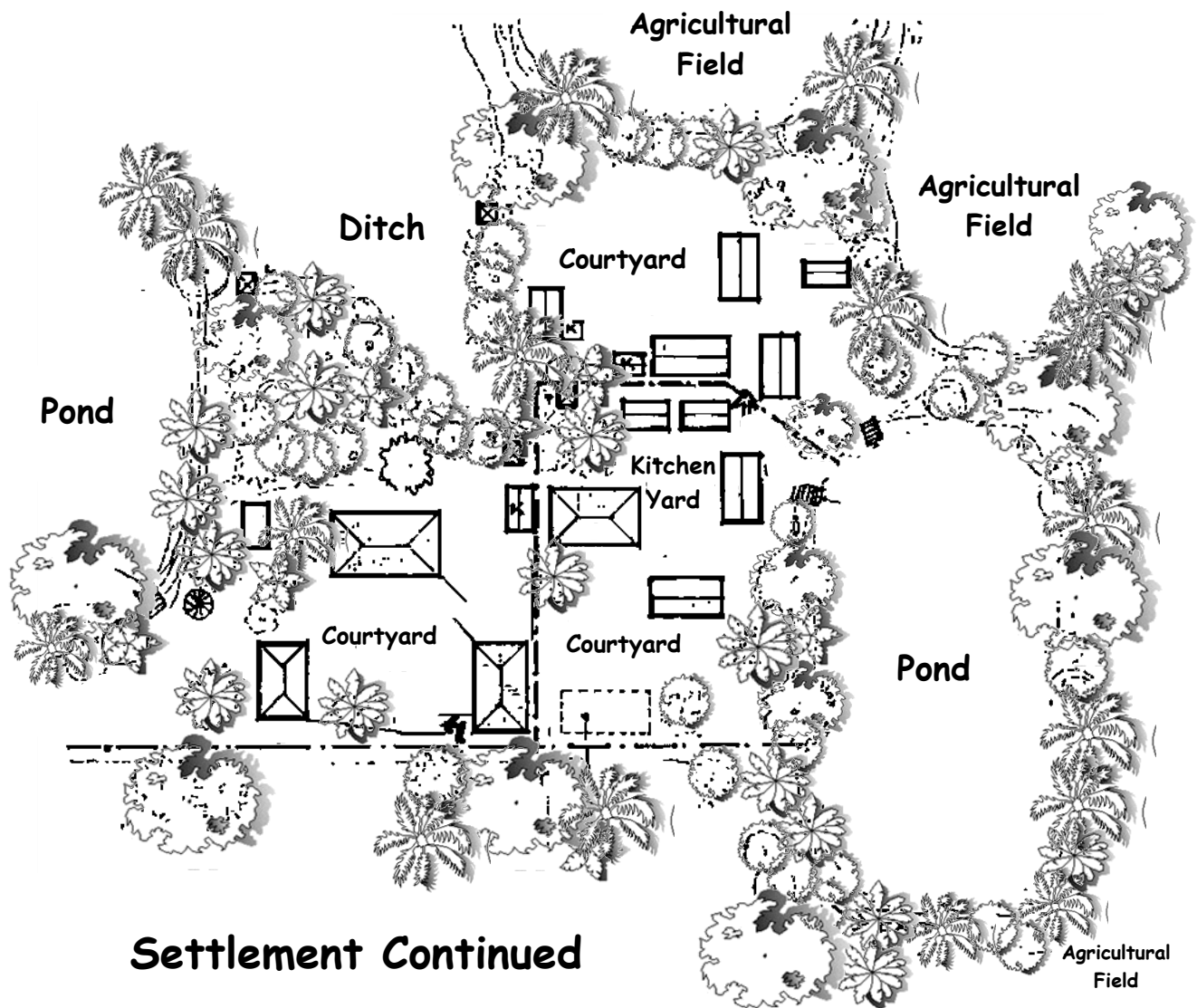
### **Numbers:**

Numbers in Islam are quantitative as well as qualitative. For example, in Islam, the number '4' symbolizes the four directions, the four seasons, the four gateways to heaven (Ardalan, 1973) and the four rivers that flow in heaven.

However, Deltaic architecture is not based on the use of any significant numbers in the process of design. Deltaic architecture is concerned about climatic issues, cultural values, and unique contextual interpretation. Anna Heringer was utterly aware of those facts and didn't explore any numbers in her design. She studied the settlement morphology of the Delta (discussed in chapter two).

The basic characteristics of Deltaic architecture:

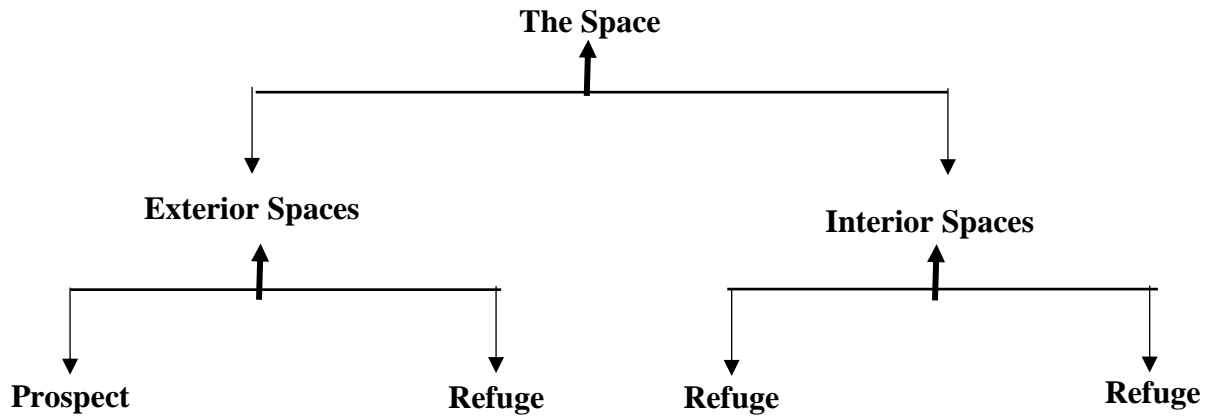
- Organic (doesn't have any significant number); 2. Simple Form (mostly rectangle)
- Horizontal development (Haque, 1997)



**Figure 5-123 Settlement patterns of Deltaic Bangladesh: organic, horizontal and there are hardly any significant figures or numbers. (Hasan D. M., 1985)**

### *Spatial Polarities in Natural Settings*

For this study, the spaces have been divided into two groups.



**Figure 5-124 Classification of Prospect and Refuge Space (Hildebrand, 2008)**

#### **Refuge:**

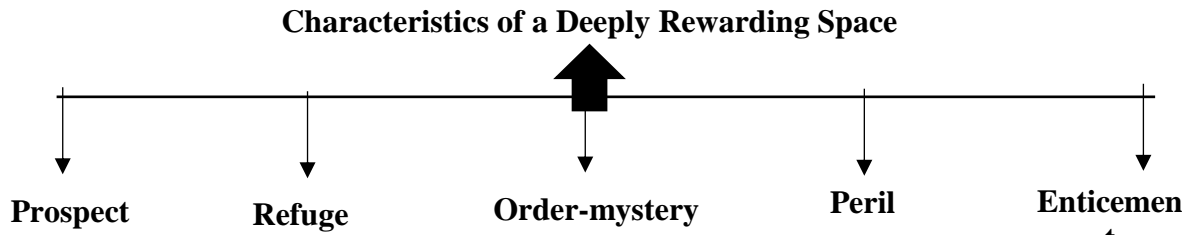
Because of our primitive instincts, humans need sheltered spaces to protect themselves from climate and other threats. This characteristic is referred as ‘refuge’ by Jay Appleton (Appleton, 1996). Nevertheless, he proposed “habitat Theory” and advanced the notion of “refuge-prospect’. Jay Appleton established a ‘Habitat Theory,’ which observed animal responses to their surroundings. Later he extended that to humans through our unique ability to recognize symbols (Lochhead, 2015). We have got some inherent sense and understanding about threatening and comforting aspects of the landscape. Appleton concluded that people got “inborn desire’ for nature from their ancestors which help them to observe without being seen – to measure threats from a place of safety. Jay Appleton stated this the ‘Prospect-Refuge Theory’ (Lochhead, 2015).

#### **Prospect:**

Humans have an inherent love for vast open spaces which are referred as “prospects.” The areas are to see the outside threats and resources. A meaningful space is created when prospect and

refuge are both present, and one can be seen from the other (Hildebrand, 2008). ‘Refuge’ is dark and narrow while ‘prospect’ is well-lit and spread out.

Grant Hildebrand (2008) has identified five characteristics of a deeply rewarding space:



**Figure 5-125 Characteristics of a Deeply Rewarding Space (Hildebrand, 2008)**

### **Exterior prospect and refuge spaces of the METI School**

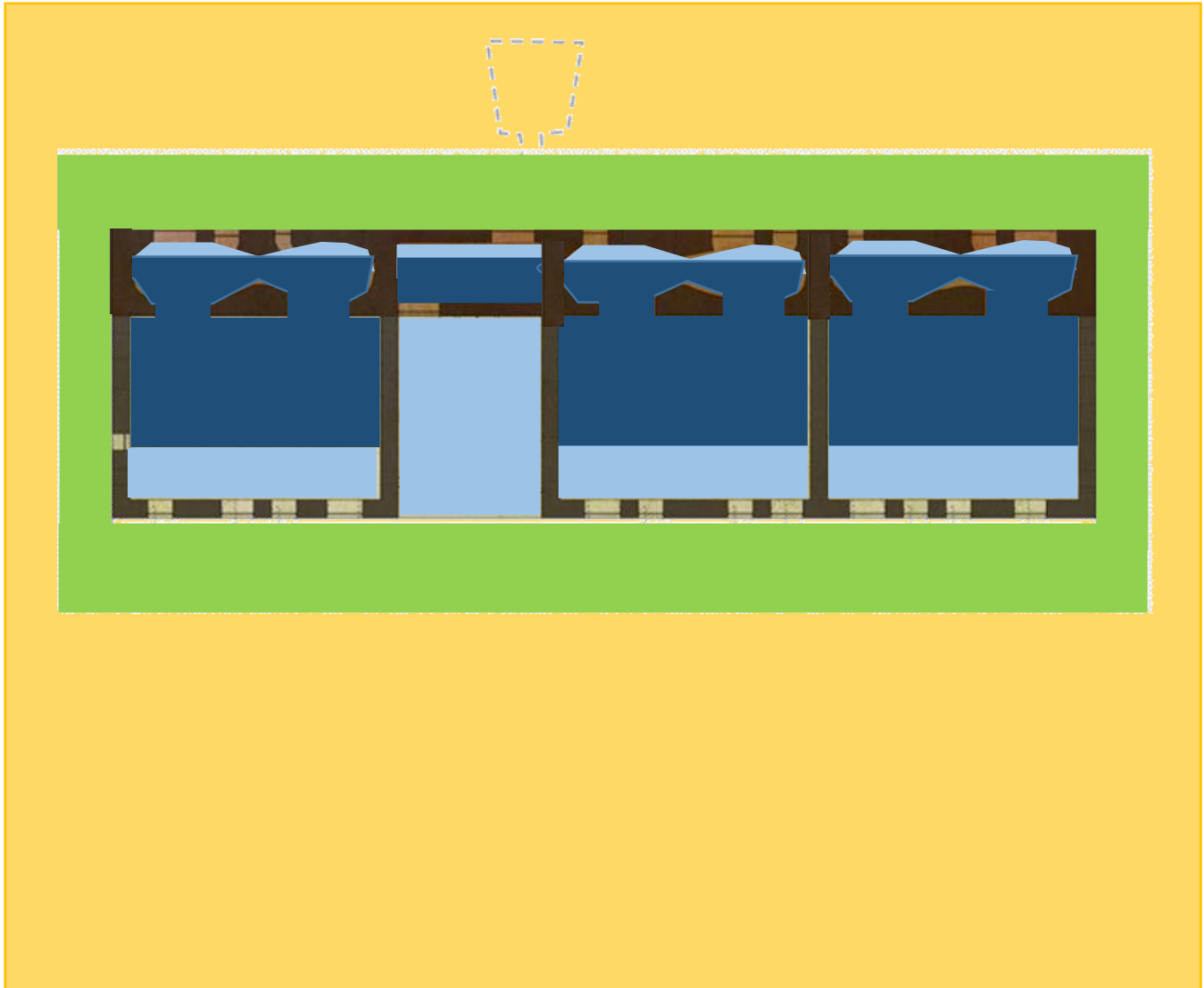
The playground of the school has a semi-covered area where shadow creates places of exterior refuge spaces. Other exterior refuge spaces are the raised brick platform which is covered by an extended roof and the staircase. These are the exterior refuge spaces from where a person is able to view the large playground and the outside threats and resources. In this project, all exterior refuge spaces open into the exposed brightly lit yards which are the exterior prospect spaces.

### **Interior Prospects and Refuges of the METI School:**

The spaces which are well-lit and have a high ceiling, are the interior prospects. These types of areas, usually are located close to the windows and doors; they give a feeling of openness and distance. An interior room can have both prospect and refuge as well (Appleton, 1996). Refuges in interior spaces are cozy and dark areas which usually are found away from the doors and windows. These areas also have a low ceiling. For the METI Handmade School, the upper-floor is well lit and naturally ventilated. From these spaces, it is possible to see the distant prospects of the pond and agricultural field. Therefore, the whole surrounding area is an exterior prospect in relation to the upper floor.

**LEGEND:**

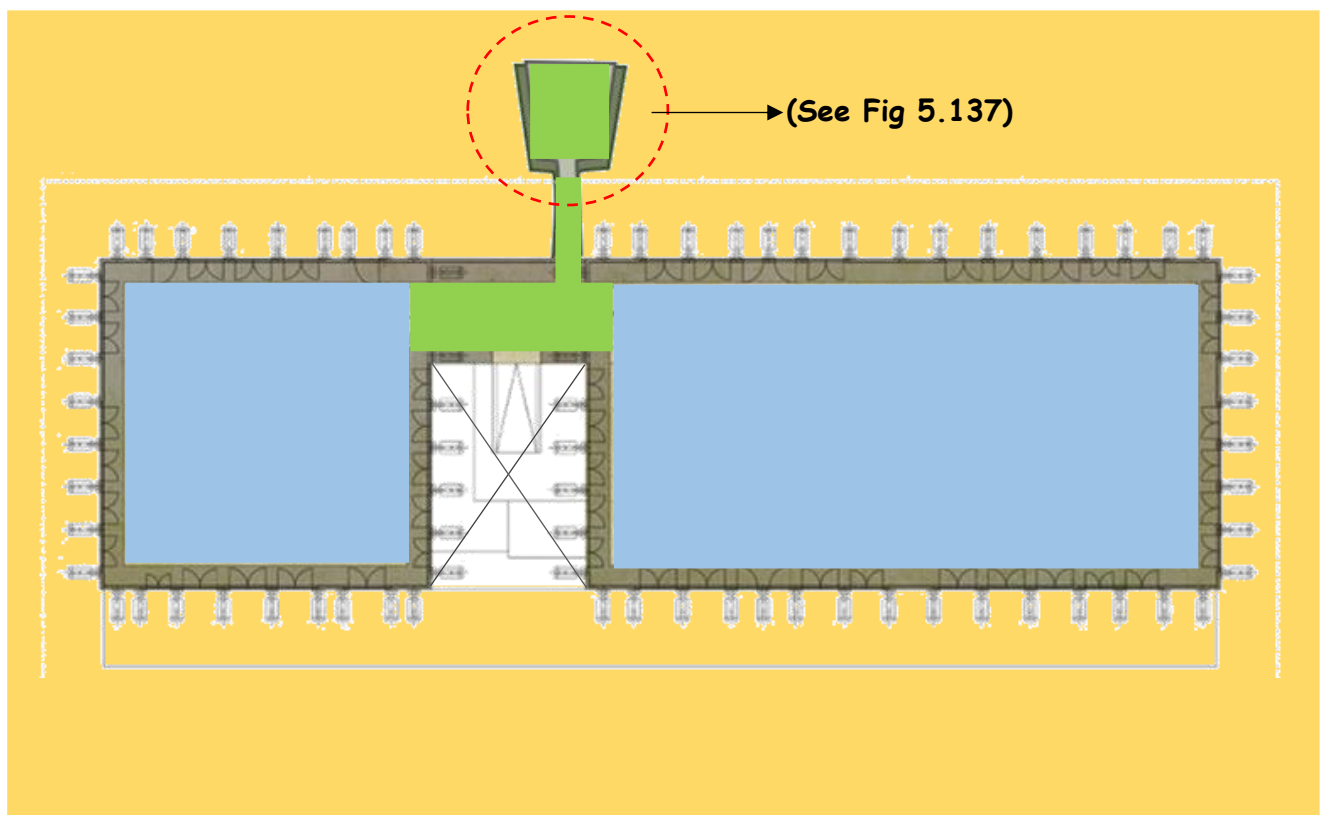
- Exterior Prospect Area
- Exterior Refuge
- Interior Prospect
- Interior Refuge



**Figure 5-126 Bottom Floor Plan: Prospect and Refuge**

**LEGEND:**

- Exterior Prospect Area
- Exterior Refuge
- Interior Prospect
- Interior Refuge



**Figure 5-127 Upper Floor Plan; Prospect and Refuge**

The Upper-floor of the METI, in particular, is made of light bamboo construction. The walls have openings and shades which are also made of woven bamboo. Therefore, air and sun can enter the rooms even when these shades remain closed. The gaps let in daylight and also the area has a high ceiling. So, the upper floor of METI school is an interior prospect; from where a



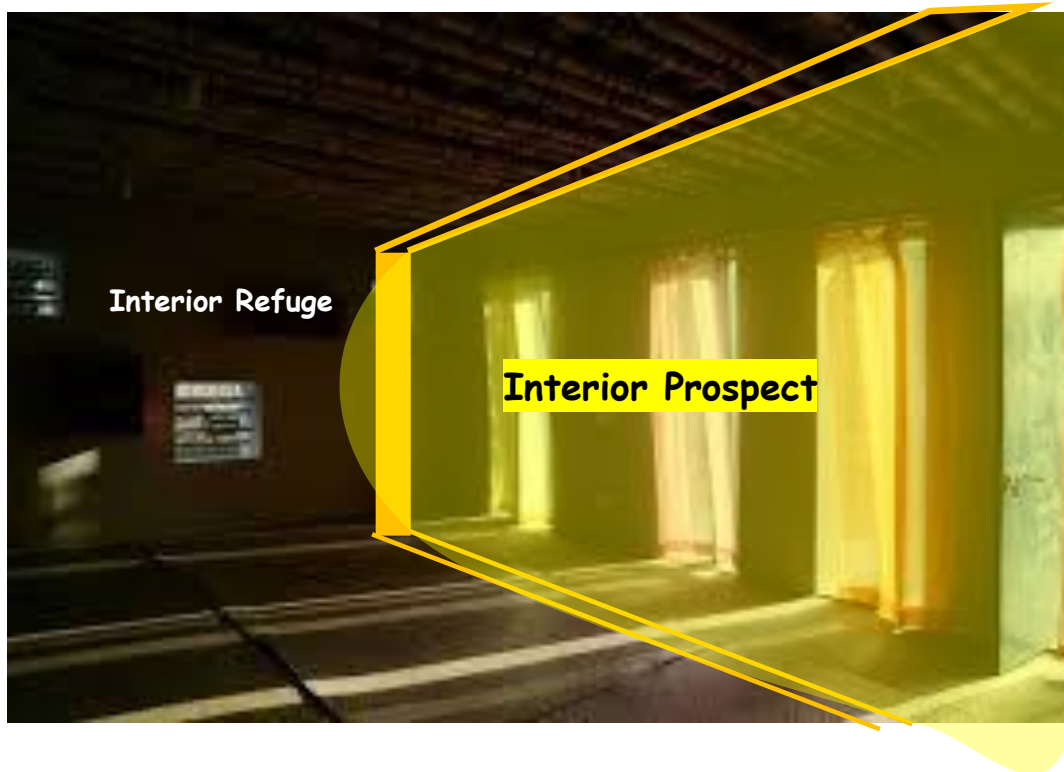
person can enjoy the vastness and immensity of nature. Since the top floor doesn't have any private and dark zones, there are no interior refuges; but the space as a whole is a refuge in relation to the surrounding landscape. A meaningful space is created when prospect and refuge are both present, and one can be seen from the other (Appleton, 1996).



**Figure 5-128 Ground floor Classrooms: Interior Refuge** (ASIA, Hand-Made School/METI School in Rudrapur, Dinajpur, 2015)



**Figure 5-129 Raised Brick Semi-Covered Platform and Playground: Exterior Refuge and Exterior Prospect** (Heringer, METI School, Bangladesh, n.d.)



**Figure 5-130 Ground floor Classroom: Interior Prospect (Lim, 2007)**



A semi-covered verandah like space on the upper floor, is the exterior refuge area from where a person can see the outside yards and resources.

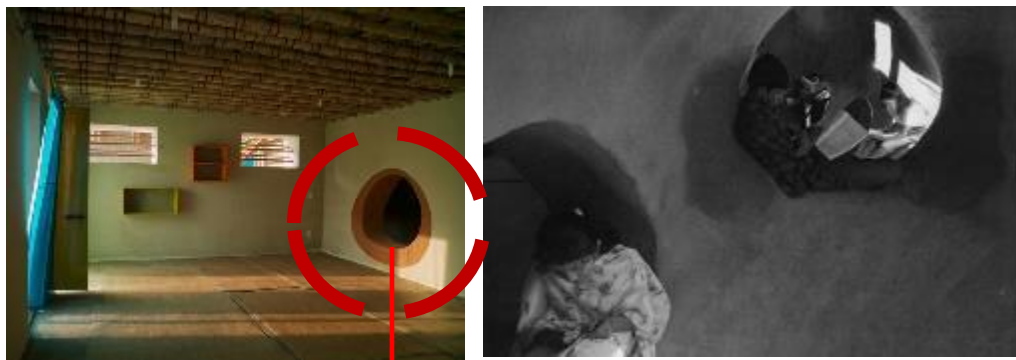
**Figure 5-131 Exterior refuge area on the upper floor of the METI School.**



**Figure 5-132 Upper floor area: Interior Prospect** (Hoerbst, n.d. )

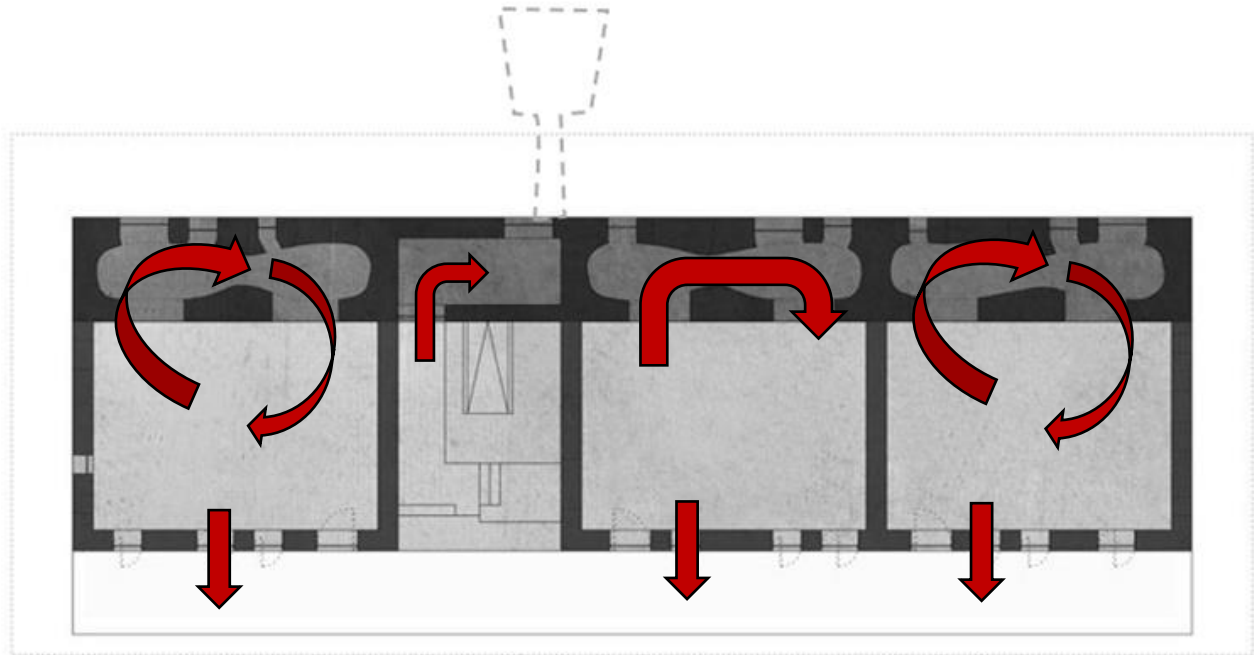
(There are no interior refuge spaces on the upper floor, but the space as a whole is a refuge in relation to the prospect of the surrounding landscape)

The METI handmade School is relatively a small project yet Heringer created an organic pattern of caves on the ground floor. These ‘caves’ are small and intimate but have short enticing trails that disappear around bends which make enticement possible. On the ground floor, upon entering the classrooms, one can see two circular openings on the opposite side of the wall. These dark cave openings might to a child look like the threatening eye sockets of a skull which creates a sense of mystery. In the METI Handmade School, all these factors like the linkage of the classrooms and caves, the combination of refuge and prospect, different materials and even the small window openings are responsible for enticing an observer into exploring further.



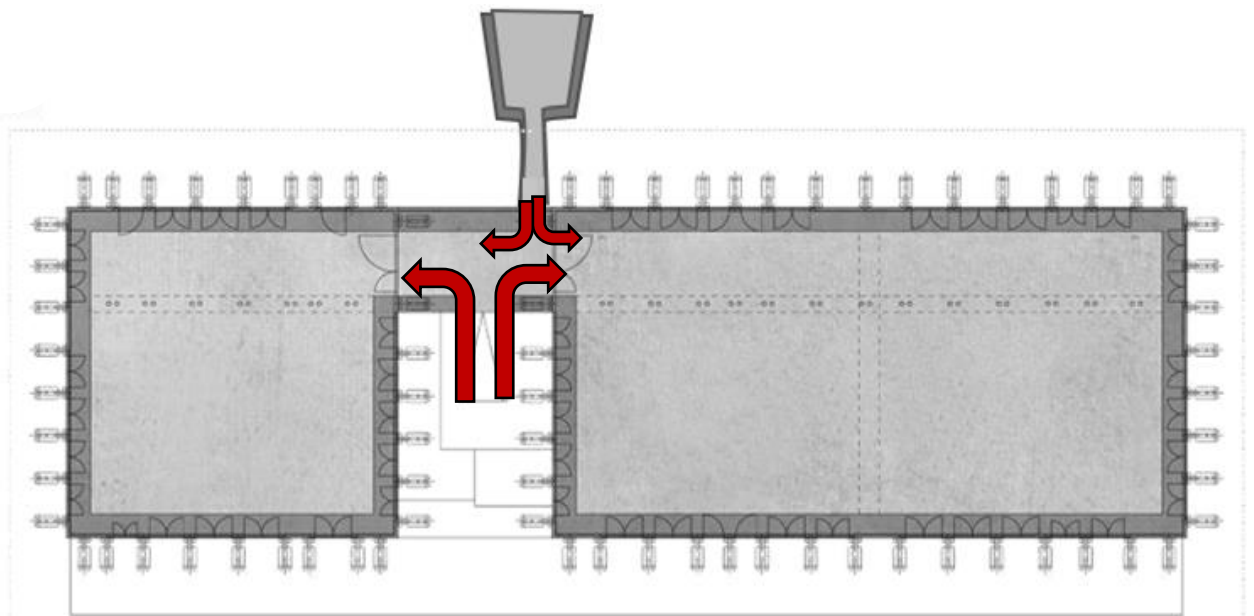
**Dark cave opening creates a sense of mystery**

**Figure 5-133 Bottom Floor Classrooms: Enticement (openings create a sense of mystery)** (Lim, 2007)



**Figure 5-134 Ground floor Plan: Enticement (turns and disappear; a sudden change of views) (Tanvi Naik, 2017)**

In the diagram above, the red arrows represent the enticement bends and paths inside the classrooms. When children come out from a classroom and see the large playground under a deep blue sky, they feel released and excited. All of these are the characteristics of enticement of a space.



**Figure 5-135 Upper-floor Plan: Enticement (turns and disappear; a sudden change of views) (Tanvi Naik, 2017)**



Again, in the diagram above, above, the red arrows represent the enticement bends and paths on the upper-floor of the METI School. A narrow wooden staircase leads into a semi-outdoor space which turns and disappears mysteriously into two functional areas (Fig. 5.135).



**Figure 5-136 Stair and Enticement: (rapid change of views; turns and disappear)** (ASIA, 2015)

In the geometric analysis, the study shows that the building has maintained a very simple order but has some structural complexities. In Bengal architecture, there are some examples of bamboo structures, but those are not complex at all. Heringer created some geometric patterns for the bamboo structure as well. The building structure has complex relationships which can't be easily understood while visiting the METI School. The bamboo structural system of this building is exceptionally innovative, yet it looks effortless.

**A perilous thrill to the users:**

The upper floor's open verandah offers a thrill to the users. The verandah is open to the sky which creates a feeling of danger. Users can also enjoy rains, the intrusion of birds and can feel the darkness at night. Nevertheless, the verandah and its height off the ground offer some thrilling views of surrounding yards, playground, and trees.



**Figure 5-137 Children are in the verandah; Peril (Lim, 2007)**



**Figure 5-138 The Hanging Verandah of the METI School, Bangladesh (YouTube, 2014)**

## **Chapter 6 - Conclusion**

### **Findings**

- In order to define, a region's architectural identity or to define a nation's historical and cultural uniqueness, Kelbaugh's five points of critical regionalism and the "Deep Beauty" framework are two important methods to follow.
- These analyses show the way how architecture could have passed the test of time.
- Aspects like climatic comforts, prospects, refuges, peril, enticement, sense of history, community and place, the orientation of a building, structural methods, social setups, and materials are some necessary features to follow for designing a sustainable architecture.

### **Future Direction**

- The rubric developed in this report establishes a criterion that can be used in the future to assess the sustainability of any architectural work.
- The analysis performed in this research sets an example to show how the Deep Beauty framework can be operationalized and explains the process of assessment.
- From this research, a more sustainable design approach could be generated for the contemporary design practices of Bangladesh.

### **Limitations**

- This research is an attempt to demonstrate the inherent power and the enduring relevance of regional architecture which is deeply beautiful and inherently sustainable. However, the study doesn't provide any ultimate design example for the Delta.

*This research must be seen as a beginning for further exploring and reinventing deltaic architecture for the future. It provides a base from where more investigations can be initiated.*

## References

- (2018). Retrieved from Bangladesh Weather:  
<https://www.weatheronline.co.uk/reports/climate/Bangladesh.htm>
- (2018, March 26). Retrieved from Designing Buildings:  
[https://www.designingbuildings.co.uk/wiki/Cross\\_ventilation](https://www.designingbuildings.co.uk/wiki/Cross_ventilation)
- (2018). Retrieved from Google Maps:  
<https://www.google.com/maps/@23.7621196,90.3786209,350m/data=!3m1!1e3>
- Aag Khan Award for Architecture*. (2007). Retrieved from <http://www.akdn.org/>
- Advisor, T. (n.d.). Tale of festival. *Oldest Temple In Bangladesh*. [tripadvisor.co.za](http://tripadvisor.co.za).
- AGA KHAN AWARD FOR ARCHITECTURE*. (2007). Retrieved from <http://www.akdn.org/>
- Ahmed, E. (2007, APRIL 17). Dhaka Daily photo blog post.
- Ahmed, K. I. (2005). *Handbook on Design and Construction of Housing for Flood-prone Rural Areas of Bangladesh*. Asian Disaster Preparedness Center.
- Akhand, B. (2010). Village House at Sabek Khator.
- Alexander, C. I. (1977). *A pattern language: Towns, buildings, construction (center for environmental structure series)*.
- Appleton, J. (1996). The experience of landscape.
- ArchDaily. (2010, March 04). "*Handmade School / Anna Heringer + Eike Roswag*", *photographs by Kurt Hoerbst*. Retrieved from Arch Daily:  
<https://www.archdaily.com/51664/handmade-school-anna-heringer-eike-roswag/>> ISSN 0719-8884
- Archilovers. (2005). *METI School handmade*. Retrieved from  
<http://www.archilovers.com/projects/27895/meti-school-handmade.html>
- architectuul. (n.d.). National Assembly Building of Bangladesh.
- Architravel. (2015). Dhaka National Assembly.
- Archive, M. I. (n.d.). *Fine Arts institute, Dhaka University, Bangladesh, 1953-55*. Retrieved from Muzharul Islam Archive, University of Asia Pacific, Dhaka:  
[http://www.muzharulislam.com/projects/fine\\_arts\\_institute\\_dhaka.html](http://www.muzharulislam.com/projects/fine_arts_institute_dhaka.html)
- ArchSociety. (2008). *METI School | The 'Handmade' School by Anna Heringer & Eike Roswag in critical lens*. Retrieved from ArchSociety:  
[http://www.archsociety.com/e107\\_plugins/content/content.php?content.31](http://www.archsociety.com/e107_plugins/content/content.php?content.31)



- Ardalan, N. B. (1973). *The sense of unity: The sufi tradition in Persian Architecture*. University of Chicago Press Chicago.
- Arif, A. (2015, January).
- Ariful. (n.d.). Rural Bangla.
- Arquitectura. (n.d.). *National Assembly Building of Bangladesh / Louis Kahn*. Retrieved from acaixanegra: <http://www.acaixanegra.com/works/national-assembly-building-of-bangladesh-louis-kahn/>
- Arsenic, S. (n.d.). Retrieved from SOS Arsenic: (Image: <http://www.sos-arsenic.net/english/intro/index.html>)
- Ashraf, K. K. (1998). *An Architecture of Independence: The Making of Modern South Asia: Charles Correa, Balkrishna Doshi, Muzharul Islam, Achyut Kanvinde*. Princeton Architectural Press.
- Ashraf, K. K. (n.d.). *Vastukala : The Architecture of Muzharul Islam*. Retrieved from Depart: <http://www.departmag.com>
- ASIA, A. S. (2015). *Hand-Made School/METI School in Rudrapur, Dinajpur*. Retrieved from ARCHITEXTUREZ SOUTH ASIA: <https://architexturez.net/doc/az-cf-166255>
- Bangladesh, G. o. (2018). Geography of Bangladesh.
- Banglapedia. (2018). Banglapedia.
- Bengal, H. o. (2018). *History of Bangladesh*. Retrieved from [https://en.wikipedia.org/wiki/History\\_of\\_Bengal](https://en.wikipedia.org/wiki/History_of_Bengal)
- Benyus, J. (2008). *A good place to settle: Biomimicry, biophilia, and the return to nature's inspiration to architecture. Biophilic design: The theory, science, and practice of bringing buildings to life*. Hoboken, NJ: Wiley.
- Bindia Thapar, S. B. (2004). *Introduction to Indian architecture*. Singapore : Periplus.
- Bussell, S. R. (2017). *Disaster Preparedness in Bangladesh*. Robert Strauss Center.
- Chowdhury, T. (2015).
- Coates, G. J. (2014). *Deep beauty, toward a sustainable and life-enhancing architecture of place*. Manhattan, KS: Kansas State University.
- Cramer, J. S. (2008). *Transforming building practices through biophilic design*. In N. W. Hoboken (Ed.), *Biophilic design: The theory, science, and practice of bringing buildings to life*. John Wiley & sons. Inc.
- Das, A. (2007). *HOUSING REPORT, Mud House of Bangladesh*. World Housing Encyclopedia.

- Datta, P. (2014).
- DeKay, M. &. (2013). *Sun, wind, and light: Architectural design strategies* . John Wiley & Sons.
- DESIGN, B. (2011). *BIOPHILIC DESIGN: THE ARCHITECTURE OF LIFE*. Retrieved from <http://www.biophilicdesign.net/>
- Duzenli, T. &. (2017). CONCEPT OF SUSTAINABILITY AND BIOPHILIC DESIGN IN LANDSCAPE ARCHITECTURE. *ASOSJOURNAL-The Journal of Academic Social Science*. 5., 43-49.
- Eldemery, I. M. (2009). Globalization challenges in architecture. *Journal of Architectural and Planning Research*, 26(4), 343.
- Gaisma. (2018). *Dhaka Weather*. Retrieved from Gaisma: Ref: <https://www.gaisma.com/en/location/dhaka.html>
- Ganguly, B. (2015, May 31). Photographed at the Dhaka university, Dhaka, Bangladesh.
- Goins, K. (2017, Dec 28). Old Dhaka city Image.
- Goodwin, D. (2015, May 27 May). Bamboom: Elora Hardy's TED Talk on Bamboo's Exploding Popularity. *ArchDaily*, pp. <https://www.archdaily.com/635886/bamboom-elora-hardy-s-ted-talk-on-bamboo-s-exploding-popularity>.
- Guide, H. (2016). How to decide Orientation of a house? Deam Home Guide .
- Haque, S. U. (1997). *Pundranagar to Sherebanglanagar. Architecture in Bangladesh*. Chetpana Sthapatya Unnoyon Society, Dhaka.
- Harries, K. (1993). *Thoughts on a non-arbitrary architecture. Dwelling, Seeing, and Designing: Toward a Phenomenological Ecology*.
- Hasan, D. M. (1985). *A study of traditional rural house form in Bangladesh*.
- Hasan, M. (2017, Feb). Retrieved from Google Maps: <https://www.google.com/maps/@23.7356766,90.3950921,3a,75y,261.81h,79.23t/data=!3m7!1e1!3m5!1sAF1QipMJfBahU6dooEI1Mh843jnsCaLZXRPsu89j2Uhs!2e10!3e11!7i13312!8i6656>
- Heringer, A. (2010, July 17). Sustainable Beauty. (ARCHIsquad, Interviewer)
- Heringer, A. (2012). Sustainable Beauty. (ORIS, Interviewer) Retrieved from ORIS.
- Heringer, A. (n.d.). *METI School, Bangladesh*. Retrieved from Anna Heringer: <http://anna-heringer.com/index.php?id=31>
- Hildebrand, G. K. (2008). Biophilic architectural space.

- Hoerbst, K. (n.d. ). METI Handmade School.
- HOLLADAY, M. (2013, May 3). *All About Thermal Mass*. Retrieved from Green Building Advisor: <http://www.greenbuildingadvisor.com/blogs/dept/musings/all-about-thermal-mass>
- Hosey, L. (2012). *The shape of green: aesthetics, ecology, and design* . Island Press.
- Huda, K. &. (2009). Small water bodies in Bangladesh. *ResearchGate*, Area. 42. 217 - 227. 10.1111/j.1475-4762.2009.00909.x.
- Hugelberry. (2010). JATIYO SANGSAD BHABAN. *Hugelberry's Adventures*.
- inspiration, D. (n.d.). Retrieved from DETAIL inspiration: <https://inspiration.detail.de/vocational-school-in-rudrapur-106109.html?lang=en>
- Islam, M. R. (n.d.). *BANGLADESH: THE LAND OF SMILES*. Retrieved from Bengal Logistics: <http://bengallogistics.blogspot.com>
- James-Chakraborty, K. (2013). Reinforced concrete in Louis Kahn's National Assembly, Dhaka: Modernity and modernism in Bangladeshi architecture. *ScienceDirect*. Retrieved from wikiarquitectura: <https://en.wikiarquitectura.com/building/national-assembly-of-bangladesh/>
- Kahn, L. I. (1994). *Louis I. Kahn, National Capital of Bangladesh, Dhaka, Bangladesh, 1962-83 (Vol. 72)*. ADA EDITA Tokyo.
- Kahn, N. (Director). (2003). *My Architect: a son's Journey Film* [Motion Picture].
- Kamar, R. K. (n.d.).
- Karim, N. (2015). Traditional Housing Form of Rural Areas of Bangladesh. Forum for Physical Development of Bangladesh.
- Kelbaugh, D. (2007). Critical regionalism: an architecture of place. The urban design reader.
- Kreis, G. (2013, February 21). *Wyss' Archiv: Unerwartete Begegnung*. Retrieved from TagesWoche: <https://tageswoche.ch/allgemein/wyss-archiv-unerwartete-begegnung/>
- Lewcock, R. (1988). Working with the past. . *the Theories and Principles of Design in Architecture of Islamic Societies: Proceeding of a Symposium*. the Aga Khan Program for Islamic Architecture (AKPIA), Cambridge, Massachusetts: AK.
- Lim, J. C. (2007). *Hand-Made School, Rudrapur, Bangladesh, photographs by Kurt Hoerbst*. Aga Khan Development Network.
- Lochhead, G. (2015, August 3). Prospect-Refuge Theory. *earnest*.

- Louv, R. (2008). Children and the success of biophilic design. . In *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life*. John Wiley & Sons, Hoboken, NJ,.
- Mahmud. (2017, September 06). *Contour: Bangladesh*. Retrieved from Map & Basic Information about Bangladesh: <https://www.thebangladesh.net/contour-map-of-bangladesh.html#map-1>
- Map, G. (2018). Retrieved from <https://www.google.com/maps/@25.726714,88.550161,788m/data=!3m1!1e3>
- Map, G. (2018, March 25). *Google Map*. Retrieved from <https://www.google.com/maps/place/Dinajpur+District,+Bangladesh/@25.642765,88.5630161,10z/data=!3m1!4b1!4m5!3m4!1s0x39fcab08431748c5:0x8df9a73629fb8d7b!8m2!3d25.6279123!4d88.6331758>
- Maps, G. (n.d.). <https://www.google.com/maps/@21.9175127,80.625403,5.25z>. Retrieved from Google Maps.
- MoMA. (n.d.). *METI-Handmade School, Rudrapur, Bangladesh*. Retrieved from MoMA: [https://www.moma.org/interactives/exhibitions/2010/smallscalebigchange/projects/meti\\_handmade\\_school.html](https://www.moma.org/interactives/exhibitions/2010/smallscalebigchange/projects/meti_handmade_school.html)
- Mori, S. (2018). Retrieved from <https://www.facebook.com/photo.php?fbid=1211013355695332&set=a.161965573933454.35259.100003600377421&type=3&theater>
- Murphy, D. (2017, May 11). Where is the world's densest city? *The Guardian*.
- (n.d.). Retrieved from Architecture Asia: <http://www.architectureasia.com/INDIA/>
- National Assembly Building*. (1987-1989 Cycle). Retrieved from AGA KHAN AWARD FOR ARCHITECTURE: <http://www.akdn.org/architecture/project/national-assembly-building>
- National Assembly of Bangladesh*. (n.d.). Retrieved from wikiarquitectura: <https://en.wikiarquitectura.com/building/national-assembly-of-bangladesh/>
- Nayeem. (n.d.). Jorbangla Temple.
- News, I. L. (1874). *A Bengalee Village*. Retrieved from [http://www.columbia.edu/itc/mealac/pritchett/00routesdata/1600\\_1699/calcutta/famine/famine.html](http://www.columbia.edu/itc/mealac/pritchett/00routesdata/1600_1699/calcutta/famine/famine.html)
- Omrania. (2017, August 02). *A SCHOOL MADE BY HAND, USING LOCAL KNOWLEDGE AND MATERIALS*. Retrieved from Omrania: <https://omrania.com/inspiration/school-made-hand-using-local-knowledge-materials/>
- Pallasma, J. (2013). *The eyes of the skin: Architecture and the senses*. Wiley & Sons.

- Pallasmaa, J. (2011, September 27). Rachel Hurst talks to Juhani Pallasmaa. (R. Hurst, Interviewer)
- Pallasmaa, J. (2013). *The eyes of the skin: Architecture and the senses*. Wiley & Sons.
- Pfeifer, G. &. (2007). *Courtyard houses: A housing typology*. Walter de Gruyter.
- Photos, O. I. (1880's). Indian Village Scene c. 1880's .
- Polyzoides, S. S. (1992). *Courtyard housing in Los Angeles*. Princeton Architectural Press.
- Qureshi, R. A. (2015). *The traditional courtyard house of Lahore: an analysis with respect to Deep Beauty and sustainability*.
- Rapoport, A. (1969). *House form and culture*.
- Reardon, C. C. (2013). *Thermal Mass*. Australia: Your Home. Retrieved from <http://www.yourhome.gov.au/passive-design/thermal-mass>
- Reynolds, H. (2016, February 1st). *Diary of my 03 weeks trip to Bangladesh (part II)*. Retrieved from <https://nijhoom.net/>: <https://nijhoom.net/bangladesh-travel/bangladesh-travel-stories/first-trip-bangladesh-2/>
- Rossi. (n.d.). Retrieved from <http://www.checkonsite.com/art-institute-dhaka/>
- Rowlatt, J. (2016, May 12). India's Dying Mother. *nikos 13galani's blog*.
- Schneider, M. S. (1994). *A Beginner's Guide to Constructing the Universe: The mathematical archetypes of nature, art, and science*. New York: HarperCollins. Chicago.
- Schoenauer, N. &. (1962). *The Cour-Garden House*. Montreal: McGill University Press.
- Shahriar Shams, M. M. (2014). Housing Problems for Middle and Low Income People in Bangladesh: Challenges of Dhaka Megacity. *SAGE Journals*.
- Souza, E. (2010, October 20). *AD Classics: National Assembly Building of Bangladesh / Louis Kahn*. Retrieved from ArchDaily: <https://www.archdaily.com/83071/ad-classics-national-assembly-building-of-bangladesh-louis-kahn>
- TALK, T. (2017). Anna Heringer: The warmth and wisdom of mud buildings. (T. TED, Interviewer)
- Tanvi Naik, V. Z. (2017, June). *The METI School is an inspirational paradigm of sustainable design using the local construction techniques and labour by Anna Heringer and Eike Roswag*. Retrieved from Volume Zero: <http://volzero.com/the-meti-school-is-an-inspirational-paradigm-of-sustainable-design-using-the-local-construction-techniques-and-labour-by-anna-heringer-and-eike-roswag/>
- travel, C. t. (n.d. ). Retrieved from <https://www.climatestotravel.com/climate/bangladesh>

- Wasif, M. (2010). *Viejo Dhaka-Pertenencia*. Retrieved from Zone Zero:  
[http://v2.zonezero.com/index.php?option=com\\_content&task=view&id=1172&Itemid=&lang=es#](http://v2.zonezero.com/index.php?option=com_content&task=view&id=1172&Itemid=&lang=es#)
- Watch, H. R. (2018). *Map of India and Bangladesh*. Retrieved from  
<https://www.hrw.org/report/2010/12/09/trigger-happy/excessive-use-force-indian-troops-bangladesh-border>
- wikipedia. (n.d.). Retrieved from wikipedia: [https://en.wikipedia.org/wiki/Jor-bangla#/media/File:Jor\\_Bangla\\_Temple\\_Arnab\\_Dutta\\_2011.JPG](https://en.wikipedia.org/wiki/Jor-bangla#/media/File:Jor_Bangla_Temple_Arnab_Dutta_2011.JPG)
- World, F. S. (2015, December 7). *ARCHITECTURE, SOCIAL SUSTAINABILITY* . Retrieved from Field Study of The World: <http://www.fieldstudyoftheworld.com/medi-handmade-school-design-from-tradition/>
- Worldatlas. (2018). *Dinajpur, Bangladesh*. Retrieved from  
<https://www.worldatlas.com/as/bd/01/where-is-dinajpur.html>