CRAFTING RESILIENT COMMUNITIES

The Intersection of New Vernacular Materials and Adaptive Design in Public Architecture

A Thesis

Submitted to the

Faculty of Miami University

In partial fulfillment of

The requirements for the degree of

Master of Architecture

Department of Architecture and Interior Design

By

Syed Saif Uddin Ahamed

Miami University

Oxford, OH

2025

Chair_____

Jeff Kruth

Reader_____

Mary Rogero

Reader_____

Terry Welker

CRAFTING RESILIENT COMMUNITIES

The Intersection of New Vernacular Materials and Adaptive Design in Public Architecture



Figure 1: Chattogram Ship-Breaking Yard

SYED SAIF UDDIN AHAMED
sy3dsaif@gmail.com
© 2025 ALL RIGHTS RESERVED

Crafting Resilient Communities

Acknowledgement

I would like to express my sincere gratitude and appreciation to everyone who supported and assisted me throughout my Thesis Project.

First and foremost, I am deeply thankful to my thesis Chair, Jeff Kruth, and my Readers, Mary Rogero and Terry Welker, for their unwavering guidance, thoughtful critiques, and continuous encouragement. Their insights have been instrumental in shaping the clarity and depth of my work, and their belief in my vision gave me the confidence to push forward at every stage.

I would also like to thank Gerardo Brown-Manrique and Kim Wuertemberger for always being by my side whenever I needed them. My journey would not have been the same without their cordial help. I would also like to thank the faculty and staff of the Department of Architecture and Interior Design at Miami University. Their commitment to teaching, research, and mentoring has provided the foundation for my academic and personal growth throughout this journey.

Lastly, I am forever grateful to my wife, Romana Ferdous, for her unwavering love, support, and encouragement, and for being a constant source of motivation throughout my journey.

I also want to thank my Ammu and Abbu, my sisters, and my friends for their unconditional support, especially during the most demanding phases of my design process. Their love and encouragement made this achievement possible.



Syed Saif Uddin Ahamed

Table of Contents

Acknowledgement 5
Table of Contents 7
With Gratitude: Notes from My Committee 8
Abstract 13

CHAPTER 01

Concept & Background 14
Introduction Hypothesis + Speculation 14
Observations, Arguments & Relevance 14
Thesis Question and Statement 15
Theoretical Practitioners & Opposing Viewpoints . . 16
Theoretical Practitioners 16
Case Studies/Analyses 18
Design Process Tactics 20
Tactics from analysis of Theoretical practitioners and Project Case Studies 20
Potential Contextual Settings for Thesis Design Inquiry . 20
Site Selection Considerations 21

CHAPTER 02

Context & Analysis 24
Context of Shipbreaking Yard of Bangladesh 25
How the Model Works 28
Design Opportunities Emerging from These Challenges 28
Conceptual Framework 29
Design Strategy 30
Adaptive Design and Material Reuse 32
Worker Empowerment Through Design 33
Chattogram Shipbreaking Yard 35
History 35

CHAPTER 03

Design for Resilience 42
Site Analysis 44
Site Selection 46
Designing a Welfare Center Rooted in Community Needs 52
Placing at the intersection of the waterbody and road 53

CHAPTER 04

Masterplan Design 56
Programmatic Space Allocation 58
Translating Vernacular Spirit into New Architectural Language 63
Establishing Spatial Connections and Looping Through Bridges 66
Marketplace Design 71
Form generation 72
Contextual Adaptation in Design 73
Facade study using salvaged materials 75
Exhibition and Creative Space Anchoring Memory and Identity 80
Form Development from Site Forces and Visual Connection 80
Spatial Experience, Traditional Essence, and Vernacular Materiality 80
Spatial Organization and Vertical Zoning 84
Open Auditorium 88
A Cultural Core Shaped by Light, Community, and Tradition 88
Architecture in Motion: Designing with Time and Intention 91
Model Photos 92
Conclusion and Vision 94
List of figures 95
Bibliography 97

With Gratitude: Notes from My Committee

May 1, 2025

Syed Saif's project grows from a challenging and very dangerous industry of 'ship breaking" in his home city of Chattogram, Bangladesh. The most physically dangerous job in the world employing 50,000 people of course has dire ramifications that extend into the economic, social and cultural aspects of life. This thesis project successfully questions the possibility of architecture to positively affect these conditions.

By integrating sustainability and worker empowerment he proposes an architecture that is community built, craft-forward and memory laden. This design courageously takes the memorable parts of disassembled ships to make new public places using the local vernacular skills of craftsmen to reinvent a sense of place that honors the workers of the region and reveals a new path of sustainability. I offer my congratulations to Saif for his visionary thesis project.

Sincerely,



Terry Welker, FAIA

May 3, 2025

Dear Saif,
Congratulations on the completion of your M.Arch thesis. Your project is the culmination of a year and a half of exploration, and I was so pleased to have been a part of your journey. As one of your thesis advisors, I was impressed by the depth of your inquiry—in both your writing and your design—and the commitment you brought to the work.

You took on a challenging but important topic by investigating the ship-breaking process in Chittagong—an area with implications that are often overlooked—and approached it with sensitivity and purpose. Your work demonstrated not only a deep concern for environmental and worker safety issues, but also a strong sense of cultural awareness. By envisioning how a current industrial zone could be improved to become more accessible and culturally significant, you offered a compelling and thoughtful contribution to a difficult design problem.

It also marks a milestone for me, as I am retiring this year. I'm glad to have concluded this chapter of my academic career by engaging on such a thoughtful and well-executed project.

Wishing you all the best in the next steps of your journey.

Warm regards,



Mary Rogero

May 1, 2025

It has been a privilege to serve as advisor to Saif Uddin Ahamed during their graduate thesis year. Saif's project, which delves into the architectural, material, and human implications of material re-use in the ship-breaking yards of Chattogram, Bangladesh, represents an exceptional synthesis of design thinking, research depth, and ethical inquiry. With this thesis, Saif demonstrates not only technical competence and aesthetic sensitivity, but also the capacity to engage architecture as a critical and transformative discipline. It's been a pleasure to serve as both a studio instructor and as thesis chair.

Chattogram's industrial sites—spaces of extreme labor, global material flows, and ecological and social precarity—present architectural challenges that are difficult to confront through conventional design approaches. This highlights the importance of a thesis project, and how thoughtful reflection and research show the capacity of our discipline to creatively and meaningfully intervene in sites like Chattogram's ship-breaking yards. Saif did not attempt to simplify or aestheticize these realities. Instead, he immersed themselves in the tensions: the intensity and ingenuity of manually disassembling the ships, the informal economies of re-use, and the contradictions of economic value, toxicity, and new forms of vernacular architecture that linked to the material remains of the ships.

One of the most compelling dimensions of this thesis is the strong ethical position Saif maintained throughout the project. Rather than impose an abstract architectural vision onto a distant site, he worked to understand the material afterlives of ships and how they influenced the everyday lives of workers in Bangladesh. Saif's approach underscores the potential for architects to act not only as designers, but also as researchers, storytellers, and facilitators of translocal and vernacular knowledge.

Saif's use of drawing as a research method has been especially remarkable. He used drawing not only as a representational tool but as an investigative and interpretive act—one that reveals layers of labor, atmosphere, and structural intelligence that would otherwise remain invisible. His sensitive and careful ethnographically-based studies of the retail spaces that use scrapped parts was particularly impressive, even though they were simple. They are reminiscent of the observational research methods developed by Venturi Scott-Brown in the 1970's. Saif's work also engages contemporary discourse around global flows of materials, and the role of maintenance and care as a social and aesthetic act. I would encourage him to further these rich topics after he graduates through further exploration and development of research, publications, and exhibitions. His talents and intuition around these topics will lead him to new places as a designer.

Another strength of the work is the way Saif draws connections between the specificity of the Chattogram yards and broader architectural questions about circularity, labor, and material ethics. They avoid the trap of romanticizing vernacular reuse, which I immensely appreciate. Rather than holding a nostalgic or romanticized view of the vernacular, through the project, Saif critically assessed what it meant to have the materials of the ship-breaking yard as a new form of vernacular material. To what degree should contemporary residents of Chattogram embrace this form of production as a cultural value and material aesthetic? How does it differ or complement existing forms of vernacular architectural production? Saif engaged these questions very well in the project.

To conclude, I want to acknowledge the depth of commitment this project required. This was not an easy topic, and it demanded intellectual vulnerability, perseverance, and self-direction. I remember our early conversations, and Saif's curiosity about materiality and in exploring Chattogram as a site, given his familiarity with it. He willingly entered into an intellectual space that was uncomfortable, and I think grew from that process. He was willing to find comfort in the uncertainty of the project, and through diligent reflection and production continuously evolved his project into one of the strongest thesis projects I have seen here at Miami.

Finally, I want to emphasize what a wonderful personality Saif has. He is thoughtful, grounded, kind, and committed. Every conversation I had with Saif was a true pleasure, and I will miss him as he moves into the next phases of his career. I wish him all the best, and hope that he fondly remembers his time here at Miami, and the rich possibility of always remaining curious.
All my best,



Jeff Kruth

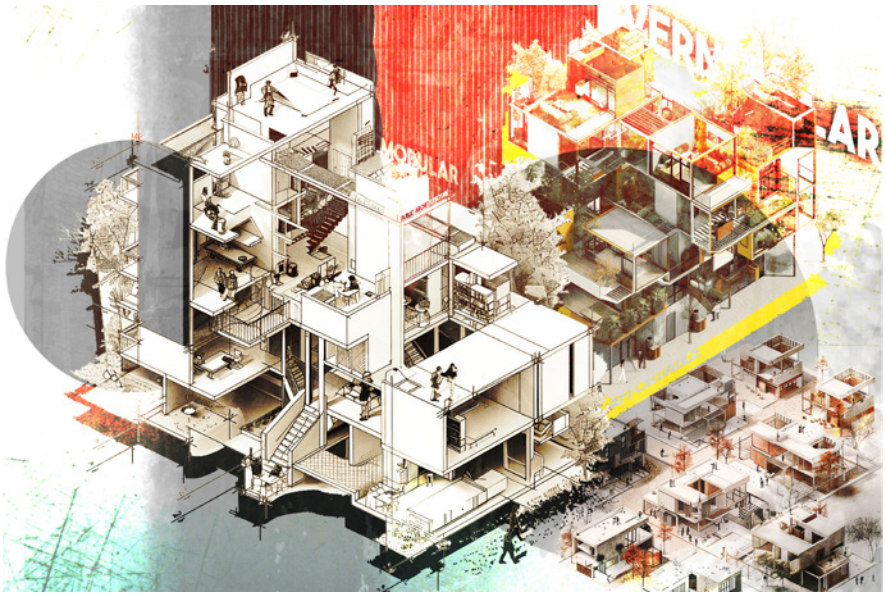


Figure 2_Design Soiree illustration, Midjourney + Photoshop

Abstract

This thesis investigates the transformative role of public architecture in fostering socio-environmental resilience through the integration of new vernacular materials, adaptive resilient design, and community engagement. Grounded in the context of Chattogram's shipbreaking yard, a site marked by industrial intensity, ecological fragility, and human labor, it reimagines how architecture can emerge from within rather than be imposed from above. The project navigates complex intersections of material reuse, cultural memory, and economic precarity, offering an architectural framework that is deeply rooted yet globally adaptable.

Through case studies, theoretical frameworks, and design prototypes, the research explores how participatory processes and local craft can align with advanced digital techniques to form a responsive design language. The work embraces adaptive-transformative modularity, utilizing flexible design tactics that allow architecture to evolve with time and need. By centering the voices and labor of marginalized communities, the thesis positions architecture as a mediator between tradition and innovation, the human and the industrial, the ephemeral and the enduring.

Ultimately, this thesis proposes a contextual, inclusive, and scalable approach to architecture—one that not only addresses housing affordability, climate adaptability, and cultural continuity but also catalyzes dignity, participation, and long-term sustainability in public space design

CHAPTER 01
Concept & Background

Introduction Hypothesis + Speculation

Growing up on the outskirts of Chattogram City, where nature intertwines with urban life, I've witnessed firsthand the transformation of serene surroundings into a concrete jungle. Urbanization brought both benefits and challenges, with high population density leading to chaotic conditions and resource depletion. Reflecting on this, I've recognized the need for mindful urban planning that respects available resources and accommodates diverse needs.
Despite its rich history, my city has struggled to integrate new challenges effectively. However, I've found resilience in vernacular approaches and adaptive solutions. Leveraging vernacular materials in public projects fosters community ownership and involvement, crucial for shaping our surroundings positively. Public architecture, with its societal impact potential, can catalyze shifts in perspectives and behaviors. To address urban challenges, efficient and cost-effective architectural solutions are essential. Modular and sustainable construction methods reduce costs and adapt to changing needs. Community engagement and vernacular materials increase participation and ownership.

This study aims to explore the impact of vernacular materials, modular design, and community engagement in public architecture. By addressing urgent issues like housing affordability and environmental sustainability, we seek to promote comprehensive urban development. Integrating advanced technologies with traditional materials underscores the adaptable nature of architectural design. We aim to create resilient and inclusive communities that preserve cultural heritage while navigating urbanization.

Observations, Arguments & Relevance

The central idea of this paper is about the potential of integrating vernacular materials, adaptive design principles, and community engagement in public architecture. It explores the challenges posed by rapid growth and urban sprawl and how traditional, locally sourced materials and adaptive design strategies can help navigate and adapt to changing urban landscapes.

Using locally sourced, traditional materials is an important component of adaptive design, as it allows for more sustainable and context-sensitive solutions that can be easily maintained and modified over time. Adaptive design strategies focus on enhancing the resilience and sustainability of urban landscapes, enabling them to withstand better and adapt to challenges such as climate change, demographic shifts, and economic transformations. This helps cities to navigate and adapt to changing conditions more effectively. The paper highlights the importance of honoring local contexts and traditions in shaping the built environment, drawing on history lessons, particularly in regions where indigenous building techniques have stood the test of time.

The paper argues that public architecture promotes community engagement, sustainability, and empowerment. It suggests using vernacular materials that help create a sense of ownership and connection to the place and adopting modular construction methods that enable participatory contribution and swift deployment, combined with contemporary designs.

In addition to community participation and using vernacular materials, the concept of adaptive-transformative modularity plays a crucial role in shaping contemporary public architecture. This innovative approach allows for creating dynamic spaces that can easily adapt to changing needs and circumstances. By incorporating modular elements into the design, architects can create

flexible environments that can be modified or expanded without requiring extensive demolition or reconstruction.

Adaptive-transformative modularity enhances contemporary design principles by prioritizing functionality, sustainability, and aesthetics. Modular components are designed to seamlessly integrate with the existing built environment, creating harmonious and visually appealing spaces that enhance the overall urban fabric. This approach also allows for greater experimentation and creativity in architectural expression, as designers can explore novel ways of combining modular elements to achieve unique and innovative designs. In addition, contemporary design techniques such as parametric modeling and digital fabrication further enhance the adaptability and sustainability of modular architecture. These tools enable architects to optimize the use of materials, minimize waste, and create efficient and environmentally friendly structures. By embracing technology-driven design processes, architects can unlock new possibilities for creating resilient and future-proof public spaces.

The combination of adaptive-transformative modularity and contemporary design principles provides a hopeful framework for tackling the intricate challenges that urban environments face today. Architects can employ modular elements, vernacular materials, community engagement, and technology to design public spaces that are both functional and sustainable while also reflecting the exceptional cultural identities and aspirations of the communities they serve.

Thesis Question and Statement

How can architecture support socio-economic and environmental resilience?
How can new local materials bridge the past and future?
How can we design spaces that empower rather than exploit?

The fusion of global knowledge with local resources enables contemporary architectural solutions to empower communities while promoting environmental stewardship. This thesis proposes advancing the intersection of adaptive modularity with vernacular architecture's materials and methods to create resilient community-engaged public architecture.

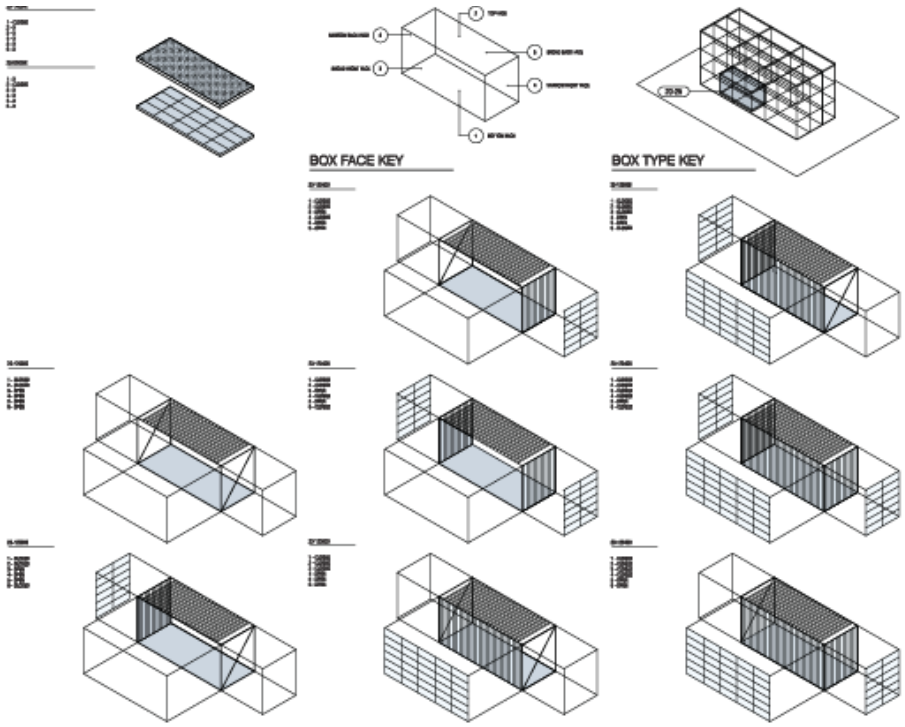


Figure 3_some modules can create an endless series of compositions.

Theoretical Practitioners & Opposing Viewpoints

Theoretical Practitioners

Christopher Alexander
"Every society which is alive and whole will have its own unique and distinct pattern language. Every individual in such a society will have a unique language, shared in part, but which as a totality is unique to the mind of the person who has it"
-A Pattern Language

Christopher Alexander, the author of "A Pattern Language" and "The Timeless Way of Building," emphasized the importance of prioritizing the needs and desires of people who use the built environment. Understanding and implementing timeless, human-centered design principles can create environments that promote connection, vitality, and a sense of belonging. It showcases the wisdom of seasoned architects who concentrate on pivotal aspects that profoundly influence the quality of a design, a skill that novices often struggle to master.

Alexander underlines the pivotal role of architects in shaping spatial quality, emphasizing how interconnected elements within a space are and how recurring patterns can either elevate or diminish the overall spatial quality. It underscores the architects' responsibility to rectify detrimental patterns to safeguard a space's integrity.

The book inspires designers to look beyond isolated components, urging them to envision the comprehensive picture and foster seamless integration and functionality throughout the design process. Alexander explores two primary building methodologies: modular and organic. While modular construction relies on standard components for systematic assembly, organic construction prioritizes adaptability to suit specific contexts. The book aims to combine the strengths of both approaches to streamline the design and construction processes.

In essence, the book serves as a comprehensive guide to designing superior buildings and spaces. It offers insights into leveraging patterns to achieve harmonious integration and optimal functionality and includes a chapter on applying these principles in real-world projects, showcasing their practicality and effectiveness.

David Wallance
In "The Future of Modular Architecture" by David Wallance , the concept of modular adaptability emerges as a cornerstone for architectural innovation. Wallance emphasizes the importance of designing modular structures that can seamlessly accommodate a variety of surface variations and compositions. This emphasis on adaptability aligns with contemporary architectural practices, where flexibility and versatility are increasingly valued to respond to evolving societal needs and environmental challenges.

Wallance also highlights the significance of

standardization alongside flexibility in modular architecture. While standardizing components within modular systems can enhance efficiency and streamline construction processes, it is essential to strike a balance with design flexibility to allow for creative expression and adaptability. This notion challenges traditional perceptions of standardization as limiting, advocating for a nuanced approach that maximizes both efficiency and design innovation.

Another crucial aspect discussed in Wallance's book is the concept of intermodal modular architecture, which heralds a new paradigm in building design. This approach harnesses the power of distributed intelligence and collective imagination to reimagine the built environment. By pooling diverse perspectives and expertise, architects can collaboratively conceive and execute modular architectural projects that are innovative, sustainable, and responsive to communities' needs.
The article "The Future of Modular Architecture" highlights the significant benefits of incorporating modular design principles into architectural practice. By prioritizing adaptability, standardization, and collective collaboration, architects can create modular structures that meet the functional needs of modern society while promoting creativity, resilience, and sustainability in the built environment.

Bernard Rudofsky
"Architectural history, as written and taught in the Western world, has never been concerned with more than a few select cultures. In terms of space it comprises but a small part of the globe -Europe, stretches of Egypt and Anatolia- or little more than was known in the second century AD. Moreover, the evolution of architecture is usually dealt with only in its late phases."
- Architecture without Architects

"Architecture Without Architects" challenges traditional paradigms by exploring diverse vernacular designs, advocating for a more inclusive approach to design beyond trained professionals. Rudofsky critiques the overemphasis on prestigious landmarks and iconic architects, instead encouraging exploration of overlooked vernacular traditions worldwide.

The themes of inclusivity, cultural sensitivity, and exploration of diverse architectural expressions align closely with the core themes of my thesis, drawing a clear parallel between Rudofsky's work and my own. Rudofsky's observations on the collaborative nature of vernacular architecture deeply resonate with the core themes of my thesis. His critique of the overemphasis on prestigious architectural landmarks and his advocacy for exploring diverse architectural expressions align with my emphasis on community engagement and inclusivity in public architecture. Rudofsky identifies standard functionality, adaptability, and sustainability principles beyond geographic and cultural boundaries by exploring vernacular architecture from different cultures, providing valuable insights for contemporary architectural practice.

Rudofsky highlights the collaborative essence of vernacular architecture, urging practitioners to prioritize local residents' needs in design. His work underscores the enduring significance of local knowledge and traditions in shaping our spaces. Architects are encouraged to rethink their design approach, embracing inclusive, context-sensitive, and community-focused practices. Rudofsky's exploration expands our understanding of architectural creativity, emphasizing cultural context and community collaboration in design.

Opposing viewpoints

I firmly believe modular construction has immense potential to revolutionize the construction industry. From an article by Mark Erlich's Harvard Business Review, there are some challenges. Factory-based production offers efficient and precise manufacturing processes, making modular construction an appealing option. The controlled environments of modular construction help mitigate weather-related delays common in traditional on-site building. Advancements in technology and industry collaboration have improved the success rate of modular construction. For instance, FactoryOS demonstrates the viability and scalability of modular methods. Despite challenges, such as complexity reduction, proponents believe modular construction can substantially enhance productivity, sustainability, and affordability in the construction industry. While advocates of a production system claim that off-site prefabrication would reduce on-site complexities, critics argue that certain projects require on-site work due to their unique nature or site-specific challenges.

Not all construction projects can be prefabricated off-site, as it may compromise quality or functionality. Regulatory hurdles still exist despite claims of improved quality control. Market distortions may limit consumer choice and innovation. The impact on skilled labor and technology investment must be considered. It's important to consider stakeholder perspectives carefully.

Case Studies/Analyses

Rohingya Cultural Memory Center

For Vernacular architecture practice tactics, I tried to analyze the Rohingya Cultural Memory Center, which is in the world's largest Refugee Camp, Kutupalong, Ukhia, Cox's Bazar, Bangladesh. The center was built with the aim of creating stories and dialogue that everyone in the community can relate to.



Figure 4_Community workers working with vernacular materials using local techniques. Photo by Rizvi Hassan

The Rohingya Community, despite facing numerous challenges in their lives and residing in a densely populated refugee camp, has established a Cultural Memory Center to preserve their identity, memories, knowledge, and stories. The center reflects the community's rich cultural heritage using materials such as Nipa palm leaf pallets for roofing and bamboo weaving techniques.

Located on a hilltop within the camp, the center's construction was designed to be flexible and adaptable, accommodating the community's evolving needs. Adaptive modular design principles allow for future modifications and expansions, including easily removable pre-cast columns, modular flooring blocks, and nut-bolt joints. Overall, the Cultural Memory Center is a testament to the resilience and cultural richness of the Rohingya Community, embodying their identity and heritage amidst adversity.



Figure 5_Rohingya Cultural Memory Center. Photo by Rizvi Hassan

Lycée Schorge

The Lycée Schorge Secondary School, designed by the internationally renowned architect Francis Kere, symbolizes educational excellence in Burkina Faso, the third-most populous city.
The Lycée Schorge Secondary School is an innovative educational institution that showcases local building materials and contemporary aesthetics. Its modular architecture consists of nine modules arranged radially around a central courtyard, fostering community and protecting the students from harsh winds and dust prevalent in the region. Each module features wind towers, which regulate the interior climate by allowing hot air to escape. The walls of the modules are made of laterite stone, sourced locally, and known for their thermal mass properties, which help to maintain comfortable indoor temperatures.

What makes this project unique is the personalization of each module, which adds an artistic essence to the architecture. Modern design components have been merged with adaptable modular construction methods, all crafted from local materials. A loosely defined amphitheater, created with local eucalyptus wood, offers informal gatherings and celebration spaces. The school's classroom ceilings feature

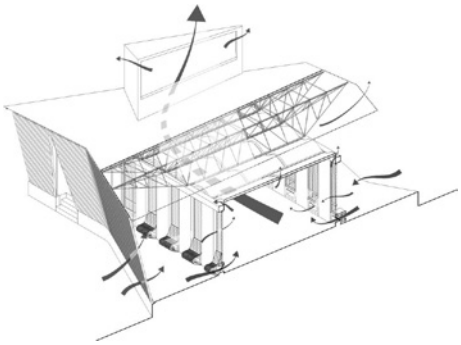


Figure 6_Climate diagram of Lycée Schorge. Single module

perforated plaster vaults, which diffuse indirect sunlight, facilitate air circulation, reduce heat, and enhance learning environments.

It showcases the potential of local materials and creative teamwork to create meaningful and lasting architectural impact, aligning with our mission to inspire and uplift.

Loblolly House

Loblolly House, a project by KieranTimberlake shows how can we holistically transform the way we make architecture, compressing the construction timespan and making use of technology to create a truly sustainable, aesthetically moving shelter. It is a perfect example of contemporary modular housing and construction techniques that aim to integrate with the natural environment. It



Figure 7_Students in a lesson at Lycée Schorge. Photo by Andrea Maretto for Kéré Architecture.

emphasizes productivity, affordability, quality, and ethical design to reimagine building possibilities.

In 2004, the house's elements were digitally modeled, and parametric modeling software ensured a perfect fit during off-site assembly. Smart cartridges, integrating the house's systems, reduced on-site effort by 70%. Modular construction facilitated on-site assembly, with elements designed for connection using simple hand tools.

All mechanical, plumbing, and electrical lines were integrated into the modules. On-site construction of the Loblolly House began traditionally after foundation placement, with modular pre-built elements, floor, and ceiling cartridges fitting seamlessly into place. This unique feature and its blend of contemporary design tactics and cutting-edge construction techniques showcase the potential of modular construction and technology integration. Its success inspires exploration and adoption of integrated design techniques but also piques curiosity about the future of sustainable housing.

Apart from these projects Also The ReHome concept intersects design principles, construction techniques, and social impact, David Wallance's analysis of the Philadelphia Mixed-Use Project in "The Future of Modular Architecture" offers



Figure 8_Stephen Kieran and James Timberlake, The Loblolly House

a nuanced understanding of applying modular design to shape urban developments. Zaha Hadid's Beijing Daxing International Airport also inspires.

The Gelephu Mindfulness City project by BIG Architects in Bhutan showcases a resilient city model blending modern design with vernacular approaches, demonstrating the adaptability of modular architecture to diverse cultural contexts. Anna Heringer's Meti School Project in Bangladesh highlights the importance of resilient materials and vernacular practices in sustainable construction, emphasizing the role of local technology in building resilient communities.

Shigeru Ban's innovative Paper Log Houses demonstrate the transformative potential of recyclable materials and modular construction techniques in addressing housing affordability challenges. Case studies like Alibaba HQ by Foster + Partners and Ardmore Residence by Unstudio exemplify the successful integration of affordable, modular, and vernacular construction systems into public facilities.

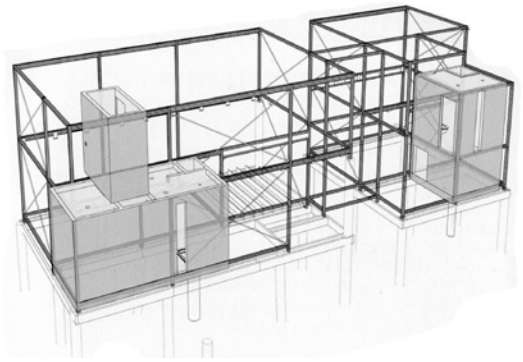


Figure 9_Stephen Kieran and James Timberlake, The Loblolly House

Analyzing case studies like Elemental Projects, Selgascano Projects, and refugee camps provides insights into using vernacular materials, modular design, and community engagement in public architecture. The analysis highlights sustainability, inclusivity, affordability, and community empowerment and reveals practical applications and challenges.

Design Process Tactics

Tactics from analysis of Theoretical practitioners and Project Case Studies

Architecture's design process relies on a balance between theoretical knowledge and practical experience. These insights serve as guiding principles for creating architecture that looks good and fits perfectly with its surroundings and the people who use it.

Effective architectural design requires contextual adaptation and community engagement. Architects must have a deep understanding of local culture, climate, and community needs. By engaging with local residents, architects can foster a sense of ownership, leading to more sustainable and successful design outcomes.

Flexible and sustainable design is critical to achieving architectural excellence. Using local materials and construction methods can minimize environmental impact and strengthen cultural connections. A well-designed hierarchy of spaces and attention to human-scale environments can enhance user experiences, promoting social interaction and community engagement.

Innovation and collaboration drive architectural progress. By embracing new technologies and construction systems, architects can create efficient, adaptable, and visually captivating designs. Empowerment and creativity are essential elements of successful architectural design, prioritizing the needs and aspirations of the community and creating spaces that empower communities, promote social interaction, and enrich lives.

These tactics, including intermodal modular architecture, community-centric design, efficiency, sustainability, and technology integration, create a framework for architectural design that transcends mere functionality, embodying the spirit of its context and inhabitants.

Potential Contextual Settings for Thesis Design Inquiry

The focus of this thesis inquiry is to examine how vernacular materials, adaptive design, and community engagement can be integrated in diverse contextual settings to create adaptable and resilient built environments. Urban redevelopment projects, such as those in Detroit and Camden, illustrate the practical application of sustainable and inclusive public architecture through adaptive reuse and community involvement. Rural communities facing population growth or infrastructural challenges present opportunities for innovative public architecture solutions that are tailored to specific community needs while respecting local culture and resources.

Refugee camps, including those in Bangladesh and Kenya, underscore the importance of resilient and adaptable architecture in ensuring dignified living conditions for displaced populations. Emphasizing community engagement and empowerment fosters a sense of belonging and stability in these challenging environments. Indigenous communities, like Native American reservations and villages in Mexico, provide unique opportunities to integrate vernacular materials and adaptive design principles rooted in local culture and traditions.

Informal settlements in fast-growing cities like Dhaka and Mumbai often lack essential services, creating opportunities for affordable construction systems and community-driven design to enhance living conditions. Sustainable projects led by organizations like Habitat for Humanity aim to improve housing and promote environmental sustainability in poverty- or disaster-affected regions. Educational institutions and formal settlements, including airports, benefit from adaptable architecture, while emerging markets present opportunities for developing organic vernacular architecture suited to local contexts.

Site Selection Considerations

Accessibility: Ensure the site is accessible for research, data collection, and engagement activities.

Data Availability: Choose a site with enough data to inform design and support analysis.

Community Engagement: Select a location where community involvement is feasible and stakeholders are willing to participate.

Diverse Contexts: Consider sites representing various socio-economic, cultural, and geographic contexts for a comprehensive understanding of design implications.

Personal Interest: Align site selection with the researcher's interests and passions for a meaningful thesis exploration.

By considering these factors, the thesis can explore how integrating vernacular materials, modular design, and community engagement can promote sustainability and inclusivity in public architecture.itecture.

Crafting Resilient Communities



Figure 10. Ship-breaking Yard in Chattogram

CHAPTER 02
Context & Analysis



Figure 11_Ship-breaking Yard in Chattogram

This thesis delves into the potential of combining traditional materials with modern technology in public architecture to promote innovative construction methods in response to global challenges. It emphasizes the importance of integrating these approaches to improve infrastructure and design techniques, aiming to bridge the gap between advanced technology and traditional building systems. The research uses case studies to demonstrate how these methods can address critical issues such as enhancing construction affordability, promoting environmental sustainability, and empowering local communities also addressing socio-economic issues. The study concludes by proposing design strategies and contextual frameworks to create fair and resilient built environments, with a focus on social equity, cultural preservation, and adaptability to environmental and economic challenges. It highlights the revitalization of traditional craft and labor as a cultural and economic force for future architectural innovation.

Context of Shipbreaking Yard of Bangladesh

Chattogram, Bangladesh, is home to one of the largest shipbreaking yards in the world, stretching over 11 miles along the coastline. This site serves as a vital component of the global ship recycling industry, where decommissioned ships are dismantled to recover valuable raw materials such as steel, aluminum, and timber. It plays a significant role in both local and international construction and manufacturing sectors.

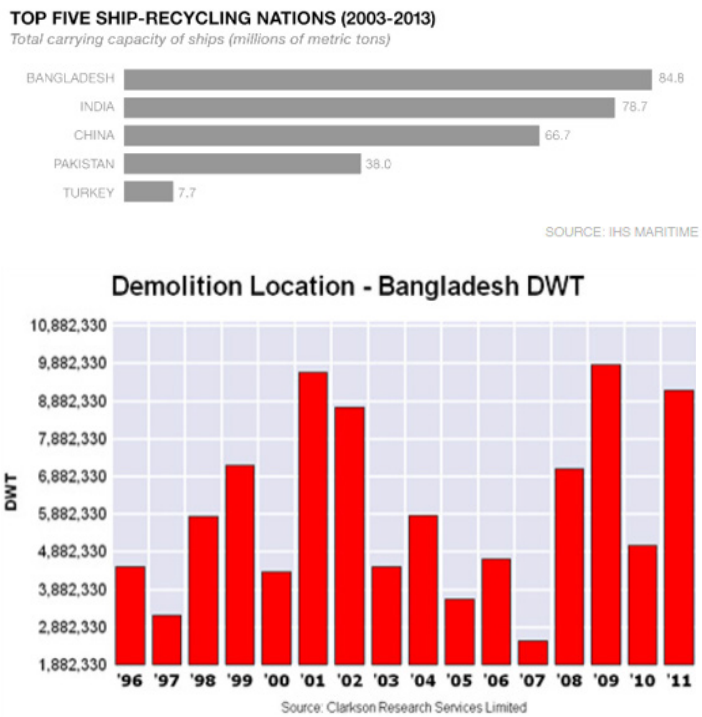


Figure 12_Bangladesh Ship-breaking Deadweight Tonnage, years chart



Figure 13_World's Second-largest shipbreaking yard stretching 11 miles.

The yard directly employs over 50,000 workers and supports an additional 100,000 indirectly, underpinning the region's economy. The materials sourced from these ships provide essential resources for Bangladesh's domestic construction industry, resulting in a robust supply of recycled steel, aluminum, and timber. This environment encourages architectural innovation, allowing salvaged materials to be creatively repurposed into cost-effective, modular, and sustainable public spaces.

Chattogram's identity is closely linked to maritime activity. Historically, it has been a major port city, facilitating colonial and post-colonial trade, industry, and shipbuilding. Today, the shipbreaking industry has evolved into a globally interconnected hub of material flows. The striking image of massive ships being dismantled, combined with the labor-intensive processes of material extraction and reuse, symbolizes the intersection of industry, labor, and opportunity.

Key Challenges

Bangladesh has a population density of approximately 3,496 people per square mile—one of the highest in the world. This intense pressure on land and resources makes spatial, environmental, and economic sustainability a growing concern, especially in industrial zones like Chattogram. One such site is the shipbreaking yard, which, while offering abundant reusable materials, also presents significant social, environmental, and architectural challenges. Below is a breakdown of these key issues:



Figure 14_The most dangerous job in the world by ILO

A. Social Challenges

The Most Dangerous Job in the World:
According to the International Labour Organization (ILO), shipbreaking is one of the most hazardous jobs globally. Workers are exposed to toxic substances like asbestos, heavy metals, and oil residues.

Injury and Fatality Rates:
Limited access to safety equipment and inadequate enforcement of safety protocols lead to high rates of injuries and fatalities. Workers often climb rusted ships barefoot or with minimal protective gear, and they frequently work without harnesses or safety nets.

Impact on Workers' Health:
Prolonged exposure to toxic chemicals can cause long-term health issues, including respiratory diseases, skin conditions, and neurological problems.

Migratory Workforce:
Approximately 65% of the workers migrate from rural areas in search of employment at shipbreaking yards. This migratory lifestyle often disconnects them from stable communities and healthcare support, negatively impacting their social well-being.

B. Economic Challenges

Exploitation and Low Wages
Workers often face low wages for their labor-intensive and dangerous jobs, with many coming from impoverished communities that leave them little choice but to accept unsafe working conditions to earn a living. The lack of opportunities for career advancement or skill development means that most remain stuck in low-wage, entry-level positions. Additionally, the absence of formal contracts perpetuates economic exploitation, as it prevents workers from demanding fair pay, insurance, or compensation for injuries.

Lack of Economic Mobility
Many workers have limited education, which confines them to menial, labor-intensive jobs. Opportunities for skill development or knowledge transfer are scarce, which hinders workers from pursuing better-paying positions in other sectors. Without proper training, workers remain reliant on hazardous jobs, perpetuating cycles of poverty and economic insecurity.

C. Environmental Challenges

Shipbreaking and Environmental Impact:
Shipbreaking is a major contributor to environmental degradation. During the dismantling process, oils, heavy metals, and toxic chemicals can leak into the soil and seawater, contaminating local ecosystems.

Water Contamination:
Harmful substances such as oil, lead, and polychlorinated biphenyls (PCBs) are released into nearby water bodies, negatively impacting aquatic life and compromising water quality for local communities.

Air Pollution:
The use of gas torches to cut metal generates toxic fumes, which deteriorate air quality in the surrounding area.

Waste Mismanagement:
Hazardous waste from dismantled ships is frequently disposed of improperly, resulting in long-term soil contamination and disruption of ecosystems.

Sustainable Material Use:
Traditional construction typically relies on new materials, but shipbreaking provides an alternative by supplying recycled steel, aluminum, and timber. However, the extraction process of these materials also carries significant environmental costs, particularly if not managed sustainably.

Upcycled Materials in Architecture:

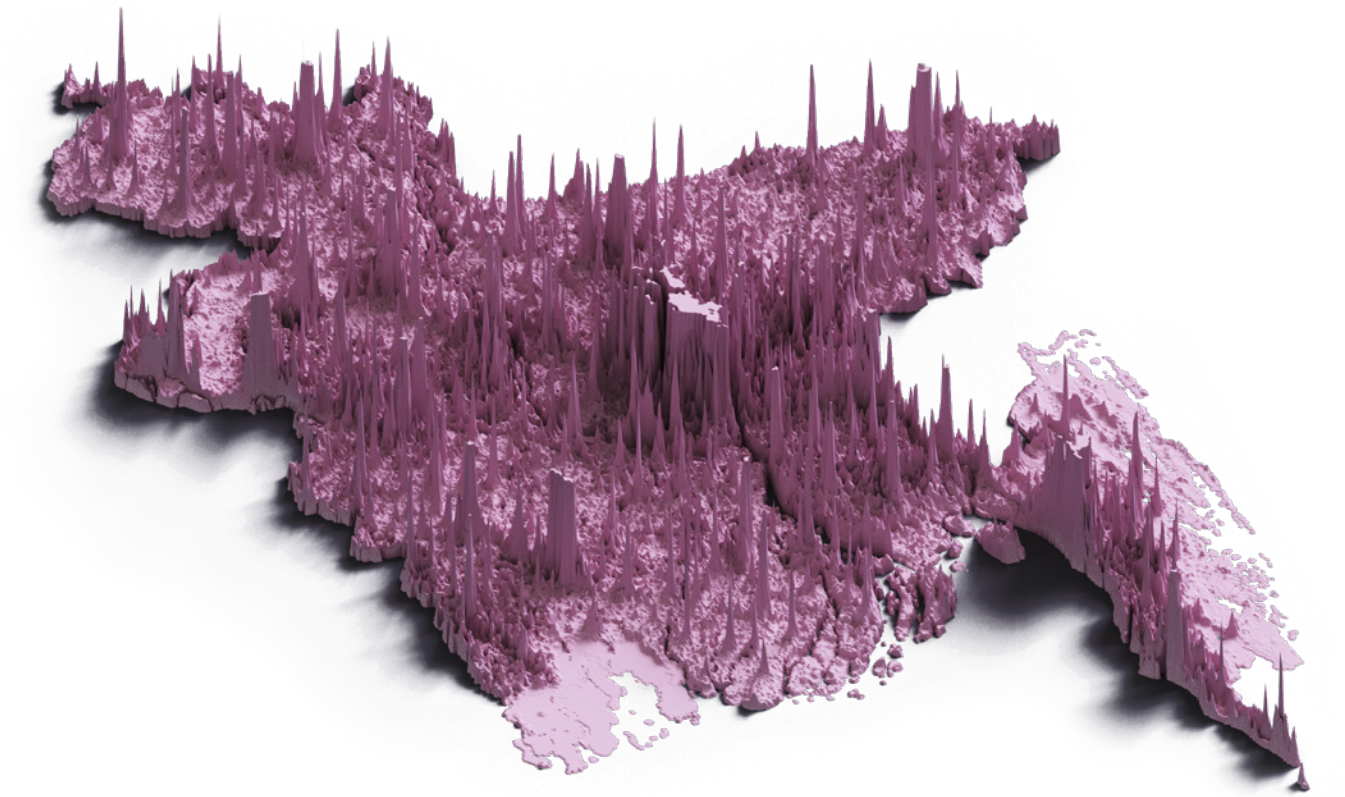


Figure 15_Population Density Spike map of Bangladesh by Muyeed Mohammad 2024

By utilizing upcycled materials from shipbreaking yards, architects can contribute to more sustainable building practices. can reduce the environmental impact of new construction.

D. Architectural Challenges

Design Constraints

1. Material Variability

The size, shape, and condition of salvaged materials from shipbreaking yards are not uniform. This inconsistency makes it challenging to design using conventional methods that typically rely on standardized materials.

2. Structural Integrity

Salvaged materials, such as steel plates or metal panels from ships, may experience corrosion or damage, which can compromise their structural reliability. Additional processing is necessary to ensure that these materials meet construction safety standards.

3. Inconsistent Supply

The availability of materials fluctuates based on the number of ships being dismantled. Since the shipbreaking industry operates on an unpredictable schedule, there is no guarantee of a consistent flow of materials.

Design Complexity

1. Hybrid Construction Methods

Traditional architectural design depends on predictable, mass-produced materials. However, working with salvaged materials necessitates flexible, site-specific design solutions.

2. Modular Adaptation

Due to the variability in the size and condition of salvaged materials, modular designs must be adaptable, allowing for on-site adjustments. Architects need to develop systems that can respond effectively to these changing inputs.

3. Integration of Traditional and Modern Practices

Designing with vernacular materials, such as bamboo or clay, alongside salvaged steel requires a thoughtful integration of traditional knowledge with contemporary design tools, including digital fabrication and parametric design.

How the Model Works

Low Labor Costs
The availability of a cheap and readily accessible workforce is essential to the profitability of the shipbreaking industry. Laborers, often coming from impoverished rural areas, accept low wages due to a lack of alternative job opportunities. This low labor cost allows yard owners to offer competitive pricing to third-party clients, such as global shipping companies looking to dismantle decommissioned vessels economically. As a result, the Chattogram yards attract more contracts, reinforcing their dominance in the global shipbreaking market.

Figure 16_ The Profitability Cycle; Diagram how the model works



2. Lack of Safety Codes
With no enforced safety standards, the operational costs for shipbreaking yards are significantly reduced. Yard owners are not required to invest in protective gear, medical facilities, or training programs for their workers. While this maximizes profits for the owners, it exposes workers to dangerous conditions, including toxic materials and high-risk physical injuries. However, the absence of safety codes ensures faster turnaround times, further incentivizing third-party contracts.

3. Low Regulations
Minimal regulatory oversight allows shipbreaking operations to bypass compliance costs related to environmental protection, worker rights, and labor laws. For example: Hazardous waste, such as asbestos and oil residues, is often disposed of improperly, avoiding expensive waste management processes. Employers ignore labor laws that require fair wages or proper contracts. This lack of enforcement allows the yards to operate with greater flexibility and speed, making them more attractive to international clients seeking quick and cost-effective solutions.

The Profitability Cycle
The interplay of several factors creates a profitability cycle in the shipbreaking industry:

Low labor costs attract more contracts from global clients seeking affordable dismantling services.Minimal regulations enable the yard to operate without the burden of compliance expenses, which streamlines operations and reduces delays.The absence of safety codes lowers investment in worker protections, further decreasing operational costs.

This cycle not only sustains the industry but also strengthens its competitive advantage in the global market. As long as these conditions remain in place, shipbreaking yard owners can continue to position themselves as a cost-effective solution for disposing of end-of-life ships.

Design Opportunities Emerging from These Challenges

While the challenges are significant, they offer a unique opportunity for architectural innovation. By utilizing local materials, harnessing the skills of workers, and fostering community engagement, we can develop a new architectural framework. Here's how these challenges can be transformed into opportunities:

1. Worker Empowerment:
Through training and workshops, workers can learn to repurpose salvaged materials, enhancing their skills and creating pathways for career advancement. Design projects such as community centers, modular housing, and market spaces can function as public architecture, directly benefiting workers and their families.

2. Environmental Sustainability:
Utilizing salvaged materials can significantly reduce the construction industry's carbon footprint. Recycled steel, timber, and aluminum lessen the need for mining, extraction, and processing of new raw materials. The environmental impact of

shipbreaking yards can be mitigated by creating self-contained, closed-loop systems where waste from shipbreaking is repurposed as input for new construction projects.

3. Innovative Design Possibilities:

Architects have the chance to work with non-standard materials, exploring adaptive, organic forms that evolve from the characteristics of salvaged materials. This design methodology challenges traditional processes and encourages a shift toward parametric design and modular adaptability.

"How can the integration of traditional materials and modern technology in public architecture foster innovative, affordable, and sustainable construction practices that address socio-economic challenges, enhance community empowerment, and preserve cultural heritage?"

4. Community-Centric Design:

By using salvaged materials to create community-oriented spaces (such as markets, cultural centers, and libraries), architects can help reduce the social stigma faced by shipbreaking workers. Engaging the community in the design process allows for participatory input, fostering a sense of ownership and pride in the built environment.

Conceptual Framework

The conceptual framework of this research focuses on the intersection of vernacular materials, adaptive design, and community engagement to create public architecture that is socially inclusive, economically viable, and environmentally sustainable. By situating this framework within the context of the Chattogram shipbreaking yard, the research aims to transform challenges into opportunities through thoughtful and localized design.

This framework responds to the urgent need for architecture that is flexible, resilient, and relevant to the context of regions experiencing rapid urbanization and socio-economic challenges. Below is a detailed breakdown of the core elements and guiding principles of the conceptual framework.

The conceptual framework is built on three interrelated pillars that inform and shape the design process. Each pillar addresses a specific dimension of the challenges posed by the Chattogram shipbreaking yard and its broader socio-environmental context.

1. New-Vernacular Materials

Vernacular materials, defined as locally sourced, naturally occurring, and salvaged resources integral to regional building traditions, play a crucial role in sustainable architecture. Utilizing materials such as bamboo, clay, and stone not only minimizes dependence on imported products but also fosters local craftsmanship and encourages environmentally responsible construction practices. In Chattogram, for instance, the repurposing of salvaged shipbreaking materials—like steel, aluminum, and timber—highlights the importance of material reuse, which can be applied in architectural elements including structural frames, façades, and furniture. This approach not only reflects cultural identity and craftsmanship, ensuring designs are authentic and contextually relevant, but also enhances economic feasibility by reducing material costs, thereby improving access to better public facilities for marginalized communities.

2. Adaptive Design

Adaptive design is an architectural approach that facilitates the creation of spaces capable of evolving and adapting over time to address the dynamic needs of communities and users. This methodology is particularly relevant in areas like Chattogram, where ongoing changes due to migration, economic fluctuations, and climate impacts necessitate that architectural environments remain both functional and relevant. Fundamental principles of adaptive design include modularity, which utilizes prefabricated components that allow for versatile layouts and uses; kinetic elements, which incorporate dynamic features such as movable façades and sliding panels to respond to varying environmental conditions and social requirements; and flexibility and reconfigurability, which enable spaces to shift purposes, such as transforming a classroom into a workshop. Furthermore, the application of adaptive design entails site-specific adaptations that consider unique geographical challenges, such as flood risks and natural light in coastal regions, as well as creative utilization of salvaged materials, which can often be irregularly shaped. Ultimately, adaptive design prioritizes the evolving functions of communal spaces, such as libraries, shelters, and cultural hubs, ensuring their responsiveness to the changing demands of the community.

3. Community Engagement

Community engagement is a participatory design process wherein users actively contribute to shaping the spaces they inhabit, emphasizing the integration of their needs, preferences, and cultural values. This approach is critical for successful architecture, particularly in Chattogram, as it ensures that design outcomes are aligned with

the lived realities of local workers, families, and residents, thereby fostering a sense of ownership and reducing resistance to new developments. Key principles of community engagement include participatory design, which involves stakeholders through workshops and co-design sessions; local workforce involvement, which not only creates job opportunities but also facilitates knowledge transfer and builds community capacity; and the promotion of identity and belonging by utilizing local materials and vernacular architectural forms that create environments resonant with local users. The application of these principles can be observed in the development of community centers that host cultural activities, markets and courtyards that encourage social interaction and public art, and healthcare and educational facilities tailored to meet the specific needs of Chattogram's working-class population.

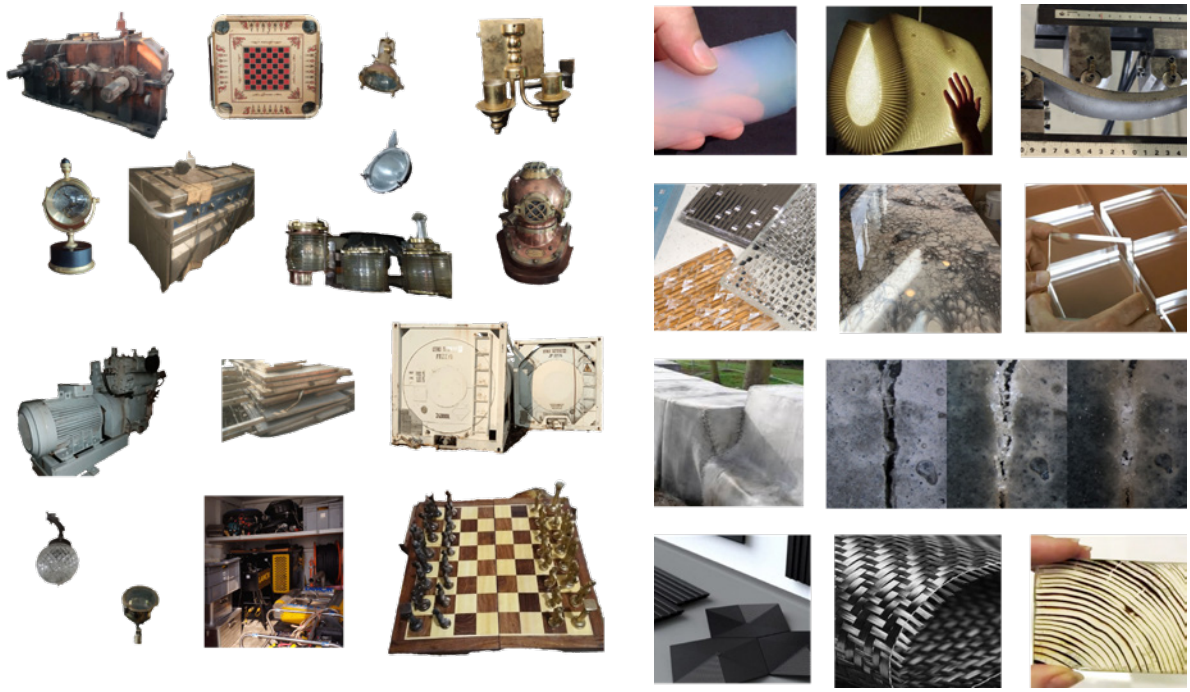


Figure 17_Materials obtained from the ship-breaking yard and some new innovative materials currently being tested for processing.

Design Strategy

Local materials, adaptable design, and community involvement create essential strategies for this research, guiding the design of public spaces, community centers, modular housing, and market hubs.

1. Contextual Design:

Each project reflects its specific context. Materials are sourced locally, spaces are configured to fit the existing urban fabric, and design decisions are informed by local conditions.

2. Circular Material Flow:

Materials salvaged from shipbreaking are repurposed into modular construction elements, minimizing waste and promoting sustainability. For example, steel beams are transformed into frame structures, ship bulkheads become modular panels, and timber decking is utilized for floors and furniture.

3. Modular and Scalable Design:

By employing modular systems, architecture can develop in phases, beginning with small community spaces that can be expanded over time. This approach ensures adaptability and affordability.

4. Participatory Co-Design:

The design process actively involves community stakeholders, particularly workers and local users. This inclusive approach grants the community a sense of "design ownership" over the resulting spaces.

5. Cultural Identity and Local Aesthetics:

The designs reflect local cultural patterns, textures, and forms. Elements such as courtyards, gathering spaces, and modular structures draw inspiration from vernacular architecture while incorporating shipbreaking materials as prominent design features.

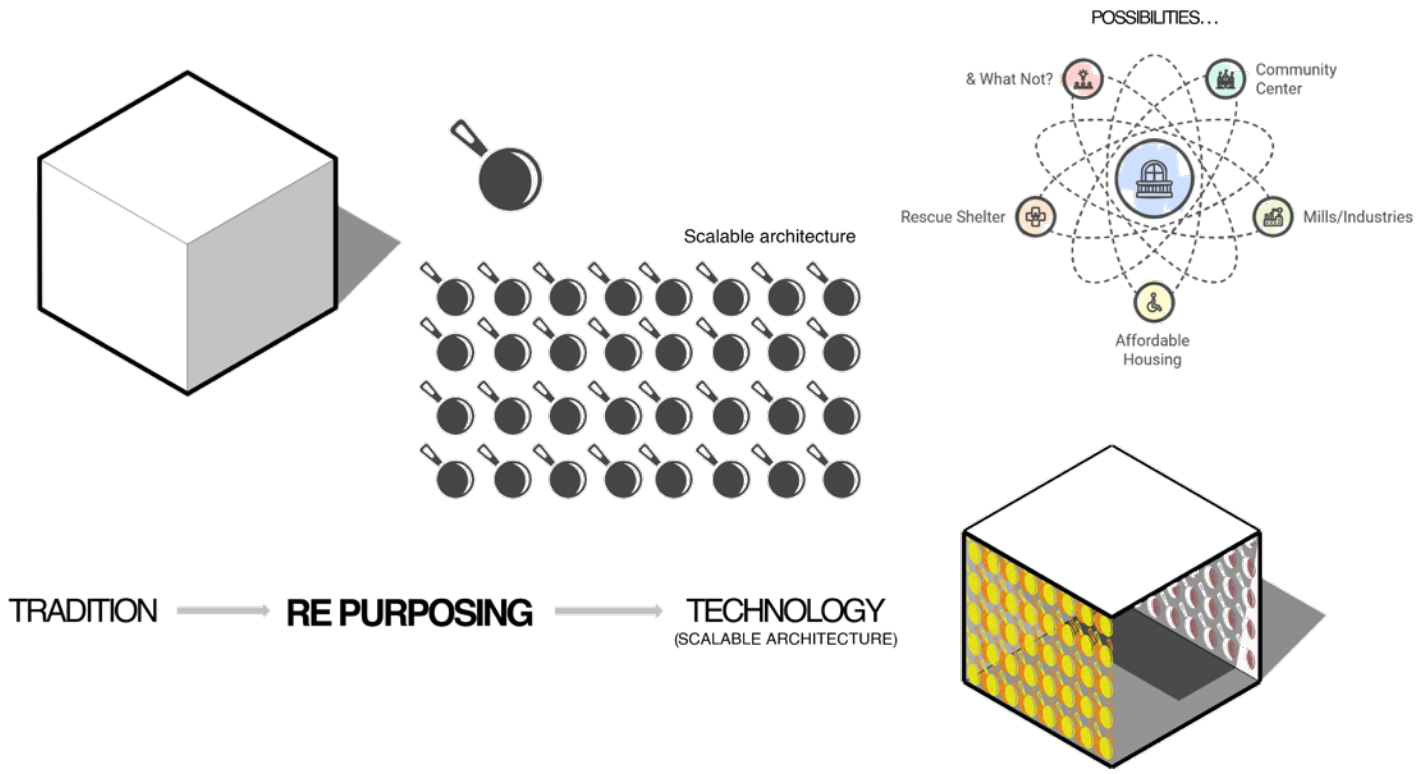


Figure 18_A simple diagram illustrating the possibilities and transformations.

Tradition

Rich tradition forms the foundation of a process grounded in local craftsmanship and the use of vernacular materials, which have long been integral to construction practices in Bangladesh. This tradition establishes a sustainable baseline, as materials such as bamboo, clay, and wood have historically been employed for their availability, affordability, and adaptability. In the context of Chattogram, this traditional knowledge is further developed through the utilization of salvaged materials from the shipbreaking industry, including steel and timber, thus creating a distinctive vernacular system that is deeply intertwined with the region's cultural identity.

Repurposing

The subsequent stage of this process involves repurposing, which entails reinvigorating materials often regarded as industrial waste. The shipbreaking industry yields a vast array of resources, notably steel plates, beams, and timber, which can be reimagined for architectural applications. In this phase:

• Salvaged components are meticulously deconstructed and reorganized into modular elements.

• Materials are adapted for use in structural components, façades, furniture, and other architectural features. This phase serves as a conduit between tradition and innovation, ensuring the preservation of the materials' environmental and cultural significance while enhancing their functional value.

Technology and Scalable Architecture

The incorporation of technology facilitates the transformation of salvaged materials into versatile architectural solutions. Techniques such as digital fabrication, modular systems, and parametric design allow for the efficient processing and reconfiguration of these materials. This scalability ensures that architectural designs can evolve in response to dynamic community needs, applicable in contexts such as:

• Community Centers: Spaces designated for education, healthcare, and social interaction.

• Affordable Housing: Modular units designed to provide flexibility and cost-effectiveness.

• Industrial Facilities: Enhanced infrastructures built with repurposed materials that support local economies.

• Rescue Shelters: Emergency facilities constructed rapidly utilizing modular systems.

The cube diagram presented in the slide encapsulates the final stage of this process, whereby traditional practices and repurposed materials converge with scalable technology to yield adaptable and functional spaces. The internal pattern of the cube symbolizes the modularity and reconfigurability inherent in these designs, illustrating how repetitive elements can be creatively assembled to meet diverse architectural requirements.

Adaptive Design and Material Reuse

Adaptive design responds to the unpredictable nature of materials from Chattogram's shipbreaking yard. This philosophy emphasizes flexibility, functionality, and context relevance, enabling evolution with available resources. At its core, adaptive design leverages the variability of salvaged materials to create dynamic, scalable, and resource-efficient architectural solutions. By aligning material reuse with adaptive strategies, this approach addresses environmental challenges and fosters innovation in public architecture.

Designing Around Materials

Adaptive design begins with recognizing both the limitations and opportunities presented by salvaged materials. Unlike standardized industrial materials, components extracted from dismantled ships—such as steel plates, beams, and timber—vary significantly in size, shape, and condition. Rather than imposing rigid architectural forms, adaptive design promotes an organic evolution of structures that responds to the dimensions and properties of these materials.

For example, a steel bulkhead salvaged from a ship may be reimagined as a modular wall panel, while wooden planks from the ship's interiors could be repurposed as flooring or furniture in community spaces.

This method of designing around materials requires a departure from traditional architectural approaches. It involves embracing irregularities and imperfections, which not only help to reduce waste but also add an authentic layer to the built environment. This philosophy aligns with global precedents, such as Bernard Rudofsky's advocacy for vernacular architecture, which emphasizes the integration of natural materials and low-impact techniques that respond to local conditions. In the context of Chattogram, this vernacular tradition is enhanced through the innovative reuse of industrial debris.

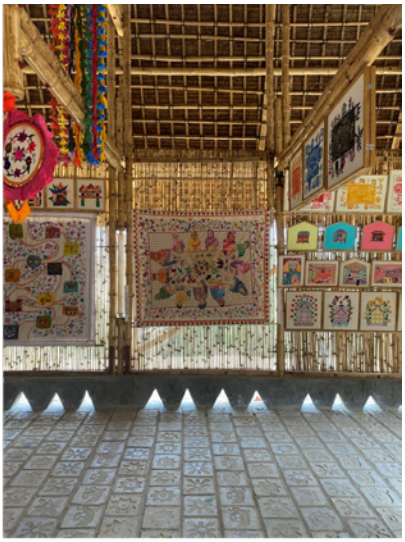
The Role of Modularity and Flexibility

Modularity is crucial in adaptive design, offering flexibility in construction and usage. Modular systems enable prefabricated architectural elements to be assembled and reconfigured to

Figure 19_This design emphasizes adaptability with modular components that respond to the changing needs of refugee settlements. The Rohingya Cultural Memory Centre , Photos by Rizvi Hassan











meet evolving needs, especially in resource-constrained areas like Chattogram, where efficiency and scalability are vital. For instance, modular housing units from salvaged steel can expand with growing family sizes or adapt to new community functions. Additionally, adaptive design allows spaces to evolve over time; for example, a marketplace can function as a cultural hub or training facility based on community needs. This multifunctional adaptability ensures architectural relevance and utility in rapidly changing urban environments.

Integrating Salvaged Materials

The use of salvaged materials from Chattogram's ship-breaking yard highlights the potential of adaptive reuse in creating sustainable architecture. Steel, aluminum, and timber sourced from decommissioned ships provide a plentiful and cost-effective resource for construction. These materials are not only durable but also possess a unique industrial aesthetic that reflects their historical origins.

Digital fabrication technologies play a vital role in optimizing the use of salvaged materials. Computer-aided design (CAD) tools allow architects to fit irregular components into precise configurations, ensuring minimal waste during the construction process. For example, large steel plates can be laser cut into smaller panels for modular assembly, while wooden components can be shaped into ergonomic furniture. This combination of traditional materials and modern techniques creates a synergy that connects the past and future of architectural practice.

Environmental and Social Implications

The reuse of salvaged materials provides significant environmental benefits by decreasing the demand for newly extracted resources and reducing waste. It also helps lower the carbon footprint associated with traditional construction methods. Beyond its ecological advantages, adaptive reuse promotes social equity by making construction more affordable and accessible. Involving local workers in the salvaging, processing, and repurposing of materials creates economic opportunities while fostering a sense of ownership and pride within the community.

Contextual Relevance

In the context of Chattogram, adaptive design and material reuse directly address the unique conditions of the shipbreaking yard. The dynamic nature of the site, characterized by fluctuating material availability and a diverse labor force, requires a flexible and resourceful approach. By embracing these challenges, adaptive design turns constraints into opportunities, resulting in architecture that is not only sustainable but also deeply connected to its surroundings.



Figure 20_The installation uses reclaimed brick pavers from demolition sites to honor the historic row houses of Chinatown and their vibrant sidewalk culture.
Ang Li Projects

Worker Empowerment Through Design

Worker empowerment through design is key to reimagining Chattogram's shipbreaking yard. While the shipbreaking industry is essential to the regional economy, its backbone—the workers—often face hazardous conditions, low wages, and social marginalization. This section explores how architectural interventions can address these challenges by enhancing safety, promoting dignity, and creating opportunities for economic and social growth.

Understanding the Workers' Reality
The shipbreaking yard employs tens of thousands of workers, many of whom migrate from rural areas in search of employment. They work under dangerous conditions, dismantling massive ships with minimal protective equipment and are often exposed to toxic substances like asbestos and heavy metals. Despite the risks, workers receive low wages and lack access to healthcare, adequate housing, or opportunities for advancement. Additionally, they face stigma due to the hazardous and polluting nature of their work. Any architectural solution must take this reality into account by prioritizing safety, well-being, and empowerment.

Design as a Tool for Empowerment
Architecture has the potential to empower workers by addressing their physical, social, and economic needs through thoughtful and inclusive design. The following strategies are essential in achieving this goal:

1. Safer Work Environments
Designing Safer Workspaces & Integrated Healthcare Facilities:
Architectural interventions within the yard can enhance worker safety by incorporating designated zones for material dismantling, waste segregation, and rest areas. These zones should include proper ventilation, protective barriers, and accessible facilities to minimize exposure to hazardous materials. On-site clinics can provide immediate medical care for injuries and long-term health monitoring for workers exposed to toxic substances. These facilities can be constructed using salvaged materials, demonstrating their functionality while addressing a critical need.

2. Affordable and Adaptable Housing
Modular Housing for Workers & Proximity to Workspaces:
Repurposed steel from ships can be used to create modular, scalable housing units for workers and their families. These units are not only affordable but also adaptable to different family sizes and community needs. Shared courtyards or open spaces within the housing complexes can foster a sense of community and belonging. Locating housing near the shipbreaking yard reduces commuting times, allowing workers to save time and money while fostering a stronger connection to their workplace.

3. Education and Training Centers
Upskilling Workshops & Knowledge Transfer:
Spaces within or near the yard can be designed to provide training in skills such as carpentry, metalwork, or digital fabrication. By learning to process salvaged materials into modular components, workers can transition from manual labor to specialized roles, opening doors to better-paying opportunities. Training programs can integrate traditional craftsmanship with modern techniques, empowering workers to view themselves as contributors to architectural innovation rather than just laborers.

4. Community Hubs for Social Connection
Cultural and Recreational Spaces & Support Network:
Community centers can serve as multifunctional hubs for education, healthcare, recreation, and cultural events. For example, exhibition spaces can showcase the contributions of workers, helping to combat social stigma and build community pride. These spaces can also host programs to address workers' mental health and well-being, creating an environment of care and dignity.

Participatory Design
Involving workers in the design and construction process is essential for empowerment. Participatory design not only ensures that spaces meet the needs of workers but also fosters a sense of ownership and pride among them. For example, workers can share their expertise in salvaging and reusing materials to build community centers, housing, or market spaces. This collaborative approach transforms architecture into a joint effort, breaking down hierarchical divides and empowering workers to become active stakeholders in shaping their environment.

Connecting Empowerment with Sustainability
Worker empowerment through design is intricately linked to the sustainable reuse of materials, as actively involving workers in the adaptive reuse process allows them to apply their skills to sustainable construction practices. This approach not only fosters economic growth by enhancing the long-term employability and economic mobility of workers, but it also yields significant environmental benefits. Specifically, the utilization of salvaged materials in architectural interventions mitigates waste and supports the principles of a circular economy, thereby promoting sustainability across multiple dimensions.

Chattogram Shipbreaking Yard

History

Chattogram is a historic port city known for traditional shipbuilding, integral to colonial and post-colonial trade and labor narratives. The shipbreaking industry rooted in this legacy.

The Chattogram shipbreaking yard, located along the southeastern coastline of Bangladesh, represents a complex interplay of global economic dynamics, local labor issues, and environmental challenges. Stretching over 11 miles, it is the world's second-largest shipbreaking facility, functioning as both an industrial engine and a site rife with socio-economic and environmental difficulties. This yard dismantles more than 200 ships each year, significantly contributing to Bangladesh's domestic steel supply and global recycling initiatives. However, it operates within a fragile balance, where worker exploitation and environmental degradation intersect with economic opportunity and material wealth.

Figure 21_Historical Timeline of Chattogram Ship Industry



Chattogram, a city steeped in maritime history, has long been a vibrant center for shipbuilding and trade. Its rich heritage as a port city dates back centuries, telling a fascinating story of evolution, adaptation, and resilience in the face of change.

The journey begins in the 14th century with Moroccan traveler Ibn Battuta, who marveled at Chattogram's thriving shipbuilding industry. He highlighted the region's prowess in crafting vessels, setting the stage for its reputation as a vital hub for maritime activities. Fast forward to the 15th century, and European traveler Oscar Frederic painted an even clearer picture, describing the bustling shipyards of Chattogram and nearby Sandwip as key manufacturing centers that facilitated both regional and international trade.

As time marched on into the 17th century, the shipyards of Chattogram gained significant influence, constructing formidable warships for the Sultan of Turkey—underscoring their strategic importance in naval power. Under the Mughal Empire in the 18th century, Chattogram blossomed into the heart of Bengal's shipbuilding industry, producing a staggering 223,250 tons of ships annually—far outpacing European colonies like North America. This impressive output not only showcased the region's unmatched craftsmanship but also solidified its essential role in bolstering the Mughal economy.

The onset of World War II marked a transformation as Chattogram's shipyards adapted to military demands, serving as a crucial logistical base in the Southeast Asian Theater. A significant turning point occurred in 1960 when a devastating cyclone left a massive cargo ship stranded on its shores. This event catalyzed a shift toward shipbreaking, laying the groundwork for a new chapter in the maritime saga of Chattogram.

The industry really took off in 1974 during the Bangladesh Liberation War when a



Figure 22_Chattogram Shipbreaking Yard Photos by Naquib Hossain, Stéphane M Grueso, Matt Hettwer

decommissioned Pakistani navy vessel was dismantled, formally establishing the shipbreaking sector and unleashing rapid growth. By the 1980s, Chattogram had firmly established itself as a global leader in shipbreaking, dismantling hundreds of vessels each year. The city's extensive shoreline, low labor costs, and plentiful workforce made it an ideal location for this burgeoning industry.

Chattogram's transformation from a renowned shipyard to one of the world's largest shipbreaking hubs encapsulates a unique blend of maritime legacy and industrial ingenuity. The city embodies the adaptive spirit necessary to navigate the socio-economic shifts that have defined its identity over the years.

During both colonial and post-colonial eras, Chattogram played a pivotal role in global trade, bridging regional markets with international economies. This legacy laid the foundation for the modern shipbreaking industry that emerged informally in the 1960s, quickly expanding to meet the escalating global demand for dismantling decommissioned vessels.

Today, Chattogram's shipbreaking yards symbolize the complex dynamics of globalization. Here, vessels built and used in the West find their final resting place, where they are carefully dismantled and transformed into raw materials. This process highlights a stark reality in the global economy, as labor-intensive and hazardous tasks are often outsourced to developing regions with lower wages and limited regulations.

Material Flow and Economic Contribution

The shipbreaking industry offers pipes, steel plates, panels, even wood—all ripe for reuse. These materials carry stories, scars, and value. My design approach embraces them not just as structure, but as symbol.

The shipbreaking yard not only facilitates material recovery but also sustains a substantial informal economy that employs over 50,000 workers directly and generates indirect employment for an additional 100,000, thereby serving as a critical source of livelihood in the region. Surrounding the yard, secondary markets flourish, trading in salvaged materials, ship parts, and machinery, which bolsters local industries and stimulates a ripple effect of economic activity. However, the benefits of this economic ecosystem are counterbalanced by significant drawbacks, including the prevalence of exploitative working conditions and severe environmental impacts associated with the shipbreaking processes.

The bar chart depicts the estimated breakdown of materials recovered from dismantled ships in Chattogram's shipbreaking yard. Steel elements—mainly plates, beams, pipes, and angles—make up roughly 75% of the total salvaged materials, highlighting their prevalence in volume and potential for reuse in local construction. Machinery and mechanical parts account for about 11%, including engines, gear systems, and propeller components, which are frequently refurbished and repurposed. Scrap metal waste, consisting of irregular or corroded pieces, represents approximately 6% and is usually destined for melting and recycling. Brass, copper, and aluminum fittings comprise around 4%, obtained from electrical and plumbing systems. Less common items like marine furnishings, antiques, and instruments contribute merely 2%, typically gathered for resale or heritage purposes. Lastly, beach-found or informally scattered debris constitutes less than 1%, indicating materials that slip through formal salvage operations. This distribution emphasizes the prevalence of structural steel while also highlighting both opportunities and constraints regarding the architectural reuse of other salvaged materials.

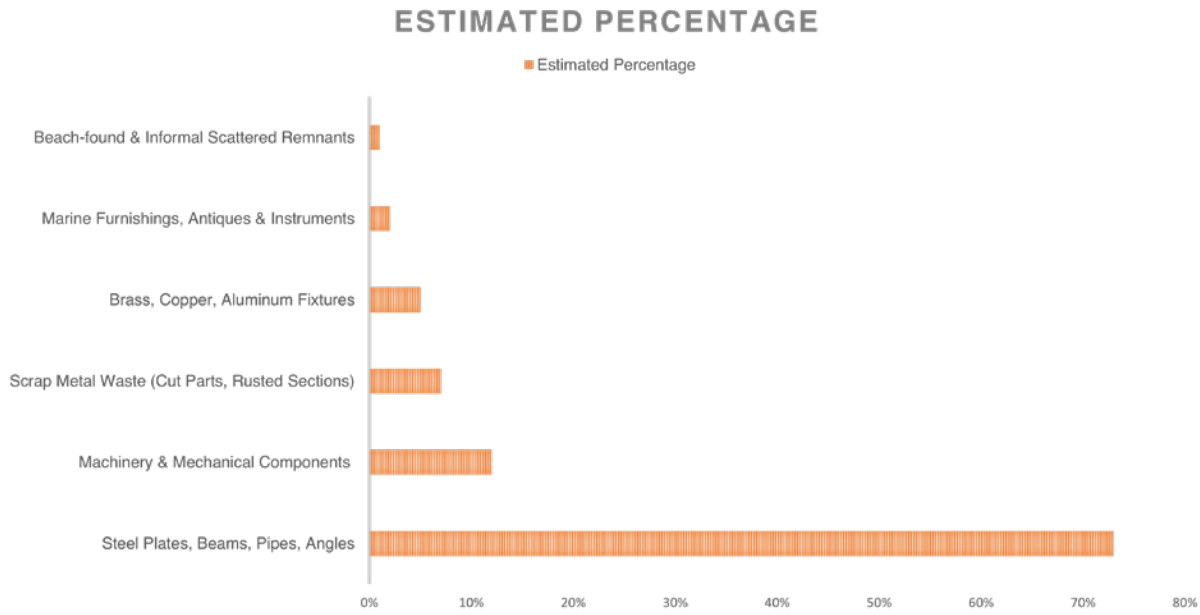


Figure 23_Estimated percentage of material Flow. Source:
-NGO Shipbreaking Platform Reports
-BUET (research on shipbreaking material flows
-Journal articles on South Asian ship recycling (e.g., Habib et al., 2019, Hossain & Islam, 2018)
-Field studies and salvage yard inventories from Sitakunda, Chattogram



Figure 24_Scrap materials and other items obtained from the shipbreaking yard.

material flow



The ships are first dismantled into larger sections



Those larger sections are dragged by the winch during high tide to the end of the muddy areas beyond the water line



Workers Use blowtorches to cut these large sections into smaller ones



Then, they are carried by the magnetic grabs to the trucks. Workers carry small, lightweight pieces from ships to dry areas to sell



A massive scale weighs both unloaded and loaded trucks to measure the number of metals sold.

Figure 25_This diagram illustrates the material flow of ship-breaking yard



Some materials goes to small shop/workshops for further process



60% of the materials are sent directly to the steel rolling mill for recycling.

Challenges of the Yard

The shipbreaking yard plays a crucial role in supplying raw materials for Bangladesh's domestic economy. Annually, over 1 million tons of steel, along with aluminum, timber, and machinery, are salvaged. These materials are repurposed for local construction, manufacturing, and infrastructure development, which significantly decreases the need for imported resources.

1.Worker Exploitation:

The shipbreaking industry heavily depends on cheap, unskilled labor. 60% of workers migrate from rural areas and other parts of Bangladesh in search of employment in Chattogram. These workers encounter significant risks, including exposure to toxic materials such as asbestos and lead-based paints, physical injuries from dismantling large ships, and long-term health issues. Despite these dangers, wages are low, and safety protocols are nearly non-existent.

2. Environmental Impact:

Pollution: Hazardous waste generated from dismantled ships, including oil, heavy metals, and chemicals, frequently leaks into the soil and water, contaminating local ecosystems.

Air and Water Quality: The use of gas torches for cutting metal releases toxic fumes, while waste runoff pollutes nearby water bodies, adversely affecting marine biodiversity.

Waste Mismanagement: In the absence of proper disposal systems, hazardous materials can accumulate, leading to long-term ecological damage.

3. Social Stigma:

Workers in the shipbreaking industry often face social marginalization due to the hazardous and polluting nature of their work. This stigma also affects their families, reinforcing cycles of poverty and exclusion.

Opportunities

The unique context of Chattogram's shipbreaking yard provides a valuable opportunity for architectural innovation. By reimagining the site and its resources, design interventions can tackle existing challenges while promoting sustainability and community resilience.

Material Reuse

The abundance of salvaged materials from the shipbreaking yard allows for exceptional possibilities in adaptive reuse. Items such as steel beams, aluminum sheets, and timber can be repurposed into:

Structural Components: Beams and panels for community centers and housing.

Furniture and Fixtures: Tables, chairs, and flooring for public spaces.

Modular Housing: Scalable units designed for worker housing and community infrastructure.

Worker-Centered Spaces

The organization offers comprehensive support for workers through on-site healthcare facilities that provide primary care and treatment for work-related injuries. Additionally, dedicated training centers are available for upskilling workers in trades such as carpentry, welding, and digital fabrication, which aid in career advancement. To ensure safe and dignified living conditions, the organization also provides affordable modular housing units constructed from salvaged materials.

Environmental Mitigation

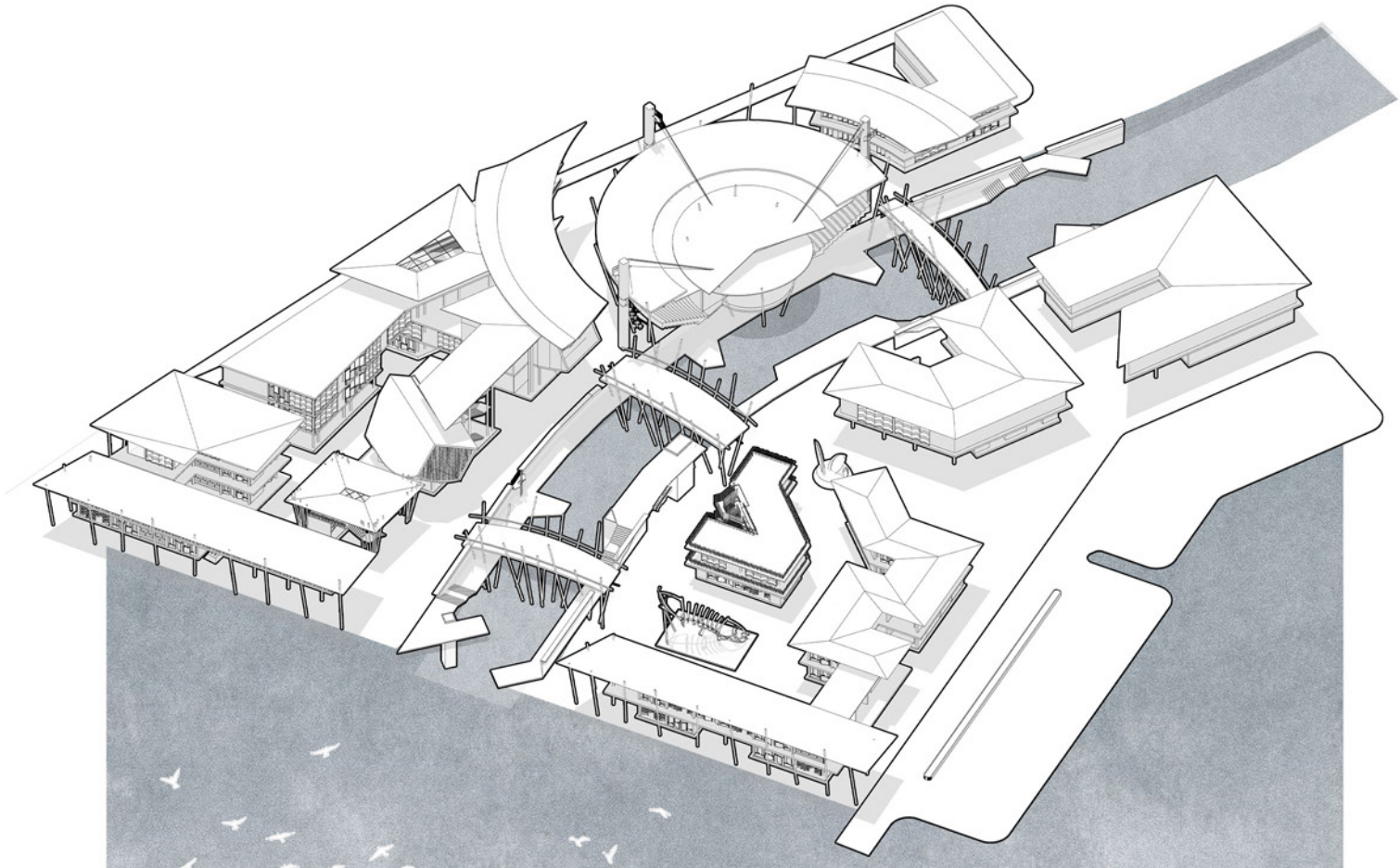
Architecture can significantly reduce the environmental impact of shipbreaking by implementing effective waste management systems that ensure the safe storage and processing of hazardous materials, as well as by creating green spaces such as public parks and buffer zones that help mitigate pollution and provide valuable amenities for the community.

A Broader Vision for Chattogram

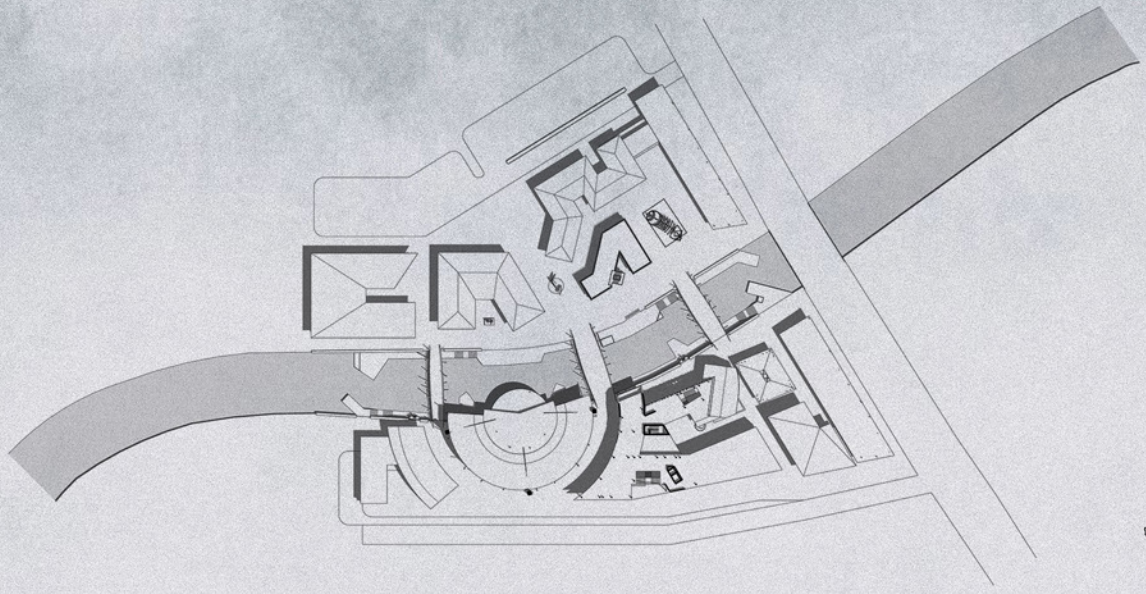
Chattogram's shipbreaking yard presents both challenges and opportunities. It highlights the exploitative nature of global material flows, but it also has the potential for transformation through thoughtful design. By reimagining the yard as a site of resilience, this research envisions:

- A circular material economy where salvaged resources are continuously repurposed for new construction.
- A worker-centered ecosystem that prioritizes safety, dignity, and empowerment.
- A model for sustainability, demonstrating how industrial sites can be reconfigured to benefit both the environment and the community

Crafting Resilient Communities



THE INTERSECTION OF NEW VERNACULAR MATERIALS AND ADAPTIVE DESIGN IN PUBLIC ARCHITECTURE



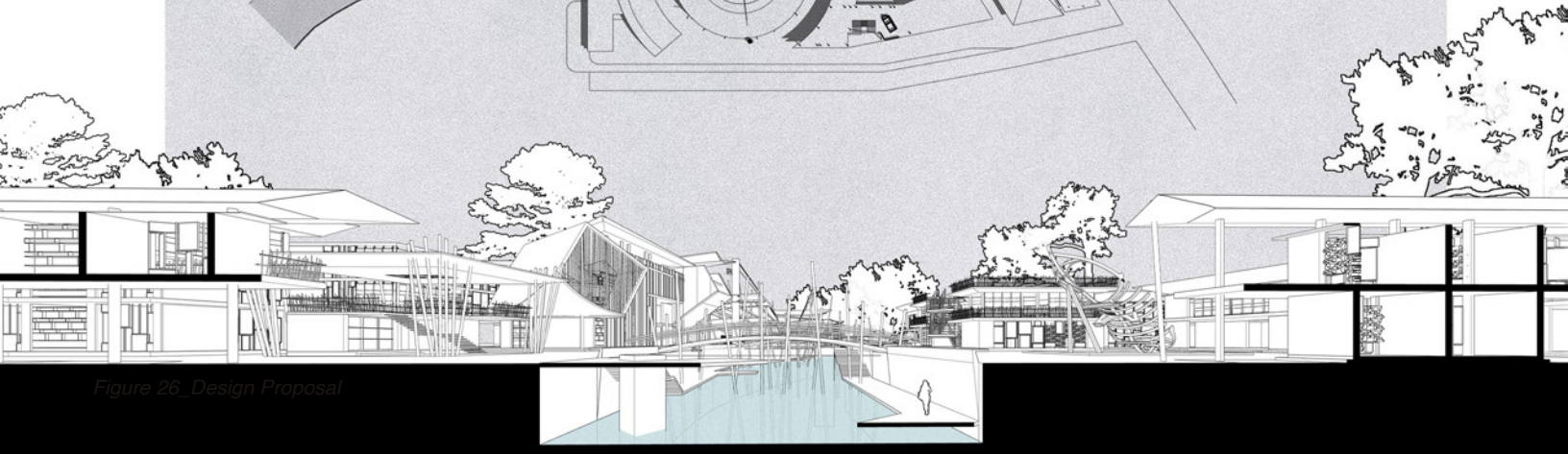


Figure 26_Design Proposal

CHAPTER 03
Design for Resilience

The material richness of the shipbreaking yard presents both a challenge and an opportunity; the environmental pressures it faces represent a crisis, yet they also unveil potential solutions; and the labor of workers, often overlooked, holds significant value. Each of these elements serves as a seed for transformation. Steel beams and aluminum panels can be repurposed as the foundation for modular housing. The expertise of workers in dismantling can be harnessed to develop innovative construction skills. Furthermore, the region's environmental vulnerabilities can inspire designs that respond adaptively to the landscape. This transition from viewing challenges as mere problems to recognizing them as opportunities underpins the concept of design for resilience—a framework that not only adapts to available materials but also empowers communities and promotes sustainable building practices for the future.

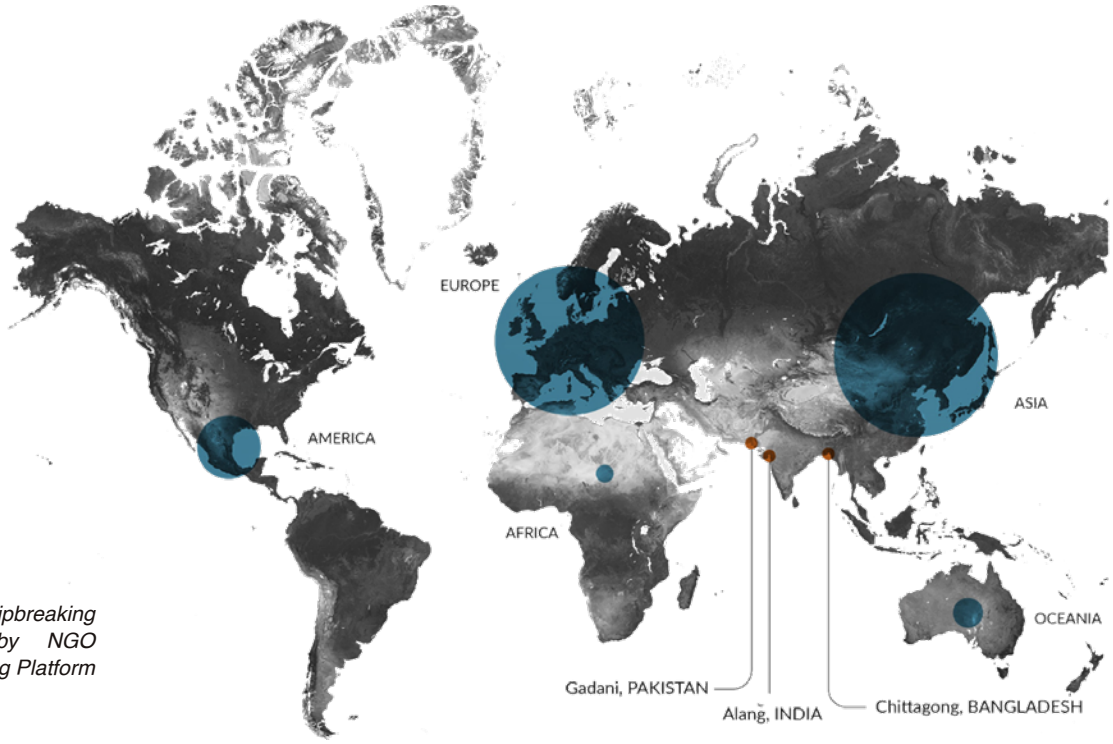


Figure 27_Shipbreaking industry map by NGO Shipbreaking Platform

● Exporters of toxic ships
Ship owners from East Asia and Europe top the list of dumpers that sell ships for breaking on South Asian beaches.

● Shipbreaking countries
In Bangladesh, India and Pakistan ships are broken apart directly on the beach instead of in an industrial site: a practice known as "beaching". Since 2009:

8221Ship Breached
449 Deaths
412 Injuries

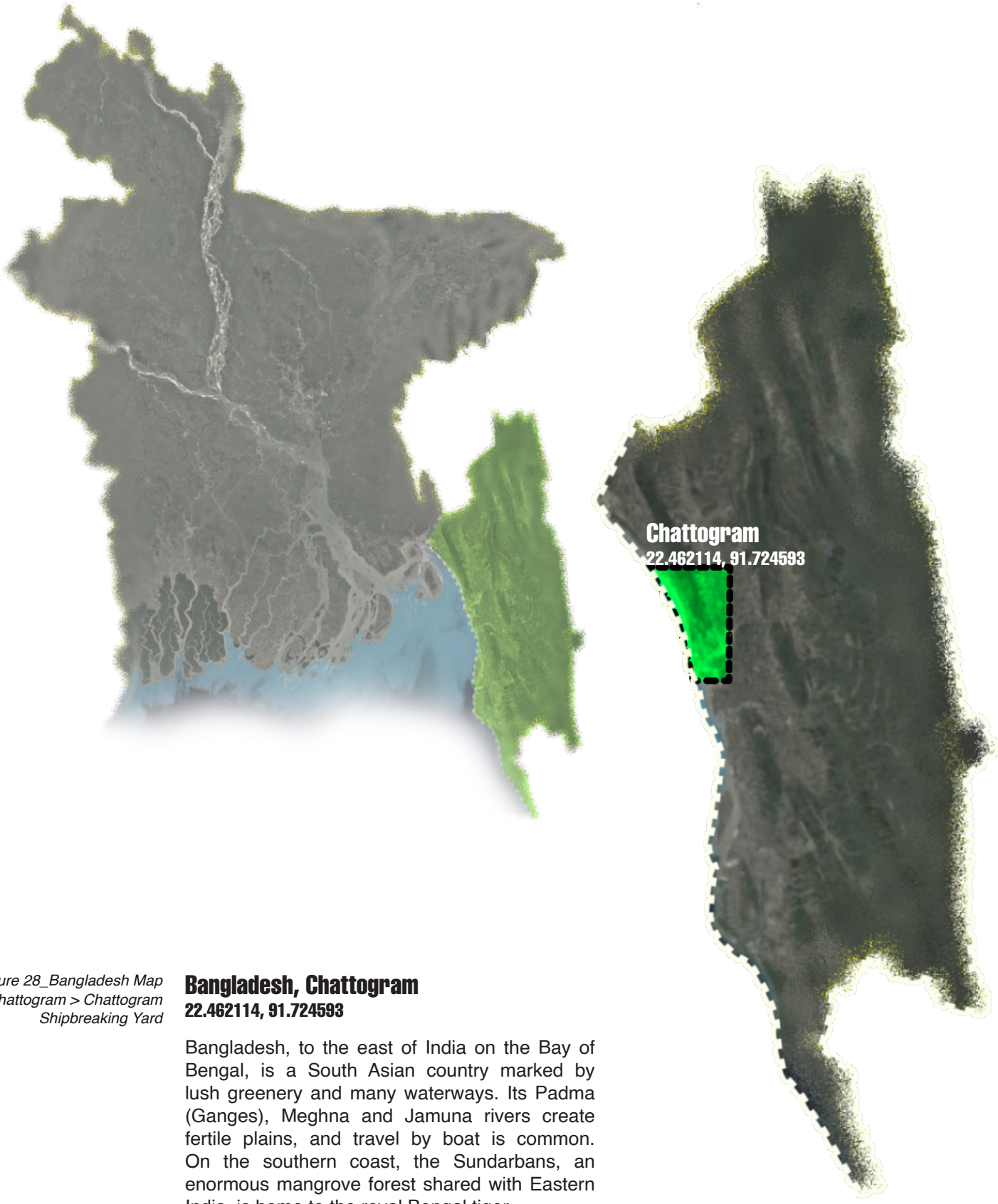


Figure 28_Bangladesh Map > Chattogram > Chattogram Shipbreaking Yard

Bangladesh, Chattogram
22.462114, 91.724593

Bangladesh, to the east of India on the Bay of Bengal, is a South Asian country marked by lush greenery and many waterways. Its Padma (Ganges), Meghna and Jamuna rivers create fertile plains, and travel by boat is common. On the southern coast, the Sundarbans, an enormous mangrove forest shared with Eastern India, is home to the royal Bengal tiger.

Site Analysis

The Chattogram shipbreaking yard is a vital industrial hub and a key player within a dynamic network of cultural, educational, and economic influences. Its strategic position along Bangladesh's southeastern coastline situates it at the crossroads of regional and global material flows. Additionally, its proximity to important landmarks and infrastructure enhances its significance as a potential site for architectural intervention.

Cultural & Recreational Context

The area surrounding the shipbreaking yard is home to a rich variety of cultural and recreational landmarks, making it a hub for social interaction and activity. Significant religious sites, including temples and other spiritual landmarks, are located nearby, attracting pilgrims and visitors from all over the country. These cultural sites not only enhance the region's identity but also highlight the importance of designing spaces that facilitate interaction between the local community and visitors.

Additionally, the landscape features an abundance of natural beauty, with scenic hills, waterfalls, and other attractions that make the area popular for recreational activities. This draws a steady influx of people year-round. The combination of these cultural and natural elements positions the site within a broader regional context, where industrial operations coexist with tourism and leisure opportunities. This unique duality makes the site an intriguing focal point for design that integrates industrial, cultural, and ecological functions.

Educational Ecosystem

Within a 10-kilometer radius of the shipbreaking yard, there are two major universities, alongside numerous schools and educational institutions. These universities significantly contribute to the intellectual and economic landscape of the region, offering valuable resources for collaboration in research, skill development, and community engagement. For example, the universities could play a pivotal role in training programs aimed at upskilling workers in the shipbreaking industry, particularly in areas such as material reuse, modular construction, and sustainable design.

The abundance of schools in the area further emphasizes the importance of creating spaces that support educational growth. By designing facilities that can function both as training centers and community hubs, architectural interventions at the shipbreaking yard can directly address the needs of students and educators, fostering a culture of learning and innovation in the region. This interconnectedness between education and industry presents a unique opportunity to reimagine the yard as a site of knowledge transfer and skill-building.

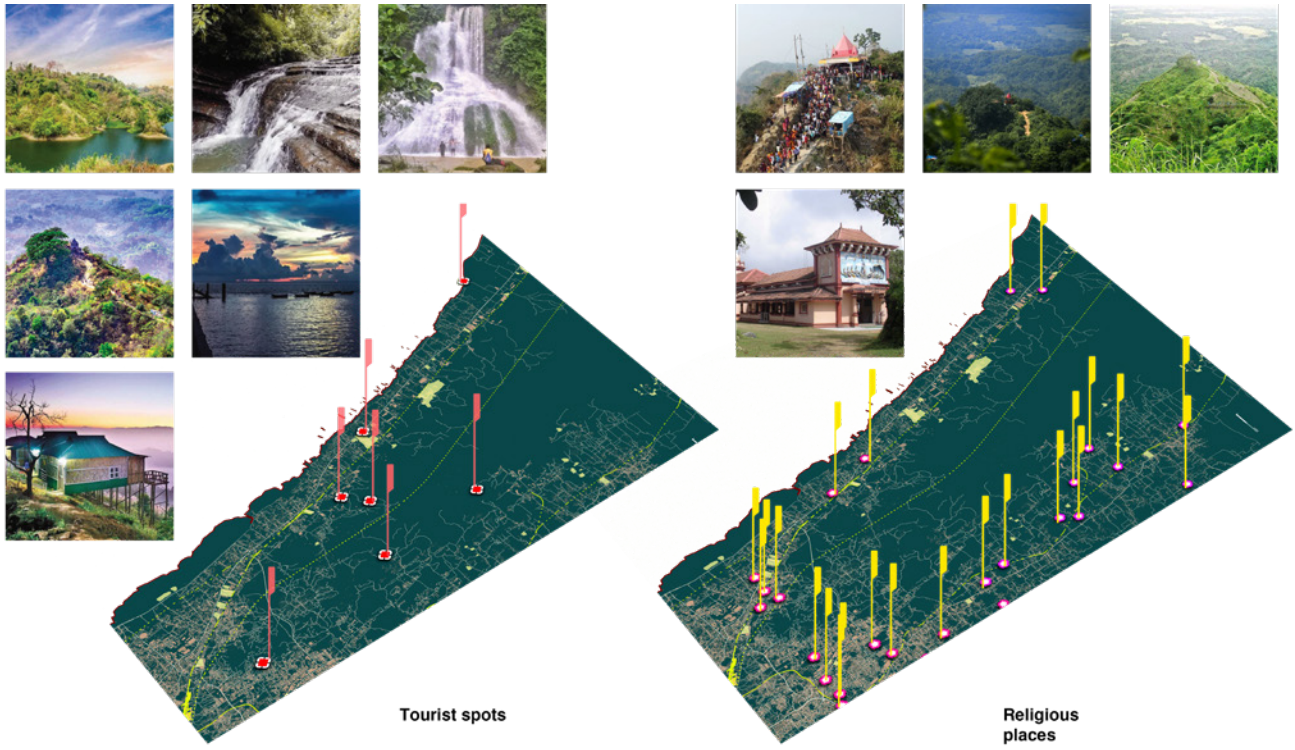


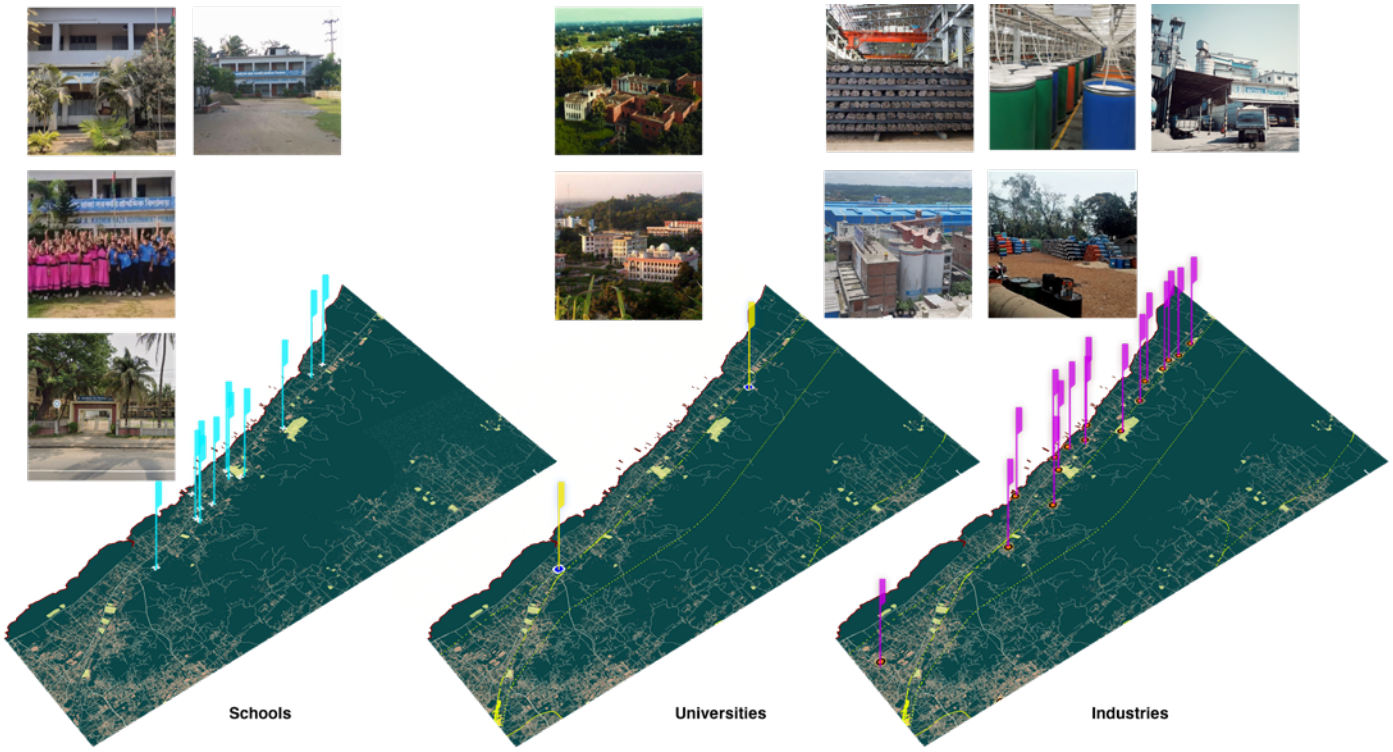
Figure 29_Annotated Tourist spot and Relgious spot around Chattogram Shipbreaking Yard area

Industrial and Economic Network

The shipbreaking yard is deeply embedded in a robust industrial network that drives the local economy. Numerous factories and industries in the vicinity rely on the materials salvaged from decommissioned ships, including steel, aluminum, and timber, which are repurposed for manufacturing and construction. This flow of materials creates a dynamic relationship between the yard and surrounding industries, highlighting the potential for architecture to serve as a bridge between industrial processes and community needs.

The industrial activity in the area also creates opportunities for designing spaces that support economic growth. For instance, markets and commercial spaces could be designed to facilitate the sale of salvaged materials and goods produced by local industries. By integrating these economic functions into the design, the site can act as a catalyst for entrepreneurship and small-scale manufacturing, further strengthening the local economy.

Figure 30_Annotated Universities, School and Industries around Chattogram Shipbreaking Yard area



"some projects need intervention without having a client"

Transportation and Connectivity

One of the most significant aspects of the site is its connection to a broader transportation network. The shipbreaking yard is situated along key economic and logistical corridors that link it to Chattogram city and beyond. This connectivity ensures the smooth movement of materials, labor, and goods, making it a vital part of the regional economy. Additionally, the site's accessibility through major roads and transport routes makes it an ideal location for community infrastructure that can serve both local residents and transient populations.

This transportation network also provides a critical link between the shipbreaking yard and other economic assets in the region. By leveraging this connectivity, architectural interventions can integrate the yard into a larger framework of industrial, cultural, and social activity, ensuring its long-term relevance and sustainability.

Why This Site Matters

The shipbreaking yard is an exceptionally significant site for intervention due to the convergence of cultural, educational, industrial, and logistical factors. It is not merely a location for dismantling ships; it is a space where global material flows intersect with local communities, creating opportunities for transformation and resilience. By recognizing the complexity and richness of its context, architecture can play a transformative role in addressing the challenges and potentials of this site.

Site Selection

After conducting a thorough analysis, I have identified four potential sites along the main street for consideration. Among these options, Site 3 stands out as the most promising choice due to its strategic location near a vital transportation loop. This transportation loop serves as a key artery, connecting Site 3 to the urban core of Chattogram, which is essential for facilitating efficient movement of goods and people.

The proximity of Site 3 to this transportation network ensures seamless integration with the city's economic and logistical infrastructure, making it an ideal location for projects that require accessibility and connectivity. Furthermore, Site 3 is situated within a short distance of important cultural, educational, and industrial nodes, including schools, universities, and various businesses. This advantageous location makes it not only functional but also a community-centric space.

By selecting Site 3 for development, we can create a balanced environment that prioritizes industrial functionality while also addressing community needs and environmental considerations. The integration of these elements will help foster a vibrant area that supports both economic growth and community well-being.

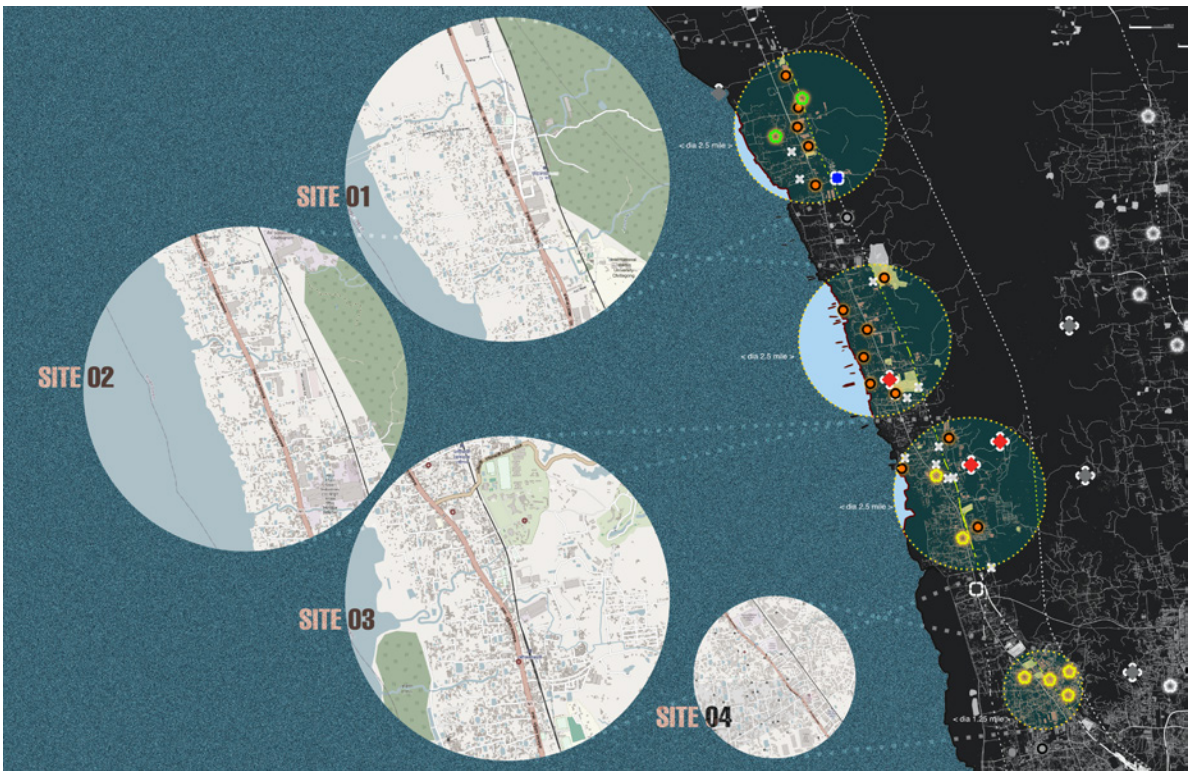


Figure 31_Potential four sites for Design



Figure 32_Loop that connects Chattogram city with Site 03

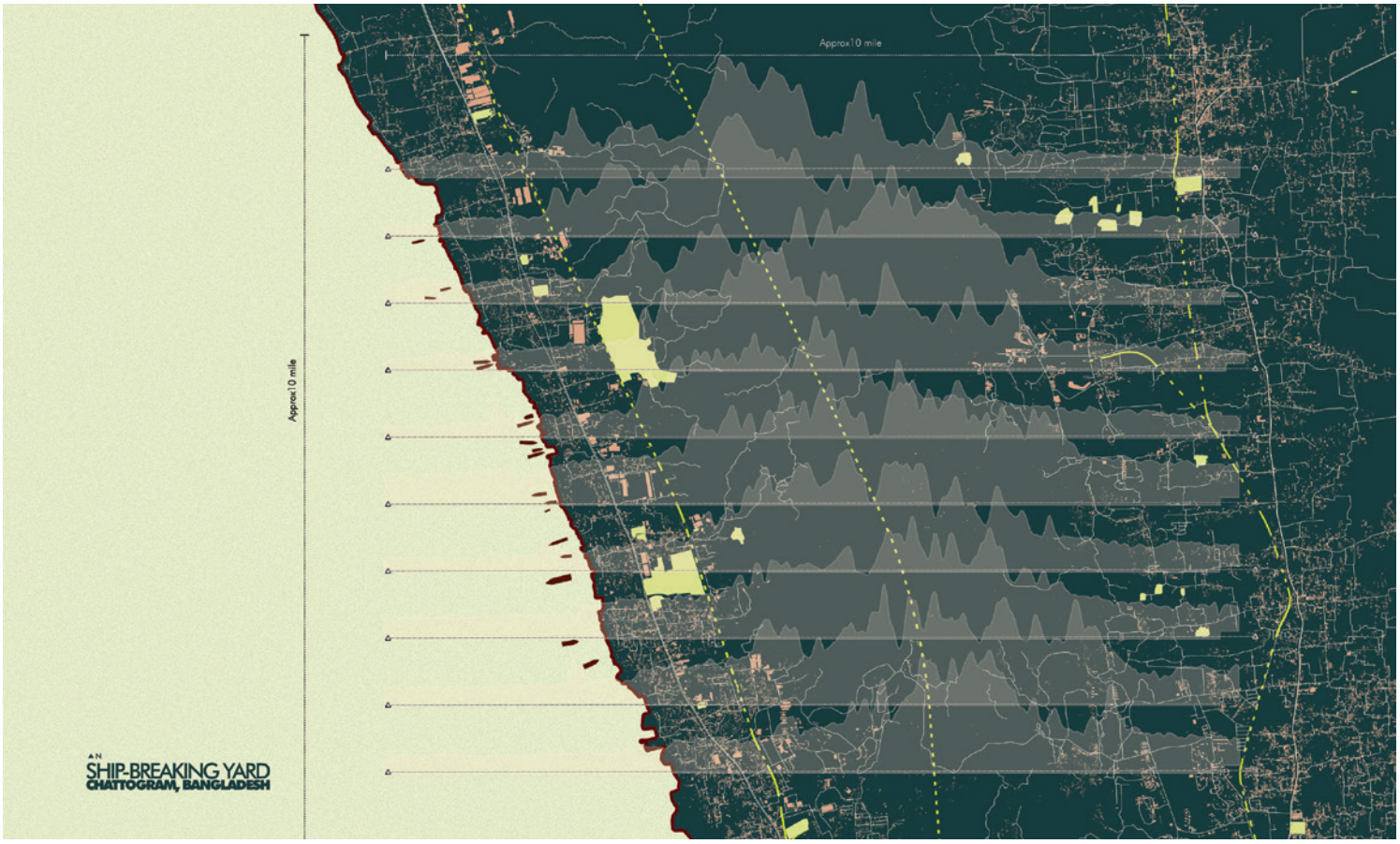


Figure 24_This captivating diagram shows how a stunning mountain range acts as a natural barrier, separating our site from the city.

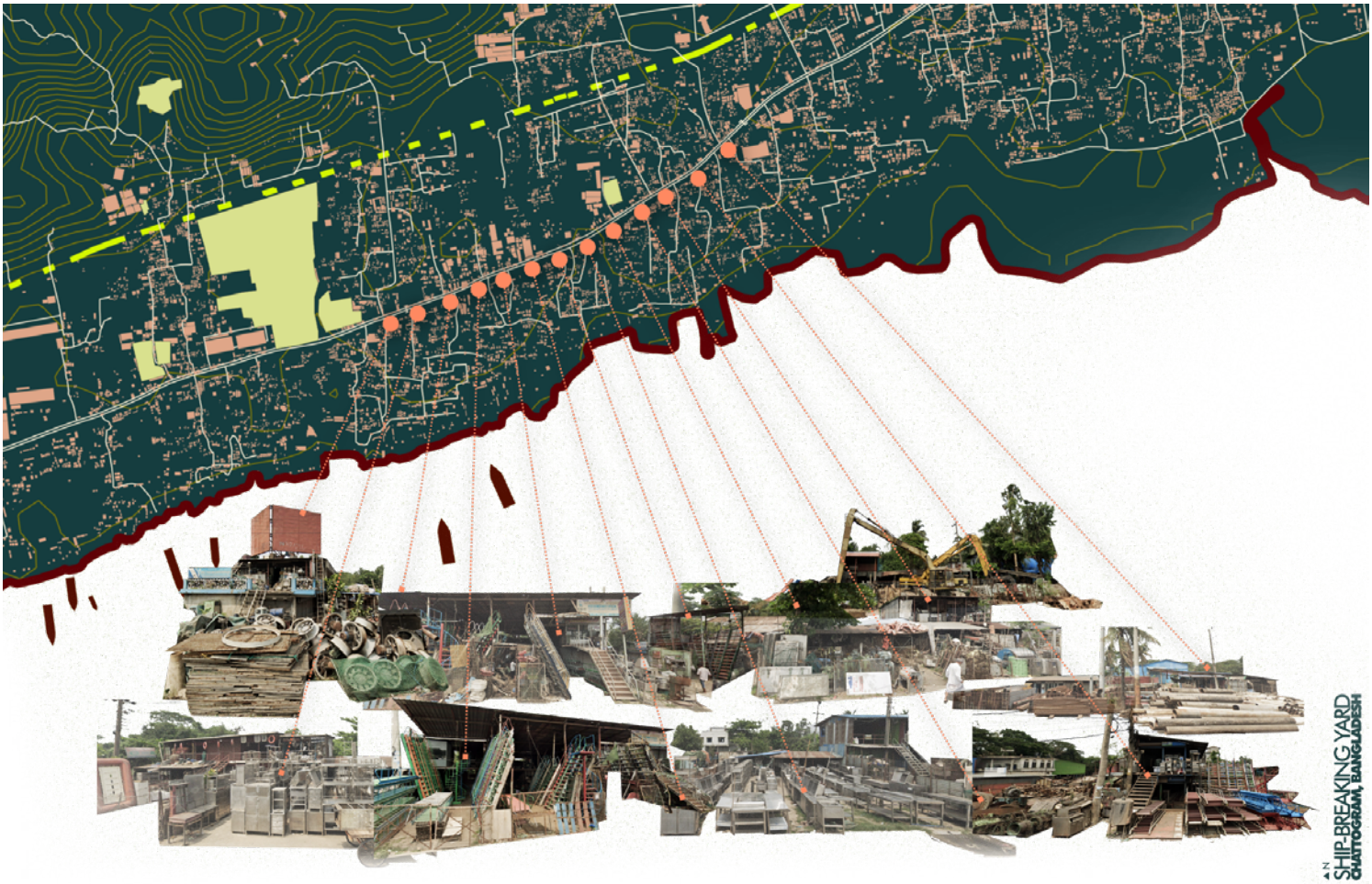
Figure 25_This Diagram shows a variety of activities along the section line.



Road Network and Market Connectivity
The road depicted in the diagram is crucial for connecting the shipbreaking yard to the larger city of Chattogram and its surrounding regions. This connectivity enables the efficient transportation of salvaged materials from the shipbreaking yard to the market and beyond, ensuring a steady flow of goods. Its close proximity to the coastline allows for the swift movement of raw materials directly from the yard to nearby businesses, making it an essential artery for the region's economic activity.

Market Conditions and Activities
The market is a bustling hub of activity where materials salvaged from ships are repurposed and sold. Various shops specialize in processing and selling specific components, creating a diverse and interconnected commercial ecosystem. Key activities in the market include:

Figure 26_This image shows the vibrant market around the Chattogram shipbreaking yard, showcasing the dynamic interplay between industrial and commercial activities.



Metal Recycling: Shops offer salvaged steel beams, aluminum panels, and other metallic components for use in construction, manufacturing, and infrastructure projects.
Wood and Timber Sales: Reclaimed wood from ship interiors is used for furniture, flooring, and decorative elements, providing affordable materials for local and regional markets.

Machinery and Spare Parts: Vendors sell used machinery, engines, and mechanical parts that have been refurbished and resold to industries or individuals.

Household and Utility Items: Everyday objects such as tools, storage containers, and even ship furniture are available, making them accessible and affordable for local communities.

Interdependence Between the Yard and Market
The vibrancy of the market is closely connected to the operations of shipbreaking yards. As ships are dismantled, the materials are sent directly to local shops, which act as intermediaries between industrial salvaging and consumer use. This symbiotic relationship ensures that materials are reused rather than wasted, showcasing a practical example of a circular economy in action.

Socio-Economic Importance
The shipbreaking yard's market conditions are vital for workers and businesses, serving as a key community hub. These markets drive growth by supporting livelihoods for shop owners and laborers involved in material processing and transport. Accessible recycled materials offer cost-effective solutions for construction and daily needs while reflecting the region's cultural identity through resourcefulness in waste transformation.

Despite its vibrancy, the market faces challenges

like limited infrastructure, environmental concerns, and regulation gaps. While the road network facilitates material transport, it suffers from congestion and pollution. These issues present opportunities for architectural enhancements to improve layout and traffic flow while adopting sustainable practices.

Tackling these challenges can strengthen the market's ecosystem. Modular stalls, better waste management, and improved transport can enhance efficiency and sustainability, ensuring the market remains an economic engine for the region.

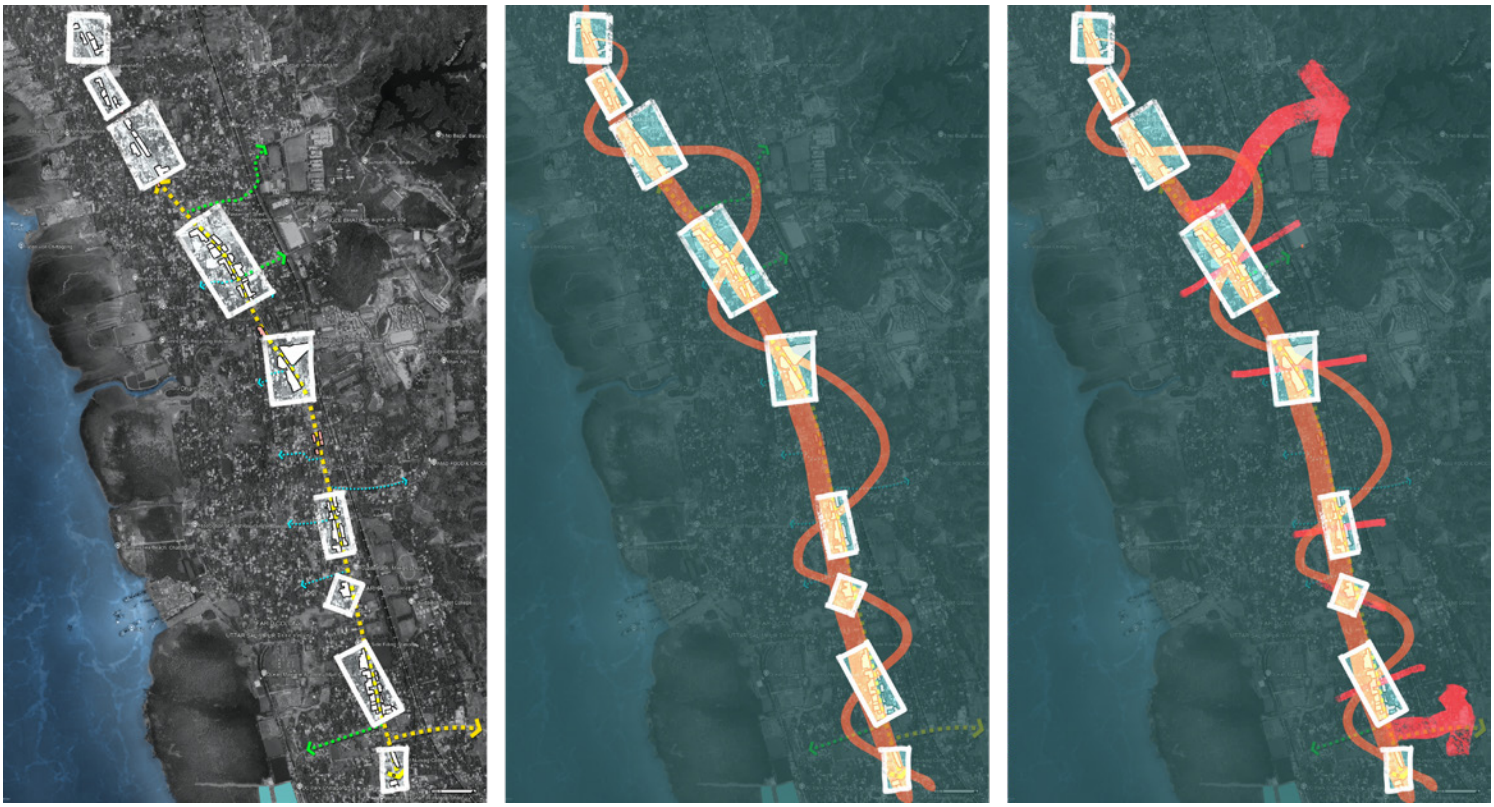


Figure 27_An overview of the marketplace shows fragmented blocks of shops along a central axis.

When viewing the marketplace from a broader perspective, its layout reveals a distinct arrangement of shops organized into separate, disconnected blocks along the main axis. This fragmented design presents both challenges and opportunities for creating a cohe-sive system. My primary concept focuses on transforming these disjointed blocks into an interconnected network by aligning them within a unifying loop that connects directly to the larger urban framework of the city. This loop serves as a vital link, integrating the site with the broader transportation and economic systems, ensuring seamless accessibility for workers, consumers, and visitors.

To achieve this, I propose establishing a central axis for each block, which will act as the structural backbone for organizing the individual shops. This axis will provide spatial or-der to each block while forming the foundation for connections to adjacent blocks. By designing pathways, corridors, or shared public spaces along this axis, we can enhance connectivity between the blocks, turning isolated clusters of shops into a unified market-place. This approach also allows for the preservation of each block's unique identity while creating opportunities for collective growth and interaction.

The concept envisions each block containing multiple shops strategically integrated within the larger network. These blocks will transition from being standalone entities to components of a broader ecosystem where commerce, mobility, and community en-gagement are intertwined. The loop will serve as a dynamic feature, facilitating the flow of goods, people, and ideas while creating a sense of spatial continuity. This integration will not only improve operational efficiency and accessibility but will also strengthen the relationship between the site and the city's economy, fostering a more inclusive and vi-brant marketplace. By unifying the blocks within this looped network, the design aims to create a system that is both functional and transformative, providing a sustainable framework for future growth.

Design Intend

The design strategy for transforming the shipbreaking yard site emphasizes resilience, sustainability, and inclusivity. It incorporates three primary components: skill-building and training for workers, the use of salvaged materials, and community-focused design. Each of these elements aims to address the social, economic, and environmental challenges present at the site.

A key aspect of this strategy is empowering workers through skill-building programs. These initiatives intend to transition workers from hazardous dismantling tasks to value-added roles in construction and craftsmanship. We plan to create dedicated training spaces where modern techniques for handling salvaged materials—such as steel, aluminum, and timber—can be taught. Additionally, innovative practices like modular construction will be introduced. By equipping workers with these skills, we ensure their involvement in meaningful, safe, and economically beneficial activities. This empowerment promotes long-term economic mobility, enabling workers to assume leadership roles and reshape their identities within the industry.

Another crucial component of the design strategy is the use of salvaged materials. Pipes, steel beams, aluminum panels, and timber recovered from decommissioned ships will be repurposed into construction elements, reflecting a commitment to sustainability and environmental stewardship. Beyond repurposing, the strategy explores enhancing these materials with modern technologies, such as incorporating translucent concrete or recycled composites, to improve their performance and aesthetic appeal. This approach not only reduces construction costs but also lessens the environmental footprint by promoting a circular economy. Moreover, relying on vernacular materials preserves the cultural and industrial heritage of the region, anchoring the design in the context of Chattogram's shipbreaking industry.

Equally important is the emphasis on community-centric spaces. The design prioritizes creating public areas that encourage collaboration and inclusivity. Marketplaces, community centers, and social hubs are envisioned as dynamic spaces where workers, residents, and visitors can come together, share ideas, and build relationships. These spaces will reflect the region's cultural identity by incorporating elements of local craftsmanship while also addressing practical needs such as accessibility and adaptability. By fostering a shared sense of ownership, the design reinforces community ties and promotes collective growth.

The overarching goal of this design strategy

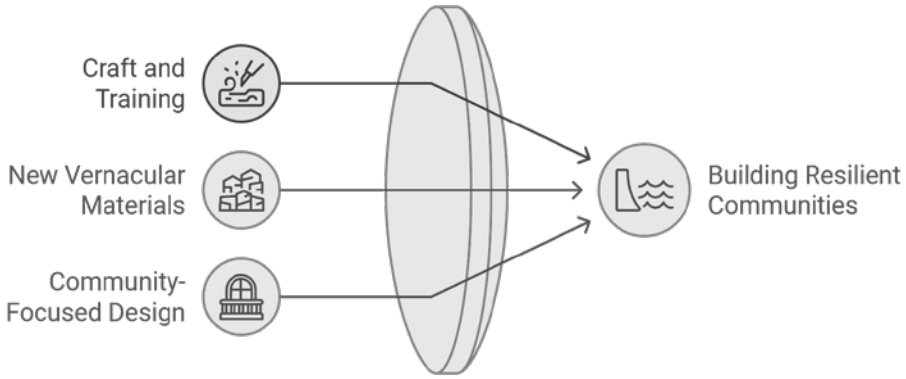


Figure 28_Design Strategy diagram

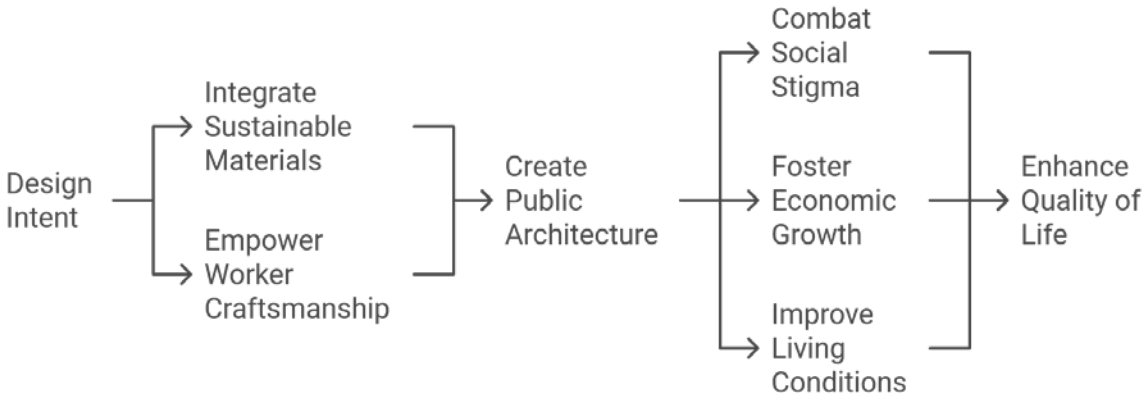


Figure 29_Design Intend diagram

is to transform the fragmented sections of the site into a cohesive, interconnected system that integrates seamlessly with the surrounding city. The scattered blocks of shops along the main axis will be reorganized and linked through a unified framework, creating a smooth flow between different spaces. This strategy not only enhances the functionality of the site but also bridges the gap between the industrial activities of the yard and the social and economic networks of the city. By leveraging the unique conditions of the site, the design aims to combat social stigma, stimulate economic growth, and improve the living conditions of both workers and residents.
Ultimately, the proposed framework seeks to create a resilient and inclusive community. The integration of sustainable materials, the empowerment of skilled craftsmanship, and the development of public spaces work together to redefine the identity of the shipbreaking yard. This transformation challenges existing perceptions of the site, turning it into a symbol of progress, innovation, and sustainability. By addressing immediate challenges while creating opportunities for long-term growth, this design establishes a model for sustainable development that could inspire similar initiatives in other industrial settings.

Total Design consists of two phases: Community Space Design and Market Design.

The Community Space phase involves a functional zoning layout for the community center that integrates various spaces, each specifically designed to meet social, cultural, economic, and wellness needs. This design is aimed at enhancing interaction and functionality.

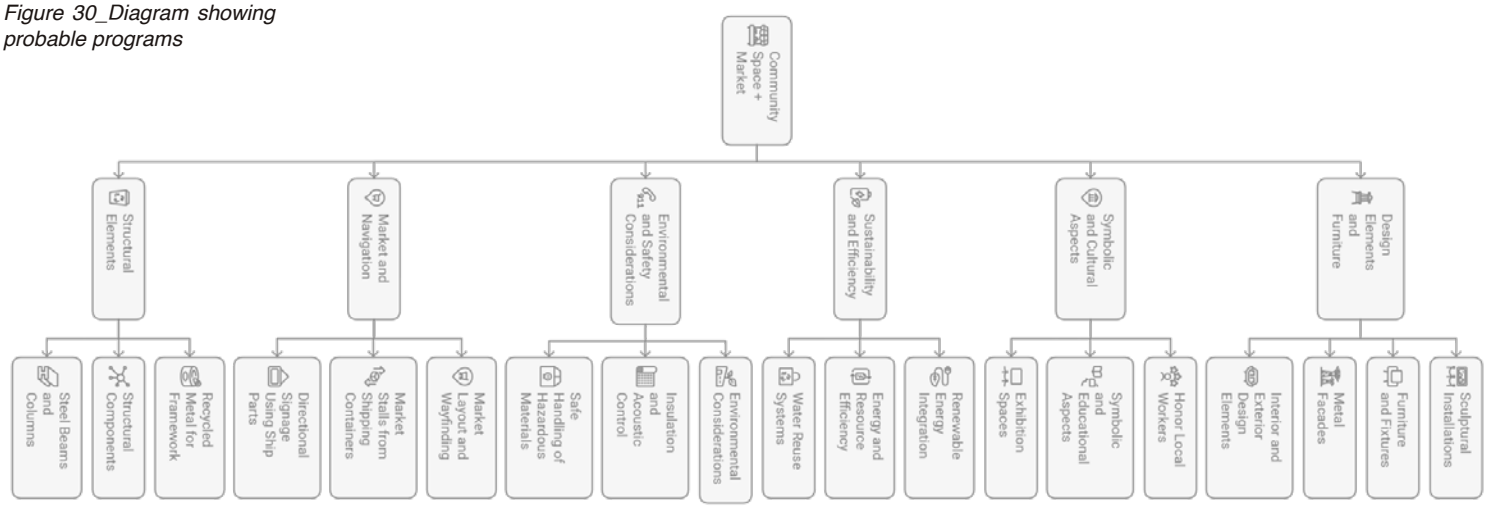
The zoning framework establishes a balanced ecosystem of spaces that interconnect different aspects of community life while prioritizing inclusivity, adaptability, and accessibility.

Programs Development



Figure 30_Comprehensive Community Development Plan

Figure 30_Diagram showing probable programs



For the Community Space after conducting a thorough analysis of all the programs, I have divided the community space function into four essential parts. This strategic division will optimize our operations and ensure that we effectively address each component.

At the core of the design is a cultural and educational space that plays a crucial role in fostering knowledge exchange and preserving cultural heritage. This area is designed to host exhibitions, workshops, classrooms, and libraries, along with outdoor spaces for social interactions. It provides an environment conducive to learning and cultural expression, serving as a hub for intellectual and creative growth within the community.
The creative and social space offers a multi-purpose area that encourages interaction and collaboration among community members. With provisions for outdoor areas, flexible seating arrangements, and opportunities for diverse social engagements, this zone emphasizes adaptability to accommodate various activities. Its goal is to nurture creativity and facilitate dynamic social experiences, reinforcing the communal fabric of the site.
The healthcare and wellness center reflects the design's commitment to addressing the physical and mental well-being of the community. This zone includes facilities such as a fitness center, mental health services, primary healthcare provisions, and relaxation areas. By integrating wellness into the design, the project prioritizes the community's health and well-being, creating a holistic approach to community building.

The administrative and commercial area combines functionality with economic activity, providing spaces like souvenir shops, office

Figure 31_Zoning Diagram

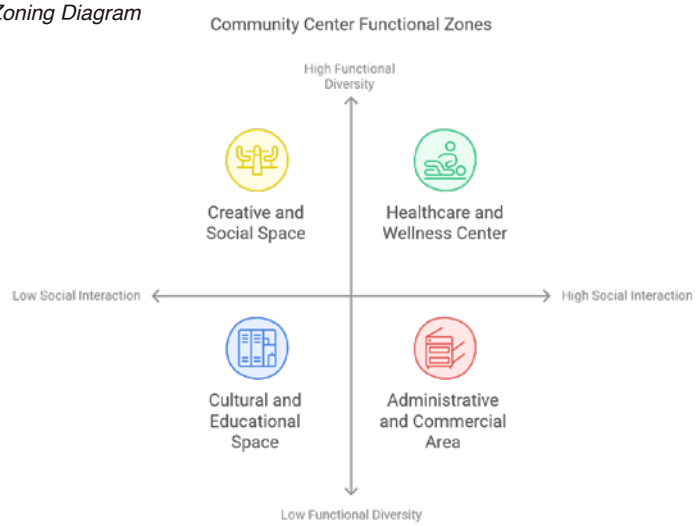




Figure 32_Functions according to zoning

facilities, auditoriums, and logistical support. This zone bridges the gap between administrative efficiency and community interaction, ensuring that economic aspects are seamlessly integrated into the overall design.

Each of these functional zones is strategically positioned within the community center to balance functional diversity with social interaction. The interaction among these spaces is designed to create a network in which high functional diversity complements strong social interaction. This arrangement allows the community center to be a dynamic and inclusive environment that not only meets individual needs but also fosters collective growth and resilience.

This layered approach to zoning enables the community center to be a cohesive yet diverse entity, addressing various aspects of community life while maintaining a strong sense of integration and purpose. Through this framework, the design aims to create a sustainable, functional, and socially vibrant space that reflects the unique identity and aspirations of the community it serves.

Placing at the intersection of the waterbody and road

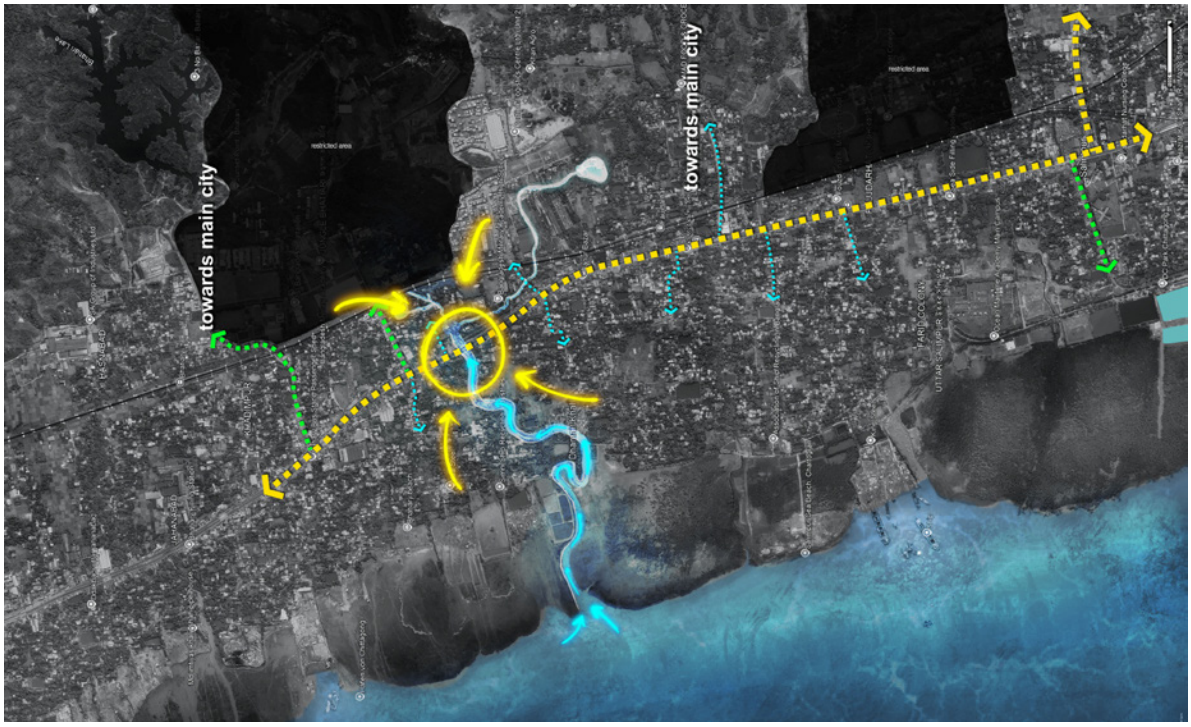


Figure 33_This image highlights the critical point where a road intersects with a waterbody.

Building on the site analysis, this intersection is a critical node in the design framework. The convergence of the main road and waterbody serves as a meeting point for natural and infrastructural elements and links the shipbreaking yard to urban and ecological networks. This node offers a unique opportunity to anchor the community space in a strategic location that maximizes accessibility and visibility.

Positioning the community space here allows it to function as a hub, connecting the waterbody with the main transportation axis. The waterbody adds ecological value, while the road ensures access to Chattogram's urban fabric. Together, they create a spatial dynamic that positions the site as a transformative space for commerce, community interaction, and ecological engagement.

This node leverages the convergence of various movements of goods, people, and materials, embodying industrial, cultural, and social layers of the site. By situating the community space here, the design integrates public architecture, green infrastructure, and modular interventions, making it a vibrant focal point for workers, residents, and visitors.

This strategic placement reinforces the importance of this intersection as a catalyst for site transformation. It addresses community needs while establishing a framework for connectivity, resilience, and sustainable development, linking the site's industrial heritage with socio-ecological revitalization.

Crafting Resilient Communities



Figure 34_Design of Exhibition Space

CHAPTER 04

Masterplan Design

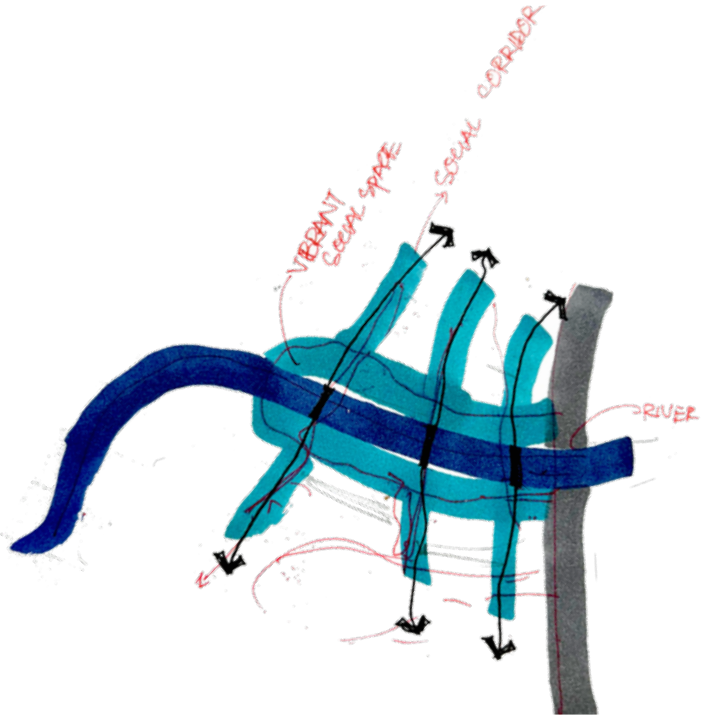


Figure 35_Conceptual Masterplan design on process

Site Strategy and Spatial Organization:

The design process for this project began with an in-depth analysis of the site forces, community behavior, and infrastructural context of the selected area in Chattogram. The first hand-drawn diagram represents this early exploration of natural and man-made influences, mapping out the key vectors that shape human movement, spatial clustering, and ecological flow.

In this diagram, the site is clearly defined by the presence of a highway cutting through its edge and a river forming a natural boundary. The directional arrows indicate major access points, user flow, and visual corridors. Key activity zones—such as gathering spaces, market nodes, and cultural platforms—are loosely identified through overlapping blue forms, which represent the fluid character of community interaction. This stage of design was less about fixed boundaries and more about identifying social energy, environmental edges, and functional potential within the landscape.

Early in the process, I considered distributing the programmatic components on both sides of the highway. However, after multiple iterations and reflection, I decided to consolidate all interventions to one side. This decision was driven by a desire to create a stronger spatial identity, reduce fragmentation, and ensure that the architecture remained legible, navigable, and contextually grounded. Keeping the design on one side of the road allowed me to focus on crafting an integrated civic space that is both protective and porous.

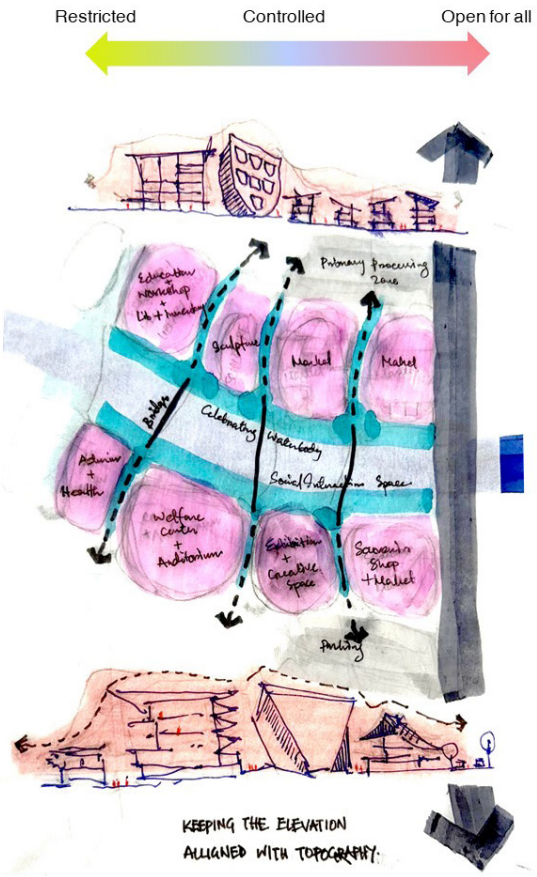


Figure 36_Conceptual Masterplan design on process

Functional Zoning and Programmatic Hierarchy:

This diagram showcases the transformation from conceptual force mapping to a functional zoning strategy. It categorizes spaces based on accessibility, purpose, and user type, moving from restricted (private/institutional) to open (public/market-driven) areas. This gradient of accessibility is represented by a color scale, moving from left to right—restricted (green) to controlled (blue) to open (red). Each programmatic component is carefully placed along this spectrum to create a balance of interaction and autonomy.

At the restricted end, spaces like the education and workshop zone, library, and primary healthcare unit are placed closer to the site edge, ensuring a calm, semi-enclosed environment suitable for focused activity. The central belt, which acts as the spine of the site, includes welfare and administrative spaces, exhibition areas, and creative zones. These are designed as shared community anchors—places of gathering, making, and exchange. Moving further toward the open edge, one encounters the social commons, public seating zones, and the market—spaces that invite informal interaction, commerce, and daily activity.

The sectional elevation sketch at the bottom of the diagram illustrates how the built form is carefully integrated with the site's existing topography. Rather than flattening or ignoring the landscape, the architecture steps with the slope, allowing buildings to emerge gently from the ground. This maintains visual continuity and allows accessibility for different user groups, including children, elderly, and workers.

Design Ethos and Reflection:

Throughout this process, my design was guided by three core principles,

Community-built: involving people and their local knowledge in shaping space

Craft-forward: celebrating the use of salvaged materials and vernacular skills

Memory-conscious: ensuring that architecture carries the narrative of labor, resilience, and renewal

These diagrams were not merely technical studies but tools for reflection, helping me understand how architectural form can emerge from a deep reading of place, people, and purpose. They represent the ideological backbone of a project that seeks not only to serve, but to elevate and honor a community too often overlooked.

Programmatic Space Allocation

The diagram above illustrates the estimated spatial requirements for the key functional zones within the proposed master plan. Each vertical volume represents a distinct programmatic component, labeled with both its allocated square footage and its target user capacity. Together, these programs form the foundation of a socially responsive and community-oriented architectural intervention. The total estimated built-up area ranges between 52,500 to 95,500 square feet, allowing flexibility for spatial expansion or densification based on budget, phasing, and future demand.

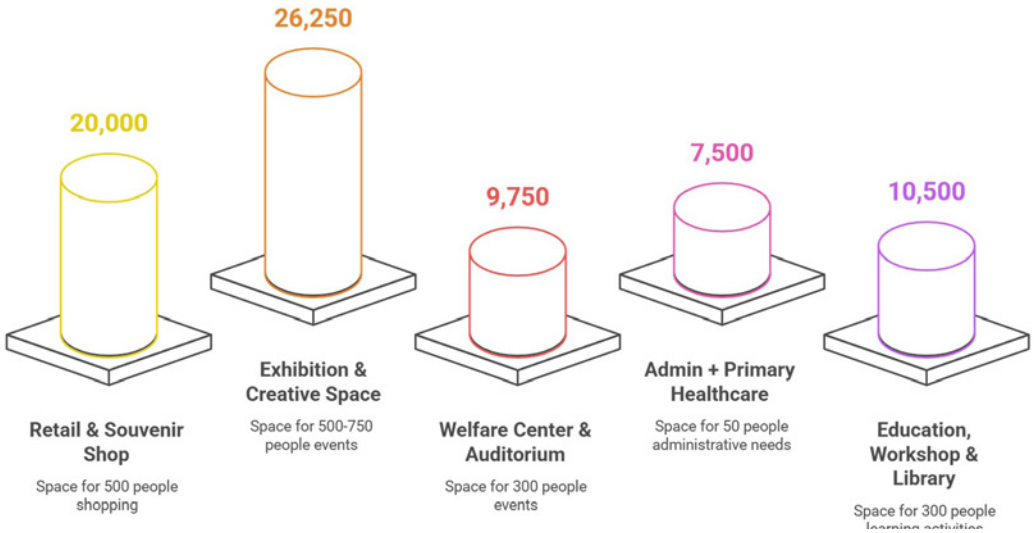


Figure 37_Diagram of Programmatic Space Allocation

Retail & Souvenir Shop (20,000 sq. ft.) Designed to accommodate up to 500 people, this space supports local craft economies and cultural exchange. It serves as a public-facing node, integrating commerce with storytelling.

Exhibition & Creative Space (26,250 sq. ft.) Intended for 500 to 750 people in large events or rotating showcases, this zone merges art, culture, and upcycled architectural exploration. It is the largest programmed area due to its flexible, open spatial needs.

Welfare Center & Auditorium (9,750 sq. ft.) With capacity for 300 people, this space supports health workshops, public addresses, community gatherings, and awareness campaigns—positioned as a heart of civic engagement.

Admin + Primary Healthcare (7,500 sq. ft.) Serving up to 50 people at a time, this area hosts administrative functions, record keeping, and offers first-line health services, particularly for workers and families in need of immediate care.

Education, Workshop & Library (10,500 sq. ft.) Targeted toward 300 users, this program fosters skill-building, intergenerational learning, and literacy through formal and informal educational activities.

The varying heights of the cylinders visually express the proportional space assigned to each function, creating a quick comparative view of how the program is spatially distributed based on use intensity, occupancy, and spatial demands.



Figure 38_Masterplan evolving with the site forces, focusing on the refinement of urban form, circulation paths, and the emergence of active public nodes within the architectural fabric.

In figure 37 presents the evolution of the master plan, focusing on the refinement of urban form, circulation paths, and the emergence of active public nodes within the architectural fabric. These four progressive layers demonstrate a clear transition from conceptual massing to a highly responsive, pedestrian-oriented layout.

The first image captures the early stage of form generation, where primary building blocks are loosely arranged around the canal. This preliminary massing tests spatial enclosure and basic relationships between built form and the natural water edge. The geometry at this point is exploratory, helping to define the urban grain and edge conditions.

In the second phase, the building forms are further refined into more defined clusters, creating distinct courtyards, alleyways, and edges. This iteration begins to respond to topography, existing site flows, and human-scale spatial rhythms. The layout becomes more porous, hinting at interior-exterior gradients and framed public spaces.

Primary and secondary circulation routes are overlaid in red, demonstrating the connectivity and movement logic of the site. The bold lines represent major pedestrian axes, while circular red markers indicate key gathering nodes—likely intersections, plazas, or shared communal areas. This diagram clarifies how people will navigate the site and how spaces are stitched together through intuitive, walkable pathways.

The final diagram introduces shaded zones that represent activated public edges and interactive thresholds. These yellow-highlighted areas indicate spaces of overlap between buildings and circulation, often designed for markets, seating, workshops, or informal gathering. The strategic positioning of red paths and nodes ensures a looped, continuous flow, reinforcing community engagement and accessibility across the site. This plan shows a well-integrated spatial system that supports both movement and lingering.

Figure 39_Masterplan Zoning



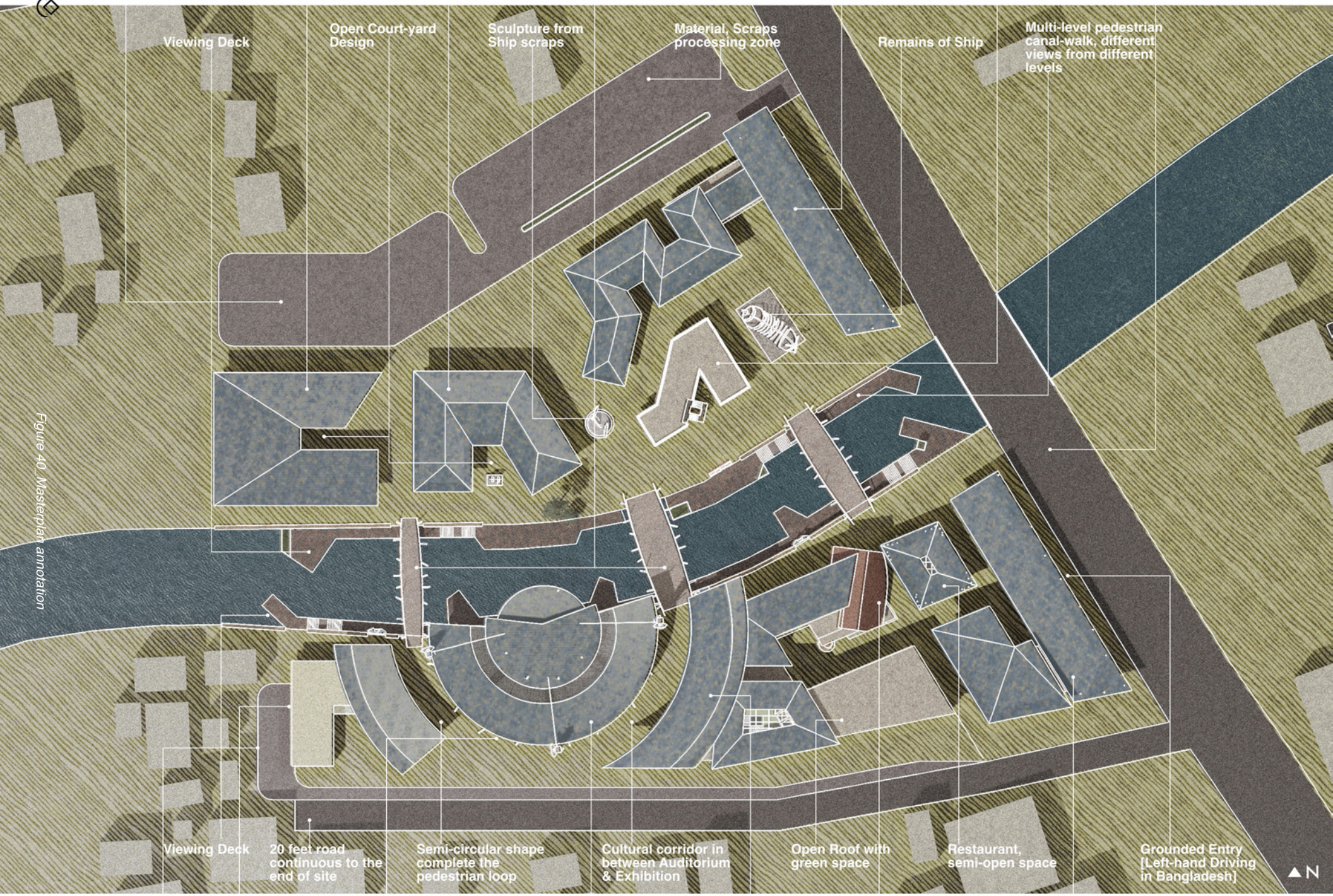


Figure 40_Masterplan annotation

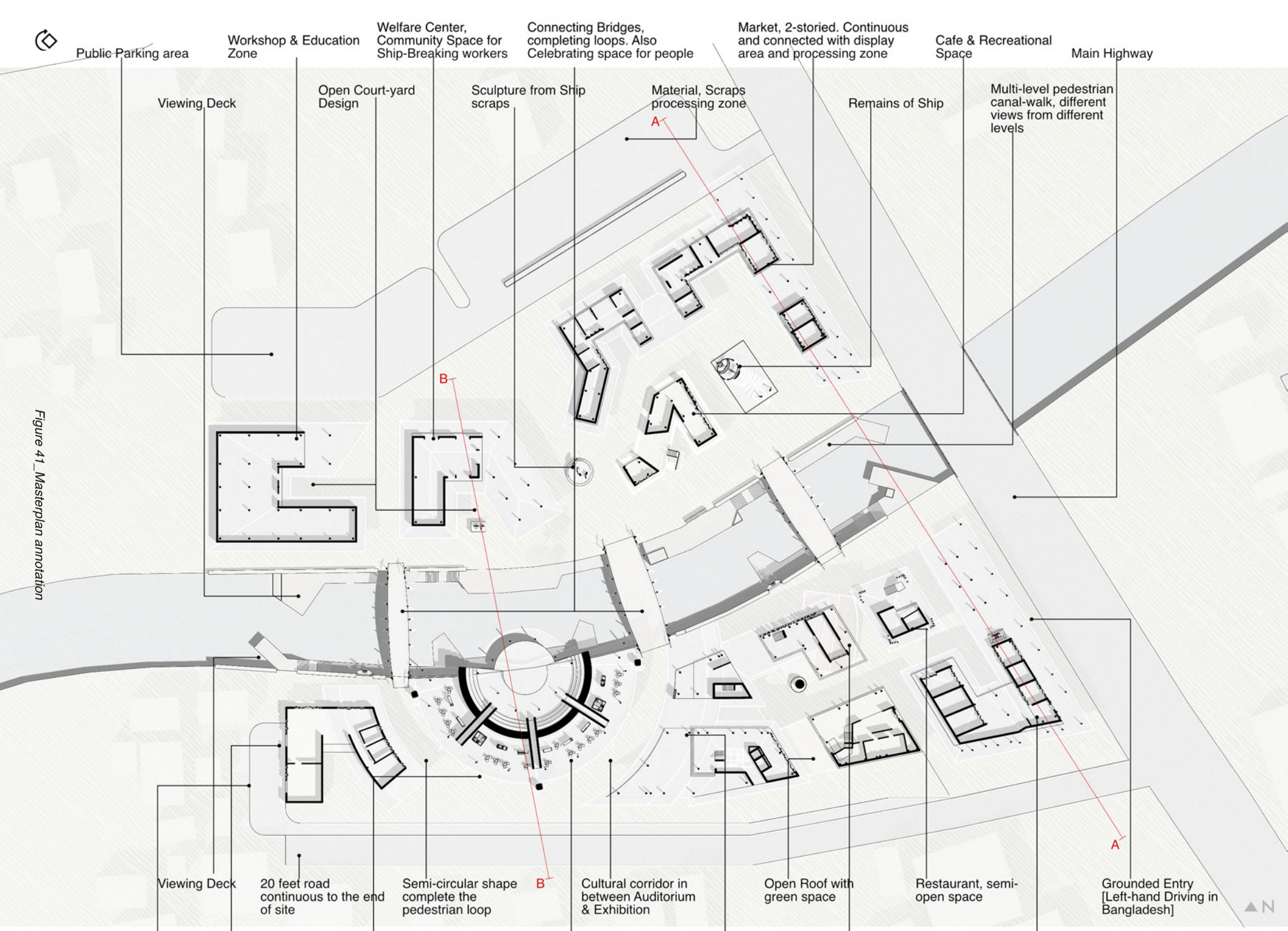


Figure 41_Masterplan annotation

Translating Vernacular Spirit into New Architectural Language

These images capture more than just local infrastructure. They depict an architecture of necessity, creativity, and deep cultural resonance. The bamboo bridges, built by communities using the most basic materials and simplest joinery, are expressions of collective ingenuity. As children run across them or leap into the water below, these structures become not only connectors across rivers but also platforms for life, joy, and memory.

This bridge typology became a conceptual backbone for my project. I interpreted its basic geometric logic and structural clarity into a new





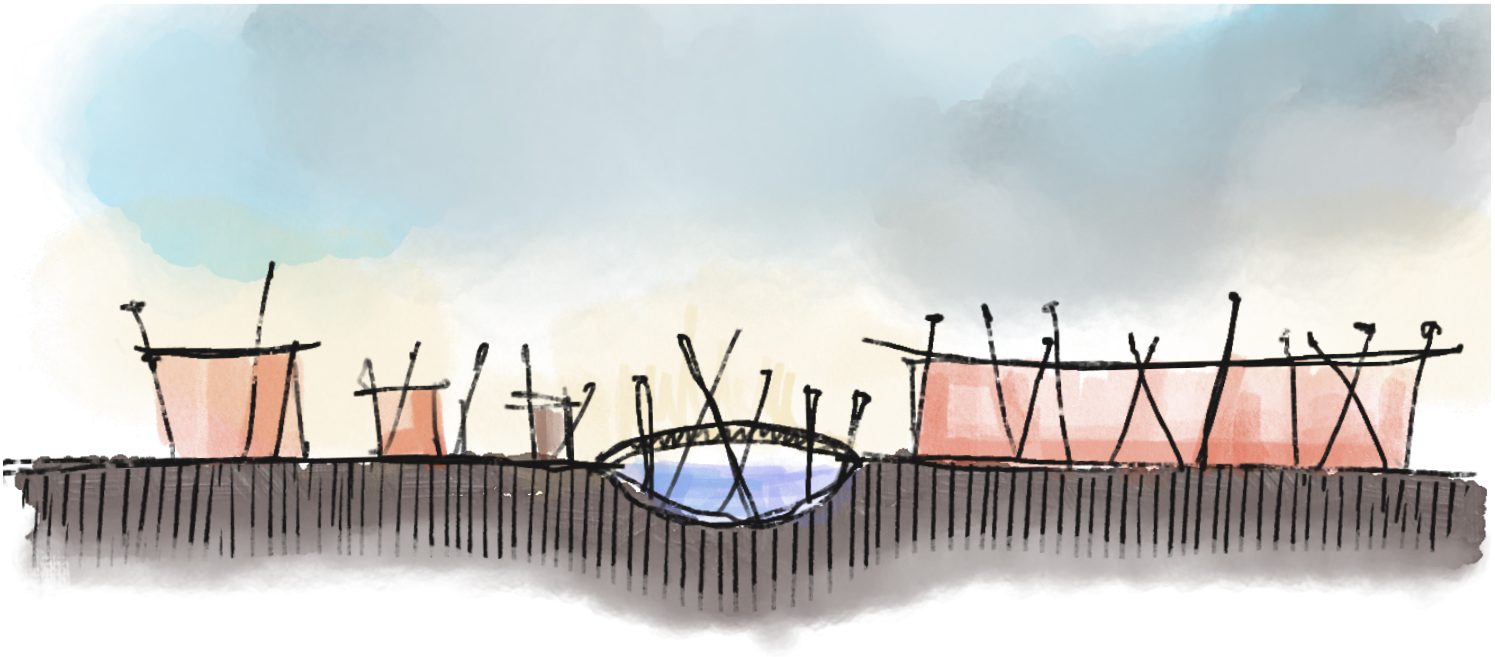


Figure 42_Learning from Bamboo Bridges: Translating Vernacular Spirit into New Architectural Language

What fascinates me most is their sense of lightness, rhythm, and adaptability. Each pole is placed not with precision, but with intuition. They are structurally sound, yet utterly unpretentious. These are not designed for permanence, but they endure through relevance.

In my design, I have attempted to carry forward this essence. While my materials such as salvaged steel and repurposed ship parts are different, the intent remains the same—to build something simple, modular, and grounded vernacular language that responds to today's material conditions. Rather than imposing complexity, I chose to embrace simplicity, crafting a spatial system that reflects both tradition and the possibility for transformation.

Topographic Expression through Architectural Form

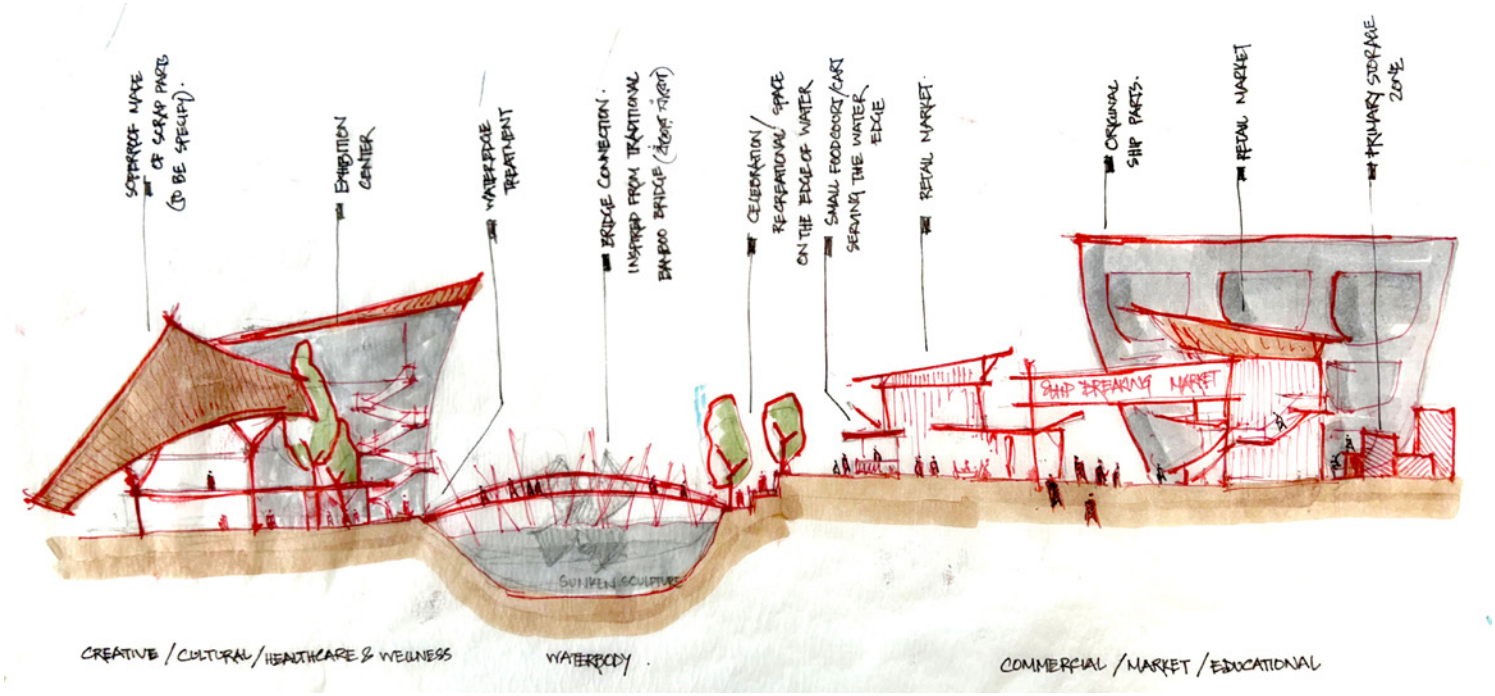


Figure 35_Conceptual section

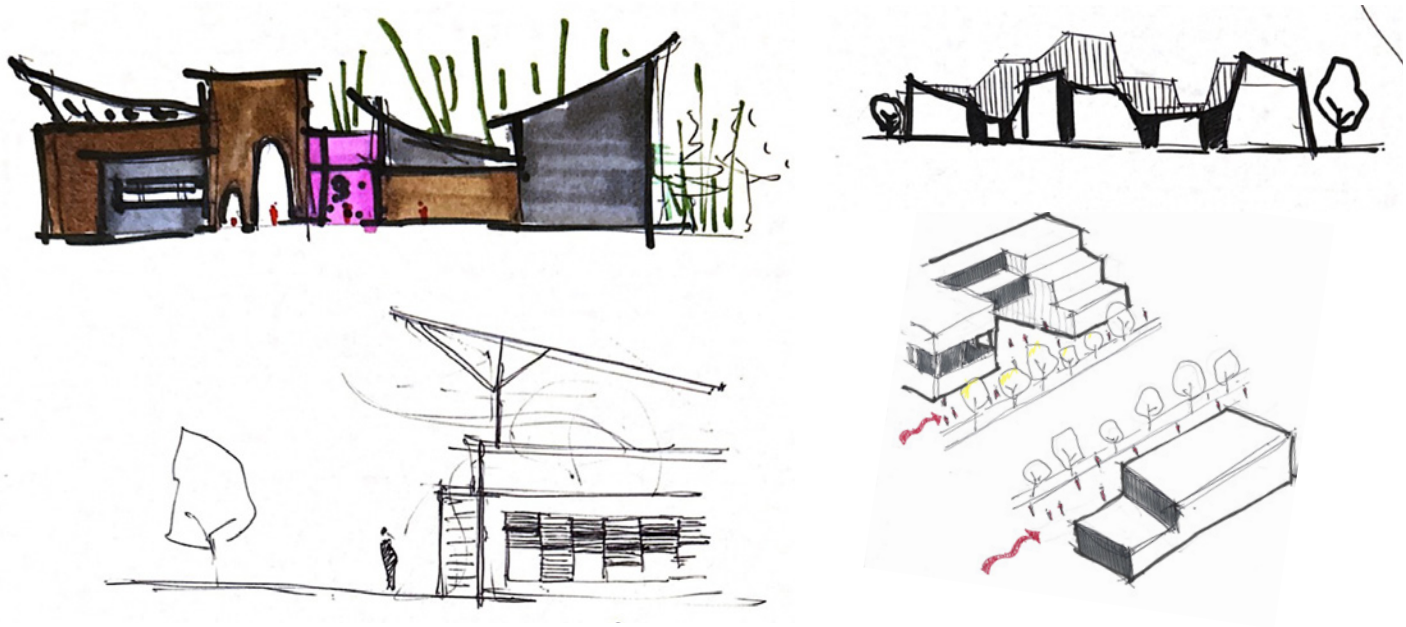


Figure 43_Some concept generation drawing

The conceptual elevation illustrated above draws direct inspiration from the undulating terrain and layered geography of Chattogram. Rather than imposing a uniform skyline, the project embraces a staggered architectural rhythm, where each structure rises and falls in dialogue with the surrounding landscape. The varying rooflines, building heights, and angular profiles evoke the natural contour of the hills, creating a built environment that feels embedded in its context rather than imposed upon it. This vertical articulation is not merely formal—it is experiential. As users move through the site, the changing elevation reveals new spatial relationships, shaded thresholds, framed views, and moments of compression and release. These height variations help to organize the program into zones of activity and calm, reflecting the complexity and texture of the local environment. Just as the hills of Chattogram unfold in layers, this architectural composition creates a topographic language of space, rooted in place and memory.

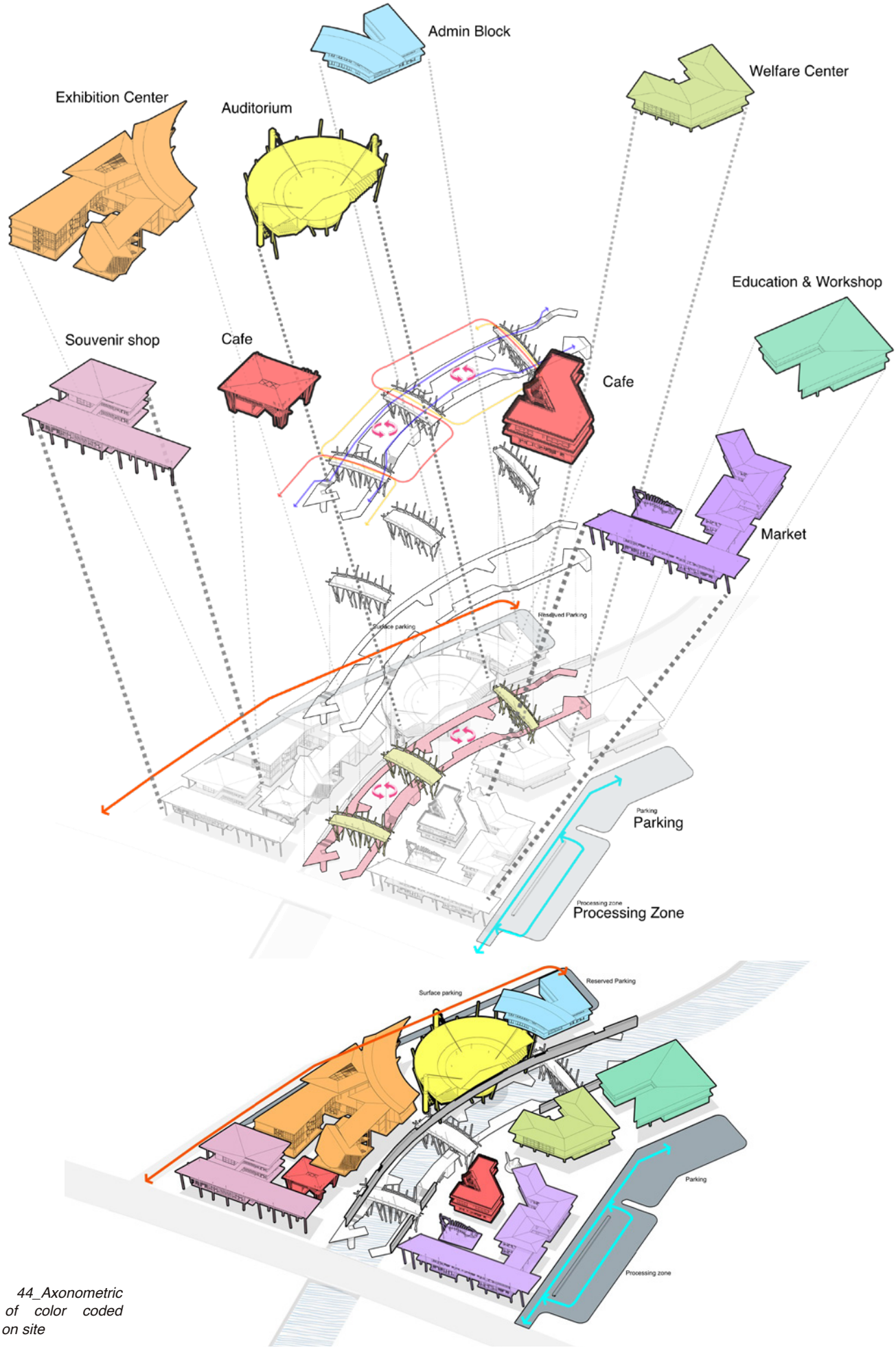


Figure 44_Axonometric diagram of color coded programs on site

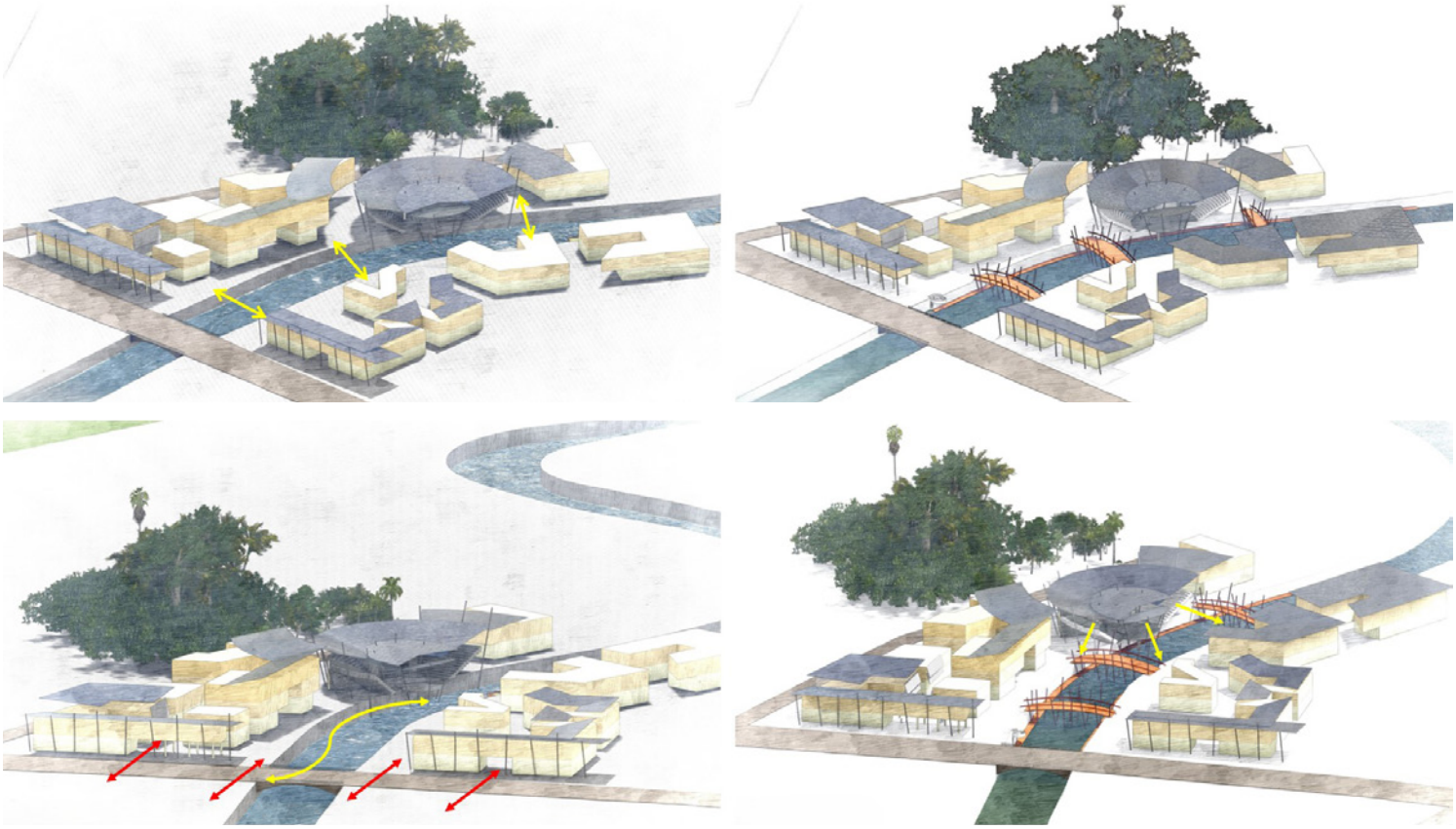
Establishing Spatial Connections and Looping Through Bridges

The series of perspective diagrams above illustrates the strategic layering of architectural form and spatial connectivity through three-dimensional design. At the heart of this approach is the canal, a linear void that transforms into a central organizing spine, around which the site's key programs are arranged. Rather than allowing the water to act as a boundary, the design leverages it as a unifying feature by integrating a series of lightweight pedestrian bridges, inspired by vernacular bamboo crossings.

These bridges do more than provide access, they create loops of circulation, ensuring that movement across the site is fluid, continuous, and engaging. The multiple access points and visual corridors link the market zone, exhibition space, welfare center, and educational blocks, enabling users to experience the project as an interconnected network rather than isolated buildings.

Through elevation changes, transparent spans, and angled views, the bridges introduce a dynamic spatial rhythm, making the movement through space not just practical but experiential. This looped circulation strategy reinforces inclusivity, encourages exploration, and reflects the collective nature of the community it serves.

Figure 45_ Establishing Spatial Connections and Looping Through Bridges



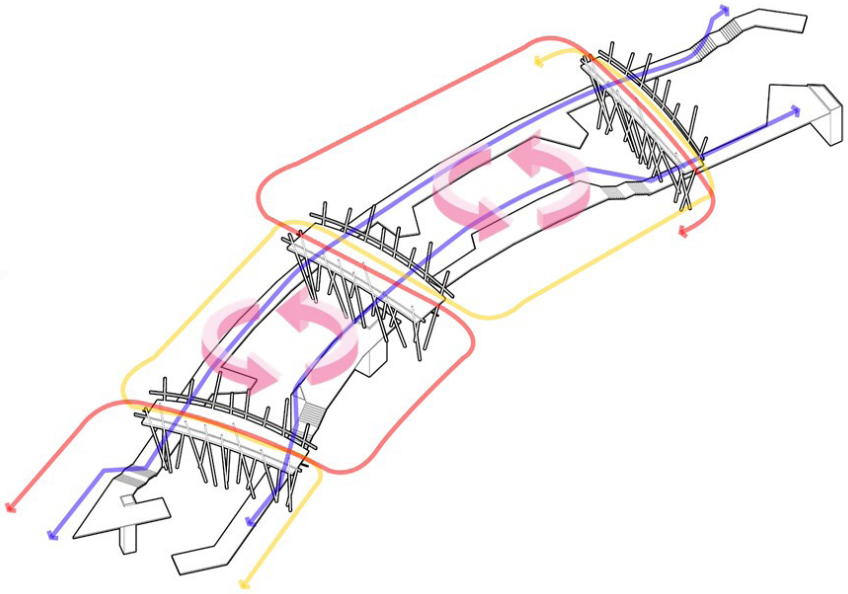


Figure 46_Creating multiple options for pedestrian pathways

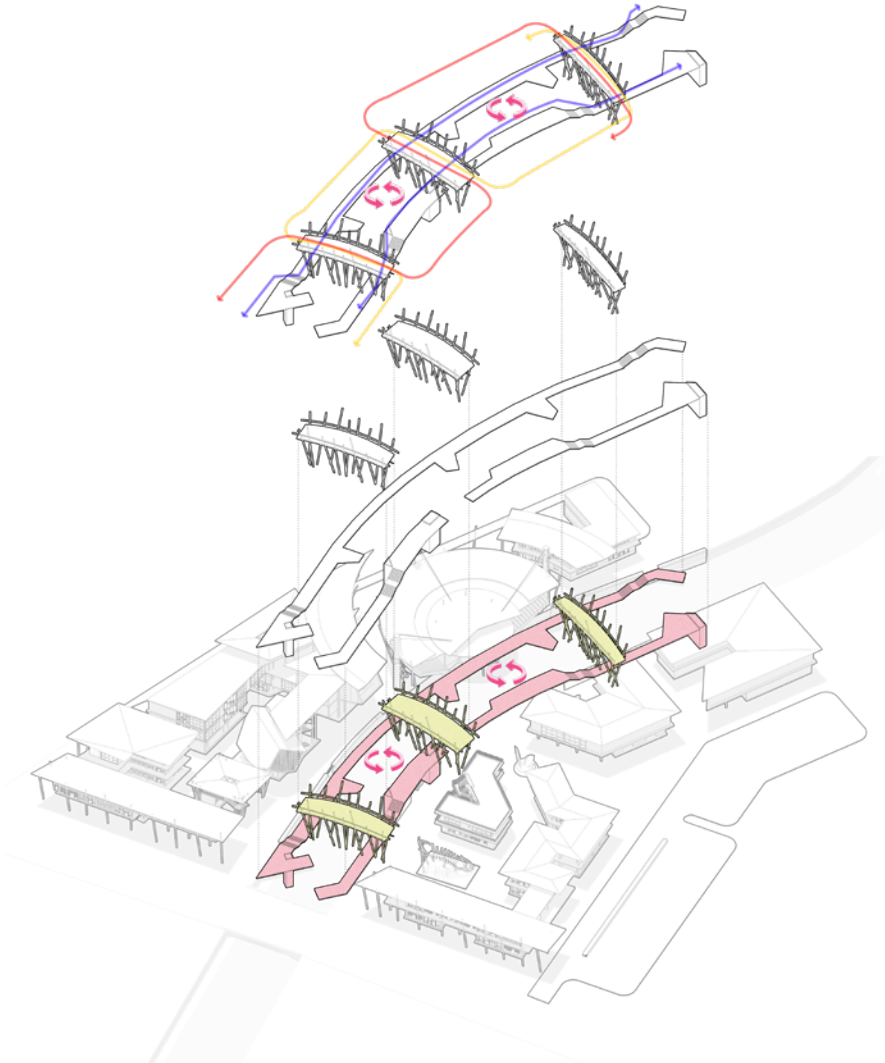


Figure 47_Relationship between canal walk and bridge. Establishing an urban ritual around the bridge and place of celebration.



Figure 48_ Axonometric view of Designed Complex

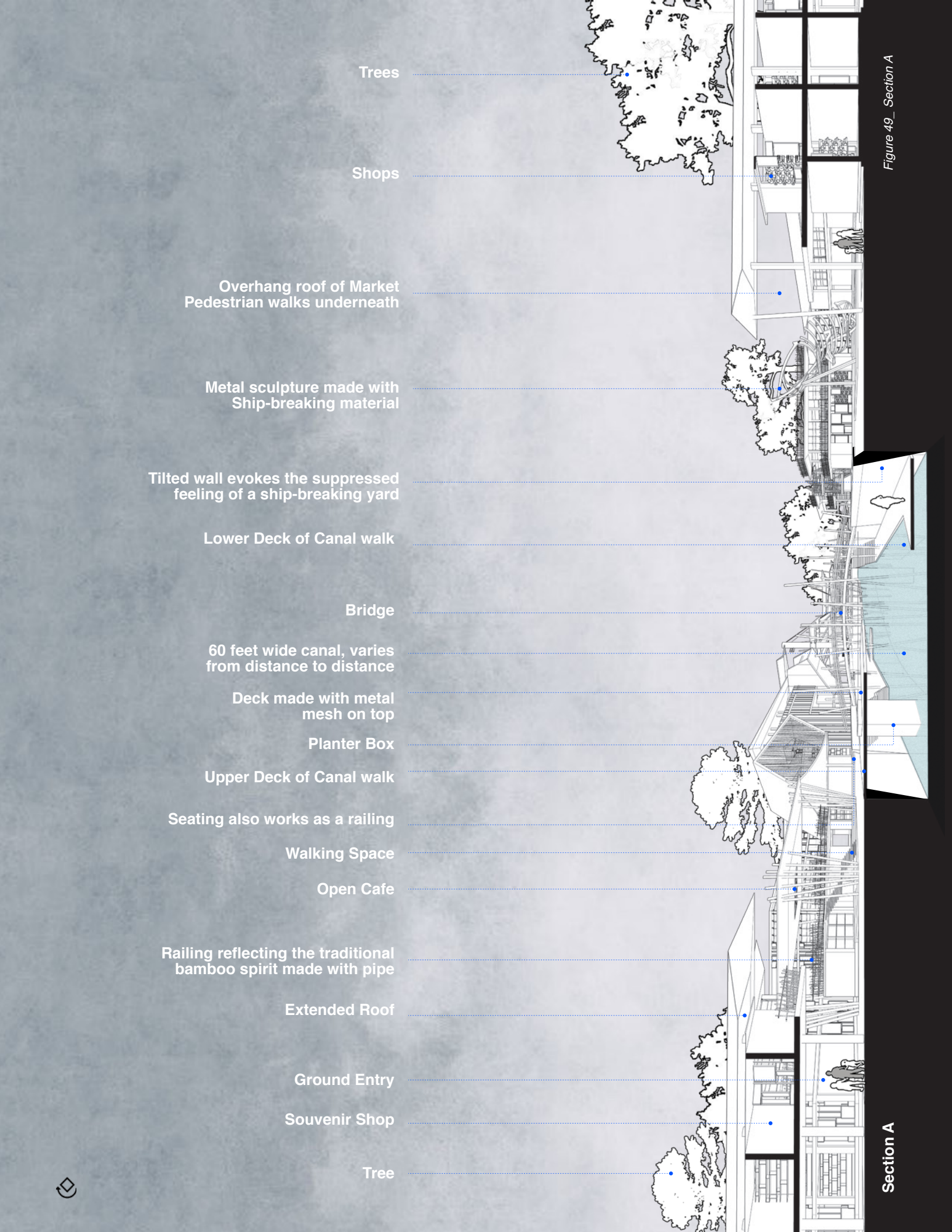


Figure 49_ Section A

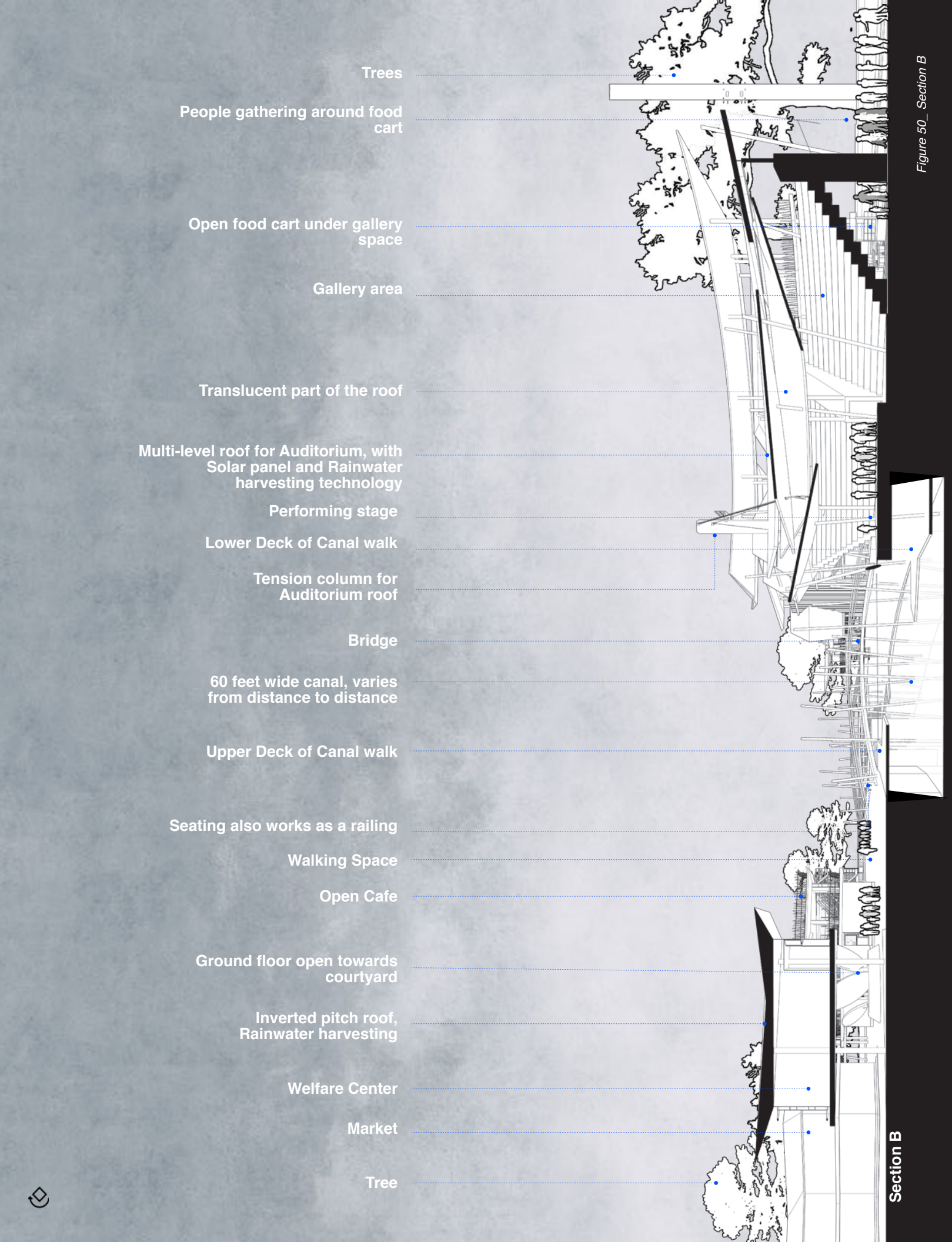


Figure 50_ Section B

Marketplace Design

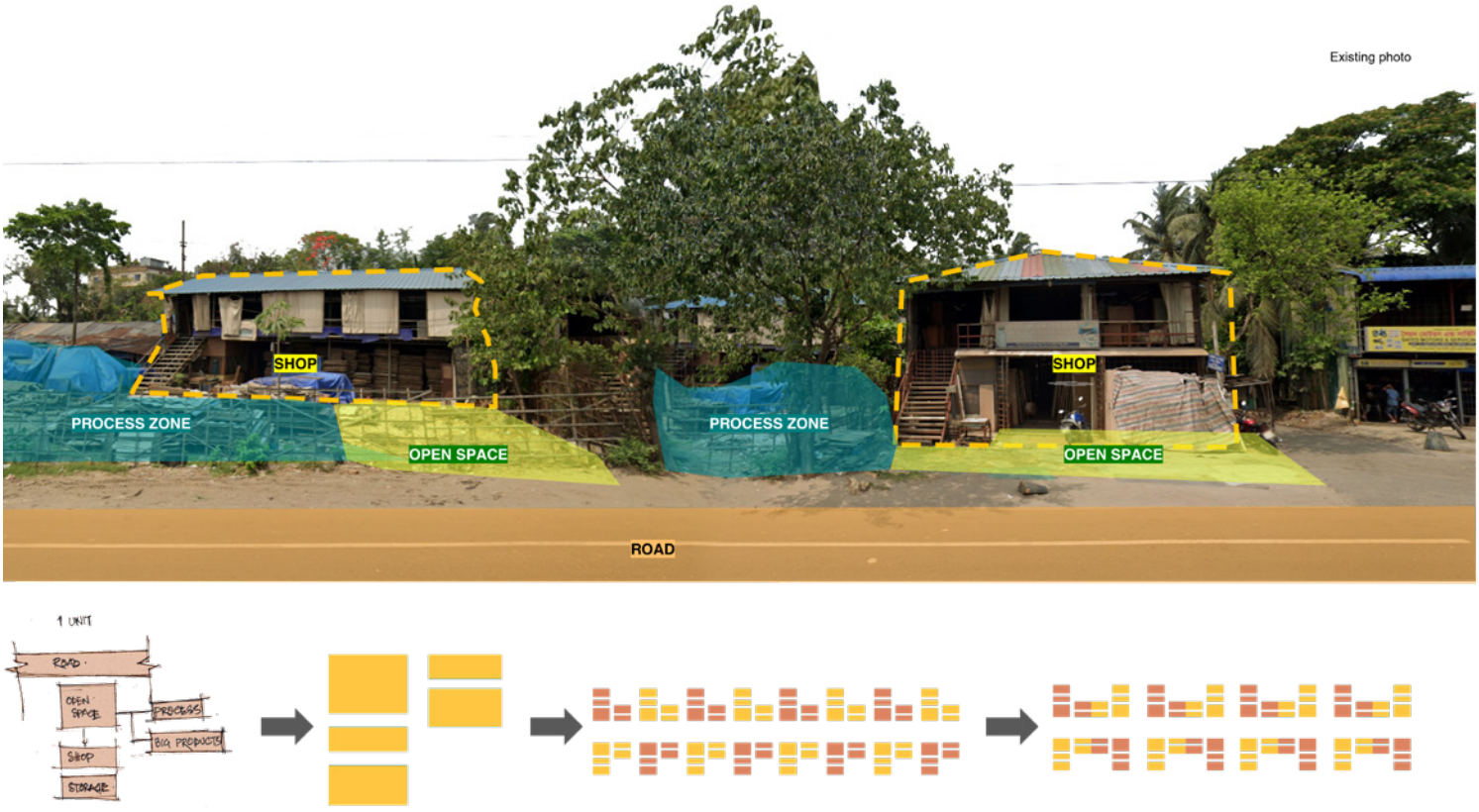


Figure 51_Analyzed market pattern along the roadside showing the division of spaces into five functional zones: open space, shop, storage, processing zone, and big product display. This study informs a modular reconfiguration to improve functionality, efficiency, and user experience in the marketplace

The current setup of shops and markets along the road reflects the vital needs of our community, often with an organic yet fragmented feel. These market units can be divided into five zones: open spaces, shops, storage areas, processing zones, and large product displays. Each zone serves a key purpose, but there's an opportunity to enhance their arrangement for improved efficiency and experience for all.

The open spaces at the front serve as welcoming transitions between the road and shops, ideal for gatherings, initial customer interactions, or showcasing smaller items. Behind these areas, the shops act as commercial hubs for lively transactions. Storage zones behind the shops keep materials organized, maintaining a clutter-free environment. Processing zones are essential for repairs or product preparation, while large display areas provide room for showcasing bigger items, often extending into appealing open spaces.

Assessing this arrangement reveals inefficiencies like overlapping functions and underutilized spaces. By reorganizing these areas, a thoughtful redesign could define each zone's purpose, maximizing flow and usability. By modularizing these units along the roadside, we can create a cohesive marketplace that meets the needs of both vendors and customers.

This reconfiguration enhances market functionality and lays a foundation for future development sensitive to our community's evolving needs. A flexible modular pattern allows for easy adaptation, ensuring the market remains responsive while fostering order and identity. This approach also paves the way for infrastructure improvements, like shaded walkways, drainage systems, and better storage facilities, enhancing the overall experience in our vibrant marketplace.

Form generation

The form generation process shown above starts with a basic block, which is then strategically carved out to create open spaces, such as courtyards, within the mass. These open spaces introduce opportunities for natural light, ventilation, and circulation within the structure. The subsequent iterations explore breaking the mass further into smaller interconnected units, creating axial relationships and directional flows. This step emphasizes accessibility and ensures spatial hierarchy. The resulting modular design incorporates layers of interaction—allowing for functional flexibility while ensuring harmony with the surrounding context. The modular units are further adjusted to align with pathways, courtyards, and movement flows, which integrate seamlessly into the site's natural and urban axes. This iterative process embodies a blend of adaptive reuse, cultural relevance, and functional efficiency, laying the foundation for a dynamic and inclusive architectural intervention.

Figure 52_Market Place Space & Form generation

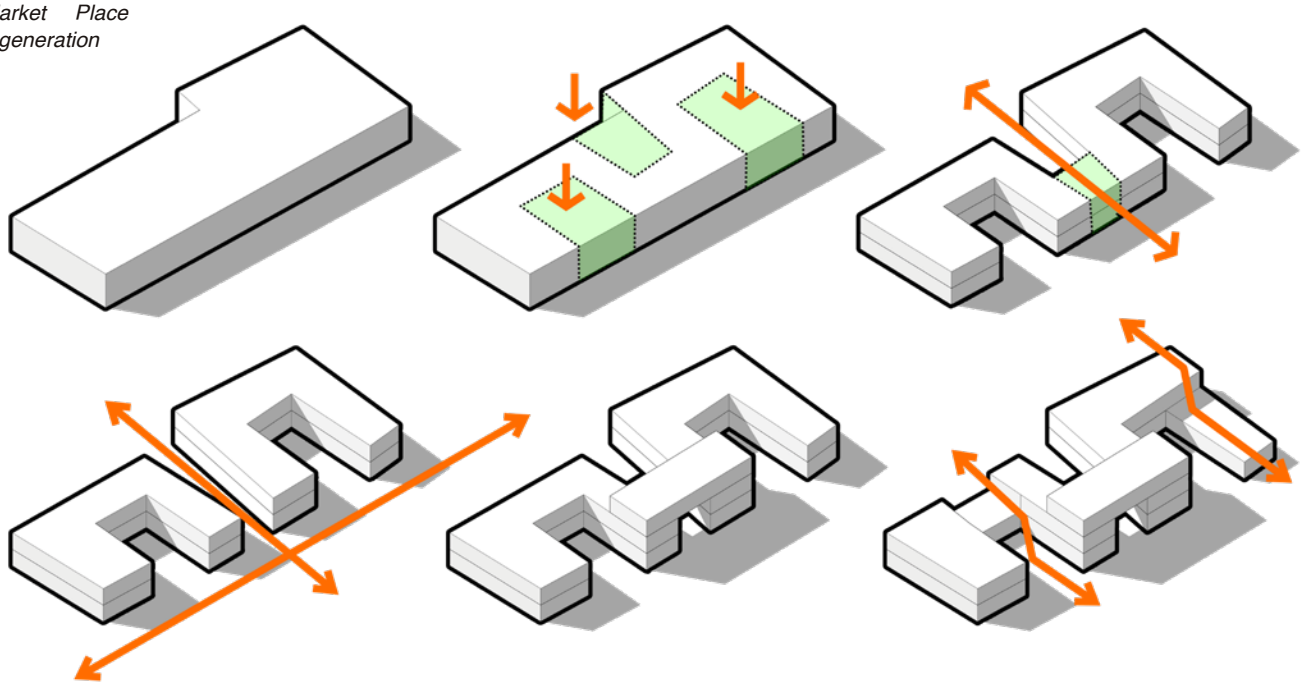
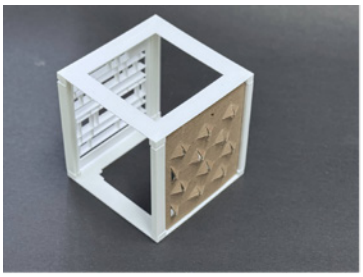
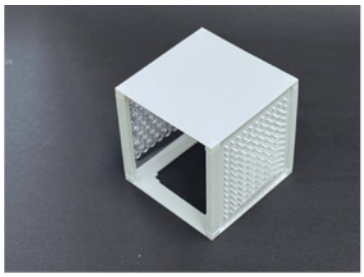


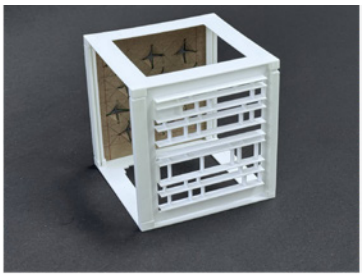
Figure 53_Study model of experimenting with multiple facade treatments in a modular box, where all walls, roof, and ceiling can be changed accordingly. Different materials and techniques are also used to gain a better understanding of the new vernacular.



2D Perforation



Cylindrical shape study



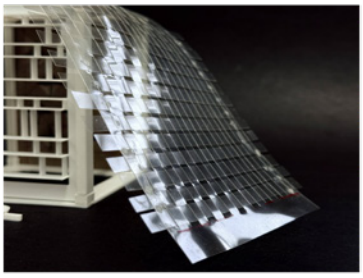
Plates and linear study



Study models



Scalable element study



Weaving Techniques

Contextual Adaptation in Design

Designing for resilience within the context of Chattogram's shipbreaking yard entails the creation of spaces and systems that dynamically respond to environmental, social, and economic challenges. In this framework, resilience encompasses more than just structural durability; it also involves adaptability, sustainability, and the ability to enhance community well-being over time. This approach utilizes salvaged materials, modular construction techniques, and participatory design processes to develop architecture that evolves in accordance with the needs of its users while effectively addressing the region's inherent challenges.

Adapting to Environmental Conditions

The shipbreaking yard operates within a challenging climatic environment characterized by high humidity, heavy rainfall, and a significant risk of flooding, necessitating the implementation of resilient architectural design solutions that mitigate these environmental vulnerabilities while enhancing durability. Strategies such as flood-resilient structures, which utilize raised platforms or stilted constructions made from salvaged steel beams, can effectively protect spaces from waterlogging during monsoon seasons. Additionally, passive design approaches that incorporate large openings and cross-ventilation, alongside salvaged materials like perforated steel panels, contribute to maintaining thermal comfort without dependence on energy-intensive systems. Furthermore, the integration of green buffers, including planted areas surrounding community structures, serves to counteract the environmental degradation associated with shipbreaking activities while improving overall air and water quality.

Flexible and Modular Design

Modularity is a cornerstone of resilient design in this context. Salvaged materials from the shipbreaking yard, such as steel plates and aluminum panels, naturally lend themselves to

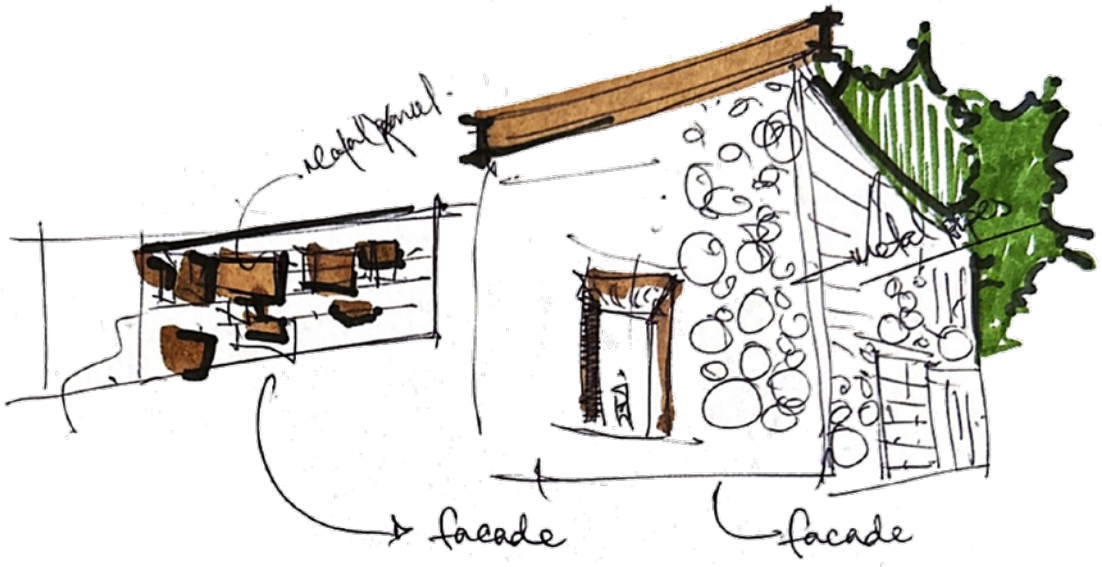


Figure 54_Conceptual sketch for a facade using new vernacular materials

modular construction. These components can be prefabricated and assembled into scalable units that adapt to varying needs, including:

Community Centers: Spaces that can expand or reconfigure to serve as classrooms, healthcare facilities, or cultural hubs.

Housing Solutions: Modular homes designed with salvaged materials can accommodate changing family sizes or evolving community demands.

Marketplaces: Flexible layouts with movable stalls and open courtyards can adjust to different vendor requirements or seasonal activities.
The modular approach ensures that these spaces remain functional and relevant, even as the surrounding community grows or changes.

Kinetic and Responsive Architecture
Resilient design includes elements of kinetic architecture, which refers to structures that can move or adapt to changing external conditions. Salvaged materials, like steel panels and beams, can be repurposed to create dynamic façades or movable partitions. These features enable buildings to respond effectively to environmental factors such as sunlight, ventilation, and temperature. Here are a couple of key components:
Movable Façades: Panels that adjust to control light and airflow, enhancing both energy efficiency and user comfort.
Dynamic Shelters: Modular units that can transform into shaded areas or enclosed spaces depending on weather conditions.
This kinetic approach not only improves the functional resilience of buildings but also promotes innovative and user-centered design.

Social and Economic Resilience
Resilient design must address not only environmental challenges but also the socio-economic realities of shipbreaking yards. The architectural interventions proposed in this framework aim to foster resilience by empowering workers and supporting the local economy:
Empowering Workers: Involving workers in the construction and maintenance of modular structures creates opportunities for skill development and economic mobility. Training programs integrated into community centers can teach workers how to process salvaged materials, allowing them to become valuable contributors to the design process.
Strengthening Local Economies: Marketplaces constructed with salvaged materials can support small-scale entrepreneurs and create new economic opportunities. The flexibility of these spaces ensures they can host a variety of activities, from markets to cultural events, effectively integrating them into the social fabric of the community.

Facade study using salvaged materials

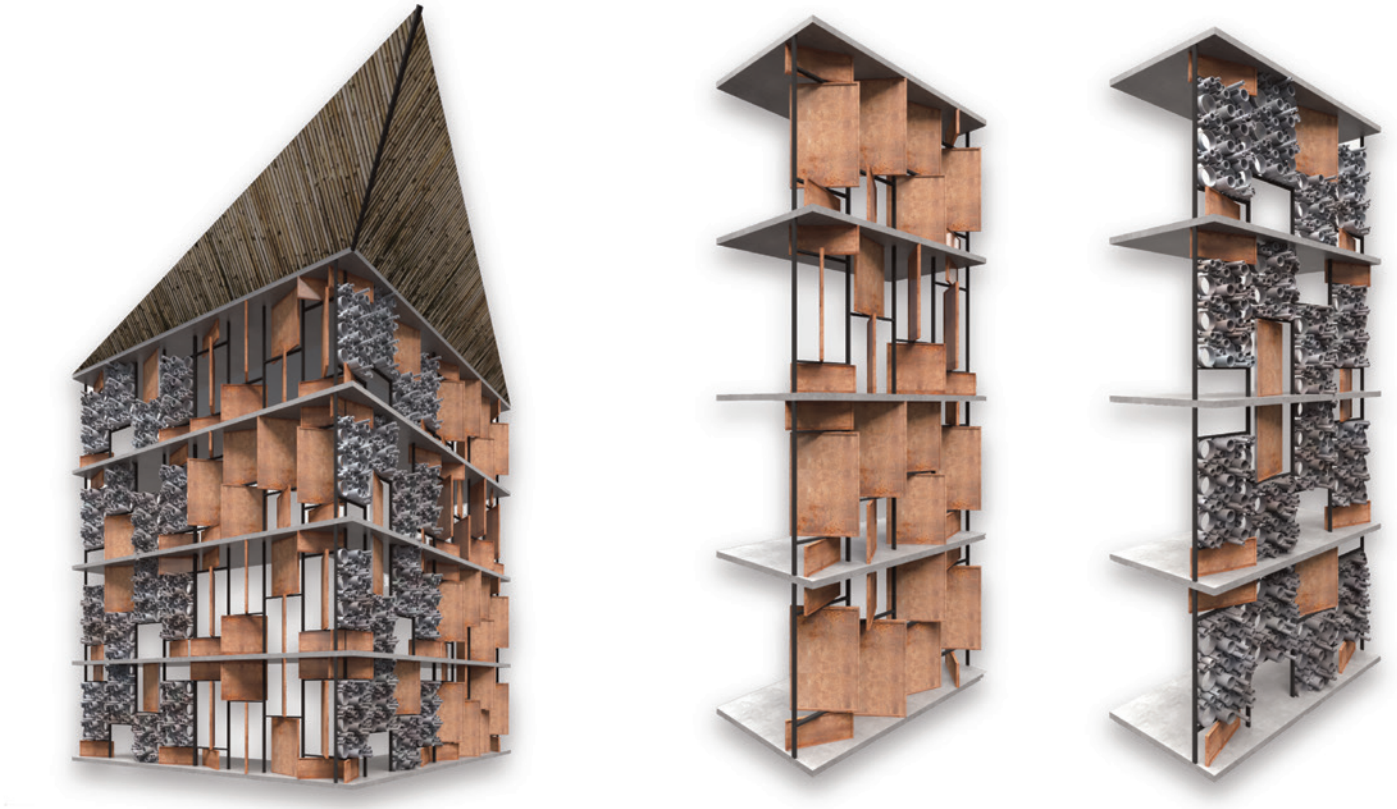


Figure 55_acade design utilizing salvaged pipes and metal scraps from the shipbreaking yard, blending sustainable reuse with local craftsmanship to create a dynamic and contextually rooted architectural identity.

The facade studies investigate the potential of repurposing materials salvaged from shipbreaking yards, including metal pipes and scraps, to craft a sustainable and contextually relevant architectural expression. By integrating these materials into the facade design, the project not only underscores the importance of adaptive reuse but also weaves the visual narrative of the site's industrial heritage into the architectural language.

The design process emphasizes the modularity and scalability of these materials, ensuring both structural efficiency and ease of assembly. The layered arrangement of metal scraps and pipes creates a dynamic facade that offers shading, ventilation, and a distinct aesthetic character, all while minimizing construction costs and environmental impact. Furthermore, this approach fosters a connection between the building's users and local craft traditions, as community workers and artisans participate in the assembly and detailing of the facade.

The integration of traditional roof structures with the innovative use of salvaged materials produces a juxtaposition that links the vernacular with the contemporary. This design not only functions as a sustainable architectural solution but also serves as a testament to community empowerment, illustrating how industrial remnants can be transformed into meaningful and functional design elements.

Figure 56_Market Section, use of spaces





Figure 57 Axonometric view of MarketPlace



Figure 58_Entrance through souvenir Shop



Figure 59_Entrance through souvenir Shop

Exhibition and Creative Space Anchoring Memory and Identity

Form Development from Site Forces and Visual Connection

The exhibition space, highlighted in the plan, is a pivotal architectural element designed in response to site-specific forces. Its form was shaped by the surrounding landscape—especially to preserve key views toward the shipbreaking yard and the distant Chattogram hills. These two visual axes deeply influenced the orientation and angularity of the structure. Through a series of formal iterations, the design evolved from a basic mass into an expressive, fragmented form, echoing the broken, layered, and dynamic nature of the shipyard. This evolution was driven not only by aesthetics but also by climate, movement, and the surrounding topography.

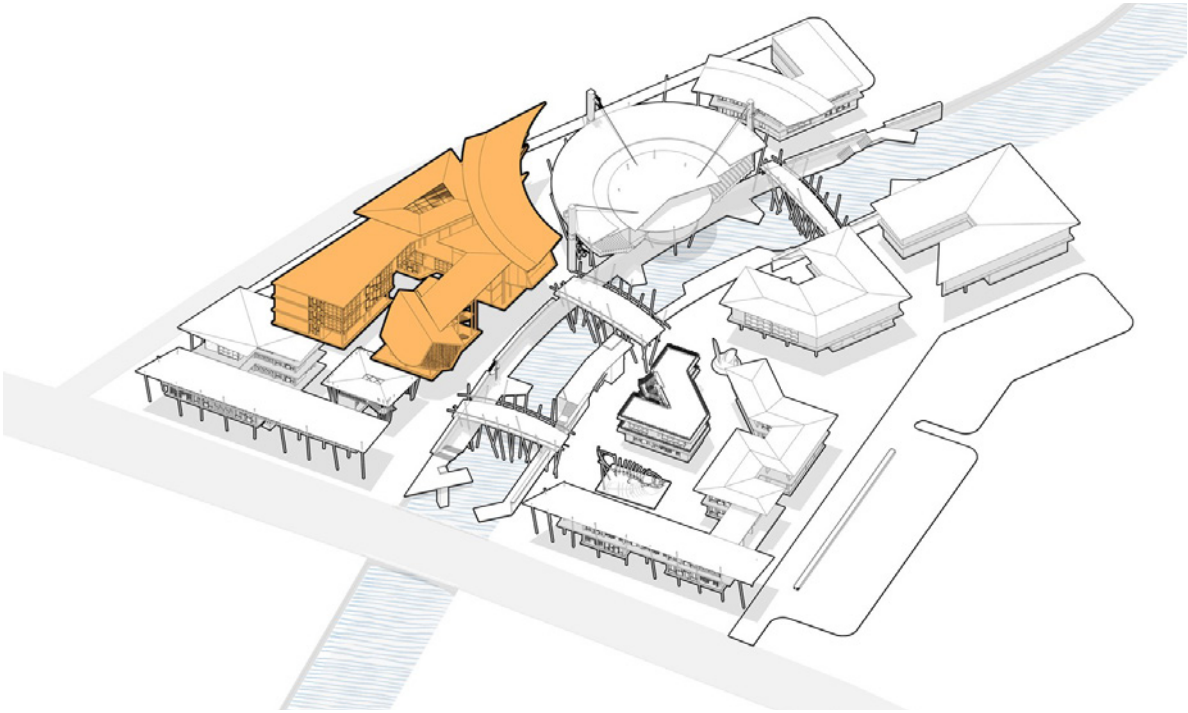


Figure 60_The highlighted volume in the overall masterplan represents the Exhibition and Creative Space

Spatial Experience, Traditional Essence, and Vernacular Materiality

Internally, the building unfolds through a sequence of open and semi-enclosed spaces, with multiple levels and visual layering to evoke the complexity and rhythm of a ship's interior. The central courtyard offers a cozy yet open atmosphere, inviting visitors to pause and reflect—mimicking the intimate enclosures found within ship structures. The experience is enhanced through different elevations and walkways that guide movement organically. Material choices further root the design in its context. Salvaged steel panels and rusted textures from the shipbreaking yard are carefully integrated alongside woven bamboo screens and other traditional vernacular materials. These breathable screens not only soften the facade but also respond to climate and craft.

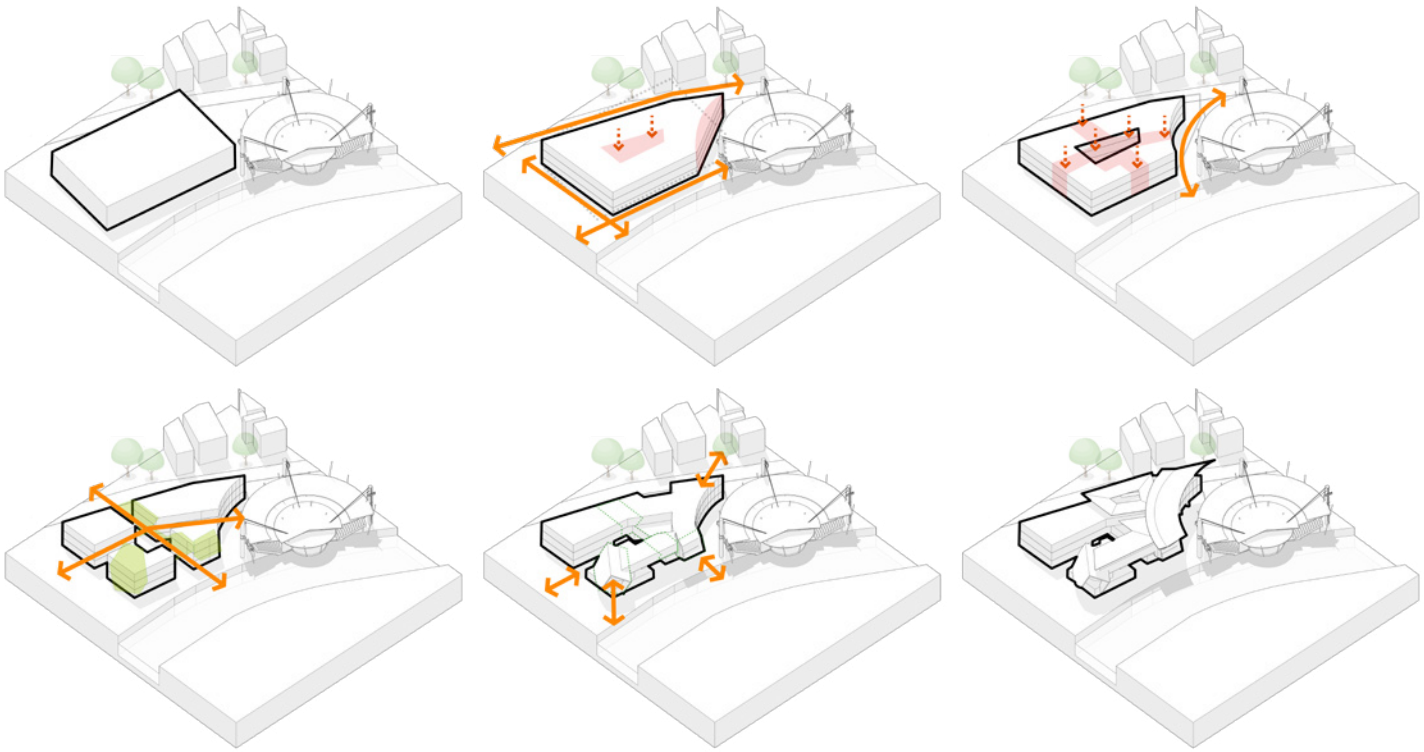
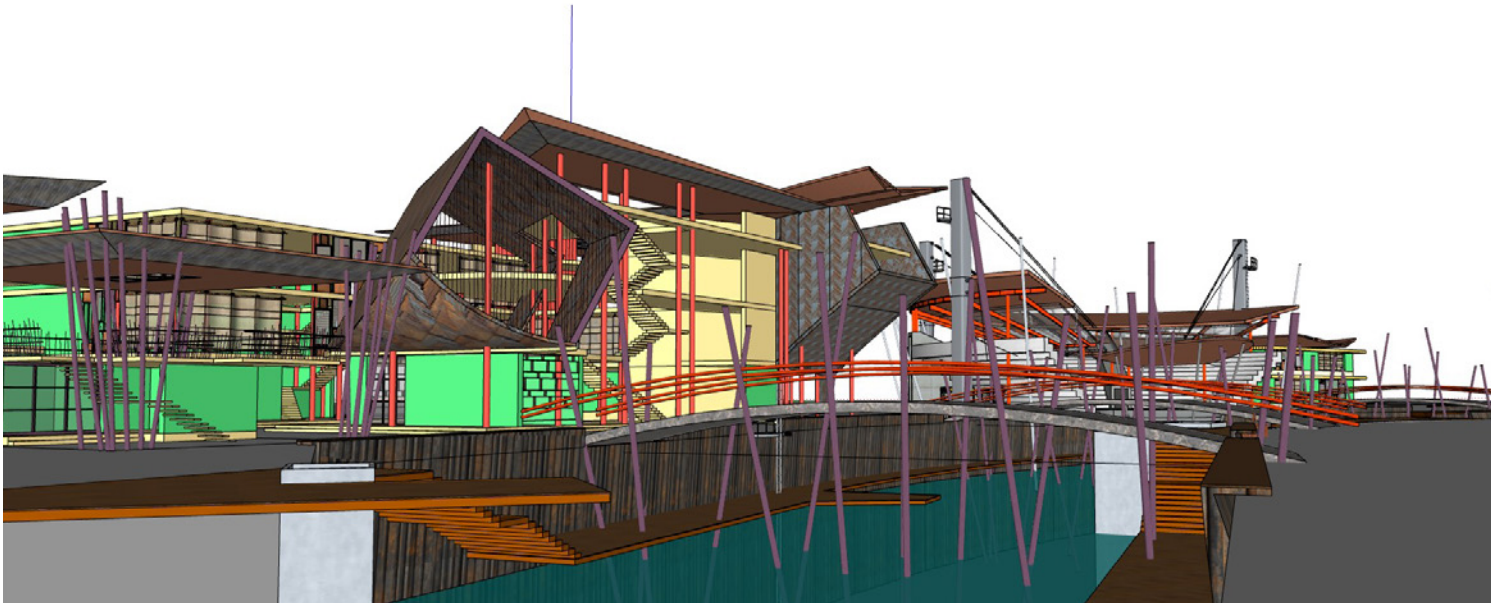


Figure 61_Exhibition & Creative Space form generation using site forces

More than just a gallery, this exhibition space becomes a narrative environment—merging industrial past with cultural future. It celebrates community memory by transforming discarded remnants into meaningful public space. Its form, materials, and modular spatial language echo the fundamental spirit of resilience and local craftsmanship. The architecture doesn't just reflect tradition—it reimagines it, using familiar forms and textures in new ways to engage the community, honor the workers, and instill pride in a shared built identity.

Figure 62_illustrates 3D models of the Exhibition & Creative Space, highlighting its relationship with the building and the surrounding area, and creating a blend of tradition and technology.of traidiotn and technology



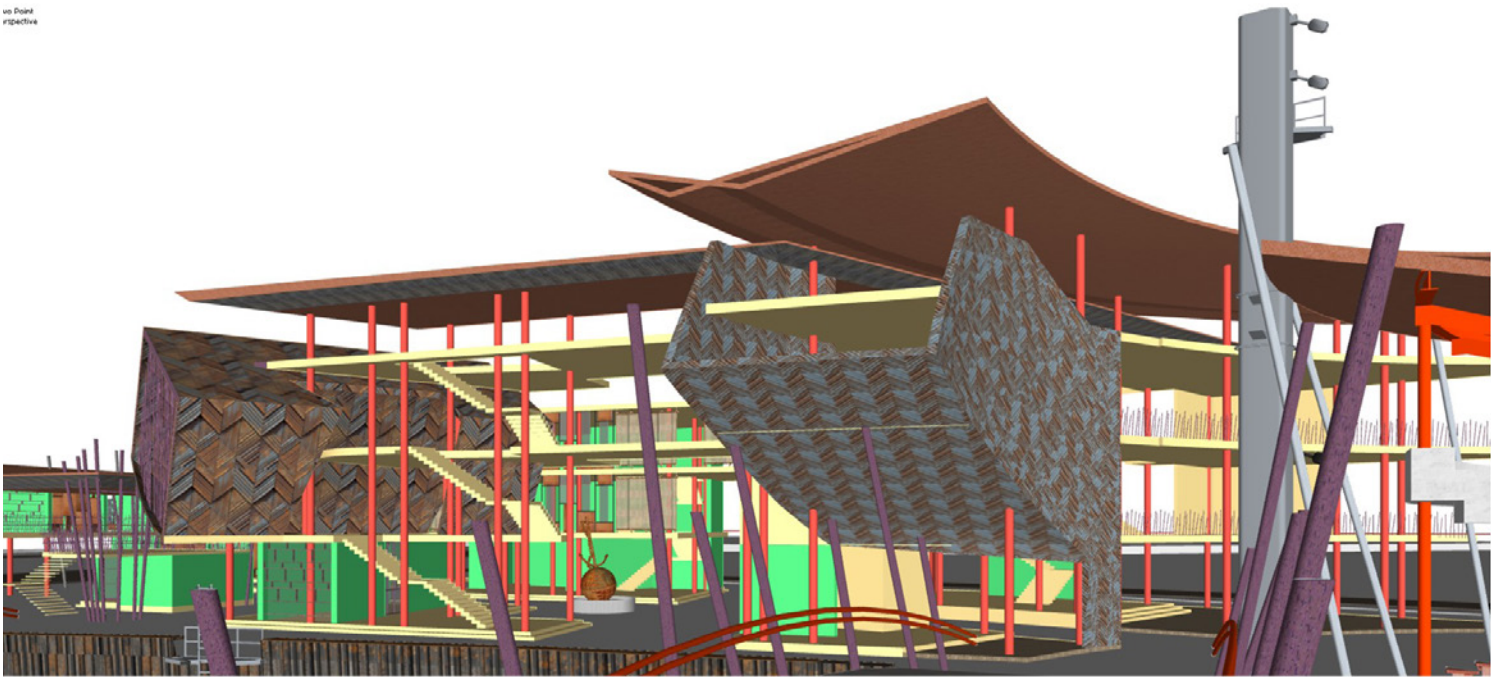


Figure 63_Exploded Axono of Exhibition & Creative Space describing vertical zoning

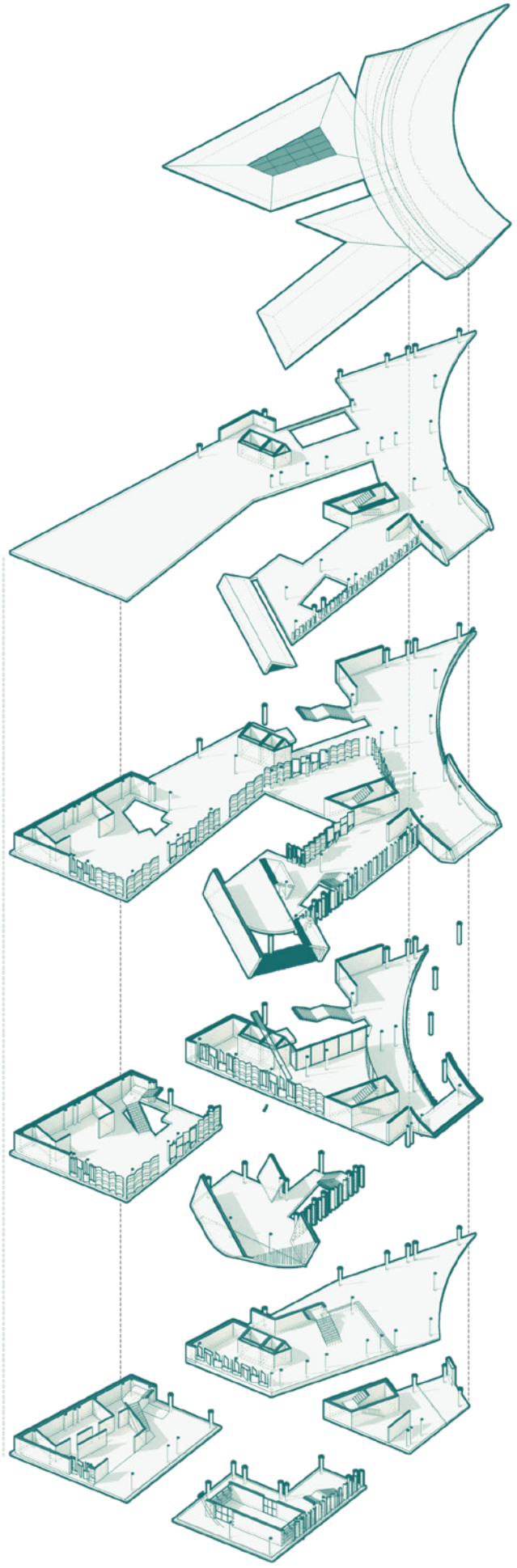
+ **Roof**
Layered Roof + Skylight + Solar and Rainwater Harvesting

+ **Fourth floor**
Roof Garden Space + Viewing Deck + Local Exhibit + Lift + Stair

+ **Third floor**
Exhibitions Halls (2) + Viewing Space + Office + Toilets + Lift + Stair

+ **Second floor**
Exhibitions Space + Maker Space + Viewing space + Multimedia Room + Toilets + Lift + Stair

+ **First floor**
Reception + Open Lobby + Local Exhibits + Toilets + Lift + Stair



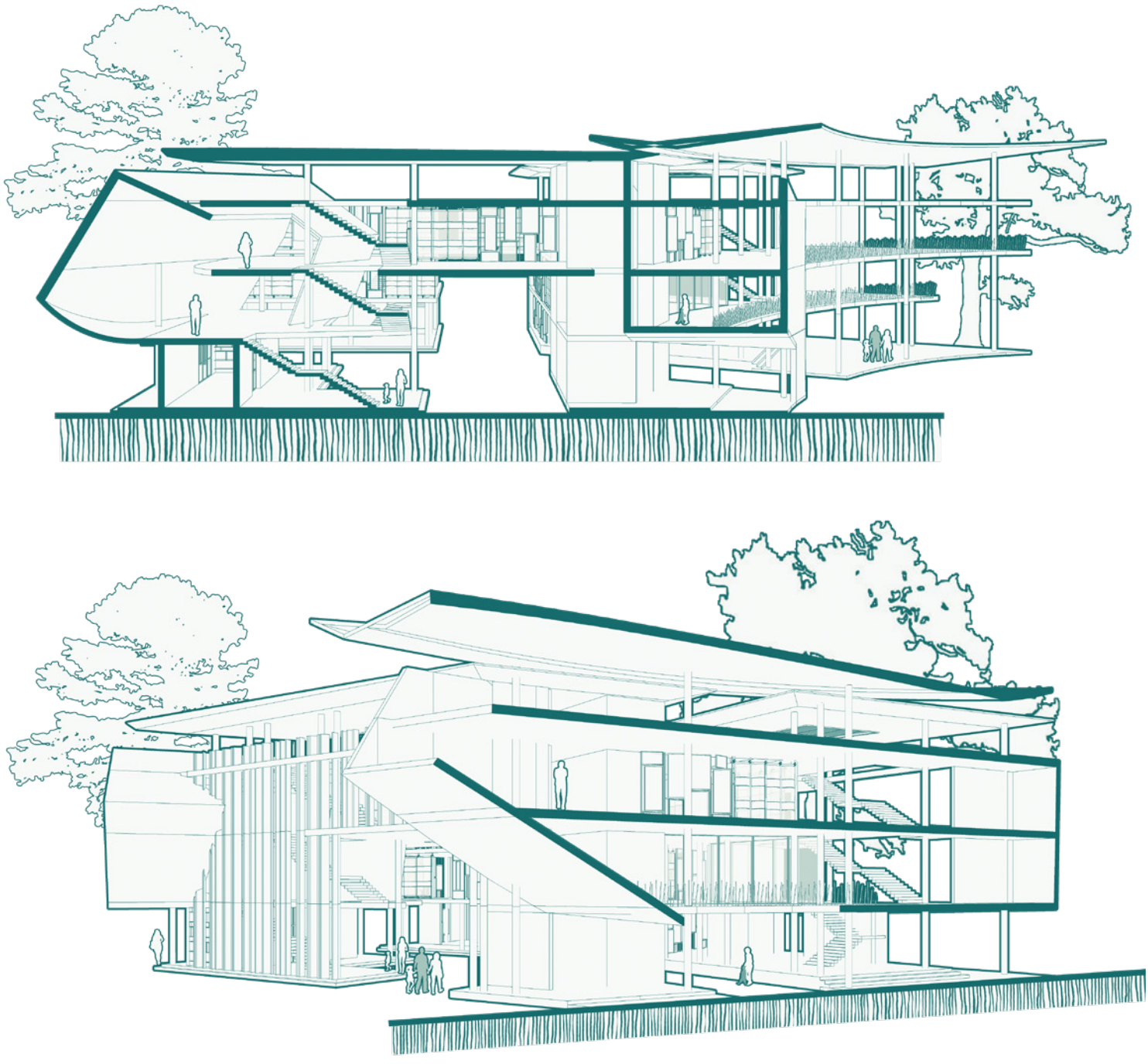
Spatial Organization and Vertical Zoning

In the Exhibition and Creative space, each floor has distinct yet interconnected public and semi-public functions. The ground level (first floor) introduces a reception area, an open lobby, and local exhibit spaces, establishing an accessible entry point for visitors. It includes necessary services like toilets, a lift, and stairs to ensure vertical mobility.

Ascending to the second floor, visitors enter a more immersive experience zone, which features dedicated exhibition spaces, a maker space, and a multimedia room. These areas encourage interaction and creativity. The third floor expands further with two formal exhibition halls, an office space, and a viewing platform—making it suitable for curated displays and administrative coordination.

The fourth floor opens up to a roof garden with a viewing deck and additional exhibit areas, blending nature with built form. At the top, the roof design incorporates layered forms with skylights and systems for solar energy and rainwater harvesting, emphasizing environmental responsibility.

Figure 64_Sections of Exhibition & Creative space



The structure's expressive form, evident in the sectional profiles, is influenced by the site's unique conditions, including wind direction, natural light, and key sightlines to the shipbreaking yard and distant mountains. The flowing rooflines and stepped massing echo the undulating terrain of Chattogram, creating a built environment that feels both anchored and dynamic.

Inside, the central atrium and interconnected walkways encourage seamless movement and visual continuity across levels, enhancing the overall spatial experience. Deep overhangs, permeable facades, and shaded terraces facilitate passive cooling, while well-placed skylights reduce reliance on artificial lighting.

Crucially, the design draws direct inspiration from the shipbreaking yard—not only in material choice but also in ambiance. Certain areas are deliberately crafted to evoke a sense of compression and rawness, mirroring the emotional and physical intensity faced by workers within that industrial backdrop. This layered spatial narrative invites visitors to connect not just with the architecture but also with the stories embedded within it.

Figure 65_Multiple levels and angled walkways create dynamic perspectives and moments of pause, evoking the layered complexity of a working shipyard.





Figure 67_Exhibition & Creative Space



Figure 68_From Market Court to Exhibition & Creative Space

Open Auditorium

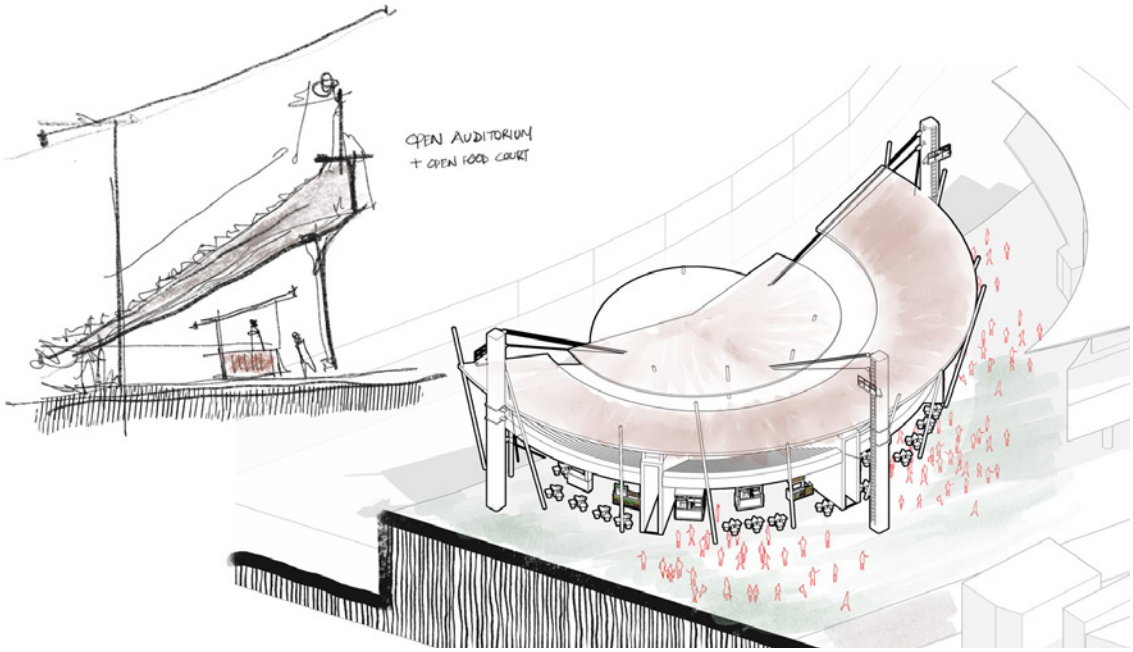
A Cultural Core Shaped by Light, Community, and Tradition

The open auditorium serves as a central spatial and cultural anchor of the project, designed to bring together performance, gathering, and everyday community life. Architecturally, it features a multilayered roof system, with the uppermost layer crafted from translucent solar glass. This not only allows diffused natural light to flood the space throughout the day but also contributes to energy efficiency by harnessing solar power. The flowing rooflines, inspired by traditional bamboo canopies, reinterpret vernacular forms using contemporary materials and structural expression.

food carts is integrated into the design—offering space for local vendors and creating a vibrant social edge. This element draws directly from the everyday street culture of Bangladesh, where food vending is a deeply rooted tradition. By accommodating these informal vendors within a formal civic setting, the auditorium becomes a hybrid space—part performance hall, part street corner—blurring the boundary between celebration and daily livelihood.

The visualizations reveal this rich interaction: the

Figure 69_Conceptual Section of the Auditorium



The stepped gallery embraces a semi-circular stage, creating an intimate amphitheater setting for performances, talks, or informal social gatherings. The layering of volumes allows visual openness while still defining functional zones. Views toward the river and the broader site have been carefully framed to enhance the spatial experience and connect users with the surrounding landscape.

Beneath the gallery, a row of traditional open

elevated stage over water, floating walkways, and curved roofing generate a sense of movement and lightness, while the textured materials—including rusted metal cladding and woven bamboo elements—evoke the spirit of the shipbreaking yard and the resilience of the local community. The auditorium, therefore, becomes more than a building—it becomes a living cultural forum that supports memory, adaptation, and exchange.



Figure 70_Open Auditorium



Figure 71_Vibrant pace under the Gallery

Architecture in Motion: Designing with Time and Intention

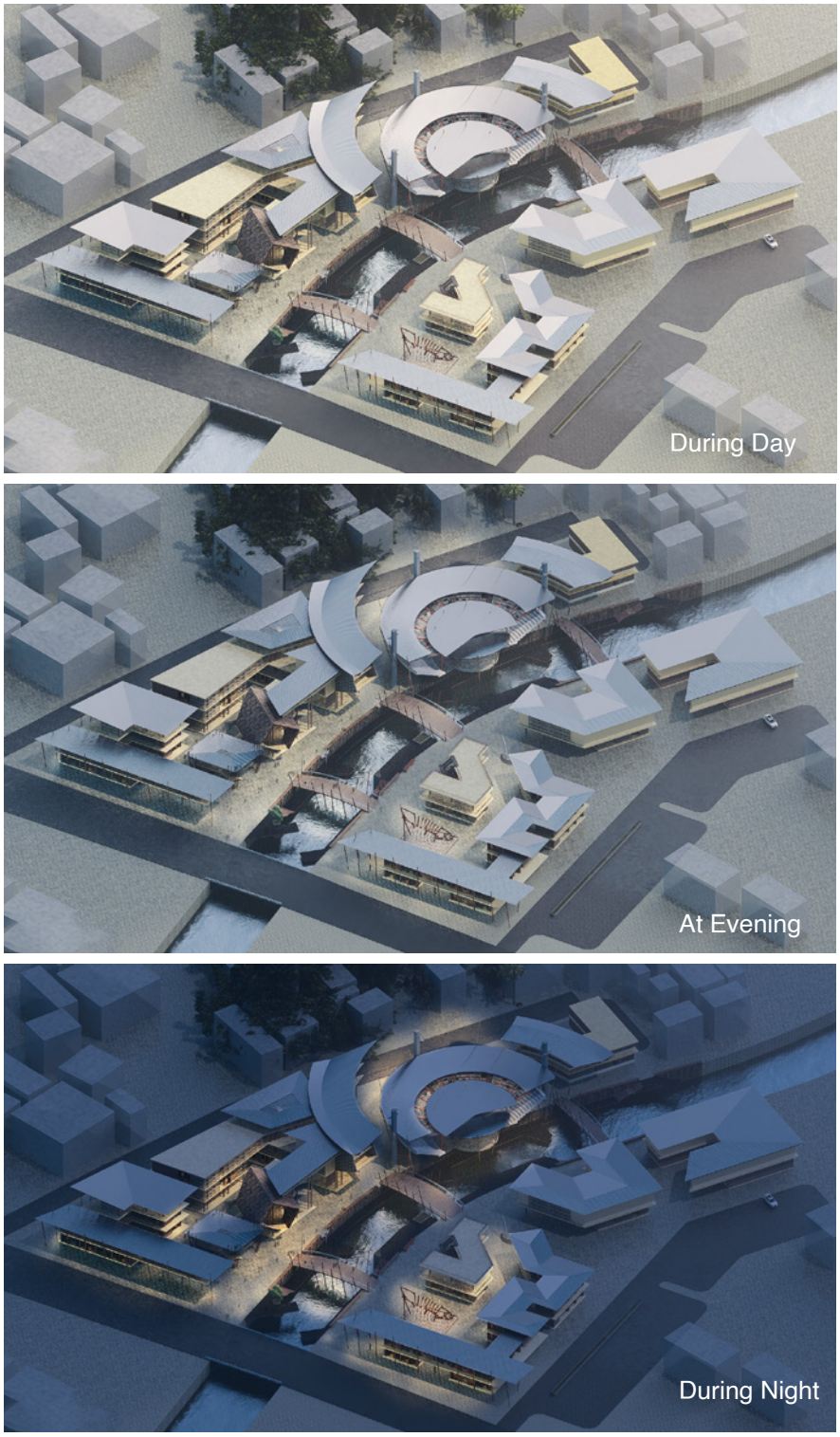


Figure 72_Designing with Time and Intention

This series of aerial views illustrates how the site evolves over time—daylight, dusk, and night—highlighting the dynamic nature of the space. The architecture is designed with a strong understanding of how it will adapt and operate over time. The spatial layout is both structured and open: it guides movement while ensuring flexibility, supports distinct functional areas, yet encourages community interaction.

Each zone activates differently throughout the day in response to natural light, shadows, and public use. Morning times emphasize communal courtyards and gathering decks, whereas shaded galleries and market areas thrive in the afternoon. As evening approaches, the site gradually transforms into a space for performance and reflection—where pedestrian bridges, reflective canals, and illuminated pavilions foster both social and intimate interactions.

The controlled openness results from assigning specific functions to each building while intertwining them with shared courtyards, bridges, and transitional platforms. This architectural approach honors the master plan's design yet permits varied usage, creating a rhythm that naturally evolves throughout the day. Such thoughtful coordination ensures that the project remains vibrant and significant over time—an evolving architecture that engages in dialogue with its users and surroundings.

Model Photos

For More Details, please scan the QR code

Figure 73_Bird's eye view



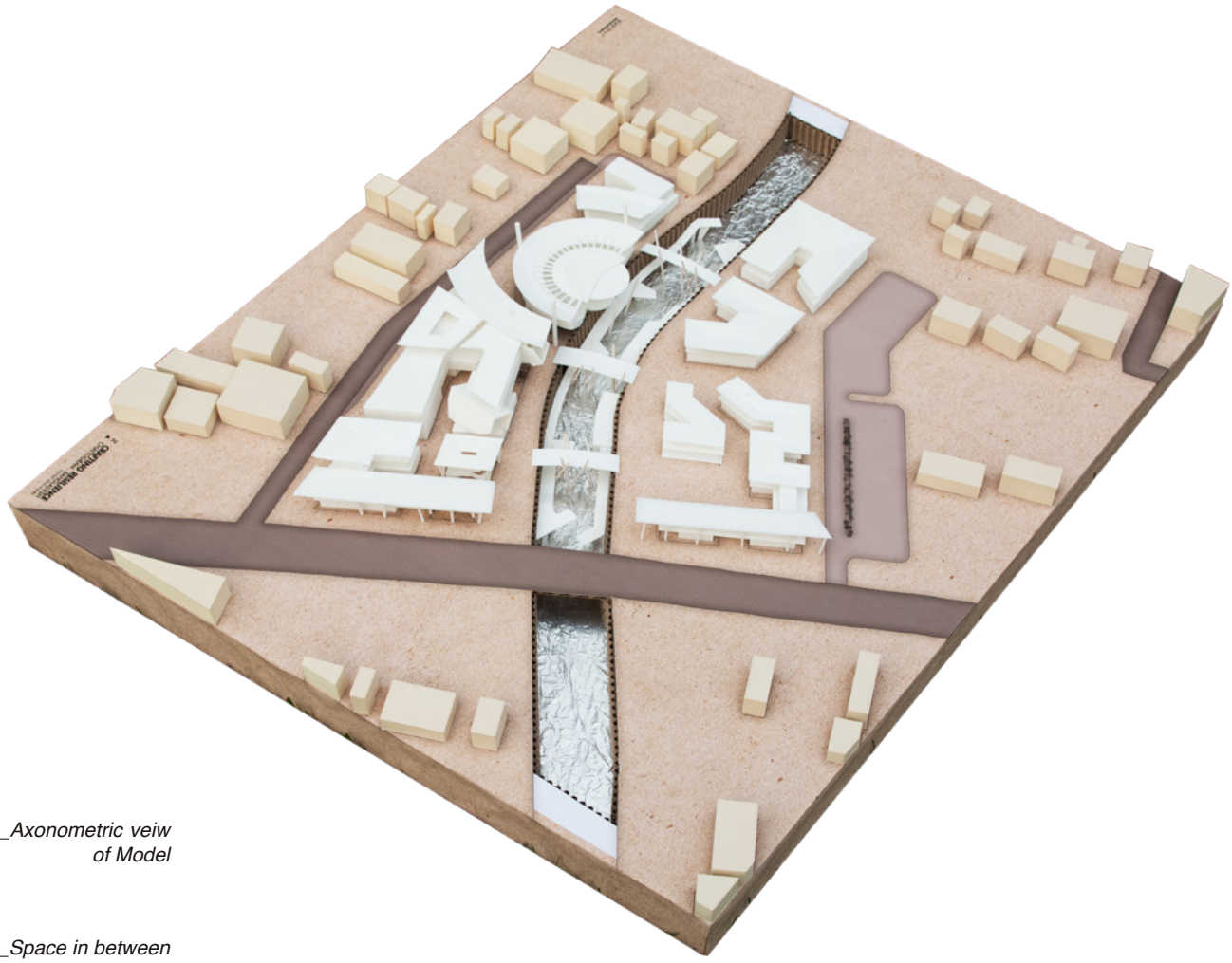


Figure 74_Axonometric veiw of Model

Figure 75_Space in between Gallery and Exhibition Center



Figure 76_Bridge and Canal walk in the model



Conclusion and Vision

This thesis reimagines public architecture as a powerful medium for social empowerment, environmental restoration, and cultural continuity—particularly in contexts marked by economic marginalization and industrial degradation, like Chattogram's shipbreaking yard. By centering vernacular materiality, adaptive design, and participatory co-creation, the research proposes a framework where architecture becomes a catalyst for transformation—of people, places, and resources.

The project no longer views salvaged shipbreaking materials merely as affordable resources but instead reframes them as cultural artifacts—bearing scars of global commerce yet full of local potential. Integrating these irregular, historically charged materials into modular systems allows architecture to embrace imperfection, foster flexibility, and respond to resource variability in real time. Tools like digital fabrication and parametric design help adapt traditional crafts to modern methods, creating a hybrid aesthetic grounded in both locality and innovation.

Moreover, this work emphasizes worker-centered design, transforming a space of labor exploitation into a site of dignity, knowledge, and mobility. Through modular training centers, adaptable housing, and healthcare-integrated workplaces, the design empowers workers not as passive users but as co-creators—people who dismantle ships and rebuild futures. Community involvement isn't just encouraged but essential, rooting architecture in shared ownership and collective resilience.

The broader vision extends beyond Chattogram, presenting a replicable model for post-industrial landscapes worldwide. From refugee settlements to informal markets, the thesis argues for an architectural ethic that foregrounds circular economies, modular growth, and adaptive reuse—not as trends, but as necessities for a world shaped by inequality and climate volatility. Ultimately, this research bridges the wisdom of vernacular architecture with the precision of contemporary systems, offering a vision for design that is context-aware, environmentally conscious, and socially just.

List of figures

Figure 1_Chattogram Ship-Breaking Yard

Figure 2_Design Soiree illustration, Midjourney + Photoshop

Figure 3_some modules can create an endless series of compositions.

Figure 4_Community workers working with vernacular materials using local techniques. Photo by Rizvi Hassan

Figure 5_Rohingya Cultural Memory Center. Photo by Rizvi Hassan

Figure 6_Climate diagram of Lycée Schorge. Single module

Figure 7_Students in a lesson at Lycée Schorge. Photo by Andrea Maretto for Kéré Architecture.

Figure 8_Stephen Kieran and James Timberlake, The Loblolly House

Figure 9_Stephen Kieran and James Timberlake, The Loblolly House

Figure 10_Ship-breaking Yard in Chattogram

Figure 11_Ship-breaking Yard in Chattogram

Figure 12_Bangladesh Ship-breaking Deadweight Tonnage, years chart

Figure 13_World's Second-largest shipbreaking yard stretching 11 miles.

Figure 14_The most dangerous job in the world by ILO

Figure 15_Population Density Spike map of Bangladesh by Muyeed Mohammad 2024

Figure 16_ The Profitability Cycle; Diagram how the model works

Figure 17_Materials obtained from the ship-breaking yard and some new innovative materials currently being tested for processing.

Figure 18_A simple diagram illustrating the possibilities and transformations.

Figure 19_This design emphasizes adaptability with modular components that respond to the changing needs of refugee settlements.

The Rohingya Cultural Memory Centre , Photos by Rizvi Hassan

Figure 20_The installation uses reclaimed brick pavers from demolition sites to honor the historic row houses of Chinatown and their vibrant sidewalk culture.

Ang Li Projects

Figure 21_Historical Timeline of Chattogram Ship Industry

Figure 22_Chattogram Shipbreaking Yard

Photos by Naquib Hossain, Stéphane M Grueso, Matt Hettwer

Figure 23_Estimated percentage of material Flow.

Source:

-NGO Shipbreaking Platform Reports

-BUET (research on shipbreaking material flows

-Journal articles on South Asian ship recycling (e.g., Habib et al., 2019, Hossain & Islam, 2018)

-Field studies and salvage yard inventories from Sitakunda, Chattogram

Figure 24_Scrap materials and other items obtained from the shipbreaking yard.

Figure 25_This diagram illustrates the material flow of ship-breaking yard

Figure 26_Design Proposal

Figure 27_Shipbreaking industry map by NGO Shipbreaking Platform

Figure 28_Bangladesh Map > Chattogram > Chattogram Shipbreaking Yard

Figure 29_Annotated Tourist spot and Relgious spot around Chattogram Shipbreaking Yard area

Figure 30_Annotated Universities, School and Industries around Chattogram Shipbreaking Yard area

Figure 31_Potential four sites for Design

Figure 32_Loop that connects Chattogram city with Site 03

Figure 25_This Diagram shows a variety of activities along the section line.

Figure 24_This captivating diagram shows how a stunning mountain range acts as a natural barrier, separating our site from the city.

Figure 26_This image shows the vibrant market around the Chattogram shipbreaking yard, showcasing the dynamic interplay between industrial and commercial activities.

Figure 27_An overview of the marketplace shows fragmented blocks of shops along a central axis.

Figure 28_Design Strategy diagram

Figure 29_Design Intend diagram

Figure 30_Diagram showing probable programs

Figure 30_Comprehensive Community Development Plan

Figure 31_Zoning Diagram

Figure 32_Functions according to zoning

Figure 33_This image highlights the critical point where a road intersects with a waterbody.

Figure 34_Design of Exhibition Space

Figure 35_Conceptual Masterplan design on process

Figure 36_Conceptual Masterplan design on process

Figure 37_Diagram of Programmatic Space Allocation

Figure 38_Masterplan evolving with the site forces, focusing on the refinement of urban form, circulation paths, and the emergence of active public nodes within the architectural fabric.

Figure 39_Masterplan Zoning

Figure 40_Masterplan annotation

Figure 41_Masterplan annotation

Figure 42_Learning from Bamboo Bridges: Translating Vernacular Spirit into New Architectural Language

Figure 35_Conceptual section

Figure 43_Some concept generation drawing

Figure 44_Axonometric diagram of color coded programs on site

Figure 45_ Establishing Spatial Connections and Looping Through Bridges

Figure 46_Creating multiple options for pedestrian pathways

Figure 47_Relationship between canal walk and bridge. Establishing an urban ritual around the bridge and place of celebration.

Figure 48_ Axonometric view of Designed Complex

Figure 49_ Section A

Figure 50_ Section B

Figure 51_Analyzed market pattern along the roadside showing the division of spaces into five functional zones: open space, shop, storage, processing zone, and big product display. This study informs a modular reconfiguration to improve functionality, efficiency, and user experience in the marketplace

Figure 52_Market Place Space & Form generation

Figure 53_Study model of experimenting with multiple facade treatments in a modular box, where all walls, roof, and ceiling can be changed accordingly. Different materials and techniques are also used to gain a better understanding of the new vernacular.

Figure 54_Conceptual sketch for a facade using new vernacular materials

Figure 55_acade design utilizing salvaged pipes and metal scraps from the shipbreaking yard, blending sustainable reuse with local craftsmanship to create a dynamic and contextually rooted architectural identity.

Figure 56_Market Section, use of spaces

Figure 57_Axonometric view of MarketPlace

Figure 58_Entrance through souvenir Shop

Figure 59_Entrance through souvenir Shop

Figure 60_The highlighted volume in the overall masterplan represents the Exhibition and Creative Space

Figure 61_Exhibition & Creative Space form generation using site forces

Figure 62_illustrates 3D models of the Exhibition & Creative Space, highlighting its relationship with the building and the surrounding area, and creating a blend of tradition and technology.of traidiotn and technology

Figure 63_Exploded Axono of Exhibition & Creative Space describing vertical zoning

Figure 64_Sections of Exhibition & Creative space

Figure 65_Multiple levels and angled walkways create dynamic perspectives and moments of pause, evoking the layered complexity of a working shipyard.

Figure 67_Exhibition & Creative Space

Figure 68_From Market Court to Exhibition & Creative Space

Figure 69_Conceptual Section of the Auditorium

Figure 70_Open Auditorium

Figure 71_Vibrant pace under the Gallery

Figure 72_Designing with Time and Intention

Figure 73_Bird's eye view

Figure 74_Axonometric veiw of Model

Figure 75_Space in between Gallery and Exhibition Center

Figure 76_Bridge and Canal walk in the model

Bibliography

Abdel, Hana. “Rohingya Cultural Memory Centre / Rizvi Hassan.” ArchDaily, February 20, 2023. https://www.archdaily.com/982761/rohingya-cultural-memory-centre-rizvi-hassan.

“Ardmore Residence.” UNStudio. Accessed December 14, 2024. https://www.unstudio.com/en/page/12106/ardmore-residence.

Barbosa, Filipe, Lola Woetzel, Jan Mischke, Maria João Ribeirinho, Mukund Sridhar, Matthew Parsons, Nick Bertram, and Stephanie Brown. “Reinventing Construction Through a Productivity Revolution.” McKinsey & Company, 2017. https://www.mckinsey.com/capabilities/operations/our-insights/reinventing-construction-through-a-productivity-revolution.

De Luca, Francesco. “Emergent, Adaptive and Responsive Urban Landscapes Design Strategies.” Acta Architecturae Naturalis 4 (2018): 20–32.

Erlich, Mark. “Why Modular Building Hasn’t Revolutionized Construction.” Harvard Business Review, December 22, 2023. https://hbr.org/2023/12/why-modular-building-hasnt-revolutionized-construction.

Fakharany, Nour. “BIG Unveils Gelephu’s ‘Mindfulness City’: Bridging Bhutan’s Heritage and Future.” ArchDaily, December 21, 2023. https://www.archdaily.com/1011445/big-unveils-gelephus-mindfulness-city-bridging-bhutans-heritage-and-future.

Frearson, Amy. “Cutwork Designs Modular Housing to Be Used for Long-term Living or Emergency Shelter.” Dezeen, January 5, 2024. https://www.dezeen.com/2024/01/05/rehome-housing-cutwork/.

Harrouk, Christele. “Foster + Partners to Design Alibaba’s New HQ in Shanghai.” ArchDaily, January 9, 2020. https://www.archdaily.com/931599/foster-plus-partners-to-design-alibabas-new-hq-in-shanghai.

Hossain, Md. M., M. M. Islam, and M. Golam Mahboob. “Drastic Expansion of Ship Breaking Yard in Bangladesh: A Cancerous Tumor to the Coastal Environment.” Conference Paper, September 2010

Ico, Fundación, and Arquitectura Viva. Anna Heringer: Essential Beauty, 2022.

Jafar, Rahanat Ara, and Sadia Nowsin. “Rethinking the Residential Environment of Ship Breaking Worker’s Community.” Department of Architecture, Chittagong University of Engineering & Technology. Presented at the International Conference on Sustainability in Natural and Built Environment (iCSNBE2019), January 19-22, 2019

Kutub, Md. Juel Rana, Nishat Falgunee, Shahreen Muntaha Nawfee, and Yasin Wahid Rabby. “Ship Breaking Industries Impacts on the Local People and Environment of Coastal Areas of Bangladesh.” Department of Geography and Environment, University of Dhaka

Krishna. “Beijing Daxing International Airport.” Airport Technology, September 8, 2022. https://www.airport-technology.com/projects/beijing-daxing-international-airport-china/?cf-view.

“Kéré | Work.” Accessed December 14, 2024. https://www.kerearchitecture.com/work/building/lycee-schorge.

Kuruüzüm, Umut. 2022. Building From Scrap: War, Recycling, and Labor in Iraqi Kurdistan. Palgrave Macmillan.

“Loblolly House | Prefabricated Architecture Integrated With Nature.” KieranTimberlake. Accessed December 14, 2024. https://kierantimberlake.com/page/loblolly-house.

Md. M. Maruf Hossain and M. Mahmudul Islam. Ship Breaking Activities and Its Impact on the Coastal Zone of Chittagong, Bangladesh: Towards Sustainable Management. Chittagong, Bangladesh: Young Power in Social Action (YPSA), 2006

Muhibbullah, Md., Morshed Hossan Molla, Kazi Md. Barket Ali, Md. Iqbal Sarwar, and Nazmul Hossain. “Health Hazards and Risks of Ship Breaking Activities in Bangladesh: An Environmental Impact Assessment Approach.” European Journal of Advanced Research in Biological and Life Sciences 2, no. 1 (2014)

N. M. Golam Zakaria, Mir Tareque Ali, and Kh. Akhter Hossain. “Underlying Problems of Ship Recycling Industries in Bangladesh and Way Forward.” Journal of Naval Architecture and Marine Engineering 9, no. 2 (2012): 91–102

NGO Shipbreaking Platform. 2024. “NGO Shipbreaking Platform.” July 11, 2024. https://shipbreakingplatform.org/.

Pulli, Juho, Jonna Heikkilä, and Lauri Kosomaa. Designing an Environmental Performance Indicator for Shipbuilding and Ship Dismantling. Reports from Turku University of Applied Sciences 185. Turku University of Applied Sciences, 2013

Rudofsky, Bernard. 1987. Architecture Without Architects: A Short Introduction to Non-pedigreed Architecture. UNM Press.

Sarraf, Maria, Frank Stuer-Lauridsen, Milen Dyoulgerov, Robin Bloch, Susan Wingfield, and Roy Watkinson. The Ship Breaking and Recycling Industry in Bangladesh and Pakistan. Washington, D.C.: The World Bank, 2010.

"Technics and Civilization (Lewis Mumford, 1895–1990)." 2012. In Routledge eBooks, 226–31. https://doi.org/10.4324/9780203816653-46.

Wallance, David, and Taylor & Francis Group. The Future of Modular Architecture. New York: Routledge, 2021.

YPSA. Workers in Shipbreaking Industries: A Baseline Survey of Chittagong (Bangladesh). Chittagong, Bangladesh: Young Power in Social Action (YPSA), 2005

CRAFTING RESILENT COMMUNITIES
SYED SAIF UDDIN AHAMED
sy3dsaif@gmail.com
© 2025 ALL RIGHTS RESERVED