Article

Impact of tall buildings in environmental pollution

H. Hayati, M.H. Sayadi
Environment and Civil Engineering Department, University of Birjand, Birjand, Iran.
E-mail: Mh_sayadi@yahoo.com

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Abstract
Today, tall building is a phenomenon that the world particularly large cities are facing. The tall buildings in order to exploit the land with having the negative affects in the environment create new problems including increasing congestion population, environmental pollution, reduce citizen access to fresh air and sunlight. However, regarding to population increasing and land shortage, tall buildings could not be avoided. This paper investigates the relationship of tall buildings with urban air pollution as well as the possible reducing of negative affects of tall building on environmental pollution with respect to geographical position, technical rules, immunization, green space, direct of wind, appropriate distance to other buildings, design in terms of visibility and landscape and urban appearance were reviewed. The study showed that the tall buildings cause increasing the air pollution in large urban area due to changing in wind and its direction and also congestion of tall buildings as a pollution sources. Therefore some techniques to design the tall building must be considered to reduce the negative affects of the tall buildings on environmental pollution. Unfortunately the lack of the construction roles in term of environmental protection and also control of the rules in construction process causing the environmental pollution particularly air pollution. It is suggested that the re-evaluate of the rules with restricted control can improve the air quality in the large cities and also utilization of green spaces in floors and roofs of buildings as environmentally friendly buildings which are attempt to reduce environmental problems.

Keywords environmental pollution; environmentally friendly building; land shortage; population; tall buildings.

1 Introduction

Before the 19th century, tall buildings were as temples, mosques, church and etc. which are designed mainly to their political or religious. Late 19th century and early 20th century tall building in the West was a relatively new phenomenon of the architecture and urbanism as a solution to create more space in the centres of cities with high demand for offices. At the beginning in such structures were considered as a sign of technological advances and technical communities (Navabakhsh and Rahmani, 2010; Sharghi and Mohtashami, 2007). The tall buildings in order to exploit the land with having the negative affects in the environment create new problems including increasing congestion population, environmental pollution, reduce citizen access to fresh air and sunlight (Shakeri and Samadi, 2006). The purpose of this study is the investigation of tall building's effects in environmental pollutions and giving procedures for decreasing this phenomenon in this time.

2 Air Pollution Around Tall Building

Regarding to the importance roles of buildings in environmental pollution particular air pollution, Abbaspour and Behjo (2000) studied on distribution of Particulate Matter (PM) and CO concentrations besides the building and also in different heights of building. Their research was conducted in a building with 27 floors. The results showed the identification and evaluation of pollution distributed around the building will help to design engineers choosing the best position of windows regarding to minimal contact with polluted air. It also revealed that the average concentration of CO was increasing from the lowest point of the building up to about 6-9 floor then with irregular process gradually decreases. It may be due to higher wind speed in the upper edges of the building which causes decreasing the intensity of pollution. However the increasing height from the ground is caused increased distance from the primary pollution sources (cars) but the volume of pollution is not associated with the distance from pollution sources. It may be due to some factors such as local winds and eddy currents around the building, causing accumulation of pollution and scatter them in some parts of the building, therefore, the air flow around the buildings which is affected by many factors such as local streams, location and type of installation of windows is more important than pollution sources for distribution of pollution parameters (Abbaspour and Behjo, 2000).

3 Role of Buildings in Climate

Tall buildings have a special impact and play an important role on climate or weather and environment which changing climate factors are mostly related to sunshine and wind.

3.1 Sunshine

Sets high and dense buildings to benefit from sun exposure are more restricted, because the shadows on their adjoining buildings as lower floors of tall buildings as well as short buildings are more in the shade.

3.2 Wind flaw

Survey of wind flow in the urban area, especially within tall building in two terms is very important:

(1) Tall buildings can cause undesirable intensification of wind flow in urban streets and open spaces (square).

(2) On the other hand also have the ability to avoid wind flow in urban spaces.

In both cases, depending on various conditions, wind flow or wind stagnation could be favourable or not favourable. So in the polluted urban environments, increased air flow to prevent stagnation and accumulation of the pollution is very useful while for pedestrian and visitors in open space are undesirable and uncomfortable.

Generally buildings depending on how their exposure to wind flow, create dual effects including wind flow is increased or recession. Flow rate set points with a recession in the wind and the tall buildings can deal with the accumulation of air pollution on residents to stop. Also, despite these points can reduce the adverse environmental wind flow can be exploited.

If the distance between buildings is appropriate, the aerodynamic areas of each building to act individually and not interfere of wind flow in these areas, the impact of tall building on wind flow reaches minimum level. But if the distance between buildings is not appropriate the aerodynamic take effect, whatever set is denser and more compact, the behaviours of wind flow and the impact on the speed are required more complex analysis and apparent negative occurs (Masoud, 1997).

4 Effects of Tall Building in Environmental Impact

Rahbar (2002) reported that the important of environmental impact assessment on high density building in Tehran. In environmental impact assessment and high building density, considering the economic issue, social

and environmental balance it is also important. In this regard, optimal use of height in the form of implementation projects and high building density can grow in the direction of social, economic and environmental welfare of city residents is effective. This point is essential to mention that the projects of high building density having negative environmental impacts like other development projects. So it should be run with the integration of environmental considerations which are able to remove or reduce adverse effects as well as accelerate the positive effects on sustainable urban development shall provide (Rahbar, 2002).

5 Plants Role in Reducing Air Pollution

Vertical green spaces have been the perspective of design engineers. Experts believe that the role of vertical green spaces improve the urban landscape as well as reducing air pollution and noise pollution. Sharghi and Mohtashami reported that more than 800 roofs with green space has been counted in Germany and used as a field production of vegetables and edible fruits. Roof gardens help absorb heat and cause lower the temperature in summer and higher temperature in winter inside the building, consequently reducing the energy. In addition plants can balance temperature and humidity and also able to absorb toxic gases such as palm green leafy tillers in each hour absorb and remove 20 mg of ammonia in the air. Therefore, the role of environmental plants and green spaces including, release oxygen in the air, cooling hot air, shadows and air filtration (Sharghi and Mohtashami, 2007).

6 Skeptics

The lack of attention to environmental issues in terms of construction, resulting the occurrence of environmental pollution, especially air pollution in large cities of many countries like Iran. Therefore it is necessary to re-evaluate the legislation construction and stringent regulation in order to enforce these laws by relying on the core principles of environmental criteria.

7 Conclusions

Tall buildings affect on the air flow and pollution parameters is not distributed consequently the air pollution in cites are increasing. In addition to obstruction of visibility and confined spaces and also play a key role in changing winds direction. But regarding population growth of cities and land shortages and high prices make them inevitable. Other advantages of the towers can save energy and prevent pollution increases. Therefore, the appropriate principles and standards in height, properly locate them, the scale tall buildings, technical rules in making them, Immunization, Landscaping and creating green space around the towers, how exposure to towers for wind flow, appropriate distance to the other buildings, how to design them in terms of urban landscape must be considered to reduce the negative effects of tall buildings. In order to remove or reduce the environmental impact, create green spaces in floors and roofs of buildings are helpful to reduce environmental problems which is named environmentally friendly buildings and green architecture.

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