International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 7 Issue 6 ǁ 2019 ǁ PP. 01-05

Wind Flow and Temperature Variation in High-Rise ApartmentIt's Analysis

Mir Nasser Hussain[1], Rama Chandra Parida[2]
1 Department of Mechanical Engineering ,Gandhi Engineering College , Odisha ,India
2 Department of Mechanical Engineering ,Gandhi Institute For Technology , Odisha , India

ABSTRACT: *As the rapid expansion of cities as a result of economic development, many people flowed into the cities, and the structure of the cities became overcrowded, resulting in a higher density of buildings. And the disordered arrangement buildings causes changes in the wind flow and reduces the amount of wind.*
This study performed a numerical analysis with the STAR-CCM+ program on the relationship of wind field formation in an apartment complex according to the housing form, number of floors, and direction of layout of high-rise apartments that significantly affect wind path to adapt to climate changes, and the temperature distribution in the apartment complex was analyzed. A numerical results show that the temperature is increased by 2℃at the back of the group C in the 90° swing arrangement and the 45° swing arrangement exceptfortheparallelarrangementinthe60thfloorapartmentcomplex,whereasinapartmentsonthe15thand 30th floors, the temperature at the building has dropped significantly, except for the tower-type with 45° swing arrangement in the 30th floor apartment complex. This study will carry out a detailed study on fine dust in the apartment complex in the future.
Keywords:*Climate change, STAR-CCM+, Wind field, Temperature distribution*

I. INTRODUCTION

Recently, many population flow into the city due to the industrialization and urbanization and as a high-rise and high-density building is being built, it is now feared to be development thoughtless for the environment[1)].

In reality, it is not very much to conduct wind environment assessment of a building from its planning stage[2)]. Hence, deteriorating wind environment is not only adversely affecting the outdoor environment in the apartment complex, but also significantly impacting the indoor environment[3)].

This study is utilize the STAR-CCM+ program to establish the main building types, floors, the relationship between wind direction and wind field formatting by layout direction of high-rise apartments that have a influence on the wind path when planning the layout of apartment in the apartment complex.
Then, this study presents the best apartment complex layout method for reducing greenhouse gas emission by comprehensively analyzed the flow, ventilation performance, generation of turbulence energy and distribution of temperature in the apartment.

II. RESEARCH METHODS

Numerical analysiscondition

Cheonan city and Asan city is analyzed for climate change adaptation. Cheonan city and Asan city area are northwesterly wind with the average speed of 1.6m/s[4)].

The height of the apartment is 1,000m and the height is 500m including the apartment complex applied to this study. The shape of the apartment is arranged as flat type and tower type. The height of the apartment is 2.9m and the climatic condition, the numerical analysis was performed. The temperature condition is 298K in the apartment complex, and the temperature of the wind and the temperature of the calculation area is 288K. The layout of the apartments was numerically analyzed as shown in Fig.1.

Fig. 1. Apartment complex depend on the arrangement direction

Numerical analysismethod

In this study, numerical analysis is performed with the general code STAR-CCM+ 9.04.009-R8 for the analysis. The grid is used with the polyhedral grid.

The grid generation is shown in Fig. 3. In order to facilitate the numerical analysis in the apartment complex, it was classified into 3 groups (A, B, C group).

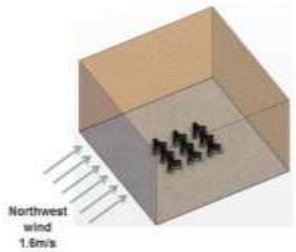

Fig. 2. Calculation domain and grid generation

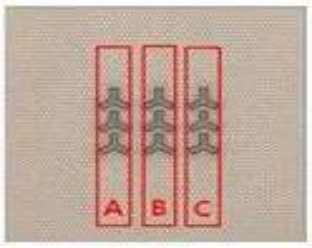

Fig. 3. Separated by apartment group in right angle arrangement

III. NUMERICAL ANALYSIS RESULTS

Winddirection

In the parallel arrangement, there is not much change in the wind flow, and in the 45° swing arrangement and right angle arrangement, the wind flow changes remarkably according to the number of layers. In the 15th floor apartment complex, the height of the building does not affect the wind flow. However, in the 30th and 60th apartment complexes, except for the parallel arrangement of the plate type, wind flow stagnant. The parallel arrangement was more active than 45° swing arrangement and right angle arrangement.

As the number of apartment floors increases, the flow is stronger as the number of apartment floorsincreases. This means that as the number of floors increases, the effect of frictional force from the ground is less.
As the flow according to the apartment type was examined, it was found that the overhead type flow was stronger than the plate type, and the flow of air from the outside was more active.

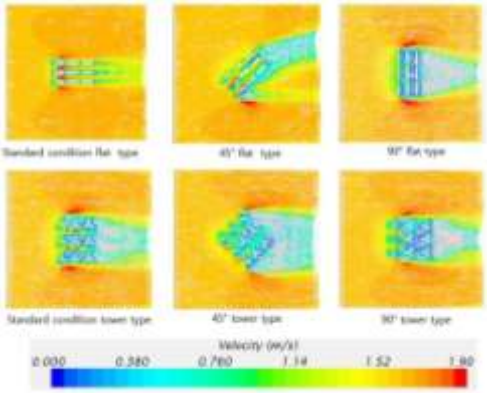

Fig. 4. The wind direction of 15layers

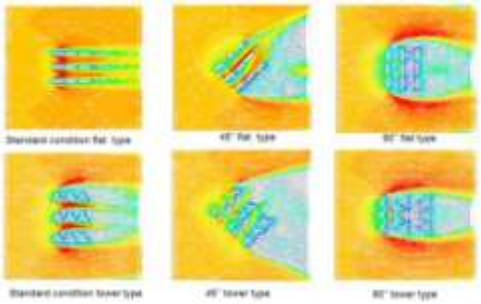

Fig. 5. The wind direction of 30layers

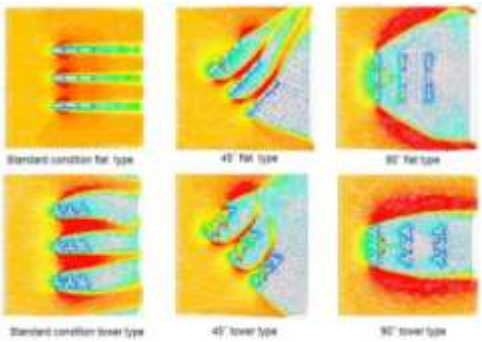

Fig. 6. The wind direction of 60layers

Temperaturedirection

In the 15th floor apartment complex, the temperature of the building is 290K.In the 30thfloor45° swing apartment complex, the local temperature rises to around 300K behind the apartment complex, but the temperature between the buildings in the rest of the apartment complex may be lower than the temperature of the building.Apart from the parallel arrangement in the 60th floor apartment complex, the arrangement of the plate-shaped and overhead-shaped arrangement at 45° swing arrangement and right angle arrangement increased the temperature of the apartment complex to about 2°C behind the apartmentcomplex.

As shown in Fig. 7, the numerical analysis area is divided, and the change in temperature according to the number of stories is analyzed in detail with the results from each area. As shown in Fig. 8, the panel shows a graph of temperature rising sharply from the number of apartment floors above 30th behind the C group.

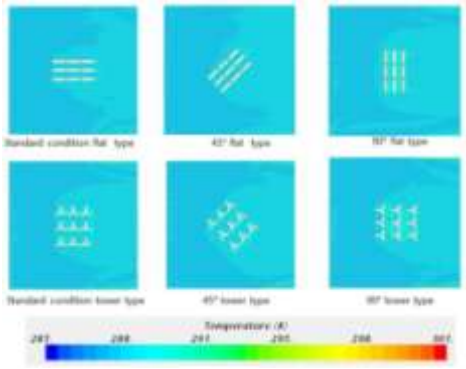

Fig. 7. The temperature direction of 15layers

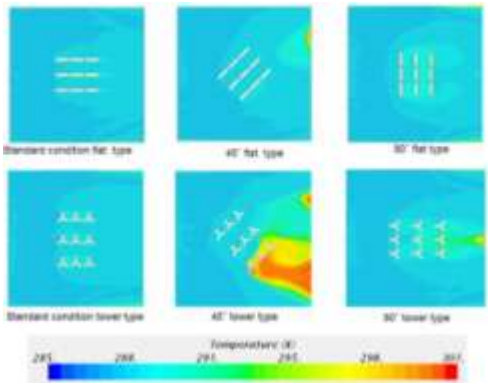

Fig. 8. The temperature direction of 30layers

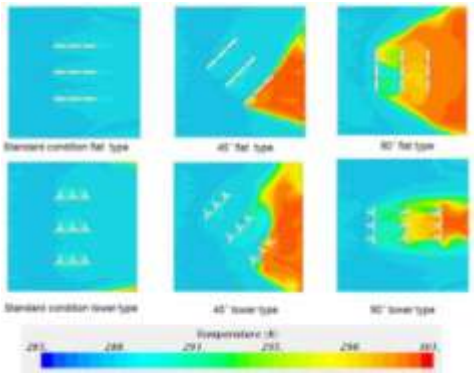

Fig. 9. The temperature direction of 60layers

IV. CONCLUSIONS

1) In case of the 15th floor apartment complex, both the direction of arrangement and housing form show a large drop in temperature, and analysis shows that the flow of wind in a parallel arrangement moves moreactively.
2) In case of the 30th floor apartment complex, it can be judged that the flat-type and the tower-type have little difference in temperature changes in parallel arrangement and right angle arrangement, whereas the flat-type may be better than tower-type if they are in a 45°swingarrangement.
3) In case of the 60th floor apartment complex, in a right-angle arrangement and 45° swing arrangement, except for a parallel arrangement the temperature is 2°Chigher behind the group C and, in particular, the flat-type indicates that the temperature changes have becomeworse.
4) In case that the temperature changes according to the number of floors by area, considering that the temperature curve rises sharply as the number of floors rises after the fact of no change to the 30thfloor, it is judged that it is possible to plan the proper layout of apartment if the floors of apartments are adjusted to be on or below the 30th floor (approximately 87m) when planning the sitelayout.

Therefore, comparing the correlation of wind flow, pressure distribution, turbulence energy generation and temperature distribution due to the reduction of greenhouse gases, the 30th floor tower-type form was superior in the right angle arrangement.

On the 45°swing arrangement, the 30th floor flat-type is found to be the optimal layout of apartments.Based on the numerical analysis results conducted in this study, the research is planned to be carried out on fine dust in apartment complex and the development of optimised apartment complex for consideration of climatechange.

REFERENCE

[1] C. S. Yun, Development and usefulness analysis of elementary horticultural education program related with global warming .5(2011)

[2] E.A.KoandB.R.Ryu,Editors.WindSimulationandOptimalBuildingAllocationusingEnvi-met3-DModel,J. of Korean Society of Environmental Technology. 208~214(2010)

[3] BottyanandJ.Unger,„Amultiplelinearstatisticalmodelforestimatingthemeanmaximumurbaheatisland", Theoretical and Applied Climatology, 75(1),233~235(2003)

[4] Korea Meteorological Administration, Mar.28(2018)