RICE RESEARCH INSTITUTE

By

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A thesis submitted to the Department of Architecture in partial fulfillment of the requirements for the degree of

Bachelor of Architecture

Department of Architecture
Brac University
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Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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Approval

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Of Summer, 2019 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Architecture on August 06, 2019.

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Abstract

Rice Research Institute, Sirajganj the selected site is in Konabari, Sirajgonj near to the Jamuna River. The north-central district Sirajganj is a BPH (Brown plant hopper) prone area of Bangladesh where rice production is decreasing day by day. Flood, water logging and river erosion, salinity of soil and sandy soil is complication to cultivate the rice in Sirajgonj. Therefore, it is important to develop a modern rice research institute in Sirajgonj so that local farmers are greatly benefited through updated knowledge and practice that would help them to increase their rice production.

The project is to design a research institute, which will be knowledge hub for local farmers and a place to celebrate rice related cultural events. A plaza is proposed in the middle point of the institute where research will be held and the cultures will be exhibited. The proposed training facilities of this institute will play a significant role in enhancing the skills, knowledge, and awareness rising of local people. The concept of this project has been taken from the paddy field's outline, which supports form generation. The focus of this project was to generate conduct proper research.

Keywords: Sirajganj, Climate, Research, Paddy Field.

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Firstly, I would like to start in the name of Almighty, who gave me the strength and made me capable to complete my thesis.

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List of Acronyms

BPH	Brown plant hopper
BRRI	Bangladesh Rice Research Institute
EPRRI	East Pakistan Rice Research Institute
GDP	Gross Demotic Product

Chapter 1

Introduction

Rice Research Institute, Sirajgonj is a new proposed project of govt. for the fulfillment of country's rice production location. In this first chapter a brief of the project is given along with a general idea about the site and its surroundings. A basic idea is also presented and formal introduction to the project and its aims and objectives are clarified in this section of the writing.

1.1 Project Introduction

Rice Research Institute is an agricultural research institute in Bangladesh. Rice is the staple food of about 135 million people of Bangladesh. Rice sector contributes one-half of the agricultural GDP. According to the climate changes more research is needed to increase the production of rice in our country. To increase rice production to necessary level, research for new variety and technology development and technology transfer accelerated need establishment of these types of institute. The idea of the project is to develop strengthen research according to the climatic changes.

1.2 Project Brief

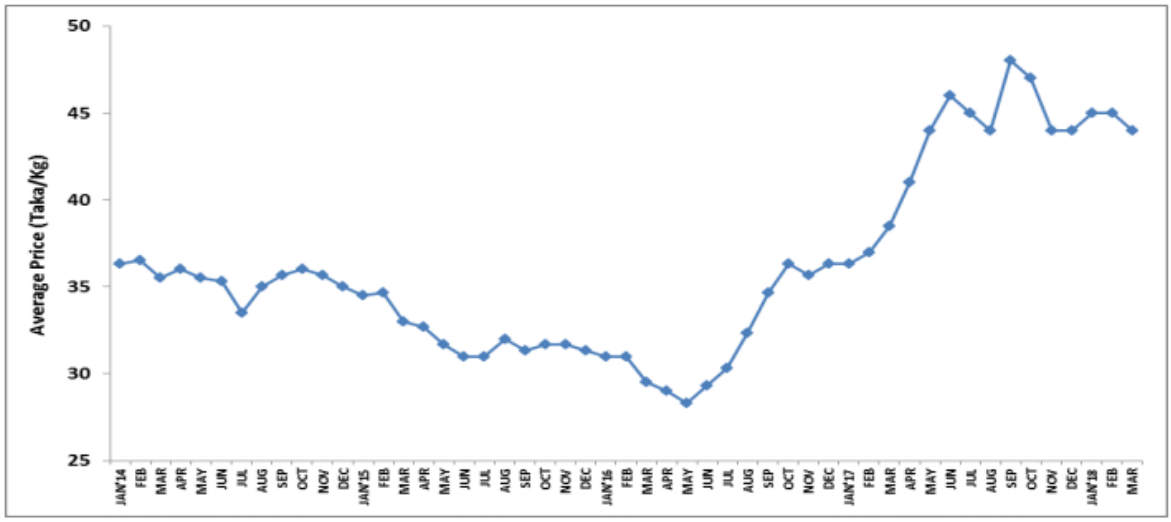
1.2.1 Project name:

Rice Research Institute, Sirajgonj.

1.2.2 Location & Site Area:

The site is located in Sadanandapur, Kamarkhand upazila, Sirajgonj. It is situated at 11 km from Bangabandhu Bridge and 12 km from Sirajganj city and adjacent to the Dhaka-Rajshahi Highway Road. The total site area is 10 acres which means 435600 sqft. It is very near to NDP (National Development Program) main branch office.

Figure 1. Bangladesh: Monthly Average Retail Prices of Coarse Rice



Source: Department of Agricultural Marketing and Trading Corporation of Bangladesh

Figure.1. Bangladesh Monthly Average Retail Prices

1.2.3 Client: Ministry of Agriculture.

- To increase more rice production in that particular area.
- Need more research as Sirajgonj is BPH prone area
- To increase socio-economic conditions of farmers of that area.
- To give water logging solution for the existing processes as farmers have problems in rice productivity in that climatic situation.
- Create some employment opportunities for the rural unemployed.

1.3 Project Background

Rice Research Institute, Sirajganj the selected site of this project is at Konabari, Sirajgonj near to the Jamuna River. All the administrative rules and regulation assigned by Bangladesh Government. Realizing the importance of rice in food security, an autonomous organization in the name of EPRRI was established in 1970, which was renamed as Bangladesh Rice Research Institute after independence in 1971. BRRI is a Major component of the national agriculture research system of Bangladesh, dealing with research and development in relation to rice production. The research institute has a great contribution for ensuring country's food security. As the rice growing environments in Bangladesh are very diverse, varying from the drought-prone high lands in the north-west through the food affected central region to the coastal saline zone. This diversity is indicated by thirty major agro ecological zones. This diversity of environment makes the task of BRRI scientists become more challenging. Researches for the development of new rice varieties and production technologies for the diverse Ecosystems existing in Bangladesh are conducted at BRRI and regional station of sirajgonj. (BRRI , 2019)

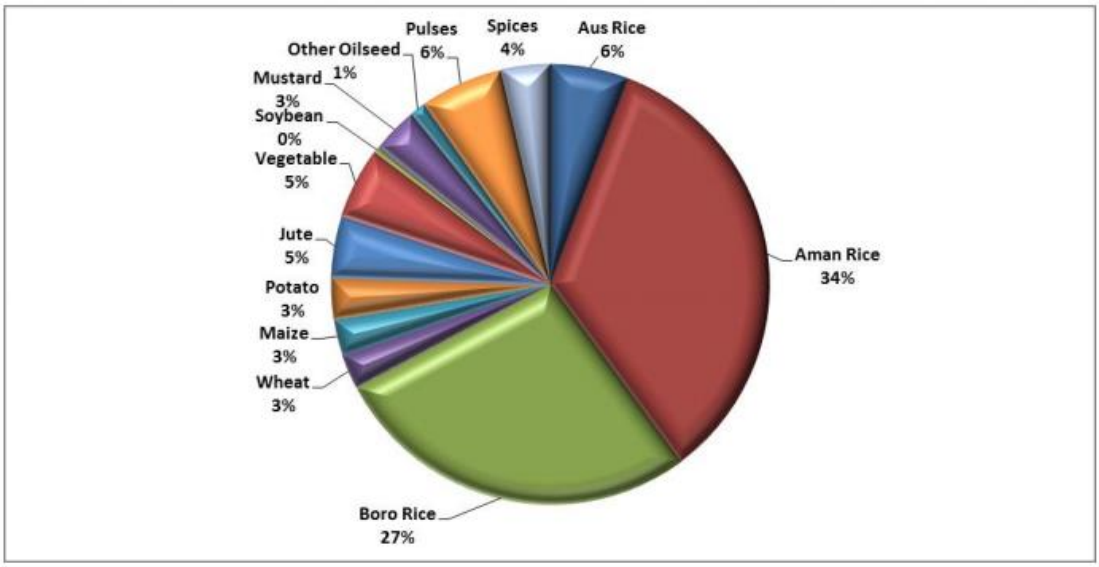


Figure.2. Bangladesh Type of Rice Production

1.4 Project Rational

The north-central district Sirajganj is a BPH (Brown plant hopper) prone area of Bangladesh that is why Ministry of agriculture thinks to establish the regional station of BRRI in this area. Flood, water logging and river erosion is the main problems in this area. In this area salinity of soil and sandy soil is another complication to cultivate the rice. Consequently the target of the project is to make climate resilient rice production and make the soil fertile. Developing of modern, high yielding inbred and hybrid varieties of rice with the aim to fit present requirement of the country is most demanding. The purpose of the project is attaining food security through new modern rice varieties and related technologies. As our country had divided on the basis of land, soil, and climate and for fulfillment of our country's rice production as well as location specific rice research Ministry of agriculture needs to build the institute in Sirajgonj.

From this chapter a basic idea of the site as well as the project can be achieved. Later parts of the writing will have elaboration of these topics discussed in details.

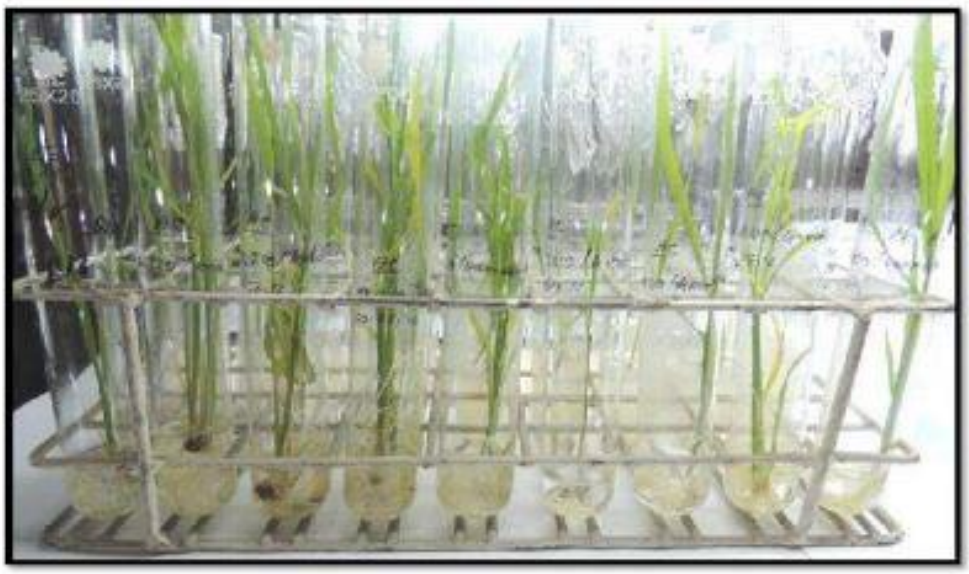
Chapter 2

Literature Review

The study focuses on issues like research, research institute and mechanism. Key concept of the study is what research is and its importance of any particular agriculture and the types of research and their application in different sector. Responsive architectural consideration is studied thoroughly. A basic idea is projected how actuation is possible for structures and their implementation.

2.1 Research

Research comprises creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications. It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories.



Source: Author

The aim of research is to make known something previously unknown to human beings. It is to advance human knowledge, or to make it more certain. The purpose of research is to discover answers to questions through the application of scientific procedures.

Scientific research is a systematic way of gathering data and harnessing curiosity. This research provides scientific information and theories for the explanation of the nature and the properties of the world. Scientific research is funded by public authorities, by charitable organizations and by private groups, including many companies. Scientific research can be subdivided into different classifications according to their academic and application disciplines. Research in the humanities involves different methods such as for example hermeneutics and semiotics. Context is always important, and context can be social, historical, political, cultural, or ethnic. An example of research in the humanities is historical research, which is embodied in historical method.

Artistic research, also seen as 'practice-based research', can take form when creative works are considered both the research and the object of research itself.

2.2 Research Institute

A research institute or research center is an establishment founded for doing research. Research institutes may specialize in basic research or may be oriented to applied research. Although the term often implies natural science research, there are also many research institutes in the social science as well, especially for sociological and historical research purposes.

A research institute is basically an institute where "research" is performed. Any research institute will typically have some focus areas and disciplines where its staff would be carrying out research.

Dhaka North City Corporation’s only archaeological heritage site, the 118-year-old Khamarbari, was the oldest research laboratory in the country. Khamarbari is the first site of many agricultural innovations in Bangladesh. It is first laboratory for research the agriculture. Among many other lots of innovations, the paddy "Najirshail" was invented here. (The Daily Star, 2019)

BRRI is a major component of the National Agricultural Research System (NARS) of Bangladesh, dealing with research and development in relation to rice production. BRRI was established in October, 1970 in Joydebpur, Gazipur. The Institute has an outstanding contribution to the food security of Bangladesh. So far it has developed 67 high yielding rice varieties including four hybrid ones. Moreover, these varieties are cultivated in about 80 percent of the total rice areas and contribute almost 91 percent of total rice production of the country. Rice research started in this part of the sub-continent in 1910. However, the modern era of rice research and development started in the mid-sixties. The demand for rice was high in the past and it has been increasing day by day because of increasing population size. (BRRI , 2019)

2.3 Agricultural Statistics

Agricultural Statistics Division is involved in research and statistical consulting for BRRI. Because of its activities, the collaborative work with other divisions gives scientists a wide range of opportunities to work and to learn practical applications of statistical principles from direct experience. The vision of the division is to improve and develop statistical standard, design, methods and application in agricultural research for rice production and for sustainable food security. And the mission is to: Provide proactive support by designing and delivering innovative programs that enable the institute to attract, maintain and develop world class scientists; Provide high quality research programs through adoption of different training

methods and comprehensive statistical programs in line with the researchers requirements; Improve statistical standards and application in agricultural research; and Disseminate statistical method in almost all aspects of agricultural research. (District Statistics 2011 , 2013)

2.3.1 Socio-economic impact: BRRI is engaged in developing new rice technologies to improve socioeconomic conditions of the rice farmers of Bangladesh. Farmers may not accept even an improved rice technology if it does not suit their socioeconomic conditions. Scientists of Agricultural Economics and Agricultural Statistics Divisions are giving inputs to biological scientists, policy makers and extension agents through: Socio-economic survey of rice farmers; Economic evaluation of new rice production technologies before and after they are released; Identifying constraints to widespread adoption of MV rice technologies; Surveying impact of MV rice technology on production, and employment; Studying rice marketing systems; Studying genetic coefficient of BRRI released varieties; Studying stability analysis of BRRI released varieties; Estimating sampling technique for rice yield components; Providing training programs for manpower development of BRRI scientists on statistical analysis, computer processing and data analysis; Disseminating statistical method in almost all aspects of agricultural research. (District Statistics 2011 , 2013)

2.4 Agronomic Practices

Farmers hardly achieve the production potentials for recommended rice varieties because of failure to apply proper cultural practices. For the benefit of the farmers, agronomists manipulate the management practices to create favorable conditions for crop production and to increase yield. Scientists of the Agronomy Division are engaged in finding, verifying and evaluating the following issues:

- Raising quality seedling and nursery management;

- Suitable planting methods for a direct-seeded upland, direct wet seeded rain fed lowland and irrigated rice;
- Variety-wise planting time of rice in different seasons;
- Fertilizer management for direct-seeded and transplanted rice;
- Increase nutrient use efficiency through different management practices;
- Soil health improvement and green manuring in rice cropping systems;
- Herbicide screening for direct-seeded and transplanted rice; Allelopathic effect of different genotypes in weed suppression;
- Agronomic management for submergence, salinity and drought tolerant varieties; and Crop modeling and resource management. (Field Crop Research)

2.5 Architectural Consideration for Lab Design

Scientific laboratory technicians carry out the work that allows scientists to concentrate on, and perform, the more complex analytical processes in the laboratory. Need to variety of laboratory-based investigations within biological, chemical, physical and life science areas. (Watch, 2016)

2.5.1 Lab Planning Module: The laboratory module is the key unit in any lab facility. When designed correctly, a lab module will fully coordinate all the architectural and engineering systems. A well-designed modular plan will provide the following benefits:

- Flexibility—the lab module, as Jonas Salk explained, should "encourage change" within the building. Research is changing all the time and buildings must allow for reasonable change.
- Expansion—the use of lab planning modules allows the building to adapt easily to needed expansions or contractions without sacrificing facility functionality. The depth is based on the size necessary for the lab and the cost-effectiveness of the structural system.

In today's lab, the ability to expand, reconfigure, and permit multiple uses has become a key concern. The following should be considered to achieve this:

- Equipment zones— these should be created in the initial design to accommodate equipment, fixed, or movable casework at a later date.
- Generic labs
- Mobile casework— this can be comprised of mobile tables and mobile base cabinets. It allows researchers to configure and fit out the lab based on their needs as opposed to adjusting to pre-determined fixed casework.
- Flexible partitions—these can be taken down and put back up in another location, allowing lab spaces to be configured in a variety of sizes.
- Overhead service carriers—these are hung from the ceiling. They can have utilities like piping, electric, data, light fixtures, and snorkel exhausts. They afford maximum flexibility as services are lifted off the floor, allowing free floor space to be configured as needed.

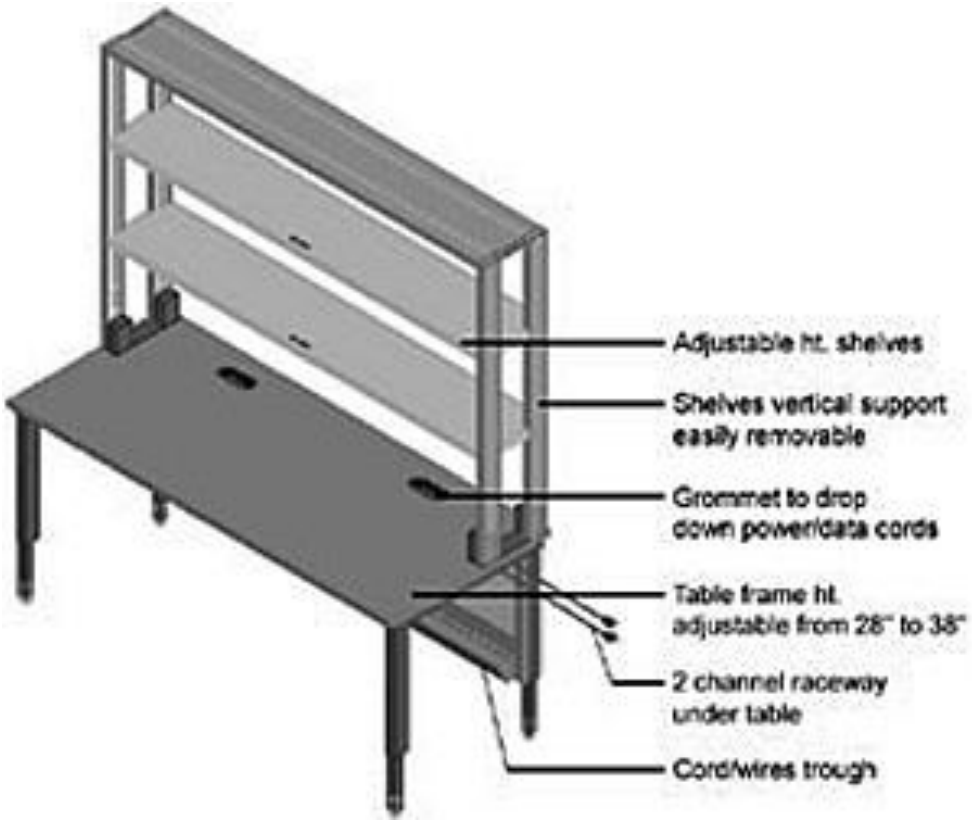
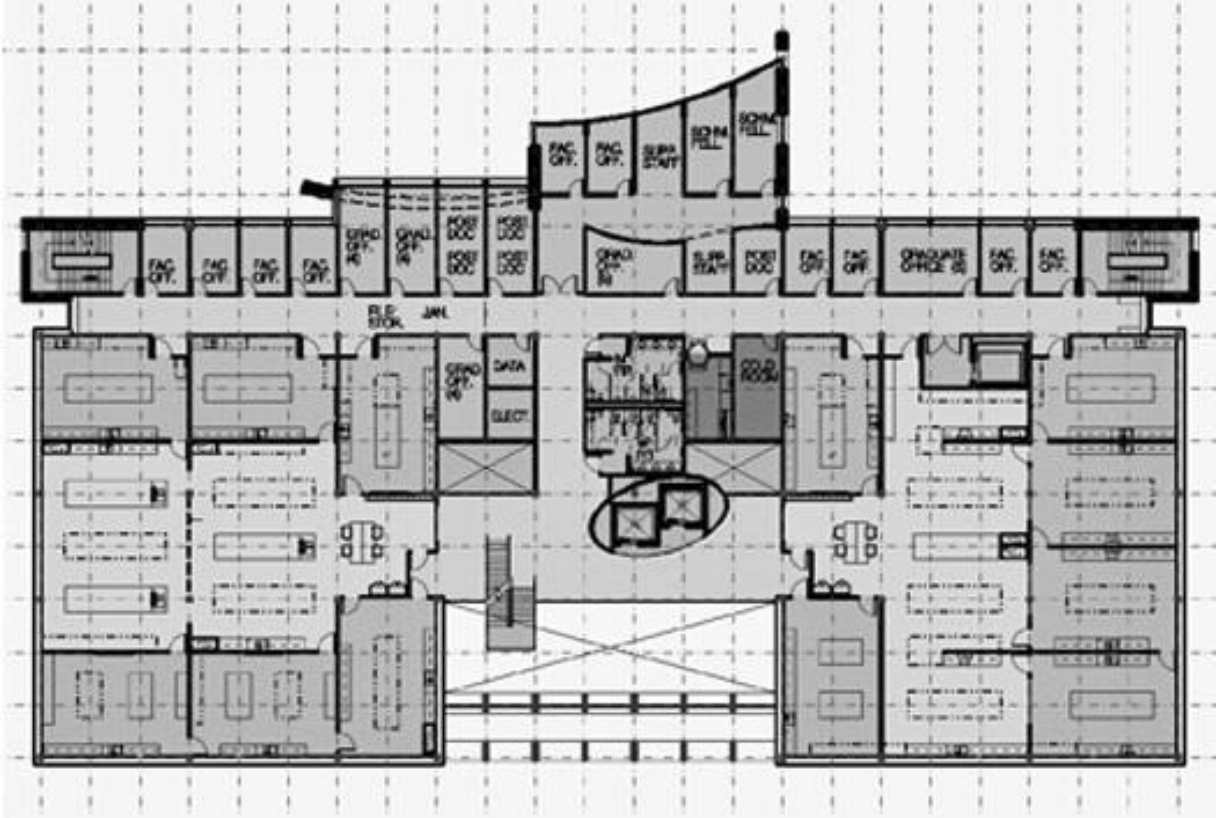


Figure 1 Mobile Case Work ***(2016)***

Figure 2 Mobile Base Cabinet ***(WBDG, 2016)***

Photo Credit: Kewaunee Scientific Corp

2.5.1.1 Two-Directional Lab Module—another level of flexibility can be achieved by designing a lab module that works in both directions. This allows the casework to be organized in either direction. This concept is more flexible than the basic lab module concept but may require more space. The use of a two-directional grid is beneficial to accommodate different lengths of run for casework. The casework may have to be moved to create a different type or size of workstation.



When the lab module is organized to work for both orientations, the laboratories are much more flexible than with a one-directional module. (Watch, 2016)

2.5.1.2 Three-Dimensional Lab Module— the three-dimensional lab module planning concept combines the basic lab module or a two-directional lab module with any lab corridor arrangement for each floor of a building. This means that a three-dimensional lab module can have a single-corridor arrangement on one floor, a two-corridor layout on another, and so on. To create a three-dimensional lab module:

- A basic or two-directional lab module must be defined.
- All vertical risers must be fully coordinated. (Vertical risers include fire stairs, elevators, restrooms, and shafts for utilities.)

- The mechanical, electrical, and plumbing systems must be coordinated in the ceiling to work with the multiple corridor arrangements.

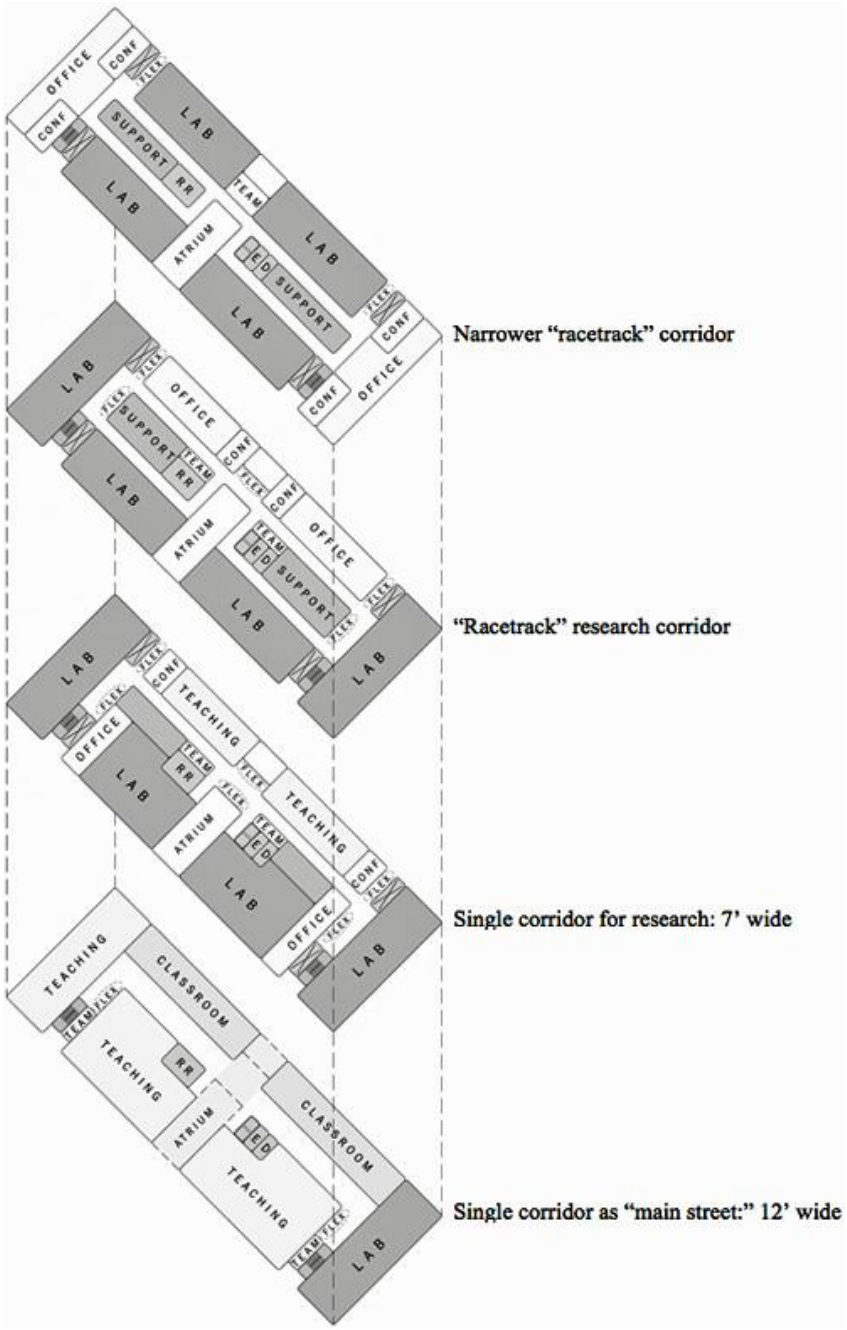


Figure 3 Plan of open Lab ***(Watch, 2016)***

2.5.1.3 Open labs vs. closed lab an increasing number of research institutions are creating "open" labs to support team-based work. The open lab concept is significantly different from that of the "closed" lab of the past, which was based on accommodating the individual principle investigator. In open labs, researchers share not only the space itself but also equipment, bench space, and support staff. The open lab format facilitates communication between scientists and makes the lab more easily adaptable for future needs. A wide variety of labs—from wet biology and chemistry labs, to engineering labs, to dry computer science facilities—are now being designed as open labs. Most laboratory facilities built or designed since the mid-1990s in the U.S. possess some type of open lab.

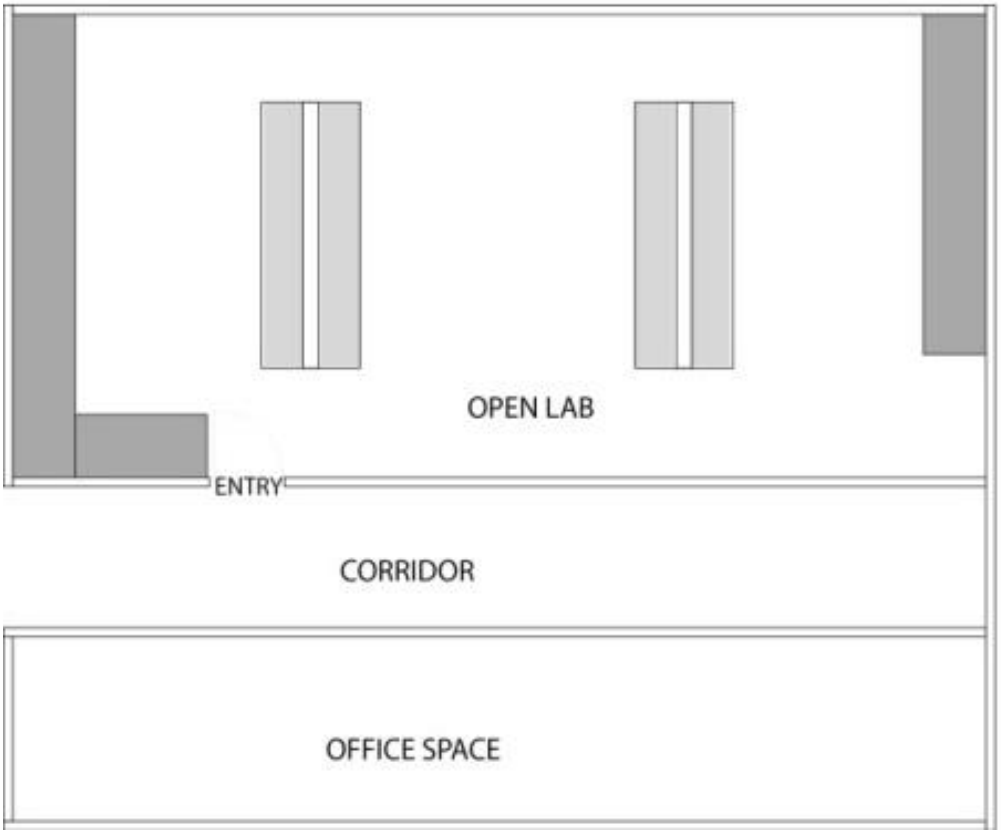


Figure 4Detail Plan of Open Lab ***(Author)***

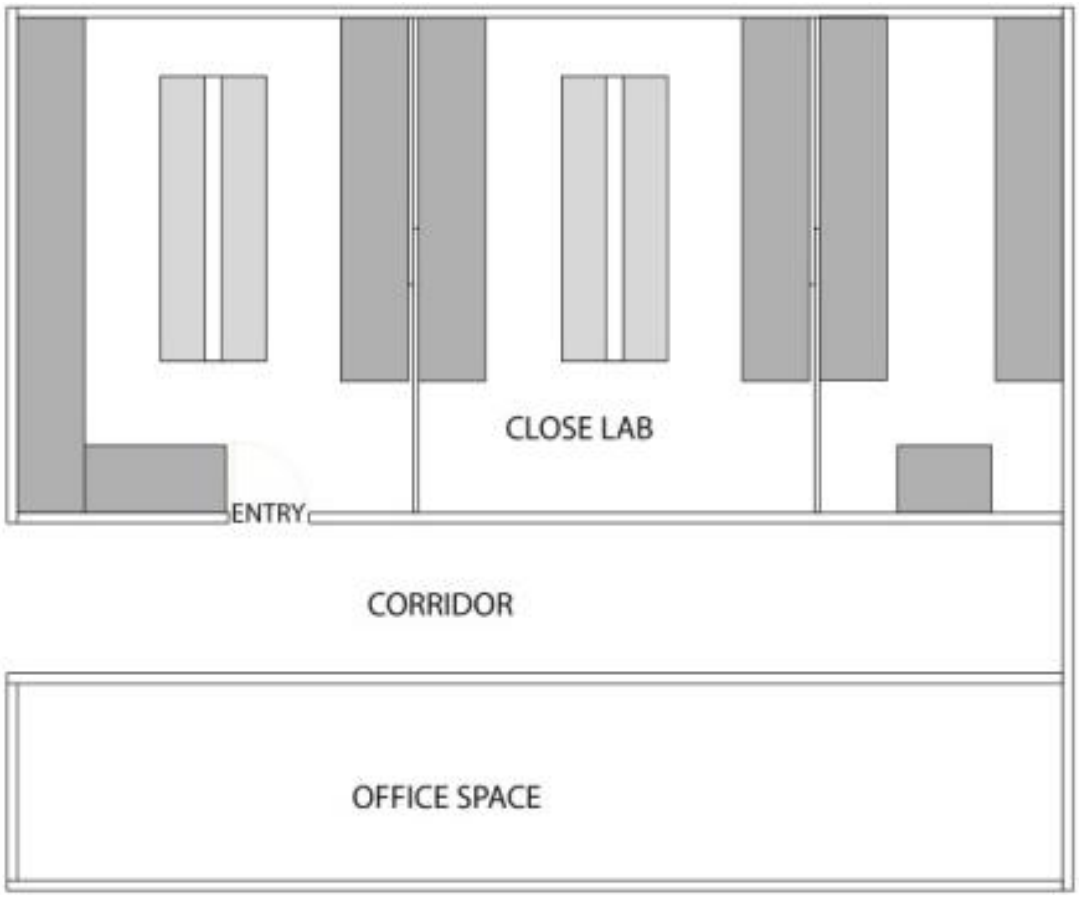


Figure 5 Detail Plan of Close Lab ***(Author)***

Figure 6 Images of Lab ***(WBDG, 2016)***

These laboratories have high, sloped ceilings which allow natural indirect light in, provide engineering services above the laboratory equipment, and provide enough space to stack the equipment easily and safely.

2.6 Lab Planning Concept

Illustrated below are three ways to organize a single corridor scheme:

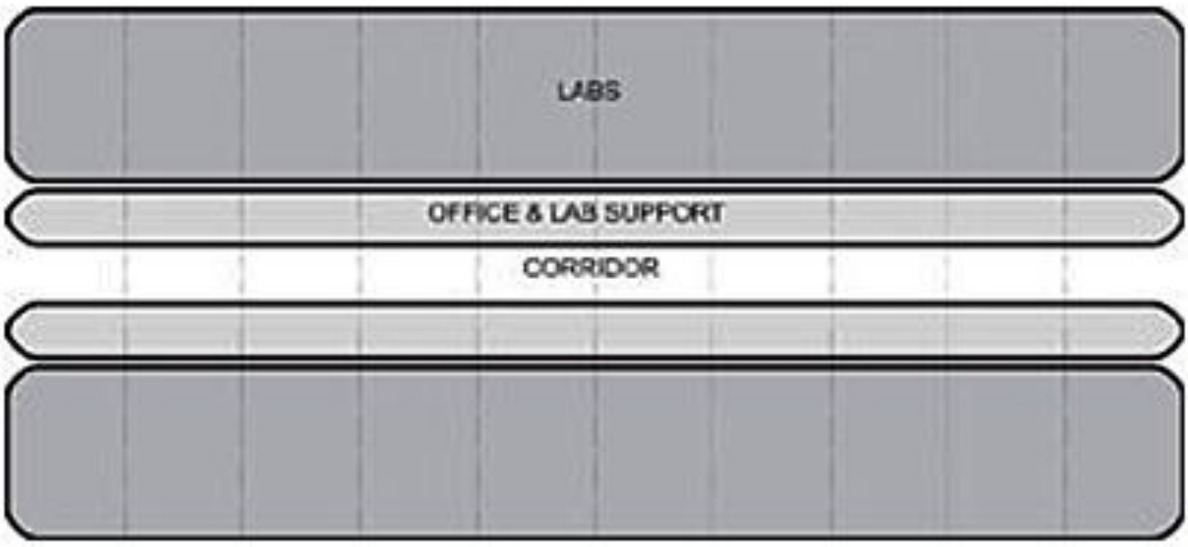


Figure 7 Single Corridor Lab Design with Labs and office. (Watch, 2016)

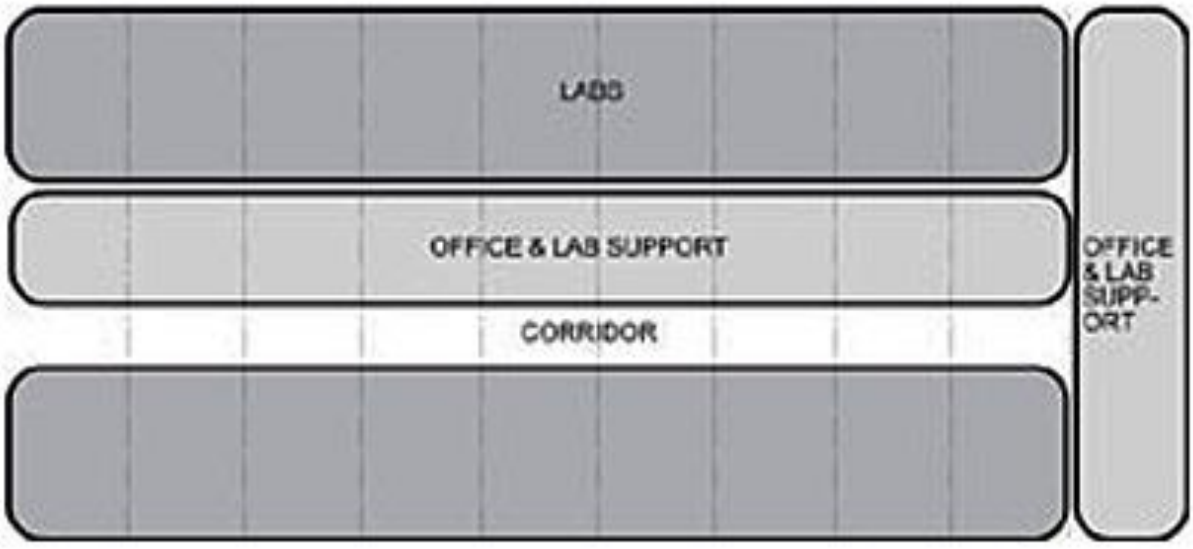


Figure 8 Single Corridor Lab Design with Clustered Together at the End. (Watch, 2016)

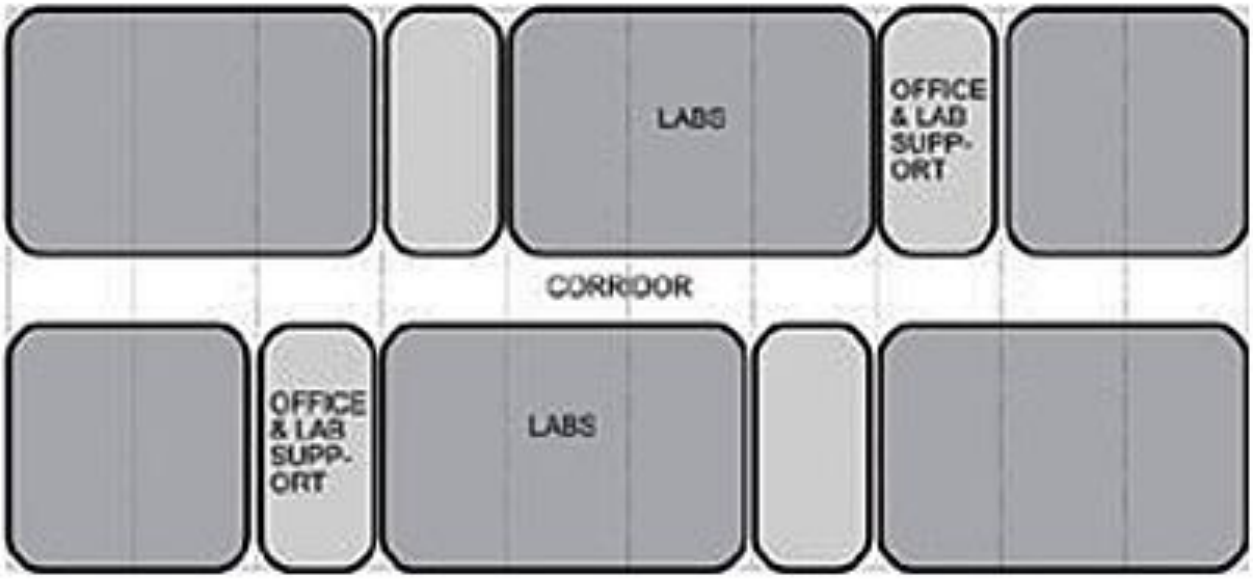


Figure 9 Single Corridor Lab Design with Office. (Watch, 2016)

Over the past 30 years, architects, engineers, facility managers, and researchers have refined the design of typical wet and dry labs to a very high level. To increase rice production to necessary level, research for new variety and technology development and technology transfer accelerated need establishment of these types of institute. The idea of the project is to develop strengthen research according to the climate change.

From this chapter an idea of research institute and program of it is achieved. The through study makes clear idea of different types of laboratories and functions and how it works actually.

Chapter 3

Site Appraisals

The site appraisal chapter holds the details of the site such as site location, area, and its surroundings. The access ways or streets and communication means, landmarks. An overall idea of the site climate or environmental situation is achieved from this chapter. Analysis of the site and its surroundings is presented here.

3.1 Site Location

The site is located in Konabari Mauja under Kamarkhand upazila of Sirajganj district, Bangladesh. It is situated at 11 km from Bangabandhu Bridge and 12 km from Sirajganj city and adjacent to the Dhaka-Rajshahi Highway Road. The site is very near to the Jamuna River.

Figure 10 Site Location in Reference to Bangladesh ***(Author)***

It is located in Jamuna's Barrage basin under the Agricultural Environment Zone 4 and 25.This district is surrounded on the notrth by Bogra district, on the east by Tangail and Manikganj districts, on the south by Manikganj and Pabna districts and on the west by Natore and Bogra districts. According to agricultural research sirajgonj district is a BPH zone prone area of Bangladesh.

Figure 11 Site Map (Google Map)

Figure 12 Site View toward to the Road ***(Author)***

Figure 13 Site View from the Road ***(Author)***

3.2 Site Surrounding

The site is about 10acres of land in which 7 acre would be used for field lab. The level of land almost the entire district is appreciably low in comparison to the land of the adjacent districts. This factor has got some influence over the growth of plants and trees in the district. This area is occupied by permeable silt loam to silt clay loam soils on the ridges and impermeable clays in the basins, neutral to slightly acid in reaction. Being near to the river Jamuna also helps, as visitors coming to this area get to experience both the rivers likewise.

Figure 14 Site Surrounding Map ***(Author)***

Figure 15 Images of Site Entry from Road ***(Author)***

3.3 Site Potentials

Our economy has flourished and our civilization has developed centered around the rivers. Behind the Jamuna River the land are fertilized enough to cultivate rice.It is the land area planted to crops which remain standing for a long period of time and do not need to be replanted after a seasonal harvest. But flood, water logging and river erosion is the main problems in this area. In this area salinity of soil and sandy soil is another complication to cultivate the rice.

3.3.1Water Bodies

Jamuna, Baral, Ichamati, Karatoa are main rivers of this district. About 10% area of the Chalan Beel is located in this district. Because of lots of water body river flood is occurred in every year of this area. Water logging and river erosion is very commom in the area. In the flood time due to water logging it is difficult to cultivate rice or others vegetables.

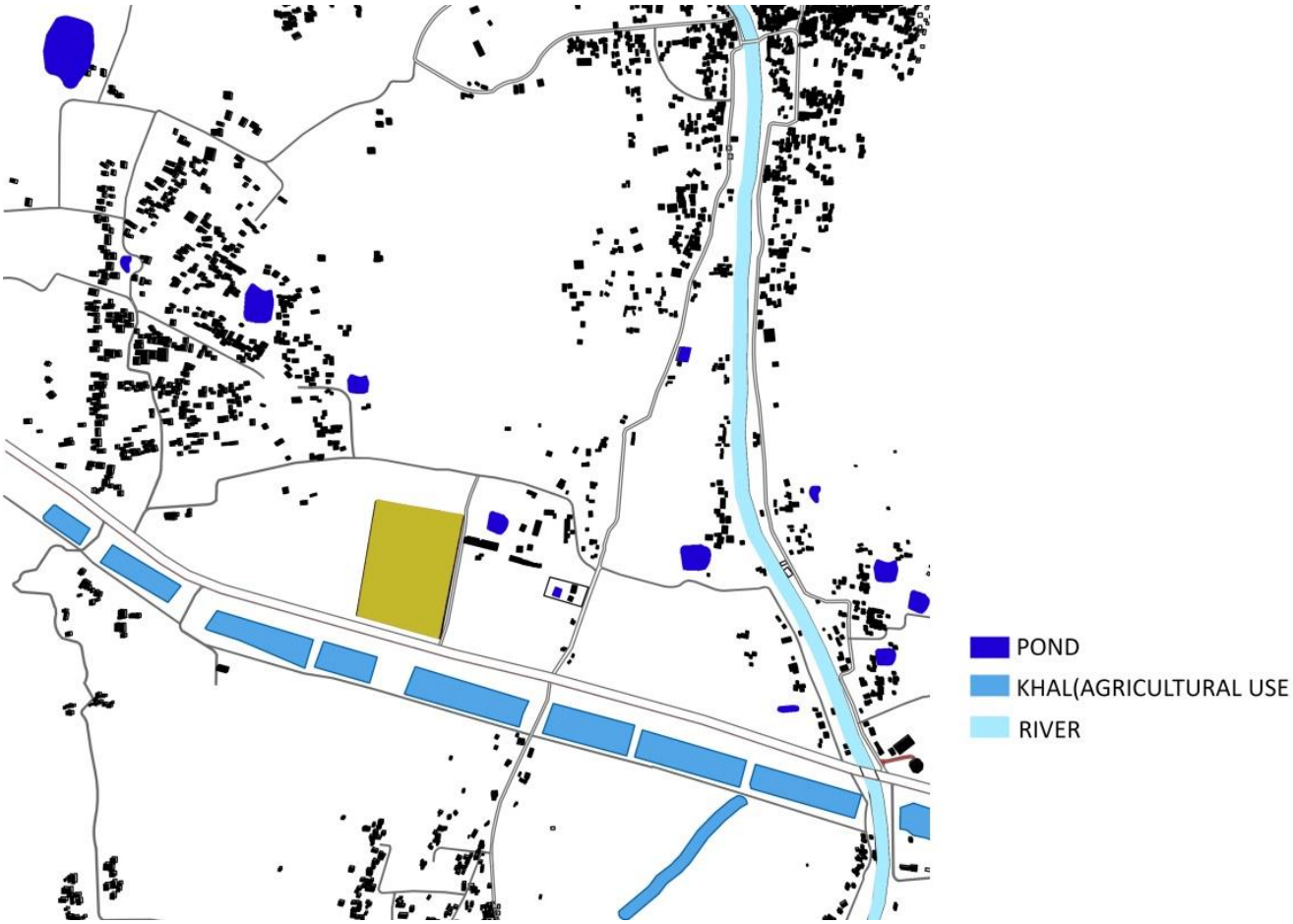


Figure 16 Water Body ***(Author)***

Figure 17 Water Bodies ***(Author)***

3.3.1Agriculture Land and Build Area

In this area, there is 70-80% agriculture land and less build form. There are many agricultural lands here that help people to manage their livelihood. Around 10 acre, 7 acre has to be field lab as requirement in the site which means the agriculture is very importance for the people of the area.

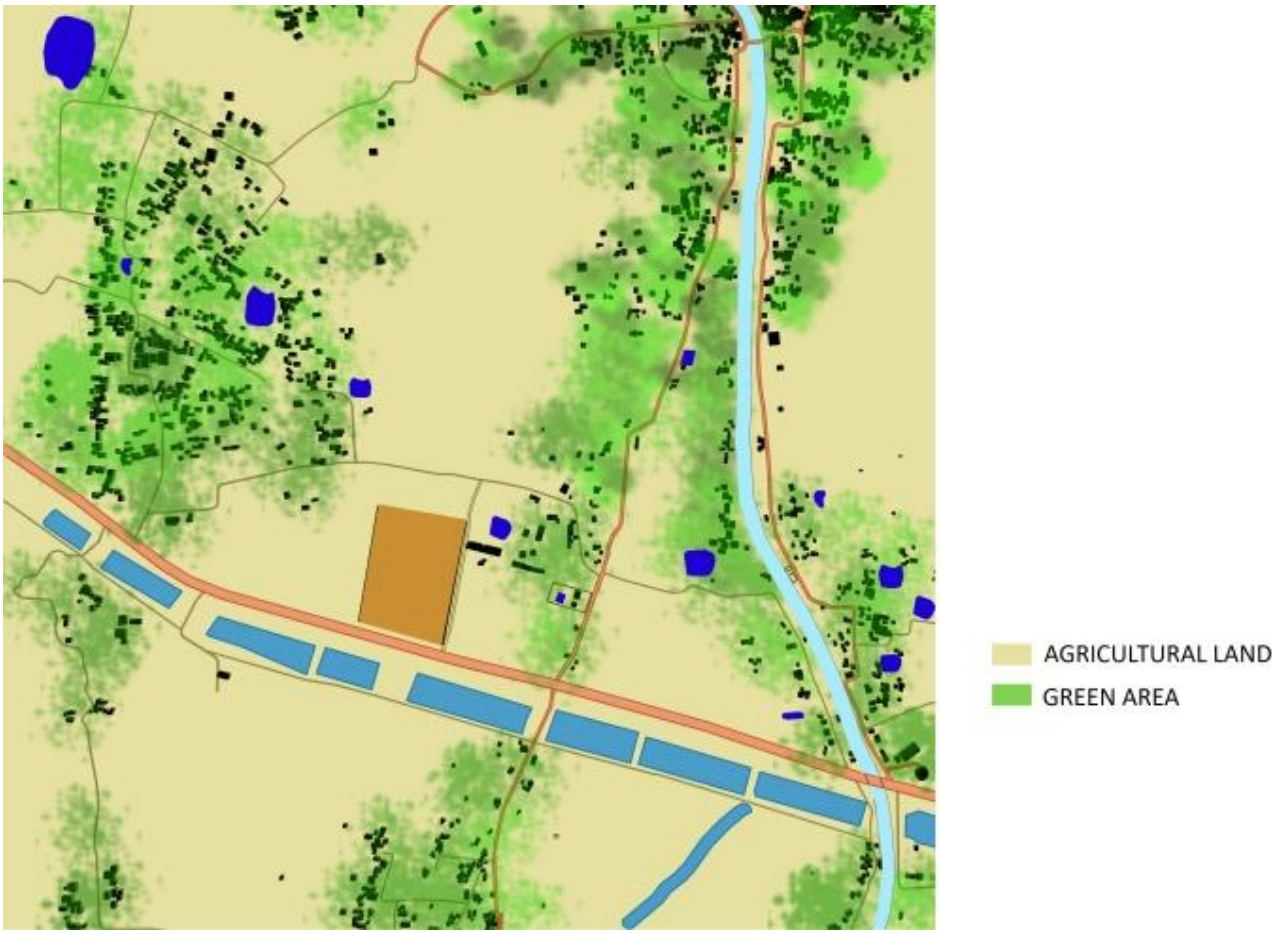


Figure 18 Agricultural Land **(Author)**

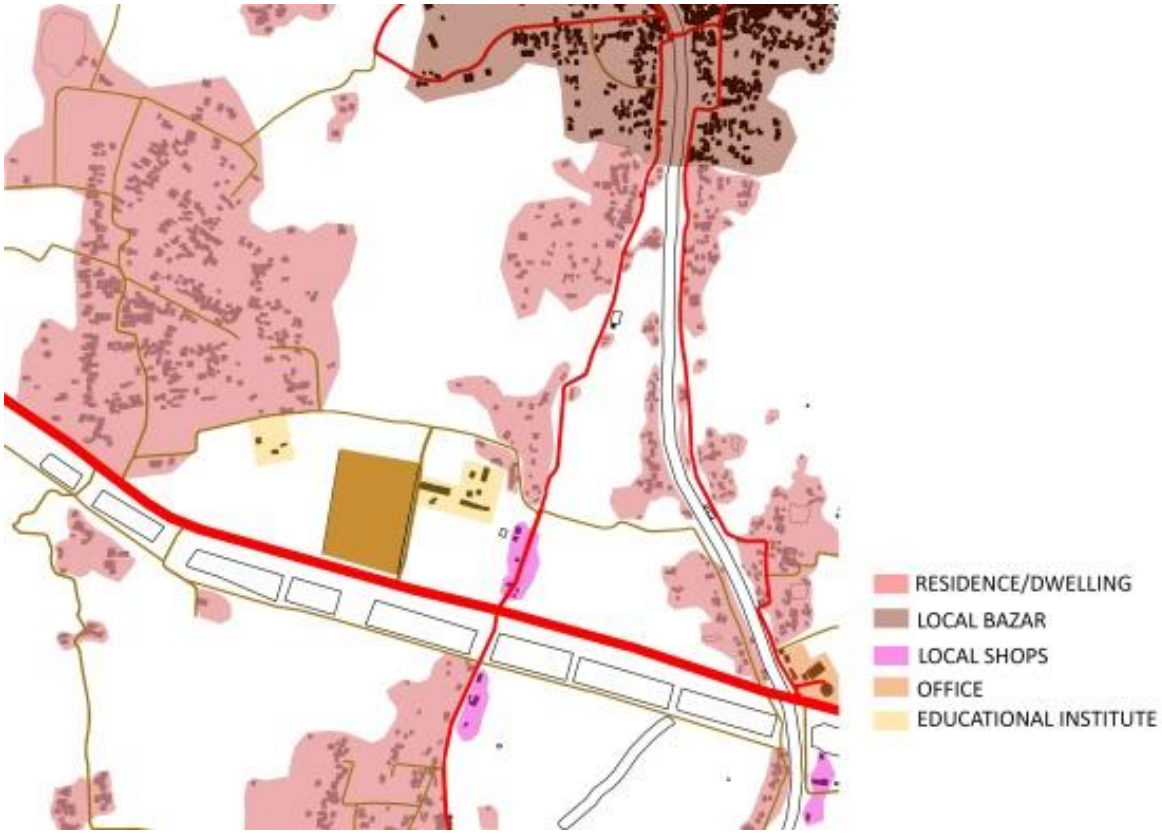


Figure 19 Build Forms ***(Author)***

3.3.3 Transportation

The site is adjacent to the Dhaka-Rajshahi Highway Road which is the primary road of the site and heavy vehicle are running here all the time. The entry of the site is from secondary road where light vehicle like rickshaw, CNG, mini truck are moving. The road network is properly developed in this area.

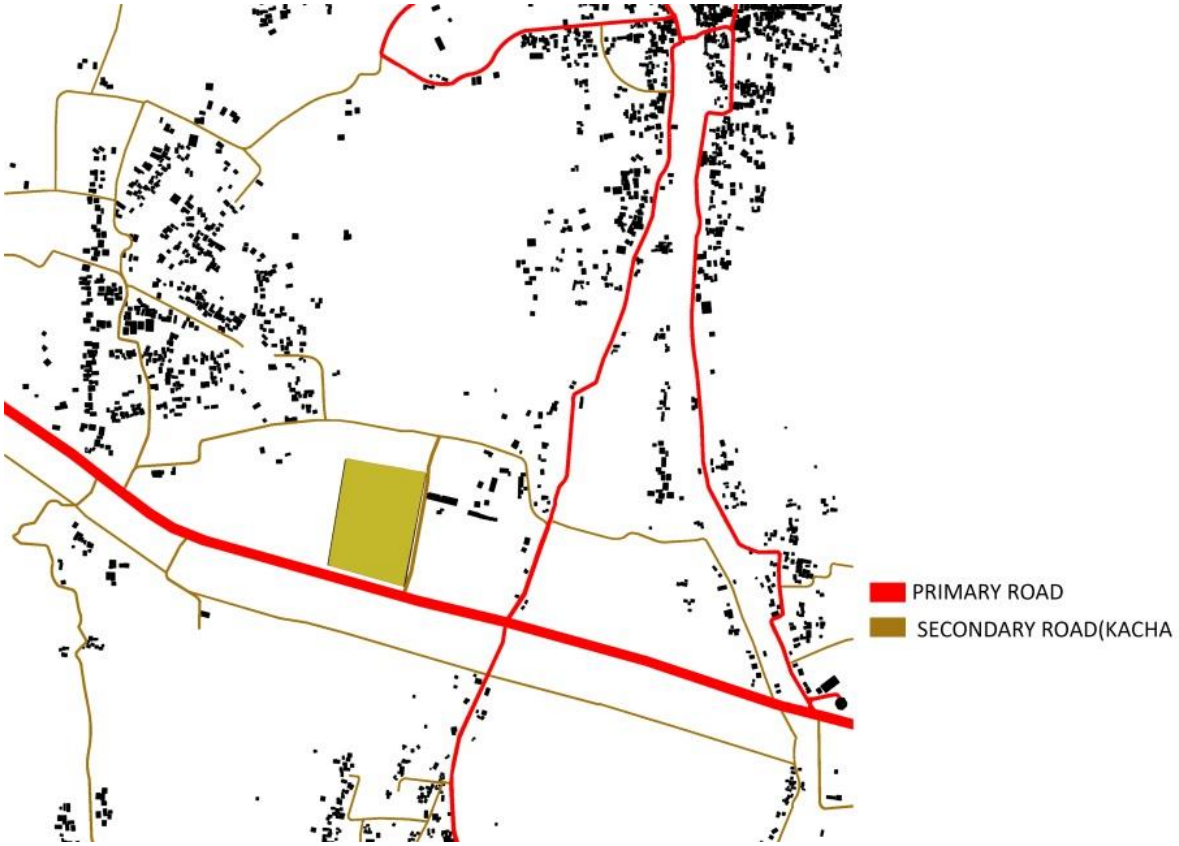


Figure 20 Road Map ***(Author)***

In the site, there is a slope of 6 to 7 ft from the primary road to the site. As this area is affected by flood in every area so the road is in upper level from the land area which creates a slope between primary roads to the secondary roads. The roads of whole Sirajgonj area are constructed in this way because of the flood, annual disaster of this area.

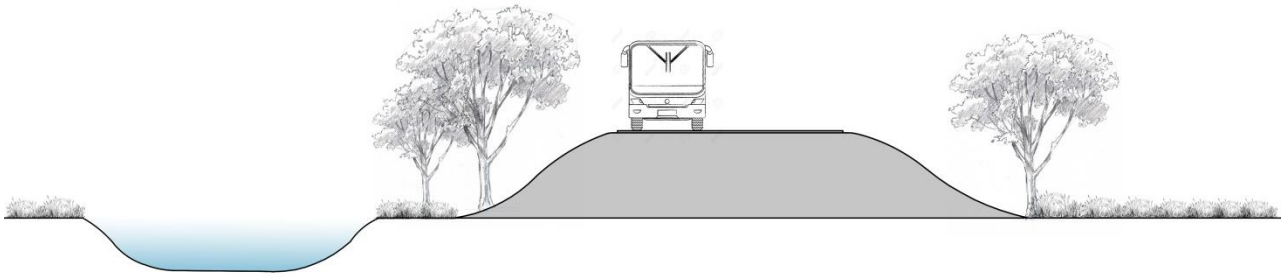


Figure 21 Section of Site Slope ***(Author)***

Figure 22 Road Slope ***(Author)***

3.4 Climate

The climate is tropical in Sirajganj. It is one of the disaster prone areas in Bangladesh. This area affected by river flood according to the flood map of Bangladesh. Fresh floods hit at least many villages of Sirajganj after a portion of an embankment eroded while the Jamuna in Gaibandha and Brahmaputra in Kurigram were flowing above the danger level, bringing misery to people in the districts.

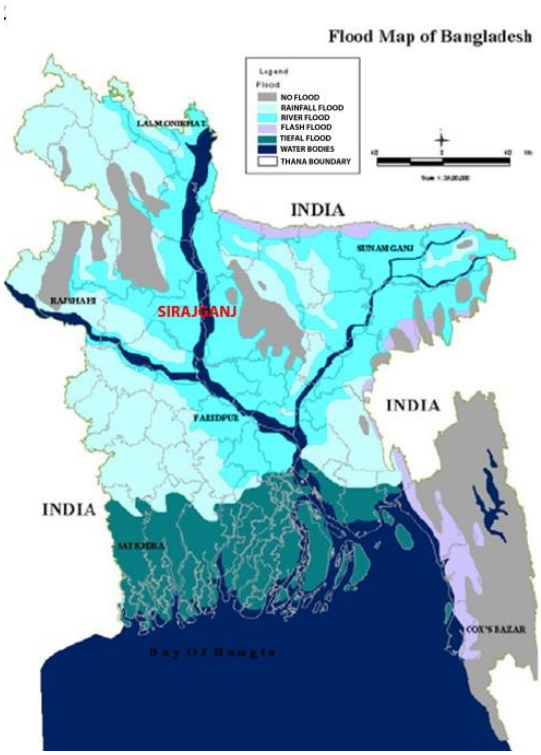


Figure 23 Flood Map ***(WARPO)***

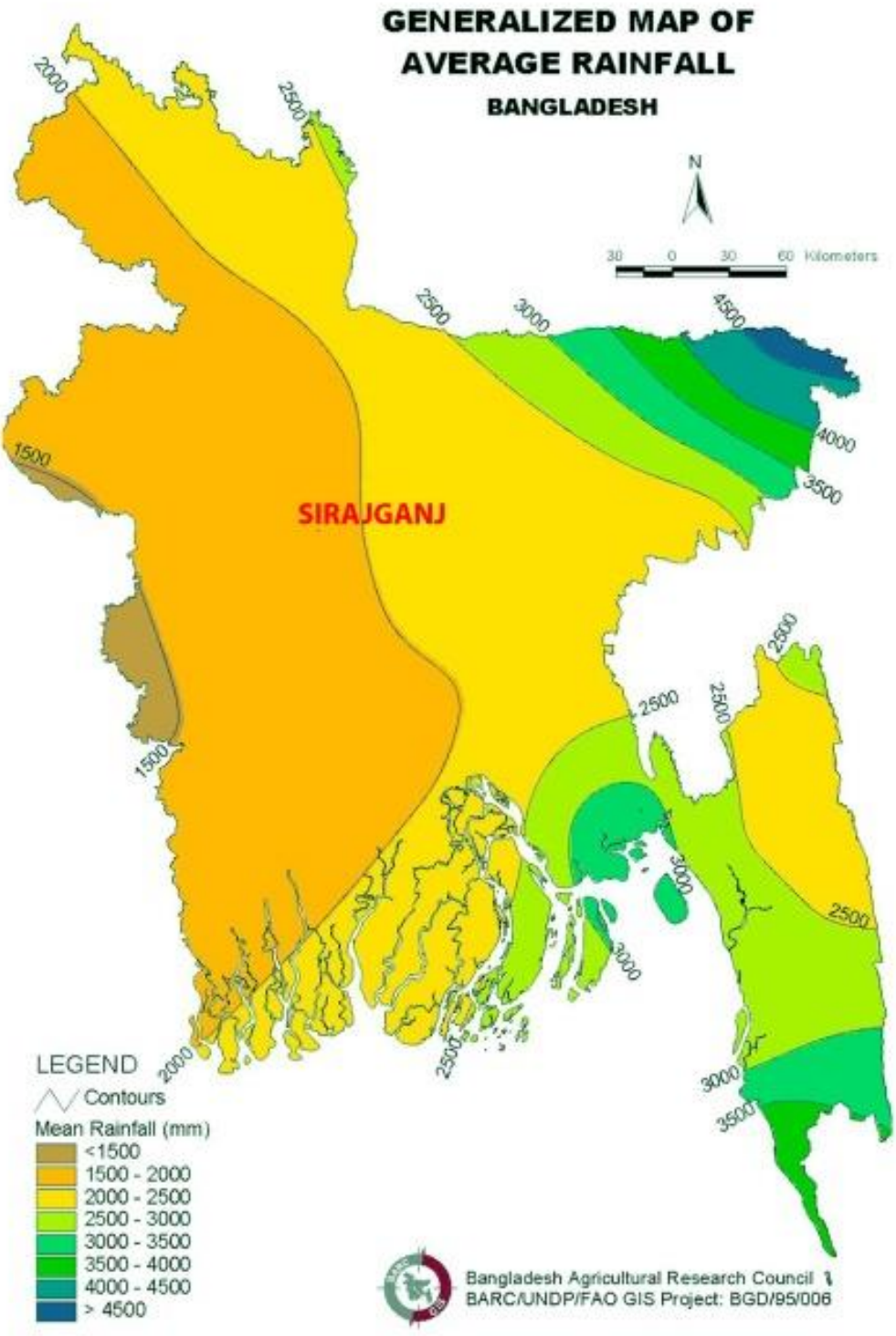


Figure 24 Flood Map ***(WARPO)***

3.4.1 Temperature, Sunny day and Humidity: The average temperature in Sirajganj is 25.5 °C. The rainfall here averages 1789 mm. With an average of 28.9 °C, May is the warmest month. January has the lowest average temperature of the year. It is 18.4

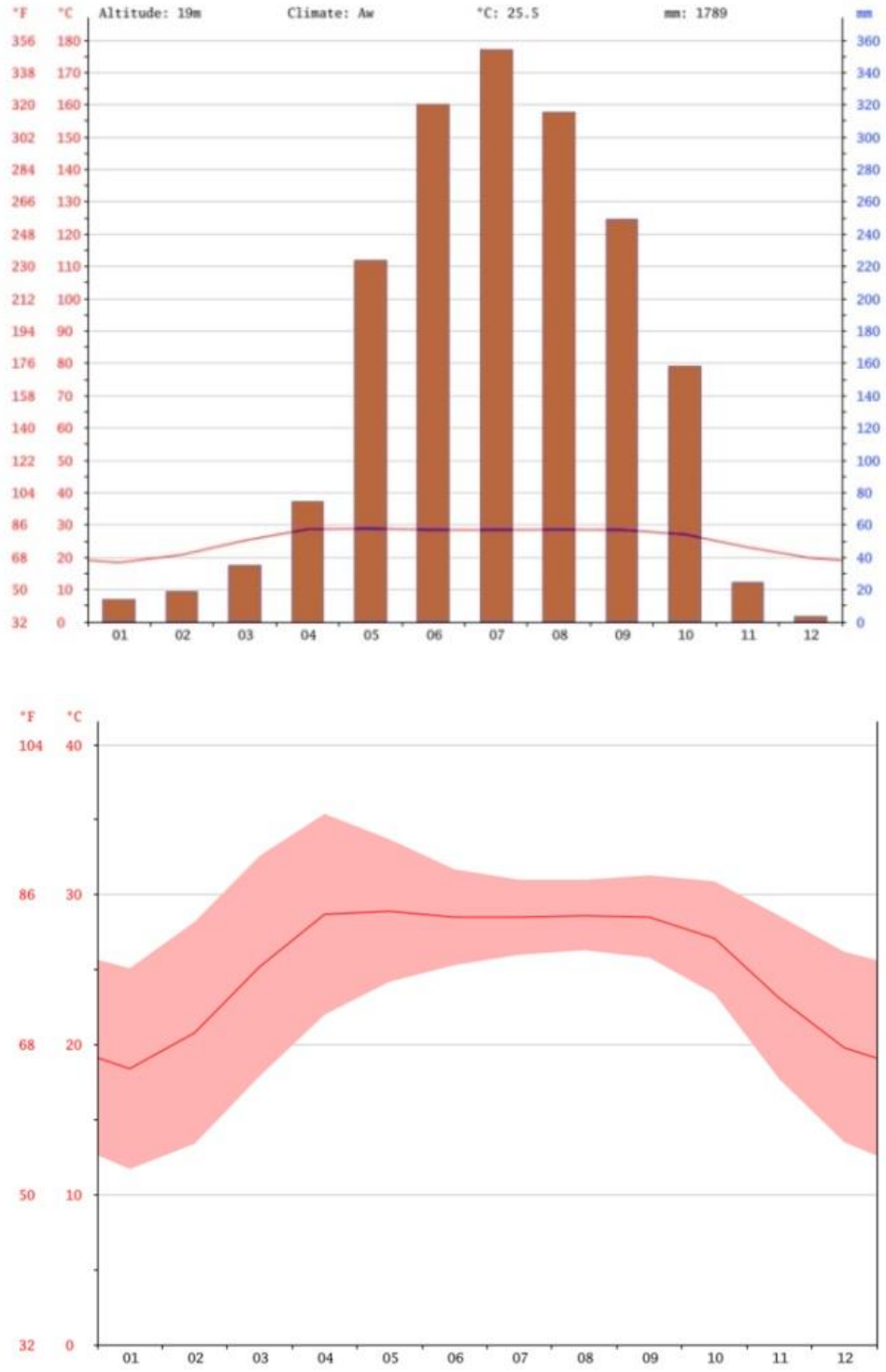


Figure 25 Sirajganj Average Temperature by Month (online, 2019)

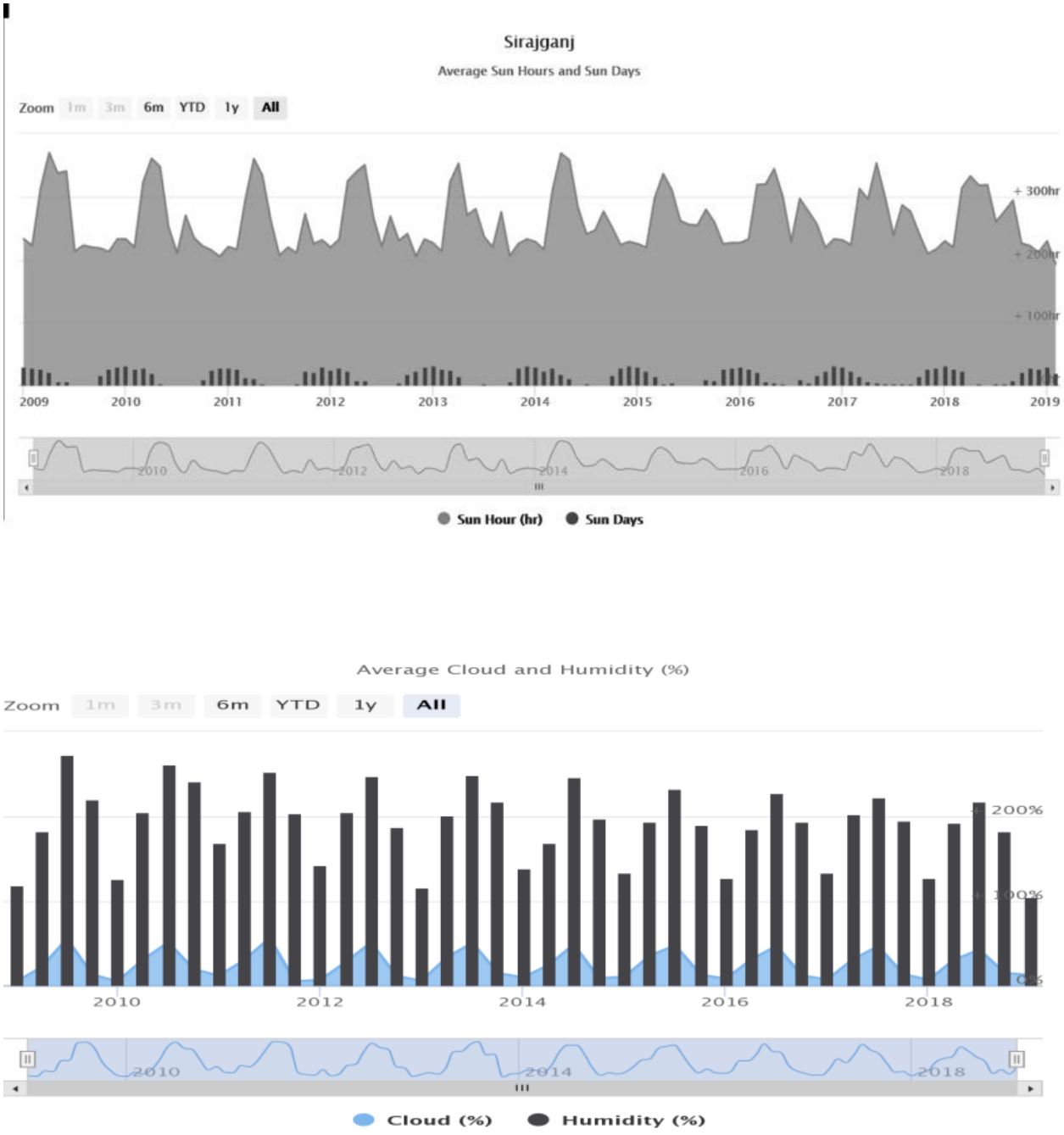


Figure 26 Sirajganj Average Sun Day by Year *(online, 2019)*

3.4.2 Flood prone area: This is a low lying area and it goes under water during the flood period. The nearest water body is Jamuna River. Due to over water flow, flood, water logging is common in this area. In winter, there is much less rainfall in Sirajganj than in summer. This climate is considered to be Aw according to the Köppen-Geiger climate classification.

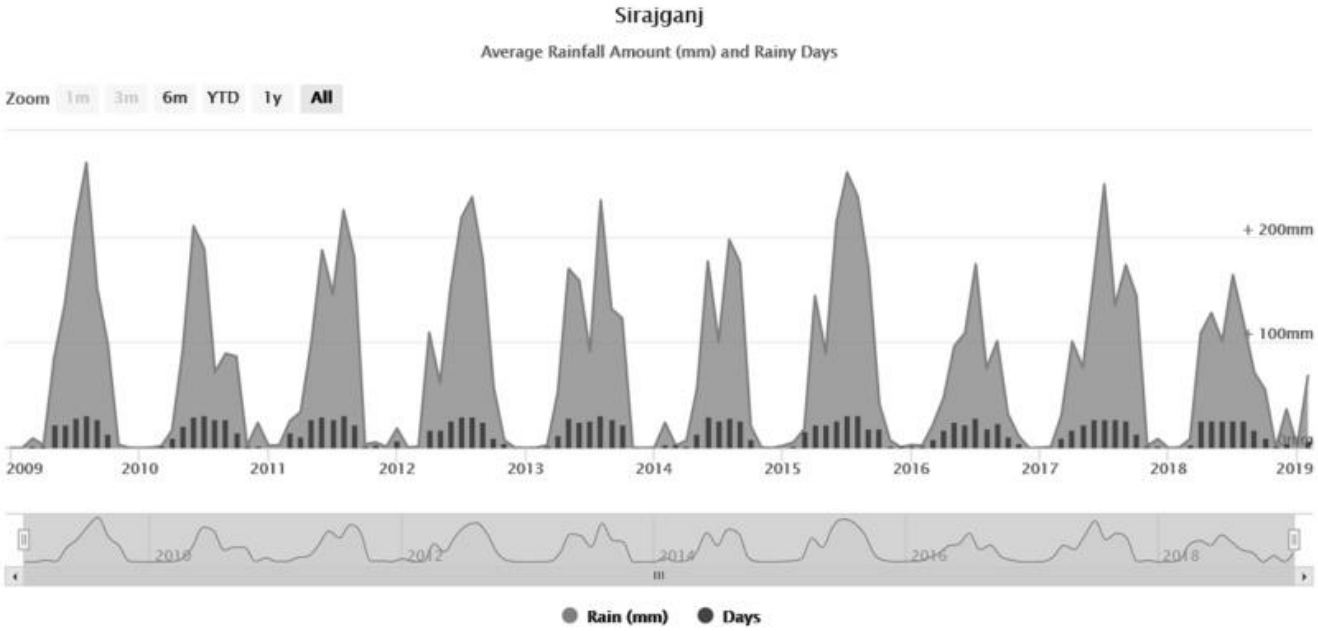


Figure 27 Sirajganj Average Rainfall by Year (online, 2019)

3.4.3 Noise: As the site is very near to the main roads and as Konabari School and Degree College is very close to the site so heavy noise is generated in the site. Noise generated by surrounded educational buildings and also from the vehicular as road is near to the site.

3.5 SWOT Analysis

3.5.1 Strength:

- The site is easily accessible.
- The site has 15 feet proposed street on the West and 100 feet proposed street on the South.
- The surrounding functions create an internal zone of education, administration and public gathering.
- **3.5.2 Weakness:**
  - The site experience flooding and water logging problems.
  - The site does not have any inherit character of its own and is crowded by different functional buildings.

3.5.3 Opportunities:

- Increase the economic growth in the sense of providing more employment.
- The site experiences flooding and is in a flat muddy area so architecture can be explored.

3.5.4 Threats:

- Being very near to the river may experience landslide.
- As it is very near to the main road so daily road accident and noise need to consider for designing a building here.

After consideration, the design would be influenced by the forces of the site. It has to merge with its surroundings. The fabrication would reflect the dwelling and the nature of the site.

Chapter 4

Case Studies

Case study is a research methodology by which we analysis the details of any project of different location among the world .It helps us to analyze a live project's space before starting a project. Before designing a building, we get to do a study of a live project of the similar category that helps us to understand the scope of our project better. In this chapter I showed the analysis of three projects that are located in three different places of the world and designed in different ways as that are required which helped me to understand the space of functions that required in a research center or institute. Project architect's thought for designing the project sometimes inspires to take decisions before started to design a project. I tried to analyze the details like site location, site environment/climate, architect's thought, functional zoning, program analysis etc. to conscious about my project's space and flow of the space. By this way I tried to be knowledgeable of space of a research institute.

4.1 Spanish-Portuguese Agricultural Research Center, Spain

Architects: Canvas Arquitectos

The site of the project is located in Salamanca, Spain and total area of the site is 4800.0 m2.The site is part of a bigger area of environmental interest close to the river Tormes. To design the research center, architect Canvas Arquitectos propose an intervention in which the architecture is not imposed but rather becomes part of the territory so the topographic redevelopment of the site leads to two levels that means first architect thought the site surrounding and climatic situation of the site.

Figure 28 Site View ***(archdaily, 2012)***

Figure 29 Site Plan ***(archdaily, 2012)***

In the research center, the site lead to two levels: in the upper, with the entrance from the street, the building is hidden in the landscape, while the lower level opens onto the river, separating from the ground by piles that isolate the construction of possible floods. Architect intends to rethink the existing terrain into a new transformed landscape. The laboratory is meant for research and experimentation in farming and plant maintenance. It has the infrastructure required to conduct research related to agricultural activities in the field of physiology, biochemistry and molecular biology of plants.

Figure 30 Zoning *(Author)*

Figure 31 Structure System of Lab toward the River

Figure 32 Roof Blend with LAndscape in Road Side ***(archdaily, 2012)***

Findings:

- The project successfully brings transparency between building and landscape.
- Focusing on the site the location of the functions is arranged.

- The functions are interconnected with Interior Street with maintaining the privacy and accessibility of all functions.
- The laboratory of the project designed in a systemic way that maintains research requirements.
- The structure system of the laboratories consider for the possible flood towards the river.
- In the main entrance building's roof blends with the landscape.
- In elevation light multilayer facade system is used, resulting in a variable density filter that meets both the heat and sunlight needs as well as the necessary privacy.

This research center is designed considering the site forces and also fulfilling the requirement of the functions. The program flows are considered the user's working flow according to the requirement. By analyzing the project I get knowledge of design scope of a research center.

4.2 Salk Institute, California

Architects: Louis Kahn

The Jonas Salk Institute for Biological Studies, built on a high coastal site in La Jolla, California from 1959-1965, is considered by Wiseman to be the "single image conveys to the public what Louis Kahn accomplished as an architect" (2007). The site offered beautiful views of the Pacific Ocean which Kahn would keep in mind through the design process

Figure 33 Site Plan ***(NBBJ)***

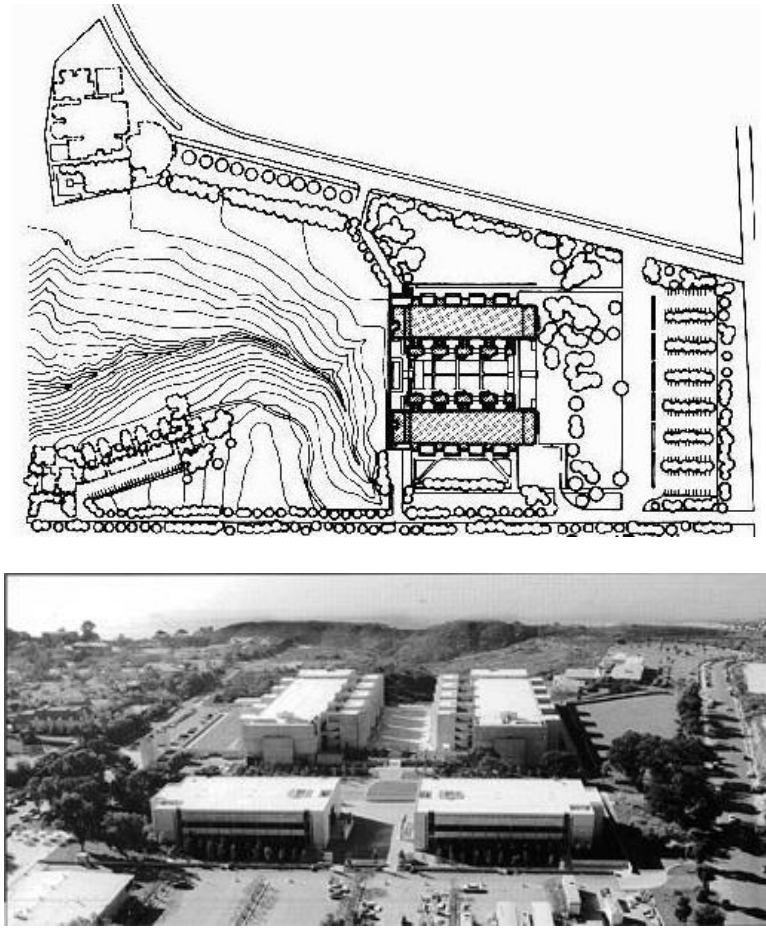
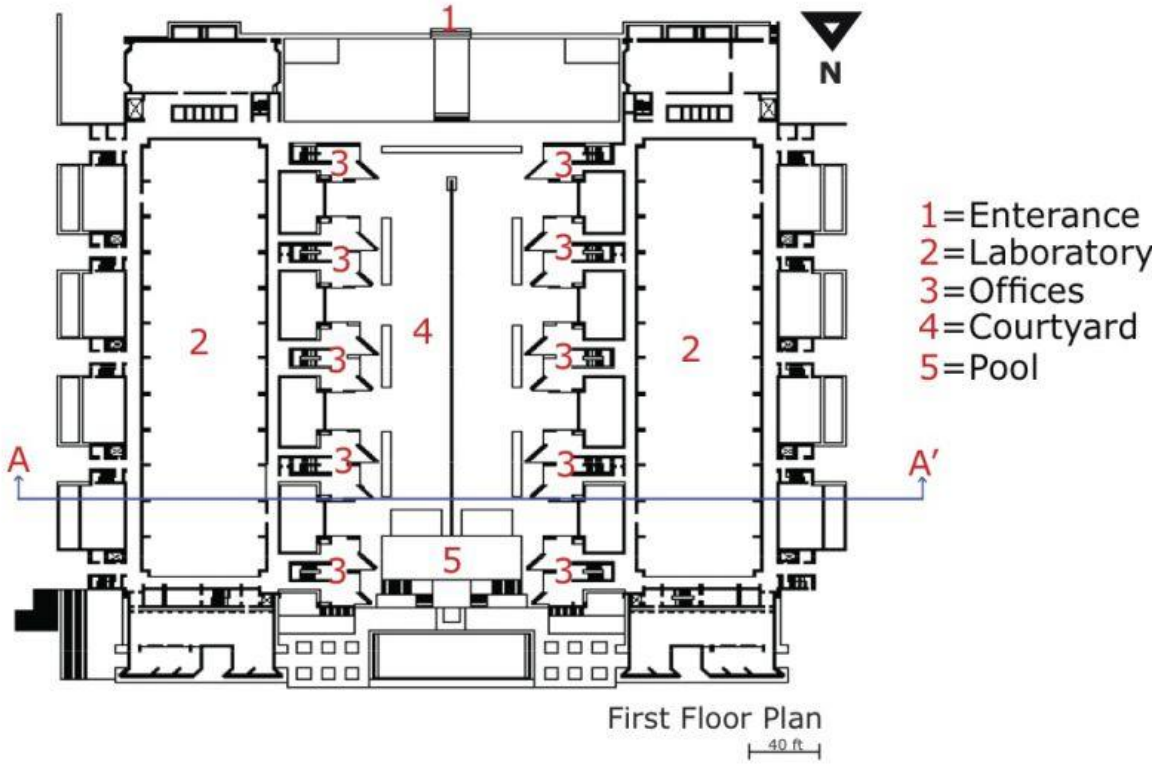


Figure 34 Site Map *(archdaily , 2019)*



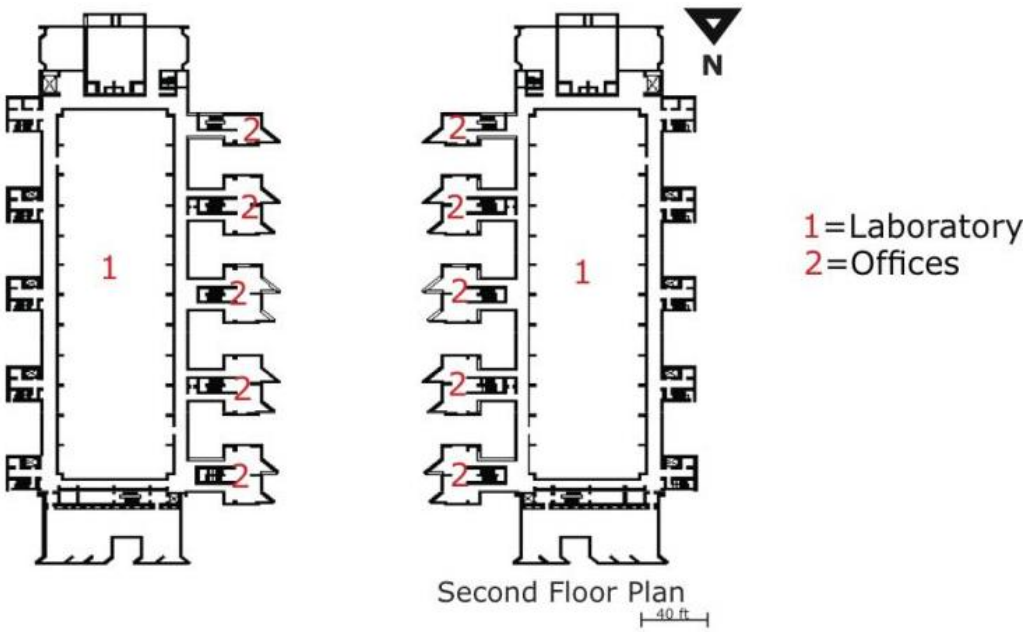


Figure 35 Zoning ***(NBBJ)***

The laboratories of the Salk Institute, first conceived as a pair of towers separated by a garden, evolved into two elongated blocks mirroring each other across a paved plaza. The central court is lined by a series of detached towers whose diagonal protrusions allow for windows facing westward onto the ocean. Kahn was more than masterful in his use of concrete for the institute, even experimenting with several types and mixtures before settling on a final product. Viewing the North or South elevations, one can see how the nearly symmetrical plan and repetition of five monolithic rectilinear forms can evoke images of classical columns. Rectilinear forms with lack of ornamentation.

Architectural Feature:

Water Feature

The water feature running the axis of the central plaza is one of the most non-Modern elements of the Salk Institute. It serves no real function other than to add a visual element to the courtyard. In some sense, it opposes the modern rejection of ornamentation. The cascading

pools of the cistern are thought to be inspired by either the Mughal garden Kahn saw in India and Pakistan or the Alhambra in Spain (Wiseman 2007).

Figure 36 View from Paved Plaza ***(archdaily , 2019)***

Figure 37Repeating same Blocks ***(archdaily , 2019)***

Findings:

- As in my project laboratories is important function so I selected salk institute as a good reference and popular work of Kahn for laboratories design.
- The project proposed connectivity and accessibility among the building mass and The functions are interconnected with internal bridge with maintaining the privacy and accessibility of all functions.
- Focusing on the site the orientation of the laboratories is organized.
- Considering the site location and required functions buildings gets the proper ocean view from west side.
- The laboratory of the project designed in a systemic way that maintains research requirements.
- There are no walls separating laboratories on any floor there is one floor in the basement which shows collaboration.

In the project Louis Kahn combined new techniques and forms with pre-Modern elements to achieve his monumental style. The program flows are considered the user's working flow according to the requirement. By analyzing the project I get the knowledge of design consideration for a scientific laboratory.

4.3 Bangladesh Rice Research Institute, Bangladesh

Bangladesh Rice Research Institute is an agricultural research institute which is one of the demand driven research centers of Bangladesh. It is an autonomous research organization established in 1970, for conducting research towards development of rice varieties. The total area of the site is 76.81 hectares on Gazipur. At first, it started with two storied building and then gradually it developed with necessary functional buildings.

Figure 38 Field Lab (Author)

Figure 39 Rearing Area (Author)

Figure 40 Open Threshing Area ***(Author)***

There are different functions in this institute. These are Research Field/ Field Lab, Threshing Floor, Cover Threshing Floor, Store, Breeder Seed Unit, Biotechnology unit, Plant Breeder Unit, Hybrid Unit, Genetic Research Centre, Office cum Laboratory, Training Building, Rearing Room, Central Laboratory ,Repair & Maintenance Lab, Workshop Center, Deep Water Rice Research Area, Experimental Farm ,Officer's Residential Area, Staff Dormitory/ Accommodation, Officer's Dormitory/ Accommodation, Labor Colony ,School.

Research Laboratories:

Focusing on the research necessity there are different types of laboratories here and the design of the lab are able to fulfill the requirement what scientist or other employees needed. There are mainly three main units: Biotechnology unit, Plant Breeder Unit, Hybrid Unit in which under has different laboratories.

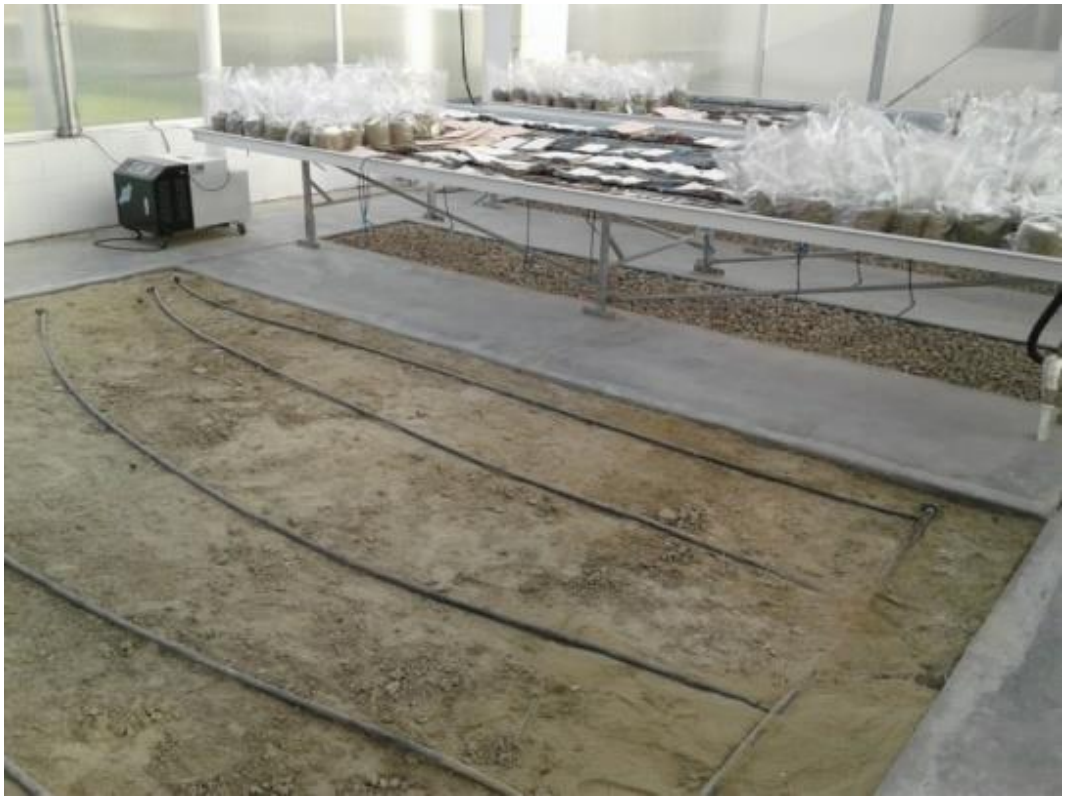


Figure 41 Green House Area ***(Author)***

Figure 42Microbiology Lab *(Author)*

Figure 43 Net Area(Author)

Figure 44Breeding Unit (Author)

Figure 45Field Lab Image (Author)

Findings:

- Maintaining the requirement and rules laboratories are designed and maintained.
- Focusing on the site the location of the functions is arranged. The functions are interconnected with accessibility of all functions.
- The laboratory of the project designed in a systemic way that maintains research requirements which are align with my ideas.
- Bricks are one of the appropriate in our context which used in this institute.

From this project I gained comprehensive understanding of a research institute how it works with many employees by fulfilling different types of requirement. I learn about universal architectural rules thought of a scientific laboratory.

In this chapter by studying different types of project in detail gets the knowledge of different design scope of a research institute. Analyzing the details with site location, site environment/climate, architect's thought, functional zoning, program analysis etc. to conscious about my project's space and flow of the space which is necessary to understand a project.

Chapter 5

Program Development

BRRI is a major component of the National Agricultural Research System (NARS) of Bangladesh, dealing with research and development in relation to rice production. To increase rice production to necessary level, regional station is also needed for more research. For new variety and technology development and technology transfer accelerated need establishment of these types of institute. For that reason in Sirajgonj station there is some programs requirement according to their necessity.

5.1 Detail Program

In this chapter an analysis of functional flow and their respective space requirement is discussed in brief. There are some programs given below:

PLANT BREEDING UNIT

a) Green House Area	Processing Room	120 sqft
	Control Room	168 sqft
	Plant Growth Room	180 sqft
	Dark Room	96 sqft
	Mist Room	180 sqft
	Screening Room	96 sqft
b) Net Area	Testing Area	1536 sqft
	Machine Stories	180 sqft
c) Laboratory	Plant Breeding lab	1000 sqft
	Genetic lab	500 sqft
	Screening lab	1500 sqft

	toilet	321 sqft
	Scientist Room	180*4= 720 sqft
	Sub total	6600 sqft

BIO-TECHNOLOGY UNIT

a) Green House Area	Processing Room	120 sqft
	Control Room	168 sqft
	Plant Growth Room	180 sqft
	Dark Room	96 sqft
	Mist Room	180 sqft
	Screening Room	96 sqft
b) Net Area	Testing Area	1536 sqft
	Machine Stories	180 sqft
c) Laboratory	Monocular Lab	1000 sqft
	Tissue Culture Lab	500 sqft
	Seed Screening Lab	1500 sqft
	toilet	321 sqft
	Scientist Room	180*4= 720 sqft
	Sub total	6600 sqft

HYBRID CELL UNIT

a) Testing Lab	320 sqft
b) Screening Lab	320 sqft
c) Rearing Room (Insect Testing Area)	320 sqft
Sub total	960 sqft

THRESHING AREA

Threshing Floor	9650 Sqft
Cover Threshing Floor	2150 Sqft

ADMINISTRATION

Functions	**Numbers**	**Sqft**
Lobby	01	300sqft
Reception	01	200sqft
Lounge	01	600sqft
Meeting room	06	600sqft
Office	02	1200sqft
Directors Room	01	250sqft
Ass. Directors Room	01	150sqft
Accountants	01	100sqft
Registrar	01	100sqft
	Sub total	3500sqft

TRAINING BUILDING

Administration	01	200 sqft
Training Room(Varieties)		500sqft
Training Room(Insect & Insecticide)		500 sqft

Training Room(Equipment Usage)		500 sqft
Workshop Space		5025 sqft
Conference Room		500 sqft
Toilet		321 sqft
	Sub total	7546t

LIBRARY

Administration	01	200 sqft
Reading Space		1200 sqft
Space for shelf	1000 books	8333 sqft
Exhibition space		1000 sqft
Archive and documentation area		400 sqft
Toilet	02	321 sqft
	Sub total	11454 sqft

REPAIR & MAINTENANCE LAB

Equipment Storage		1000 sqft
Working space	Car wash Fixing	2000 sqft
Toilet		27 sqft
	Sub total	3027sqft

STAFF ACCOMMODATION

Functions	**Users**	**Numbers**	**Sqft**
Staff's Single Dormitory	Labors	25	25*150=3750 sqft
Officer's Accommodation	CSO PSO SOS SO SA	1 2 4 6 6	2200*1= 2200 sqft 2200*2= 4400 sqft 1800*4=7200 sqft 1400*6=8400 sqft 1200*6=7200 sqft
Guest House			6900 sqft
		Sub total	40050sqft

OTHER FACILITIES

Restaurant	Seating area (100 people) Kitchen Office/ service	1800 900 100
Multipurpose hall		5025 sqft
Market Space		1500sqft
Cooking Training Center	Reception Training Room(2) Toilet	172 sqft 500 sqft 321 sqft
Medical Center & Day Care	Reception area and first aid station Treatment/ nursing area	172 sqft 320 sqft

	Day Care	1050 sqft
ATM Booth		28 sqft
Nursery School		1015 sqft
	Sub total	12900sqft

FIELD LAB

Research Field	304920 Sqft

TOTAL BUILD AREA

Total build area	94290 Sqft
Including 30% Circulation	**122,575 sqft**

5.2 Zoning

After getting the program detail I divided the programs into three zones. The zones are considered according to the use and users. The accessibility of every function depends on the every zone. In this area, staff accommodation and their living facilities like day care, preprimary school, medical center is in private zone. Research laboratories are in semipublic zone as without staff some specialized people go there for working purpose. Administration, training building, library are in public zone as all can access with these functions.

5.3 Functional Flow

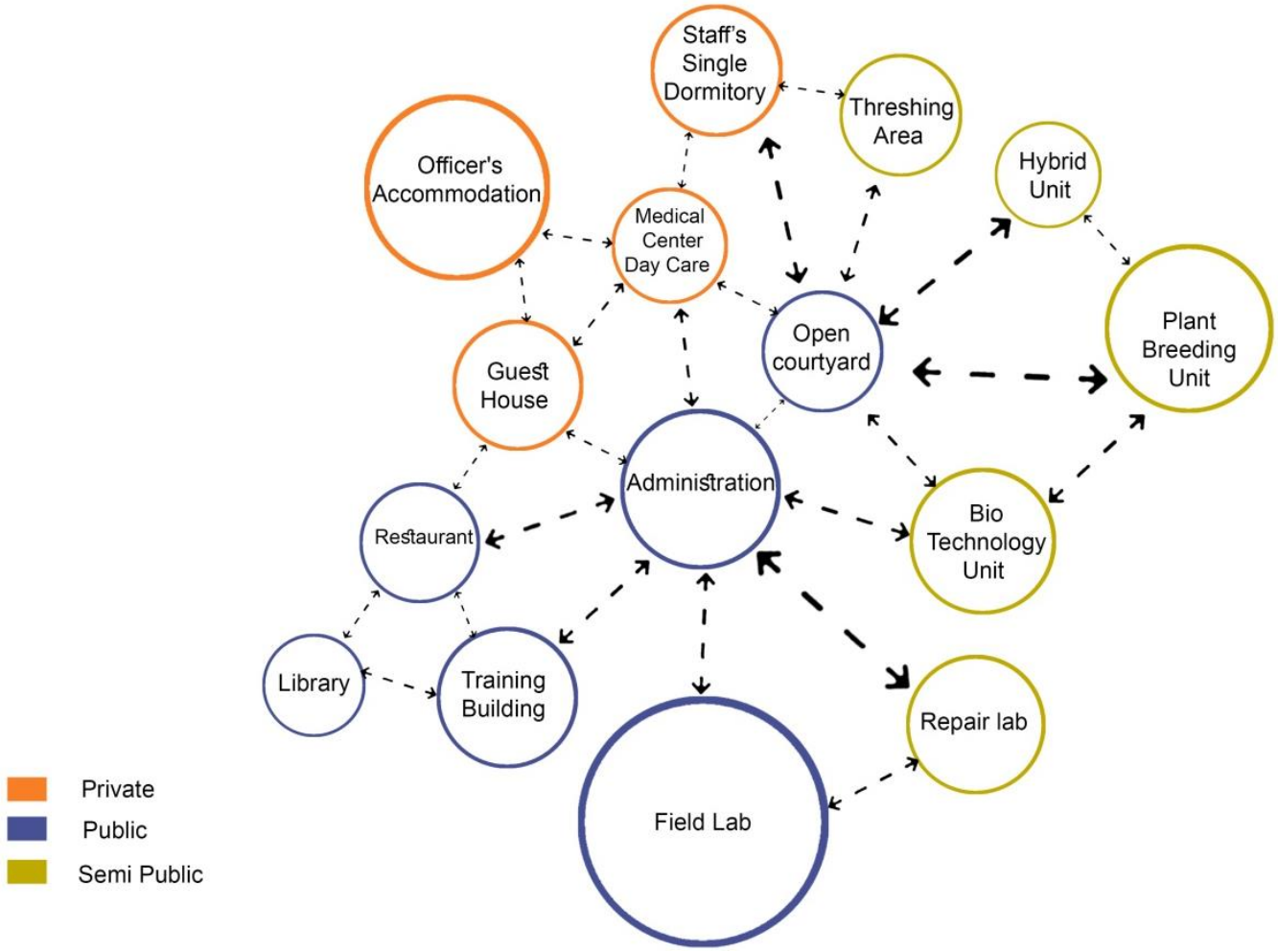


Figure 46 Functional Flow (Author)

After analyzing the local case study at Bangladesh Rice Research Institute got the idea of functional flow of these required programs.

According to their requirements three acre can be build area within ten acre and seven acre would be used for field lab. As Sirajgonj is far from Gazipur so all types of laboratory facilities are required in this station and all employees need their accommodation and some others facilities for them and their family. According to the research and employee's necessity programs are required in this institute.

An idea of the program is achieved through various analysis and study of relevant projects. A flow diagram is obtained by studying the relation between public and private functions.

Chapter 6

Design Development

6.1 Idea Generation

The idea of the project was developed from the paddy field considering the nature of the site surrounding. Geometry has been created by using the outline of the paddy field that continues in design as circulation in the building massing.

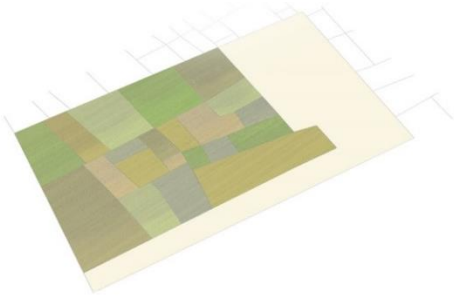


Figure 47Existing Site Fabric (Author)

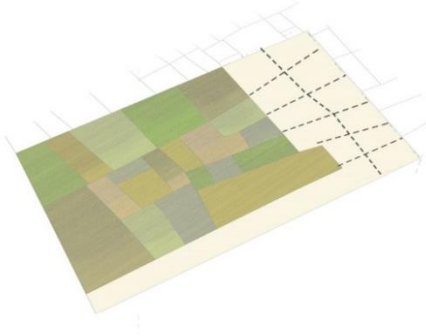


Figure 48Extension of Outline (Author)

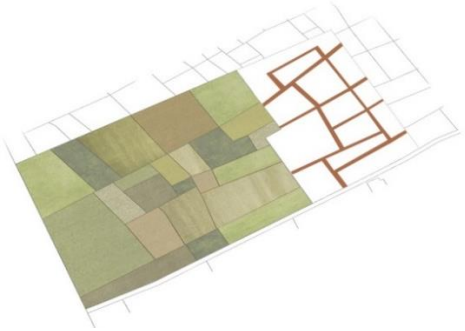


Figure 49Creating Geometry (Author)

6.2 Form Generation

According to the geometry the buildings are placed. The massing placement is arranged in such a way that the reflection of paddy field outline. The building of the institute is organized according to its purpose.

Figure 50Extension of Site Fabric into the Form Generation

6.3 Program Conceptualization

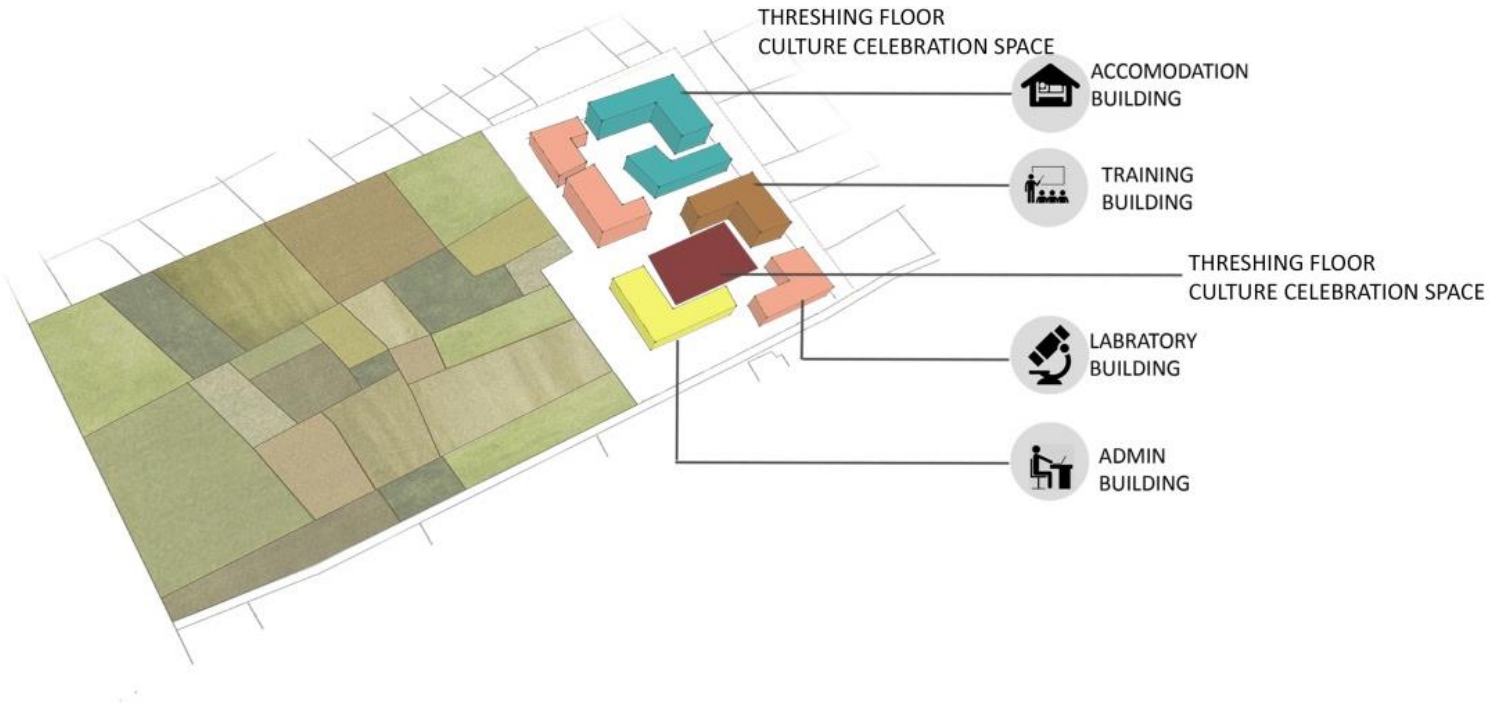


Figure 51Zoning Diagram

6.4 Final Design

Figure 52 Site Plan

Figure 53Ground Floor Plan

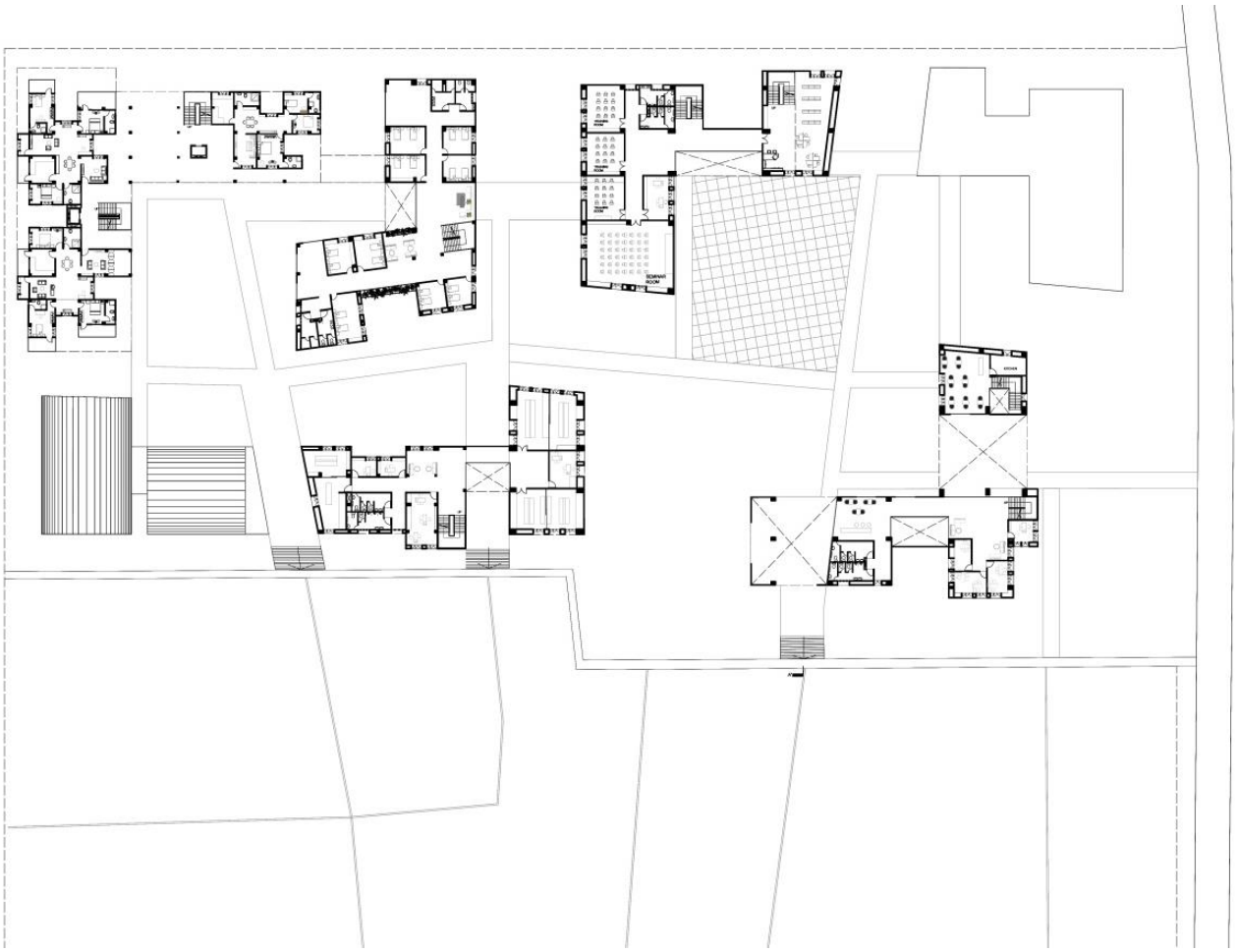
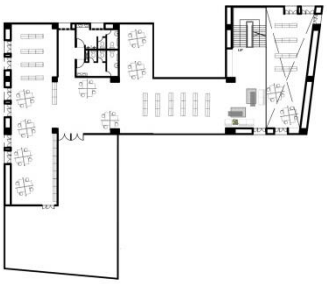
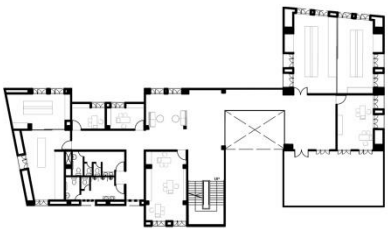


Figure 54!st Floor Plan

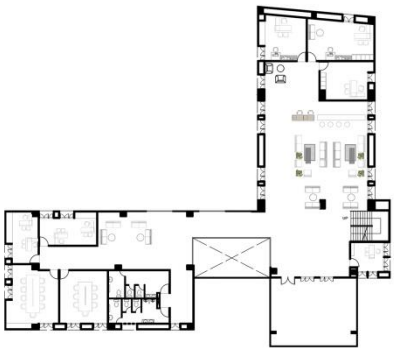
Accommodation Building



Training Building



Laboratory Building



Admin Building

Figure 55 2nd Floor Plan

Figure 56South Elevation

Figure 57SectionAA

6.4 Structure

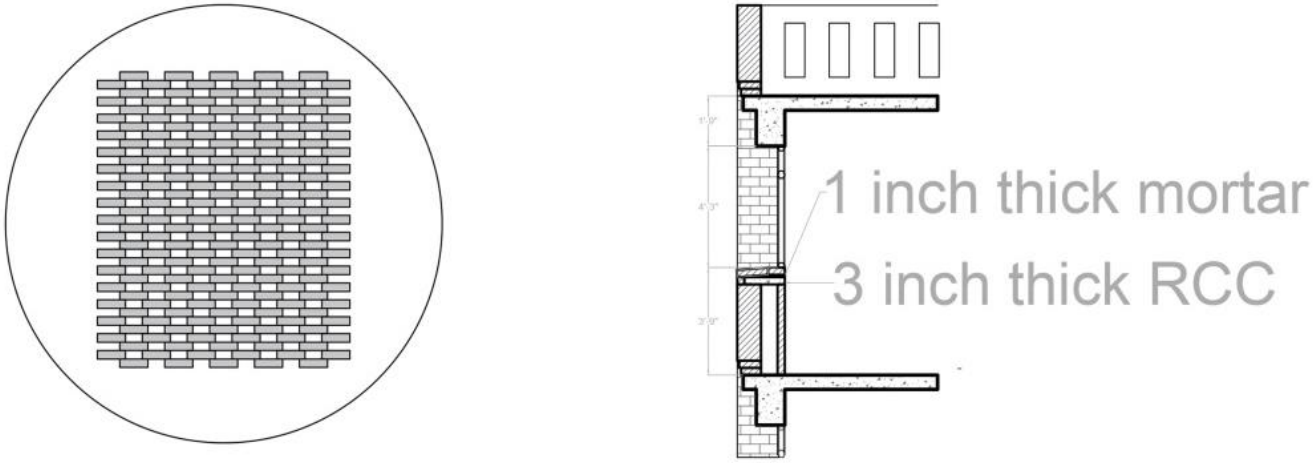
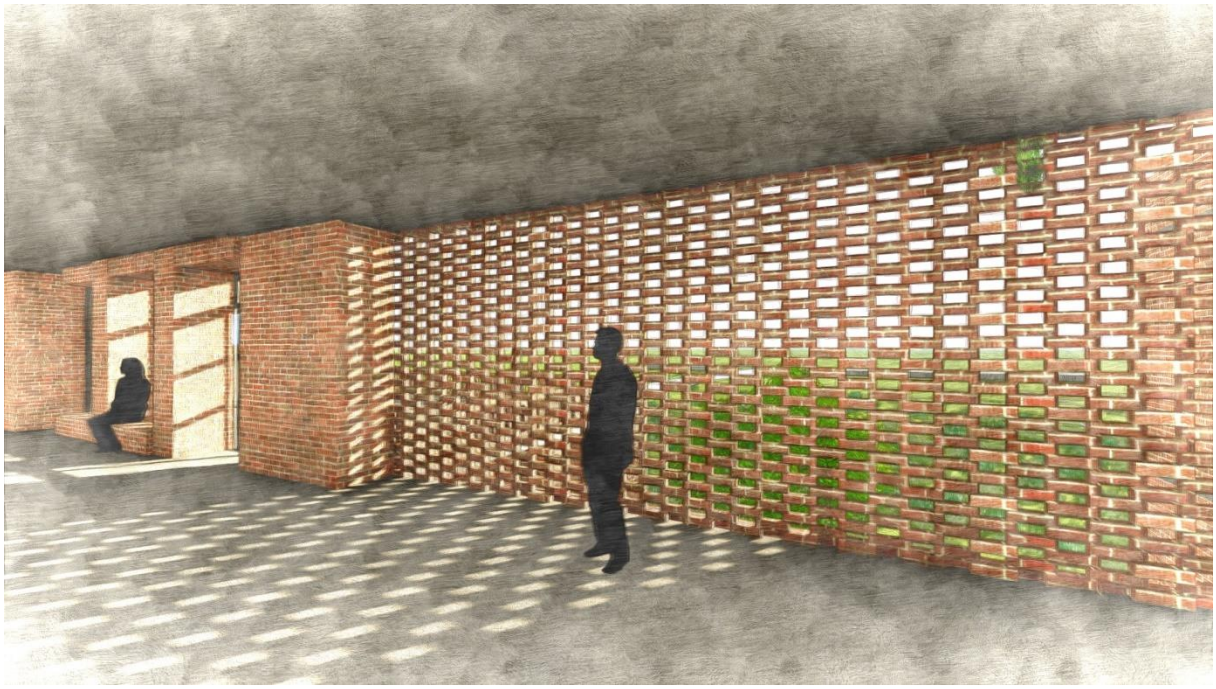


Figure 58Brick jail & Wall Detail

6.5 Render




INSTITUTE

Chapter 7

Conclusion

The Rice Institution, Sirajgonj is a project designed on the requirement of the farmers of this area who are depended on rice production. The project would help transform the updated information, knowledge and skills especially on scientific method of rice production as well as exercising the local culture that relates to agriculture in particular. The project would also contribute in increasing the food production and livelihood of the local farmers. Through this project not only the local people will be benefited but also the people of the neighboring districts.

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