Cooling by Natural Ventilation

Urvi Paras Upadhyay
Lecturer, civil engg department, PARUL INSTITUTE OF TECHNOLOGY AND ENGINEERING (DIPLOMA STUDIES).
urvi.bhatt2@gmail.com

Vijay Kishanchand Lalwani
Lecturer, civil engg department, PARUL INSTITUTE OF TECHNOLOGY AND ENGINEERING (DIPLOMA STUDIES).
vijay_lalwani3@yahoo.com

ABSTRACT

Naturally, ventilated and lighted buildings have a key role to play in mitigating climate change. Nowadays no one concentrates in the functional design of building like natural ventilation and lighting. In some highly populated areas does not gather any natural ventilation and lightings inside the buildings. The main study of the project is how to get natural energy gains into the buildings. Ventilation and lighting plays a vital role not only in buildings but also psychology and comfort level of occupants using the building. Building without ventilation and lighting will be a bad design and also called as sick building. Natural lighting and ventilation is mandatory part of today's design to save energy. It can also be called as heart of a building design. The main aim of our study is to give a conclusion for gathering natural ventilation and lighting inside the buildings. We choose one residential building in the populated area, analysed the problems and provide solutions to get natural ventilation and lights.

INTRODUCTION

Ventilation and lighting plays a vital role not only in building but also psychology and comfort level of occupants using the building. Building without ventilation and lighting will be a bad design and, also called as sick building. Natural lighting and ventilation is mandatory part of today's design to save energy. It can also be called as heart of a building design. This is free energy source is limited but can be maximized through various techniques.

Natural ventilation and lighting has the potential to significantly reduce the energy cost required for mechanical ventilation of buildings. These natural ventilation and lighting systems may reduce both initial and operating costs compared to mechanical ventilation and lighting systems Poor ventilation and lighting can affect workers' health, badly designed or poorly maintained ventilation and lighting can cause stress and lead to various forms of complaint, mind disorder, psychology related problem, eye discomfort, vision or posture. Dry or itching eyes, migraines, aches, pains and other symptoms, often known as sick building syndrome can be caused by poor or inappropriate lighting installations.

Housing continues to be basic need for human beings despite a lot of industrialization and urbanization. To provide homes to all needy sections of the society, a lot 0f building activity still has to take place. It is known that building activity constitutes to 1/3 of the total energy produced in world. A major to demand of

various sector activities is given in fig. 1. It brings out that a major portion of the energy is spent in building sector amounting 34% and continues to be of the same order up to 2035 as per projected scenario, which prompts early realization of the need to save energy at the earliest. Accordingly an attempt is made to evaluate to possible reduction in the energy consumption in construction activity by adopting alternative building materials without sacrificing the convince and comfort derived by using energy intensive material like burnt brick, cement, steel etc. Information regarding appropriate building materials and sustainable technologies along with the energy consumption of each material is gathered from different sources. The possible reduction in embodied energy is studied by estimating the energy consumption in single stored building.

METHODS OF COOLING SYSTEM

There are two type of cooling system

1) Conventional Cooling System
2) Cooling by natural ventilation

1. CONVENTIAL COOLING SYSTEM

1) Air conditioning systems control the temperature, humidity, air movement and air cleanliness inside a building, in order to provide occupants a comfortable environment with good indoor air quality.

2) Electrically powered **ceiling fan.**

3) Air coolers is also work on electricity

4) Radiant cooling system. A radiant cooling system is a system using a temperature-controlled surface that cools indoor temperatures by the removing sensible heat and where more than half of heat transfer occurs through thermal radiation. Heat will flow from objects, occupants, equipment and lights in a space to a cooled surface as long as their temperatures are warmer than that of the cooled surface and they are within the line of sight of the cooled surface.

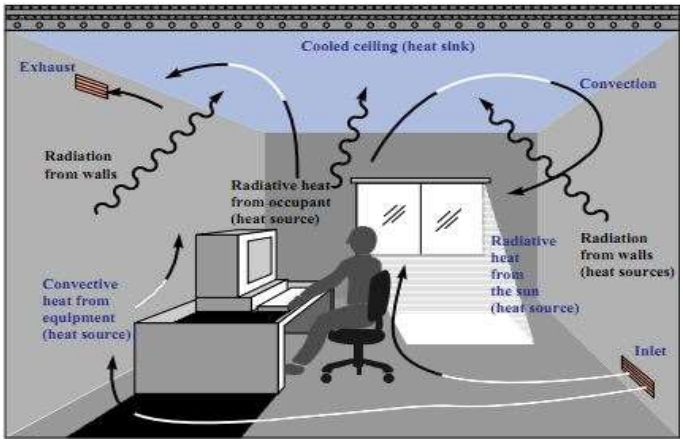

Fig. 1 Explination of radient coolong system in figure.

2) NATURAL VENTILATION SYSTEM

Natural ventilation is the process of supplying and removing air through an indoor space by natural means, meaning without the use of a fan or other mechanical system. It uses outdoor air flow caused by pressure differences between the building and its surrounding to provide ventilation and space cooling.

COMPARISION OF BOTH SYSTEM

- **DISADVANTAGES OF CONVENTIONAL SYSTEM**
  - This method is not economical.
  - It is harmful to environment.
  - It is not eco-friendly.
  - Energy is in limited sources.
  - Harmful gases coming out from A.C which causes bad effect on human beings.
  - It creates pollution.
  - This method is very costly.

- **NATURAL VENTILATION IN COMPARISION TO**

CONVENTIONAL SYSTEM

- It is eco-friendly.
- None operational cost.
- It can save's a maximum energy and cost.
- It is economical.
- Silent process.
- Combination benefit of ventilation, lighting and esthetical value.
- Reduce smoke damage.
- No harmful gases to be produced.

NATURAL VENTILATION

- **VENTILATION**

It comes from the Latin word vents and means the movement of air. Three forms of air motion in buildings can be differentiated.

i. **NATURAL VENTILATION**
ii. **INFILTRATION**
iii. **FORCED VENTILATI**

Natural ventilation relates to air movement through purposely designed openings like open windows, fireplace and open doors. The infiltration is involuntary and is caused by inadvertent leaks through the building envelope, such as cracks and leakage through doors and windows. Finally, forced ventilation is produced by mechanical ventilation systems.

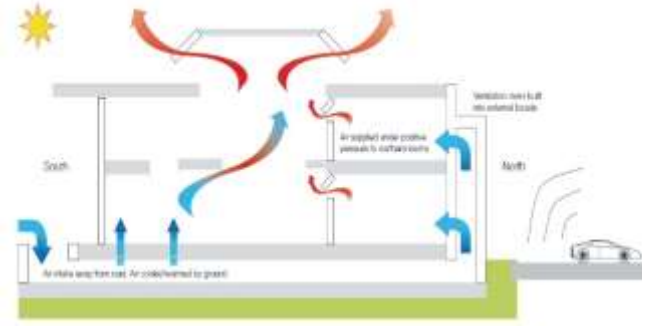

Fig. 2 supplying and removing air through an indoor space by natural means

TYPES OF NATURAL VENTILATION.

1. WIND DRIVEN VENTILATION
2. STACK VENTILATION
3. BUOYANCY-DRIVEN VENTILATION
4. CROSS VENTILATION
5. NIGHT VENTILATION

1. WIND DRIVEN VENTILATION

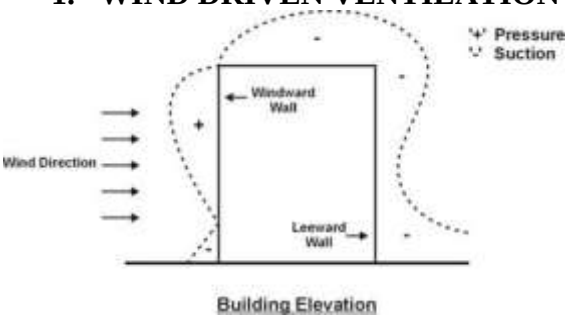

Fig. 3 Naturally occurring wind blows across a building,

As naturally occurring wind blows across a building, the wind hits the windward wall causing a direct positive pressure. The wind moves around the building and leaves the leeward wall with a negative pressure, also known as a sucking effect. If there are any openings on the windward and leeward walls of the building, fresh air will rush in the windward wall opening and exit the leeward wall opening to balance and relieve the pressures on the windward and leeward walls To capture the wind and bring ventilation to the building, the building shape becomes a crucial factor. The building shape can create wind pressures that can effectively drive the air flow through the openings of the building.

- Building orientation and location.
- Building form and dimensions.
- Window typologies and operations.
- Types, shape and size of openings.
- Construction methods and detailing.
- External elements.
- Urban planning consideration

3) STACK VENTILATION

Buoyancy ventilation can be induced by temperature (known as stack ventilation) or by humidity (known as cool tower). Most commonly used is the stack driven ventilation. For stack ventilation to work properly there must be a temperature difference. As the warm air (usually given off by the occupants and their computers), which is less dense, in the building rises, the cooler air is sucked from the openings below.

DESIGN CONSIDERATIONS FOR STACK VENTILATION

- Inlets should supply air low in the room. Outlets should be located across the room and at high level.
- The vertical distance between the inlet and exhaust openings should take advantage of the stack effect.
- Use skylights or ridge vents.
- The function as fire exits of enclosed staircases should not be compromised if stack ventilation is incorporated into the design

3) BUOYANCY-DRIVEN VENTILATION.

Buoyancy driven ventilation arise due to differences in density of interior and exterior air, which in large part arises from differences in temperature. When there is a temperature difference between two adjoining volumes of air the warmer air will have lower density, and be more buoyant thus will rise above the cold air creating an upward air stream. Forced upflow buoyancy driven ventilation in a building takes place in a traditional fireplace. Passive stack ventilators are common in most bathrooms and other type of spaces without direct access to the outdoors.

Fig. 4 The inside and outside temperatures must be different

BUOYANCY-DRIVEN VENTILATION HAS SEVERAL SIGNIFICANT BENEFITS

- Does not rely on wind: can take place on still, hot summer days when it is most needed.
- Stable air flow (compared to wind)
- Greater control in choosing areas of air intake
- Sustainable method

4) CROSS VENTILATION

Cross ventilation occurs where there are pressure differences between one side of a building and the other. Typically, this is a wind-driven effect in which air is drawn into the building on the high pressure windward side and is drawn out of the building on the low pressure leeward side.

Fig. 5 openings exactly across from each other in a space

5) NIGHT VENTILATION

Night ventilation (or "night flushing") keeps windows and other passive ventilation openings closed during the day, but open at night to flush warm air out of the building and cool thermal mass for the next day.

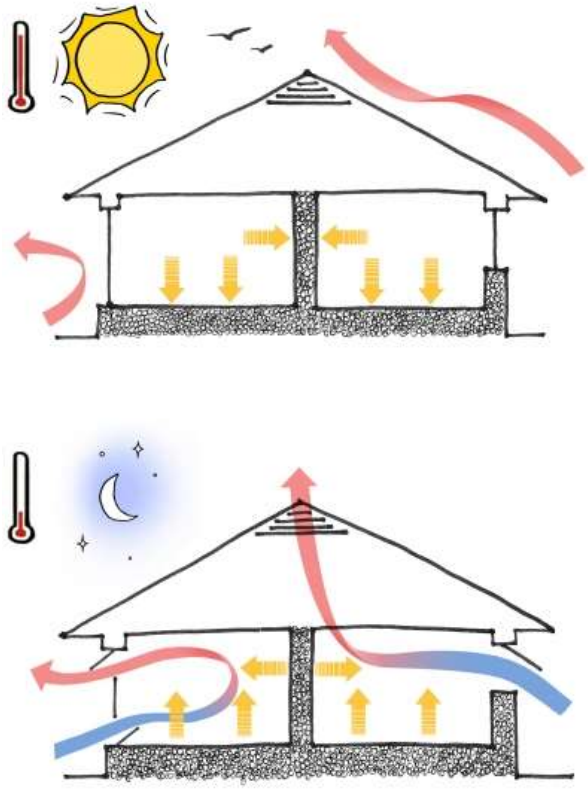

Fig. 6 difference between day and night ventilation

CONCLUSION

We suggest proposing some of the natural ventilation gainer. First, we concentrate in ventilation. Ventilation is very important to everyone. By providing wind tower in well stair one can able to get enough ventilation.
Wind tower mostly fulfils the enough of people comfort. Suit the stack in kitchen area, the warm less dense air goes up automatically fresh air come from bottom of the wind tower. Next one natural lighting, we suggest providing “light shelves”. The light shelves are reflecting the light into the rooms, wherever the fixing of light shelves. The sun tubes are provided in hall area. It does not need large change of environment. The glass block provides in the one side of dog well stair and leaves some of the open-air exchange. Heliostat is redirecting the sun light through plane mirror. The natural sunlight contains UV rays. The UV rays kill the bacteria.
.

LITERATURE REVIEW

Sustainable technology is associated with creating environment with the materials that are reproducible and would not involve materials and methods that encroach on to future needs of the society.Convetional system having its own problem and use of less energy or effective use of energy is needed at all places. By making our home naturally ventilated we can have better health noise free atmosphere.
For the design of **natural ventilation** systems for passive **cooling** in buildings, engineers and
architects are interested in the prediction of **ventilation** rates as a function of position and
size of the **ventilation** openings. Effective cooling system are good also for our pockets. Now a days IGBC having ranking system in India so passive cooling can take our rank on higher position. As per solar direction we can improve our natural ventilation..

Gordon C. McCutchan 1950 discussed about the various methods of natural ventilation. His study id totally based on the air movement in different weathering condition.

It was said by Mehdi N.Bahadori; A design is proposed to improve the performance of wind towers (or Baud-Geers) for natural ventilation and passive cooling. Under similar climatological and design conditions, the new design is capable of delivering air to the building at higher flow

rates.

REFERENCES

1) F Flourentzou, J Van der Maas, CA Roulet - Energy and buildings, 1998 - Elsevier

2) Mehdi N.Bahadori

3) Gordon C. McCutchan Professor Lawrence B. Anderson, Head Department of Architecture Massachusetts Institute of Technology Canbridge 39, Massachusetts

4) ASHRAE (2004). Standard 55-2010—Thermal environmental conditions for human occupancy.Atlanta, GA:American Society of Heating, Refrigeration, Air-Conditioning Engineers.

5)ASHRAE (2009). ASHRAE handbook—Fundamentals. Atlanta, GA: American Society of Heating, Refrigeration, AirConditioning Engineers.