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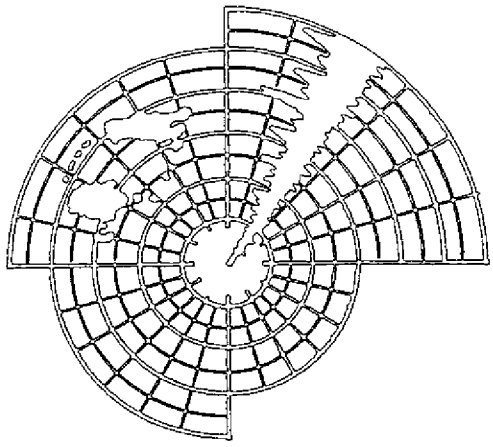


The A.B.C. of Cyclone Rehabilitation

A manual demonstrating the principles of Anchorage, Bracing and Continuity to provide structural integrity for rehabilitation of buildings damaged by cyclonic forces.

K. J. Macks, AM

Under Contract No. 107.001.4 with the Architecture for Education Unit, UNESCO Paris

UNESCO

TERMS OF REFERENCE

The brief, given by the Architecture for Education Unit to the consultant, required to:

"Prepare a document containing technical guidelines for the repair and rehabilitation of existing educational buildings following cyclone damage, including guidelines for the reinforcement of the buildings to withstand cyclone forces. The guidelines shall be presented in a manner to be easily comprehended by people at community/local level with little technical knowledge. The document shall contain the following elements.

- a short description of the problem
- methodologies for the rehabilitation and reinforcement of various types of buildings/ construction systems
- typical examples from various countries illustrating the above problems and methodologies.

The document, tentatively entitled "ABC of Cyclone Rehabilitation" shall be amply illustrated: with drawings, photographs, sketches, etc."

SYNOPSIS

Part One: Collecting the Facts

Sections 1 – 6

Part One describes the problem and collects and collates the factual information needed before the solutions are initiated

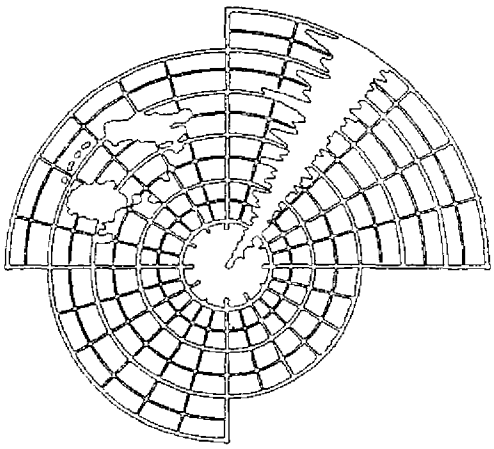
Section One introduces comments on the brief and objectives, UNESCO's contributions, the current state of knowledge, and recommends general areas where responsible actions can be taken to further existing education in this field. Section Two describes cyclones and their characteristics, lists extreme events and identifies the countries that are affected by the damaging forces of cyclones. Section Three describes the types of damages caused by cyclones and offers a case study. Section Four comments on the different methods of construction in different countries and offers typical examples in sketch form showing influences by region, climate and culture on building systems. Section Five introduces the reader to an understanding of wind loads, a commentary on wind force effects and common terminology, a procedure to determine wind loads, supported by tables determining wind loads from the British Wind Code for various parts of a building. It defines load areas and schedules the capacity of various fixings able to resist wind forces. Section Six contains evaluation methods and offers a sample maintenance inspection checklist system.

Part Two: Resolving the Problem

Sections 7 – 11

Part Two indicates the performance characteristics of common failures and lists which details to avoid and offers suggestions and typical details that can be used in the rehabilitation, together with conclusions and easy to read checklists.

Section Seven describes the principal factors that affect the performance of buildings under wind force conditions, offers practical comments and schedules examples of typical failures in construction systems. Section Eight models the loads on a simple three classroom building. Section Nine offers solutions to the problem of rehabilitation of existing damaged buildings and identifies key factors in "hold down" techniques for wall and roof systems, the importance of bracing and the value of good fixing to doors and windows. Section Ten contains case studies of five building projects which were rehabilitated and reinforced in 1972 and survive today. Section Eleven contains the conclusions and recommendations and identifies the responsibilities to be considered in the design of the buildings to resist cyclone forces. It contains useful checklists for designers and inspectors



PREFACE

UNESCO has, over the last decade, paid considerable attention to the provision of information and guidelines for the mitigation of damages to educational buildings caused by cyclonic wind forces

Cyclone, hurricane or typhoon forces (which all are the same physical phenomenon), cause maximum damages to the natural and built environment between latitudes 7° and 30° north and south of the equator and affect approximately 30% – 40% of the world's population.

UNESCO's aid to countries has been achieved by sending missions to countries affected by cyclones, followed up by the provision of sub-regional training courses headed by selected expert consultants.

They have encouraged personnel from affected countries to broaden their experience and to liaise with neighbouring countries with common concerns.

In addition, UNESCO has prepared technical documents and responded to requests for assistance by sending technical experts to attend and conduct National Training Courses and in funding of construction of model schools in selected areas.

Whilst the regions affected by cyclones have been identified and the effects of the cyclone damages recorded, the task of providing adequate technical information to mitigate the damages has not reached a stage where it is universally adopted and extended through the building society.

The need for further education is an on-going task as many of the teachers need teaching in order to pass on the upgraded technology to the new ever growing generations.

There is a need to record and evaluate the quantum of information presently available on the subject of wind forces and methods of construction that resist these forces and to endorse the best of this knowledge to member countries.

These methods, which may vary from country to country, will consist of many variations needed to cope with the different materials and construction techniques used in the different cyclone regions but they should all recognise the ABC of cyclone construction— Anchorage, Bracing and Continuity.

Whilst new schools should be built to new state of the art techniques, the stock of existing school buildings may not be fully resistant to wind forces.

This study will examine this question of existing buildings and their level of vulnerability, especially where wind damages have occurred.

It will offer advice on the evaluation of these buildings and their construction details and will suggest how to decide whether or not they can be recycled or demolished.

In offering design solutions, wind forces will be discussed in some detail to enable the reader to understand the sheer size of the forces involved which is often much greater than the uninitiated would estimate.

Examples will attempt to relate these forces to the human scale for easier acceptance.

The study, it is hoped, will encourage architects, engineers, government officials, builders, tradesmen and others into the preparation and study of similar manuals in different countries for the guidance of designers, Ministries of Education and community leaders

These models, at village level, should also serve as examples of methods that others can use in their homes and other constructions.

About the Author

The author, architect K J Macks AM, LFRAIA, Hon.D.Eng, ASTC (Arch.) has extensive experience in design of buildings in cyclone regions. Mr. Macks is Principal of the architectural firm of Macks and Robinson Pty Ltd of Townsville, latitude 19°S, Australia, since 1963, whose buildings have yet to lose a roof. Since 1985 he has acted as an expert consultant from time to time for the UNESCO Principal Regional Office for Asia and the Pacific (Bangkok) and has been involved in many missions, national and sub-regional training courses, and has presented many papers and articles on the subject

He has, for UNESCO, produced wind loading tables for Bangladesh and Vietnam (published to member countries), and has carried out advisory missions for UNESCO in China. He was co-author of an acclaimed Wind Code Design Manual for Sri Lanka in 1979.

He is Management Committee Chairman of the Cyclone Testing Station at James Cook University of North Queensland, Townsville, Australia, and is also Advisory Committee Chairman of the Australian Institute of Tropical Architecture, a UNESCO chair at James Cook University.

The opinions in this article are his and not necessarily those of UNESCO.

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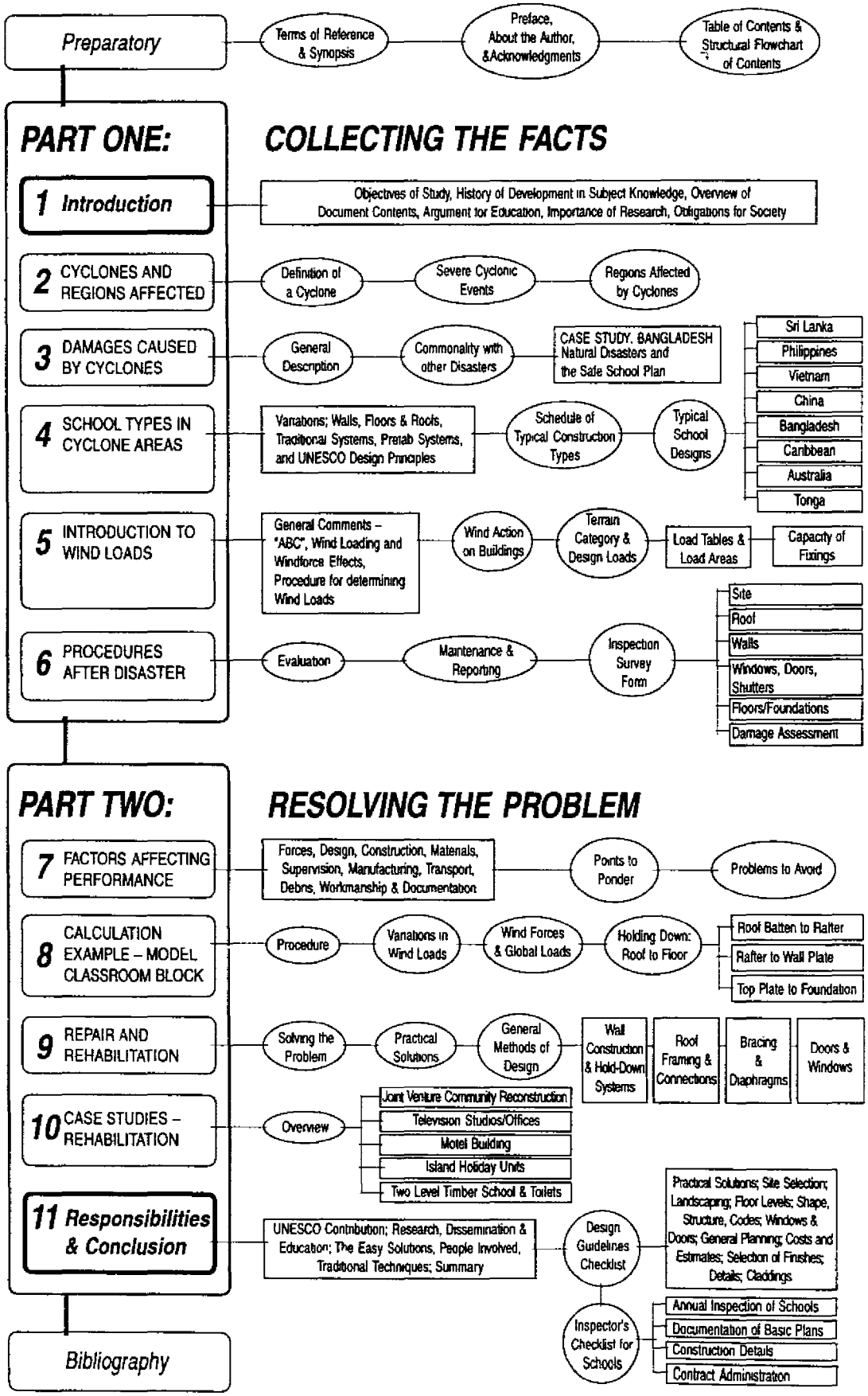
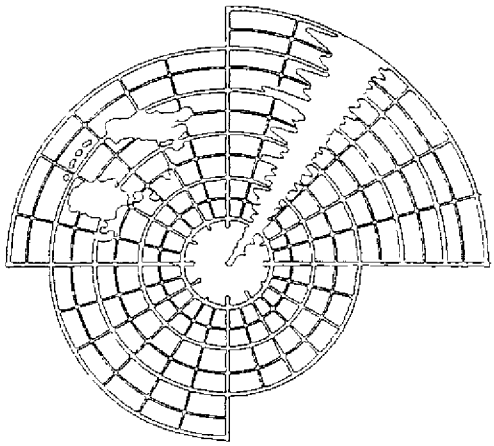
STRUCTURAL FLOWCHART OF CONTENTS





CONTENTS