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Building information modeling using in implementation of building.

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ABSTRACT

Thermal efficiency, often known as U-value, is an important statistic that is used to estimate the amount of heat that is lost via the various components of a building as a result of heat transfer. The ability to estimate it is provided by the thermal characteristics of the building's components. By increasing the thermal properties of composite walls, it is conceivable to reach high energy and environmental performance objectives for buildings, such as essentially zero-energy structures. This would be possible if it were possible to achieve these goals. Despite the benefits of this form of construction, thermal bridges may still be present in wall elements. This is because structural materials have a high thermal conductivity, which makes them susceptible to heat transfer. The purpose of this study is to evaluate how the functionality of composite walls is affected by the presence of layers of thermal insulation. In order to accomplish this goal, several different types of composite walls are assessed in each of the four main temperature zones. The only two pieces of information needed to calculate thermal transmittance using this method are the temperature of the surrounding air and the properties of the wall material. The newly established method known as MCDM generates three distinct groups of results, which are as follows: (a) the heat burden of the composite material; (b) the overall cost of the utilized wall composite materials; and (c) the ranking outcomes. An comprehensive statistical research reveals that the climate in this method has a direct influence on the amount of heat that a structure must bear as well as the effectiveness of various types of insulating materials.

Keywords: *Thermal Efficiency, Insolation Materials, Thermal Properties*

INTRODUCTION

The increasing demand for energy resources is putting stress on the planet's ecosystems and heightening concerns about the impacts of climate change. The housing sector plays a critical role in resolving these issues since it is responsible for a disproportionate share of both energy consumption and greenhouse gas emissions. In terms of worldwide final energy consumption and GHG emissions, building construction accounts for 32% and 25%, respectively[1][2]. About 33.6 percent of France's total final energy consumption is accounted for by the residential sector (25.4%), followed by the commercial/industrial sector at 8.2%. Energy efficiency in France's residential sector is complicated by the country's rich cultural history and varied climate. Rapid urbanization, population increase, and rising standards of living have all contributed to a rise in the demand for housing, which in turn has led to a rise in energy consumption. Further complicating the issue of creating energy-efficient residential structures that respond to unique local needs is France's geographical position, which exposes it to diverse climatic conditions, ranging from Mediterranean to desert temperatures[3][4]. As the second-highest energy user in France, this industry desperately needs a major transformation. Appliances including air conditioners, heaters, lights, fans, and hair dryers and irons may account for as much as 40 percent of a building's overall energy use. There are a number of factors that contribute to building energy waste, including inefficient systems or appliances, outdated envelopes and space distribution, a lack of control systems, and improper consumption practices [5] [6].

1.1. BIM Model Importance

Building information modeling (BIM) is a new technology adopted by the architecture, engineering, and construction sectors, benefiting building lifecycle management. Mostly used by architectural designers, BIM has shown benefits compared to older CAD tools. Construction managers play a crucial role in ensuring successful project completion, understanding methodologies and tools throughout the project lifetime. Although not typically part of a construction manager's job description, BIM plays a significant role in project management[7] [8].

The asset needs to be managed throughout its entire existence, beginning with its conception and continuing through its operation and eventual decommissioning. Knowledge of building information modeling (BIM) and the abilities to comprehend, query, contribute to, and assess the data are necessities for construction managers. They need to be able to better support new building methods, scheduling, cost, quality, coordination, fabrication, sequencing, and facilities management, to name just a few of these areas. This may be accomplished by leveraging the value of data through the use of model information and new ways of working. In light of the extra duties that they now have, the construction manager will need to

examine the methods, procedures, and skill sets that they are now using [9] [10]

1.2. Problem Statement

The construction sector is becoming increasingly receptive to sustainable development and the more environmentally conscientious mindset that it inspires. Utilizing environmentally responsible architectural practices can help bring down the overall cost of construction projects. BIM is gaining more and more traction as a valuable tool for use in the management of building projects anywhere it is being implemented. The audit team will need to collect crucial pieces of information in order to give relevant comparisons. These pieces of information include the technical characteristics of the building's many cooling factors as well as an analysis of the cost over the long term. In addition to this, the crew needs to educate themselves on the cooling apparatus found in the building and become comfortable with it. Existing building envelope systems, building orientation, integration of renewable energy sources, and day lighting design techniques were the most widely used in buildings; nevertheless, it is uncertain whether the technology that is currently available may be successfully employed to generate a functional evaluation.

1.3. Objective of Study

a) To analyze the energy performance of a five-storey residential building in France using BIM techniques and simulation tools.

b) To identify and evaluate various design strategies that can improve the energy efficiency of residential buildings in France.

To provide practical recommendations for architects, engineers, and policymakers to enhance energy-efficient building practices in France

2. OVERVIEW OF BUILDING INFORMATION MODELING (BIM)

BIM is a way to viewing and coordinate the construction and maintenance of a building or infrastructure project digitally. Design, operation, construction, and maintenance are just few of the many facets of a building project that may be brought together using building information modeling (BIM)[11] [12]. The construction industry has adopted building information modeling (BIM) as the new standard by which cooperation and value delivery on projects are measured. Cost savings, less conflict, faster project completion, improved design, and more stakeholder cooperation are just few of the causes that BIM was developed[13] [14]. The building industry in the United Kingdom, the United States, and other nations has recently shown increased interest in and use of this groundbreaking technology. These nations have taken the most active steps toward implementing BIM, earning the title of "BIM adoption leaders." The United States, the United Kingdom, Finland, and Norway are among these nations. However, the approaches of implementation that are used in

these nations differ from one another since they are adapted to each country's unique economic climate and other circumstances. The research shows that developing nations have difficulties while attempting to implement BIM[15] [16].

3. METHODOLOGY

3.1. Implementing Revit Model

During the design and construction phases of a project, structural engineers and builders use a broad variety of tools to improve their efficiency, accuracy, and adherence to schedules. The realm of design is enormous and diverse, offering something of interest to people from many walks of life. At least twice, he struck his ear with the mallet while he was angry. Revit is one of the most popular pieces of engineering software, and it has received a lot of praise for its adaptability, precision, and speed. REVIT is an acronym that refers to what Revit performs, which is modeling information infrastructure. Revit also has this name. The development of information modeling made it possible to combine and organize all of the data, knowledge, and research that had been accumulated up until that point. It is impossible to have a complete understanding of the situation unless one considers both the final product and the actual structure that will be constructed. The information obtained from this source requires additional context information in order to be comprehended correctly. The authentic condiments and finishing touches for the dish. The most common strategies for completing projects on schedule and without going over budget were discussed. The manufacture of AEC has been analyzed, and the bottlenecks and cost increases that now exist have been found. Following that, assistance with the REVIT technique was requested from a local architect as well as a building management company. Extensive investigation was conducted on both the procedure and the core idea. By examining the data obtained from 3D models, it was shown that this unique method to the execution of projects increases productivity while simultaneously reducing associated expenses. The probable problems that could arise from using the REVIT approach and the remedies to those problems have been compiled. At the conclusion of this involved procedure, we had a lengthy conversation on the ways in which the use of REVIT will make the project better. The application of REVIT was suggested as a viable option for use in the years to come. During the lecture, we also talked about the difficulties that users encounter while trying to use REVIT. This article will provide an overview of the many steps required in utilizing Revit.

a. draw a sketch of the foundation of the building
b. Plan the walls of the building in the second step.

These two operations are essential components of the Revit software, and they

begin with the articular icon that is displayed in the photographs.

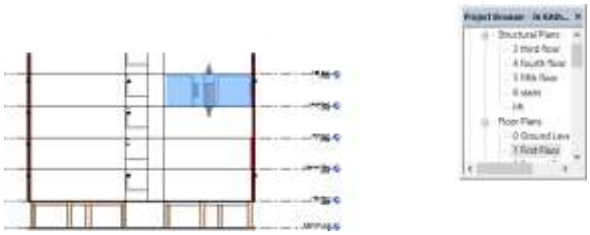

Figure 1: Draw The Foundation and Basic Walls with Specific Dimensions.

Figure 2: Insert The Concrete Column.

Figure 3: Building The Walls Of The First Floor And Specify The Building Levels.

The Floorplan dataset's Floorplan Polyline feature class enables in-depth analysis of future contributions from various categories during the design process. Multipatch features are developed in the BIM file workspace using the Exterior Shell feature class, which are applied to the Facilities 3D layer. These components are essential for the system's operation. The Rooms category creates multi-patched elements in the Units 3D layer, reflecting the size of the objects they represent. These attributes are stored in the Multipatch feature type's archival database. The Name field from the Rooms component is copied to the USE TYPE field of the Units component, and the Room Number field from the Rooms component is transferred to the NAME field of the Units component.

Figure 4: Specify The Doors.

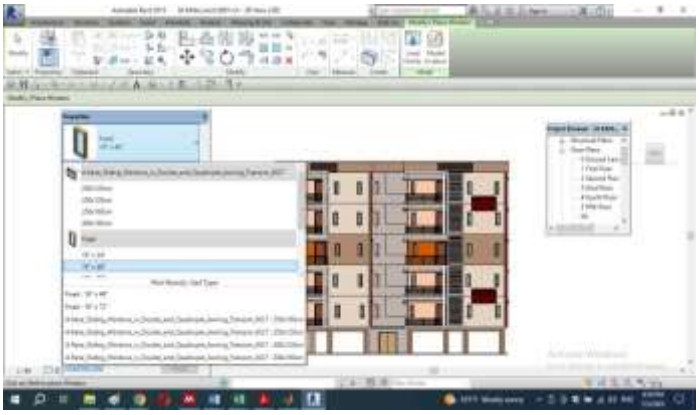

Figure 5: Specify The Windows.

Figure 6: Specify The Roof Of The Building.

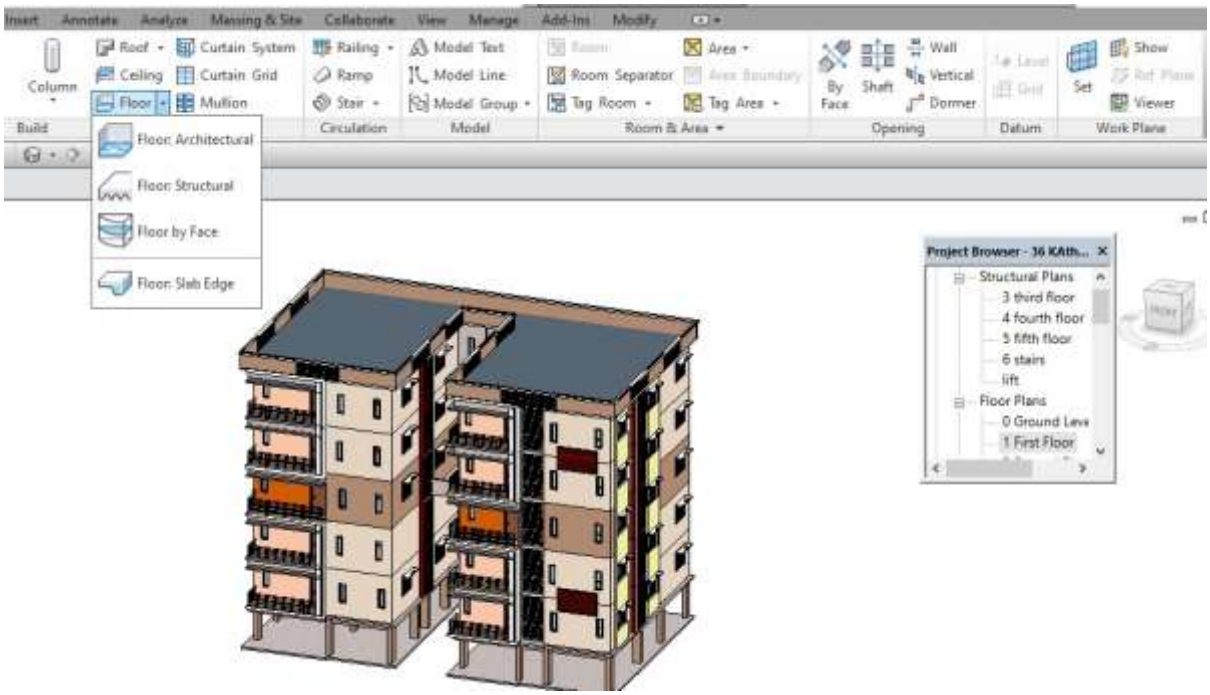

Figure 7: Specify The Building Floor.

3.2. MCDM METHOD

with the real world, we are often put with situations in which we must make decisions. The issue of how to arrive at the best decision in a variety of scenarios, ranging from the choosing of a single item to the implementation of a certain strategy, is one that is perennially relevant. These days, multicriteria decision making is considered standard practice in a vast array of industries and contexts, including the commercial world, the medical industry, and the scientific community. When applied to a complicated issue, the multi-criteria decision-making (MCDM) approach to decision-making is a decision-making method that makes use of objectives, criteria, sub-criteria, and alternatives to assist characterize the basic choice operation. Utilizing MCDM is most effective when used to judgments that are multi-attribute, complex, and ad hoc in nature. Because they take into account both material and mental factors, the decisions that are specified by these criteria challenge a framework that is solely based on rationality.

[17][18] [19].

For that, the priority MCDM method developed and applied to specify the required stations as in the stages:

Stage 1: establishment of the pairwise comparison matrix,

$$MCDM = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{bmatrix}$$

Stage 2: calculation of the weights of the criteria.

$$MCDM_{sum\_1} = \left| \sum_{i=1}^{n} i1 \quad \sum_{i=1}^{n} i2 \quad \sum_{i=1}^{n} in \right|$$

$$MCDM = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{bmatrix} \times \left| \sum_{i=1}^{n} i1 \quad \sum_{i=1}^{n} i2 \quad \sum_{i=1}^{n} in \right|^{-1}$$

$$MCDM_{sum} = \begin{vmatrix} \sum_{j=1}^{n} j1 \\ \sum_{j=1}^{n} j2 \\ \sum_{j=1}^{n} jn \end{vmatrix}$$

This is the key objective, and achievement of this goal will serve as one of the selection criteria. The eight core modules were tasked with analyzing a variety of variables that were categorized as "secondary" and "sub-factors." In order to arrive at a full and comprehensive collection of important features, a statistical population was choosing members from the most active specialists working in the field of Building Management Systems (BMSs). The evaluation criteria that IBs use, which are derived from the aforementioned eight essential aspects (quality, cost, schedule, and risk), have an effect on the entire life cycle of the building.

4. RESULTS AND DISCUSSION

For the purpose of this thesis, a case study will be developed, and Revit will be utilized to calculate the cost performance value of the building quantities that have been specified. Everyone involved in a construction project places a high priority on cost performance, including the owner, the general contractor, the consultant, and the subcontractor. The most prevalent reasons for a construction project's bad performance are delays, as well as an inability to finish the job by the agreed-upon deadline and within the budgetary constraints. There are a wide variety of internal and external elements, which, should they all come into play at the same time, could cause construction delays. The efficiency with which a project is completed financially has an impact on the output of the construction industry as well as the overall economy. The total number of previously identified factors was cut down after the deletion of variables that were functionally identical to one another and the consolidation of components with meanings that were analogous to one another. The explanation provided in the 'headline'

states that they were then divided into five distinct categories. A linear regression model was constructed in Excel during the third stage of the process in order to evaluate the varied performances and analyze the acquired data for potential dangers. The results of a cost-benefit analysis (also known as an MCDM) give the tools to accomplish the goals that were set out for the project.

4.1. Results Of Composite Wall Evaluation

The data for this study came from four diverse regions across Franc, and it was able to identify three main trends. The newly created approach known as MCDM generates three distinct groups of results, which are as follows: (a) the heat burden of the composite material; (b) the overall cost of the employed wall composite materials; and (c) the ranking outcomes. The MCDM approach is dependable and easy to put into practice thanks to the method's condensed nature. The MCD mechanical lift method consistently produces the best results across a wide range of oil field applications. In order to make it easier to make comparisons between different criteria, normalization requires converting the many scales and units that are utilized for each criterion into a standard set of measurements. MCDM's versatility and user-friendliness are undoubtedly two of its most impressive qualities. You do not need to be an expert in mathematics in order to finish the task at hand because the calculations may be conducted on a regular spreadsheet. When performing MCDM, the fact that selecting criteria and weights is an inherently subjective process can have a sizeable bearing on the overall quality of the outcomes. The MCDM method allows for the evaluation and selection of choices based on the characteristics of information and communication technology by utilizing a holistic approach and a condensed version of a practical model. This method was developed by Microsoft. This can be accomplished in a variety of different ways. This communication system and evaluation model is particularly useful as a result of the difficulty and unpredictability of the negotiation process. also, the law mandates that businesses in this sector put into effect procedures that improve the ecological efficiency of existing infrastructures and buildings. A sustainable design takes into account how natural and renewable resources, such as energy and materials, will be consumed, how this will affect the surrounding environment, and what risks these resources present to people. In order to get the most out of the resources that are available for the construction project, which items should be chosen? The term "green building materials," which is synonymous with "environmentally friendly materials," refers to those components of a structure that, over the course of its whole life cycle, have a negligible impact on the natural environment. They have to be long-lasting, organically biodegrade into something else, or be reusable; they have to be produced entirely of

recyclable materials; and they have to be easily accessible in the region where the activity is being carried out.

Table 1: Results of Composite Wall Evaluation.

		ost	eat ther mal effec t	cdm
PD 12	Fib erglass	3.50	9.63 9	.647
PD 13	Perl ite	4.20	5.90 7	.762 2
PD 14	Gyp sum board	5.60	6.39 7	.806 4
PD 15	Aer ogel	4.90	8.42 6	.658 4
PD 16	Cor k	9.1. 5	5.26	.678 5
PD 17	Extr uded polystyrene (XPS)	1.7. 5	3.82 1	.505 3
PD 18	Exp anded polystyrene	7.20	3.15 5	.949
PD 19	Pol yurethane	5.60	0.53 1	.711 2
PD 20	Cell ulose	8.40	7.08 4	.887 1
PD 21	Roc kwool	6.64	7.59 7	.851 6

Table 2: Results of Composite Wall Evaluation.

		unli ght effe ct	entl atio n to win d velo city effe ct	entl atio n to win d dire ctio n effe ct	cd m
PD 22	1 0% (Windo w size: 0.91 m X 0.91 m)	.04 2	.040	.036	.45 8

PD 23	20% (Window size: 1.29 m X 1.29 m)	.056	.037	.033	.478
PD 24	30% (Window size: 1.58 m X 1.58 m)	.057	.027	.024	.389
PD 25	40% (Window size: 1.83 m X 1.83 m)	.092	.030	.027	.491
PD 26	50% (Window size: 2.05 m X 2.05 m)	.128	.030	.027	.549
PD 27	60% (Window size: 2.24 m X 2.24 m)	.171	.028	.025	.575
PD 28	70% (Window size: 2.42 m X 2.42 m)	.273	.031	.028	.722
PD 29	80% (Window size: 2.58 m X 2.58 m)	.437	.035	.032	.920

Table 3: Results of MCDM.

unNames	Design Alternatives	unlight effect	indvelocity effect	indirection effect	CDM
PD 1	Original Orientation (North)	.70	.66	.59	.999
PD 2	North-west Direction	.65	.61	.55	.9274
PD 3	West Direction	.47	.44	.40	.6713
PD 4	South-west Direction	.53	.50	.45	.7584

PD 5	South Direction	.52	.49	.44	.7429
PD 6	South-east Direction	.49	.46	.41	.6966
PD 7	East Direction	.55	.52	.46	.7836
PD 8	North-east Direction	.62	.58	.52	.8811

4.2. Results of Revit Case Study

The drawings and other documents that were developed with Revit are included in the Building Information Model, also known as BIM. Creating blueprints from the very beginning of a project is possible using Revit. Architects and engineers who are familiar with the foundations of other comparable software will have little trouble learning their way through Revit. When utilizing the Revit BIM software, moving from a two-dimensional to a three-dimensional design is a straightforward process. One model can be used to generate many primitive documents. Architects also have the option of use Revit because it was developed specifically for that function. Users of Revit are able to do more than just design their ideas; they also have the ability to construct interactive 3D models. An established building information modeling (BIM) application is Autodesk Revit. The BIM interoperability offered by Revit considerably cuts down on complexity. As opposed to being made accessible to everybody and everyone, Revit was developed to cater to the particular requirements of the architectural and engineering sectors. It should not come as a surprise that BIM is a component of the strategy. The implementation of such digitalization is the core focus of Revit, and this objective serves as the software's raison d'être. The environment has a significant impact on behavior, which is ultimately stored in long-term memory. One of the most significant advantages is the elimination of the need to perform a second round of design inspections to guarantee that everything is in proper working condition.

Figure 9: The Revit Case Drawing Front View.

For the purpose of specifying the components, Building Information Modeling is applied. Pay attention to any unique features that may be connected to the materials that were used in the construction of the structure. In some cases, in addition to the quantity, the instructions for preparation will also be supplied. The summary might be updated with fresh information that is pertinent later on. The "Project Details" system family in Revit is responsible for recording information such as the client's name and the address of the project. Because they serve to preserve the data obtained during the site research, it is essential to have access to these characteristics prior to beginning the foundation analysis and building process. Because the parameters and structure that are generated are "Shared parameters," it is possible to use them in a range of different scenarios. The methods of structural analysis and design that are a part of this endeavor need to have access to the material characteristics, also known as the characteristics of the proposed construction materials. The following table provides additional information regarding these qualities. Included here are mass, compressive strength, tensile strength, yield strength, and elongation at break in addition to tensile strength and yield strength. Additionally, tensile stiffness and density can be found in this material.

5. CONCLUSION

In the course of analyzing the qualities of the building materials utilized in a variety of different construction endeavors, doing a search predicated on the idea of sustainability may produce results that are both reassuring and invigorating. However, in order to take into consideration the extraordinary attention that civil engineers have on this sector, this method will require some refining. In spite of this, the study came to the conclusion that isolation materials will be subjected to a great

deal of scrutiny in the field of construction as well as in further research. Any business that intends to take part in the building process should have a comprehensive understanding of the capacity to recover energy from generated heat at a cost that is comparable to that of the materials that will be utilized. Because there is a huge opportunity to use easily available sustainable resources in building development, cost estimations ought to place a higher emphasis on this new method. The purpose of this study was to uncover three distinct trends using data collected from four different regions of France. The newly developed method known as MCDM generates three distinct groups of results, which are as follows: (a) the heat load of the composite material; (b) the overall cost of the wall composite materials employed; and (c) the ranking results. This goal was accomplished by the application of the following assets and strategies:

In the first step of the process, an evaluation of the influence of effective performance standards and the amount to which they affect building projects was carried out by using surveys, the opinions of experts, interviews, and exploratory research. The selection process resulted in the selection of five categories of construction-related performances.

When developing a cost model using RII and AHP, one of the most important decisions to make was selecting the appropriate software to develop the model. This was just one of numerous key considerations. The tool for basic performance evaluation that was used was Microsoft Excel because of its usability and its capacity to make conclusions. This allowed for the calculation of the degree of influence that each category of performance had.

After reviewing the system's evaluation results, specialists determined that they were positive and a good indicator of the system's outstanding performance.

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