STUDY ON THE EFFECT OF THE CLIMATE ADAPTIVE AND ENVIRONMENT FRIENDLY INCLUSIVE HOUSING IN THE URBAN SLUM

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A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering



Department of Civil Engineering

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Section: 20A

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DECLARATION

It is hereby declared that this thesis/project or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Md. Lutfor Rahman, Head of the Department of Civil Engineering for allowing me to undertake this work.

I am grateful to my supervisors Lecturer Zeba Fariha, Department of Civil Engineering for his continuous guidance, advice, effort, encouragement and invertible suggestion throughout the research.

To my friends and family unweaving support, encouragement and understanding during the ups and down on this thesis journey, I am profound grateful. Your belief in me the strength to preserve.

ABSTRACT

This thesis presents an innovative framework that coverages two critical imperatives of our time: the urgent need for climate-friendly practices and the promotion of inclusive and equitable community spaces. The thesis at hand seems to outline a comprehensive strategy for the design and operation of “Climate smart and inclusive community center” as catalysts for sustainable, resilient and harmonious communities. Drawing from the fields of environmental sustainability, urban planning, and social inclusion, this study explores the foundational principles underpinning climate-friendly and inclusive community center. These principles encompass sustainable architecture, energy-efficient technologies, renewable energy integration and resilient infrastructure. Simultaneously, the research delves deeply into the critical aspects of inclusivity, emphasizing accessibility, diversity and community engagement. Through an integrated approach, this thesis synthesizes case studies, stakeholder engagement, and design proposals to develop a visionary model that seamlessly combines climate-friendly practices with inclusive community center concepts. This innovative approach fosters a dynamic relationship between environmental stewardship and social cohesion, serving as a beacon for sustainable community development. In addition to theoretical exploration, this research assesses the tangible benefits of implementing such an integrated model. It examines potential reductions in carbon emissions, increased energy efficiency, enhanced quality of life for community members, and the strengthening of social bonds within the community. Furthermore, it explores the policy and regulatory frameworks necessary to promote the adoption of climate-friendly and inclusive community centers. This thesis contributes a fresh perspective to the fields of architecture, urban planning, environmental science, and social inclusion. It advocates for a holistic and forward-thinking approach to community development, one that not only mitigates the impacts of climate change but also fosters inclusive, vibrant, and sustainable communities.

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CHAPTER 1
INTRODUCTION AND OBJECTIVES

1.1 Background of study

In response to the climate crisis, there is a growing emphasis on climate-friendly practices within various sectors, including architecture and urban planning. Sustainable building design, energy efficiency, renewable energy integration, and low-carbon technologies have emerged as critical strategies to mitigate environmental impacts and reduce carbon footprints. These principles are increasingly being applied to residential, commercial, and public buildings alike.

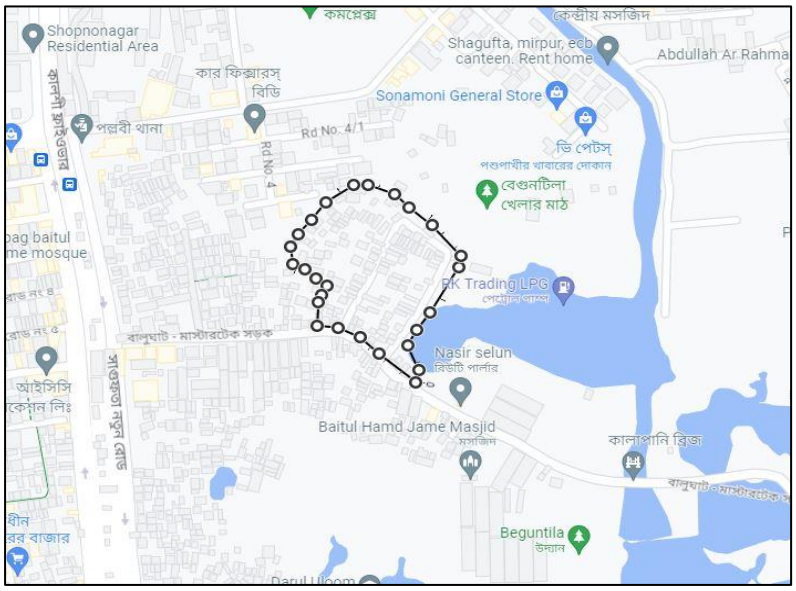


Figure 1: Beguntila slum, Mirpur-12, Dhaka [4]

The community of Beguntila slum need the community center to enhancing their quality of live, fostering community engagement supporting diverse needs and many others reason. Under this consideration we have decided to build this infrastructure, which funded by Australian Aid and the implementation partner was Habitat for Humanity International-Bangladesh (a reputed international non-government organization) and our team was one of the part of research and implementation.

1.2 Research Objectives

The broad objectives were the study on the effect of climate adaptive and environment friendly inclusive housing in the urban slum.

The specific objectives of this project are:

1. Investigating the foundational principles of climate-friendly and inclusive community center design as per the need of the community.
2. Developing a conceptual model for integrating these principles.
3. Evaluating the economic, environmental and social implications of such integration.
4. Exploring the policy and regulatory frameworks necessary to promote this integrated approach.

This thesis posits that the convergence of climate-friendly practices with the creation of inclusive community centers holds the potential to address both the environmental and social challenges of our time. By designing community centers that are sustainable, energy-efficient, and environmentally resilient, while simultaneously promoting accessibility, diversity, and community engagement, we can create spaces that empower and embrace all community members.

1.3 Overview of the climate smart and inclusive community center

Dhaka, the capital city of Bangladesh is one of the most densely populated areas in the world, with a density of 23,234 people per square kilometer. The project site “Beguntila Slum” is in Mirpur section 12 area under Dhaka North City Corporation (DNCC).

We have planned to build the climate smart and inclusive community center in “Beguntila slum” where more vulnerable people migrated to the slum and household number around 700 households and eventually, the slum area also expanded geographically (Approx.13,000 square meter to 46,000 square meter in the last 7 years) which created more needs. Though this project made a long-term impact and the interventions could met a part of the needs and there is an excessive appeal from the people in need to extend services further for improving their living conditions and resilience.

1.4 Study area characteristic

The urban slums of Dhaka, the capital city of Bangladesh, present a complex and challenging study area characterized by a unique set of socio-economic, environmental, and infrastructural factors. Understanding these characteristics is crucial for addressing the myriad issues faced by slum residents and for implementing effective development and improvement initiatives.

Here are some key characteristics of the study area in the urban slums of Dhaka:

- Highly populated density: Dhaka's slums are known for their extreme population density. The limited available land is densely populated, with a high concentration of people living in small, makeshift dwellings. This density exacerbates issues related to sanitation, waste management, and access to basic services.
- Inadequate housing: Slum dwellers often live in substandard and overcrowded housing. Many homes are constructed from flimsy materials, lacking proper ventilation, and are prone to flooding during the monsoon season.
- Poor sanitation: Access to sanitation facilities is severely lacking in many urban slums. Open defecation is common, leading to health hazards and the spread of diseases. Few slum households have access to proper toilets
- Limited access to clean water: Access to clean and safe drinking water is a significant challenge. Residents often rely on contaminated water sources, leading to waterborne illnesses.
- Inadequate healthcare: Slum communities typically have limited access to healthcare facilities. Health services are often informal and may not meet the needs of the population.
- Education disparities: Educational opportunities are limited, and illiteracy rates are high. Many children in slums are unable to attend school due to financial constraints, leading to a cycle of poverty.
- Unemployment and informal labour: A significant portion of the population in urban slums is engaged in informal labor, which offers unstable employment and low wages. This leads to income insecurity and vulnerability.
- Environmental challenge: Environmental issues such as pollution, poor waste management, and flooding are prevalent in slum areas. Inadequate infrastructure exacerbates these challenges.

- Social vulnerability: Slum residents often face discrimination and social exclusion. Vulnerable populations, including women and children, may experience higher rates of violence and exploitation.
- Lack of basic services: Access to basic services such as electricity, proper roads, and waste collection is limited. Slum dwellers often rely on self-organized systems to meet their daily needs.
- Limited land tenure security: Many slum residents do not have legal land tenure, making them vulnerable to eviction and displacement.
- Diverse demographics: Dhaka's urban slums are often ethnically and culturally diverse, with people from various regions and backgrounds coming together in these areas.
- Resilient and community network: Despite the challenges, slum communities often exhibit resilience and strong social networks. These networks can be valuable assets in implementing development interventions.

1.5 Organization of the thesis

The thesis report of the climate smart and inclusive community center is organized as bellow:

Chapter 1: Introduction and objectives. This chapter describes the introduction to the geological condition of the slum and climate-smart and inclusive community center and its necessity in this particular area instead of the needs of the community and overview as well.

Chapter 2: Literature review on climate smart and inclusive community center. A literature review on climate-smart and inclusive community centers explores existing research and scholarly works related to the integration of climate resilience and inclusivity in community center design and operations. Such community centers aim to address the challenges posed by climate change while fostering an inclusive environment that accommodates diverse community needs in this chapter. By identifying, critical analysis and categorizing from different reports, books and websites the literature review was performed.

Chapter 3: Methodology. Here is a brief description of the methodology used to identify the cause of the construction climate-smart and inclusive community center.

Chapter 4: Results and discussion. The ultimate results and the impacts of climate-smart and inclusive community centers are discussed in this chapter.

Chapter 5: Conclusion and future works

This chapter summarizes the conclusions and major contributions of this study and provides recommendations for future studies.

CHAPTER 2

LITERATURE REVIEW ON CLIMATE SMART AND INCLUSIVE COMMUNITY CENTER

2.1 Introduction

A climate-smart and inclusive community center is a facility or space designed to address the needs and challenges of a community in a way that promotes sustainability, resilience to climate change, and inclusivity.

Integrating climate resilience and inclusivity into community development is essential for building robust, sustainable, and equitable communities. It not only helps communities adapt to a changing climate but also ensures that the benefits of development are shared by all members, creating a more resilient and cohesive society.[1]

2.2 Step-by-step guide on how to develop climate smart and inclusive community center [5]

1. Needs assessments and community engagement:

   Begin by conducting a thorough needs assessment to understand the specific requirements and expectations of the community. Engage with community members, including marginalized groups and individuals with disabilities, to ensure their voices are heard in the planning process.

2. Site selection and design:

   Choose a site that is accessible to all, preferably located public transportation and within walking or cycling distance for most community members. Design the center to be inclusive, with features like ramps, elevators wide doorways, and accessible restrooms for people with disabilities.

3. Energy efficiency and renewable energy:

   Incorporate energy-efficient design principles to reduce energy consumptions. This includes proper insulation, energy-efficient lighting. Consider renewable energy sources such as solar panels to generate clean energy for the center.

4. Water conservation:

   Implement water saving technologies like low-flow faucets, toilets and rainwater harvesting systems for landscaping and non-potable uses. Educate the community on the importance of water conservation.

5. Waste reduction and recycling:

   Setup a waste management that encourages recycling, composting and proper disposal. Promote sustainable practices like reducing single-use plastics and packaging.

6. Green building materials:

   Use eco-friendly building materials that have a low environmental impact, such as recycled or sustainable materials. Ensure that the materials used are non-toxic and safe for both construction workers and occupants.

7. Landscaping and green space:

   Design the surrounding with native and drought-resistant plants to reduce water usage. Create green spaces that provide a recreational area for the community and improve air quality.

8. Climate-resilient infrastructure:

   Plan for climate resilience by elevating the building above potential flood levels and incorporating design elements that mitigate extreme heat of cold. Consider rain gardens and permeable pavement to manage stormwater.

9. Education and training:

   Develop educational programs and workshops within the community center to raise awareness about climate change, sustainability and environmental protection.

10. Monitoring and evaluation:

    Implement systems for monitoring and evaluating the center's environmental performance, including energy and water usage, waste diversion rates, and greenhouse gas emissions. Regularly engage with the community for feedback and improvement suggestions.

11. Community ownership and governance:

    Ensure that the community has a say in the governance and management of ownership and responsibility.

12. Continuous Improvement:

    Commit to ongoing improvements and adjustments based on feedback and changing environmental conditions. Stay informed about new technologies and best practices in sustainability and inclusivity.

CHAPTER 3
METHODOLOGY

3.1 Introduction

Creating an inclusive, climate-smart, and environmentally friendly community center involves a comprehensive methodology that takes into account various aspects of sustainability, accessibility, and eco-friendliness.

3.2 Methodology Overview



Figure 2: Methodology of the climate and inclusive community center

3.3 Need assessment

Our group conducted virtual FGDs (Focused Group Discussion) and one KII (Key Informant Interview) involving various community groups of Beguntila Slum in June 2023. Our survey team also had several physical visits to observe the present situation. The FGD is carried out with three separated groups of the slum community (male group, female group, and CWC members group) and each group had 8 people [2]. The questions

of the FGD were asked in an interactive way where participants were free and comfortable to provide their opinion. One KII (Key Informant Interview) has organized with the respective Ward Councilor, Mr. Sazzad Hossian. Ward no: 2, Mirpur, Dhaka North City Corporation, has firsthand knowledge about this slum and the present situation. 3 FGD and 1 KII were carried out to understand the development priorities and scenarios of Beguntila slum. The discussion was designed to gather information from the community people and ward counselor in regard to the following outcomes:

• To understand the major problems in the slum
• The main income source of the slum dwellers of this slum
• The land ownership pattern in this slum
• The main hazards of these slums
• Any WASH and DRR-related programs implemented by the municipality in these slums
• The top priority needs for improved living conditions and resilience building
• The present needs of the slum people

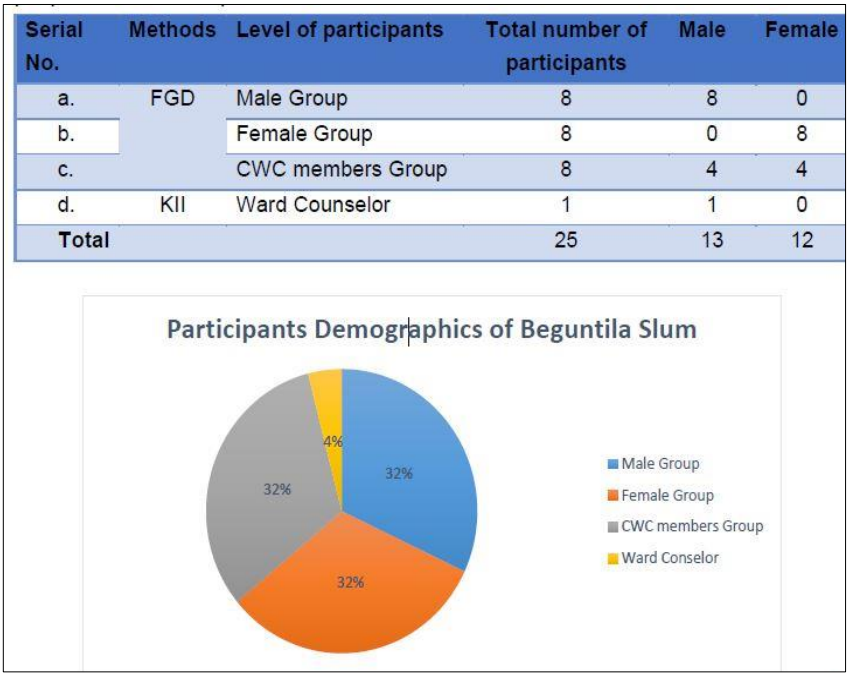
3.4 Participant's demographics

The number of participants who took part in the focus groups and KII:

A total of 25 people took part in the FGD and KII among them 13 people are male and 12 people are female as per the below table:

Table 1: FGD and KII

Serial No.	Methods	Level of participants	Total number of participants	Male	Female
a.	FGD	Male Group	8	8	0
b.		Female Group	8	0	8
c.		CWC members Group	8	4	4
d.	KII	Ward Counselor	1	1	0
Total			25	13	12



3.5 Major problems identified by FGD and KII

Like many others slums in Dhaka city, Beguntila slum faces a variety of challenges including water logging; inadequate housing; inadequate sanitation facilities, lack of access to drinking water; high risk of fire; overcrowding and lack of access to government services, health, education, waste disposal and lack of secure tenure. These needs have been identified through FGD (organized in June 2021) with the community people and CWC of Beguntila slum and KII with the respective Ward Councilor, Dhaka North City Corporation, Ward no: 2, Mirpur, Dhaka.

Major Problems:

- Water logging: Beguntila slum is located in a very low-lying area that is very prone to flood and waterlogging since it has water bodies nearby. The poor drainage system has made it susceptible to water logging.
- Poor and Insufficient Housing: Poor housing structure has made it vulnerable to high wind and heat waves and very low plinth level has made it vulnerable to flood and waterlogging. The slum houses are extremely flammable due to the lack of proper ventilation systems. The houses are mostly made of GI sheets and bamboo fences. Most of the house's fences and roofs are too old and not in good condition. Most of their houses are consists of single rooms and some have two rooms houses, some are rented and most of them are staying at their own houses with five to eight members on average. Hence, there is a lack of housing facilities comprising the population.
- Drainage: Drainage is one of the main problems of the Beguntila Slum. The drainage situation is considered to be a very important aspect of the physical
  - area and during the rainy season the area is submerged by the drainage water. The wastewater including sewerage and grey water sometimes flooded the community. Domestic wastewater and storm water should flow from the community to save the livelihood of the environment. A sustainable drainage system is essential for the community.
- Insufficient sanitation facilities due to huge population density: Around 4500 people live in the slum from 700 to 800 families in Beguntila slum. There is a lack of sanitation facilities for the huge population, moreover, some sanitation facilities' conditions are so poor and unhygienic.
- Lack of safe water access: The slum had not any water connection during Phase-II. With the advocacy and negotiation along with other INGOs, HFHB creates good

communication between government water supply service providers and slum dwellers and got some arrangements for water collection from one near the area, but that was not sufficient and not accessible for all. Currently, the Beguntila slum has lack of safe water access.

- Income source of the slum community: The slum community people are very poor and have very limited earnings to meet up their regular necessities. The main income source of the slum dwellers are Rickshaw pullers, Day Labour, Garment workers, small entrepreneurs, Mason, and Maidservants.
- No development program has been taken place by Govt: Presently, there are no activities by the municipality / City Corporation on WASH and DRR related programs in this slum. So, there is still huge demand in the community and huge scopes for work. No political or cultural barrier to implementing the HFHB project activities in the slum.

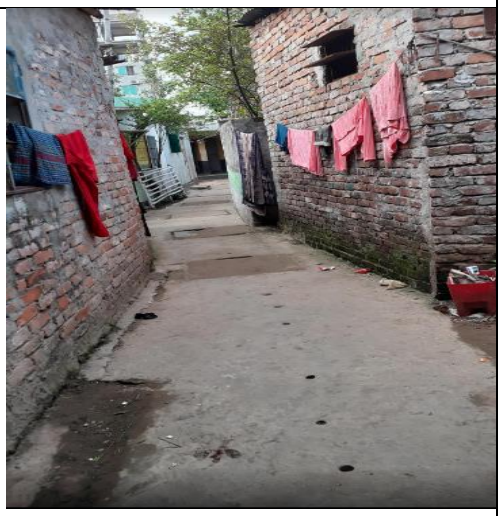
3.6 Key considering point

- Inappropriate housing condition
- Insufficient sanitation and water collection point
- Improper drainage system
- Lack of awareness

3.7 Photo gallery of Beguntila slum

Table 2: Photos of different hazard in Beguntila slum

Water logging		
Poor and Insufficient Housing		
Poor Drainage		
Insufficient sanitation facilities		

Poor waste management system		
Poor walkways		
Existing Bathing facilities and walkways constructed by NGO's		

3.8 Community development plan (CDP)

The Community Development Plan (CDP) [3] is to develop a long-term effective development plan considering the current needs/problems of the slum's community, and based on that they will do its implementation with cooperation and coordination of Go/NGOs as well as relevant service providers.

• To clearly articulate community development concepts and initiatives

• To develop local ownership and community decision making in community development initiatives/planning to promote civic pride

- Local Community Wash Committee are connected and regularly share information
- To provide range of accessible, well maintained and appropriately community infrastructure
- To support community group that contribute to community participation in the various events
- To assist in the enabling provision of adequate service to the community
- A comprehensive plan is developed where working NGOs involve to provide support.

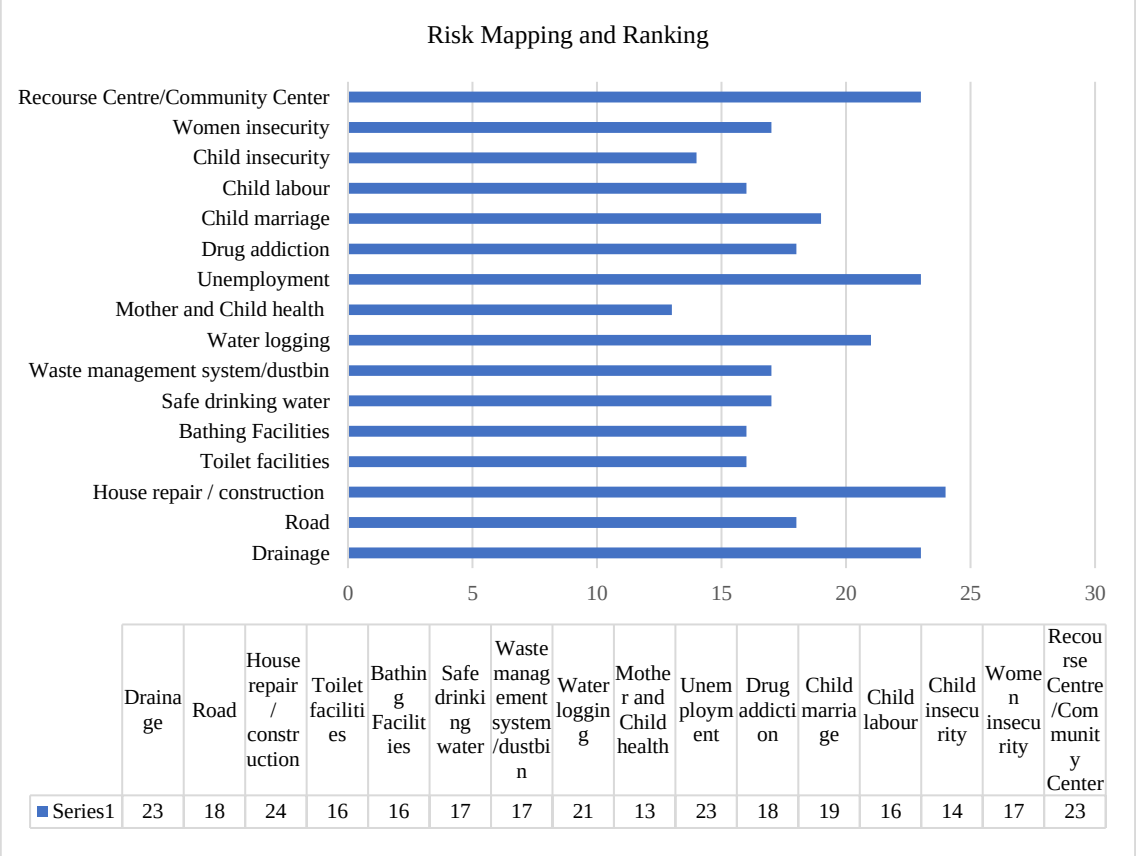
3.9 Development of CDP considering the tools

- HH survey
- Social Mapping
- Venn diagram
- Priority Ranking
- Hazard Ranking
- Seasonal Hazard Calendar

3.10 Risk mapping and its ranking

We conducted the household survey in collected the basic information of climate related problem and what they wanted to see the climate smart and inclusive community center. After collection of data we collected the social map picture, which they draw previously.

Table 3: Risk mapping



	Drainage	Road	House repair / construction	Toilet facilities	Bathing Facilities	Safe drinking water	Waste management system /dustbin	Water logging	Mother and Child health	Unemployment	Drug addiction	Child marriage	Child labour	Child insecurity	Women insecurity	Recourse Centre /Community Center
Series1	23	18	24	16	16	17	17	21	13	23	18	19	16	14	17	23

The priorities came from the FGD with the community people. The below table showed in details.

Table 4: Priority ranking

SL.	***Hazard Name***	***Point***	**Ranking**
1	House repair / construction	24	1
2	Drainage	23	2
3	Recourse Centre/Community centre	23	
4	Unemployment	23	
5	Water logging	21	3
6	Child Marriage	19	4

7	Road	18	5
8	Drug addiction	18	
9	Safe drinking water	17	6
10	Waste management system/ dustbin	17	6
11	Women insecurity	17	
12	Toilet facilities	16	7
13	Bath House facilities	16	
14	Child Labour	16	
15	Child Insecurity	14	8
16	Mother and child health	13	9
Source: FGD with the community people by local NGO's			

3.11 Social map

Social mapping is the most popular method in participatory action research. The focus is on the depiction of living conditions and the nature of housing and social infrastructure: roads, drainage system, schools, railway tracks, religious buildings, post office, well, community hall etc. This social map is prepared by the community people of Beguntila slum in participatory way.



Figure 3: Social Map

3.12 Social hazard map

Hazard maps are developed to illuminate areas that are affected or vulnerable to a particular hazard. They are typically made for natural hazards such as earthquake ground motion, flooding, landslides, liquefaction, and tsunami. Hazard maps are tools that when properly utillized by planners, developers, and engineers, can save lives and economic losses by avoiding exposure to some hazards while designing other development to mitigate or neutralize the potential negative effects of these hazards. In the Beguntila community they prepared their hazard map such way.

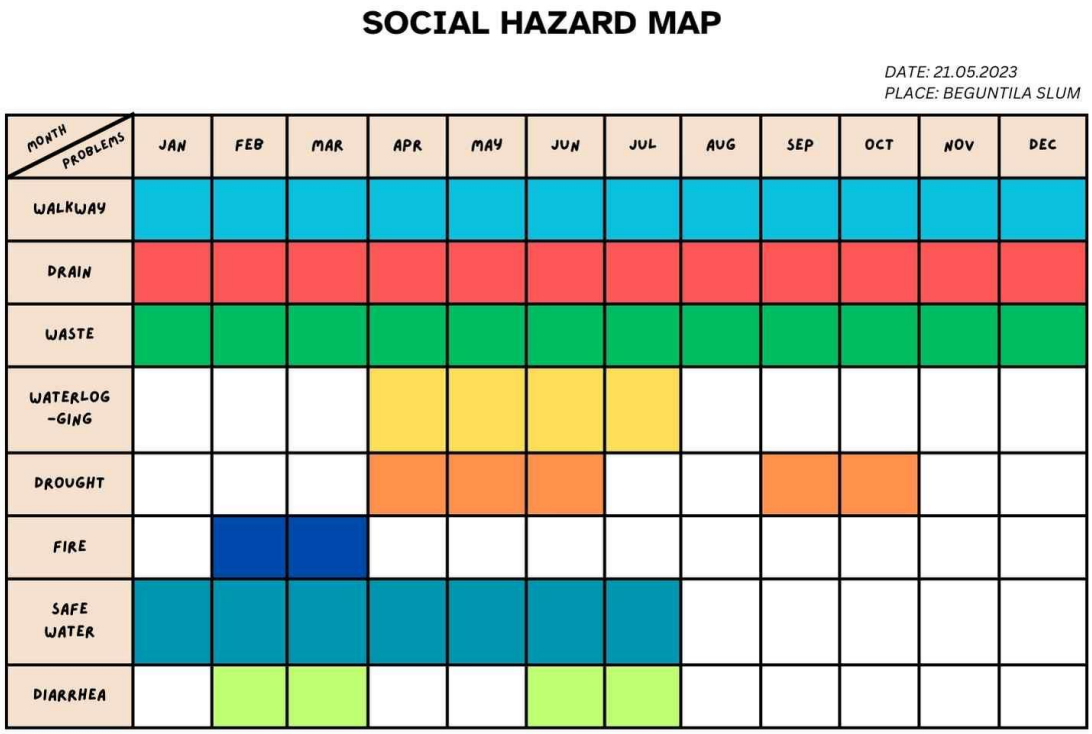


Figure 4: Social hazard map

3.13 Ven diagram

A Venn diagram illustrates the relationships between two or more data sets. Venn diagrams are especially useful for highlighting similarities and differences and are commonly used to compare and contrast the characteristics of different data sets.

In a Venn diagram, circles are used to represent each data set. Inside each circle is a list of characteristics that define that data. Characteristics shared between two or more data sets are listed in the area where the circles overlap. Simple Venn diagrams consist of two overlapping circles, but complex Venn diagrams may compare up to five or more data sets using up to five or more circles. In the Beguntila slum, there are

several NGO's and INGO's are working on different issues as they prepared the Ven diagram.

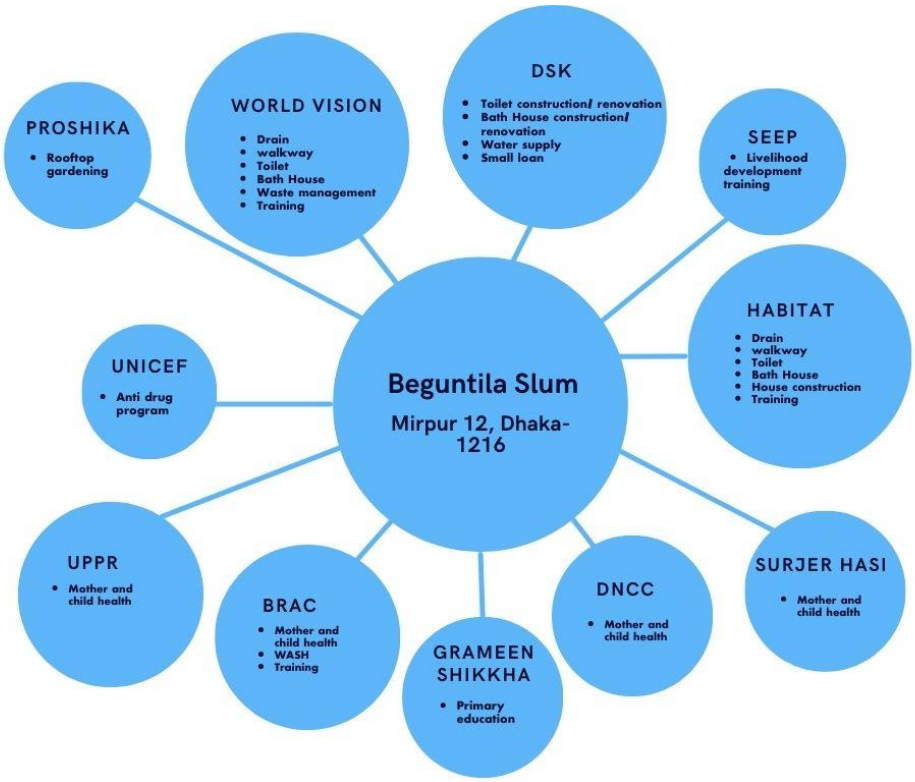


Figure 5: Ven diagram

3.14 Community risk mitigation plan

Risk mitigation is the practice of reducing the impact of potential risks by developing a plan to manage, eliminate, or limit setbacks as much as possible. After management creates and carries out the plan, they'll monitor progress and assess whether or not they need to modify any actions.

Community peoples are preparing the risk mitigation plan for the works are required in their community and who will be the implementor, how it will implement, when it will be implement, probable cost etc.

Table 5: Community risk mitigation plan

SL	Name of the activity	Who will implement?	When to implement?	Strategy of implementation	Where to implement?	Estimated cost BDT	Considerations
01	Development of drainage system	• Habitat for Humanity • World Vision	Jane 2023 to December 2024	• With the help of CWC committee and area residence • Activities implementation with working NGOs existing slum	Beguntila Slum	50,00 000 Fifty lac	▪ Area residence are incapable ▪ Water logging
02	Development of Road Communication	• World Vision • DSK • Habitat for Humanity	June 2023 to December 2024	• With the help of CWC committee and area residence • Activities implementation with working NGOs existing slum	Beguntila Slum	1,000 0000 One crore	▪ Area residence are incapable
03	Reduce Water logging	• Habitat for Humanity • World Vision • CWC committee and area people initiatives	June 2023 to December 2024	• Activities implementation with working NGOs existing slum • With the help of CWC committee and area residence	Beguntila Slum	70,00 00 Seven ty lac	▪ Financial incapacity of the local people ▪ Lack of awareness
04	Construction of Toilet Facilities	• World Vision • Habitat for Humanity • DSK	June 2023 to December 2024	• With the help of CWC committee and area residence • Activities implementation with working NGOs existing slum	Beguntila Slum	1, 00000 00 One crore	▪ Financial incapacity of the local people ▪ Lack of awareness
05	Construction of Community bath house	• Habitat for Humanity • World Vision • DSK	June 2023 to	• With the help of CWC committee and area residence	Beguntila Slum	70 ,0000 0	▪ Financial incapacity of the local people

SL	Name of the activity	Who will implement?	When to implement?	Strategy of implementation	Where to implement?	Estimated cost BDT	Considerations
			December 2024	• Activities implementation with working NGOs existing slum		Seventy lac	▪ Lack of health related awareness
06	Construction/ reconstruction of house	• Habitat for Humanity • Own initiative	June 2023 to December 2024	• Activities implementation with working NGOs existing slum • Money insolvency	Beguntila Slum	2,00000 00 One crore	▪ Financial incapacity of the local people ▪ Short-term project
07	Ensure safe drinking water	• DSK • WASA	June 2023 to December 2024	• With the help of CWC committee and area residence • Activities implementation with working NGOs existing slum	Beguntila Slum	1,00000 00 One crore	▪ Financial incapacity of the local people ▪ Quality control and ensure
08	Garbage Management /provide dustbin	• World Vision • Habitat for Humanity • DNCC	June 2023 to December 2024	• With the help of CWC committee and area residence • Activities implementation with working NGOs existing slum • With government support	Beguntila Slum	2,00,000	▪ CWC monitoring team formation ▪ Vulnerabilities ▪ Quality control and ensure

3.15 Sustainability plan

Table 6: Sustainability plan

Topic	Sustainable	Social Equity	Environmental integrity	Economic Vitality
Health	• Regular follow-up of improvement and maintenance of hardware will be required • CWC will take care in future as responsible • Community will finance this cost • Provide staffing or regular funding source • Seed funding • Taking care of the first aid kit	All community people have access equal health facilities	Environment will be less polluted	Reduce medi-care expenses
Organized	• CWC will take care to be organized • Increase CWC capacity of advocacy with the local government and government organization • Community center management committee (sub-committee) • Feedback system	Various committee will be formed to protect people rights	All community people will be concerned to protect the environmental degradation	Optimum uses of resources
Linkage and Coordination	• CWC will continuing the linkage and coordination with the service provider/ authorities for improved support and services • Linkage with the government/non-government organizations	Various linked will be established in the society	Community people acquire knowledge about environment from various sources	Alternative opportunities of professional diversifications
Infrastructure & Services	• Regular maintenance will be required • CWC will take care in future as responsible • Community will finance the require maintenance cost • Construction monitoring committee will monitor and	Infrastructure will be strong and available services for all people	Environment friendly hardware	Local resources will obe used

Topic	Sustainable	Social Equity	Environmental integrity	Economic Vitality
	maintain the quality of the work • CWC/ Waste Management Committee maintenance of garbage disposal of the community	considering gender.		
Economic Opportunities	• CWC continuing the linkage and coordination with the government/non-government organizations • Develop a training program for the community people and train them to continue the trainings among the community people after project ended	Easy access to basic rights	Alternative use of resources	Capable to professional diversify
Social Issues	• CWC continuing the linkage and coordination with the government/non-government organizations • CWC monitor adolescent and child abuse in the community • Make a partnership with organizations / NGOs who provide support for drug addiction	Community people obtain ownership for decision making	Environmental campaign	Ghastly expenses will be reduced
Knowledge & Capacity Building	• CWC continuing knowledge and capacity building support in future • Empower and train the CWC to continue provide trainings for the community people • Make a partnership with organizations / NGOs who provide support for knowledge and capacity building	Acquiring knowledge, accessing resources as well as building networks at their respective levels	Conserve essential life-support ecosystems	Manipulate knowledge & capacity for income generation.

3.16 Design process

Before site selection we conducted the environmental and social safeguard survey within the community area. In the mid stage and final stage of construction, we used the same checklist tools for finding the impacts of the climate smart and inclusive community center. Community leaders were help to find out the suitable place and we (engineer's) are prepared the design for construction work. In every stage of construction work, community was very helpful and they were actively participated including design stage, materials receive, quality control and monitoring, supervision.

We designed the climate smart and inclusive community center as inclusive [6]. Used the ramp, wide doorways and accessible restrooms for the people with disable peoples.

- Energy efficiency and renewable energy: We incorporated the energy-efficient design principles to reduce energy consumption. It's including roofing with cement sheet and provided large opening to enter the light and air and it can ultimately use of daylight and fresh air as well. Consider renewable energy sources such as solar panel to generate the clean energy from nature.
- Water conservation: Implemented water saving technologies, like rainwater harvesting system for landscaping and non-potable uses. Educate the community on the importance of the water conservation.
- Green building materials: We want to use the hollow block as wall and foundation, but due to time shortage and unavailability of materials, we used bricks instead of hollow block. But we used cement sheet as roofing materials as roofing. Cement sheets produce less heat than C.I sheet and also environment friendly material.
- Landscaping and green space: Design the surroundings with native and draught-resistance plants to reduce water uses. Create green spaces that provide a recreational area for the community and improve air quality.
- Climate resilient infrastructure: We incorporating design elements, like maintain floor height and truss design that mitigate flood or water logging and extreme heat or cold.
- Community ownership and governance: After finished the construction work of climate smart and inclusive community center we handed over to the community and in this community center they can did their meeting and community engagement.
    - Monitoring and evaluation by surveying on every stage: We did the survey with community people for analysis on environmental and social safeguard (ESS) checklist for monitoring and evaluation which collected from Climate Bridge Funded (CBF) project.

CHAPTER 4
RESULTS AND DISCUSSIONS

4.1 Results

The outcome or results of the climate smart and inclusive community center is vast and remarkable in the Beguntila slum community. 67 percent peoples of the community will be directly and indirectly benefited on the climate smart and inclusive community center. They can sit together for any type of event and they feel the intergraded climate smart technology inclusively in their area.

- Resilience to Climate Change: The community center can serve as a hub for climate adaptation and mitigation efforts. It may have features like renewable energy sources, rainwater harvesting, and resilient construction, which can help the community withstand the impacts of climate change, such as extreme weather events.
- Reduced Carbon Footprint: By incorporating green building practices and renewable energy sources, the center can significantly reduce its carbon footprint. This serves as a model for the community, demonstrating sustainable practices that can be replicated in homes and businesses.
- Education and Awareness: A climate-smart community center can be an educational resource. It can offer workshops, seminars, and exhibits that educate the community on climate change and how to address it. This can lead to a more informed and environmentally conscious community.
- Community Building: The center can foster a sense of community by providing a space for gatherings, meetings, and events. Inclusivity is a key aspect, and the center may be designed to be accessible to all, regardless of physical abilities or socioeconomic status.
- Economic Opportunities: It may support local economic development by creating jobs related to its operation and maintenance, and by promoting sustainable practices, which can lead to cost savings for the community.
- Cultural Exchange: Inclusive community centers may host cultural events, showcasing the diversity of the community. This can promote understanding and harmony among different groups within the community.

- Youth Engagement: Engaging the youth in climate-smart activities and education can instill a sense of responsibility and activism. It can also provide young people with skills and opportunities for the future.
- Emergency Shelter: In the event of climate-related emergencies, the center can serve as a safe shelter for the community, providing a vital resource during disasters.
- Health and Well-being: Inclusive community centers may also focus on promoting health and well-being by offering fitness programs, mental health support, and access to green spaces.
- Policy Influence: The success of a climate-smart community center can influence local policy decisions. It can demonstrate the feasibility and benefits of sustainable practices, potentially leading to wider adoption of climate-friendly policies.
- Reduction in Inequalities: An inclusive community center can help reduce inequalities by ensuring that all community members, regardless of age, race, gender, or economic status, have access to its resources and benefits.
- Enhanced Quality of Life: Ultimately, a climate-smart and inclusive community center can contribute to an improved quality of life for community members through reduced environmental impact, better community relations, and access to educational and recreational opportunities.

4.2 Discussions

The specific outcomes will depend on the design, objectives, and activities of the community center, as well as the needs and characteristics of the community it serves. Nonetheless, a climate-smart and inclusive community center can play a crucial role in building a more sustainable and resilient community while promoting social inclusion and well-being. The Beguntila community will be impactful and hopefully they can improve their selves with their leadership.

CHAPTER 5
CONCLUSION AND FUTURE WORKS

5.1 Conclusions

The climate-smart and inclusive community center is a vital initiative aimed at addressing both environmental sustainability and social inclusivity. By focusing on these two key aspects, the community center can serve as a beacon of progress and positive change.

In conclusion, the climate-smart and inclusive community center is an invaluable asset to the community. It not only contributes to environmental sustainability but also enhances the quality of life for residents by fostering inclusivity and community engagement. This initiative stands as a testament to the potential for positive change when environmental and social considerations are integrated into community development.

5.2 Limitations

The main limitations are as bellow:

1. Due to time and budget limitations, there are some challenges to fulfilling the community's demands as per their need.
2. Due to short time implementation period there are no opportunity to perform the baseline survey to all the households. In this case our team completed the baseline survey as sample basis.
3. As an environment-friendly material, the hollow block was decided to be used instead of bricks. However, we found the hollow block was not locally available, so the burn bricks were used for the wall.

5.3 Recommendations for Future Works

Location selection is a vital point of view for construction any type of infrastructures and the features of the climate-smart and inclusive community center should be eco-friendly like energy-efficient lighting, solar panels, rainwater harvesting system and natural ventilation. Community can rent for educational programs, workshops, and seminars for people of all ages and backgrounds to earn money to serve the communities others developments work and the maintenance work for center as well.

Community can engage by create platforms for open discussions and idea-sharing related to sustainability and inclusivity. To improve programs and services need to collect feedback from the community for feedback and assessment mechanism and regularly assess the center’s environmental impact and make necessary adjustments.

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[4] https://www.google.com/maps/@23.774609,90.4219455,15z?entry=ttu [last access 16 July 2023].

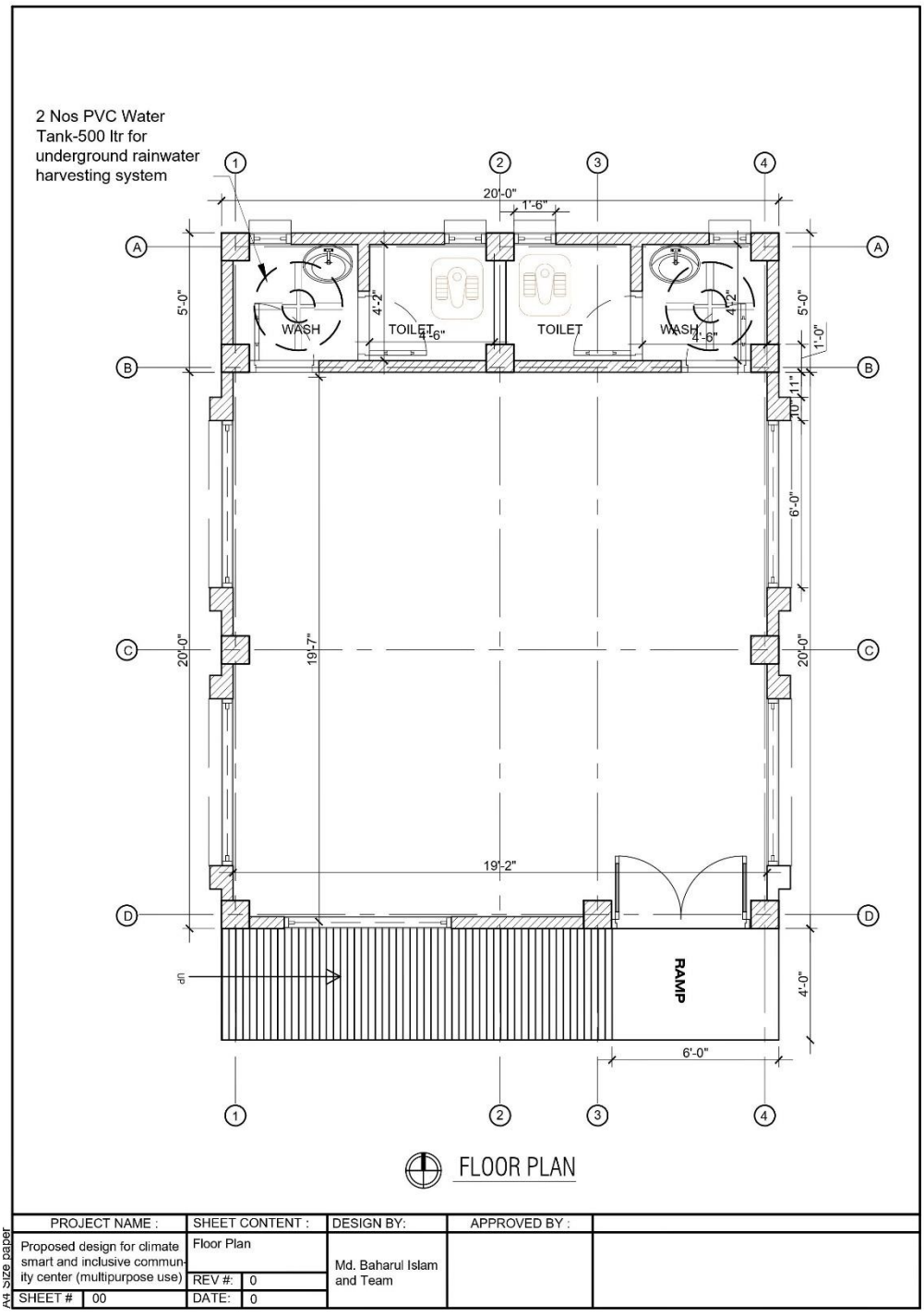
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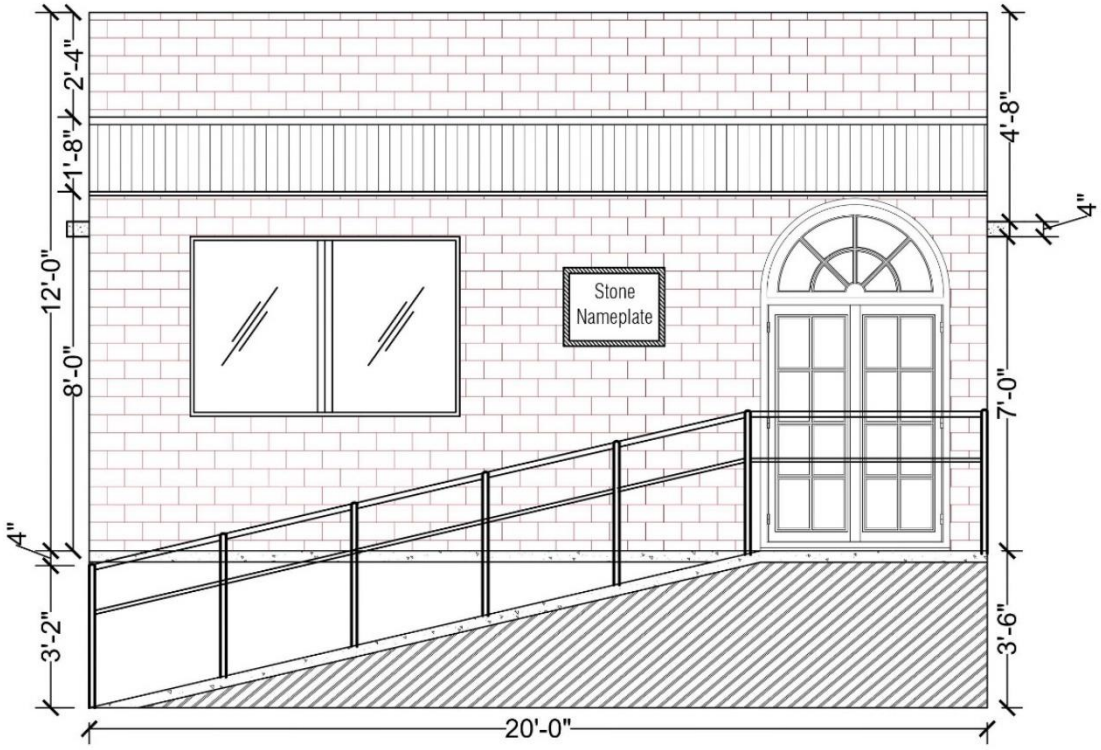
[6] OpenAI. (2023). *ChatGPT* [Large language model]. https://chat.openai.com [last access 18 September 2023].

APPENDIX

Appendix A

Drawings of climate smart and inclusive community center:

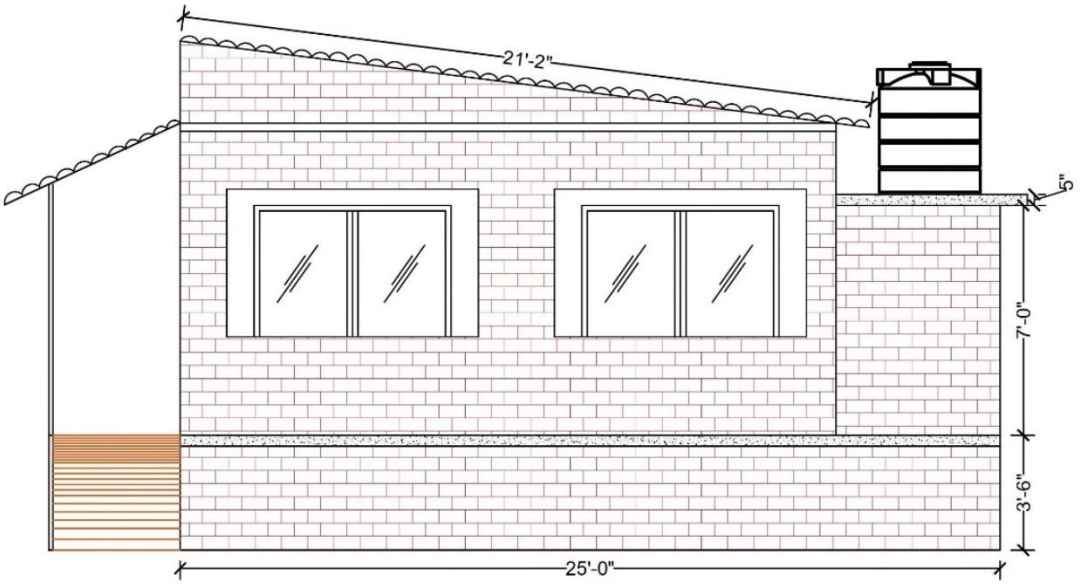




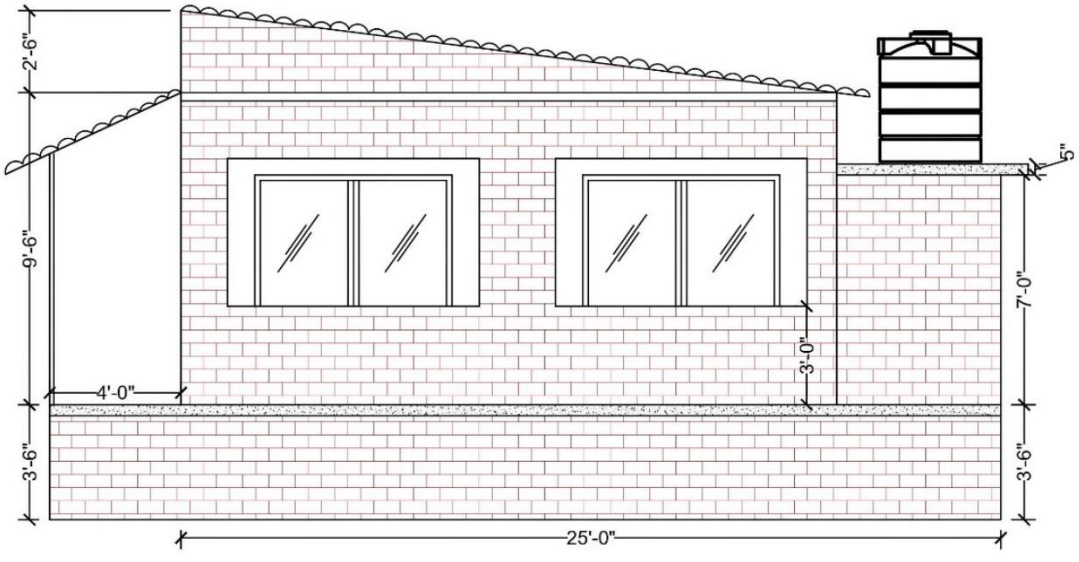
FRONT ELEVATION

PROJECT NAME :	SHEET CONTENT :	DESIGN BY:	APPROVED BY :	
Proposed design for climate smart and inclusive community center (multipurpose use)	Front Elevation	Md. Baharul Islam and Team		
	REV #: 0			
SHEET # 00	DATE: 0			

A4 Size paper



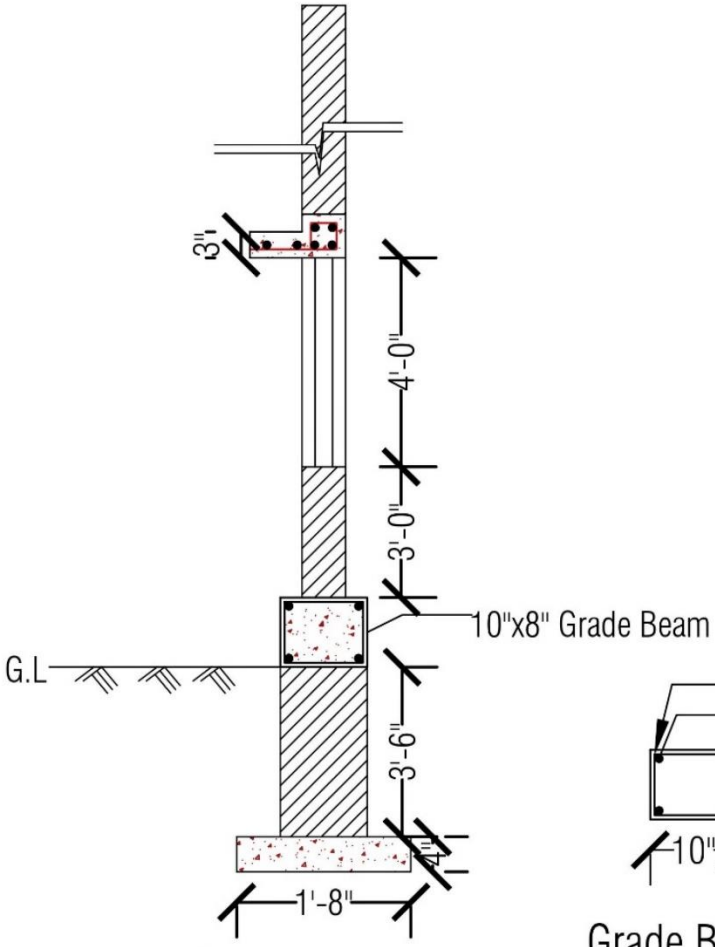
WEST SIDE ELEVATION



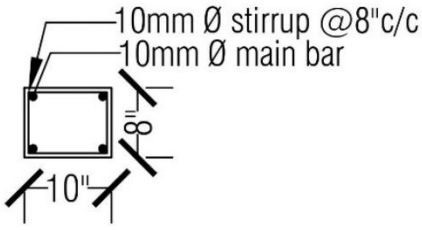
EAST SIDE ELEVATION

PROJECT NAME :		SHEET CONTENT :		DESIGN BY:	APPROVED BY :	
Proposed design for climate smart and inclusive community center (multipurpose use)		Side Elevation		Md. Baharul Islam and Team		
		REV #:	0			
SHEET #	00	DATE:	0			

A4 size paper



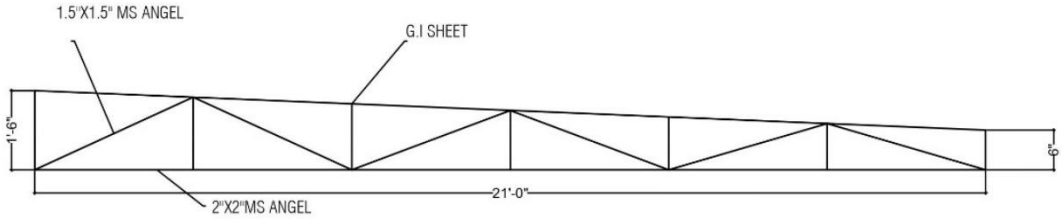
Section of Wall



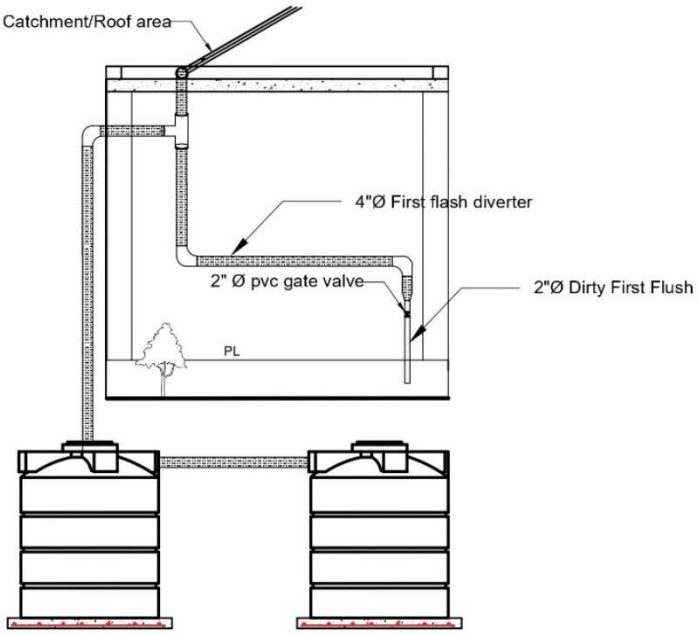
Grade Beam Section

PROJECT NAME :	SHEET CONTENT :	DESIGN BY:	APPROVED BY :	
Proposed design for climate smart and inclusive community center (multipurpose use)	SECTION	Md. Baharul Islam and Team		
	REV #: 0			
SHEET # 00	DATE: 0			

A4 size paper



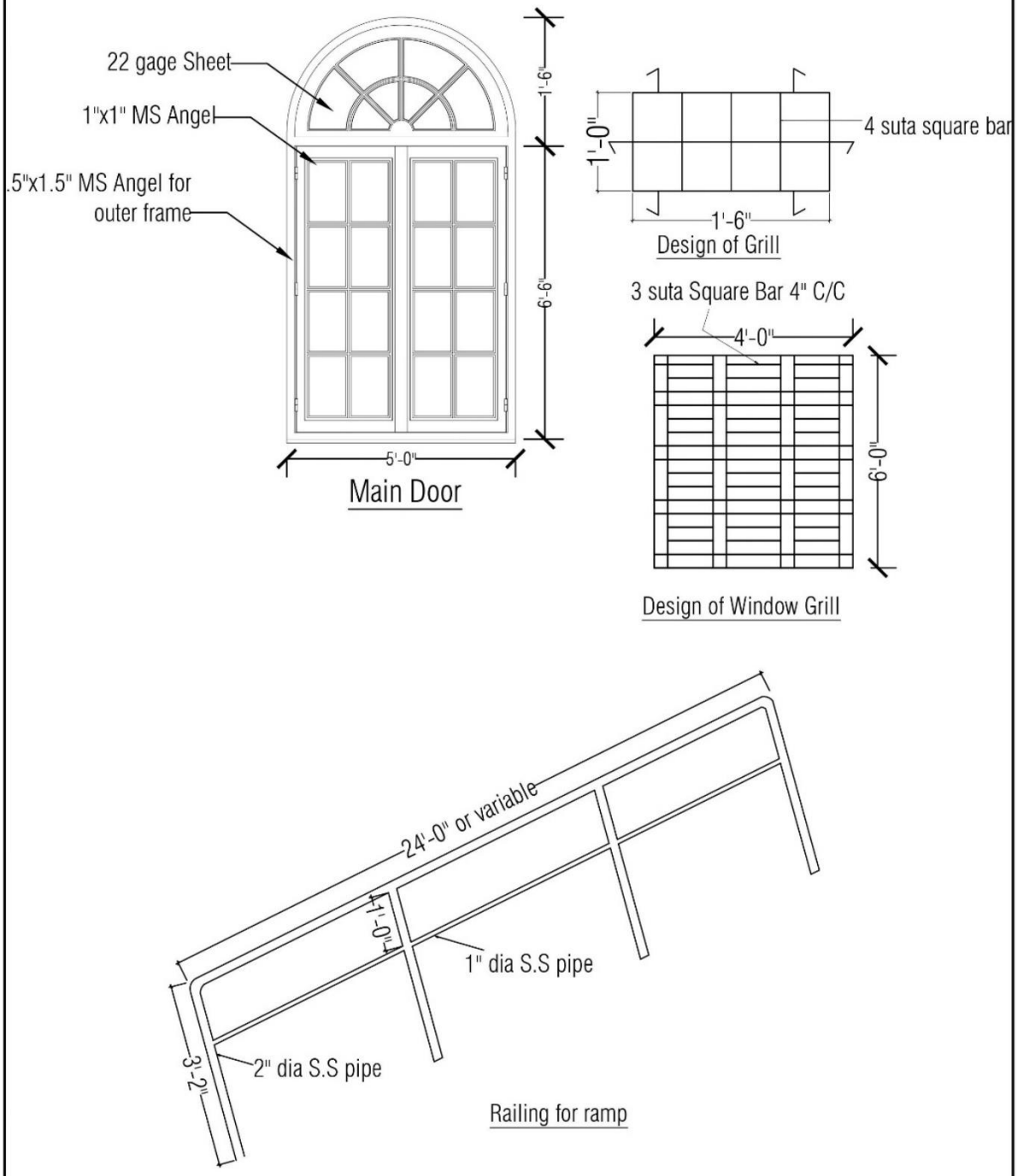
TRUSS DESIGN



ELEVATION FOR RWHS (Rain Water Harvesting System)

PROJECT NAME :	SHEET CONTENT :	DESIGN BY:	APPROVED BY :	
Proposed design for climate smart and inclusive community center (multipurpose use)	Truss design and elevation of RWHS	Md. Baharul Islam and Team		
SHEET # 00	REV #: 0			
	DATE: 0			

A4 size paper



PROJECT NAME :	SHEET CONTENT :	DESIGN BY:	APPROVED BY :	
Proposed design for climate smart and inclusive community center (multipurpose use)	Door, window, ventilator, ramp details	Md. Baharul Islam and Team		
SHEET # 00	REV #: 0			
	DATE: 0			

A4 size paper

Appendix B

Survey questionaries

Survey of climate smart and inclusive community center

Greetings... My name is ..... and I have come from Sonargaon University (SU), doing a pre-survey to implement the climate-smart and inclusive community center. We would like to collect some general information from your household and home. The information will be used for the sole purpose of research work. Your name or identity will not be disclosed without your consent. If you agree to participate and provide us with the requested information, then please give your consent below. You can decide to stop providing information at any time.

latitude (x.x °)

longitude (x.x °)

altitude (m)

accuracy (m)

close polygon

KML



Do you agree to provide information?

OK

Interviewer's name:

Block/house no:

Interview date:

Respondent's name: [Note: A respondent should be above 18 years of age]

1.1. What is your age?

- ◯ 18-25
- ◯ 26-35
- ◯ 36-50
- ◯ 51-65
- ◯ 65+

1.2. Gender

- ◯ Male
- ◯ Female
- ◯ Non-binary
- ◯ Prefer not to say

1.3 Your religion

- ◯ Muslim
- ◯ Hindu
- ◯
- Christian ◯
- Others

1.4. How long have you been a resident of this community?

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ More than 10 years

2.1. On a scale of 1 to 5, how would you rate your knowledge about climate change and its impacts?

- ◯ 1 (Low)
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5 (High)

2.2 What specific climate-related challenges do you think our community faces?

_____

2.3. Are you interested in learning more about climate-smart practices and initiatives?

_____

3.1. Have you ever visited a community center before?

- ◯ Yes
- ◯ No

3.2. What types of services or programs would you like to see offered at the community center? (Check all that apply)

- ☐ Climate education workshops
- ☐ Sustainable living classes
- ☐ Inclusive events and activities
- ☐ Green technology demonstrations
- ☐ Other (please specify): _____

4.1. How inclusive do you prefer the current community spaces are?

- ☐ Not at all inclusive
- ☐ Slightly inclusive
- ☐ Moderately inclusive
- ☐ Very inclusive
- ☐ Extremely inclusive

4.2 What barriers do you perceive that prevent some community members from participating in local activities or events?

_____

4.3. Are there specific groups within the community that you feel are underserved or overlooked?

- ◯ Yes
- ◯ No

5.1. What are your expectations from a climate-smart and inclusive community center?

_____

5.2. Do you have any suggestions or ideas for making the community center more accessible and welcoming?

_____

5.3. How can the community center contribute to addressing climate-related challenges in our community?

_____