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# Self Sustainable Portable Structure

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**Abstract:**
A portable, demountable or transportable building is a building designed and built to be movable rather than permanently located. It is constructed by using different raw materials available from all sources and manufacturing methods that can efficiently satisfy a wide range of structural and aesthetic design requirements. It consist of various components such as side wall and roof panel, steel section, truss, flooring, ceiling, lighting, doors, windows. It can be easily assemble and dismantle on the site unlike conventional structure. Portable structure also consists of various foldable units. The project duration required for the construction of portable structure is less than that of conventional structure. Portable buildings provide all the facilities of a normal structure. They also provide a provision to be transported to any other location as per the needs. Providing good thermal insulation and a variety of uses these structures are now gaining their importance in areas where temporary structure is the basic need. They do not require any large amount of labour or long construction time. The construction and manufacturing process require a maximum 10 days and the cost are also affordable. The panels provide for someone looking to build a multi-family property, portable construction offers higher quality than traditional mass construction for the same amount of money. Portable construction should be strongly considered if having consistent quality is of high value.

**Keywords:** Portable, structure, construction, solar, engineering,

## I. INTRODUCTION

A portable, demountable or transportable structure is a structure designed and built to be movable rather than permanently located. A common modern design is sometimes called modular structure, but portable structure can be different in that they are more often used temporarily and taken away later. Portable structures have been used since prehistoric times. The most familiar modern type of portable buildings are designed so that one can be carried to or from site on a large lorry and slung on and off by a crane. In this report the detail study of self-sustainable portable structure is been done. Portable buildings have been in use since humankind first began to build, yet because of their impermanent nature it is only recently that they have begun to perceive as architecture. Portable architecture consists of structures that are intended for easy erection on a site remote from their manufacture. The simplest strategy consists of buildings that are transported in one piece for instant use once they arrive at their location. The term portable architecture may be used in recognition of the fact that many contemporary examples of the structures have a significant effect on built environment. There is hardly one field of human activity that they do not support in some way- housing, education, medicine, commerce, manufacture, entertainment, military operation are a few. Portable architecture consists of structures that are intended for easy erection on a site remote from their manufacture. Portable has been used as general description for movable building for nearly two centuries. The design of portable building is not restricted by the lack of construction options, which enables them to range in size and complexity. A self-sustainable portable building includes the use of building-integrated photo-voltaic (BIPV) along with the conventional electricity.

## II. METHODOLOGY

The primary framing structure of a pre-engineered building is an assembly of I-shaped members is used. In pre-engineered buildings, the I beams used are usually formed by welding together steel plates to form the I section. The I beams are then field-assembled like bolted connections to form the entire frame of the pre-engineered building. Some manufacturers taper the framing members varying in web depth according to the local loading effects. Larger plate dimensions are used in areas of higher load effects. Other forms of primary framing can include trusses, mill sections rather than three-plate welded, castellated beams, etc. The choice of economic form can vary depending on factors such as local capabilities and variations in material versus labor costs. Typically, primary frames are 2D type frames. Advances in computer-aided design technology, materials and manufacturing capabilities have assisted a growth in alternate forms of pre-engineered building such as the tension fabric building and more sophisticated as is required by some building codes. Cold formed Z- and C-shaped members may be used as secondary structural elements to fasten and support the external cladding. Roll-formed profiled steel sheet, wood, tensioned fabric, precast concrete, masonry block, glass curtain wall or other materials may be used for the external cladding of the building. Various components of structure is shown in figure 1. In account of accurately design a pre-engineered building, engineers consider the clear span between bearing points, bay spacing, roof slope, live loads, dead loads, collateral loads, wind uplift, deflection criteria, internal crane system and maximum

practical size and weight of fabricated members. Pre-engineered building manufacturers have developed pre-calculated tables for different structural elements in order to allow designers to select the most efficient I beams size for their projects. However, the table selection procedures are becoming rare with the evolution in computer-aided custom designs. While pre-engineered buildings can be adapted to suit a wide variety of structural applications, the greatest economy will be realized when utilizing standard details. An efficiently designed pre-engineered building can be lighter than the conventional steel buildings by up to 30%. Lighter weight equates to less steel and a potential price savings in structural framework.

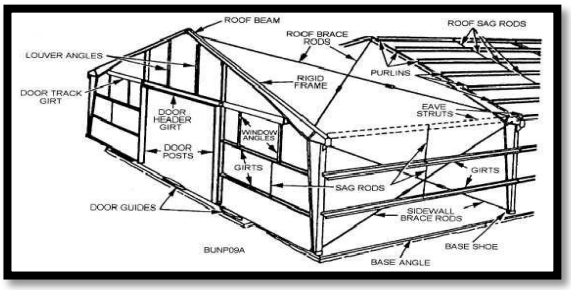


**Figure.1. Components of Structure**

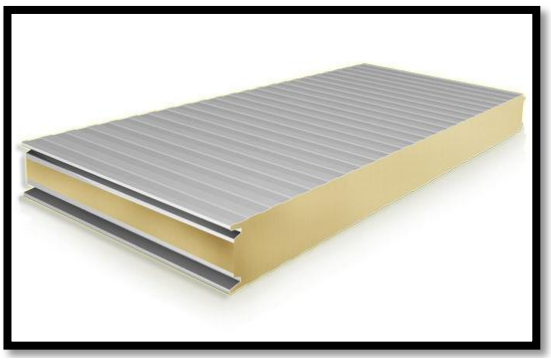

**Figure.2. Puf panel**

## III. STUDY ANALYSIS

In the survey, data collection is done by visiting different sites to get the rate details about the portable construction and as well as conventional construction. In the data collection we also know the procedures of the construction work and also find out the difficulties of the work. This collection is helpful to find out cost of the project for the both constructions. It is also find the project duration of the construction by using these enquiries. A residential building is taken for comparing and it includes the preparation of plan, data collection from portable industry, estimation of quantities, and determination of project duration.

In this analysis the cost of both portable and conventional constructions. And also the comparison cost for different stages as sub-structure, super-structure and finishing works. The sub-structure and finishing works has the similar cost for both construction of residential building and portable building, because of the sub- structure and the finishing works was done by the traditional method. But the category of super-structure has more variations, which the portable structure construction is very high cost compare to the conventional construction, because of the superstructure was done in two different methods as portable and conventional. The total project cost was calculated for both constructions i.e. construction of portable structure and conventional structure.

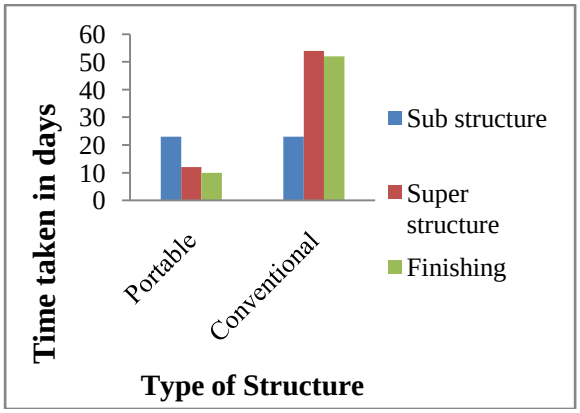


**Figure.3. Time Required For Construction**

The duration of the project is shown in three different stages. The duration of substructure was the same as conventional construction because of same method is used to construct in the portable. But the super-structures in the portable were completed earlier when compared to conventional construction. The project duration of super-structure has a huge variation and it's an advantage of portable structure construction. The portable structure construction takes less time duration in finishing works when compared to conventional construction, because of the electrical piping work was fitted already in precast walls and slabs. The plastering work is no need for portable precast elements, which is good in appearance and finishing.

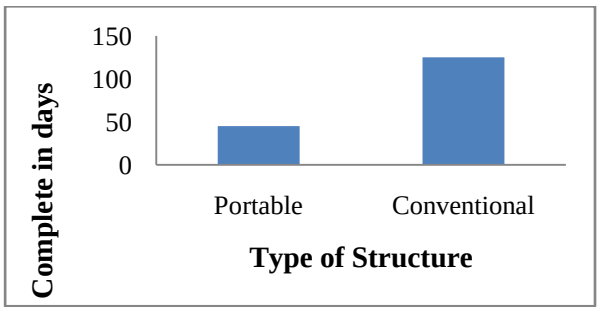


**Figure.4. Overall Time Required For Construction**

The overall time required for the construction of the portable structure is found out to be 45 days. On the other hand, the time required for the construction of the conventional structure is found out to be 125 days.

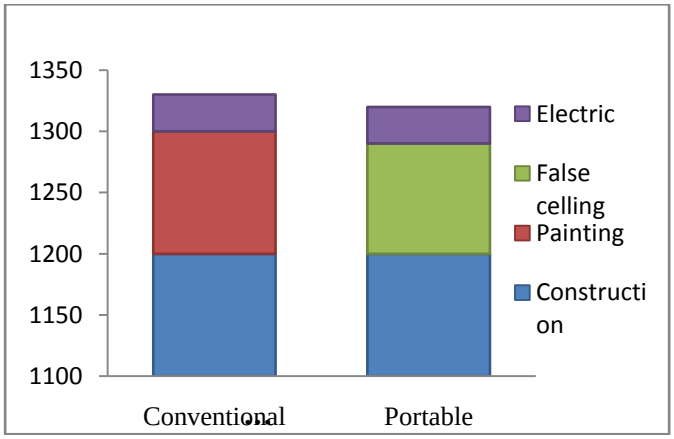


**Figure.5. cost comparison in sq. m.**

The cost of the portable structure construction was calculated through the data, which help to find the cost of the super structure of portable structure. The sub-structure and finishing work cost was the same as conventional construction because of same method is used to construct in the prefab. The cost of the construction is shown in different stages in figure 5 the data is collected for an area of 500 sq. m. which can be used for residential as well as commercial construction. Figure 6 shows that though the initial cost of solar is high but gradually is proves out to be economical than the conventional source of electricity.

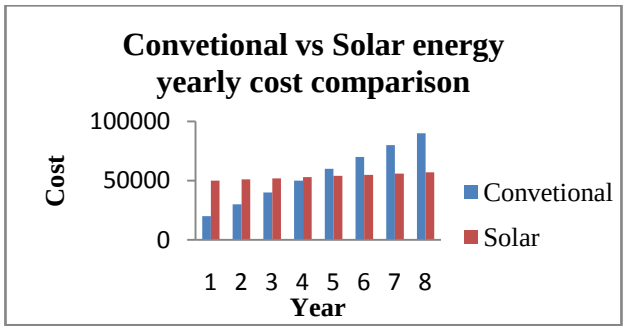


**Figure.6. Yearly Energy Comparison**

## IV. CONCLUSION

Portable construction is superior to traditional mass construction in most cases. There are a few limits to modular construction but they are usually not encountered in a multi-family building project. Modular construction is completed in about one fourth of the time it takes using traditional mass construction, meaning the property can be use, rented faster and added revenue can be created that would not be possible using traditional construction. Modular construction is also better quality. The workers are also very efficient because they do the same job repeatedly, which increases their skills and reduces errors. Very little waste is created and no materials are damaged by moisture, which creates a home with very good indoor air quality that is far superior to the average home. If knowing the price of a project upfront is important, modular construction can offer far more precision. This is especially helpful when building rental properties because an accurate estimate for return on investment can be easily calculated. Thus, from the study, it is concluded that portable buildings provide all the facilities of a normal structure. They also provide a provision to be transported to any other location as per the needs. Providing good thermal insulation and a variety of uses these structures are now gaining their importance in areas where temporary structure is the basic need. They do not require any large amount of labor or long construction time. In cases of emergencies these structures are recommended as they are easy to transport and erect at the required location. The construction and manufacturing process require a maximum 10 days and the cost are also affordable. The panels provide for someone looking to build a multi-family property, portable construction offers higher quality than traditional mass construction for the same amount of money. Portable construction should be strongly considered if having consistent quality is of high value. Comparing the per square feet cost of conventional and portable structure conclusion is that cost of portable structure is little less that of conventional which includes Rs.1250 of foundation ,plinth, walls , wall finishing and slabs.Rs.60 for painting Rs. 40 for electric and plumbing fittings. The overall cost of conventional structure comes out to be Rs. 1350 per square feet. On the other hand cost of portable structure comes out to be Rs. 1330 per square feet including cost of plinth, walls, roof false ceiling, and electric and plumbing fittings.

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