

Experimental Measurement of Pressure Coefficients around Various Opening of Typical Wind Catchers

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Abstract

Wind catchers or what is called Baud-Girs in Persian language was a main component of old buildings in central region of Iran. Its function was to capture wind from external air stream and induce it into the building in order to provide natural ventilation and passive cooling. It is normally a tall structure mounted over the building roof and has openings around its faces for capturing wind from any direction and guiding it into the building to provide thermal comfort for occupants during the summer time. In the cold seasons, the openings were closed to isolate the Baud-Gir and occupant regions. In this article, a 1:100 scale model of Lariha's house Baud-Gir with a rectangular cross section is employed in a laboratory wind tunnel and pressure coefficients were measured around all openings for various values of approaching air velocity and air incident angle. The experiments are also conducted when the Baud-Gir with adjoining courtyard is placed in the wake of upstream objects, resembling neighboring buildings. Two types of upstream objects are selected with different heights. For an isolated Baud-Gir model and for zero incident angle, It is shown that the pressure coefficients in the front or projected surface are positive and become negative downward. The same behavior is observed for other velocities. However, the pressure coefficient distributions for the back face are all negative and almost uniform, indicating a large low pressure region around this face. The effect of increasing the air incident angle is to lower the pressure coefficients along the front face. For the zero incident angle, the shading effects of upstream building was to both reducing and flattening of the pressure distribution in the projected surface of the model. For the taller upstream object, the pressure coefficients in the projected surface become uniform and negative, indicating that the model Baud-Gir is totally under the wake of the upstream building and therefore incapable of doing its duty properly.

Keywords: Baud-Gir; Passive cooling; Pressure coefficient

1. Introduction

In arid central regions of Iran due to the hot summer time, the old buildings used to have special architectural features and components in order to protect the occupants from the harsh outdoor environment. Wind catchers or what is called Baud-Girs in Persian language was a main component of buildings in this region. Its function was to capture wind from external air stream and induce it into the building and courtyard in order to provide natural ventilation and passive cooling. Baud-Gir is normally a tall structure mounted over the building roof and has openings around its faces for capturing wind from any direction and guiding it into the building to provide thermal comfort for occupants during the hot summer