

The effect of high-rise buildings on the pedestrian thermal comfort in urban areas, based on the Penn index (Case study: Hamadan Jihad Axis from Bu Ali Sina Square to Jihad Square)

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Expanded Abstract

Introduction

In relation with buildings behavior against wind, because of being three dimensional, buildings allow airflow around lateral sides same as their top. The wind (air) diverts into three sides following contact on impermeable building, top of roof, lower face to wind edge and sides of the building. The most of main flow is transferred to bottom of wall face to wind which causes to increase of small vertical flows back to the wind created by around short buildings and makes extreme vertical flow near the ground.

If the building to have sharp corners, the increasing wind flow separates on top and sides of building. In result, a suction wind is created for roof, sides and back to the wind wall, from the main perturbation which tall buildings are creating, could refer to downward wind stormy flows and towards street that, in cold climates, this phenomenon could have unpleasant effect on residents. The proportion of width, height and direct of radiation influence greatly on thermal comfort level on the street level and enclosure rate of passage becomes determinant factor. The shadowing in streets, most important, is dependent on main geometry of internal space of street and could be considered function of time. Location and geometric proportions of the street in terms of quality. Generally, tall buildings could be described based on two indices, i.e. height limit determination and settlement location. The city of Hamedan which is the center of Hamedan province, was located on foothill of Alvand. The height of these mountains reduce towards city until reach on a plain. These mountains enclosed Hamedan and only from northeast side, have open and free span. The Hamedan- Tehran road passes through this span. The altitude of Hamedan is 1747 m.

The easternmost and westernmost points of Hamedan are 49', 27" and 48', 20" away from Greenwich meridian respectively and was located in median of 34', 35" to 35' northern latitude. In view of topography. Hamedan, from south and south west leads to heights of Zagros mountain range such as Alvand with 3574 m altitude which was located between Tuysarkan and 18 km from Hamedan that come back to third era of geology and as move toward north, the level of heights is reduced and in north parts of city, reach to plains with average 1550 altitude which these figures show height difference about 2020 m. the general slape of the area which Hamedan is located on it is toward north and only in parts of north east, the general slope changes toward west.

In the present project, the meteorology data from both weather stations of airport and Nojeh has been used because of not providing data by Ekbatan dam station.

Based on it, it became possible to recognize using type in whole unit and is appreciable the utilization type of passages in different hours of day and various parts of the road. The conducted interpretations and land use map. Are determinant of commercial use dominance in road- edge of BoAli with regard to other uses.

The review of available activities on Jihad road, has introduced this road as an active commercial road with 90 percent activity, this fact is justifiable with regard to location of Jihad road along the old bazaar of Hamedan. The most rent through this road is related to retail operations and in functional category of sale and services related to durable consumer goods, this type of activities, consists 46.6 percent of total available activities on road. The reason for selection of this road is the presence of tall buildings of trade and administrative ones (Arian and

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Zagross towers). The methodology of research is of description analytical one. In the present research, we conducted library research on Persian and English resources and also field review following recognition of influential factors on comfort through these resources and determination of research frame in next step in order to designate the heights of total buildings was specified. Also, the latest weather data of Hamedan was prepared from provinces meteorology organization (temperature, wind speed...).

Following review the height data of buildings, total of these data has become three-dimensional in AutoCAD software. With regard to placement position. Construction masses were reviewed through the year, and time gap to analysis were considered as the middle of urdibehesht, Mordad, Aban and Bahman months and also in daily reviews, was based on 10 Am and 16 pm. After that, high-rise buildings were recognized with regard to components of high-rise buildings. Then, data related to temperature and shadow mask and air flow one were analyzed in Ecatect and Air flow Design softwares respectively and the results of this research was obtained.

Conclusion) in order to review and analysis of thermal situation of urban context. The context comfort criterion has been used. For this reason, by transferring maximum and minimum means of any month on vertical axis and windstorm speed in the horizontal context of total year months, the thermal situation of Arian and Zagros towers has been reviewed with regard to comfort region of shadow and sun. Based on provided case, could recognize that through context comfort index could benefit from provided guidance in order to evaluation of thermal situation of one location, determination of its eating demands and in result, designation of confrontation politics in order to control and promotion of thermal comfort conditions. For example, if it is inferred from comfort index such, the weather of an urban space will be felt comfortable because of presence of shadow and sensible wind flow in summer, it means that, should utilize the solutions related to provision of shadow and increasing wind speed and more ventilation of space and if it is inferred, the weather of desired urban space will be felt comfortable because of presence of sun and lack of sensible windflow in winter, it means that, designer should utilize design guidances in terms of provision of more sun and reducing wind flow in order to provide space thermal comfort. With regard to that, Hamedan is located in cold and mountainous climate, it firstly was seemed, the presence of tall buildings would disturb the comfort of passengers. But, following review the high-rise building in terms of thermal comfort on BuAli road, could conclude that, any of these buildings provide different comfort conditions for passengers in various environmental situation and couldn't considers high-rise buildings generally, unsuitable for comfort of passengers.

Therefore, Could propose solutions in order to promote climatic conditions as follows.

- 1) In order to prevent turbulent wind flow on the passage as much as possible should avoid construction of tall buildings over than 25 m around urban spaces.
- 2) in the case of construction of tall buildings over than 25 m around urban spaces, in order to divert the created wind pressure by these buildings on the passage, the surface toward urban space of these building should have projections and depressions.
- 3) In order to reduce the created downward wind pressure around the tall buildings inside the urban spaces, it is recommended that, tall buildings to have circular or poly gonal form.
- 4) in order to reduce the effect of downward vortex and consequently, promotion of comfort conditions against the winter wind, the tall building should have circular and aerodynamic comers and it's narrow front be toward winter wind and/ or be angular relative to wind.
- 5) In order to prevent from intensification of created turbulent flows by tall buildings around or inside the urban spaces, the concave front shouldn't be used for the front face to winter wind.
- 6) In order to prevent from intensification of the effect of corner around tall buildings, it is recommended that. Tall buildings with wide plates don't be directed against dominant wind.
- 7) In case of locating passage beside the tall buildings, in order to protect passage surface from created corner effect by tall buildings, the passage should be preserved with windbreak.
- 8) In order to reduce underside winds in urban spaces in cold season for buildings higher than adjacent ones face to wind, they should be designed as stepping and retreat form Retreat should be started from 6-10 m above street level.

Keywords: Thermal comfort, Tall Buildings, Hamadan Jihad Axis.