Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 2458-9403
Vol. 7 Issue 11, November - 2020

Integrated Project Process and Indoor Air Quality Technologies During the Construction's Building and Pre-Occupantion

Clélia Mendonça de Moraes
Araraquara City Hall: Dept. Urban Mobility
Federal University of São Carlos SP Brazil
Araraquara – SP - Brazil

***Abstract*— The labor market demands a multidisciplinary team formation to determine decision making in the construction's building project – which improves such market's communication with the user by simplifying the explanation of it's own constructions project proposal. The following article investigates the technologies which contribute to the indoor air quality during the construction's building and pre-occupation. In order to obtain thermal comfort, hence reducing consumption. The methodological approach supports itself on economic technology, power efficiency and equipment longevity and HVAC (Heating, Ventilation and Air Condition) installation. The article aims to establish a correlation between the development stages and the construction building, air quality technologies and the human thermal comfort, showing that it is possible to evaluate the human or thermal comfort interference at the construction's development and to identify which assembled variables during the development along the comfort equation's development defines therefore amplitude evaluation of thermal comfort. The process' last step concludes with the user's habitation of the building. The civic construction promoters will able to present a synthesis regarding the process which generated their final proposal, highlighting the regional climate's characteristics and its implications, as well as the power consumption estimate that should occur during the construction phase of usage. Such synthesis will have the function to clarify the responsibilities, since the decision making journey that leads to the final product's materialization is the result of the interaction between professionals of multiple qualifications and, mainly of these professiona ls's interaction with the clients and/or users.**

Keywords—integrated project, indoor air, building, human thermal comfort, technologies

I. INTRODUCTION

The formation of multidisciplinary professional teams in the integrated project process of civil construction defines the decision-making, the construction and the future of the building.

In the traditional project, the owner meets with the architect to determine the future of the construction, later the other professionals are hired and consulted.

The integrated project, the participation of the other professionals occurs during the drafting of the building project, along with the architect and the owner of the construction. The professionals may be specialists and consultants originating both from architecture and the different fields of engineering and physics, having a greater dialogue between professionals. The intention of the integrated project is to get effective and accurate answers of the proposals and the drafting of the building project, avoiding post-occupation renovations of the building. Because during the development of the building project, a significant part of the future thermal comfort and energy consumption of the building can be determined there. By presenting a new methodological approach for buildings that must be planned and integrated to the existing built environment, determining, at last, the formal, functional aspects, adapting materials and project techniques. As an example one can mention the thermal comfort and air quality specialists professionals. They can bring new HVAC equipment and facilities to the building, as well as new alternative energy sources and technological innovations to promote corporate and government changes for better financial economy. Through the analysis proposed in this article it is expected that the professionals who work directly in the development, organization and construction of the building, consider more actively the elements that involve the integrated project and the technologies for the indoor air quality during the construction and pre-occupation of the building.

II. COST-EFFECTUVE TECHNOLOGIES, AIR QUALITY AND ENERGY

A. Cost-effective Technologies

At the unstable moment of the economy, the digital transformation helps entrepreneurs to make good decisions in the civil construction sector.

In the area of technologies in environmental comfort the main instruments are based on assessing the cost of opportunities for indoor environment quality project strategies, through the use of resources of a natural and/or artificial thermal conditioning technique and in the budgetary impact of the incorporation of technologies by the indoor environment system.

The advancement of technology has the intention of providing comfort and air conditioning, together they add up comfort, air quality, safety and health to users

of the building. The most sought after equipments are those that consume less energy.

For better efficiency and comfort, the HVAC system with the inclusion of CO2 sensors avoids unnecessary spendings, on energy terms, by allowing the identification of the air conditioning demanded and optimizing the operational conditions and comfort.

B. Air Quality

The air quality should be evaluated before and during the project. According to Mundt, E.; et al. (2005) the effectiveness of ventilation (...) as well as post-installation in order to ensure: 1) commissioning; 2) quality control; 3) assessment of ventilation effectiveness, that facilitates problems resolutions that may arise due to costumer complaints; 4) a good ventilation, that is essential for the health and well-being of the occupants, the productivity of workers, the product quality in a production medium, comfort in built environment; 5) cost saving of ventilation system and its operation. (Mundt, E.; et al., 2005).

Today, the question arises: How to invest in assessing ventilation effectiveness to achieve air quality and thus fight COVID-19? In this regard, Brazilian universities and educational institutions seek, through technology, to improve air quality and to identify the COVID-19 virus. "The Aeronautics Institute of Technology (ITA) (2020), developed an equipment capable of identifying the presence of the coronavirus in the air. The new device utilizes the technology used in cloud-based radiological monitoring, being able to monitor areas of 50 square meters and indicate the risks of contamination in the space. For example, if the equipment is installed in a classroom of 40m2, a device is installed to verify the presence of COVID-19. If it is a football stadium, a drone with the equipment is used and it will circulate the stadium. The data collected by the equipment is forwarded to the hospital that will test the presence of the virus.

The University of São Paulo (USP); University of Campinas (Unicamp) and the Institute of Technological Research of the State of São Paulo (IPT), (2020) tested the environment sanitizer for general purposes to fight COVID-19, the spray eliminates the virus from the environment for up to 7 days. According to the virologist Arns, C. W., the product is 99,9% effective. Since the product is not toxic it can be used to sanitize the car. Before using it the suggestion is to leave the car's air conditioning on to disinfect the vehicle ducts.

USP, in the campus of São Carlos (2020) developed a system consisting of vacuum cycles (air removal) and ozone injection (sanitizing gas) in order to decrease the contamination of these items. "The so-called Ozone Chamber, (EMBRAPII and FAPESP) can, efficiently, decontaminate money, books and documents, minimizing the transport of microorganisms among users of the same item. The system works by placing the items inside it, creating vacuum, because all the air is removed, even between the pages of a book or the banknotes of a cash package. After the vacuum cycle is completed, the ozone gas is injected into the chamber, penetrating into all the spaces that were once occupied by the air. Given that ozone gas oxidizes virus and microorganisms in general, it promotes the decontamination of items without the obligation of decontaminating, manually, page by page or note by note. According to the project coordinator, Prof. Vanderlei Bagnato, the ozone chamber was first used in the decontamination of masks for hospital use, but it actually works for a lot more than that, since now the time has come to use this technology for other purposes. According to Bagnato, the process is highly safe and does not expose the users to any contact with ozone".

III. ENERGY

As technology advances, we seek for effective equipment that tries to reduce the energy cost, identifying the concern about the costs associated with planning and conservation of the environment and energy. It is essential to encourage the possibility of redesigning a sustainable building project, elaborated by a multidisciplinary team of professionals in accordance with national and international standards that establish equity between the human development and sustainable environment. Highlighted by the social isolation imposed by the pandemic, the importance of occupation in buildings for building systems like thermal air conditioning, lighting, heating and water distribution, controls/automation, locomotion of people and safety. The tall buildings constructed with the use of lightweight elements and glazed facades generate high energy consumption by the building systems as with air conditioning, lighting and less soundproofing, favoring low thermal inertia, that is the thermal inertia of the environments. The new technologies of the evolution of the air conditioning system invests in technological development for the: 1) reduction of energy consumption; 2) health - air renewal; 3) reduction of greenhouse gas emissions; 4) intelligent cleaning and maintenance system, mainly because of the COVID-19 pandemic; and 5) homogeneous air distribution and comfort. To reduce the thermal load demand per environment it is important to adapt the building to the local climate.

IV. BUILDING AND BUILDING PROJECT STRATEGIES FOR THE INTEHGRATED PROJECT

The quality of the constructed building can be achieved with creative solutions in the stages of the development of the building project, when applied in the product process, it allows the decision-making during the development of the building project. Table 1. By establishing a correlation of these development and building construction steps, with the formation of a multidisciplinary team of professionals working in various areas of knowledge, it is possible to assess the interference of the integrated project in the development of the construction and to identify which variables are aggregated throughout the comfort equations development, thus defining the breadth of

each theory in the environmental comfort assessment. At the end of the process, the designer may present a synthesis of the process that resulted in its final proposal, highlighting the characteristics of air quality and its implications just as well as the estimate of the energy consumption that should occur in the using phase of the building. Such synthesis will have the role to clarify that the responsibilities insofar as the set of decisions that lead to the completion of the final product is the result of the interaction between professionals from different qualifications and the interaction of those professionals with the costumer and/or users.

TABLE I. INTEGRATED PROJECT STEPS AND THEIR ACTIONS TO DEVELOPMENT AND ASSESSMENT

Integrated Project Idealization	***Steps***	***Air Quality***
Feasibility study	Data collection	1. Proposal presented by the owner of the construction; 2. Physical and building data; 3. Thermal comfort and energy.
Preliminary mass study Preliminary study	Development of building project and environmental comfort	4. Application of environmental comfort; 5. Definition of the physical characteristics of the building.
Pre-project	Development of building project	6. Evaluation of thermal performance through simulation; 7. Evaluation of ventilation through simulation; 8. Meeting between the construction promoter and the owner for possible adaptation of the proposal presented by the costumer and the construction schedule.
Building permit/ Negotiation	Computer graphics	9. Reevaluation of thermal performance through simulation (if there is a change in the project);
Construction documents	Detailed project	10. Revaluation of ventilation through simulation (if there is a change in the project);
Final product		

V. CONCLUSION

The integrated building project with the formation of multidisciplinary teams is essential to the labor market. Because it relies on health and economic technologies with benefits like air quality, thermal comfort, energy efficiency, favoring the steps of building project and construction as well as avoiding post-occupation problems of the building.

ACKNOWLEDGMENT

Araraquara City Hall and University Federal of São Carlos UFSCar.

REFERENCE

[1] Moraes, Clélia Mendonça de Conforto térmico em salas de aula no Brasil: análise experimental e numérica / Clélia Mendonça de Moraes. --Campinas, SP: [s.n.], 2009. Orientadores: kamal Abdel Radi Ismail. Tese de Doutorado - Universidade Estadual de Campinas, Faculdade de Engenharia Mecânica.

[2] Mundt,E.; Mathisen, H.M.; Nielsen, P.V. e Moser,A. Eficácia de Ventilação. Rehva, Termos de refêrencia n°2 (Guidebook n°2), Lisboa, 2005).

[3] http://www.ita.br/

[4] https://www.youtube.com/watch?v=w9gl52qSoSs&feature=youtu.be

[5] http://www.saocarlos.usp.br/usp-sao-carlos-camara-de-ozonio-descontamina-dinheiro/

[6] https://www.gbcbrasil.org.br/docs/zero.pdf