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## Analysis & Design of Row House Using Ancient Techniques

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**Abstract :** Traditional housing has become a subject of great interest amongst everyone for a number of good reasons. It is very clear that extreme use of technology accelerates various environmental problems. This report aims to design and analyze a row house that combines traditional and modern housing & construction practices with lower construction costs, better indoor climate, and sustainability.

An online survey was conducted where the respondents, also the future end-users of this design, were asked about their experiences and suggestions that proved helpful in creating the final design. The results showed that most respondents were willing to adopt traditional housing when combined and catered to the modern lifestyle. The construction cost of the house thus designed was compared with that of a modern house to demonstrate the cost-effectiveness of the designed structure. The outcome was very positive due to the significant reduction in cost and the better sustainability of the structure.

**Keywords** - Ancient construction, Climate modifier, Cost-effective, Energy efficient, Sustainable building, Traditional housing, Vernacular architecture

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### I. INTRODUCTION

Prior to the arrival of the industrial age and the innovation of mechanical heating and cooling, bio-climatic means were used exclusively to achieve moderately comfortable climates inside buildings. Active heating and cooling devices today provide comfort for the interior, but require significant energy input [1]. However, given the dual challenge of a growing fuel crisis and global warming concerns, the amount of energy used to deliver the levels of thermal comfort will become unsustainable. Sustainable, environmentally friendly, and climate-adaptable architecture provides possible solutions to these challenges. Many architectural publications advocate traditional and vernacular housing practices being the foundation of environmentally conscious design. The lessons learned from traditional and vernacular architecture can help to design an environmentally friendly future. Traditional housing has always tried to provide a safe place to live and to create suitable positions that are coordinated with their environment. Though it has been dismissed as coarse and unrefined, it also has advocates who stress its importance in current design.

While Traditional Ecological Knowledge is a complement to modern science, it is now under severe threat to disappear. This report, hence, focuses on this conceptual, scholastic, and theoretical context.

### II. METHODOLOGY

Before beginning to design the intended structure, we conducted a questionnaire survey that was circulated among people having no background related to construction or architecture since these were the people who represent a major part of the population that was going to use the intended structure. This survey helped us better to analyze the idea from various points of views and at the end draw a combined yet clearer conclusion.

The data collected in this survey included age groups ,familiarity of the respondents with the term “ancient construction practices”,the source of the respondents’ knowledge about the topic,sustainability of traditional

housing ,getting to know the respondents' surroundings ,adopting traditional housing practices in metropolitan areas ,areas suitable for traditional housing ,favorability of traditional housing practices,cost efficiency of traditional housing and probability of recommendation.

The next step was to begin with the actual designing of the row house that incorporated all the ideas and facts & findings drawn from the study done in the due course of the first phase of this project. The Row house was designed by using AUTODESK REVIT software. The key components that differentiate our design from an average modern house include:

1. Red oxide flooring in place of flooring tiles [2]
2. Lofts that provide more floor area without any extensions
3. Higher ceilings for better indoor climate [3]
4. Load bearing structure
5. Brickwork with lime plaster finishing that replaces toxic wall paints
6. Central courtyard that acts as a daylight source and as climate modifier
7. Rat-trap bond that delays heat movement
8. Sloping roof

Then the actual design of the structure was started. Revit software was used to design our model which was a G+1 structure. There were many different designs and sizes for doors, windows, slab small components,etc which helped a lot. After the successful designing of the structure the next task was the analysis of the structure.

In Indian for analysis of the structure the most reliable software is Staad pro so we start our analysis on this software.First a single slab was designed to check whether it was safe for design and the slab came perfectly safe for the design. Lastly the entire structure was designed which also matched our expectations.

After successful designing, analysis of the design will be done for obtaining both structural and cost efficiencies. The structural analysis will be done using STAAD PRO or a similar software based on the system requirements and suitability. We intend to demonstrate a comparison between the construction costs of an average modern row house and the row house designed for this project.

The design and analysis of the structure was done with the help of two softwares which were AUTODESK REVIT & STAAD PRO. There were quick problems that we faced while designing and the analysis of the structure which are mentioned below:

- AutoDesk Revit:-
  - The software being of a very large size took double the time it would've otherwise taken if it worked smoothly.
  - Rendition of graphics for traditional materials was a tedious task as there was no provision built-in in the software.
  - The files of one software version are not compatible with another version. hence the work could not be split among other members due to this compatibility issue.
- Staad Pro:-
  - Slight variation in the placement of the nodes can give an error in the analysis at the end results.
  - Searching for respected codes is a very challenging task.
  - Improvement in the software version flexibility can prove to be very helpful and can increase the productivity of the project as a whole.

### III. FIGURES



Fig. 01: Red Oxide Flooring

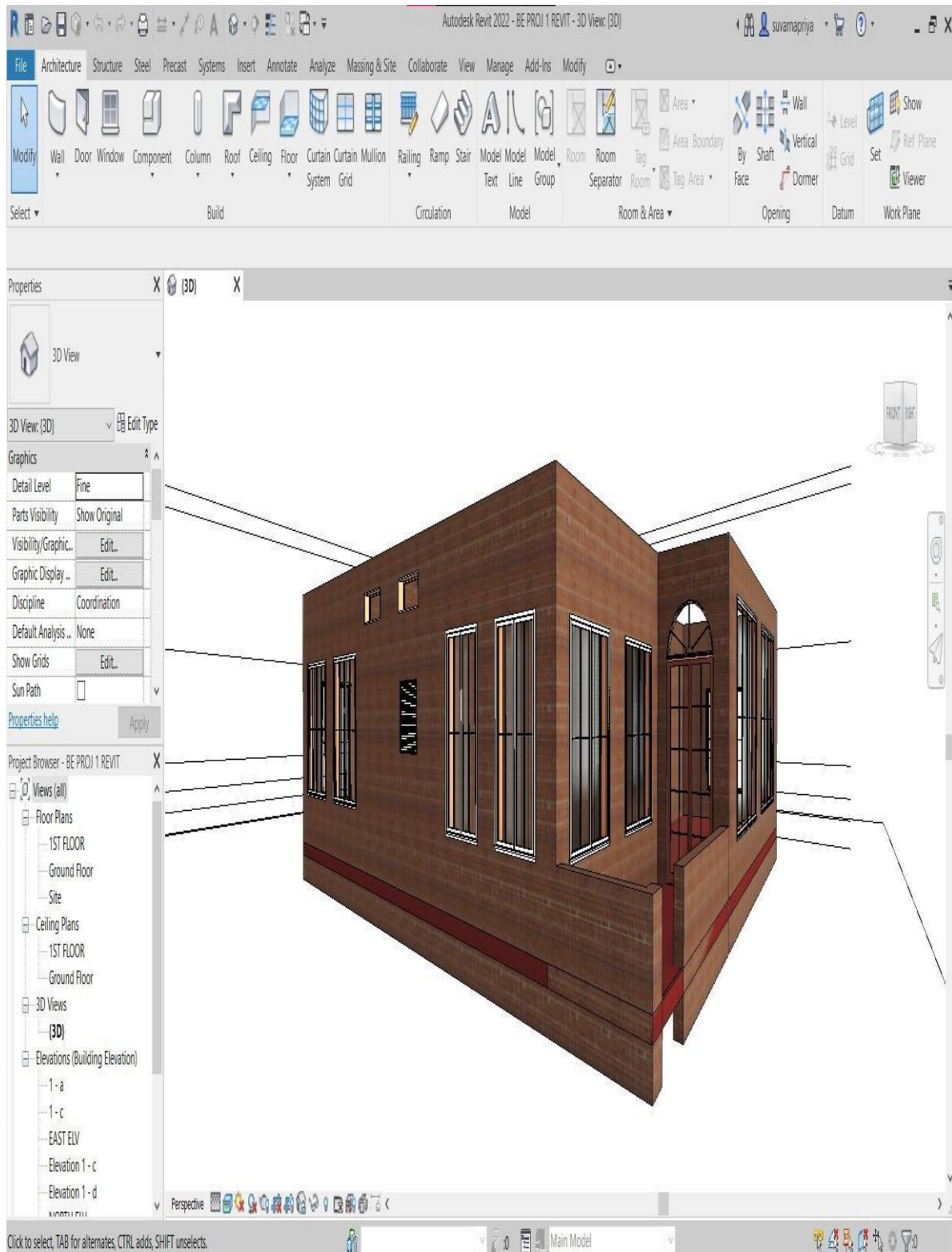


Fig. 02: Design of the Row House using Revit

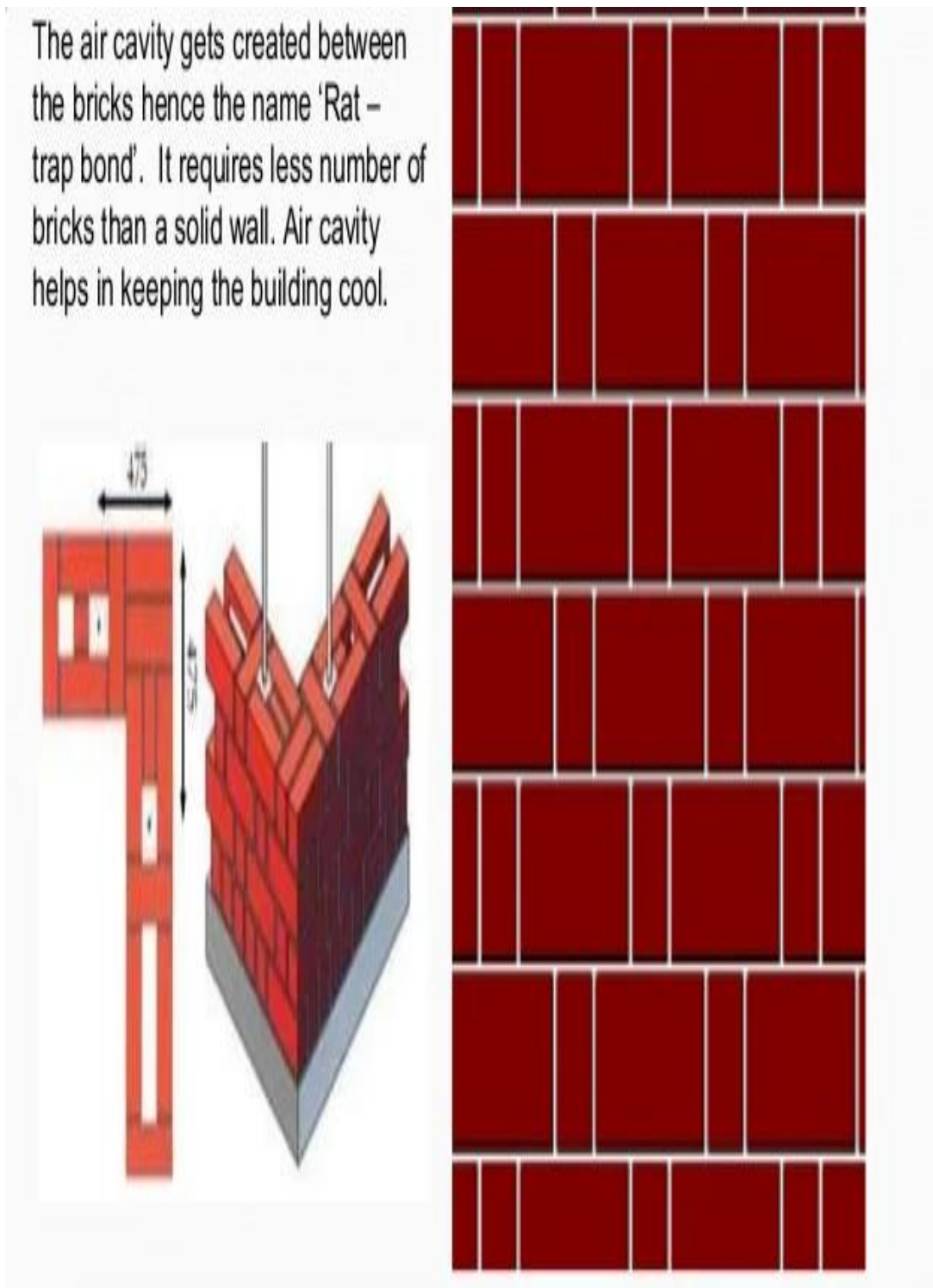


Fig. 03: Rat-Trap Bond

#### IV. CONCLUSION

With people nowadays being more aware and updated, different styles are being adopted for the constructions of row houses inspired from various parts of the globe. This paper focussed on bringing back the styles from our cultural roots that are slowly losing its essence with increasing modernization. The difficulties in using different softwares for adopting the methods that are less common in the current era surely was a setback. The incorporation of these aspects into systems and softwares is something that needs to be worked on.

Even though it took some more time to complete than anticipated, due to the issues discussed above, we were successful in rendering our idea into this project effectively. Designing a load bearing brick structure reduced the cost of steel used in a modern framed RCC structure. Red oxide flooring not only eliminated the cost of tiles but also provided comparatively cooler indoor temperature. This also gave an emotional sense of being connected to the earth. The provision of lofts significantly benefits the house owner in terms of usable floor area without even extending an inch of the carpet area.

After taking all aspects into consideration, we studied that the techniques used in traditional architecture and in the early ages are quite effective and save a lot of energy as well as money because of the simplicity and efficiency of the structure. Though we have designed a structure which is based on ancient techniques, we do have a modern touch to it. Along with being structurally sound, the structure we designed proves to be more cost effective than the ones designed with standard construction methods. Even though it took some more time to complete than anticipated, due to the issues discussed above, we were successful in rendering our idea into this project effectively. Designing a load bearing brick structure reduced the cost of steel used in a modern framed RCC structure. Red oxide flooring not only eliminated the cost of tiles but also provided comparatively cooler indoor temperature. This also gave an emotional sense of being connected to the earth. The provision of lofts significantly benefits the house owner in terms of usable floor area without even extending an inch of the carpet area. After taking all aspects into consideration, we studied that the techniques used in traditional architecture and in the early ages are quite effective and save a lot of energy as well as money because of the simplicity and efficiency of the structure. Though we have designed a structure which is based on ancient techniques, we do have a modern touch to it. Along with being structurally sound, the structure we designed proves to be more cost effective than the ones designed with standard construction methods.

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