# Exploring the Affordable Housing Solutions for the Resettlement Projects of Padma Bridge

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**Abstract:** The construction of Padma Bridge in Bangladesh has necessitated the resettlement of displaced residents, highlighting the need for affordable and sustainable housing solutions aligned with Sustainable Development Goals 9 (Industry, Innovation, and Infrastructure), 10 (Reduce inequality), and 11 (Sustainable Cities and Communities). This study aims to engage undergraduate architecture students in a design studio exercise to develop innovative housing models for resettlement projects, addressing displaced communities' social, economic, and environmental challenges. A multi-criteria decision analysis (MCDA) framework is introduced, integrating stakeholder data. In the design studio, students explore housing alternatives and concentrate on community-driven cooperative housing, assessing their effectiveness, feasibility, and sustainability using the MCDA framework. The exercise produces a range of housing solutions that balance affordability, sustainability, and community-centric design. Students demonstrate the potential of novel approaches to address the complex challenges displaced communities face and contribute to equitable development in Bangladesh. Engaging architecture students in developing affordable housing solutions provides valuable insights for policymakers and stakeholders in resettlement. The study emphasizes the need for holistic, participatory approaches and highlights the role of innovative, sustainable housing models in enhancing the quality of life for those affected by the Padma Bridge project, aligning with the SDGs.

**Keywords:** Affordable Housing, Sustainable Development Goals (SDGs), Resettlement Project, Padma Bridge, Design studio exercise

## 1. INTRODUCTION

The concept of housing affordability pertains to the expenses incurred for housing services and shelter (Rashid, 2022), which encompasses rental and ownership arrangements concerning the disposable income of an individual or household. Although a universally accepted definition for this term is yet to be established (Bieri and Dawkins, 2018). In general, affordable housing units for low- and moderate-income households are referred to as affordable housing. Housing is deemed inexpensive when rent or mortgage payments, property taxes, and other housing-related expenses do not exceed 30% of a household's income (Stone 2009). This criterion guarantees that families can afford other fundamental necessities like food, healthcare, education, and transportation while maintaining a decent standard of living. Apartments, single-family homes, and government-subsidized housing programs are all examples of affordable housing (Hamidi *et al*., 2016). Affordable housing refers to residential environments designed for individuals and families with limited financial resources, providing a healthy and socially supportive living space (Rashid, 2019). Resettlement projects, on the other hand, involve the process of relocating communities and providing them with new housing opportunities (Rashid, 2020; Parvin *et al*, 2022), typically due to infrastructure development or natural disasters (Vanclay, 2017). These projects often prioritize affordable housing solutions to ensure displaced people can maintain a decent quality of life (Zaman, Nair and Guoqing, 2021).

The construction of the Padma Multipurpose Bridge, a prominent 6.15 km long megastructure in Bangladesh connecting Mawa to Janjira end (The measure of Padma Multipurpose Bridge, Bangladesh, 2022) has necessitated the implementation of resettlement projects for the affected communities (Hasan, 2022). The project led to the acquisition of 2,452 acres of land in Munshiganj, Madaripur, and Shariatpur, affecting 22,593 households (bdnews24, 2013). RAPs (Resettlement Action Plans) were created to address and alleviate the negative impacts of land acquisition.

The Sustainable Development Goals (SDGs) are 17 global goals established by the United Nations General Assembly in 2015 to promote sustainable development worldwide. They aim to address economic, social, and environmental challenges and ensure that development is sustainable and equitable for all (United Nations Department of Global Communications, 2015). Resettlement projects can have significant implications for achieving the SDGs, particularly Goals 11 and 9, which emphasize the need for sustainable, inclusive, and resilient cities and settlements. Resettlement projects can be designed with community participation to reduce inequalities and promote social inclusion, contributing to SDG 10. These projects can promote

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social cohesion and benefit equitable development by empowering local communities.

This research paper addresses innovative and sustainable housing solutions for the affected community. Housing that will comply with the United Nations Sustainable Development Goals and serve as a guide for policy development for future endeavors. The study will employ a multi-criteria decision analysis (MCDA) framework (Sangkakool *et al.*, 2018) to evaluate housing alternatives, incorporating stakeholder data and assessing the proposed models' effectiveness, feasibility, and sustainability. By focusing on community-driven cooperative housing and involving undergraduate architecture students in the design process, this study seeks to contribute to equitable development in Bangladesh and provide valuable insights for policymakers and stakeholders in resettlement projects. The emphasis is on holistic, participatory approaches and the role of innovative, sustainable housing models in enhancing the quality of life for those affected by the Padma Bridge project.

## 2. BACKGROUND

The construction of the Padma Multipurpose Bridge has affected more than 80,000 individuals from around 22,593 families (Jagonews24.com, 2022) who contributed to the project by relinquishing their farming lands or homes, amounting to at least 2,452 acres (Billah, 2022). As part of the resettlement project, 14,000 families who needed relocation have received compensation (Padma Bridge: Connecting People to Prosperity in Bangladesh, 2011). The government spent approximately 2,6987.3 million BDT to acquire the lands, additionally allocating 1,5150 million BDT in financial aid for the affected families (S. A. Solution Art Ltd., 2015), almost 10% of the total construction cost (Jagonews24.com, 2022). Furthermore, 1,141 families received assistance to build homes in other locations.

The National Policy on Resettlement and Rehabilitation (NPRR) in Bangladesh notes that the country has no recognized resettlement policy. The Asian Development Bank (ADB) funded Technical Assistance (T.A.) for Bangladesh in 1999 to take steps to improve the country's resettlement policies. According to a proposed draft policy of NPRR, further compensation will be made for land acquisition, and the focus will be on protecting the rights of affected persons, minimizing negative impacts, and providing support to ensure livelihoods are improved or restored (Al Atahar, 2014).

Another landmark project, the Jamuna Multipurpose Bridge Project in Bangladesh, involves the displacement of people from their original land. Resettlement sites were planned on both sides of the Jamuna River, but many people chose to resettle elsewhere due to the significant time gap between eviction and the development of the resettlement sites. Moreover, the land price fixation system has undervalued land, and allegations of malpractice by the D.C. office in paying compensation have been made (Siddiqui, 2013). Although in this project, the policy framework has not been updated, eviction and the development of the resettlement sites took almost a decade, and people complained about the victimization of the land price fixing in the Padma bridge project, the government has managed to carry out the rehabilitation process; without considering the consequence and learning from the previous project (JMBP).

However, Resettlement Action Plans (RAPs) were developed to address and mitigate the adverse effects of land acquisition for the Padma Multipurpose Bridge Project. There are four resettlement sites, two on either side of the Padma River, with 3,011 residential plots (Monir, 2022), 100 commercial plots, and 120 open commercial plots (S. A. Solution Art Ltd., 2015). Civic amenities such as schools, mosques, marketplaces, water supply, electricity supply, roads, and more have been built at these locations. Plot holders have begun to relocate to these locations, and the process is ongoing (Alam, 2019)

The Padma Bridge Resettlement Activities have developed seven distinct resettlement projects, which include R.S. 2, Jashaldia RS 3, Kumarbhog, Louhajang, RS 4, Pocchim Nawdoba, RS 5, Bakhorerkandi, Shibchar, RS 6, Nawdoba, Janjira, RS 7, and Madenimondol, Louhajang, RS 8, Kumarbhog, Louhajang. The projects above are located in three separate districts, namely Munshiganj, Madaripur, and Shariatpur, and comprise four Upazilas, namely Louhajang, Shreenagar, Shibchar, and Janjira. In addition, the resettlement work spans nine unions, namely Meadenimondol, Kumarbhog, Halodia, Kolapara, Kathalbari, Madborerchar, Kutubpur, Nawdoba, and Purbo Nawdoba, facilitating the relocation of around 22,688 individuals (Field Survey, 2022). Out of the projects mentioned above, the Kumarbhog Resettlement Site: RS-03 has been chosen for additional evaluation due to its advantageous placement near the Padma Bridge. The site provides a blend of commercial and residential properties, rendering it a particularly advantageous option for resettlement.

### 2.1. Kumarbhog Resettlement Site: Rs-03

In the context of these resettlement projects, our design studio focuses on the "Kumarbhog Resettlement Site: RS-03" on Munshiganj Highway, Mawa (World Bank Group, 2010). The site comprises 458 residential plots and 21 commercial plots, with 425 allotments of plots and 421 handed-over plots (Figure **1**). The plots are available in three sizes: 2.5, 5, and 7.5 decimals (Development of Resettlement Sites for Relocation of Affected Households, 2015). Upon conducting a thorough survey of the local users, the research team identified several critical deficiencies in the existing setup, including the absence of designated community spaces, insufficient green spaces, inadequate workflow organization, mismanagement of allocated funds, the ineffectiveness of the training programs, non-operational local markets, and overemphasis on training at the expense of educational aspects. Further, the existing row house pattern lacks proper connections between neighboring houses. Visiting generic settlements adjacent to the site provides insight into the community's shared use of space and their reliance on professions such as agriculture, fishing, and farming. The team also observed several positive aspects within the community, such as a well-functioning school, access to a healthcare center, and a local market. The design studio exercise is to investigate and identify the most articulated and practical housing possibilities for the Kumarbhog Resettlement Site: RS-03, despite the fact that it has already been developed.

**Figure 1:** Resettlement Site-3(RS-3), Kumarbhog, Source: (Resettlement Site-3(RS-3), Kumarbhog, 2022).

## 3. METHODOLOGY

For this study the research question has been set which is: How can undergraduate architecture students contribute to developing and implementing innovative and sustainable housing solutions in resettlement projects, such as the Padma Bridge project, to ensure alignment with the United Nations Sustainable Development Goals and benefit the affected communities?

The study aimed to achieve the following objectives:

1. This research paper aims to involve undergraduate architecture students in the design process to develop affordable housing models for resettlement projects.

2. The Padma Bridge project should integrate innovative and sustainable housing solutions to improve the quality of life for displaced individuals and families.

3. The study aims to contribute to equitable development in Bangladesh by engaging young architects and providing insights for policymakers and stakeholders in resettlement projects.

This research emerged from a collaborative effort by 17 undergraduate students in the Architecture Department at Southeast University in Dhaka, Bangladesh, in 2022. The exercise was carried out within the context of the Design Studio course (Design 9: Community Architecture 02) under the supervision and guidance of the designated author. The research methodology encompassed integrating undergraduate architecture students in a design studio exercise (Rashid, 2020), during which they actively participated in the design process, model creation, and jury defense. The exercise focuses on exploring alternatives with an emphasis on community-driven cooperative housing. Students will be encouraged to address the social, economic, and environmental challenges associated with the resettlement projects.

A multi-criteria decision analysis (MCDA) methodology is applied to analyze student-generated alternatives to housing. Multi-Criteria Decision Analysis, or MCDA, is a decision-making process that helps analyze, compare, and choose the best choice based on numerous criteria. This method helps decision-makers evaluate multiple considerations when making complex, competing judgments. (Xiong, Sun, and Ren, 2020). This framework incorporates stakeholder data and facilitates the assessment of each proposed housing model's effectiveness, feasibility, and sustainability. Through this collaborative and hands-on process, the study aims to produce

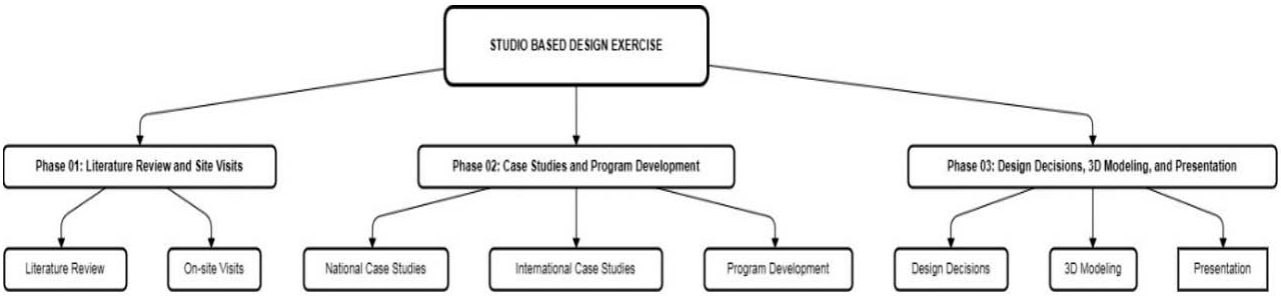


**Figure 2:** Flowchart of Design Studio Exercise.

diverse, affordable housing solutions that balance affordability, sustainability, and community-centric design.

Following a thorough site analysis, the authors provided guidance and oversight to four distinct groups of students, consisting of 17 individuals. Specifically, there were four students in three groups and five in the remaining group. These groups undertook a comprehensive three-phase design activity under the author's supervision. The utilization of Multi-Criteria Decision Analysis (MCDA) is pervasive throughout the entirety of the design exercise phase. The methodology is presented as follows:

### 3.1. Phase 01: Literature Review and Site Visits

The initial phase of the research methodology focused on a comprehensive literature review and on-site visits, providing the students with a fundamental understanding of the greater context of the design exercise. The literature survey encompassed an extensive review of local and international Sustainable Development Goals (SDGs), offering students an all-encompassing comprehension of the strategic goals' effectiveness, objectives, and possible ramifications for the present assignment. Furthermore, the students were able to acquire direct insight into the regional circumstances, obstacles, and prospects and develop a deeper understanding of the distinct requirements and needs of the impacted groups through on-site visits to resettlement points near the Padma Multipurpose Bridge. The amalgamation of theoretical and empirical knowledge has established a robust groundwork for the subsequent stages of the research methodology.

### 3.2. Phase 02: Case Studies and Program Development

The subsequent stage of the research methodology focused on a comprehensive investigation of national and global case studies, intending to expand students' comprehension of the varied approaches, tactics, and resolutions executed in different settings. The national case studies encompassed regional initiatives, such as "Disappearing Lands: Supporting Communities Affected By River Erosion" and "Comprehensive Village Development Plan Study for Galania." The examination of international case studies, namely "Bela Pur Housing," "Aranya Low-Cost Housing," and "Villa Verde Project," yielded valuable perspectives on novel, eco-friendly, and culturally suitable housing remedies. Employing a meticulous examination of these specific instances, scholars could recognize optimal methodologies, valuable insights, and plausible drawbacks, all of which contributed to creating a customized initiative for the target audience of the suggested undertaking. The program's development encompassed the amalgamation of research discoveries, analysis of case studies, observations made during site visits, and identification of crucial performance indicators and benchmarks to gauge the project's success.

### 3.3. Phase 03: Design Decisions, 3D Modeling, and Presentation

The final stage of the research methodology involved making proficient design choices, generating three-dimensional models, and exhibiting resolved projects to a jury board. Drawing upon a comprehensive analysis of relevant literature, on-site visits, and case study examinations, the students arrived at design choices that took into account a range of factors, including but not limited to functionality, aesthetics, formal articulation, materials, cultural and social context, and alignment with Sustainable Development Goals (SDGs). In order to enhance the visualization of their design concepts, the students utilized 3D modelling techniques. Ultimately, the students delivered their projects to a panel of experts from diverse disciplines. The experts provided constructive feedback and criticism, augmenting the

students' capacity to engage in subsequent design endeavours with heightened assurance and proficiency.

## 4. SYNTHESIS

Four distinct solutions came from the design studio exercise. These innovative approaches have been aptly titled Synthesis-1, Synthesis-2, Synthesis-3, and Synthesis-4. Each solution uniquely addresses the design objectives, demonstrating the diverse ways architectural creativity can manifest itself.

The primary objective of this project was to enhance the sense of connectivity and foster interaction among community members, increase functional efficiency, and overall infrastructural development to improve the overall neighborhood. The studio aimed to design and create better communities through a three-phase approach: unit development, cluster development, and master planning.

### 4.1. Synthesis- 1

The "Journey with Connectivity" concept focuses on fulfilling social needs and enhancing housing quality. It aims to create a cohesive and interconnected community by linking various functional elements, landmarks, and essential facilities, ultimately improving residents' quality of life (Figure **3**).

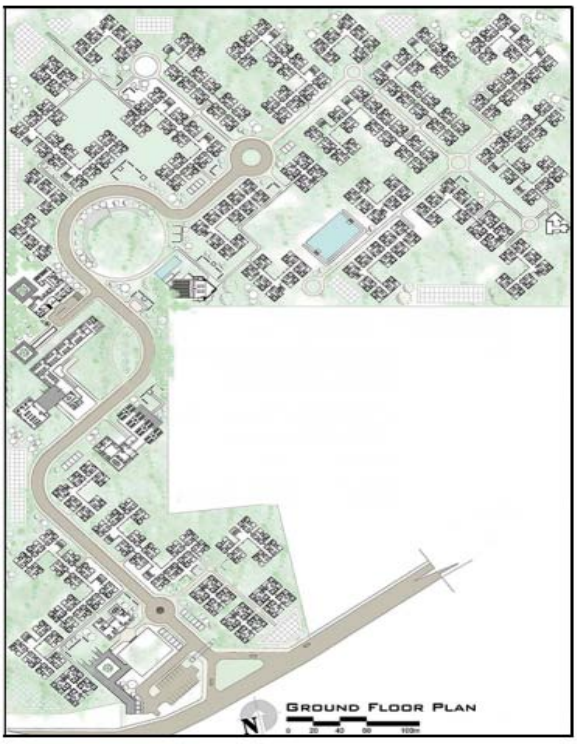


**Figure 3:** Proposed master plan of Synthesis-1.

#### *4.1.1. Hierarchical Connections*

A well-structured approach to connections is employed, encompassing unit-to-unit, cluster-to-cluster, and society-to-community levels. This strategy fosters a harmonious living environment, promoting social interaction and collaboration among community members (Figure 4).

#### *4.1.2. Visual Integration*

The design prioritizes height flows, ensuring seamless visual connections throughout the residential area. This approach facilitates easy navigation and fosters a sense of unity within the community, as residents can quickly identify various landmarks and facilities (Figure **5**).

#### *4.4.3. Essential Facilities*

The project integrates essential facilities, including educational institutions, communal spaces, recreational areas, green spaces, and medical centers. The facilities mentioned above serve the varied requirements of the community, augmenting the state of being healthy and guaranteeing the availability of crucial amenities, thereby promoting a flourishing and self-reliant locality.

#### *4.1.4. Sustainable Infrastructure*

The development emphasizes sustainable infrastructure, including residential roads, waste management systems, and biogas installations. This focus on sustainability promotes eco-friendly living and ensures the efficient use of resources, minimizing the community's environmental impact.

#### *4.1.5. Economic Opportunities*

By incorporating home-based corner shops, markets, and animal husbandry, the project supports local economic growth and self-reliance. These opportunities enable residents to engage in various income-generating activities, ultimately fostering financial stability and empowerment within the community.

### 4.2. Synthesis- 2

The concept, "Enhancing Living Quality through Connection and Open Spaces," aims to foster community by improving neighbourhood connections among individuals. The underlying principle is that well-designed communities can contribute to improving neighbourhoods (Figure **6**).


**Figure 4:** Hierarchical Connections of spaces and essential facilities placed in the centre for accessibility.

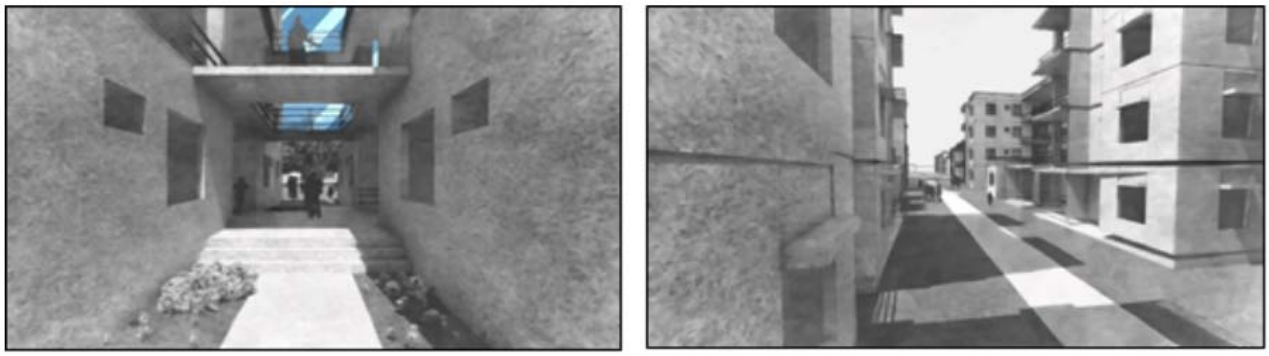

**Figure 5:** Architectural Design Prioritizes Vertical Flows for Optimal Visual Integration.

#### *4.2.1. Secondary Roads and Nodes with Amenities*

From the central path, subsidiary roads connect to clusters and nodes, with grocery stores conveniently situated near these nodes for residents' convenience (Figure **7**).

#### *4.2.2. Ensure ample parking and minimize congestion*

The site includes a parking lot at the entrance and additional spaces in adjacent areas and strategically positions the bazaar to reduce traffic within the complex.

#### *4.2.3. Strategic Placement of Programs*

The bazaar is located at the entrance to minimize traffic congestion, while community programs such as the school, mosque, and training center are centrally placed to serve residents effectively.

#### *4.2.4. Central Vehicular Path and Emergency Access*

A primary vehicular route is a backbone, linking the site's components and providing easy access for larger vehicles during emergencies like fires or medical incidents.

#### *4.2.5. Recreational and Multipurpose Spaces*

The design includes a variety of open spaces, such as a large field adjacent to the school and an inclusive, open field catering to diverse recreational and leisure needs for individuals of all ages.

#### *4.2.6. Innovative Spatial Design*

The layout avoids monotonous corridors by integrating open spaces and double-height areas in clusters, providing versatile spaces for play, leisure, and income generation (Figure **8**).


**Figure 6:** Proposed master plan of Synthesis- 2.

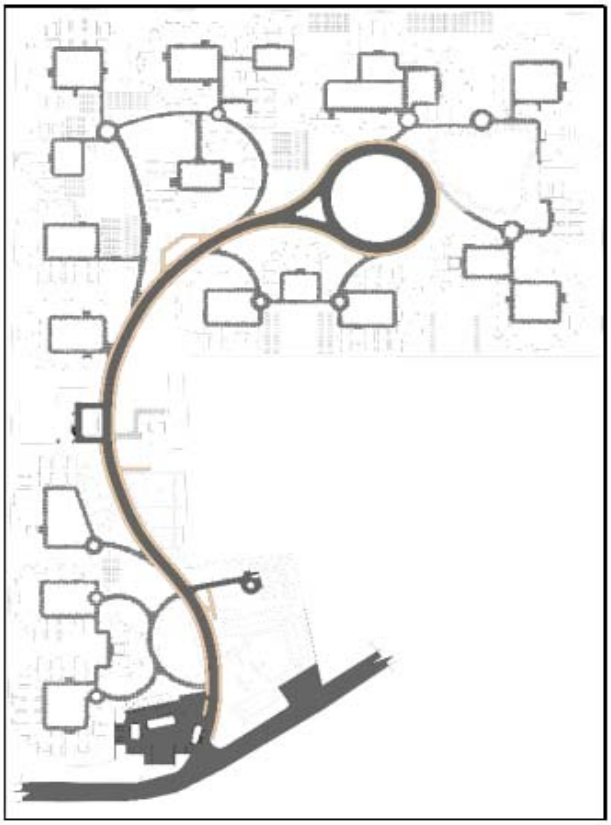

**Figure 7:** Proposed vehicular and pedestrian routes.

**Figure 8:** Proposed cluster section shows the activity in the courtyard, connection with the waterbody and visual interaction (From top to bottom).

#### *4.2.7. Cluster and Unit Variety*

The design includes six distinct cluster types with varying sizes and unit numbers. Three unit types (one-bed, two-bed, and three-bed) cater to families of different sizes, with allocation based on family size for suitable accommodation (Figure **9** & **10**).

### 4.3. Synthesis- 4

The concept is "community-oriented housing design," which aims to create meaningful family connections and memories through shared spaces that encourage communication, social interactions, and play (Figure **11**).

#### *4.3.1. Transportation and Road Connectivity*

The site, beside the Dhaka-Mawa highway, features a traffic zone and station for residents. Primary and secondary roads are designed at 20' and 10' widths, respectively, along with 5' sidewalks, ensuring smooth vehicular movement and pedestrian access. Emergency access is also provided within the housing zone's 250'-320' radial area.

#### *4.3.2. Public Amenities and Social Connections*

Public parking and a bazaar are conveniently placed near the main road for easy access, catering to housing residents and outside. A refreshment and recreational zone is located at the housing entrance,

**Figure 9:** Proposed cluster plan and 3D views (From right to left).

**Figure 10:** Proposed One Bed Unit, Two Bed Unit & One Bed Unit (From right to left) as per the requirements of different users.

while a bank, housing society room, and art and craft training center are also provided.

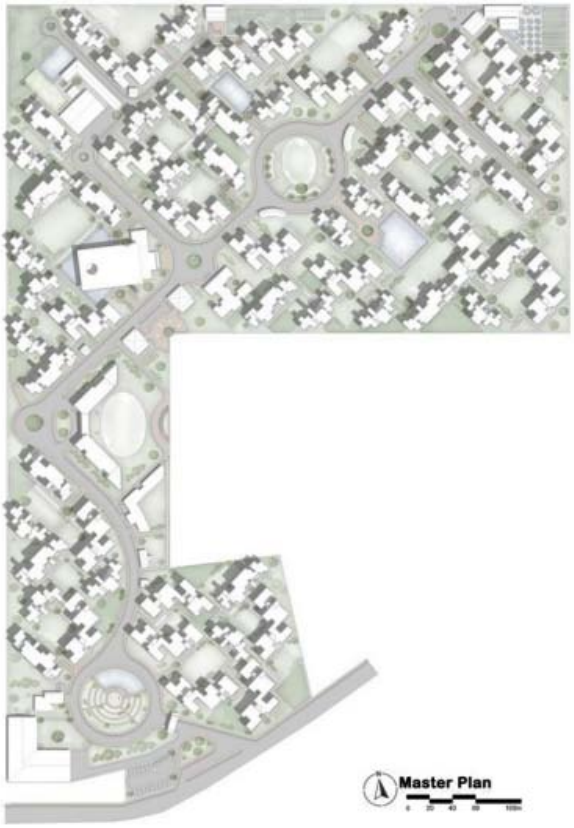


**Figure 11:** Proposed Master Plan (Syntheses three).

#### *4.3.3. Educational and Health Facilities*

The housing project includes a school designed for 250 students, local hotels with parking, a clinic for first aid and other treatments, and a mosque that can accommodate 1,500 people.

#### *4.3.4. Central Cultural Hub and Recreational Spaces*

A central cultural hub within the housing estate offers space for morning walks, play, and social gatherings. Trees and natural elements surround this refreshing environment and encourage community bonding and recreation (Figure **12**).

#### *4.3.4. Sustainable Living and Employment Opportunities:*

A cattle house for 60 cattle and an organic farming area that uses cattle surplus as fertilizer are designed. A hydroponic agriculture system is in place for fish and vegetable production, providing sustenance and employment opportunities for housing residents (Figure **13** & **14**).

#### *4.3.6. Environmentally Conscious Design*

Water bodies are integrated for cooling and rainwater storage while building orientations optimize natural light and wind flow. This approach ensures energy efficiency and equal environmental considerations for all units (Figure **15**).

#### *4.3.7. Flexible Cluster and Unit Layouts*

The design features three cluster forms to accommodate varying family sizes, providing 1,648 units with 1-2-3 bedroom options. Slight size adjustments maintain the core design principles while offering flexibility (Figure **16**).

#### *4.3.8. Optimized Building Orientation*

Forms are rotated 45° to face southeast, ensuring all four sides receive North-South Facilitate and Southeast winds for equal environmental consideration.

### 4.4. Synthesis Four

Acknowledging the importance of space for the community, the concept of "Space as a Resource" is developed, focusing on creating a design that emphasizes the importance of shared spaces to foster community connections and improve overall living conditions (Figure **17**).

#### *4.4.1. Public Space*

The market, located at the front of the site adjacent to the main road, serves as a public space and income generator for the housing community. It accommodates loading and unloading activities and attracts crowds for specific periods.

#### *4.4.2. Semi-Public Space*

A bank, furniture shop, and welding shop are designed within semi-public spaces. The bank is strategically placed near the market for economic and safety purposes.

#### *4.4.3. Employment and Services*

The furniture and welding shops provide small-scale employment opportunities for residents while meeting the demands for furniture and other services within the housing community.

#### *4.4.4. Green Space and Community Bonding*

Cluster arrangement in the housing project promotes connected courtyards and uninterrupted

**Figure 12:** Section and 3D views of Proposed Cultural Hub.

**Figure 13:** Plan of hydroponic agriculture system: pisciculture and organic farming (from left to right).

**Figure 14:** 3D views of hydroponic agriculture system: pisciculture and organic farming (from left to right).

**Figure 15:** Incorporating water bodies to create a more sustainable environment.

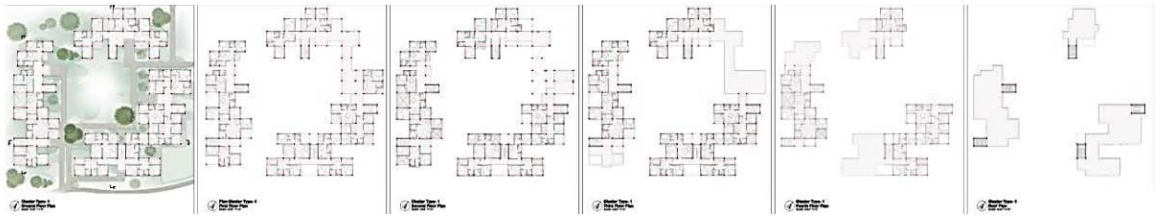

**Figure 16:** Cluster Plan.


**Figure 17:** Proposed Master Plan (Syntheses four).

green space. This fosters community bonding as people share space, time, and memories. Setback spaces are utilized for vegetation and grocery shops to provide residents with easy access to daily products.

#### *4.4.5. Centralized Facilities and Public Spaces*

The NGO and clinic are strategically placed at the centre of the site for equal access to facilities. A community space and common field are located beside the clinic and are visually connected. The mosque and school behind it share a playground and a pond for economic and practical reasons. Roads are designed to be pedestrian-friendly, with emergency vehicle access when needed (Figure **18**).

#### *4.4.6. Self-Sustaining Community Features*

The housing project includes a temple for the Hindu community, a cattle house, and a duck house. The duck house pond is used for fish production, utilizing duck and cattle waste. Vegetation, fishing, and cattle farming are emphasized to encourage self-sustainability within the community (Figure **19**).

#### *4.4.7. Unit Plans for Various Family Sizes*

Units are designed in three sizes based on average household sizes: 3 Persons, 5 Persons, and 7 Persons. Some units feature shared verandas. Kitchens and toilets in each unit vary in size, adhering to BNBC standards, with shared fixtures in certain unit types.

#### *4.4.8. Structural Design and Integration*

The primary structural system of each cluster is a frame structure with carefully arranged beams and columns. Structural elements are integrated to define functional spaces without using walls or other obstacles. Semi-outdoor transitional spaces can be found on roof terraces.

## 5. FINDINGS

This comprehensive housing design focuses on creating sustainable, interconnected communities that prioritize shared spaces, essential facilities, and self-sufficiency. The project incorporates a variety of amenities, employment opportunities, and living options for diveRSe family sizes, emphasizing eco-friendly

**Figure 18:** Proposed Cluster plan and 3D views (from left to right).

**Figure 19:** Courtyard and roof are proposed for community participation.

living and fostering strong community bonds. Based on those mentioned above four synthesizes, the following research findings can be drawn:

### 5.1. Importance of Connectivity

A strong focus on connectivity at various levels (unit-to-unit, cluster-to-cluster, and society-to-community) is crucial in fostering a harmonious living environment and promoting social interaction among community members.

### 5.2. Visual Integration

Seamless visual connections throughout residential areas, achieved through strategic height flows and placement of landmarks, facilitate easy navigation and foster a sense of unity within the community.

### 5.3. Access to Essential Facilities

Incorporating essential amenities such as schools, community centers, playfields, parks, and clinics within the housing project is essential for enhancing residents' well-being and ensuring access to necessary services.

### 5.4. Sustainable Infrastructure and Practices

Emphasizing sustainable infrastructure and environmentally conscious design elements, such as water bodies for cooling and rainwater storage, energy-efficient building orientations, and green spaces, contribute to eco-friendly living and reduce the community's environmental impact.

### 5.5. Economic Opportunities

Providing opportunities for local economic growth and self-reliance through home-based corner shops, markets, and animal husbandry, as well as small-scale employment in various services, fosters financial stability and empowerment within the community.

### 5.6. Flexible and Diverse Housing Options

Offering a variety of cluster types and unit sizes caters to families with different needs and ensures suitable accommodation for all residents.

### 5.7. Community Bonding through Shared Spaces

Designing shared spaces, such as connected courtyards, semi-outdoor transitional spaces, and recreational areas, promotes community bonding and interaction among residents.

### 5.8. Centralized and Strategic Facility Placement

Placing essential facilities and services, such as clinics, mosques, schools, and community spaces, in centralized and strategic locations ensures equal access for residents and enhances the overall living experience.

## 6. CONCLUSION

The exercise conducted in the design studio generated four unique and inventive outcomes, which were appropriately designated as Synthesis-1, Synthesis-2, Synthesis-3, and Synthesis-4. The project's principal objective was to augment connectivity, cultivate interaction among community members, enhance functional efficiency, and encourage comprehensive infrastructural development to establish superior residential areas. The prioritization of various elements, including road connectivity, essential facilities, recreational spaces, sustainable infrastructure, and economic opportunities, was undertaken to enhance the residents' quality of life. As mentioned earlier, solutions amalgam design highlights the importance of architectural ingenuity and originality in tackling intricate communal predicaments. Implementing a comprehensive strategy that integrates community development's social, economic, and environmental dimensions can engender flourishing and self-reliant localities that effectively address their inhabitants' heterogeneous requirements and ambitions.

The efficacy of the design studio in producing the four solutions mentioned above underscores the significance of employing a thorough and repetitive research methodology, which includes a review of relevant literature, visits to the site, analysis of case studies, and the creation of 3D models. The rigorous process facilitated the acquisition of comprehensive comprehension of the context by the students, leading to the development of design solutions that were responsive to the specific needs and aspirations of the target community, based on well-informed decisions. A fundamental insight gained from this project is the significance of cross-disciplinary cooperation and the assimilation of heterogeneous viewpoints in designing. Furthermore, the project emphasizes the significance of sustainable design principles in promoting ecologically responsible communities. The project above has the potential to serve as a fundamental basis for future investigations and examinations in the realm of community-oriented architectural design. The exercise has yielded valuable lessons and insights that can be utilized to shape the creation of novel design methodologies and innovative strategies transferable to analogous projects in diverse settings. Furthermore, the project presents prospects for assessing the executed remedies, facilitating the recognition of optimal methodologies, knowledge acquired, and probable avenues for enhancement. The continuous development of resilient and sustainable communities necessitates the iterative process of reflection and adaptation.

In brief, this project serves as evidence of the influence of architectural ingenuity and originality in molding societies toward a more optimistic tomorrow. The insights garnered from this project and its potential for future development make a valuable contribution to the ongoing dialogue surrounding sustainable and community-focused design methodologies. This highlights the significance of adopting a holistic, interdisciplinary, and iterative approach in architecture and urban planning.

## REFERENCES


Al Atahar S. (2014), Development-driven forced displacement and compensation-based resettlement: experiences from the Jamuna multipurpose bridge project, Development in Practice 24(2): 258–271. https://doi.org/10.1080/09614524.2014.887660

Alam MM. (2019), *Socio-economic impact of Padma Bridge : A new lease of life for many*, https://archive.dhakatribune.com/. Available at: https://archive.dhakatribune.com/business/2019/08/17/socio-economic-impact-of-padma-bridge-a-new-lease-of-life-for-many (Accessed: April 25, 2023).

bdnews24 (2013), *Land for Padma bridge*, https://bdnews24.com/, 24 June. Available at: https://bdnews24.com/bangladesh/land-for-padma-bridge (Accessed: April 30, 2023).

Bieri DS, Dawkins C. (2018), *Amenities, Affordability, and Housing Vouchers*, SSRN Electronic Journal [Preprint]. https://doi.org/10.2139/ssrn.3138613

Billah M. (2022), *They gave up homes and livelihoods for Bangladesh's longest bridge. How are they doing now?,* bdnews24.com. Available at: https://bdnews24.com/bangladesh/they-gave-up-homes-and-livelihoods-for-bangladesh-s-longest-bridge.-how-are-they-doing-now (Accessed: April 25, 2023).

Development of Resettlement Sites for Relocation of Affected Households (2015), *Bangladesh Bridge Authority*. Dhaka, Bangladesh. Available at: http://www.padmabridge.gov.bd/resetacplan.php (Accessed: April 25, 2023).

Hamidi S. *et al*. (2016), *How Affordable Is HUD Affordable Housing?* Housing Policy Debate 26(3), pp. 437–455. https://doi.org/10.1080/10511482.2015.1123753

Hasan M. (2022), *Padma Bridge: Wait for new dawn almost over*, Dhaka tribune, 23 June. Available at: https://www.dhakatribune.com/bangladesh/2022/06/23/padma-bridge-opening (Accessed: April 25, 2023).

Jagonews24.com (2022), *Int'l standard followed in Padma Bridge land acquisition*, https://www.jagonews24.com/en, June. Available at: https://www.jagonews24.com/en/national/news/62460 (Accessed: April 25, 2023).

Monir KM. (2022), *How is life in Padma Bridge rehabilitation centres?*, https://publisher.tbsnews.net/, 12 June. Available at: https://publisher.tbsnews.net/bangladesh/infrastructure/how-life-padma-bridge-rehabilitation-centres-438150 (Accessed: April 23, 2023).

Padma Bridge: Connecting People to Prosperity in Bangladesh (2011), *World Bank*. Available at: https://www.worldbank.org/en/news/feature/2011/02/24/connecting-people-to-prosperity-in-bangladesh.

Parvin A, Hakim SS, Islam MA. (2022), *Policy, design, and way of life in resettlement projects: The case of Ashrayan, Bangladesh,* International Journal of Disaster Risk Reduction 77: p. 103073. https://doi.org/10.1016/j.ijdrr.2022.103073

Rashid MU. (2020), Factors Affecting Location and Siting of Settlements. Southeast University Journal of Science and Engineering, Southeast University 2020; 14(1): 44-52 ISSN No.: 1999-1630.

Rashid MU. (2022), *Study of Generic Settlement Pattern in the Bengal Delta,* PhD Thesis. Selinus University of Sciences and Literature, Italy. DOI: 10.13140/RG.2.2.12255.53922

Rashid MU. (2019), *Transformation of Housing in Low-income Settlement: A Study of Domestic Spaces in Ershad Nagar Resettlement Camp,* Nakhara : Journal of Environmental Design and Planning 16: 119–146. https://doi.org/10.54028/NJ201916119146

Rashid MU. (2020), Identification of Housing Crisis in a Confined Settlement: A study of Mohammadpur Geneva Camp, Creative Space 7(2): pp. 125–142. https://doi.org/10.15415/cs.2020.72011

Resettlement Site-3(RS-3), Kumarbhog. (2022), Asiafirms. https://bd.asiafirms.com/dhaka/resettlement-site-3-559115.html

SA. Solution Art Ltd. (2015), *Padma Multipurpose Bridge Project, Padma Multipurpose Bridge Project*. Available at: http://www.padmabridge.gov.bd/resetacplan.php#:~:text=Resettlement%20Action%20Plan%20Resettlement%20Action%20Plans%20%28RAPs%29%20was,major%20Components%20of%20the%20Bridge%20as%20mentioned%20below%3A (Accessed: April 30, 2023).

Sangkakool T. *et al*. (2018), *Prospects of green roofs in urban Thailand – A multi-criteria decision analysis*, Journal of Cleaner Production, 196, pp. 400–410. https://doi.org/10.1016/j.jclepro.2018.06.060

Siddiqui T. (2013), *Policies and Issues in Resettlement of the Displaced*, https://www.thedailystar.net/. Available at: https://www.thedailystar.net/news/policies-and-issues-in-resettlement-of-the-displaced (Accessed: April 26, 2023).

Stone ME. (2009), Unaffordable "Affordable" Housing: Challenging the U.S. Department of Housing and Urban Development Area Median Income. USA. Available at: https://scholarworks.umb.edu/csp_pubs/36/ [Accessed: 25 April 2023].

Td, S.A. (2015), *Padma Multipurpose Bridge Project, Padma Multipurpose Bridge Project*. Available at: http://www.padmabridge.gov.bd/rdpp.php (Accessed: April 25, 2023).

The measure of: Padma Multipurpose Bridge, Bangladesh (2022), *The measure of: Padma Multipurpose Bridge, Bangladesh*, E&ampT Magazine. Available at: https://eandt.theiet.org/content/articles/2022/08/the-measure-of-padma-multipurpose-bridge-in-bangladesh/.

United Nations Department of Global Communications (2015), *The 17 Goals | Sustainable Development*. Available at: https://sdgs.un.org/goals (Accessed: April 25, 2023).

Vanclay F. (2017), *Project-induced displacement and resettlement: from impoverishment risks to an opportunity for development?,* Impact Assessment and Project Appraisal, 35(1): 3–21. https://doi.org/10.1080/14615517.2017.1278671

World Bank Group (2010), *Bangladesh - Padma Multipurpose Bridge Project : Resettlement Plan : Summary Of The Social Action Plan*, https://www.worldbank.org/en/home. Washington, D.C., USA: World Bank Group. Available at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/874921468201261691/summary-of-the-social-action-plan (Accessed: April 25, 2023).

Xiong H, Sun Y, Ren X. (2020), Comprehensive Assessment of Water Sensitive Urban Design Practices based on Multi-criteria Decision Analysis via a Case Study of the University of Melbourne, Australia, Water 12(10): 2885. https://doi.org/10.3390/w12102885

Zaman M, Nair R, Guoqing S. (2021), *Resettlement and development*, Resettlement in Asian Countries, pp. 1–13. https://doi.org/10.4324/9781003159780-1

Received on 26-08-2023 Accepted on 21-09-2023 Published on 10-10-2023

https://doi.org/10.6000/2817-2310.2023.02.09