Effect of tall building cluster on Environmental Quality within and in adjacent areas. (A case of Pune City.)

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Abstract— Today, tall building is a phenomenon that the world, particularly large cities are facing. Tall buildings are constructed in order to exploit the land, but have negative effects on the environment and create new problems including increase in congestion, environmental pollution and cut city-dweller' access to fresh air and sunlight. However, due to ever increasing population and land shortage, tall buildings cannot be avoided. This paper investigates the relationship of tall buildings with environmental parameters, namely sunlight, air temperature and wind patterns. The study is done to understand the impact on air temperature and wind pattern due to a group of 12 floors (36m) tall buildings. The study also aims to verify that the impacts studied in other research paper, hold true for a buildings with 36m height. The study is carried out in Pune and two case studies are considered for the study. Readings are taken at identified points. It is found that there is no air temperature variation observed due to the shadows casted by the buildings. The wind speeds however vary within and in adjacent areas. The variations observed are not only because of the heights but also due to architectural form and layout of the project.

Index Terms— tall buildings, environmental parameters, wind speed, air temperature, impact of building height, architectural form, environmental quality.

1 INTRODUCTION

T all buildings may also be referred to as 'Multi Dwelling Unit' or 'Vertical cities'. Tall buildings have gained popularity throughout the world. They act as landmarks of the city; create a unique skyline and increase land use efficiency (K.Rangwala, Feb,2010). Tall buildings have the potential to decongest the urban sprawl on the ground and increase the urban density by housing higher number of people in lesser space (Ali, July 2012.). Tall buildings are constructed in order to exploit the land but have negative effects on the environment and create new problems including increase in congestion, environmental pollution, cut citizen access to fresh air and sunlight.

Although there is no precise definition that is universally accepted, various bodies have tried to define what 'high-rise 'means (Patil, February 2014):

- The New Shorter Oxford English Dictionary defines a high-rise as "a building having many stories".
- The International Conference on Fire Safety in high-rise Buildings defined a high-rise as "any structure where the height can have a serious impact on evacuation"
- The International Building Code (IBC 2000) and the Building Construction and Safety Code, NFPA 5000TM-2002,Paragraph 3.3.28.7 of the Life Safety Code®, 2006 edition, define high-rise buildings as buildings 75 feet or greater in height measured from the lowest level of fire department vehicle access to the floor of the highest occupiable story.
- The National Building Code of India (NBC), a tall building is one with four floors or more or a high-rise building is one 15 meters or more in height.
- The Pune Municipal Corporation (PMC) proposed that any building with a height of 36m (twelve floors) be categorized as a high rise.

2 DATA OF PUNE

2.1 Climatic Data of Pune

Pune is located 18°31′13°N and 73°51′24°E. The study for the project is carried out in October. The climatic data considered for the base case, therefore for the month of October. The daytime and nighttime temperature of Pune in October is 31.8°C and 18.8°C respectively. The relative humidity is 63.8%. The prominent wind direction, in October, in morning and evening is west. Wind speed in the morning is 7km/h and in the evening it is 19km/h. (IMD)

2.2 High rise structures in Pune

Pune is the seventh largest city in India and second largest city in Maharashtra after Mumbai (L. KantaKumar, 2011). The distance from Mumbai is 148 kms. Pune Municipal Corporation (PMC) jurisdiction extends up to an area of 243.84 sq. km. housing 2.54 million populace within 144 wards. (Pune Municipal Corporation. Pune and Growth direction. Comprehensive mobility plan for Pune city.) The population of Pune accounts for 35 percent of the total Urban population in Pune District and 60 percent of total PMR population. The PMC's population has grown from 1.57 million in 1991 to 2.54 million in 2001, and in the last decade experienced a compounded annual growth rate of 4.94 percent. (L. KantaKumar, 2011) In Pune a high-rise building is defined as classified in the National Building Code (NBC). Any built structure, which is 36m and above is classified as a high-rise. The development pattern of Pune indicates that though suburb areas like Hinjewadi developed as IT hub, have witnessed high rise structures, most of the city and its peripheral suburbs have developed tall structures for residential use (Sundrani).

2.3 Role of building on Climate

Tall buildings have an effect on the urban wind pattern. Urban wind is wind flowing over an open area, above and around