

# DESIGN OF EXHAUST DUCTING SYSTEM FOR THE MULTI-STOREY BUILDING

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**Abstract:** Prior the utilization of cooling for solace object was viewed as costly, yet presently a-day, it has been a need for every single person. Window forced air systems, split climate control systems are utilized in little structures, workplaces and so forth. However, when the cooling load required is exceptionally high like huge structures, multiplex, multi-story structures, emergency clinics and so forth. In Heat Ventilation and Air Conditioning Technology Ventilation through exhaust ducting system for the multistorey building is efficient and effective for the removal of heat air and excess humidity content and foul smell and has to maintain hygienic environment in rooms or closed space. In a totally shut room of a structure, air can only with significant effort leave the room, making air contaminations remain and increment in the room. Ventilation is critical for weakening and dislodging these air toxins. Now a days as a part of being reducing the space of construction of buildings and apartment's due to small availability, the multistorey buildings are become congested. The air in the room becomes hot and change in humidity percentage is also increasing according to the room availability. Mostly ventilation is required for machine rooms, bathrooms, parking cellar. Elevator machine room, machinery spaces that contain the operation or motion controller for elevator operation are required to be provided with an independent ventilation or air conditioning system to protect against the overheating of the electrical. To maintain comfort and hygienic environment exhaust ducting technology really helpful. Revit software is used to create 3D model of exhaust ducting system for multistorey building.

**Key Words:** Ventilation, Exhaust Duct, Revit Software, Air conditioner.

## 1. INTRODUCTION

### 1.1 HVAC

Most importantly, HVAC represents warming, ventilation, and cooling. This framework gives warming and cooling to private and business structures. You can find HVAC frameworks anyplace from single-family homes to submarines where they give the means to ecological solace. Turning out to be increasingly more well known in new development, these frameworks utilize outside air from outside to give high indoor air quality. The V in HVAC, or ventilation, is the most common way of supplanting or trading air inside a space. This gives a superior nature of air inside and includes the expulsion of dampness, smoke,

scents, heat, dust, airborne microorganisms, carbon dioxide, and different gases just as temperature control and oxygen renewal.

#### 1.1.1 How does an HVAC system works:

The three primary elements of a HVAC framework are interrelated, particularly while giving satisfactory indoor air quality and warm solace. Your warming and cooling framework is regularly one of the most confounded and broad frameworks in your home, however when it quits working, you'll know soon enough! There are nine sections to your HVAC framework that you ought to be acquainted with the air return, channel, exhaust outlets, conduits, electrical components, open air unit, blower, loops and blower.

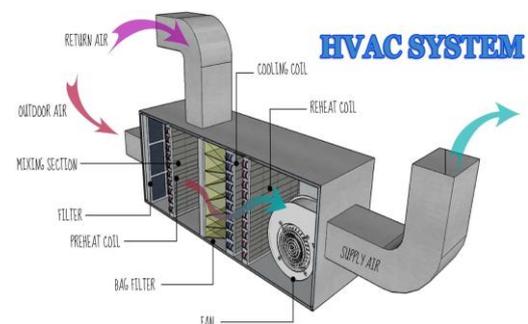


Fig-1: HVAC system[7]

#### 1.2 Ventilation:

##### 1.2.1 Definition of ventilation:

Ventilation moves outside air into a structure or a room, and disperses the air inside the structure or room. The broadly useful of ventilation in structures is to give solid air to breathing by both weakening the poisons starting in the structure and eliminating the toxins from it.

Building ventilation has three basic elements:

- Ventilation rate — how much outside air that is given into the space, and the nature of the open air.

- Wind current bearing — the general wind stream course in a structure, which ought to be from clean zones to filthy zones; and
- Air dissemination or wind current example — the outside air ought to be conveyed to each piece of the space in an effective way and the airborne toxins produced in each piece of the space ought to likewise be taken out in a proficient way.

### 1.2.2 Types of ventilation:

There are three methods that may be used to ventilate a building: natural, mechanical and hybrid (mixed- mode) ventilation.

#### Natural ventilation:

Regular powers (for example winds and warm lightness power because of indoor and open-air thickness contrasts) drive outside air through reason constructed, assembling envelope openings. Reason assembled openings incorporate windows, entryways, sun-oriented smokestacks, wind pinnacles and stream ventilators. This normal ventilation of structures relies upon environment, building plan and human conduct.

#### Mechanical ventilation:

Mechanical fans drive mechanical ventilation. Fans can either be introduced straightforwardly in windows or dividers, or introduced in air pipes for providing air into, or debilitating air from, a room.

The kind of mechanical ventilation utilized relies upon environment. For instance, in warm and muggy environments invasion might should be limited or forestalled to decrease interstitial buildup (which happens when warm, wet air from inside a structure enters a divider, rooftop or floor and meets a virus surface). In these cases, a positive tension mechanical ventilation framework is regularly utilized. Then again, in cool environments, exfiltration should be forestalled to lessen interstitial buildup, and negative tension ventilation is utilized. For a room with privately created toxins, like a restroom, latrine.

## 2. LITERATURE SURVEY

The purpose of an HVAC system is more than just warming or cooling a space. Instead, it serves to improve indoor air quality and provide comfort for everyone inside a building. While there are several different types of HVAC systems, they all begin with the same essentials.[1]

In the first place, there is a wellspring of natural air admission from an external perspective or from inside the home. This interaction is called ventilation, and it occurs in two unique ways. Regular ventilation is available in many homes and alludes to the manner in which air commonly moves in and out through windows, entryways, vents, and

different openings. This trade of air is important to renew oxygen, and to eliminate smells, carbon dioxide, and extreme dampness.[2]

Mechanical ventilation utilizes a mechanical framework - the V in HVAC - to move air in and out. Before, there was a lot of regular ventilation in many homes from holes and breaks in the development alongside opening and shutting of entryways. Nonetheless, present day development is making homes that are undeniably more firmly fixed so ventilation is turning into an inexorably significant part in home HVAC frameworks. When the air is acquired, it is brought into an air taking care of unit where the work starts. Here, air is attracted through channels to eliminate soil, residue, allergens, and different particles.

Following up, is solace. Air is either shipped off be warmed or shipped off be cooled and have overabundance mugginess eliminated. When the air is spotless, new, and at an agreeable temperature, it is coordinated into the home. For focal frameworks, this implies traveling through an organization of conduits and registers to various rooms. For different frameworks, this generally implies being coordinated directly into the space.[2]

### 2.1 Ventilation:

Ventilation is the most common way of trading indoor (dirtied) air with outside (probably new and clean) air. Its fundamental reason for existing is to make ideal conditions for people in indoor conditions, considering their wellbeing, solace, and efficiency by giving air to breathing, for eliminating and weakening indoor toxins, for adding or eliminating dampness, and for warming or cooling. [4]

#### 2.1.2 How ventilation system works:

An assortment of mechanical ventilation frameworks are accessible to choose from, in view of neighborhood environment and the home's warming and cooling framework. Notwithstanding one of the essential frameworks depicted beneath, "spot" ventilation fans ought to likewise be accommodated kitchens and showers to eliminate the concentrated dampness and scents that can happen in these rooms. The normal frameworks and suggested environments are portrayed beneath:

Supply Ventilation Systems—Hot or Mixed Climates. Outside air is attracted through an air "consumption" vent and dispersed to many rooms by a fan and pipe framework. A fan and set of conduits devoted exclusively to ventilation can be utilized, or an external air admission can be associated with the primary return air channel, permitting the warming and cooling framework's fan and pipes to convey the outside air. The advantage of interfacing with the return air pipe is that open air can be cooled or dehumidified before it is brought into the home. Since supply frameworks consistently present open air, a home can turn out to be somewhat compressed. Thus, these frameworks are regularly not fitting for cold

environments where a danger of warmed indoor air is being pushed through any leftover openings and breaks in the development get together where it could arrive at cold outside surfaces, consolidate, and cause dampness issues.

lessening the dampness content of the approaching air that would somehow must be dehumidified with the cooling gear or a dehumidifier. ERVs likewise give extra solace in the colder time of year by adding dampness from the active air to the approaching air to assist with staying away from unnecessarily dry indoor conditions.[5]

### 3. DESIGN OF VENTILATION SYSTEM:

The plan area ought to be referred to and applied in all new development projects just as any ventures including work on ventilation parts or frameworks in POAH improvements. This segment ought to likewise be referred to during arranging exercises to direct the extent of forthcoming redesign to existing structures. Ventilation fundamentally affects inhabitant wellbeing, occupant fulfillment with the living climate and on building energy use. Verifiable structure ventilation approaches are probably not going to give suitable ventilation in present day structures or for current assumptions. It ought not be accepted that new frameworks intended to satisfy current code guidelines will convey powerful and productive ventilation in multifamily structures.[6]

#### 3.1.2 Duct Components:

The figure underneath shows a schematic and a three-dimensional portrayal of supply and return air ventilation work. The focal air taking care of unit (AHU) is associated with the air plenum at the beginning stage. AHU fans attract air through grilles called returns and power air through the plenum and into the adapted space through supply registers.

#### 3.1.3 Duct Materials:

Ducting is by and large framed by collapsing sheet metal into the ideal shape. Customarily, cooling ventilation work is made of stirred steel, next in ubiquity is aluminum. Different metals utilized under unique conditions are copper and treated steel.

#### 3.1.4 Duct Shapes:

Conduits are regularly framed by collapsing sheet metal into the necessary shape. Conduits generally utilized for conveying air are of round, square, or rectangular shape. All enjoy benefits and impediments, and find applications where one is most certainly better than the other.

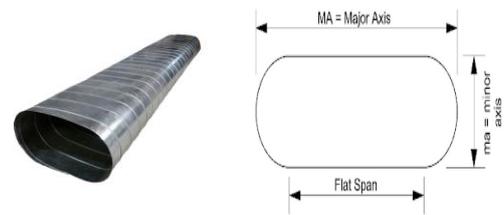


Fig-2: Oval duct[8]



Fig-3: Rectangular duct[9]

#### 3.1.5 Duct Sizing:

The most widely used method to size ducting is the equal friction method. The other methods are velocity reduction and static regain.

#### 3.1.6. Equal friction method:

The Equal Friction plan technique estimates the pipes for a steady "Grating Rate", which portrays the normal strain drop per 100 feet of channel in a framework. An extremely normal contact rate for a sensibly very much planned framework is 0.1 in.- wc per 100 ft. of conduit length. Decreased erosion paces of 0.05 in.- wcS per 100 ft. expands the conduit size and expenses by 15%, however cuts the part of the absolute strain drop in ventilation work by half, bringing about fan energy investment funds of 15% to 20%.

#### Procedure:

Equivalent rubbing technique utilizes a conduit slide rule, pipe mini-computer, or erosion rate diagram to decide the connection between pipe size and wind current, for example how much air will emerge from a given size channel. The procedure is as per the following:

- a. Select maximum air velocity in main duct after fan outlet.
- b. Enter the friction chart knowing the cfm and velocity to determine the friction rate per 100 feet of duct length and select the diameter (refer to chart below).
- c. From the friction rate obtained in the previous step, use the same value to determine diameters for all other sections of the ductwork.

The complete grating misfortune in the conduit framework is then determined by increasing the rubbing misfortune per 100-foot of length to the same length of the most basic way of the ventilation work having greatest obstruction.

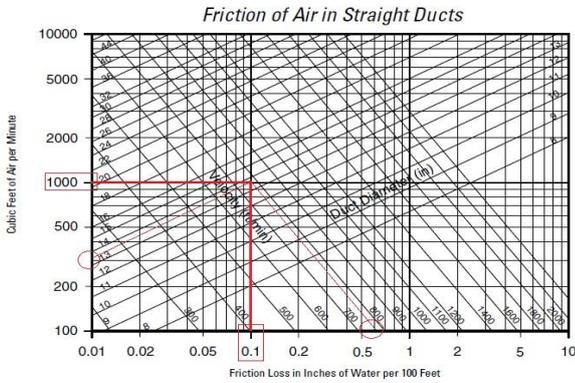


Chart-1: Friction chart

There is an assortment of industrially accessible channel number cruncher instruments (otherwise called ductulators) that are simple and precise to use for measuring conduits assuming you realize the stream rate and erosion misfortune or speed. Utilize the accompanying grinding misfortune rules for estimating channels with a pipe adding machine instrument

4. RESULT

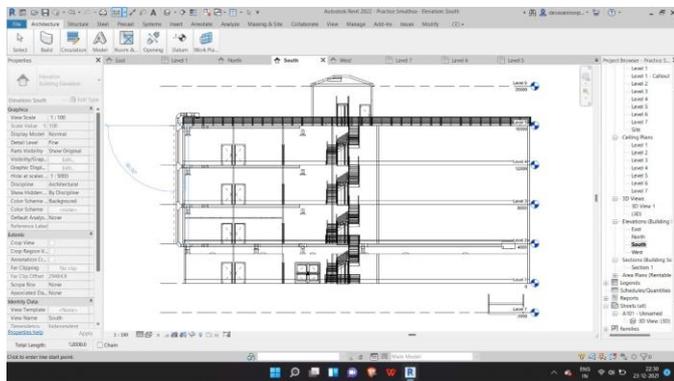


Fig-4: Building layout

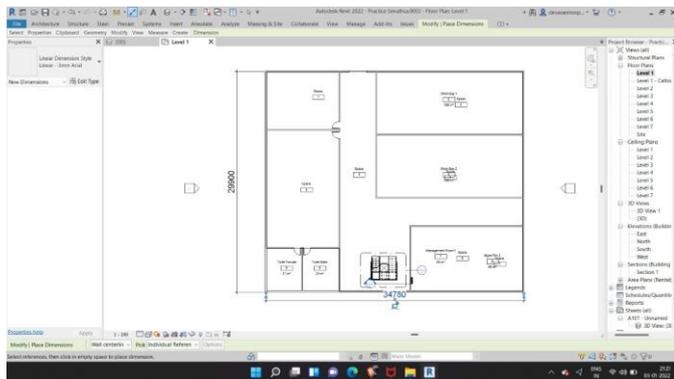


Fig-5: Floor Plan

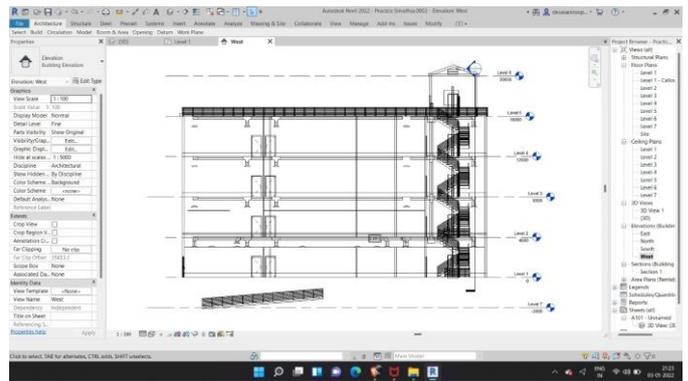


Fig-4: Design of Duct System for All Floors

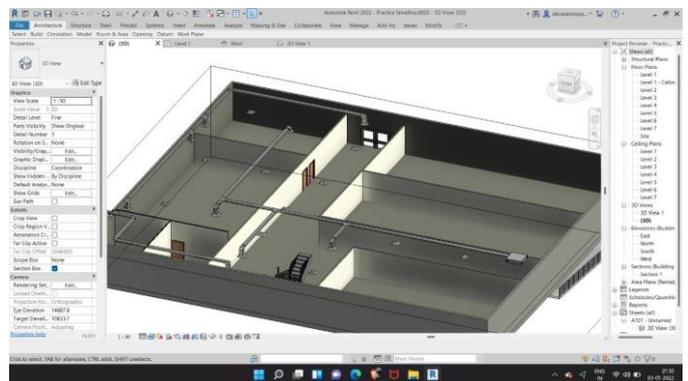


Fig-4:3D View of Duct System in Floor

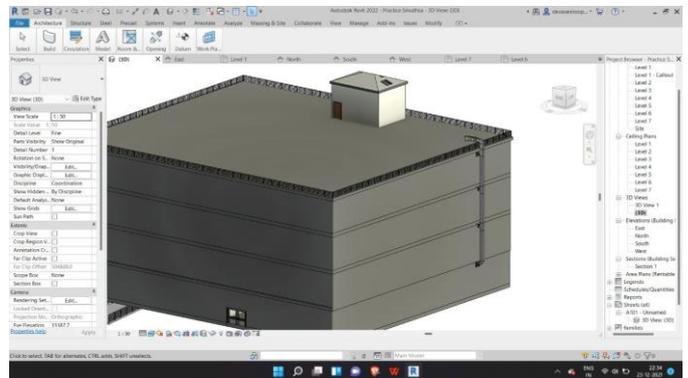


Fig-4: Exhaust Duct for Multi Stored Building

The above figure is the design of Exhaust ducting system of the Multi store building. The design is created using Revit Software.

5. CONCLUSION

The exhaust ducting system is an important aspect to provide required ventilation for living space in multi store buildings. Exhaust duct is important for transferring the excess indoor pollutants, humidity and bad odors from the living space to the exhaust. In order to provide good thermal comfort, proper ventilation system is required. The exhaust duct is designed according to the ventilation required for the living space in multi store building. Exhaust ducting system

plays an important role in providing conferrable air to the building occupants. By using Revit Software, it is easy to design the buildings and Ducting system models can be created.

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