

Research Note

SITE SELECTION AND PHYSICAL PROPORTIONS IN TALL BUILDINGS

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ABSTRACT

The present paper investigates the impact of tall buildings on urban environment considering function, aesthetic, confinement and other aspects. The impacts of tall buildings considering aspects such as height, form, privacy and scale is also studied. This paper provides some criteria and proposals regarding proper site selection for tall building, and some regulations on construction of such buildings in Iran.

Keywords: Tall buildings, site selection, construction, urban landscape

1. INTRODUCTION

Tall buildings are among major components of today's cities. People interested in closely browsing tall buildings had to make a trip to New York or Chicago to see them, however, nowadays skyscrapers may be found in majority of metropolitan cities. Urban Communities are confronting new problems, due to the development of over populated large cities. These problems are basically the outcome of high-density and over-populated areas. Nowadays, tall buildings are inseparable components of large cities and the major factor for the changes in the profiles of cities. Although living in these buildings makes the life easy for the inhabitants from some points of view, however, these have also created some problems due to the high density and various social classes that ought to live together.

In this paper, recommendations are presented to improve the present criteria and deliberations topics relevant to site selection, physical proportions, urban perspective and urban space.

2. HISTORICAL TALL BUILDINGS

Before 19th century, tall buildings were limited to workshop spaces, pyramids, castles,

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mosques and churches, as the symbols of powers and faith. Other tall buildings included 3 and 4 storey house buildings where their first floor was allocated to commercial activities.

The dominant type of constructions were masonry. In ancient Rome, concrete materials were also used in buildings. The most famous concrete building of this period is the Pantheon Temple in Rome, Figure 1.



Figure 1. Pantheon temple in Rome

In the centre of old cities like Babylonia, Athens and Bysantium, many apartment buildings were built from adobe and timber, Figure 2.

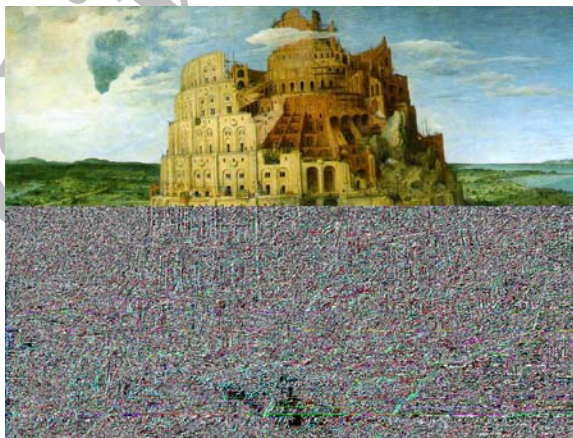


Figure 2. Tower of Babel

The traditional style of high building construction is still applied in the southern part of Saudi Arabia and Yemen and some 30-80 meter high buildings are built from merely adobe blocks, Figure 3.

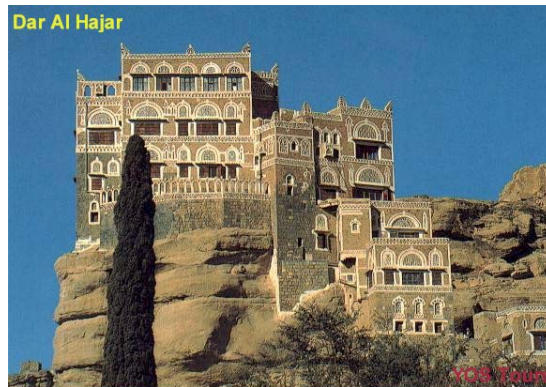


Figure 3. A house in Yemen

But in the middle age Asia, the prevalent building materials for tall buildings were bricks, stons and timbers skeleton, filled with masonry fillers.

By the beginning of 19th century, the steel skeleton substituted heavy masonry structures, in construction of tall buildings. Leaf of sufficient stability and flexibility in designing masonry buildings was a good reason for development of steel structures and simultaneous with the industrial revolution, a new type of construction was made prevalent.

According by, the first actual skyscraper was born in 1885:

The 10-storey life insurance company building in Chicago, whose whole weight was supported by its steel structure, Figure 4.

We should consider that the age of symbolic towers like Eiful Tower (Paris) and statue of Liberty (New York) as buildings, which are accessible trough their internal space, are much longer than this.



Figure 4. Insurance company building in Chicago

In Tehran's Azadi Square, this monument is a combination of Islamic and Sasanid architectural styles. Inaugurated on October 16th 1971, it was designed by Hossein Amanat. It is 45m high, the largest arch is 21m and the base is 63m wide. It is part of the Azadi cultural complex, an area of some 5 hectares. This cultural complex has several sections: The audio-visual hall, some art galleries and halls, the Diorama hall with its 12 chambers, a cinema and a library. It is also a meeting point for large demonstrations, Figure 5.

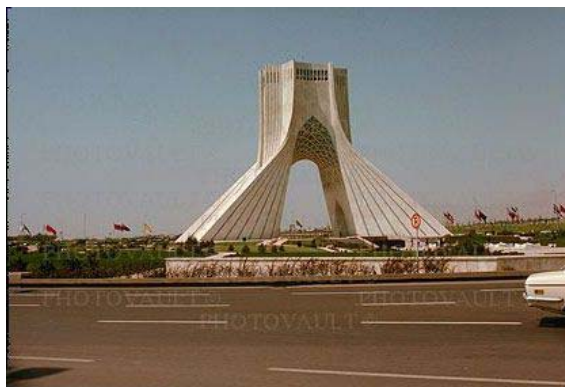


Figure 5. Tower of Azadi in Tehran

3. DEFINITION OF A TALL BUILDING

When talking about tall buildings, it may be assumed that people have similar attitudes about it, but this is not true. There is no unique approach in this respect not only among the public but also among expert. The following different approaches about tall buildings are:

- According to the regulations of Danish, German and some other European countries, the 72ft. (21.6m = 8 storeies buildings), having fire-fighting equipment, are known as tall buildings, Ref. [1].
- Definitions represented by the U.S. Council on tall buildings and urban settlement refers to tall buildings as these in which the height, influences the planning, construction and spaces application aspects of the building considerably without specifying the number of storags, Ref. [1].
- The national land planning committee in Switzerland refers to tall buildings are those buildings that are considerably higher than their adjacent buildings. This definition might seem logical but is not useful for applied research because in an urban texture with four densities (1story), 4 and 5 storeies buildings are assumed as tall buildings, Ref. [2].
- Urban planners and designers in Iran, refer to tall buildings as those with more than 10 storeies. Although this measure is not taken valid by economic, engineering and technical studies, but it is an attempt towards defining tall buildings. This definition is accompanied by a supplementary phraze, adding that the main feature of a tall

building is that full design of one of its faces reveals total number of storeies. In other words, an exhibition, factory and any other high-rise building is not covered by this definition.

Tehran is a large, metropolitan city and during the last 20 years the vertical growth in Tehran has been quite considerable. Like the other metropolitan areas in the world, residential, administrative and communal buildings are being built in town blocks. It is to be mentioned, what called a tall building in Tehran is a building consisting of 20-30 storeies with maximum height of 90 meters, while in industrial cities of the world, the medium number of storeies in high buildings is 100 storeies with the height of 400- 450 meters.

The construction of tall buildings in Iran goes back to 1970 and consists of two phases:

Phase 1, In this stage, the buildings are residential, being designed and built in a specific planning framework and by governmental, the buildings of this period have appropriate installations and sufficient facilities.

Phase 2, With the beginning of 1990, the turbulence period in construction of tall buildings in Tehran started, and the site selection and urban architectural designing of the tall buildings were decided upon by the owners were economic out put. For this specific reason, unsuitable location and lack of urban facilities like communal spaces, parkings and other services, have all created some major problems.

4. THE EFFECTS OF TALL BUILDINGS ON THE URBAN SPACE

The urban space as the space for social life of the people is influenced by the existence of tall buildings. Many experts emphasize on three main characteristics of the urban space, as follows:

- The space being confined.
- The aesthetic quality of the space.
- Social functions and activities being executed in that space, Ref. [8].

4.1 The space being confined

When space as a confined area should enjoy a quality that creates the most desirable visual effects for the uses of the space and therefore this confinement should be associated by human measures. The urban space in areas where the tall buildings are the most prevalent type, do not enjoy such human atmosphere and the narrow streets between these buildings destroy possible perspectives from inner spaces towards open spaces. This obstruction in the sight will create more tightness in the space in case the building is taller. The undesirable circumstances will be intensified by the shadows being made, lack of sufficient lighting and lack of sunlight.

For solving this problem, the following three remedial measures are recommended:

- Making openings among buildings by establishing open or green spaces along the length of the tower blocks, in the streets, Figure 6.

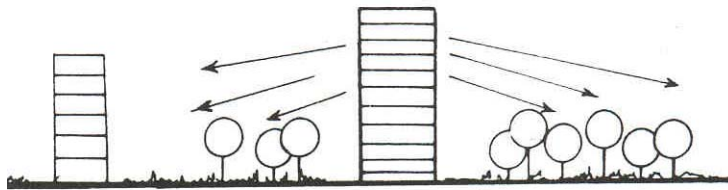


Figure 6. Open and green space among buildings

Recession in some buildings.

- Change of height towards its appropriation and adjacency of tall and short buildings, Figure 7.

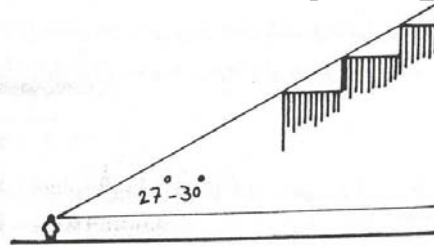


Figure 7. Change of height in adjacency buildings

4.2 The aesthetic quality of space

Tall buildings have a nice perspective from relatively long distances. However, they do not look beautiful from close destinations. In order to modify the aesthetic aspect of the urban space, when the tall buildings are the most prevalent types and to improve the physical and visual aspects of these spaces, the dimensional proportions should somehow be near to the human measures. In the other words, the heights of buildings in the main envelope should be reduced, Figure 8.

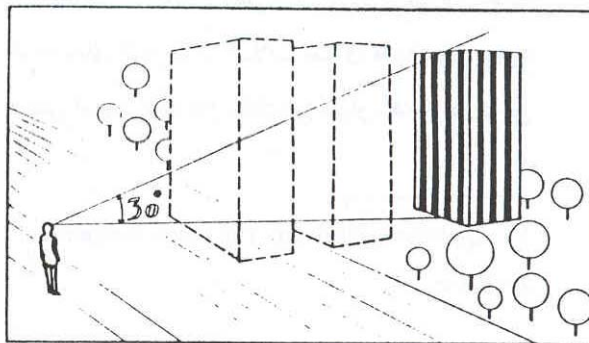


Figure 8. Optimum visual aspects

4.3 Social functions and activities in space

Social functions and activities in tall building are not successful, due to confinement, lack of sight and landscape perspective and thus smaller populations are attracted to such spaces. Therefore by recession of those buildings from the frontier envelope of urban space and construction of short buildings instead, the space would be more suitable and will enjoy the possibility of creating more and better visual perspectives.

As such, the tall buildings are located further away from the space surrounding so that their undersizable influences on the urban space will diminish.

5. EFFECT OF TALL BUILDINGS ON THE URBAN PERSPECTIVE

Adherents of tall buildings believe that one of the major advantages of these buildings is provision of urban perspective and sight from inside higher storeys of these buildings. But it should be remembered that the phenomenon of tall buildings has generally some undesirable impacts on the adjacent environment for example: Obstruction of view, shadowing, reducing the privacy of interior space by the adjacent buildings and influencing the green areas. All these effects which are mostly seen and felt in high-density areas and cause disorder in the urban space.

The above mentioned visual effects are related to some factors such as; height and relative height (scale), form of building, spatial privacy, decoration and type of facades. The compatibility of the building with the nearby environment (built and natural environment), In other words, single buildings have different effects on the environment, Ref. [7].

As an example, privacy is an important issue, which is considered in the following, Figure 9.

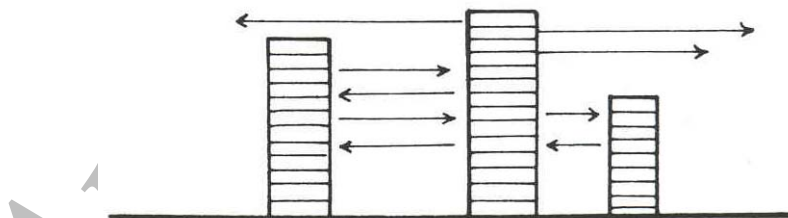


Figure 9. Height and relative height

5.1 Height and relative height

The height of the building due to its quantitative nature is a factor, which easily controlled due to the destination between the object and the observer, as well as the confinement of the building as 1 to 2, buildings higher than 3 storeys are out of the sight of observer. In other words, the observer would be able to use the building by moving his eyes or neck muscles. In fact, the scale is a factor that not only relates to the height but to every factor that relates to perception. Studies on the visual effects of tall buildings in Tehran show that the scale factor of tall buildings is a vital phenomenon in the quality of tall buildings. In other words,

being away from tall buildings reduces visual effects for the observer because of the sight angle extension.

It is generally concluded that the visual effects have direct relationship to the distance between the observed and the observer, and although the special distribution and combination of tall buildings.

As well as their architectural form are influential factors on the urban space and the city form, but the undersirable visual effects of tall buildings are intensified in the adjacent streets, conquered to far away areas. The reason is quite clear: When the observer is far from the tall building, he or she will see the relative height but when the observer is close to the tall building, the actual height is observed by them, Ref. [3].

5.2 Architectural form

The architectural form is one of the most influential factors on the total urban form. Tapered (Lengthy & Low-width) towers, block a considerable part of the background and dominate the city and the environment. While the stepped and sharp type of blocks, make the best combination with their adjacent environment and develop vest neutral spaces around, and leave the function of forming plane areas to shorter buildings.

6. SPACE PRIVACY

The space privacy can be defined as:

1. The hierarchy of privacy consists of privacy of private spaces (house) towards public space (town)

- The physical order of cities during the history of mankind has always had a hierarchy between public and private space. To access the private space, man has gradually moved from public spaces to the more private space.
- Although the privacy hierarchy is not followed accurately in the modern cities and the rule of hierarchy is disrupted many times, but the problem with tall buildings is more serious, from the privacy point of view. This occurs when is an urban area with certain identification and character, a tower block is built and a large population inhabit there. In a situation like this, the identification and nature of the area, which was allways associated by unique neighbourhood is changed and destroyed. In fact the so-called hierarchy is disrupted. This phenomenon like many other problems of tower blocks is the result of unsuitable adjacency of these buildings with ordinary buildings.

2. Overhang

Overhang means to have the ability overlooking the private space of neighbouring houses. In the hierarchical process of space privacy, the more private the space, the less overhanging probable in a way that in the quite private spaces, there should be no overhanging at all. The units located in tall buildings make this problem for adjacent shorter buildings. This phenomenon destroys the privacy of open spaces (yards), Figure 10.

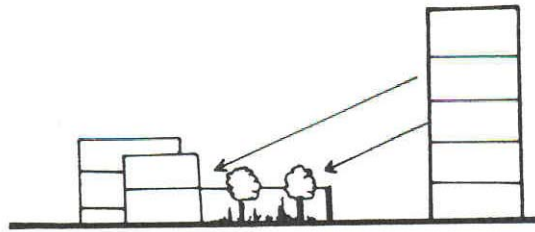


Figure 10. Open space in yards

7. URBAN LANDSCAPE

Urban landscape as the most important communication factor between the city and the observer, is the legible language of a city. This, is the symbol of the city nature, and has the most important visual impacts on the observers. Studying the effects of tall buildings on urban perspective, requires thinking about the scale, form and color.

Scale: Scale, as a tool for measuring and comparing, including many relationships. The human scale means the relationship between construction and human conditions, as well as a relationship between the building and the man's ability for data processing. What is meant by scale in a tower block, is the height and proportions independently or cumulatively.

Taking into account this measure, as well as the width of surrounding streets, buildings of more than 3 storeies in many streets are out of standard scale and thus do not stimulate. The human is feeling towards friendship, adjacency, protection and security by observing them, Ref. [7].

Form: Studying the form from the point of view of its visual influences is of great importance. The tall buildings attract the sight of observers, because of their height, but when the form of the building is also put forward, the effects would be more adverse.

The general forms of tall buildings are usually tall cubic rectangless due to structural, safety and simple construction. These shapes are able to provide from aesthetic point of view the slender types of tall buildings are more attractive compared to massive buildings.

Color: color is another vital factor in the urban perspective. The clean and fresh colors of buildings make the space more attractive, and on the contrary the old and untidy facades, reveal boredom, cold atmosphere and tiresome. Therefore selection of the color of tower blocks should be done on the basis of social culture and aesthetic aspects.

8. RECOMMENDATIONS FOR CONSTRUCTION OF TALL BUILDINGS IN IRAN

Living in high buildings is more than a requirement. It is a compulsion in the world, and requires it's own specific culture. But it should not be forgotten that construction of tall

buildings, even in areas that the master and comprehensive urban plans permit the existence of tall buildings, some major factors should be accurately considered:

- The neighbourhood rights.
- Psychological, physical, social and cultural needs of the residents.
- Width of the adjacent route.
- Physical specifications of the site.
- The per capitacion open space.

Therefore, provision of special regulations leads the tall buildings to an appropriate planning, designing and construction style.

Before 1998, there were no regulations for designing and construction of tall buildings, but in 1998, the regulations for tall buildings were issued by “ The High Council on Urban Planning and Architecture”. These regulations have been provided on the basis of earthquake risk, environmental limitations due to air polution and traffic problems, Ref. [9].

In this paper some of the major joints of these regulations are put forward:

1. To access to the same horizon, the buildings should be in linear order.
2. Tall building should be recessed not less than $\frac{1}{4}$ of the height of the building, from the middle of the street length.
3. In areas specified as (Town-Garden), the construction is permitted only in lands larger than 1000m, with the maximum built space equal to 15% of total land area, following the space pyramid rule.
4. For encouragement of people for construction of slender tall buildings, instead of massive buildings, the width of each block should not exceed 40m, or $\frac{1}{2}$ of the building height (6 storeies)
5. In semi-attached (squatted) buildings establishment of opening in all 4 sides of the building is permitted.
6. In spacings less than 5m, to the edge of the ground and on eastern, western dimention, the opening (windows) of the building should be located on a height more than 160cm and the fixed opening should have patterned glass.
7. Decorative facades in all the 4 sides of the buildings are compulsory and lateral facads should be the same as the main facade.

9. CONCLUDING REMARKS

The important factors to be remembered before any decision making is where and for whom the buildings are going to be constructed? What is the social class of residents? How is the family size and culture of the future inhabitants? Tall buildings with residential use should certainly be constructed in an urban district. For this reason, it is important to know the role of the building in the area, considering the socio-economic as well as the physical conditions. The sights that have to be seen by the residents, as well as the environmental

conditions of the area is also very important to be considered before planning. Therefore for planning tall buildings, preservation of neighbourhood and provision of required welfare and social facilities must be taken into account.

1. Communication and transportation routes, public facilities and infrastructure, conservation of natural and environmental resources, prediction of the population, beautification and development of desirable landscape, compatibility of adjacent buildings are both from the perspective are among the most important factors to be considered when selecting the site for a tower block.
2. Accessibility of relief and emergency services, e.g. fire fighting facilities to the building is another important factor, therefore:
 - 2.1. Tall buildings should not be located in narrow and blind areas, mountain skirts and high hills; the latter for creating sloping passages, Ref. [8].
 - 2.2. The tall building should have sufficient frontage in order to provide enough protection. When fire accidents occur in nearby blocks. At emergency times, the passages and routes must be so designed that the relief services would have an easy access to the building. The fire fighting services should be able to deploy at the least 8m far from the construction spaces.
3. Development of buildings that will lead to the formation of unpleasant, dense, and over-populated areas without sufficient social relationship should be avoided.
4. Tall buildings should not be located too close, or in an area consisting of ordinary buildings. This disrupts the hierarchical process of space privacy in quite private places (House) and semi-private places (alleys, blinds, etc...). Tall buildings should also be so designed that no overview would exist.
5. Tall buildings should have sufficient co-ordination, not only with their own components but also with adjacent installations, e.g. roads, public parkings, schools, shopping centers, libraries, parks and green areas. In other words, the complex should provide residents with all requirements.

According to the density and relative to the height of buildings, open spaces should be allocated. Therefore, the psychological security of the residents is provided, various functions would take place and in a small area, multi-storey buildings would be constructed. The open spaces are more vital for residential complexes, since children and old people, are a major part of inhabitants which need open spaces at their free time, Ref [5], Figure 11.

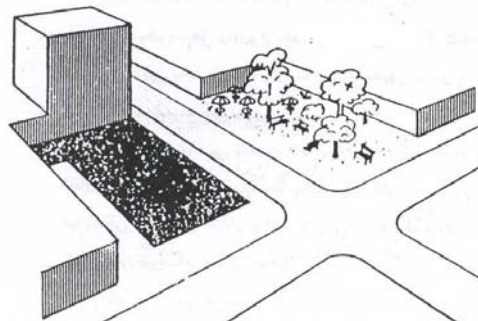


Figure 11. Open space in residential complex

The location (site) of the buildings should be selected and designed in such a manner that creates no obstacles for the view of residents of the surrounding buildings. The sunshine should not be obstructed either, Figure 12.

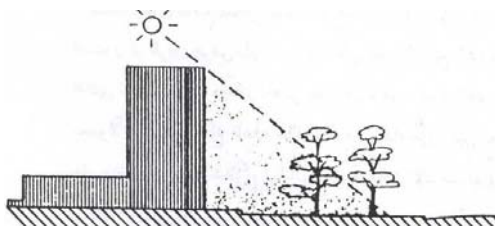


Figure 12. The sunshine and residents

1. Establishment of open spaces around the tower blocks may somehow contribute in abolishing the inhomogeneity of the urban texture. Also in order to prevent the change of scale and hence to establish harmony in the urban perspective, an open space should be allocated between tall and medium scale buildings.
2. Site locations of tall buildings in a city should be so decided such that they provide a scattered perspective.
3. Building blocks should be spaced at least 2-2.5 times the height of the highest building.
4. The facades should be designed in harmony with the city profile.
5. In order to prevent sun radiation obstruction especially in cold seasons, the tall buildings should be built separately. In case they are designed in rows, they should be spaced with the length of the winter shadow.
6. For every 30.48cm (1ft) height, 7.6cm (3inches) spacing between buildings is necessary and this spacing, in any case, should not be less than 2.5m (u.s. zonation regulations).

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