ENERGY CONSERVATION: COMPARATIVE ANALYSIS OF ENERGY EFFICIENT MATERIALS

Tarunveersingh Yadav[1], Antriksh Sharma[2]
PGP- Advanced Construction Management, NICMAR – Pune
[2]PGP- Advanced Construction Management, NICMAR - Pune

EXECUTIVE SUMMARY

Energy conservation is the efforts made to reduce the consumption of energy by using less of an energy service. This can be done by using more energy efficient materials. Energy conservation reduces the need for energy services and can result in increased environmental quality. Energy conservation techniques can help to reduce overall carbon usage and saves money in longer run.Energy conservation is an important method to prevent climate change.Industrial and commercial users can increase energy use efficiency to maximize profit.The present study focuses on thermal insulation of a commercial building envelope's like wall, roof and ground floor as well as the optimal window properties, in order to reduce energy consumption.Result can be obtained by replacing the actual materials with energy efficient materials. This will help in lower the economy along with saving energy consumption of the building in longer run.

1) INTRODUCTION

1.1 What is EnergyConservation?

Energy conservation are efforts made to reduce the consumption of energy by using less of an energy service. This can be achieved either by using energymore efficiently or by reducing the amount of services.Energy conservation techniques can help to reduce overall carbon usage and saves money in longer run.Energy conservation is an important method to prevent climate change.Industrial and commercial users can increase energy use efficiency to maximize profit.

Energy conservation is not about making limited resources last as long as they can, that would mean that you are doing nothing more than prolong a crisis until you finally run out of energy resources all together. Conservation is the process of reducing demand on a limited supply and enabling that supply to begin to rebuild itself. Many times the best way of doing this is to replace the energy used with an alternate.

1.2 Aim of the Project

Comparative analysis of conventional and non-conventional materials or energy efficient materials with its properties and operation cost. Energy conservation can be achieved through increased energy efficient use along with decrease in the consumption of energy.

1.3 Objectives of Energy Efficient Materials

Cost comparison of materials used in commercial building by replacing them with Energy Efficient Materials. This will minimize the energy consumption in the building. Being good at energy conservation will save your business a lot of money over time and is also good for the environment.

Some Other Objectives of Energy Efficient Materials are as follow:

- To study the different green building materials
- Use of recycled and Environmental friendly Materials
- Use of non-toxic materials
- Adoption of Cost-effective Materials

Energy efficiency measures are meant to reduce the amount of energy consumed while maintaining or improving the quality of services provided in the building.

2) Study Area

For this project we select BLISS AVENUE as study area. This building is situated in Balewadi, Pune.

Table1: Study area

Sr. no.	Item	Details
1.	Name of the project	Bliss Avenue, Balewadi
2.	Number of Floors	G+7
3.	Proposed capacity/area/length/tonnage to be handled/command are/lease area/number of well to be drilled	Carpet Area-79.43 sq.m. Project area- 55.60sq.m.
4.	New/ expansion/ modernization	New
5.	Number of windows per Floor	30

3) Surveys and Data Collection

3.1 Properties of Conventional Materials

3.1.1 Normal Clay Bricks

Bricks should be hand or machine molded and made of admixture of suitable soils. Bricks should be uniformly burnt, free from cracks and flaws such as nodules of stone, black coring and organic matter. Frog dimensions should same for both modular and non modular size bricks. Frog dimension should be either 10 or 20mm for and hand molded bricks of 90 or 70 mm height.

- Varying colour as per soil

- Lightly bonded
- Heavier in weight
- Compressive strength is around 35 Kg/cm2
- More porous
- Thermal conductivity 1.25 – 1.35 W/m2 ℃
- Water absorption 20-25%

3.1.2 Normal Window Glass

Glass is the name given to all amorphous bodies that are obtained by lowering the temperature of a melt independently of its chemical composition and the temperature range of solidification, which as a result of the gradual increase of viscosity adopts the mechanical properties of a solid body.Glass is melted at a temperature between 1000 and 2000° C.The microscopic structure of glass is comparable to that of a liquid in which the individual constituents form an irregular network without a long range order. Glass is also the name given to a cooled melt.

- The thermal, Optical, Electrical and Chemical properties of glass vary with its composition.
- Glass is good thermal conductor.
- Glass is an electrically insulating material: it does not conduct electricity.
- Normal Glass does transmit infrared radiation.

3.1.3 Shutters

Various properties of shutters are as follows:

- To control the amount of sunlight that enters a room.
- To provide privacy and security.
- To protect against weather or unwanted intrusion or damage.
- Exterior shutters were originally constructed for light control, privacy, security and protection from the elements.

3.1.4 Flooring

Flooring is the general term for a permanent covering of floor , or for the work of installing such a floor covering. Floor covering is a term to generically describe any finish material applied over a floor structure to provide a walking surface.

- Durability: Ceramic tiles are more durable as compared to other types of tiles that are used to cover the floors and walls.
- Strength: It has a high strength at high temperature.
- Fire Resistance: Ceramic tiles are completely fire proof at any temperature.
- Heat Resistance: It has low electrical conductivity, low thermal conductivity, low and poor thermal expansion.
- Water Absorption: It is very porous and hence absorbs water easily. So the tiles may get damaged quickly.

3.1.5 Conventional Paints

Paint is used to decorate, protect and prolong the life of natural and synthetic materials, and acts as a barrier against environmental conditions.Paints may be broadly classified into Decorative paints, applied on site to decorate and protect buildings and other objects.

- To protect the material from weathering,oxidation process and damages by insects.
- To improve the beauty of materials.
- To facilitate the cleaning process of the surface.
- Average coatings required is 5-7

3.2Properties of Energy Efficient Materials

3.2.1 Fly ash brick

Fly ash bricks are hi-tech well-improved quality bricks used for construction of brick masonry structures. They are used as replacement for normal clay bricks and has better properties than it.Fly ash bricks competitive in comparison to the conventional clay bricks and provide enormous indirect benefits. The utilization of fly ash bricks results in conservation of natural resources as well as protection of environment.

- Uniform in shape and smooth in finish

- Dense composition
- Lighter in weight and less porous
- Compressive strength is around 100 Kg/cm2
- Thermal conductivity 0.90-1.05 W/m2 ºC
- Water absorption 6-12%

3.2.2Autoclaved Aerated concrete block (AAC)

AAC is a highly thermally insulating concrete-based material used for both internal and external construction. Besides AAC's insulating capability, one of its advantages in construction is its quick and easy installation, because the material can be routed, sanded, or cut to size on site using standard carbon steel power tools.AAC is well suited for urban areas with high rise buildings and those with high temperature variations. Due to its lower density, high rise buildings constructed using AAC require less steel and concrete for structural members.

- Uniform pleasing colour like cement
- Uniform in shape and smooth in finish
- Dense composition
- No plastering required
- Lighter in weight than brick
- Zero soil consumption
- Less porous
- Fire resistance up to 7 hours

3.2.3Wool Bricks

Researchers have added wool fibers to the clay material used to make bricks and combined these with an alginate, a natural polymer extracted from seaweed. The result is bricks that are stronger and more environmentally-friendly.The objective was to produce bricks reinforced with wool and to obtain a composite that was more sustainable, non-toxic, using abundant local materials, and that would mechanically improve the bricks strength.

- Manufactured by adding wool fibre and natural polymer to the clay material.
- It results in 37% more strength than burnt bricks

- Resistant against cold and wet climate
- Environmental friendly
- It does not need exterior or interior finishes

3.2.4High Performance Glass

High Performance Glass is one which reduces the ingress of heat and at the same time allows higher penetration of daylight.

3.2.4.1. Double Glazed Glass

Double glazing is made from two pieces of glass sealed together with an air space in between. A double glazed window sits in your window frame just as regular single glazing would, but provides a number of extra benefits.

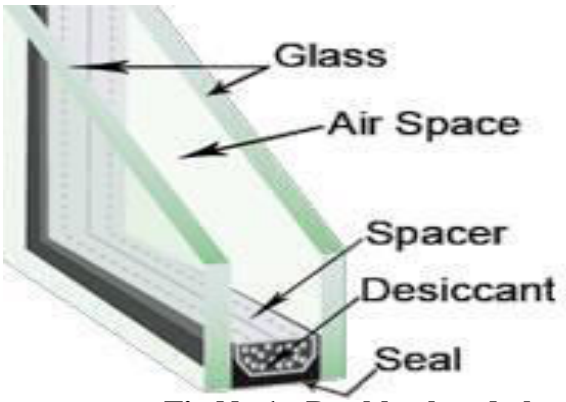

Fig No.1 : Double glazed glass

3.2.4.2 Gas Filled Glazing

To improve the thermal performance of glazing, the space between the glass panes is filled with inert gas. Because these gases have a higher resistance to heat flow than air, they are sealed between the window panes to decrease the glazing's U-factor. The most common types of gas used include argon and krypton.

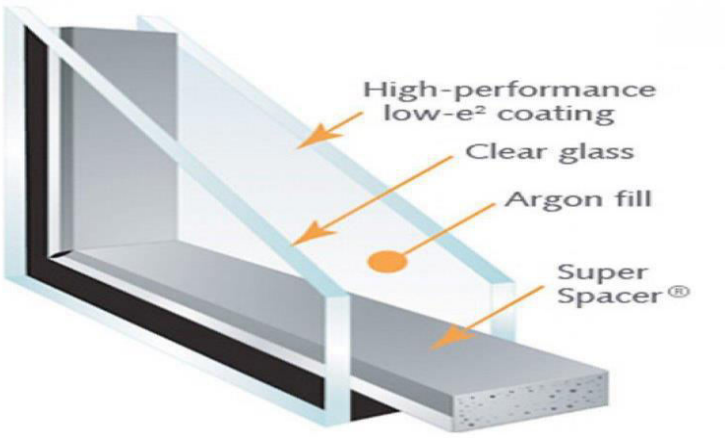

Fig No. 2 :Gas Filled Glazing

3.2.5 Vinyl Flooring

Vinyl flooring is the best choice as it is long lasting and the price is affordable. Vinyl flooring can even be used in kitchens, bathrooms and basements etc. Vinyl flooring has gained popularity in the recent times not just because it is affordable and durable but because there is a wide range of selection when it comes to designs and colors.

- Low cost and long lasting
- Easy to maintain
- Moisture resistant
- Usable in heavy traffic areas and commercial buildings
- Comfortable underfoot
- Provides good insulation

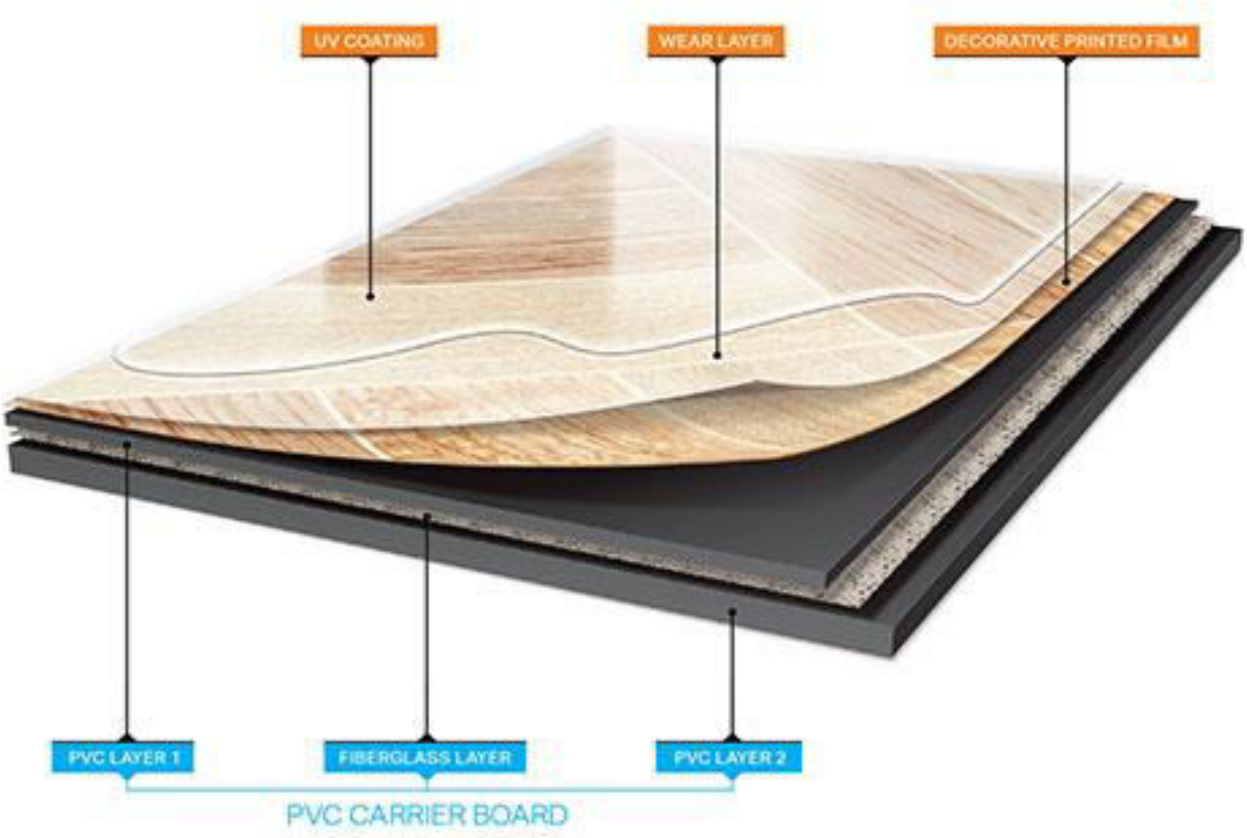

Fig No. 3: Vinyl Flooring

3.2.6 Paper Insulation

Paper insulation is a smart alternative to fiberglass. It provides a green, efficient, non-toxic, affordable thermal solution that's worth considering.

- Environmental friendly
- Air leakage is less
- It is also a good form of sound insulation
- It is treated with the fire retardants , it helps to reduce the risk of fire in the home

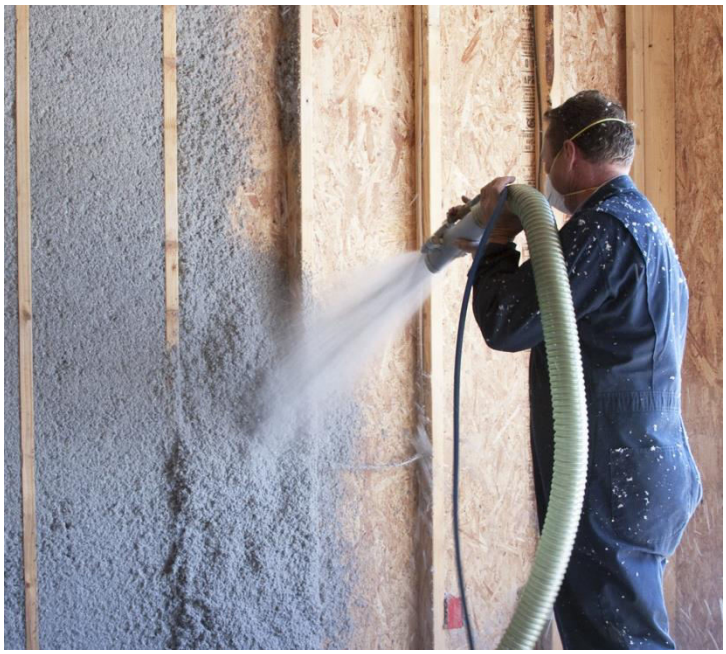

Fig No. 4:Paper Insulation

3.2.7Low-VOC (Volatile Organic Compound) Paints

Volatile organic compounds (VOCs) are organic chemicals that have a high vapor pressure at ordinary room temperature. Choosing low-VOC or zero-VOC paint is an important step toward turning your interior or exterior paint job "green." And with little to no odor, and performance and price that rival conventional products, paint manufacturers increasingly are producing low-VOC paints.

- Lower levels of ozone pollution

- Fewer emissions of smog-forming chemicals
- Low VOC paints are cost competitive
- Better indoor and outdoor air quality
- Average coating required is 2 to 3 times (0.05 mm- 0.1 mm).

3.2.8Bamboo corrugated sheet

Bamboo has been intensively utilized as a building material since ancient times. However, due to the scarcity of wood in recent years, bamboo has gained great importance as a source of renewable fiber as a suitable alternative to wood. Particularly, bamboo is suitable for low cost housing in earthquake-prone regions due to its sturdiness and versatility. This versatile forest produce lends itself to be manufactured into mat-based industrial products such as bamboo mat board, bamboo mat veneer composite, bamboo mat molded products, bamboo mat corrugated sheet for roofing, etc.

Fig No. 5:Bamboo corrugated sheet

3.3 Comparison of Conventional and Energy Efficient Material

Table 2: Comparison of normal clay brick & AAC block

Normal clay brick	Autoclaved aerated concrete block
Varying colour as per soil	Uniform pleasing colour like cement
Uneven shape as hand made	Uniform in shape and smooth in finish
Lightly bonded	Dense composition
Plastering required	No plastering required
Heavier in weight	Three times Lighter in weight than brick
Cost Per Sq. Foot : Rs. 35	Cost Per Sq. Foot : Rs. 150
More porous (Dimensionless)	Less porous than clay bricks (Dimensionless)
No reduction in dead weight	Reduction in dead weight leading to savings in steel and concrete.
Fire resistance upto 2 hours	Fire resistance up to 7 hours

Table 3:Comparison of normal clay brick & fly ash brick

Normal clay brick	Fly ash brick
Varying color as per soil	Uniform pleasing color like cement

Uneven shape as hand made	Uniform in shape and smooth in finish
Lightly bonded	Dense composition
Plastering required	No plastering required
Heavier in weight(2.4 kg)	Lighter in weight
Compressive strength is around 35 Kg/cm2	Compressive strength is around 100 Kg/cm2
More porous (Dimensionless)	Less porous than clay bricks (Dimensionless)
Thermal conductivity 1.25 – 1.35 W/m2 ℃	Thermal conductivity 0.90-1.05 W/m2 ℃
Water absorption 20-25%	Water absorption 6-12%
Cost Per Sq. Foot : Rs. 35	Cost Per Sq. Foot : Rs. 20

Table 4: Comparison of conventional paint and low VOC paint

Conventional paint	**Low VOC Paints**
Suffocating Odour	No Odour
Average coating required is 4 to 5 (0.05mm-0.1 mm)	Average coating required is 1 to 2 (0.05mm-0.1 mm)
It has Latex or Oil Base	It has only Latex Base

It is harmful to environment	It is eco-friendly
Cost Per Gallon : Rs. 3000 Per Coating	Cost Per Gallon: Rs. 4200 per Coating

4) Estimation And Costing

Fig. No. 6Plan[3]

[3]www.99acres.com/lunawat-bliss-avenue-balewadi-pune

4.1 Measurement Sheet

- Measurement sheet of 3BHK apartmentusing conventional materials.

3 BHK MEASUREMENT SHEET								
Sr. No	Description of items	No.	Length(m)	Breadth(m)	Height(m)	Quantity	Cubic meter	Sq ft
1	1st Class brick masonry in CM (1:6) for superstructure							
	LIVING ROOM LW1	1	5.79	0.23	3.5	4.66		
	LW2	1	5.79	0.23	3.5	4.66		
	SW1	1	3.5	0.23	3.5	2.82		
	SW2	1	3.5	0.23	3.5	2.82		
	KITCHEN LW1	1	3.5	0.23	3.5	2.82		
	SW1	1	2.43	0.12	3.5	1.02		
	LW2	1	3.5	0.23	3.5	2.82		
	SW2	1	2.43	0.12	3.5	1.02		
	BEDROOM 1 LW1	1	3.6	0.23	3.5	2.89		
	SW	2	3.35	0.12	3.5	1.4		
	LW2	1	3.6	0.12	3.5	1.51		
	BEDROOM 2 LW1	1	3.5	0.23	3.5	2.82		
	LW2	1	3.5	0.12	3.5	1.35		
	SW1	1	3.35	0.23	3.5	2.7		
	SW2	1	3.35	0.12	3.5	1.4		
	BEDROOM3 LW	2	3.5	0.12	3.5	2.95		
	SW1	1	3.05	0.23	3.5	2.45		
	SW2	1	3.05	0.12	3.5	1.28		
	TOILET 1							
	LW	4	2.29	0.12	3.5	3.85		
	SW	4	1.37	0.12	3.5	2.3		
	TOILET 2							
	LW	2	1.98	0.12	3.5	1.66		
	SW	2	1.37	0.12	3.5	1.15		
			NET QUANTITY OF BRICK MASONRY WORK				52.35	151
2	DEDUCTIONS							
	DOOR							
	D1	1	1.2	-	2.2	2.64		
	D2	3	0.8	-	2.2	5.28		
	D3	3	0.75	-	2.2	4.95		
	D4	1	0.8	-	2.2	1.76		
	D5	2	1.5	-	2.2	6.6		
	VENTILATION							
	V	4	0.45	-	0.9	1.62		
			NET QUANTITY OF DEDUCTIONS				22.85	86.67
			TOTAL NET QUANTITY OF MASONRY WORK				29.5	102.8
3	GLASS							
	W1	2	1.5	-	1.2	3.6		
	W2	1	1.8		1.2	2.16		
			NET QUANTITY OF GLASS PER SQ. M.				5.76	34.6
4	FLOORING							
	LIVING ROOM	1	5.79	3.53		19.39		
	KITCHEN	1	3.53	2.43		8.57		
	BEDROOM 1	1	3.6	3.35		12.06		
	BEDROOM 2	1	3.53	3.04		10.18		
	TOILET	3	2.28	1.37		9.36		
							59.56	164.16

Abstract sheet 3BHK					
Sr. No	Description of items	Quantity(sqft)	Rate (Rupees)	Per	Amount(Rupees)
1	1st Class brick masonry in CM (1:6) for superstructure	151	125	sqft	18875
2	Woodwork for doors and ventilation	246	200	sqft	49200
3	Glass	62	90	sqft	5580
4	Flooring	641.09	38	sqft	24361.4
TOTAL=					98016.4

- **Measurement sheet of 2BHK apartment using conventional materials.**

2BHK MEASUREMENT SHEET								
Sr. No	Description of items	No.	Length(m)	Breadth(m)	Height(m)	Quantity	Cubic meter	Sq ft
1	!st Class brick masonry in CM (1:6) for superstructure							
	LIVING ROOM LW1	1	5.48	0.23	3.5	4.4114		
	LW2	1	5.48	0.23	3.5	4.4114		
	SW1	1	3.5	0.23	3.5	2.82		
	SW2	1	3.5	0.23	3.5	2.82		
	KITCHEN LW1	1	3.5	0.23	3.5	2.82		
	SW1	1	2.43	0.12	3.5	1.02		
	LW2	1	3.5	0.23	3.5	2.82		
	SW2	1	2.43	0.12	3.5	1.02		
	BEDROOM 1 LW1	1	3.35	0.23	3.5	2.69675		
	SW	2	3.05	0.12	3.5	2.562		
	LW2	1	3.35	0.12	3.5	1.51		
	BEDROOM 2 LW1	1	3.5	0.23	3.5	2.8175		
	LW2	1	3.5	0.12	3.5	1.35		
	SW1	1	3.2	0.12	3.5	1.344		
	SW2	1	3.2	0.12	3.5	1.344		
	TOILET 1							
	LW	4	2.29	0.12	3.5	3.85		
	SW	4	1.37	0.12	3.5	2.3		
			NET QUANTITY OF BRICK MASONRY WORK				41.92	129.9
2	DEDUCTIONS							
	DOOR							
	D1	2	1.2	-	2.2	5.28		
	D2	2	0.8	-	2.2	3.52		
	D3	3	0.75	-	2.2	4.95		
	D4	2	0.8	-	2.2	3.52		
	VENTILATION							
	V	3	0.45	-	0.9	1.21		
			NET QUANTITY OF DEDUCTIONS				18.48	75.23
			TOTAL NET QUANTITY OF MASONRY WORK				23.44	88.16
3	GLASS							
	W1	2	1.5	-	1.2	3.6		
	W2	1	1.8	-	1.2	2.16		
			NET QUANTITY OF GLASS PER SQ. M.				5.76	34.59
4	FLOORING							
	LIVING ROOM	1	5.48	3.53		18.35		
	KITCHEN	1	3.53	2.43		8.57		
	BEDROOM 1	1	3.53	3.2		11.3		
	BEDROOM 2	1	3.35	3.04		10.18		
	TOILET	2	2.28	1.37		6.24		
							54.64	155

Abstract sheet 2BHK					
Sr. No	Description of items	Quantity(sqft)	Rate (Rupees)	Per	Amount(Rupees)
1	1st Class brick masonry in CM (1:6) for superstructure	130	125	sqft	16250
2	Woodwork for doors and ventilation	199	200	sqft	39800
3	Glass	62	90	sqft	5580
4	Flooring	588.14	38	sqft	22349.3
TOTAL=					83979.3

- **Measurement sheet of 3BHK apartment using non- conventional materials**

3 BHK MEASUREMENT SHEET								
Sr. No	Description of items	No.	Length(m)	Breadth(m)	Height(m)	Quantity	Cubic meter	Sq ft
1	AAC block masonry for superstructure							
	LIVING ROOM LW1	1	5.79	0.23	3.5	4.66		
	LW2	1	5.79	0.23	3.5	4.66		
	SW1	1	3.5	0.23	3.5	2.82		
	SW2	1	3.5	0.23	3.5	2.82		
	KITCHEN LW1	1	3.5	0.23	3.5	2.82		
	SW1	1	2.43	0.12	3.5	1.02		
	LW2	1	3.5	0.23	3.5	2.82		
	SW2	1	2.43	0.12	3.5	1.02		
	BEDROOM 1 LW1	1	3.6	0.23	3.5	2.89		
	SW	2	3.35	0.12	3.5	1.4		
	LW2	1	3.6	0.12	3.5	1.51		
	BEDROOM 2 LW1	1	3.5	0.23	3.5	2.82		
	LW2	1	3.5	0.12	3.5	1.35		
	SW1	1	3.35	0.23	3.5	2.7		
	SW2	1	3.35	0.12	3.5	1.4		
	BEDROOM3 LW	2	3.5	0.12	3.5	2.95		
	SW1	1	3.05	0.23	3.5	2.45		
	SW2	1	3.05	0.12	3.5	1.28		
	TOILET 1							
	LW	4	2.29	0.12	3.5	3.85		
	SW	4	1.37	0.12	3.5	2.3		
	TOILET 2							
	LW	2	1.98	0.12	3.5	1.66		
	SW	2	1.37	0.12	3.5	1.15		
			NET QUANTITY OF AAC block MASONRY WORK				52.35	151
2	DEDUCTIONS							
D1		1	1.2	-	2.2	2.64		
D2		3	0.8	-	2.2	5.28		
D3		3	0.75	-	2.2	4.95		
D4		1	0.8	-	2.2	1.76		
D5		2	1.5	-	2.2	6.6		
	VENTILATION							
V		4	0.45	-	0.9	1.62		
			NET QUANTITY OF DEDUCTIONS			11.9	22.85	86.67
			TOTAL NET QUANTITY OF MASONRY WORK				29.5	102.8
3	DOUBLE GLAZED GLASS							
	W1	2	1.5	-	1.2	3.6		
	W2	1	1.8		1.2	2.16		
			NET QUANTITY OF GLASS PER SQ. M.				5.76	34.6
4	FLOORING							
	LIVING ROOM	1	5.79	3.53		19.39		
	KITCHEN	1	3.53	2.43		8.57		
	BEDROOM 1	1	3.6	3.35		12.06		
	BEDROOM 2	1	3.53	3.04		10.18		
	TOILET	3	2.28	1.37		9.36		
							59.56	164.16

Abstract sheet 3BHK					
Sr. No	Description of items	Quantity(sqft)	Rate (Rupees)	Per	Amount(Rupees)
1	AAC block for superstructure	151	100	sqft	15100
2	Woodwork for doors and ventilation	246	200	sqft	49200
3	Double glazed glass	62	320	sqft	19840
4	Vinyl Flooring	641.09	50	sqft	32054.5
TOTAL=					116194.5

- **Measurement sheet of 2BHK apartment using non- conventional materials**

2BHK MEASUREMENT SHEET								
Sr. No	Description of items	No.	Length(m)	Breadth(m)	Height(m)	Quantity	Cubic meter	Sq ft
1	AAC block masonry for superstructure							
	LIVING ROOM LW1	1	5.48	0.23	3.5	4.4114		
	LW2	1	5.48	0.23	3.5	4.4114		
	SW1	1	3.5	0.23	3.5	2.82		
	SW2	1	3.5	0.23	3.5	2.82		
	KITCHEN LW1	1	3.5	0.23	3.5	2.82		
	SW1	1	2.43	0.12	3.5	1.02		
	LW2	1	3.5	0.23	3.5	2.82		
	SW2	1	2.43	0.12	3.5	1.02		
	BEDROOM 1 LW1	1	3.35	0.23	3.5	2.69675		
	SW	2	3.05	0.12	3.5	2.562		
	LW2	1	3.35	0.12	3.5	1.51		
	BEDROOM 2 LW1	1	3.5	0.23	3.5	2.8175		
	LW2	1	3.5	0.12	3.5	1.35		
	SW1	1	3.2	0.12	3.5	1.344		
	SW2	1	3.2	0.12	3.5	1.344		
	TOILET 1							
	LW	4	2.29	0.12	3.5	3.85		
	SW	4	1.37	0.12	3.5	2.3		
			NET QUANTITY OF AAC block MASONRY WORK				41.91705	129.9
2	DEDUCTIONS							
	DOOR							
	D1	2	1.2	0.08	2.2	0.42		
	D2	2	0.8	0.06	2.2	0.2112		
	D3	3	0.75	0.06	2.2	0.29		
	D4	2	0.8	0.06	2.2	0.2112		
	VENTILATION							
	V	3	0.45	0.12	0.9	0.1458		
			NET QUANTITY OF DEDUCTIONS				1.2782	75.23
			TOTAL NET QUANTITY OF MASONRY WORK				40.63885	88.16
3	DOUBLE GLAZED GLASS							
	W1	2	1.5	-	1.2	3.6		
	W2	1	1.8		1.2	2.16		
			NET QUANTITY OF GLASS PER SQ. M.				5.76	34.59
4	FLOORING							
	LIVING ROOM	1	5.48	3.53		18.35		
	KITCHEN	1	3.53	2.43		8.57		
	BEDROOM 1	1	3.53	3.2		11.3		
	BEDROOM 2	1	3.35	3.04		10.18		
	TOILET	2	2.28	1.37		6.24		
							54.64	155

Abstract sheet 2BHK					
Sr. No	Description of items	Quantity(sqft)	Rate (Rupees)	Per	Amount(Rupees)
1	AAC block for superstructure	130	100	sqft	13000
2	Woodwork for doors and ventilation	199	200	sqft	39800
3	Double glazed glass	62	320	sqft	19840
4	Vinyl Flooring	588.14	50	sqft	29407
TOTAL=					102047

- **Note-As the thermal conductivities of conventional materials is more than thermal conductivities of non-conventional materials , so we will observe a temperature drop of 3ºC-5ºC by using non-conventional materials[4]. Hence the room will be cooler and the electricity consumption will be lesser.**

Table 5:Comparison Of Rates For 3bhk

Used Materials	Replaced Materials
Normal Clay Brick (cumec) Rs. 18875	AAC Blocks (cumec) Rs. 15100
Normal Glass (Sqm.) Rs. 5580	Double glazed Glass (Sqm.) Rs.19840
Ceramic Flooring (Sqm.) Rs. 24361.4	Vinyl Flooring (Sqm.) Rs. 32054.5

Savings in Electricity Bill Using 1 A/C

- **Assumptions:**
- City- Pune
- 5-star Split AC with electricity cost-Rs7/unit

[4]**www.livemint.com/Money/VOUrj7s47bJreraISIca0J/Running-your-AC-at-27C-vs-18C-can-cut-your-electricity-bil.html**

- AC functioning for 10hrs per day for 30 days in a month.
- You save 3%-4% power for every degree increase.

Table 6: Savings in energy

Temperature of AC	Total energy used	Rupees per Day	Rupees Per Month	% of energy saved
27°C	9	63	1890	315
24°C	10.5	73.5	2205	NA

Total Energy saved in 5 years

- Total cost of conventional materials-Rs 98016.4
- Total cost of non-conventional materials- Rs 116194.5
- Difference in cost- Rs 18178.1
- Energy conservation in 5 years-2700 units
- Total savings- Rs 18900

5) Conclusion

After comparison of materials used in conventional buildings and replacing them with non-conventional materials it has resulted into minimisation of energy consumption in the building. Being good at energy conservation will save your business a lot of money over time which has been found out this comparative study and is also good for the environment.Energy efficiency measures are meant to reduce the amount of energy consumed while maintaining or improving the quality of services provided in the building.

Through this study we found by taking a sample time frame of operational time - 10hrs/day for 12 months and temperature to be operated on 27 degrees which will make the AC consume less electricity up to 2700 units over the time period of 5 yrs. However, as it is a relative time frame study, if we reduce the operational time to 5hrs /day, the recovery time will be increased to 10yrs.

Also the carbon footprint of selected conventional materials was comparatively higher than carbon footprint of selected non-conventional materials. This would heavily impact the Air Quality Index (AQI) of the building as well as the environment.