



ANALYSIS OF CSEB AS A MODERN, LESS THERMAL CONDUCTIVITY SUSTAINABLE MATERIAL USED FOR RESIDENCE @COIMBATORE

¹VAISHNAVI RAMAKRISHNAN

¹*Vaishnavi Ramakrishnan, Licensed Architect since 2021.*

*(M Arch Sustainable Graduate 2023 batch), Architecture Research Scholar
Karpagam Nagar 1st street, Tambaram, Chennai – 600073, Tamil Nadu, India.*

Abstract: Energy consumption has become major concern in Tropical region where the heat ingress during the day is high due to the use of modern material concrete glass, aluminum etc. So, this demand has to be addressed by an alternate material which has a lower embodied energy & which can also give better results in terms of thermal perform in a built structure.

CSEB is an identified alternative material which is now widely picking up in few areas for the built structures which seems to be addressing the heat ingress & lowering the temperature & gives better human comfort this has to be proved by quantitative approach or few empirical. This paper has been intended to have a quantifiable result by the size of CSEB block in the built structure & the results taken in the field seems to be satisfactory with both quantitative & subjective evolution. This experiment is carried out in coimbatore for a single residence of a family & the results were analyzed.

Index Terms - Ecotect, Building Simulation, Effective Shading Coefficient, Indoor thermal comfort, passive shading strategies, External Shading; Coimbatore Climate.

1. INTRODUCTION

1.1 MATERIAL BACKGROUND STUDY - CSEB BLOCKS HISTORY

The primary tries for compressed earth blocks were tried within the period of the nineteenth century in Europe. The designer François Cointereaux formed little blocks of rammed earth and he used hand rammers to compress the wet soil into a tiny low wood mould control with the feet.

The primary steel manual press that has been made within the world during 1950's was the Cinvaram. It absolutely was the results of an exploration programme for a social housing in Colombia to improve the hand moulded & sun-dried brick.

1.2 CSEB PROCESS & USAGE

The CSEB can be made to regular blocks in form and size, denser, stronger and additional water resistant safe than the normal adobe. More forms of machines were designed and plenty of laboratories got specialized and delicate to spot the soils for buildings. Several countries in continent yet as South America, Asian country and South Asia are using this system. The soil, raw or stabilized, for a compressed earth block is slightly moistened, poured into a steel press so compressed either with a manual or motorized press. CSEB may be compressed in many various shapes and sizes. Compressed earth blocks may be stabilized or not, however, most of the days, they're stabilized with cement or lime. The input of soil stabilization has created higher with thinner walls, that have a far better compressive strength and water resistance. With cement stabilization, the blocks should be cured for four weeks when producing. After this, they will dry freely and be used like common bricks with a soil cement stabilized mortar.

1.3 NEED FOR THE STUDY

To identify & give out a solution for the reduction of indoor heat gain in a building by achieving thermal comfort with holistic living during all the season at tropical Zone. Major concern was additional awareness of how the human body experiences atmospheric conditions, such as air temperature, humidity, wind and radiation. The study was introduced to review regarding different sustainably strong material, and additionally bound techniques accustomed to attain the passive style. This research is on how does this sustainable adobe/compressed stabilised earth block material reduce indoor heat transmittance from wall (cseb) and how to make comfort indoor using adobe material, parallelly to analyse the surface temperature of all directions and natural lighting with variations in building, and wind flow at each direction indoors.

The research was to bring in Calmness and mindfulness of public with senses like Sound, more of visual comfort indoor and outdoor with the material. Create awareness of inexperienced infrastructure and domestically available materials. Minimizing space between human and nature i.e, more of landscaping or gardening, farming inside the building to tackle the additional heat gain along with the CSEB material.

This press could get regular blocks in form and size, denser, stronger and additional water resistant safe than the normal adobe. Since then, more forms of machines were designed and plenty of laboratories got specialised and delicate to spot the soils for buildings.

1.4 FACTORS CONCERNING CSEB

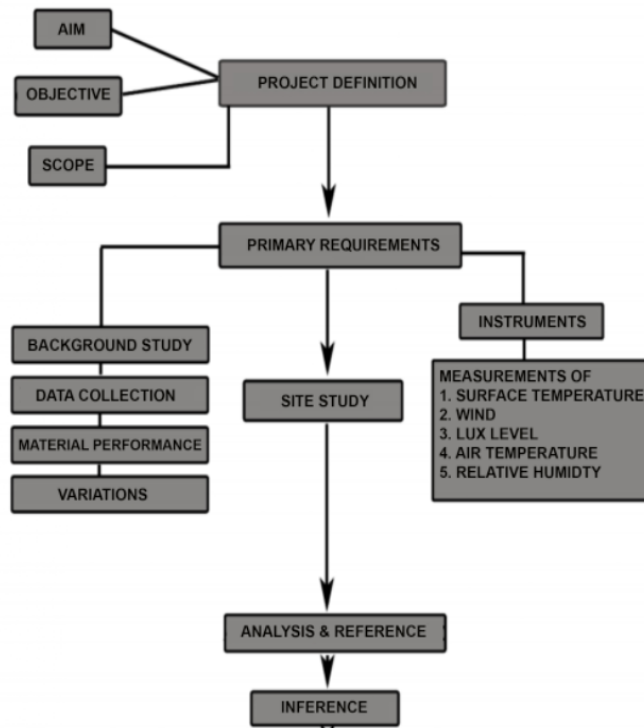
SUSTAINABILITY AND ENVIRONMENTAL FRIENDLINESS OF CSEB

Earth may be a native material and also the soil should preferably be extracted from the location itself or not transported from too far. Carbon emissions of CSEB are 12.5 times less than country fired brick. The embodied energy of CSEB is 10.7 times less than country fired brick. It is a cost and energy effective material. Labour prices for CSEB production amount to forty to forty fifth of the full price. This promotes endogenous development.

SOIL QUALITY & STABILIZATION FOR CSEB & COST EFFICIENCY

Not every soil is appropriate for earth construction and CSEB in particular. It is noted that the Topsoil and organic soils should not be used distinguishing the properties of a soil is essential to perform, at the end, sensible quality product. Some easy sensitive analysis can be performed after a short training. Cement stabilization are better for sandy soils. Lime stabilisation will be better suited for clayey soils. The choice of a stabilizer can rely upon the soil quality and also the project necessities. Cement will be preferred for sandy soils and to achieve quickly a higher strength. Lime will be rather used for very clayey soil, however can take an extended time to harden and to provide strong blocks. CSEB are most the time cheaper than fired bricks and concrete blocks.

2.0 METHOD



Firstly, I searched for the sustainable materials which are locally available., which proceeded with the Traditional old adobe-built houses under vernacular architecture, and then I checked how adobe blocks could be further bought up into this generation as a modern and beneficial material, found that already CSEB is doing good at thermal comfort of people who live inside and so I proceeded to take readings and get to know a lot about the material as well as the design and the comfort level at CSEB to that of other materials.[conventional buildings]

2.1 INSTRUMENTS USED



Wind - Anemometer



Surface temperature –
Infrared meter



Digital Thermometer



Daylight – Lux meter

These are the instruments used to take the readings of the residence. Readings were taken for 5 summer days for 12 hours which is 7am – 7pm at 2 hours' time interval. (Own instruments used).

2.2 DETAILS OF THE RESIDENCE

I took readings of the following given residence at Coimbatore, where we have many variations at ground floor and first floor designed by “**Studiovelicham by Ar. Muthuchellapan**”. So, starting off with north elevation we can see projected out elongated windows which has been planned for achieving daylight, to that of southern elevation we can see the windows are placed with sun shades and many different sizes of windows were being used and at First floor as we can't see we have jali works at East and South sides. At south and west sides, we have 1 feet wall exterior and rest two direction its normal 9 inches.

I have attached the residence's plan below and further have added all the readings/measurements taken and the analysis results as follows:

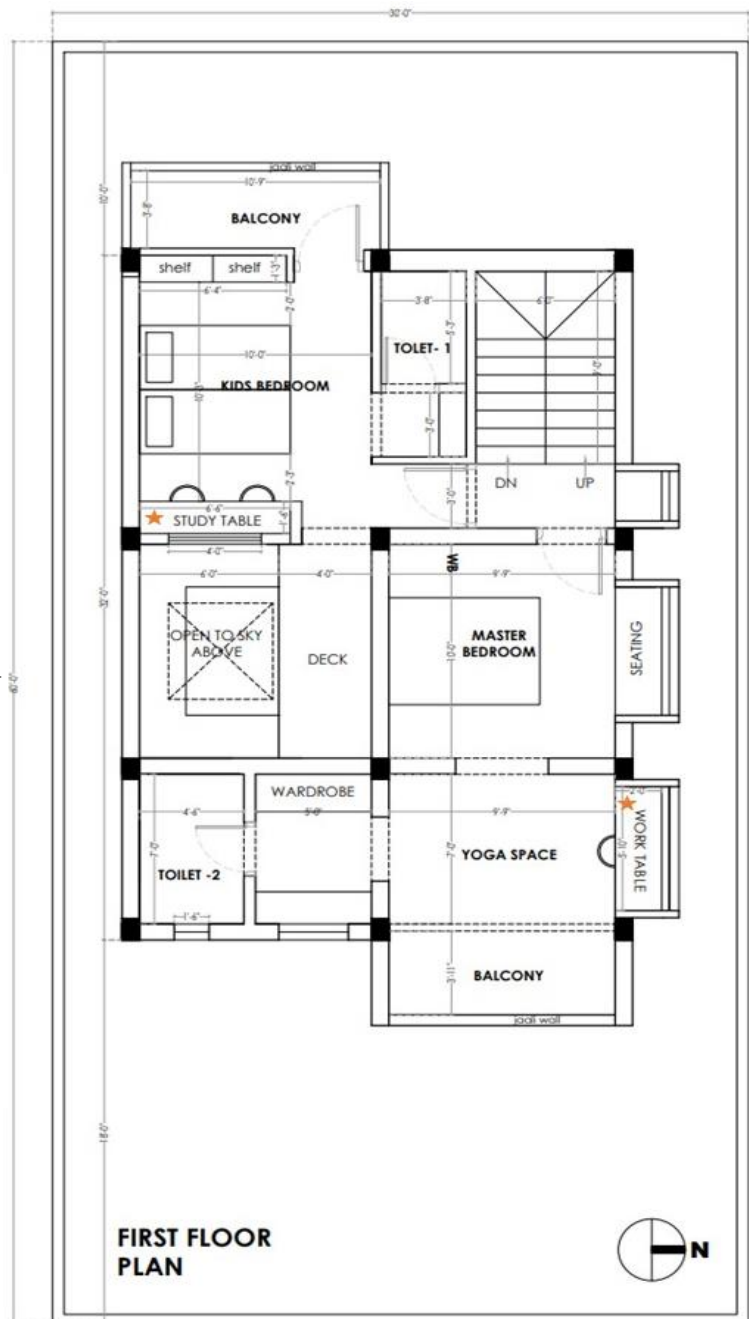
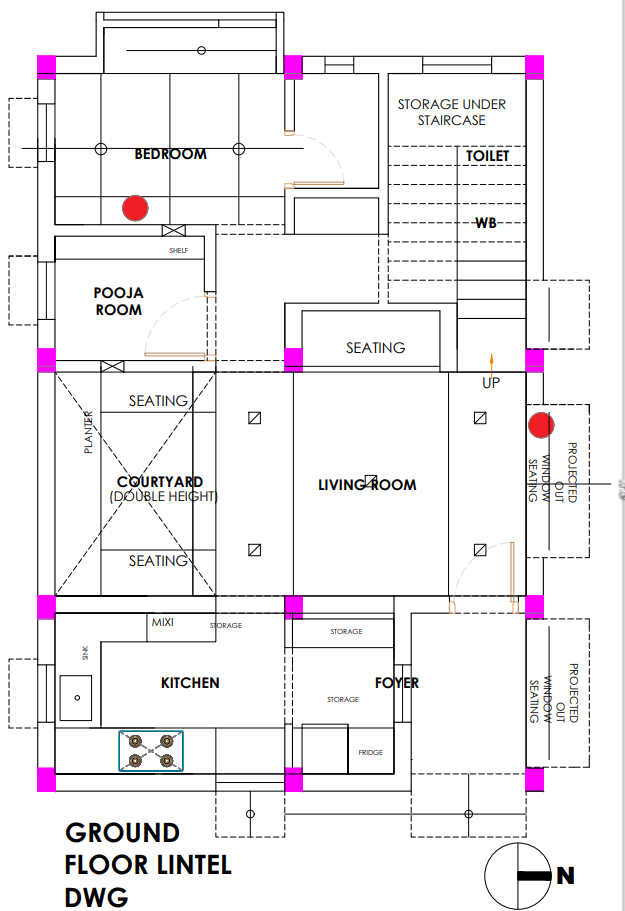
2.3 EXPERIMENT PROCEDURE & MONITORING SCHEDULE

So, as I already mentioned I was interested to check the comfort level and the temperature variants at a residence made out of CSEB block at coimbatore, all the Air temperature, Relative humidity, Surface temperature outside to that of inside was taken direction wise to check how exactly the material works along with each direction.

The readings were taken for 12hrs 7am-7pm. Here, with air temperature and relative humidity we can see that it increases during the early mornings and late evenings and during the mid-day the temperature and humidity is less. Air temperature had 2–3-degree difference at south-west to that of north-east and it had 3–4-degree difference from early morning to that of afternoon and evening respectively.

Designed by Studiovelicham
by Ar. Muthuchellapan

<https://www.instagram.com/muthuchellapan/>
Muthuchellapan92@gmail.com



So, this is the ground and first-floor plan of the residence where I placed my instruments for the measurement of air temperature and relative humidity. The readings were taken for 5 days each day at 2 hours interval [7am,9am...7pm].

We also have difference at the thickness of walls southern and western side we have 1 feet wall and rest exterior is 9 inches wall thickness also at interior we have 6 inches wall so the designing part played a very major role here, the north side has elongated and projected out windows to achieve the daylighting and at

south side we can see from the image that they have given different sizes of windows but we have sun-shades as at southern side we don't have much exposure to daylighting, at east and west side we can see the placement of balconies with jali works to achieve wind flow and also some amount of lighting. The residence was designed in such a way that achieves south-west wind more than that of north-east and at north-east direction it achieves more of the natural daylighting.

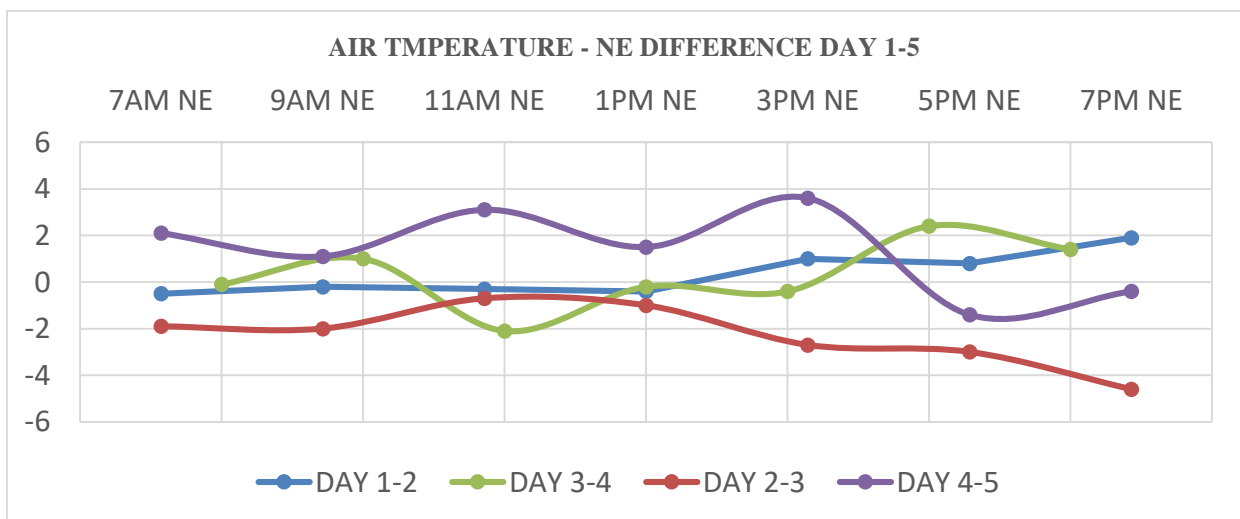
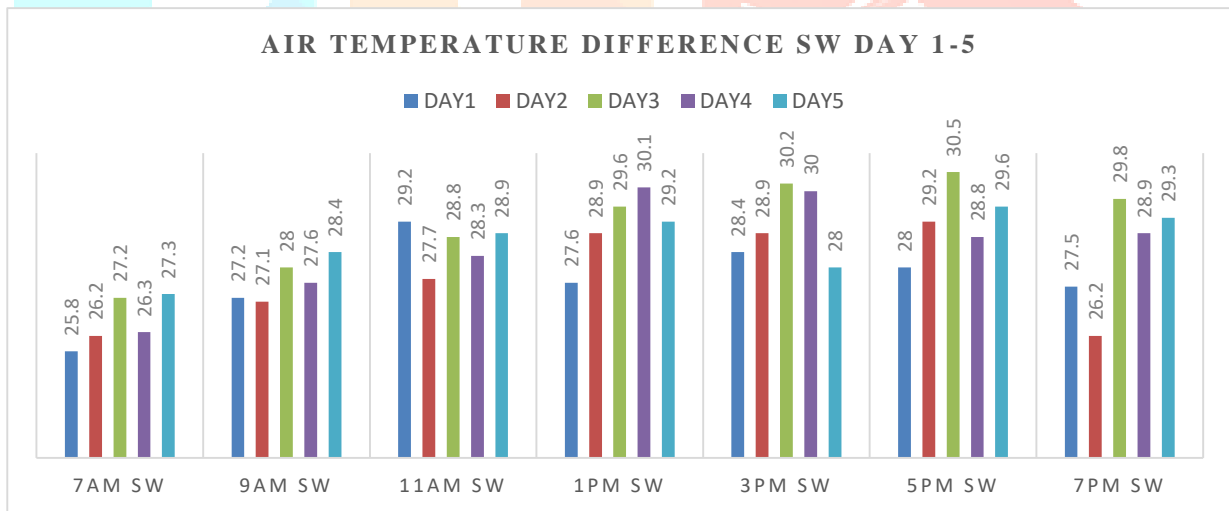
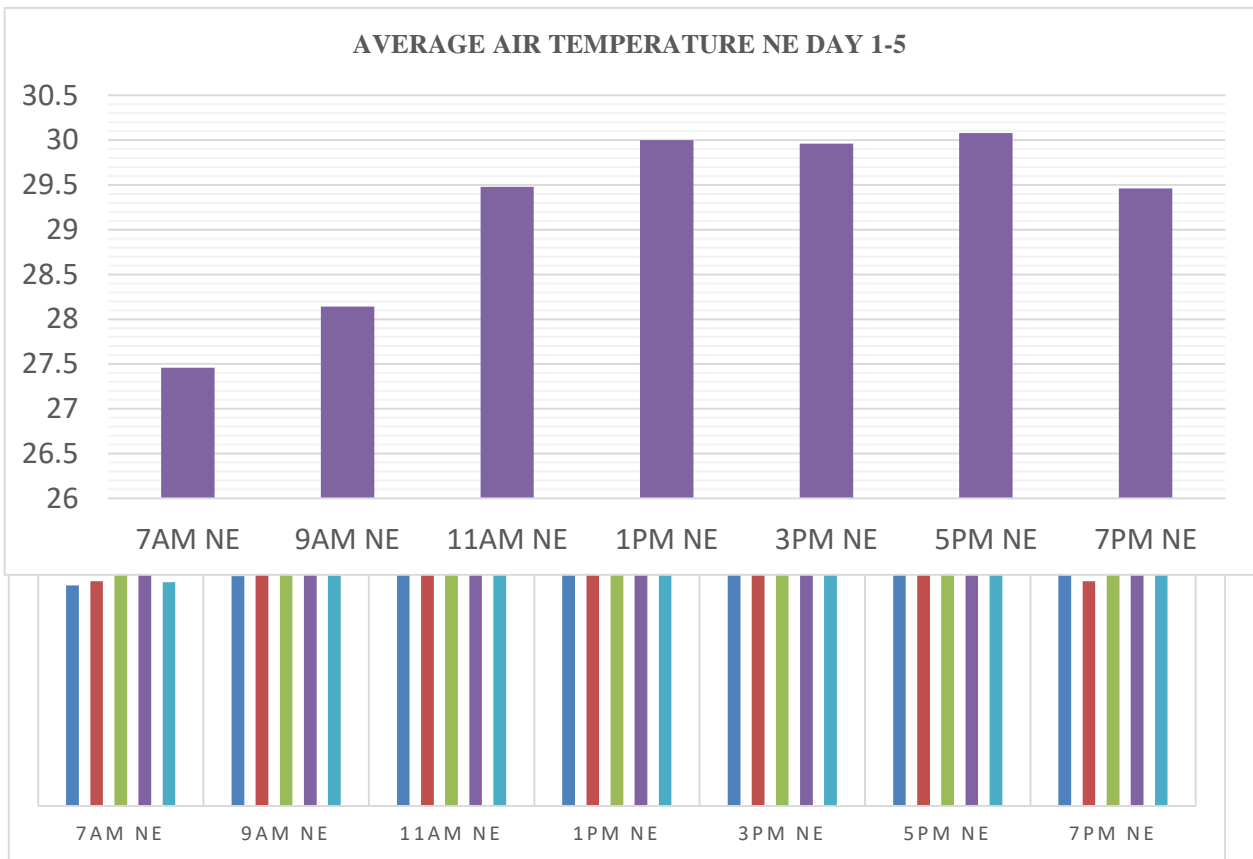
The client/owner they did not use AC at the whole residence as the temperature was around 25°C during the noon and they did not even use fans so by here I also noticed that the CSEB material consumes less external or artificial energy when compared with normal conventional building and the major difference was the people who live in CSEB block where very comfortable than people living in other/conventional block. The physiological [people behavior] who live in CSEB to that of conventional building shows more difference i.e., the people residing at a CSEB building feel more comfortable and have a kind of mental stress relief which is the major importance at this and near future era.

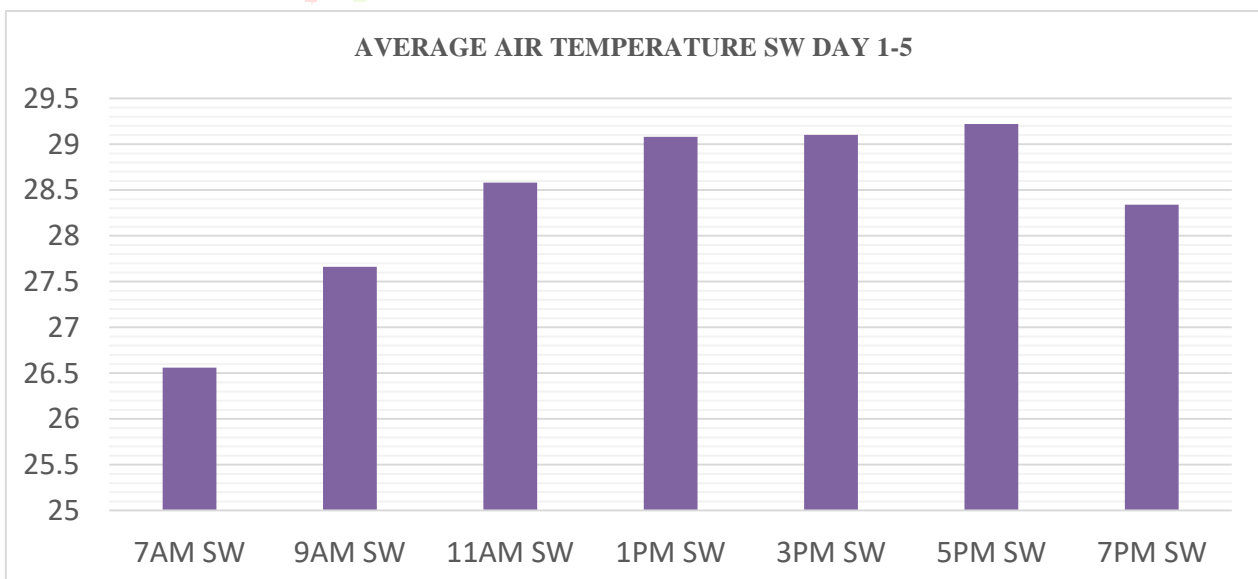
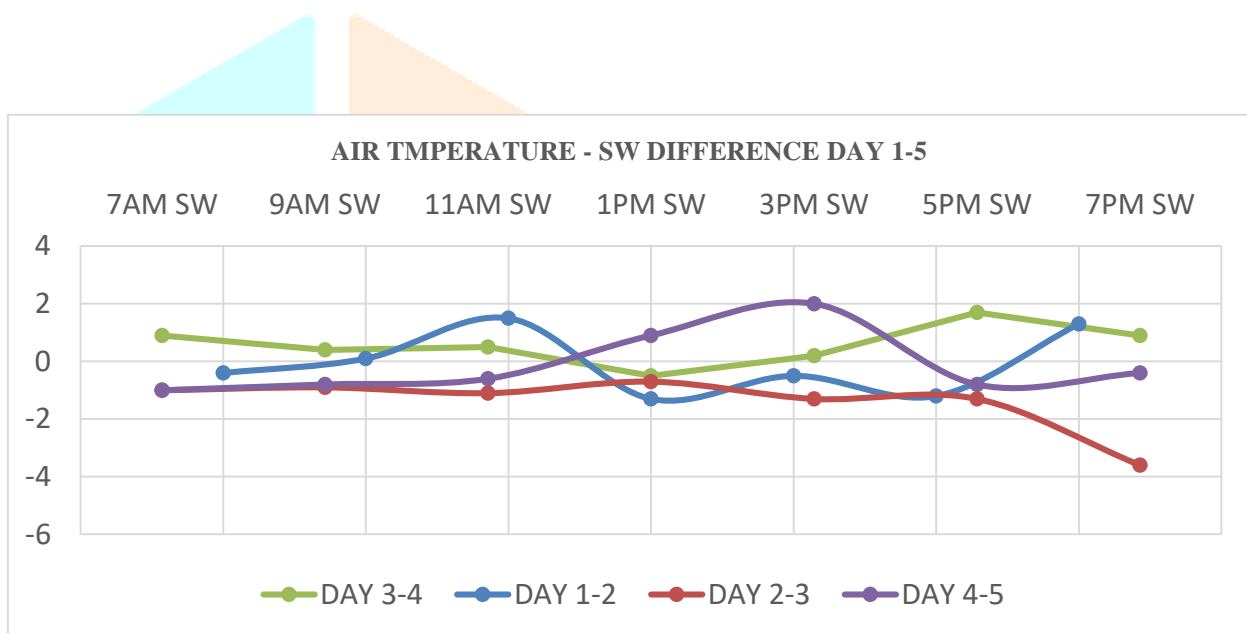
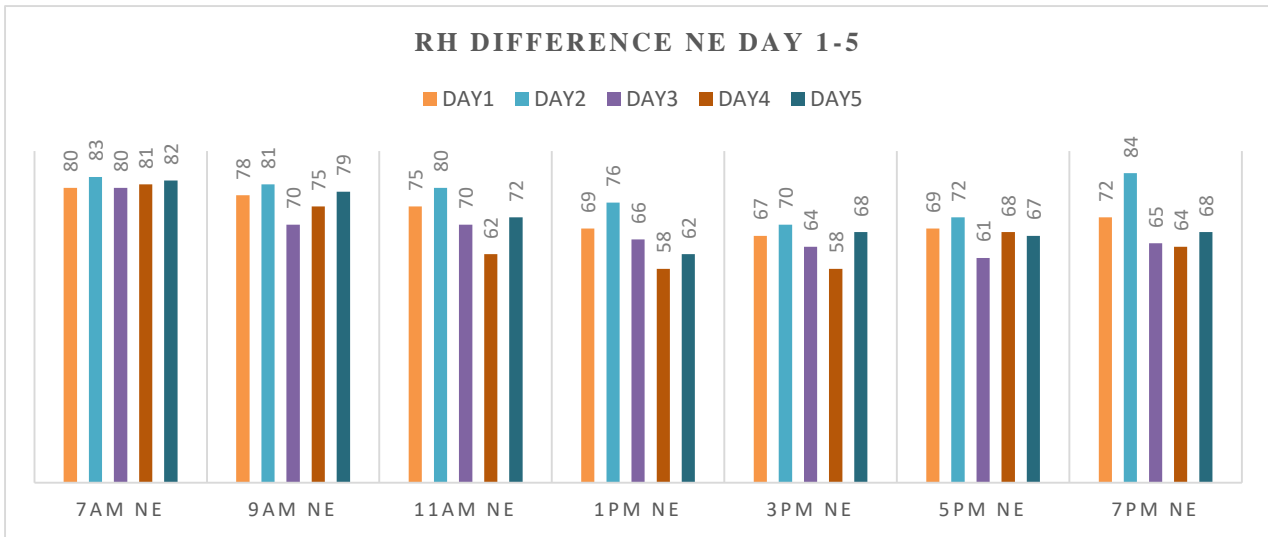
This material also goes with the thermal and psychological "feel good, peaceful" factor of human being, in addition we don't have to even paint the walls it's aesthetic is really good and very cost effective, and it really has good compressive strength, different vaulted roofs could be an interesting factor with this material also it is a fire resistance material almost we can name it as modern self-insulated material.

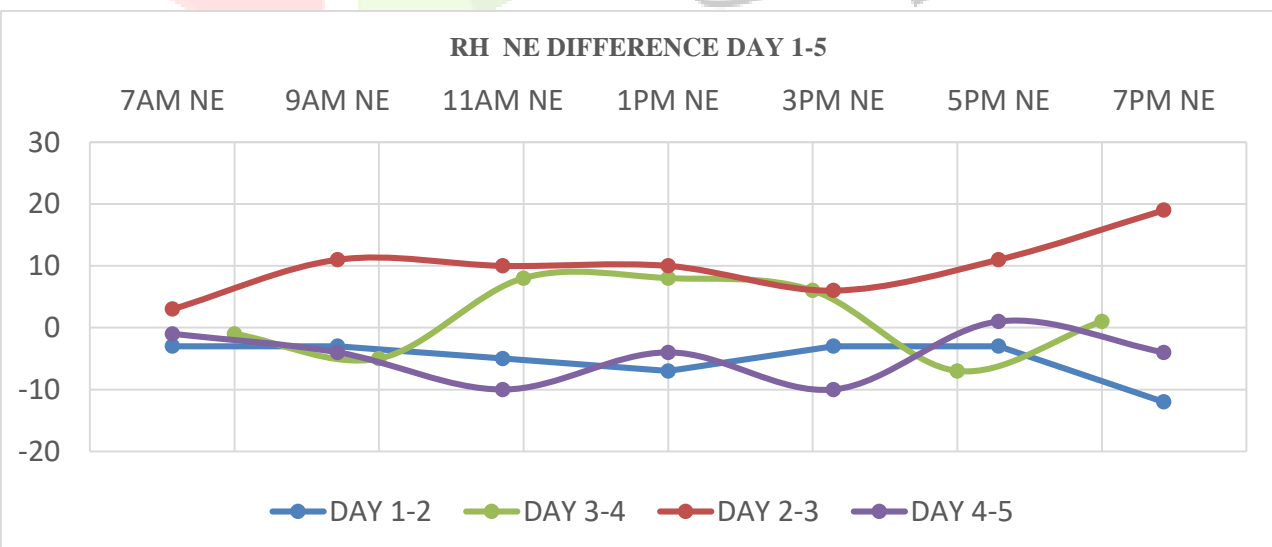
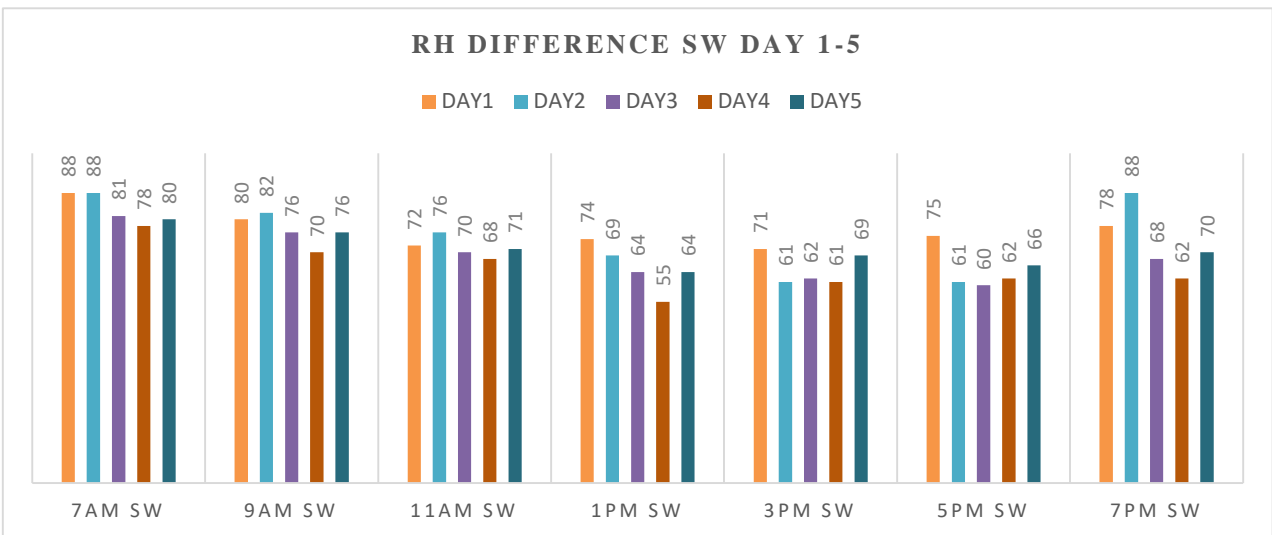
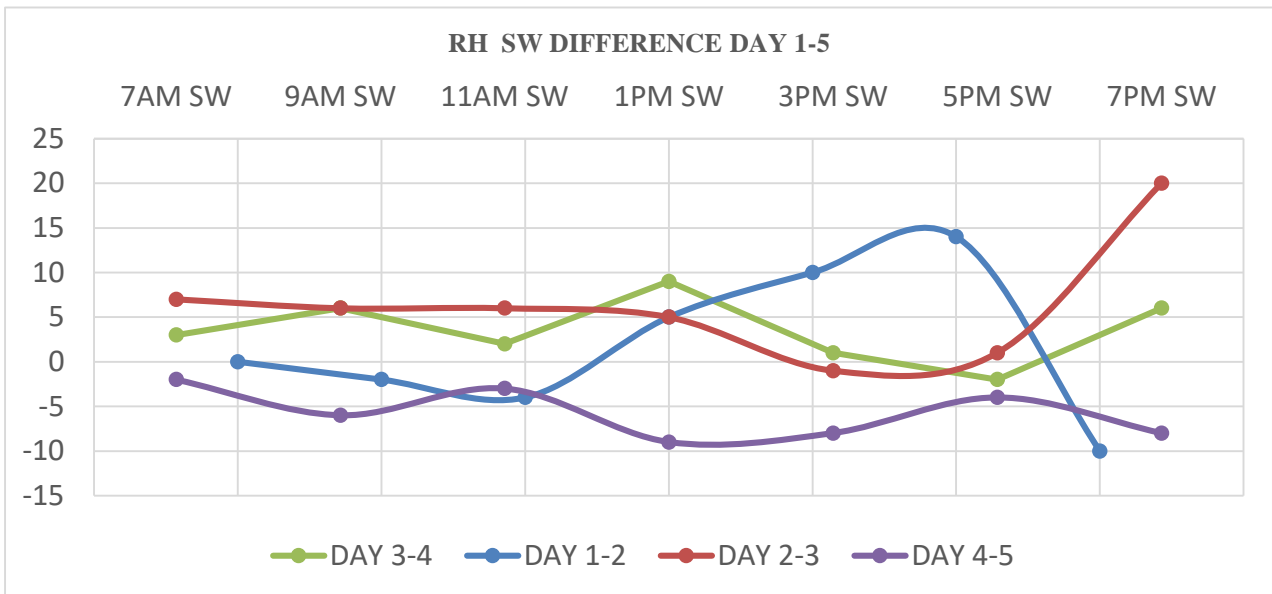
I have attached the data collection and further details below



3.0 DATA COLLECTION







4.0 RESULTS AND DISCUSSION

- AIR TEMPERATURE INDOOR NE, SW DIRECTIONS DAY 1-5

From the readings we can see that the instrument placed at SW direction to that of NE direction has a difference of 2-3 Degree Celsius.

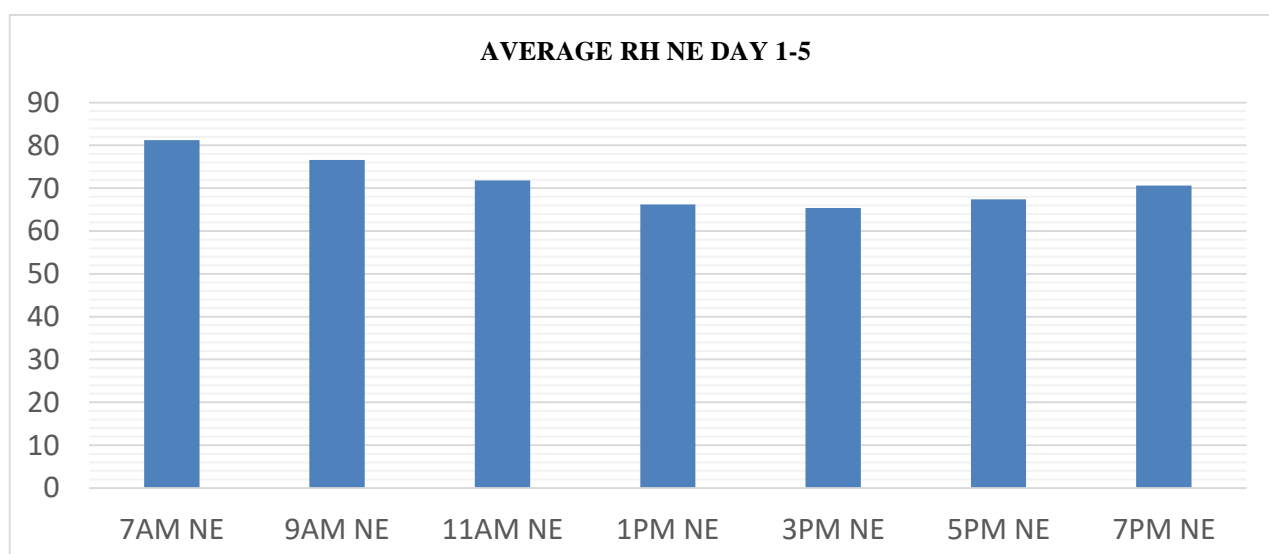
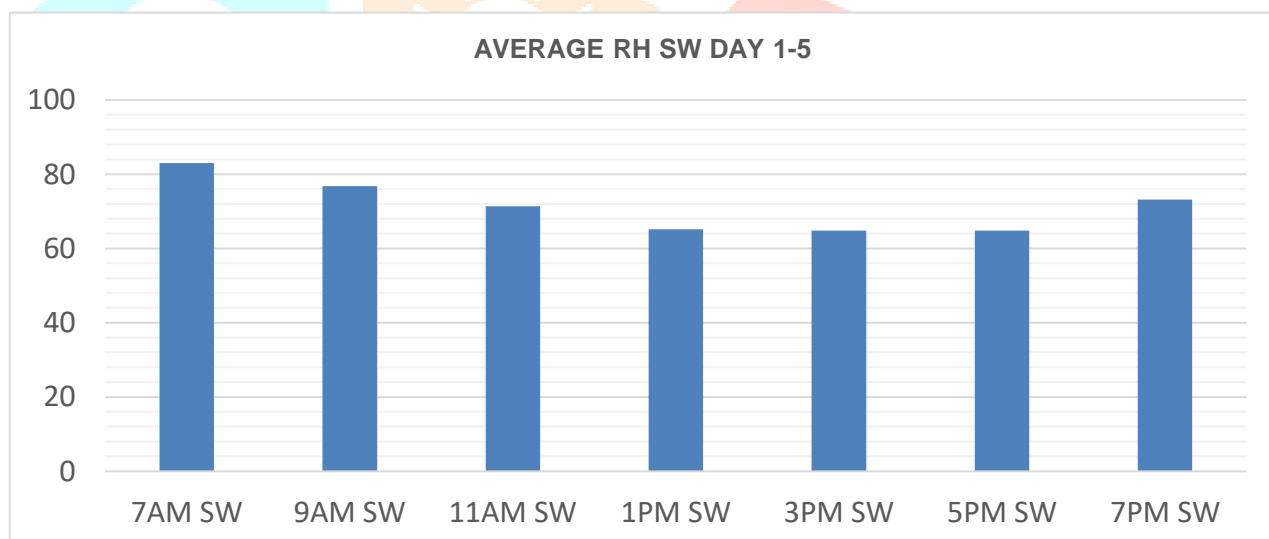
- RELATIVE HUMIDITY INDOOR NE, SW DIRECTIONS DAY 1-5

From the readings we can see that during early mornings and late evenings the RH is high to that of in mid-day hours its quite normal which is around 60%.

5.0 CONCLUSION

As per the values the CSEB material could even reduce up to 25-27°C indoor air temperature and also 60-80% of relative humidity in overall view. It was being noticed the Relative humidity is 60% during noon time Hence, as per my personal analysis and findings I conclude/suggest that the CSEB material or so to say the Mud earth blocks are more comfortable for people who lives inside for warm and humid climatic zone.

Regarding the Thermal comfort inside a CSEB residence, it is essential to tackle the summer in coimbatore (warm-humid, moderate), Further experiment can be done for winter and analyzed whether the material is actually suitable for composite climate like feels cold during summer and warm during winter and can have better results.



6.0 RECOMMENDATIONS

- 1] This material could be used for the residential purpose for the warm-humid, moderate[coimbatore], hot & dry climatic zones.
- 2] This material could also be applied to buildings at certain direction so that it achieves more benefits.
- 3] The Transmittance value of CSEB compared to conventional brick building is good, i.e, this material obviously has less thermal conductivity which would result in temperature management.

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BIOGRAPHY OF AUTHOR



Vaishnavi Ramakrishnan is an accomplished architect (COA, IIA Member) and sustainable design expert. She obtained her Bachelor's and Master's degrees in Architecture from Karpagam Academy of Higher Education, Coimbatore, specializing in sustainable design during her Master's program. Born on January 28, 1999, in Madurai, Vaishnavi has always been passionate about creating environmentally friendly spaces.

With her exceptional communication skills, Vaishnavi has been able to effectively convey her ideas and collaborate with colleagues and clients. Her expertise in sustainable architecture has allowed her to work on various innovative projects that prioritize environmental preservation.

