International Journal of Innovative Environmental Studies Research 10(2):25-32, April-June, 2022

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Usefulness Of Building Ventilation

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ABSTRACT
The usefulness of outdoor air for natural ventilation in a Building, combined with natural cooling process and the usefulness of a natural daylight, have been essential elements of Classical architecture, U-shaped floor plans was used, together with open courts, limited plan depth and maximum windows sizes, to exploit natural ventilation and daylight. In high- and middle-income countries presently, mechanical ventilation systems have been use in placed of natural ventilation. It is seem that, full mechanical heating, ventilation and air-conditioning systems solve all the realistic problems of natural ventilation. Nevertheless, mechanical ventilation also need careful design, firm equipment protection, adoption of accurate principles, and design strategy that take into deliberation all aspects of indoor environmental value and power effectiveness. Natural ventilation has its problems, particularly for facilities in countries that have cold winters. More work is needed to design low-cost and reliable ventilation systems for rooms rather than prevent the flow of air and yet permit interior temperature control. It is noted that in practice natural and mechanical ventilation systems can equally be efficient for pollution control. Nevertheless, natural ventilation can only be effective when natural forces are obtainable, such as, winds or breezes, and when inlet and exhaust apertures are kept open. On the other hand, the challenging in installing and maintaining a mechanical ventilation system may lead to a high concentration of infectious droplet and ultimately result in an increased risk of disease transmission. in a wider building, natural ventilation will not be effective in the distribution of a fresh air evenly and effectively to every part. A building that will adopt a natural ventilation system must not exceed a width of 45 feet. Which is the mean reason why so many buildings with natural ventilation are always with an articulated floor plan? Two individual exhaust and supply openings per room is of very important. The stack effect can be maximized through the exhaust high above the inlet. There must be room Windows and it must be offset from each other; this gives minimum airflow obstructions and maximum integration within the room. Occupants must find the window good to be use.
Keywords: natural ventilation, building, mechanical ventilation

INTRODUCTION

Ventilation is earnings of life to humanity, when there is a present of ventilation in a space, there is a present of life, rest, peace and harmony in a space. Ventilation primarily is in two forms. (Natural and mechanical). Natural ventilation is the process or means in which fresh air comes into a building through openings such as window, door or other opening while mechanical ventilation is air that is converted from its real states through machinery (typically fans) into a building.

Human well being required clean and good ventilation; which is to provide fresh air in exchange of stale air to sub stains the correct levels of oxygen and carbon dioxide in the air, and removes excess heat, odors, bacteria, and other atmospheric contaminants. It also prevents condensation, which is caused by excess humidity. The capability of a ventilation system for an individual room is usually measured according to how many 'changes of air' it is capable of per hour, that is how many times all the air in the

room can be completely replaced. The functions of a space determined the amount of ventilation required in a particular space; an office will typically need far fewer changes of air than a kitchen or factory.

Natural ventilation systems have many advantages over mechanical ventilation. The truth is that mechanical systems of ventilation depends on electricity for it's to be effective, while natural ventilations are effectively 'free' which is undependable. There are also considerable capital costs in installing mechanical systems. Many people prefer opening a window to having forced air and natural systems are easier to control locally, i.e. by opening or closing a window as required. On the other hand, mechanical systems have distinct advantages over natural systems as well. Natural ventilation is generally not effective in buildings with a large floor plan and opening windows to get fresh air while heating systems are operational wastes energy. Air brought in via mechanical systems can be heated or cooled and the humidity can also be controlled. This can avoid the need for separate heaters or air conditioners. Mechanically drafted air is also generally filtered so is arguably purer than natural air.

Ventilation is the intentional introduction of outdoor air into a space. Ventilation is mainly used to control indoor air quality by diluting and displacing indoor pollutants; it can also be used to control indoor temperature, humidity, and air motion to benefit thermal comfort, satisfaction with other aspects of indoor environment, or other objectives.

Ventilation is the process in which outdoor air flow into a building or a space, and distributes the air within the building or space. The primarily needs of ventilation in buildings is to generate good and healthy air for breathing by diluting the pollutants originating in the building and removing the pollutants from it

LITERATURE REVIEW

The intentional introduction of outdoor air is usually categorized as either mechanical ventilation, natural ventilation, or mixed-mode ventilation (hybrid ventilation).

- Mechanical ventilation is the intentional fan driven flow of outdoor air into a building. Mechanical ventilation systems may include supply fans (which push outdoor air into a building), exhaust fans (which draw air out of building and thereby cause equal ventilation flow into a building), or a combination of both. Mechanical ventilation is often provided by equipment that is also used to heat and cool a space.
- Natural ventilation is the intentional passive flow of outdoor air into a building through planned openings (such as louvers, doors, and windows). Natural ventilation does not require mechanical systems to move outdoor air. Instead, it relies entirely on passive physical phenomena, such as wind pressure, or the stack effect. Natural ventilation openings may be fixed, or adjustable. Adjustable openings may be controlled automatically (automated), controlled by occupants (operable), or a combination of both.
- Mixed-mode ventilation systems use both mechanical and natural processes. The mechanical and natural components may be used at the same time, or at different times of day, or in different seasons of the year.[3] Since natural ventilation flow depends on environmental conditions, it may not always provide an appropriate amount of ventilation. In this case, mechanical systems may be used to supplement or regulate the naturally driven flow.

Ventilation is typically described as separate from infiltration.

- Infiltration is the circumstantial flow of air from outdoors to indoors through leaks (unplanned openings) in a building envelope. When a building design relies on infiltration to maintain indoor air quality, this flow has been referred to as adventitious ventilation.[4]

The design of buildings that promote occupant health and well-being requires clear understanding of the ways that ventilation airflow interacts with, dilutes, displaces or introduces pollutants within the occupied space. Although ventilation is an integral component to maintaining good indoor air quality, it may not be satisfactory alone.[5] In scenarios where outdoor pollution would deteriorate indoor air quality, other treatment devices such as filtration may also be necessary. In kitchen ventilation systems, or for laboratory fume hoods, the design of effective effluent capture can be more important than the bulk

amount of ventilation in a space. More generally, the way that an air distribution system causes ventilation to flow into and out of a space impacts the ability for a particular ventilation rate to remove internally generated pollutants. The ability for a system to reduce pollution in a space is described as its "ventilation effectiveness". However, the overall impacts of ventilation on indoor air quality can depend on more complex factors such as the sources of pollution, and the ways that activities and airflow interact to affect occupant exposure.

Aims And Objectives

Natural ventilation does not only save costs but also reduce energy use significantly. It also offers a safe and high-quality, comfortable, and healthy indoor climate (Fresh air). These are more significant perks than what the contemporary option of mechanical ventilation will ever provide. Natural ventilation will come handy as a better alternative to air conditioning plants in places and situations where the climate and building types are favorable. With this arrangement, up to 30% of total energy consumption can be saved.
By working on the principle of pressure differences, natural ventilation systems supply the entire building with fresh air evenly. The change in pressure may be due to a change in humidity or the buoyancy effect created by temperature differences or wind. Irrespective of the cause, the opening sizes and placements determine the amount of ventilation a building gets.
Let us compare a natural ventilation system to a circuit, without prioritizing exhaust over supply and vice versa. The airflow circuit in a building is completed either by opening between rooms, including grills, louvers, or transom windows, or open-plan techniques. Some of the challenges a natural ventilation designer must contend with include the code requirements concerning smoke and fire transfer. Code requirements have made it impossible to use the stairway as an exhaust stack – an arrangement obtainable in most historic buildings.

METHODOLOGY

The research is desk top based. The method involves review of published and unpublished literatures.
Themes that is relevant to the study.

FINDING OF THE RESEARCH

Ventilation moves outdoor air into a building or a room, and distributes the air within the building or room.
Building ventilation has three basic elements: ventilation rate — the amount of outdoor air that is provided into the space, and the quality of the outdoor air.
Ventilation systems can be categorized as one of four types:
Exhaust.
Supply.
Balanced.
Heat-recovery.
The right ventilation system for a particular house depends upon the climate and the needs of the structure.
Ventilation is the intentional introduction of outdoor air into a space. Mechanical ventilation systems may include supply fans (which push outdoor air into a building), exhaust fans (which draw air out of building and thereby cause equal ventilation flow into a building), or a combination of both.
There are three methods that may be used to ventilate a building such as
Natural, mechanical and hybrid (mixed-mode) ventilation.

What is natural ventilation?

Natural ventilation is the in and out flow of air in a confined space. Nevertheless, natural ventilation is natural forces such as (winds and thermal buoyancy force due to indoor and outdoor air density differences) drive outdoor air through purpose-built, building envelope openings. Purpose-built openings include windows, doors, solar chimneys, wind towers and trickle ventilators. This natural ventilation of buildings depends on climate, building design and human behavior.

What is mechanical ventilation?

Mechanical fans drive mechanical ventilation. Fans can either be installed directly in windows or walls, or installed in air ducts for supplying air into, or exhausting air from, a room.

The type of mechanical ventilation used depends on climate. For example, in warm and humid climates, infiltration may need to be minimized or prevented to reduce interstitial condensation (which occurs when warm, moist air from inside a building penetrates a wall, roof or floor and meets a cold surface). In these cases, a positive pressure mechanical ventilation system is often used. Conversely, in cold climates, infiltration needs to be prevented to reduce interstitial condensation, and negative pressure ventilation is used. For a room with locally generated pollutants, such as a bathroom, toilet or kitchen, the negative pressure system is often used.

In a positive pressure system, the room is in positive pressure and the room air is leaked out through envelope leakages or other openings. In a negative pressure system, the room is in negative pressure, and the room air is compensated by "sucking" air from outside. A balanced mechanical ventilation system refers to the system where air supplies and exhausts have been tested and adjusted to meet design specifications. The room pressure may be maintained at either slightly positive or negative pressure, which is achieved by using slightly unequal supply or exhaust ventilation rates. For example, a slight negative room pressure is achieved by exhausting 10% more air than the supply in a cold climate to minimize the possibility of interstitial condensation.

What is hybrid or mixed-mode ventilation?

Hybrid (mixed-mode) ventilation relies on natural driving forces to provide the desired (design) flow rate. It uses mechanical ventilation when the natural ventilation flow rate is too low.

When natural ventilation alone is not suitable, exhaust fans (with adequate pre-testing and planning) can be installed to increase ventilation rates in rooms housing patients with airborne infection. However, this simple type of hybrid (mixed-mode) ventilation needs to be used with care. The fans should be installed where room air can be exhausted directly to the outdoor environment through either a wall or the roof. The size and number of exhaust fans depends on the targeted ventilation rate, and must be measured and tested before use.

Problems associated with the use of exhaust fans include installation difficulties (especially for large fans), noise (particularly from high-power fans), increased or decreased temperature in the room and the requirement for non-stop electricity supply. If the environment in the room causes thermal discomfort spot cooling or heating systems and ceiling fans may be added.

Another possibility is the installation of whirlybirds (whirligigs or wind turbines) that do not require electricity and provide a roof-exhaust system increasing airflow in a building.

DISCUSSION ON FINDING

Ventilation moves outdoor air into a building or a room, and distributes the air within the building or room

Building ventilation has some basic elements: ventilation rate — the amount of outdoor air that is provided into the space, and the quality of the outdoor air

Ventilation systems can be categorized as one of four types: exhaust, supply, balanced, and heat-recovery. The right ventilation system for a particular house depends upon the climate and the needs of the structure.

Ventilation is the intentional introduction of outdoor air into a space Mechanical ventilation systems may include fans which push outdoor air into a building, exhaust fans (which draw air out of building and thereby cause equal ventilation flow into a building), or a combination of both.

Ventilation is necessary in buildings to remove 'stale' air and replace it with 'fresh' air. This helps to: Moderate internal temperatures. Reduce the accumulation of moisture, odours and other gases that can build up during occupied periods.

From the view point of comfortable living & working conditions, the good and efficient ventilation system should meet the following functional requirements:

- Rate of Supply of Fresh Air.
- Air movements or Air Changes.
- Temperature of Air.
- Humidity.
- Purity of Air.

Natural ventilation

If well installed and maintained, there are several advantages of a natural ventilation system, compared with mechanical ventilation systems.

- Natural ventilation can generally provide a high ventilation rate more economically, due to the use of natural forces and large openings.
- Natural ventilation can be more energy efficient, particularly if heating is not required.
- Well-designed natural ventilation could be used to access higher levels of daylight.

From a technology point of view, natural ventilation may be classified into simple natural ventilation systems and high-tech natural ventilation systems. The latter are computer-controlled, and may be assisted by mechanical ventilation systems (i.e. hybrid or mixed-mode systems).

High-tech natural ventilation may have the same limitations as mechanical ventilation systems; however, it also has the benefits of both mechanical and natural ventilation systems.

If properly designed, natural ventilation can be reliable, particularly when combined with a mechanical system using the hybrid (mixed-mode) ventilation principle, although some of these modern natural ventilation systems may be more expensive to construct and design than mechanical systems.

In general, the advantage of natural ventilation is its ability to provide a very high air-change rate at low cost, with a very simple system. Although the air-change rate can vary significantly, buildings with modern natural ventilation systems (that are designed and operated properly) can achieve very high air-change rates by natural forces, which can greatly exceed minimum ventilation requirements.

There are a number of drawbacks to a natural ventilation system.

- ❖ Natural ventilation is variable and depends on outside climatic conditions relative to the indoor environment. The two driving forces that generate the airflow rate (i.e. wind and temperature difference) vary stochastically. Natural ventilation may be difficult to control, with airflow being uncomfortably high in some locations and stagnant in others. There is a possibility of having a low air-change rate during certain unfavourable climate conditions.
- ❖ There can be difficulty in controlling the airflow direction due to the absence of a well-sustained negative pressure; contamination of corridors and adjacent rooms is therefore a risk.
- ❖ Natural ventilation precludes the use of particulate filters. Climate, security and cultural criteria may dictate that windows and vents remain closed; in these circumstances, ventilation rates may be much lower.
- ❖ Natural ventilation only works when natural forces are available; when a high ventilation rate is required, the requirement for the availability of natural forces is also correspondingly high.
- ❖ Natural ventilation systems often do not work as expected, and normal operation may be interrupted for numerous reasons, including windows or doors not open, equipment failure (if it is a high-tech system), utility service interruption (if it is a high-tech system), poor design, poor maintenance or incorrect management.
- ❖ Although the maintenance cost of simple natural ventilation systems can be very low, if a natural ventilation system cannot be installed properly or maintained due to a shortage of funds, its performance can be compromised, causing an increase in the risk of the transmission of airborne pathogens.

These difficulties can be overcome, for example, by using a better design or hybrid (mixed-mode) ventilation. Other possible drawbacks, such as noise, air pollution, insect vectors and security, also need to be considered. Because of these problems, natural ventilation systems may result in the spread of infectious diseases through health-care facilities, instead of being an important tool for infection control.

Mechanical versus natural ventilation for infection control

The decision whether to use mechanical or natural ventilation for infection control should be based on needs, the availability of the resources and the cost of the system to provide the best control to counteract the risks.

For example, in the United Kingdom, the National Health Service policy tends to limit the adoption of mechanical ventilation to the principal medical treatment areas such as airborne infection isolation rooms, operating theatres and associated rooms. Patient wards are usually not required to be mechanically ventilated and natural ventilation through opening windows is usually the most common solution also states that "One of the major energy users in hospitals is air treatment. The low-energy hospital study identified this as an area for saving by naturally ventilating all 'nonclinical' areas, and current NHS guidance has adopted this conclusion." Conversely, in the American Society of Heating, Refrigerating and Air-Conditioning Engineers design guide all areas are required to be ventilated mechanically.

Mechanical ventilation is expensive to install and maintain in isolation rooms. It often does not deliver the recommended ventilation rate and may fail to maintain negative pressure (and may even be under positive pressure

In addition, a number of problems related to the use of mechanical ventilation can arise from the lack of active collaboration between medical and technical personnel, which can also occur with natural ventilation building repair, without adequate control, may adversely affect nearby areas with high cleanliness requirements;

- sophisticated and expensive ventilation systems are often not properly integrated into the building design, and then maintained, or even used; and
- medical staff often have poor knowledge of the intended operational performance of ventilation systems, even with regard to their protective functions; systems that were originally properly designed can be misused to the extent that the intended functionality is reduced, leading to increased risks.

On the other hand, the difficulties involved in properly installing and maintaining a mechanical ventilation system may lead to a high concentration of infectious droplet nuclei and ultimately result in an increased risk of disease transmission.

In existing health-care facilities with natural ventilation, this system should be maximized where possible, before considering other ventilation systems. However, this depends on climatic conditions being favorable for its use.

Buoyancy

There are two forms of buoyancy ventilation – humidity-induced, also known as the cool tower, and temperature-induced, also known as the stack ventilation. It is possible to integrate both – create a cool tower that can supply evaporative cooled air low in space while relying on the increased buoyancy of the humid air to warm to exhaust air from the space via a stack. The weight of the column of cool air above the space pressurizes the cool air supply to the same space. While it is possible to use both stacks and cool towers individually, the integration of both only works in a space where the aim is to stabilize airflow. Buoyancy is caused by a difference in air density, which, in turn, depends on humidity and temperature. This is plausible, considering that at the same temperature, humid air weighs more than dry air, while at the same humidity, warm air weighs more than the cool air. The effects of humidity and temperature in the cool tower are contradictory in actions; the former pulls upward while the latter pulls downward. The air in the room will rise ordinarily, thanks to the heat and humidity from internal sources and the room's occupants. The presence of the existing heated air finding its way through the ceiling or roof openings allows fresh air to enter the lower openings to replace it. The effectiveness of the stack effect ventilation is maximum during the winter, considering that the temperature difference of the outdoor and indoor environment is at the peak. Conversely, the effectiveness is reduced significantly in the summer because the requirement of the indoor being warmer than the outdoors cannot be met. Depending on the local climate and building type, the approach and design of natural ventilation systems may differ. The best designs or approaches are those that take care of the internal spaces and the placement and size of the openings in the buildings. These two factors majorly determine the amount of ventilation a building gets. Hence, it will not be strange to have slight or dramatic different values at a remote building site.

It is best to build on sites where there are no or little summer wind obstructions. If there are evergreen trees on site, the resulting windbreak will help significantly in mitigating cold winter winds originating from the north.

Narrow buildings work best with natural ventilation.

CONCLUSION AND RECOMMENDATION

Buildings are generally designed to use ventilation and ventilation is such of life to humanity when there is ventilation, there is life, rest, peace and harmony in a space. However, ventilation is the inlet and outlet flow of air in a given space and air is life, life is God. Where there is no ventilation there is no life. In the absent of ventilation to human body, the body will be unrest but when there is present of ventilation in a space there is life.

However, in the quest to make buildings more modern, we have jettisoned natural ventilation media for aesthetic reasons like the integration of mechanical systems and interior partition walls. With these compromises come some challenges, including increased cost and adverse environmental impacts. To resolve these challenges, designers and contractors are now returning to the era of natural ventilation.

Natural ventilation does not only save costs but also reduce energy use significantly. It also offers a safe and high-quality, comfortable, and healthy indoor climate. These are more significant perks than what the contemporary option of mechanical ventilation will ever provide. Natural ventilation will come handy as a better alternative to air conditioning plants in places and situations where the climate and building types are favorable. With this arrangement, up to 30% of total energy consumption can be saved.

By working on the principle of pressure differences, natural ventilation systems supply the entire building with fresh air evenly. The change in pressure may be due to a change in humidity or the buoyancy effect created by temperature differences or wind. Irrespective of the cause, the opening sizes and placements determine the amount of ventilation a building gets.

If a building is very wide, natural ventilation will do a poor job distributing fresh air evenly and effectively to every part. A building that will adopt a natural ventilation system must not exceed a width of 45 ft. This is why most buildings with natural ventilation come with an articulated floor plan.

There should be two individual exhaust and supply openings per room. The stack effect can be maximized through the exhaust high above the inlet. Windows should be across the room and offset from each other; this guarantees minimum airflow obstructions and maximum mixing within the room. Occupants should find the window easy to use. **I which every building will be Ventilated** to remove 'stale' air and replace it with 'fresh' air. Which will helps to Moderate internal temperatures? Reduce the accumulated moistures, odors and other gases that can build up during occupied periods

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