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Heat Load Calculation with Duct Design of a Multi Storeyed Residential Building

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ABSTRACT

The heating, ventilation, and air conditioning (HVAC) system is arguably the most complex system installed in a 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[1]. This role is played by HVAC (Heating, ventilation and air conditioning) systems. The heat load calculations along with the duct design for a HVAC system installed in a multistorey residential building is calculated and analyzed to maintain a desired temperature based on outer environmental temperature. The duct design is analyzed which create an impact on system performance. The layout of a multistorey residential building is made by using Autodesk REVIT software. A complete air conditioning system was designed along with ducts and VAV system to control the indoor environment conditions like temperature, relative humidity, air movement, etc.

Based on the obtained Heat Load Calculations CFM & T.R values were found for each spaces and ducting design was done for all the spaces by considering the quantity of CFM to be supplied. A suitable air handling unit (AHU) is selected based on the CFM value for multi storey residential building. With this the capacity of equipment was estimated and selected for the installation.

KEYWORDS: *HVAC system, Heat load calculation, Duct design*

1. INTRODUCTION

Heat ventilation and air conditioning

Air conditioning is used in most commercial properties, ranging from small shops and cafes 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. The "luxury label" attached to air conditioning in earlier decades has given way to appreciate it practically in improving human comfort came the realization that goods could be produced better, faster, and more economically in a properly controlled environment.

History of HVAC

In 1902, a 25 year old engineer from New York named Willis carrier invented the first modern air conditioning system. The mechanical unit, which sent air through water cooled coils, was not aimed at human comfort, however, it was designed to control humidity in the printing plant where he worked [2].

The first modern electrical air conditioning unit was invented by Willis carrier in 1902 in buffalo, New York. After graduating from Cornell University, carrier found a job at the buffalo forged company.

Heating, ventilation and air conditioning is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality.

Air conditioner use chemical that easily convert from a gas to a liquid and black again. This chemical is used to transfer heat from the air inside of a home to the outside air. The machine has three main parts. They are a compressor, a condenser and an evaporator.

HVAC:

Heating, ventilation, And air conditioning (HVAC) equipment perform heating and cooling for residential 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. A properly designed system will provide a comfortable indoor environment year round when properly maintained.

Duct system

Duct: Ducts are conduits or passages used in heating, ventilation, and air conditioning (HVAC) to deliver and remove air. The needed air flows include, for example, supply air, return air, and exhaust air. Ducts commonly also deliver ventilation air as part of the supply air. As such, air ducts are one method of ensuring acceptable indoor air quality as well as thermal comfort.

A duct system is also called ductwork. Planning (laying out), sizing, optimizing, detailing, and finding the pressure losses through a duct system is called duct design.

Process duct work conveys large volume of hot, dusty air from processing equipment to mills, bughouses to other process equipment. Process duct may be round or rectangular. Although round duct work costs more to fabricate than rectangular ductwork, it requires fewer stiffeners and is favored in many applications over rectangular duct work.

The air in process duct work may be at ambient conditions or may operate at up to 900F (482 C) [3]. Process duct work varies size from 2ft diameter to 20 ft diameter or to perhaps 20ft by 40 ft rectangular.

Large process duct work may fill with dust, depending on slope, to up to 30% of cross section, which can weigh 2 to 4 tons per linear foot.

Round ductwork is subject to duct suction collapse, and requires stiffeners to minimize this. But is more efficient on material than rectangular duct work.1.10

Duct materials

Ducts are generally made of the following materials:-

- Galvanized steel
- Aluminum (Al)
- Polyurethane and phenolic insulation panels (pre-insulated air ducts)
- Fiberglass duct board (pre insulated non-metallic ductwork)
- Flexible ducting
- Fabric ducting
- PVC low profile ducting

About REVIT Software

Autodesk Revit is building information modelling software for architects, landscape architects, structural engineers, 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. Revit is 4D BIM capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later maintenance and/or demolition.

Revit can be used as a very powerful collaboration tool between different disciplines in the building design sphere. The different disciplines that use Revit approach the program from unique perspectives. Each of these perspectives is focused on completing that discipline's task. Companies that adopt the software first examine the existing work flow process to determine if such an elaborate collaboration tool is required.

1.14 Modelling through REVIT

The Revit work environment allows users to manipulate whole buildings or assemblies or individual 3D shapes. Modeling tools can be used with pre-made solid objects or imported geometric models. However, Revit is not a NURBS modeler and also lacks the ability to manipulate an object's individual polygons except on some specific object types such as roofs, slabs and terrain or in the massing environment.

Revit includes categories of objects ('families' in Revit terminology).

These fall into three groups:

- System Families, such as walls, floors, roofs and ceilings, built inside a project
- Loadable families/components, which are built with primitives separately from the project and loaded into a project for use
- In-Place Families, which are built in-site within a project with the same toolset as loadable components

An experienced user can create realistic and accurate families ranging from furniture to lighting fixtures, as well as import existing models from other programs. Revit families can be created as parametric models with dimensions and properties. This lets users modify a given component by changing predefined parameters such as height, width or number in the case of an array. In this way a family defines a geometry that is controlled by parameters, each combination of parameters can be saved as a type, and each occurrence of a type can also contain further variations. For example, a swing door may be a Family. It may have types that describe different sizes, and the actual building model has instances of those types placed in walls where instance-based parameters could specify the door hardware uniquely for each occurrence of the door.

Due to the copyright nature of project work, it is rare and impractical to be able to buy fully 3D modelled Revit project models. Indeed as most projects are site specific and bespoke, obtaining an existing model is in many instances unsuitable. However, there are circumstances where new practices or students that are training to learn Revit, do have a need to refer to completed models. Sources for these are limited, however they can be purchased at websites like BIM Gallery and downloaded from websites like Grab Cad.

Although Revit software comes with a range of families out of the box (OOTB), they are limited, so users can find a need to build their own families or buy them from online stores such as Plansort, Bimbandit or Andekan. A number of websites offer families for free including Revit City, AUGI, BIMobject, BIMsmith, National Bim Library and BIM&CO.

In 2011 Dynamo was released in beta form allowing first glimpses of directly programming the behavior of hosted components through a drag and drop node interface. This is similar to the way the visual programming language Grasshopper 3d works on objects in Rhinoceros 3D.

2. LITERATURE SURVEY

In the paper "Modeling, analysis and state feedback control design of a multi zone HVAC system" the authors have designed a HVAC system for a four floors building and they compared usage data on simulated power and measured data for 3 months and found out that measured data was close to the simulated data[4].

"The necessity of HVAC system for the registered architectural cultural heritage building" highlights the role of the ventilation and air conditioning system for a theatre. Three different scenarios of main hall have been made and studied carefully.

"Advanced Energy Design Guide for Small Hospitals and Healthcare Facilities" is a sixth document in the series of guides designed to achieve 30% savings over the minimum code requirements.

In the paper "Experimental investigation of noise characteristics for HVAC silencers" the authors felt that it is necessary to control or reduce the noises produced inside the ducting system, so they have tested various types of silencers of different geometry and compare d their efficacies[5].

"Analysis of the impact of simulation model simplifications on the quality of low energy buildings simulation results", deals with, amount of time consumed in simulation of HVAC system for a big building is more so they have worked out a way to do it for a low level building and generalize it for actual building, which is time saving.

"Computational intelligence techniques for HVAC systems", this article presents a comprehensive and critical review on the theory and applications of CI techniques for prediction, optimization, control and diagnosis of HVAC systems.

In the article "Decentralized optimization for a novel control structure of HVAC system "[6], the authors have discussed about the cost cutting ways in HVAC systems by de-centralizing the control unit and the advantages of it.

"Energy demand and thermal comfort of HVAC systems with thermally activated building systems as a function of user profile", presents the numerical Analysis of a HVAC system with TABS energy demand and indoor thermal comfort of a representative room in a nonresidential building.

In the paper "A comfort-Aware Energy Efficient HVAC System based on the Subspace Identification Method", deals with the effective way to decrease the energy required for HVAC system by identifying the subspace [7].

"A Hybrid Dynamical Modelling and Control Approach for Energy Saving of Central Air conditioning", emphasis on the control of the emission products on decrease the amount of emissions, the authors proposes a hybrid system for modelling and control of emissions.

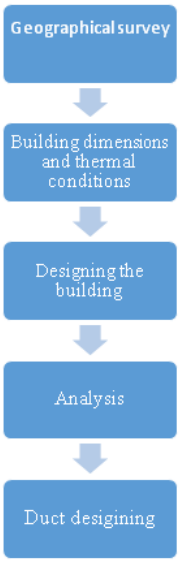
The paper "CFD simulation of a cabin thermal environment with and without human body-thermal comfort evaluation", the ideal temperature and surroundings air velocity with and without a driver are computed in a car using CFD software.

"Smart HVAC Control in Iota: Energy Consumption Minimization with User Comfort Constraints", the authors have given two steps to achieve user comfort constraints and minimize energy consumption

The "Review on the HVAC System Modeling Types and the shortcomings of their application", shows types of the HVAC model and the advantages and disadvantages for each application of them, and it finds out the gray-box type is the best one to represent the indoor thermal comfort. But its application fails at the integration method where its response deviated to unreal behavior.

In the paper "Optimization of ventilation system in the open office space", two study subjects have been taken each of different intensity of use and compared based on the emission of office workers and coefficients were developed at optimal working parameters of fans in the ventilation system [8].

3. METHODOLOGY



4. DESIGN AND ANALYSIS

4.1 Geographical survey

- **Building location:** Bangalore
- **Orientation:** Equal share of wall on all the sides
- **Application:** Residential building
- **Latitude:** 12.98^0
- **Longitude**: 77.58^0

4.2 Building dimensions

- **Building type:** Multi family
- **Area:**$820.53m^2$
- **Volume:** $2000.79m^3$

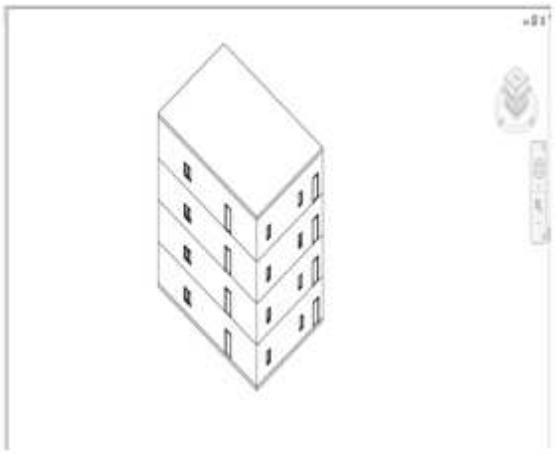
4.3 Thermal Conditions

- **Summer dry bulb temperature**:35^0C
- **Summer wet bulb temperature:** 23^0C
- **Winter dry bulb temperature:** 15^0C
- **Mean daily range temperature:** 10^0C

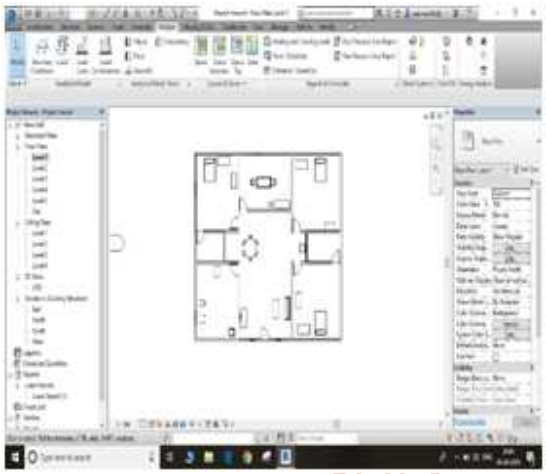
4.4 Design of building

The building has been designed using REVIT software and further analysis are also done in REVIT.

The following are the pictorial views of the building which are designed in REVIT



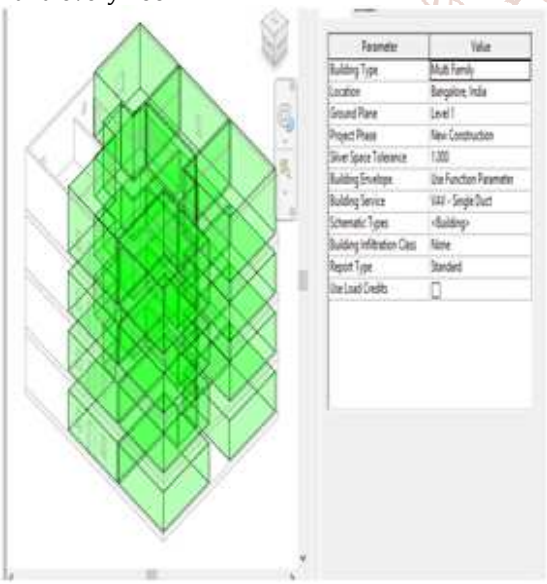
Building layout



Floor sketch

ANALYSIS

After designing the building each floor is selected and spaces are selected for making of zones to design HVAC system for that particular floor. The same procedure is followed for each and every floor.



Parameter	Value
Building Type	Multi Family
Location	Bangalore, India
Ground Plane	Level 1
Project Phase	New Construction
Sliver Space Tolerance	1.000
Building Envelope	Use Function Parameter
Building Service	VAV - Single Duct
Schematic Types	<Building>
Building Infiltration Class	None
Report Type	Standard
Use Load Credits	

Creating spaces

After giving the input of no. of people and all the other parameters the settings are saved and the calculations are started. The following are the step by step pictorial representation of the calculations

Project Summary

Location and Weather	
Project	Heat load calculation with duct design of a multi-storey residential building
Address	M.G Road , Bengaluru, Karnataka,560001
Calculation Time	08 April 2019 11:06
Report Type	Standard
Latitude	12.98°
Longitude	77.58°
Summer Dry Bulb	35 °C
Summer Wet Bulb	23 °C
Winter Dry Bulb	15 °C
Mean Daily Range	10 °C

Project summary

Building Summary

Inputs	
Building Type	Multi Family
Area (m²)	820.53
Volume (m³)	2,000.79
Calculated Results	
Peak Cooling Total Load (W)	168,517
Peak Cooling Month and Hour	April 13:00
Peak Cooling Sensible Load (W)	168,141
Peak Cooling Latent Load (W)	375
Maximum Cooling Capacity (W)	168,517
Peak Cooling Airflow (L/s)	10,217.9
Peak Heating Load (W)	28,255
Peak Heating Airflow (L/s)	2,495.5
Checksums	
Cooling Load Density (W/m²)	205.37
Cooling Flow Density (L/s·m²)	12.45
Cooling Flow / Load (L/s·kW)	60.63
Cooling Area / Load (m²/kW)	4.87
Heating Load Density (W/m²)	28.34
Heating Flow Density (L/s·m²)	3.03

Building summary

Zone Summary - 1

Inputs	
Area (m²)	205.13
Volume (m³)	500.28
Cooling Setpoint	23 °C
Heating Setpoint	21 °C
Supply Air Temperature	13 °C
Number of People	5
Infiltration (L/s)	0.0
Air Volume Calculation Type	VAV - Single Duct
Relative Humidity	44.00% (Calculated)
Psychrometrics	
Psychrometric Message	None
Cooling Coil Entering Dry-Bulb Temperature	28 °C
Cooling Coil Entering Wet-Bulb Temperature	19 °C
Cooling Coil Leaving Dry-Bulb Temperature	13 °C
Cooling Coil Leaving Wet-Bulb Temperature	12 °C
Mixed Air Dry-Bulb Temperature	28 °C
Calculated Results	
Peak Cooling Load (W)	42,040
Peak Cooling Month and Hour	April 13:00
Peak Cooling Sensible Load (W)	41,982
Peak Cooling Latent Load (W)	59
Peak Cooling Airflow (L/s)	2,552.2
Peak Heating Load (W)	5,814
Peak Heating Airflow (L/s)	621.4
Peak Ventilation Airflow (L/s)	0.0
Checksums	
Cooling Load Density (W/m²)	204.94
Cooling Flow Density (L/s·m²)	12.44
Cooling Flow / Load (L/s·kW)	60.68
Cooling Area / Load (m²/kW)	4.88
Heating Load Density (W/m²)	28.34
Heating Flow Density (L/s·m²)	3.03

Zone-1 summary

Components	Cooling		Heating	
	Loads (W)	Percentage of Total	Loads (W)	Percentage of Total
Wall	700	1.66%	858	14.76%
Window	111	0.26%	66	1.13%
Door	117	0.28%	175	3.01%
Roof	38,949	87.89%	4,715	81.10%
Skylight	0	0.00%	0	0.00%
Partition	0	0.00%	0	0.00%
Infiltration	0	0.00%	0	0.00%
Ventilation	0	0.00%	0	0.00%
Lighting	1,289	3.07%		
Power	1,842	4.38%		
People	141	0.33%		
Plenum	0	0.00%		
Fan Heat	888	2.11%		
Reheat	0	0.00%		
Total	42,041	100%	5,814	100%

1 Spaces

Space Name	Area (m²)	Volume (m³)	Peak Cooling Load (W)	Cooling Airflow (L/s)	Peak Heating Load (W)	Heating Airflow (L/s)
1 Space 1	31.05	75.72	6,387	394.9	959	102.5
2 Space 2	28.23	68.85	5,689	352.7	748	79.9
3 Space 3	35.66	86.96	7,152	442.2	1,025	109.5
4 Space 4	35.66	86.96	7,149	443.2	1,059	113.2
5 Space 5	74.52	181.72	14,813	918.3	2,024	216.3

Zone-1 components summary

Zone Summary - 2

Inputs	
Area (m²)	205.13
Volume (m³)	500.20
Cooling Setpoint	23 °C
Heating Setpoint	21 °C
Supply Air Temperature	12 °C
Number of People	8
Infiltration (L/s)	0.0
Air Volume Calculation Type	VAV - Single Duct
Relative Humidity	44.00% (Calculated)
Psychrometrics	
Psychrometric Message	None
Cooling Coil Entering Dry-Bulb Temperature	28 °C
Cooling Coil Entering Wet-Bulb Temperature	19 °C
Cooling Coil Leaving Dry-Bulb Temperature	12 °C
Cooling Coil Leaving Wet-Bulb Temperature	14 °C
Mixed Air Dry-Bulb Temperature	28 °C
Calculated Results	
Peak Cooling Load (W)	**42,129**
Peak Cooling Month and Hour	April 13:00
Peak Cooling Sensible Load (W)	42,035
Peak Cooling Latent Load (W)	94
Peak Cooling Airflow (L/s)	2,354.5
Peak Heating Load (W)	**5,814**
Peak Heating Airflow (L/s)	621.4
Peak Ventilation Airflow (L/s)	0.0
Checksums	
Cooling Load Density (W/m²)	205.37
Cooling Flow Density (L/(s·m²))	12.45
Cooling Flow / Load (L/(s·kW))	60.63
Cooling Area / Load (m²/kW)	4.87
Heating Load Density (W/m²)	28.34

Zone-2 summary

Components	Cooling		Heating	
	Loads (W)	Percentage of Total	Loads (W)	Percentage of Total
Wall	700	1.66%	858	14.76%
Window	111	0.26%	66	1.13%
Door	117	0.28%	175	3.01%
Roof	38,949	87.70%	4,715	81.10%
Skylight	0	0.00%	0	0.00%
Partition	0	0.00%	0	0.00%
Infiltration	0	0.00%	0	0.00%
Ventilation	0	0.00%	0	0.00%
Lighting	1,289	3.06%		
Power	1,842	4.37%		
People	232	0.55%		
Plenum	0	0.00%		
Fan Heat	889	2.11%		
Reheat	0	0.00%		
Total	42,129	100%	5,814	100%

2 Spaces

Space Name	Area (m²)	Volume (m³)	Peak Cooling Load (W)	Cooling Airflow (L/s)	Peak Heating Load (W)	Heating Airflow (L/s)
6 Space 6	31.05	75.72	6,415	396.3	959	102.5
7 Space 7	28.23	68.85	5,689	352.4	748	79.9
8 Space 8	35.66	86.96	7,161	443.6	1,025	109.5
9 Space 9	35.66	86.96	7,149	443.8	1,059	113.2
10 Space 10	74.52	181.72	14,842	919.3	2,024	216.3

Zone-2 Component summary

Zone Summary - 3

Inputs	
Area (m²)	205.13
Volume (m³)	500.20
Cooling Setpoint	23 °C
Heating Setpoint	21 °C
Supply Air Temperature	12 °C
Number of People	9
Infiltration (L/s)	0.0
Air Volume Calculation Type	VAV - Single Duct
Relative Humidity	44.00% (Calculated)
Psychrometrics	
Psychrometric Message	None
Cooling Coil Entering Dry-Bulb Temperature	28 °C
Cooling Coil Entering Wet-Bulb Temperature	19 °C
Cooling Coil Leaving Dry-Bulb Temperature	12 °C
Cooling Coil Leaving Wet-Bulb Temperature	14 °C
Mixed Air Dry-Bulb Temperature	28 °C
Calculated Results	
Peak Cooling Load (W)	**42,159**
Peak Cooling Month and Hour	April 13:00
Peak Cooling Sensible Load (W)	42,053
Peak Cooling Latent Load (W)	106
Peak Cooling Airflow (L/s)	2,355.3
Peak Heating Load (W)	**5,814**
Peak Heating Airflow (L/s)	621.4
Peak Ventilation Airflow (L/s)	0.0
Checksums	
Cooling Load Density (W/m²)	205.52
Cooling Flow Density (L/(s·m²))	12.46
Cooling Flow / Load (L/(s·kW))	60.62
Cooling Area / Load (m²/kW)	4.87
Heating Load Density (W/m²)	28.34
Heating Flow Density (L/(s·m²))	3.03
Ventilation Density (L/(s·m²))	0.00
Ventilation / Person (L/s)	0.0

Zone-3 summary

Components	Cooling		Heating	
	Loads (W)	Percentage of Total	Loads (W)	Percentage of Total
Wall	700	1.66%	858	14.76%
Window	111	0.26%	66	1.13%
Door	117	0.28%	175	3.01%
Roof	38,949	87.64%	4,715	81.10%
Skylight	0	0.00%	0	0.00%
Partition	0	0.00%	0	0.00%
Infiltration	0	0.00%	0	0.00%
Ventilation	0	0.00%	0	0.00%
Lighting	1,289	3.06%		
Power	1,842	4.37%		
People	261	0.62%		
Plenum	0	0.00%		
Fan Heat	889	2.11%		
Reheat	0	0.00%		
Total	42,159	100%	5,814	100%

3 Spaces

Space Name	Area (m²)	Volume (m³)	Peak Cooling Load (W)	Cooling Airflow (L/s)	Peak Heating Load (W)	Heating Airflow (L/s)
11 Space 11	31.05	75.72	6,387	394.4	959	102.5
12 Space 12	28.23	68.85	5,718	354.1	748	79.9
13 Space 13	35.66	86.96	7,161	443.5	1,025	109.5
14 Space 14	35.66	86.96	7,178	444.5	1,059	113.2
15 Space 15	74.52	181.72	14,842	919.1	2,024	216.3

Zone-3 Components summary

Zone Summary - 4

Inputs	
Area (m²)	205.13
Volume (m³)	500.20
Cooling Setpoint	23 °C
Heating Setpoint	21 °C
Supply Air Temperature	12 °C
Number of People	10
Infiltration (L/s)	0.0
Air Volume Calculation Type	VAV - Single Duct
Relative Humidity	44.00% (Calculated)
Psychrometrics	
Psychrometric Message	None
Cooling Coil Entering Dry-Bulb Temperature	28 °C
Cooling Coil Entering Wet-Bulb Temperature	19 °C
Cooling Coil Leaving Dry-Bulb Temperature	12 °C
Cooling Coil Leaving Wet-Bulb Temperature	14 °C
Mixed Air Dry-Bulb Temperature	28 °C
Calculated Results	
Peak Cooling Load (W)	**42,188**
Peak Cooling Month and Hour	April 13:00
Peak Cooling Sensible Load (W)	42,071
Peak Cooling Latent Load (W)	117
Peak Cooling Airflow (L/s)	2,356.6
Peak Heating Load (W)	**5,814**
Peak Heating Airflow (L/s)	621.4
Peak Ventilation Airflow (L/s)	0.0
Checksums	
Cooling Load Density (W/m²)	205.69
Cooling Flow Density (L/(s·m²))	12.48
Cooling Flow / Load (L/(s·kW))	60.60
Cooling Area / Load (m²/kW)	4.86
Heating Load Density (W/m²)	28.34
Heating Flow Density (L/(s·m²))	3.03
Ventilation Density (L/(s·m²))	0.00

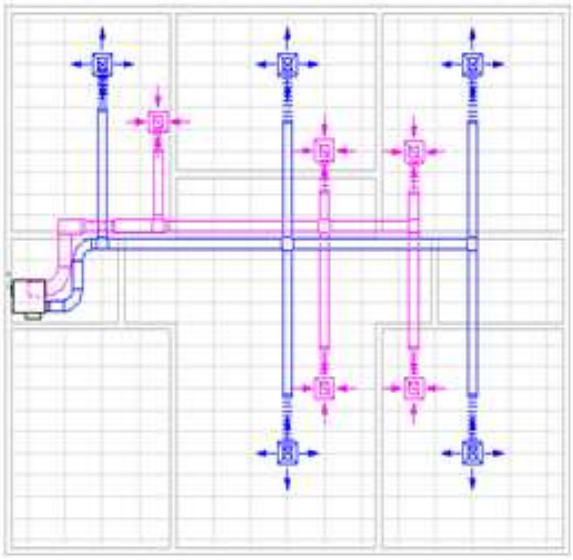
Zone-4 summary

Components	Cooling		Heating	
	Loads (W)	Percentage of Total	Loads (W)	Percentage of Total
Wall	700	1.66%	858	14.76%
Window	111	0.26%	66	1.13%
Door	117	0.28%	175	3.01%
Roof	36,949	87.58%	4,715	81.10%
Skylight	0	0.00%	0	0.00%
Partition	0	0.00%	0	0.00%
Infiltration	0	0.00%	0	0.00%
Ventilation	0	0.00%	0	0.00%
Lighting	1,289	3.06%		
Power	1,842	4.37%		
People	290	0.69%		
Plenum	0	0.00%		
Fan Heat	890	2.11%		
Reheat	0	0.00%		
Total	42,188	100%	5,814	100%

4 Spaces

Space Name	Area (m²)	Volume (m³)	Peak Cooling Load (W)	Cooling Airflow (L/s)	Peak Heating Load (W)	Heating Airflow (L/s)
16 Space 16	31.05	75.72	6,415	396.1	959	102.5
17 Space 17	28.23	68.85	5,689	352.2	748	79.9
18 Space 18	35.66	86.96	7,161	443.3	1,025	109.5
19 Space 19	35.66	86.96	7,178	444.4	1,059	113.2
20 Space 20	74.52	181.72	14,871	920.6	2,024	216.3

Zone-4 component summary



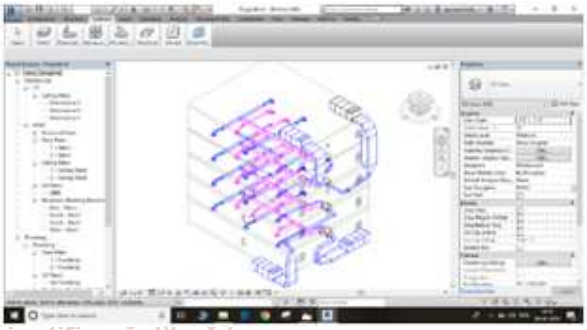
Top view of the ducting system

After the completion of zone summary and zone components the specific space contents and summary is represented pictorially.

Design of Ducts

The ducts are designed based on the load calculation obtained in the software and a suitable ducking system is taken by the software accordingly [9].
The duct used in this design is rectangular duct.

The following are the pictures of ducting system done in REVIT



Air handling unit in REVIT

5. RESULTS

SL NO	FLOOR	ROOM NAME	FLOW (L/s)	TONNES
1	Ground	Bed room 1	394.9	1.816
2	Ground	Living room	352.7	1.617
3	Ground	Bed room 2	442.2	2.027
4	Ground	Bed room 3	443.2	2.032
5	Ground	Hall	918.3	4.212
6	First	Bed room 1	396.3	1.824
7	First	Living room	352.4	1.617
8	First	Bed room 2	443.6	2.036
9	First	Bed room 3	442.8	2.032
10	First	Hall	919.3	4.221
11	Second	Bed room 1	394.4	1.816
12	Second	Living room	354.1	1.625
13	Second	Bed room 2	443.5	2.036
14	Second	Bed room 3	444.5	2.041
15	Second	Hall	919.1	4.221
16	Third	Bed room 1	396.1	1.824
17	Third	Living room	352.2	1.617
18	Third	Bed room 2	443.3	2.036
19	Third	Bed room 3	444.4	2.041
20	Third	Hall	920.6	4.228

Overall Cooling air flow is 10217.9 L/s
Overall cooling load is 47.916 TR

6. CONCLUSION

From the above calculated results, the peak cooling total load is 47.916 TR and peak cooling air flow is 10217.9 L/s. From the data obtained in the above the air handling unit is selected. The type of air handling unit used is indoor air handling unit horizontal chilled water coil is selected. It is used for a maximum of 6000 CFM. In this work the calculated cfm values of each room in each floor are obtained from analysis of the spaces and zones created in each floor. The CFM and BTU are for every room are estimated.

The capacity of unit is 5100 CFM approximately but used 6000 CFM machine to avoid the fluctuations in the working. In this all the parameters were taken into consideration for high accuracy and proper estimation of suitable machine.

Based on the obtained CFM for each rooand for all the floors the duct design was done using Revit software. All the diagrams related to the plan are shown in the Revit. From this we can conclude that our estimated values are enough to establish the air conditioning system in the specified location. This is one of the most well designed and most useful method in the present-day installations.

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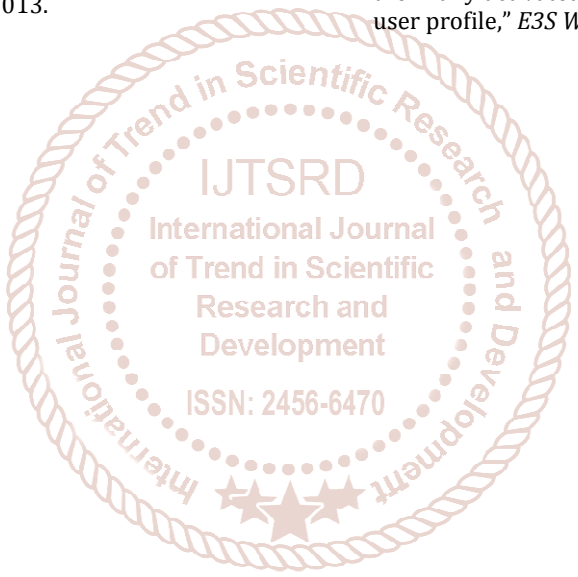
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