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Ventilation System Design for the Parking Layout of Commercial Building

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***Abstract*: The Heat Ventilation and air conditioning (HVAC) system is arguably the, most complex system installed in the building and is responsible for a substantial component of the total building energy use. Maintaining optimal temperature and air circulation are the basis of a comfortable indoor environment. This role is played by HVAC systems. The Parking layout is made by Autodesk REVIT software. A Complete air conditioning system was designed to control the temperature, relative humidity, air movement etc. In this project calculations were done by using the Revit air conditioning software. After taking the plan and heating and cooling load calculations values were taken by us. The same values we will give in the Revit software at human comfort condition then we will get to know the amount of heat exhausted through the exhaust fans.**

***Keywords*: Ventilation System, Parking Layout, Commercial Building**

1. Introduction

A. *Heat Ventilation and Air- Conditioning*

Air conditioning is used in most commercial properties, ranging from small shops and cafés to large office buildings and public spaces. To meet these diverse applications, air conditioning systems have different heating and cooling capacities and come with various setups and layouts.

Many of our homes and most offices and commercial facilities would not become fordable without control of the indoor environment. Along with rapid development in improving human comfort came the realization that goods could be produced better, faster, and more economically in a properly controlled environment.

HVAC: Heat Ventilation and Air Conditioning (HVAC) equipment perform heating and/or cooling for residential, commercial or industrial buildings. The HVAC system may also be responsible for providing fresh outdoor air to dilute interior airborne contaminants such as odors from occupants, volatile organic compounds (VOC's) emitted from interior furnishings, chemicals used for cleaning, etc.

B. *Importance of HVAC*

HVAC is an important part of residential structures such as single family homes, apartment buildings, hotels and senior living facilities, medium to large industrial and office buildings such as skyscrapers and hospitals, onboard vessels, and in marine environments, where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors. Ventilating or ventilation (the V in HVAC) is the process of exchanging or replacing air in any space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, airborne bacteria, carbon dioxide, and other gases.

C. *Types of Air Conditioning Systems*

1. Window Air Conditioner.
2. Split Air Conditioner.
3. Packaged Air Conditioner.
4. Central Air Conditioning System.
5. VRV, VRF air Conditioning System.

2. Literature review

In the USA, full scale computer applications for HVAC related problems started in the early '60s when the author was involved in the US government's projects to evaluate the thermal environment in fallout shelters by an hour by hour simulation of heat and moisture transfer process between human occupants and shelter walls under limited ventilation conditions. General building thermal simulations based on hour by hour calculations were started at that time by gas and electric industries. This led to the formation of the ASHRAE Task Group on Energy Requirements to develop a comprehensive hourly energy performance simulation of buildings as well as the APEC (Automated Procedure for Engineering Consultants) activities for cooling load calculation. These activities were linked to the four successful international symposia on the use of computers for environmental engineering related to buildings, the forerunner of IBPSA. A considerable amount of effort went into the earlier thermal simulation programs to improve the physical and empirical modeling of air and moisture and heat transfer processes in and through a complex building structure under varying weather conditions and building use conditions.

J. Trojanova et. al. [1] from his journal paper titled "Fault Diagnosis of Air Handling Units" concluded that the diagnosed faults reported by the FDD system were confirmed by the building technician. The problems were fixed and the extra

operational cost of building caused by simultaneous heating and cooling was reduced

K. Ratna kumari et. al. [2] from his paper titled "Design and Drafting of HVAC, Central Air Conditioning for an Office Building", the author concluded that the heating, ventilation, and air-conditioning (HVAC) is the arguably the most complex system is installed in a building and is responsible for a substantial component of the total building energy use. A right sized HVAC system will provide the desired comfort and will run efficiently.

S.M. Gheji et. al. [3] from his paper titled "Basic Classification of HVAC Systems for Selection Guide", concluded that in industry and commercial world, Air conditioning is known as HVAC (Heating, Ventilation and Air Conditioning) systems. Air conditioning means processing of air in an indoors environment to maintain temperature, humidity, air quality (Cleanliness), air motion and ventilation. Temperature is controlled either by heating or cooling the air. Humidity is controlled either by removing or adding the moisture to air.

3. Methodology

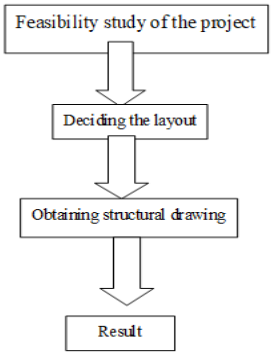

Fig. 1. Methodology

4. Analysis

A. *Introduction to AUTODESK REVIT*

Autodesk Revit is Building information modeling software for architects, landscape architects, structural engineers, mechanical, electrical and plumbing (MEP) engineers, designers and contractors. The original software was developed by Charles River Software, founded in 1997, renamed Revit Technology Corporation in 2000, and acquired by Autodesk in 2002. The software allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database.

B. *History*

Charles Rivet Software was founded in Newton,MassachusettsonOctober31, 1997, by Leonid Raiz and Irwin Jungreis, key developers of PTC's Pro/Engineer software for mechanical design, with the intent of bringing the power of parametric modeling to the building industry (PTC had previously tried and failed to market its recently acquired Reflex software to the construction sector). With funding from venture capitalists Atlas Venture and North Bridge Venture Partners, Raaz and Jungreis hired several software developers and architects and began developing Revit in C++ on the Microsoft Windows platform. In 1999 they hired Dave Lemont as CEO and recruited board members Jon Hirsch tick, founder of Solid Works, and Arlo Wolford, founder of CMD Group.

Fig. 2. Logo of Autodesk REVIT software

C. *Use and Implementation*

Revit can be used as a powerful collaboration tool between different disciplines in the building design sphere. The different disciplines that use Revit approach the program from unique perspectives is focused on completing that disciplines task.

D. *Some of the shortcuts used in the software*

- CL [STRUCTURAL COLUMN]: Adds a vertical load-bearing element to the building model.
- CM [PLACE A COMPONENT]: Place a component.
- DR [DOOR]: Adds a door to the room or building.
- GR [GRID]: Places column grid lines in the building design.
- LL [LEVEL]: Places a level in view.
- RM [ROOM]: Creates a room bounded by model element and separation lines.
- RP [REFERENCE PLANE]: Creates a reference plane using drawing tools.
- RT [TAG ROOM; ROOM TAG]: Tags the selected room.
- SB [STRUCTURAL FLOORS]: Adds structural floors to a building model.
- WA [ARCHITECTURAL WALL]: Creates a non-bearing wall or a structural wall in the building model.
- WN [WINDOW]: Places a window in a wall or skylight in a roof.

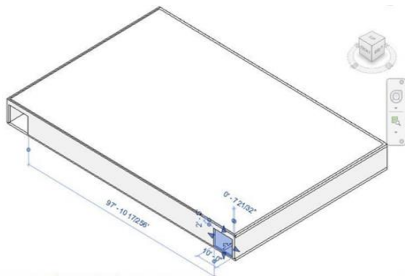

Fig. 3. Parking Area

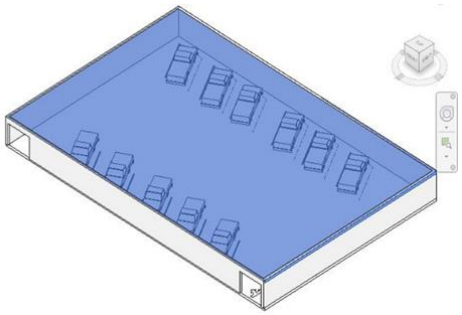

Fig. 4. Top view of Parking Layout

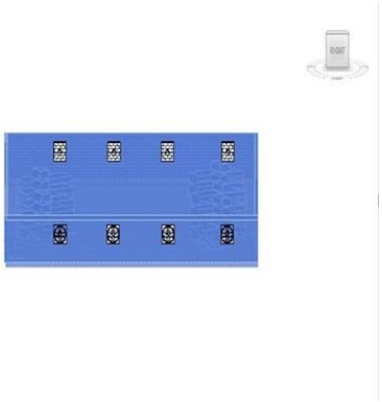

Fig. 5. View of Exhaust Fans

All the energy that is released by burning up fuel in the car is eventually converted into heat-either directly via heat of the motor and heated exhaust gases or indirectly by heating up the air through air friction while driving, heating up the tires, sound waves converted into heat etc. Even the potential energy you gain while driving up hill is eventually released as heat. let's take a car that consumes 7 Litres of petrol per 100km, driving at 100km/h. It consumes 7 Litres per hour. 7 Litres of petrol have a calorific value of about 60 kWh. Burned in one hour, that means a heat output of 60kW on average. That's about 30 typical electric fan heaters. while idle, a typical motor consumes about 0.6 liters per hour. That makes a heat output of about 5kW, the equivalent of two to three electric fan heaters.

5. Results and discussions

1	Area	896.86 sq.metre
2	Entrance Door Height	0.929 sqm
3	Heat Exhausters	8
4	Time taken (in sec)	60
5	Area*Entrance Door height * No. of Exhausters per minute	896.86*0.929*8/60

Total area of the body is 896.86square meter. Height of the entrance is 0.929 square meter. volume of parking area is 662.836 square meter. Total number of heat exhausters used are

Calculation:

891.86*0.929=82.85 sq. m

82.85*8=662.83 sq. m

662.83/60=110.47 cubic meter/min

From the above calculations the estimated values the temperatures of different regions were find out and the project summary is provided and the temperature excel sheets and provided. In this all the parameters were taken into consideration for high accuracy and proper estimation of suitable machine. All the diagrams were shown in the civil plan. From this we can conclude that our estimated values are enough to establish the air conditioning system in the specified location.

Fig. 6. Exhaust Fan

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