Engineered cyclone shelter for disaster prevention

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Engineered Cyclone Shelter for Disaster Prevention

Prévention des dégâts de cyclones par abris adéquats

Ingenieurmässig konstruierte Schutzbauten gegen Wirbelstürme

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SUMMARY
The paper describes a technical study on the behaviour of cyclone shelter models in the wind tunnel. Two different types of shelter have been considered. The superior performance of these shelters has been highlighted.

RÉSUMÉ
L'article présente une étude technique comparative sur le comportement de deux modèles d'abris prévus contre les cyclones et soumis à des essais en soufflerie. Il met en relief les résistances performantes de telles constructions.

ZUSAMMENFASSUNG
Zwei Typen von Schutzbauten gegen Wirbelstürme wurden vergleichenden Tests in einem Windtunnel unterzogen. Die vorliegende technische Studie bespricht die überragende Widerstandsfähigkeit dieser Konstruktionen.

1. GENERAL

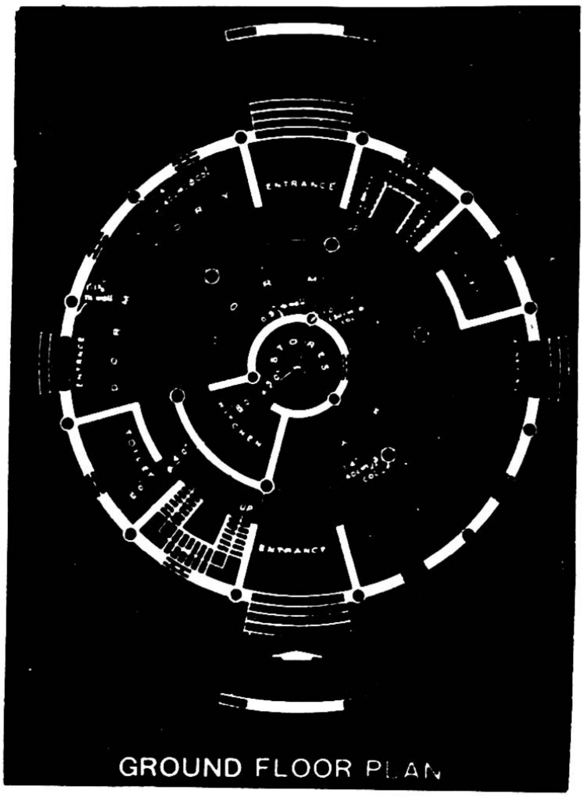
Safeguarding life and property from the destructive effects of cyclones is a major worldwide problem. India being a peninsula with 5000 Km coast, is often threatend by this natural hazard. Every year the cyclones damage crops, distroy human lives, cattle and structures. Safe design of structures against wind require a reasonably accurate estimate of loads as well as a knowledge of structural behaviour when subjected to these loads. As a part of disaster prevention plan, a program of building cyclone shelters for housing the people who are rendered homeless has been taken up at sites shown in Fig.1.

Fig.1 Distribution of Cyclone shelters

2. TYPE OF STRUCTURES

The cyclone shelter(Type I) as shown in Fig.2, is of circular plan form so that it offers least resistance to wind force from any dorection. The diameter of the shelter is 15 metres. The height is 7.5 metres. It has two floors. The shelters are erected on a raised ground to prevent flood waters reaching the floor.

In another type design, the bath and washing were provided outside the main floor area as shown in Fig.3.In this type, the symmetry of the structure is broken by the inclusion of a projection over a 60° plan form. The second type (typeII) of shelter has also been studied.



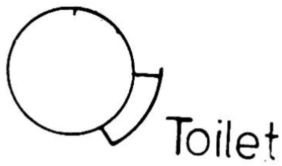


Fig.3 Type II shelter

Fig.2 Type I shelter

3. MODEL TESTING

Model test in a wind tunnel has been conducted to estimate the variation of pressures along the walls and roofs of the cyclone shelters and thus find the aerodynamic forces and moments. The subsonic wind tunnel situated at Anna University was used for testing. The shape of the cyclone shelter has been faithfully reproduced. The windows, ventilators and openings have been scaled down to a model scale of 1/50. Since the Reynolds Number of the structure and the model are well over 10^6, it is reasonable to assume that the force coefficients of the prototype and model are directly related. Structural similarity between the model and prototype is not attempted as only a static model was tested. Monometers and pitot tubes have been used to measure the wind pressure and wind speed respectively. A typical model is shown in Fig.4.

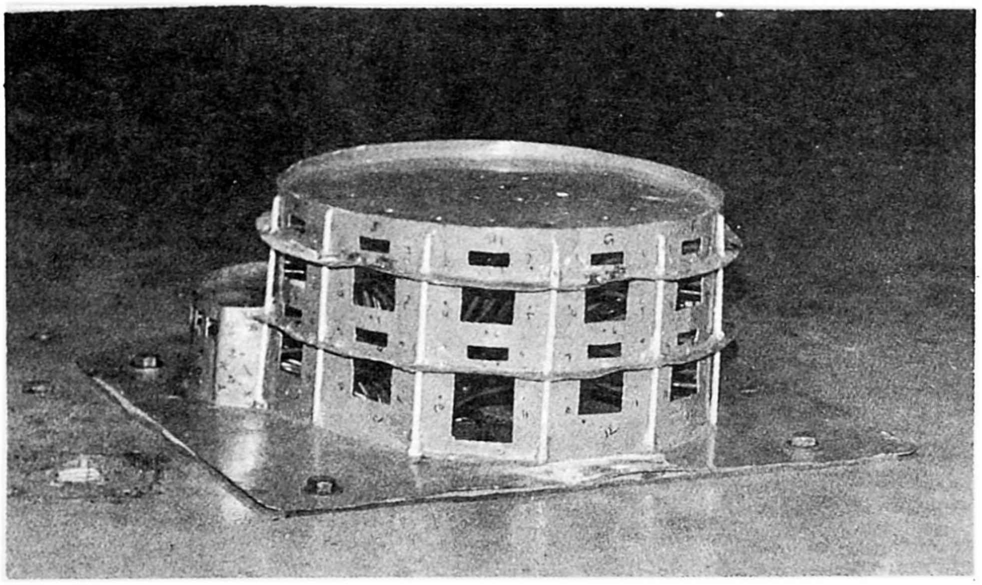


Fig.4 A typical model

Type II was tested for nine different postions as shown in Fig.5.

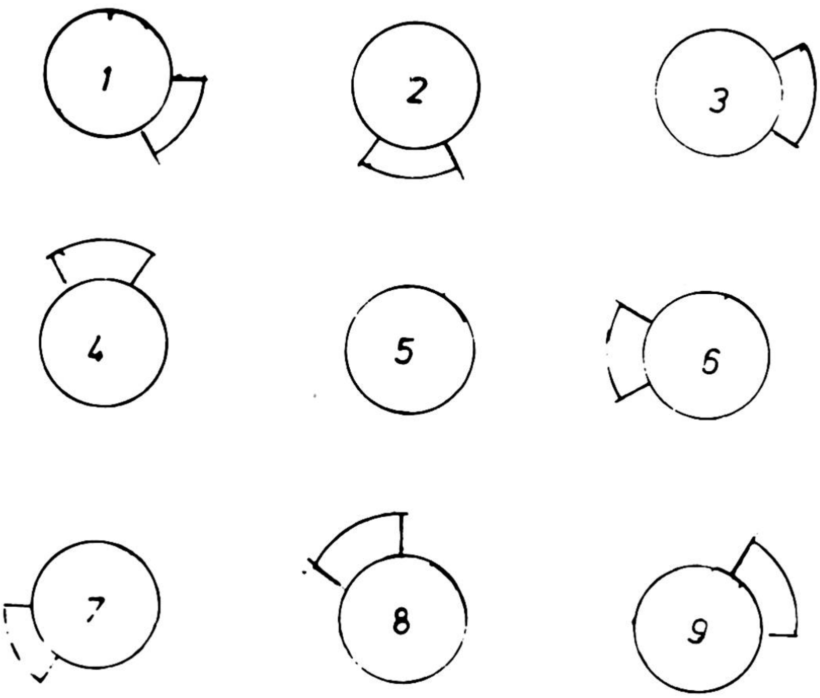


Fig.5 Positions during testing

4. WIND LOADS ON THE STRUCTURE

From the model tests pressure coefficient C_L at different wind speeds for various positions of models and different permiabilities were obtained. The flow lines obtained during testing of both type I and Type II models are shown in Fig.6 and Fig. 7 respectively.

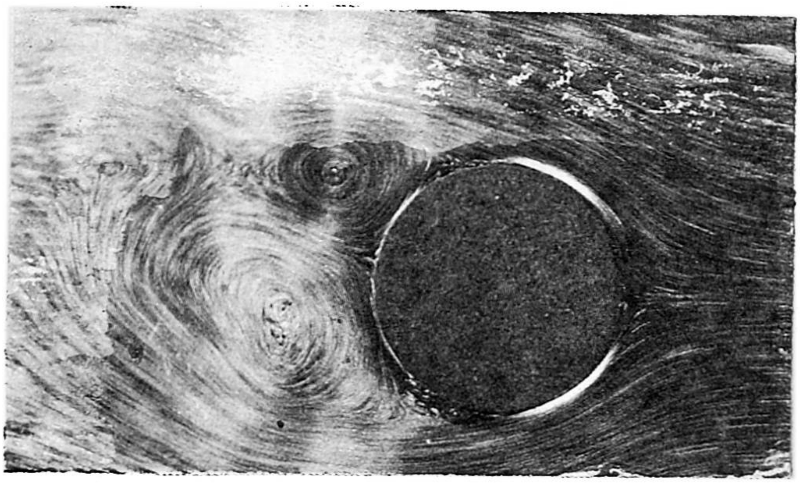


Fig.6 Flow lines for type I

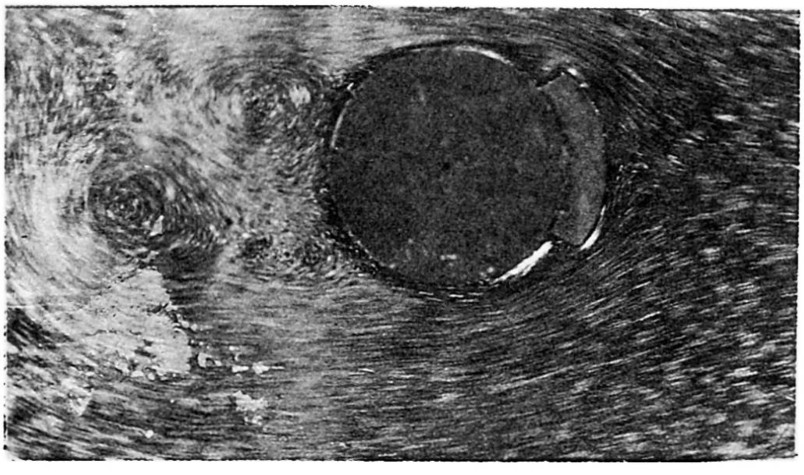


Fig.7 Flow lines for type II

5. CONCLUSION

The calculations show that present structure put up along the coast of India are safe from usual cyclones that form in Bay of Bangal for wind speeds upto 150 Kmph.

Type II has to resist three times the overturning moment as Type I. though both are safe.

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