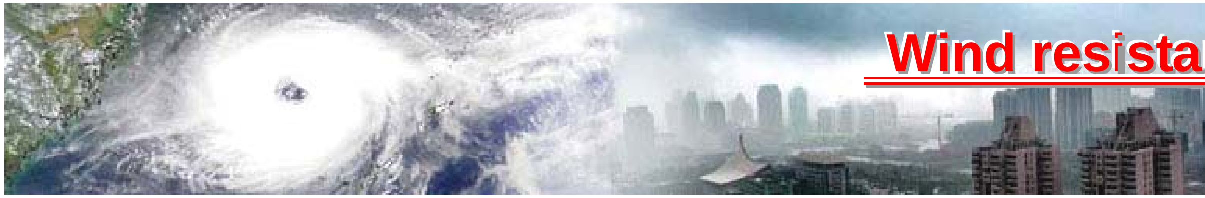

Wind resistant design of structures

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1 Introduction

1.1 Various structures

It can be classified based on the height of the structure as Low-rise building, Middle-rise building and High-rise building. With regard to the span of the structure Small-span structures, Middle-span structures and Large-span structures can be designated. If being classified based on materials there will be steel structures, wooden structures, stone structures, blocks structures, and reinforced concrete structures. If being classified on the basis of the dimension of the structure there will be one-dimension structure; plane structures; space structures. For etc.

1.2 Wind effects on structures

Static effect: Mean wind component can act on some structures as a static load.

Dynamic effect: Mean wind component can also cause dynamic effect on structures or members such as buffeting and galloping of bridges. Fluctuating wind component gives rise to wind-induced vibration. Vibration or resonant response can also excited by vortex shedding, along wind can also lead to cross wind vibration. Further research work on random vibration analysis and parametric vibration analysis is needed.

Fig. 1 Membrane broken

Fig. 2 Collapse of frame

Fig. 3 Advertisement board

Fig. 4 Highway entrance roof

1.3 Wind-induced disasters

From a structural engineer's viewpoint wind-induced disaster can be classified into three types. One is the strength failure of frames (Collapse of the whole structure) and members (Local failure). Second is instability phenomenon occurs for example aeroelastic instability. Third is for deformation control of structure serviceability design. There are other types of failure such as fatigue of structural member, cladding materials strength failure, roof tiles blew away and membrane broken by strong wind.

2 Wind loading estimation for structure design

(1) Horizontal wind loads on structural frames

Horizontal wind loads are calculated from Equation (1)

$$W_f = q_H C_f G_f A \tag{1}$$

Where W_f is wind load, q_H is design velocity pressure, C_f is wind force coefficient, G_f gust effect factor, A is projected area at height Z.

(2) Roof wind loads for structural frames

For roof wind loads the internal gust effect factor should be included.

(3) Wind loads for components/cladding

Wind load is important for claddings or components.

(4) Additional procedures

Some special structures need to be designed with consideration of across vibration analysis, torsional vibration analysis and vortex shedding induced vibration.

3 Envision

Structural frames, members or claddings with wind resistant design based on code of practice broken in strong wind or special wind climates are still not rare in the world. Further research work is needed.