Report on the Progress of :

An Investigation of Environmental Performance Assessment of the Building Prototypes built by Alternative Building Materials at HBRI.

'বিকল্প নির্মাণ উপকরণ দ্বারা নির্মিত ভবনের পরিবেশগত সক্ষমতা নিরূপণ শীর্ষক পরীক্ষা।'

Objective:

With a vision to ensure housing for all through optimum utilization of scarce resources of this country, Housing and Building Research Institute (HBRI) has been working in the research and development of Alternative Building Technology. From these researches, HBRI has developed some environment friendly and sustainable building prototypes using non-fired concrete blocks and ferro-cement roofing panels. These prototype buildings are economic and structurally efficient. For the promotion of this Alternative Building Technology, the buildings will have to be Environmentally effective along with its structural and economic factors. So, the question remains that how these alternative buildings can contribute in providing better living environment in terms of the environmental perimeters of Thermal Comfort, Relative Humidity, Ventilation and Sound Absorption. For the future sustainability in the housing sector of Bangladesh, the quantitative analysis of the environmental impact is really important. To measure the environmental factors of the alternative buildings, both quantitative and simulative method will be applied. Data collection will be conducted using thermal data loggers, Thermo Hydrometers and Sound level meters. The collected data will be integrated in the computational simulation where the environmental factors will be comparatively analyzed by the side of the environmental parameters of conventional buildings. This investigation will thrive to find out the comparative analysis in numerical values which will clarify the benefits of alternative buildings both in human comfort and economic context. The study will also be able to find out the potential energy efficiency factor of the alternative buildings and its impact on sustainable housing for the development of Bangladesh.

Methodology:

The investigation of the Environmental performance assessment of the Alternative Buildings will be conducted in four phases.

1. Literature Review, Research Planning and Procurement of Scientific Equipments.
2. Installation of Environmental Meters and Data Collection.
3. Compilation of collected data and Computational Simulation Analysis.
4. Publication of Research Findings.

At the first phase of research, the material properties of the Alternative Materials, like non-fired concrete hollow blocks, ferro-cement roofing pannels will be compiled along with the conventional building materials. From the literature review and previous researches of Environmental Performance Analysis, the data collection sequency and the timeline will be defined. At the same time, the scientific equipments like environmental meters will be in process of procurement.

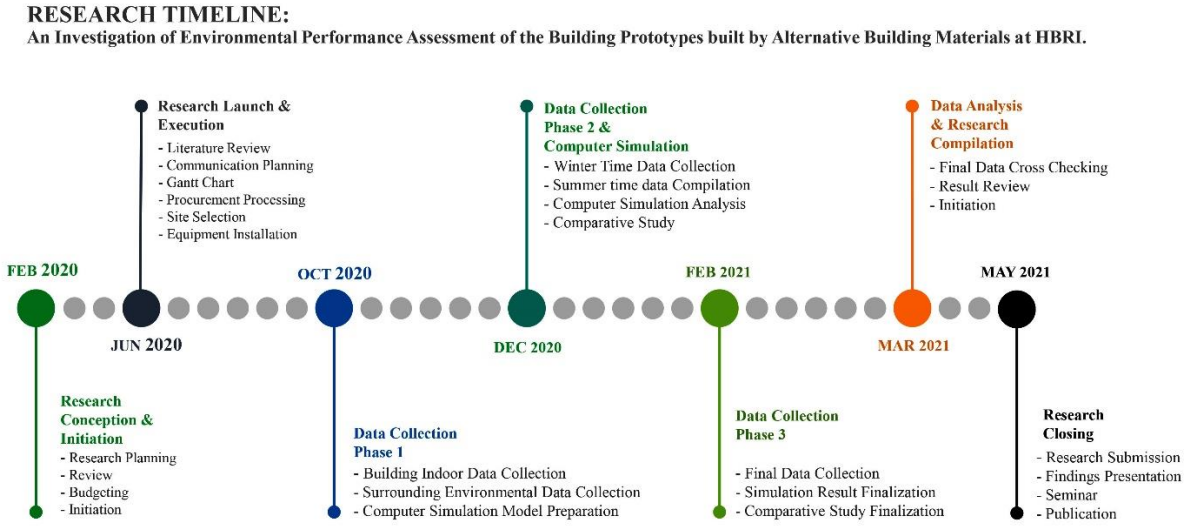
At the second phase, Environmental meters will be installed at the selected research buildings along with its surrounding areas and Environmental Datas, like Air temperature, Relative Humidity, Air Velocity and Sound Absorption will be collected in seasonwise phases. Collected indoor and outdoor datas will be compiled and prepared for Software based simulation for the visualization of environmental performance.

At the third phase, Analysis of the collected datas and computer simulation will be performed and finally the comperative analysis and benifits will be calculated.

Finally, The research findings will be finalized and prepared for publication and dissemination. A technical seminar will be organized presented by Researchers of the relavent fields, Government Officials, Practicing Architects, Engineers and concerned professionals for the public dessimination.

Research Timeline:

Planning of the Research has been done carefully to cover all the bases from initiation to completion of the research in oderly fashion. The investigation has been initiated after the acceptence of the Director General of Housing and Building Research Institute (HBRI) on February, 2020. From then, the research project has been planned to complete in May 2021, by covering both Summer and Winter season to analyze the deviation in temperarute and performace of the building in all seasons in Bangladesh. Temperature, Humidity, Air flow all the environmental perameters changes according to the seasons and micro climatic effect through the year round. A Comprehenssive analysis will be performed by this research, to investigate the performance of the Alternative Building Materials. The Schedule of the research has been shown in the following gantt chart diagram:



Scientific Equipment:

For the investigation of Environmental Performances (Thermal Comfort, Relative Humidity, Air Velocity, Sound) of the Alternative Building Materials, A few scientific equipments will be used to collect the environmental datas. The Collected data will be processed and will be used in computer simulation for the comperative study. A list of scientific equipments has been provided below:

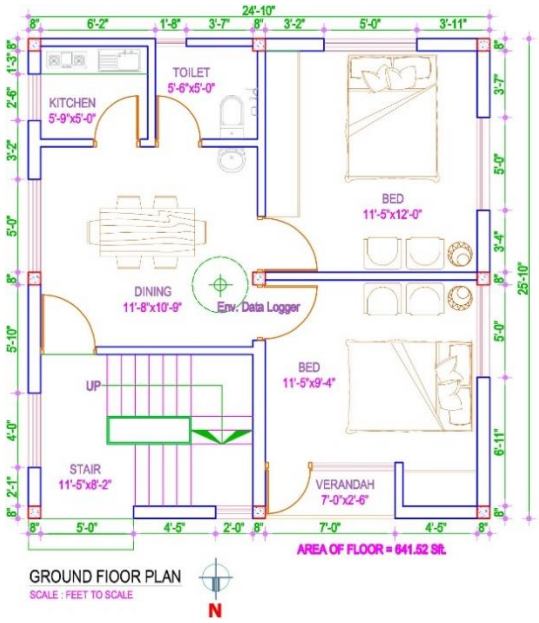
I. 5 in 1 Multifunctional Environmental Meter Specifications & Features: 1. Frequency Range: 31.5Hz to 8KHz 2. Frequency Weighing: dBa 3. Operating Conditions: -20 to 60°C < 90%RH (non-condensing) 4. Storage Conditions: -30 to 70°C < 75%RH 5. Battery: 1 x 9V (included) 6. CE & RoHS/WEEE: Compliant 7. LCD Dimensions: 55 x 45mm 8. Product Dimensions: 252 x 66 x 33mm	
II. Thermal Data Logger Specifications & Features: 1. Temperature measuring range: -30°C +60°C; for optional external sensor: - 40°C +85°C Ambient environmental temperature: -30°C +60°C 2. Accuracy: ±1°C 3. Accuracy: ±1°C 4. Record capacity: 16000 points (MAX) 5. Record interval: 10s~24hour adjustable 6. Sensor: Internal NTC thermal resistor 7. Communication interface: USB interface 8. Power supply: CR2450 battery or power supply via USB interface 9. Battery life: in normal temperature, if the record interval sets as 15 minutes, it could be used above one year 10. Item Size: approx. 84 (L) x 44 (W) x 20 (H) mm (3.3 x 1.73 x 0.79 inch) 11. Item Weight: approx. 60 g	
III. Infrared Thermometer Specifications & Features: The most basic design consists of a lens to focus the infrared (IR) energy on to a detector, which converts the energy to an electrical signal that can be displayed in units of temperature after being compensated for ambient temperature variation. Infrared Thermometers allow users to measure temperature in applications where conventional sensors cannot be employed. Specifically, in cases dealing with moving objects (i.e., rollers, moving machinery, or a conveyor belt), or where non-contact measurements are required because of contamination or hazardous reasons (such as high voltage), where distances are too great, or where the temperatures to be measured are too high for thermocouples or other contact sensors.	

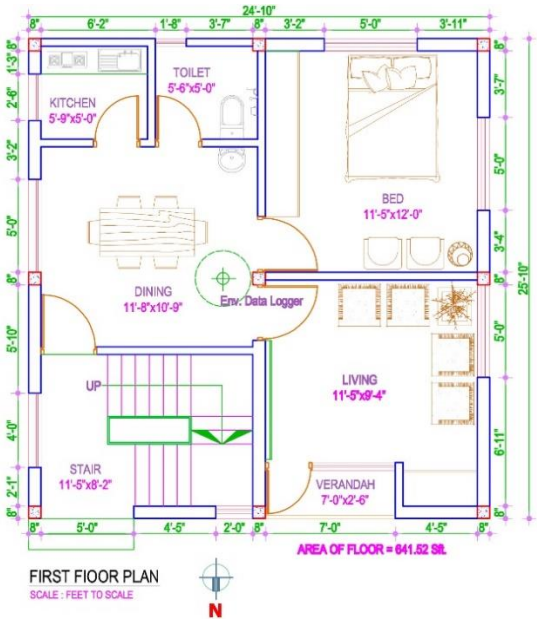
Computer Softwares:

1. EnviMET Environemtal Analysis
2. EcoTect Environmental Design

Experimentation Site:

Housing and Building Research Institute has been constructed a number of Pilot Houses for the demonstration of Alternative Building Materials and Construction Technique in last few years. For this investigation we have selected a two storied model house, constructed by concrete hollow block and ferro cement roofing channels which will be very effective in comparison with conventional clay burnt bricks. The plan of the building and the position of the Environmental meters has been provided below:





Current Progress of the Research:

After complition of Literature study, the team has been aquired pre-requisite datas and information regarding this investigation. Previous Researched completed on similar topics in different countries has been throughly studies and analysed. For the computer silumation, a training session has been conducted and weather data has been collected from EnviMet Corp. Along with this Literature study, a proper research planning has been done and a schedule has been prepared for this investigation which has been provided above. Through this study and planning a proper guideline has been made and the research initiated. Required Scientific equipements has been partially purched and others are on route for installation. Data Collection has been started marking the Summer season of 2020 for Phase 1. After the collection of Environmental Datas, the computer simulation model will be prepared.

Remaining Question:

Through this process a set of environmental datas will be collected from time to time and after that all the datas will be compiled and processed in respective scientific equations. Along with that, The computer simulation model will show the visualization in Thermal Comfort, Relative Humidity and Air Flow though this alternative buildings.

Expected Result:

This investigation will thrive to find out the Environmental Performance of Alternative Building Materials by comperative analysis. From this Research, the benefits of using alternative building materials will be clearly understood and will be able to express in numerial values. The level of Energy Consumption will be calculated and by that the savings of electricity will be calculed which will show how much benefits people can get by using this alternative building materials. The research will be published in international conferences and HBRI will organize a dessemination conference locally after the review and completion of this study. Hence, The expected result of this research can be summaried as, The Environmental Performance and Energy Efficiency of the Alternative building materials will be found though this research for the improvement of the housing sector in Bangladesh.