



# Assessing the visual impact of physical features of tall buildings: Height, top, color



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## ARTICLE INFO

### Article history:

Received 18 May 2015

Received in revised form 15 November 2015

Accepted 16 November 2015

Available online xxxx

### Keywords:

Visual impact assessment

Tall building

Physical features

Height

Top

Color

## ABSTRACT

Considering their features, tall building are of high importance in the view of a city. Among their important features are height, top and color which are also some of the most important factors in their effectiveness. In the present study we assessed the effectiveness of these physical features in the overall visual impact of these tall buildings and determined the significance of each of these features in the visual impact of the tall buildings. To this end, we examined a tall building in the largest city of Iran (Tehran). We altered the physical features (its height, top, and color) of the building, providing nine images for each variable element. Combining these pictures, 27 trio pictures were eventually prepared and assessed by a sample of 384 people randomly selected from the population of Tehran. Then, the data were analyzed. The results indicated that height was the most effective factor in the eyes of the citizens, followed by top and, then, color with the least effect among the three factors. In a more thorough analysis of the interactive effect of the factors on each other, we reached the conclusion that height can affect the visual impact of top and color but top can only affect the visual impact of color and slightly the impact of height. However, the effect of color on the other two factors was insignificant.

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## 1. Introduction

### 1.1. Visual impact assessment

Assessment of visual impact is a well-known method for assessing the visual impacts of the different elements of buildings in both built and natural environments. Although there is no agreement on the definition as well as implementation of such assessment, this method is widely accepted as appropriate for assessing visual impacts (Hernández et al., 2004). In fact, visual impact assessment is central to the assessment of environmental effects (The Landscape Institute, 2002) for creation and maintenance of a well-built environment, especially in an urban context. In urban planning, visual impact assessment is quite different from other approaches. In the studies conducted about perspective planning, the aim is to minimize the effects of urban development and hide as much as possible the built elements (Gimblett et al., 1987) so that, for example, the main objective in assessing the effects of constructing a bridge or a wind-farm is reduce the degree to which it can be seen.

In urban planning according to visual impact assessment, the aim is totally different. Visual impact assessment has both advantages and disadvantages. For instance, a historical monument such as a mosque or a

church can be positively foregrounded if two tall buildings are constructed on its both sides while these two buildings may also negatively affect its perspective and overshadow its beauty.

The assessment of the visual impact of the features used in the environment of a city has not received much attention. The experiments conducted into visual impacts have been more concerned with the view. In assessing the visual impact, precise and reliable evaluations are gaining increasing significance. In understanding the visual environment, quantitative studies are vital to objective assessment (Shang and Bishop, 2000).

Iverson (1985) discusses the concept of visual mass which is the outcome of the vertical and horizontal angles of an object to describe the visual aspect of an object from the standpoint of quantity. Magill (1990) attempted to define the thresholds of visual denotation, recognition and reaction using a set of projects and landscapes but failed to reach the quantitative thresholds due to problems associated with assessment and systematic alteration of the view and also the nature of the search engine used in the study. Hull and Bishop (1988) used pictures from transportation towers in three different environmental settings and found the visual impact threshold in the range of one kilometer.

Another study of visual thresholds was carried out by Shang and Bishop (2000) to determine the thresholds based on scale, shape and contrast in order to assess the impact of objects on a view. Using a linear Logit model to categorize the results, they used a series of collateral black and white pictures to seek people's perception of various objects, contrast levels and scales in different views. Another study was concerned with the use of logistic equations (Bishop, 2002) in relation to

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the thresholds regarding wind turbines. In order to determine the effect of a moving object (the rotating blades of the turbines), experiments were conducted on the perceived scales. The results were combined with the environmental dispersion in the color contrast that was seen. The issue of environmental dispersion or the effect of the mist is a factor that has been neglected in the studies done on visual sources (Larson, 1992; Latimer et al., 1981).

In another study, Hernández et al. (2004) analyzed buildings in rural settings through the GIS program in order to enhance the integration of this construction into the view and ultimately choose sites for new buildings. To examine the effect of the visual impact of the buildings, they did a survey with the following two questions: 1) How do you assess the buildings' integration into its surrounding? 2) Which factor of these buildings should be reformed or altered in order for them to have a better integration into its surroundings more beautifully?

Concerning the assessment of the visual impact, further individual projects have been so far conducted among which the following can be mentioned: Torres et al. (2009a); Ladenburg (2009) and Bishop and Miller (2007). Torres et al. (2009a) studied the esthetic aspects of the integration of wind fields into the surrounding landscape in order to develop an objective factor using pictures and interviews. This approach was developed in a study by Torres et al. (2009b) on solar plants who suggested a factor based on four criteria, namely, view, color, fractal and harmony between stable and moving panels. This was further expanded in order to enhance quantifiability of esthetic factors. Ladenburg (2009) examined the observer's background experiences by means of a new technology and general topography to expand his analysis. Bishop and Miller (2007) reported some parameters in their visual evaluations which included distance, contrast and movement. In this approach, pictures and images simulated by computers and interviews were utilized. The above-mentioned methods can be helpful in the assessment of the visual impact of single technologies on a local scale.

Rodrigues et al. (2010) developed a method for assessing visual impact which can be used to measure the effectiveness of renewable technologies on a bigger scale. They suggested a number of factors (visually-affected area, visually-affected populated, visually-affected travel time) for this purpose.

With regard to visual impact, a number of studies have been conducted into surface mining extraction (Dentoni and Massacci, 2007, Dentoni and Massacci, 2013). In a study (Dentoni and Massacci, 2007) by two groups of students from the University of Calgary, a good correlation was established between the level of visual impact and real visual perception, and in a recent study by Dentoni and Massacci (2013), the visual impact of surface mining extractions was measured by two methods, one defined by the EC decision (Commission Decision, 2002) and the other which was based on the assessment of the level of visual impact (LVI) developed by Dentoni and Massacci (2013).

Reviewing the experimental literature on the subject shows that in the field of urban spaces and the effects of their elements on individuals, no systematic study has been carried out. Tall buildings have a very important impact on a city's infrastructure and environmental quality. In regard to environmental quality, their impact on the view of a metropolitan area is very significant (Heath et al., 2000). Tall buildings are among the most important factors of city settings which have a considerable amount of visual impact on citizens because of their special physical and skeletal features each of which can play a significant role in the visual impact of these buildings.

### 1.2. Tall buildings

As to their visual aspect in an urban context, tall buildings can be approached in three different ways:

- as group in the skyline;
- their physical appearance;
- and their visibility in urban views.

In terms of the collective effect of tall buildings in the skyline, there is a small number of studies in the literature that examine tall buildings as a group in the skyline of cities. These studies address the skyline and its relationship with the background items such as mountains (Stamps, 2002a) as well as the effect of tall buildings in the skyline on natural views and corridors (Zacharias, 1999). Stamps et al. (2005) investigate the juxtaposition of tall buildings from a public point of view with an emphasis on the skyline, height changes, and rotation in the general shape of the roofs of tall buildings.

With regard to the physical appearance of tall buildings, Heath et al. (2000) study the complexity of the silhouette of buildings and their façade and evaluate the public perception of the complexity of silhouette and façade by means of questionnaire.

The last aspect, which is dealt with in the present study, is related to the visibility of tall buildings in urban views. In this regard, Short (2007) examines the effect of selected tall buildings or those which are built on old and historical urban textures in four British cities. The results suggest that the impact of tall buildings on these textures depend on the local circumstances. As with viewshed and viewshed maps which are part of GIS, research deals with the elements that, in a binary manner, can be either seen or not seen from different urban views. As a solution to this problem, Rød and van der Meer (2009) present a formula for visibility that calculates the visibility of each spot and, at the same time, takes into account the effect of buildings and trees. The formula results in the fact that, in addition to absolute visibility or invisibility of a tall building, the degree of visibility, i.e. the visible portion of the height from each spot, can also be determined.

A successful instance of the assessment of the visual impact of individual tall buildings is related to a tower that was never built in Netherlands. In a research study, the visual impact as well as the visibility of Belle Tower was calculated by means of viewshed and a map was prepared that showed the visual impact of this tower on different urban scopes (Lörzing, 2011). The results of the study prevented the construction of this tower.

Another type of this research is to study tall buildings as a cluster and their visibility in the skyline. Van der Hoeven and Nijhuis (2011) study the visibility and the visual impact of the tall buildings of Rotterdam by means of GIS.

Relevant factors in the assessment of the visual impact of tall buildings are physical and environment-related factors. The most important factors in this regard are background environment, weather conditions, contrast in viewshed, ambient light, appearance of the surrounding environment, and physical factors such as materials, color, height, top, texture, the ratio of transparent surface to the mass of the building, and the manner of connection to the ground.

## 2. Research questions

The main goal of this paper is to analyze the physical impact of tall buildings on the visual impact of these buildings in the eyes of city dwellers.

The main question of this article is as follows: which one of these features has the most significant effect on the visual impact of tall buildings? And how is the interaction among these factors with respect to their visual features?

These questions help us to determine the most crucial criteria for designing and constructing tall buildings. For example, if a designer wants to increase or decrease the visual impact of a building, which features should he or she consider most?

## 3. Method

### 3.1. Case study

This case study examines a tall building in Tehran. This building lies in the third district of Tehran, in Africa Boulevard, as an individual tall building along the street. It was one of the few buildings that possessed all the

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