

Implications of using Physical Equipments and Digital Medium during the Process of Architectural Design

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Abstract—Today each and every individual has become aware about the energy issues which our further generation is going to face. Hence everyone is doing their bit towards saving energy. The architectural sustainability can be achieved by making the building climate responsive, energy efficient, and energy conscious. All are almost similar terms since they all are moving towards a single goal which is to save energy resources for our future generations. The theoretical data is always helpful in making a building energy efficient. Many architects as well as students of architecture use this theoretical data during design process. The quality of design process as well as the final output can be further enhanced if the climatological tools are used like physical equipments, graphical as well as the e- equipments(Softwares) during design process. The present paper delineates various tools like physical, graphical, software's etc which can be use for measuring the accuracy of the building to suit the particular climatic region for climate responsiveness. Advancement in technology leads to use of various software's for testing building efficiency which also comes with certain limitations. This paper highlights various physical equipments that can be used by practising architects as well as schools of architecture in design process for taking efficient design decisions. The habit of making climate responsive buildings should be inculcated from schools of architecture itself, which will remain with individual throughout their life.

Keywords: Climate responsive, Software's, Physical equipments, Efficient Design.

1. INTRODUCTION

Today each and every individual has become aware about the energy issues which our further generation is going to face. Hence everyone is doing their bit towards saving energy. Concrete jungles contribute nearly half of the energy use in India. Ultimately it contributes in global warming which is one of the main cause for climate change. To overcome this problem the time has come where we have to go back to our basics and carefully design a building and minimize the potential of extreme energy use. The architectural sustainability can be achieved by making the building climate responsive, energy efficient, and energy conscious. All are almost similar terms since they all are moving towards a

single goal which is to save energy resources for our future generations.

Architectural schools impart in structuring such type of knowledge and sensitized towards these issues. The theoretical data is always helpful in making a building *energy efficient*. Many architects as well as students of architecture use this theoretical data during design process. The quality of design process as well as the final output can be further enhanced if the climatological tools are used like physical equipments, graphical equipments as well as e- equipments (Software's) during design process.

The equipments which are three dimensional where actually the phenomenon or simulation can be seen through model of the building are Physical Equipments. There are number of physical equipments available from data collection to analysing the data for architectural building purpose. Graphical Equipments are the charts and tables where climatic data needs to be filled in for getting the guidelines for designing buildings as per climate. These equipments doesn't require any model of the building and the e-Equipments are various software's available where in direct three dimensional model in computer graphic can be made by feeding the climatic data of the region where the building needs to be built. It helps in saving the time also.

There are number of Physical equipments, those are for collecting climatological data and can be used to analyse the design proposal or to take effective design decisions during the design process. Some of the physical equipments are artificial skies, heliodon, lux meter, Solarscope, Sun dial, Wind Stimulator etc., all equipments helps in accounting the sun and wind direction and penetration. Setting up of these equipments cost are not too high, it is from Rs.5,000 to Rs.15,000 and can be made by carpenters as per standards or can be purchased. Once the functioning of these instruments are demonstrated, one can easily use it further in their design process. On such type of equipments one can see the actual simulation process, like if someone is using heliodon or

sundial one can see the actual penetration of sun and creation of shades and shadows. Similarly one carry out the experiment on wind stimulator, where one can see the actual wind movement and study the wind pattern. These physical equipments can be kept in one dedicated room and it is maintenance free. For using these instruments it is necessary to make scaled models for testing. While using these equipments it is necessary that the model should be designed as per particular climatic region climatic data. These are user friendly equipments.

The charts and tables like Mahoney's Table, Bio-climatic chart or comfort zone chart, Day light Protractor, Lux-Grid Chart, Psychometric Chart, Pepper pot diagram, Shadow Template

Shadow angle protractor, Solar Chart/ Sun path diagram, Temperature Isopleth etc.

where climatic data needs to be filled in for getting the guidelines for designing buildings as per climate. These equipments doesn't require any model of the building. Again in this one has to fill up the climatic data correctly or properly.

Advancement in technology leads to use of various software's for testing building efficiency which also comes with certain limitations. Again there are number of software's available in market. Some of them related to climatic study or energy efficiency are Building Design Advisor, Design Builder, Ecotect, Energy Plus, ParaSol VisualDOE etc. Some of the software's like in Design Builder, it gives advanced modelling tools in an easy-to-use interface User-friendly modelling environment where you can work (and play) with building models. It provides a range of environmental performance data such as: energy consumption, internal comfort data and HVAC component sizes. Output is based on detailed sub-hourly simulation time steps using the Energy Plus simulation engine. Design Builder can be used for simulations of many common HVAC types, naturally ventilated buildings, buildings with day lighting control, double facades, advanced solar shading strategies etc. but the shortcoming of this

software is a range of common HVAC systems is available from within the Design Builder user interface but users requiring a wider range of different HVAC types should consider exporting Energy Plus IDF input files and working in the Energy Plus IDF editor. Similarly if we look at the Ecotect software, it is sustainable design analysis software. It proposes a wide range of simulation and building energy analysis functionality that can improve performance of existing buildings and new building designs. The feature of this software is it gives various aspects of sustainability like whole building energy analysis, thermal performance water usage and cost evaluation, solar radiation- day lighting, shades and shadows. These simulations can happen with reference to the context of its environment.

The most important thing while using software's is that the data especially climatic needs to be filled correctly. By any chance if the data is filled wrongly then the results will be completely wrong. For example to know the thermal performance of any material, if we fill the climatic data in it, for requirement of morning temperatures we fed it evening and vice versa then the results will not come as per theoretical back up, which creates confusion. So the data should be properly feeded while using any software's. The costing for software's are in lakhs, and it varies as per packages for interface and for the place where it is to be used like in architects office or in educational institutes. Also for using software's one should be equipped with the knowledge. One has to take tutorials and which is for two three months duration of time. Once the person is equipped with the software's knowledge it is very easy to handle and time saving also, at the same time with the variety of different aspects of sustainability. Also it can be used from concept level of design to the final product of design.

For the use of software's one should have the knowledge of computer also. Use of software is time saving but it is not so user friendly.

The software's are very helpful in design process in fact more than that of physical equipments. But use software's is limited