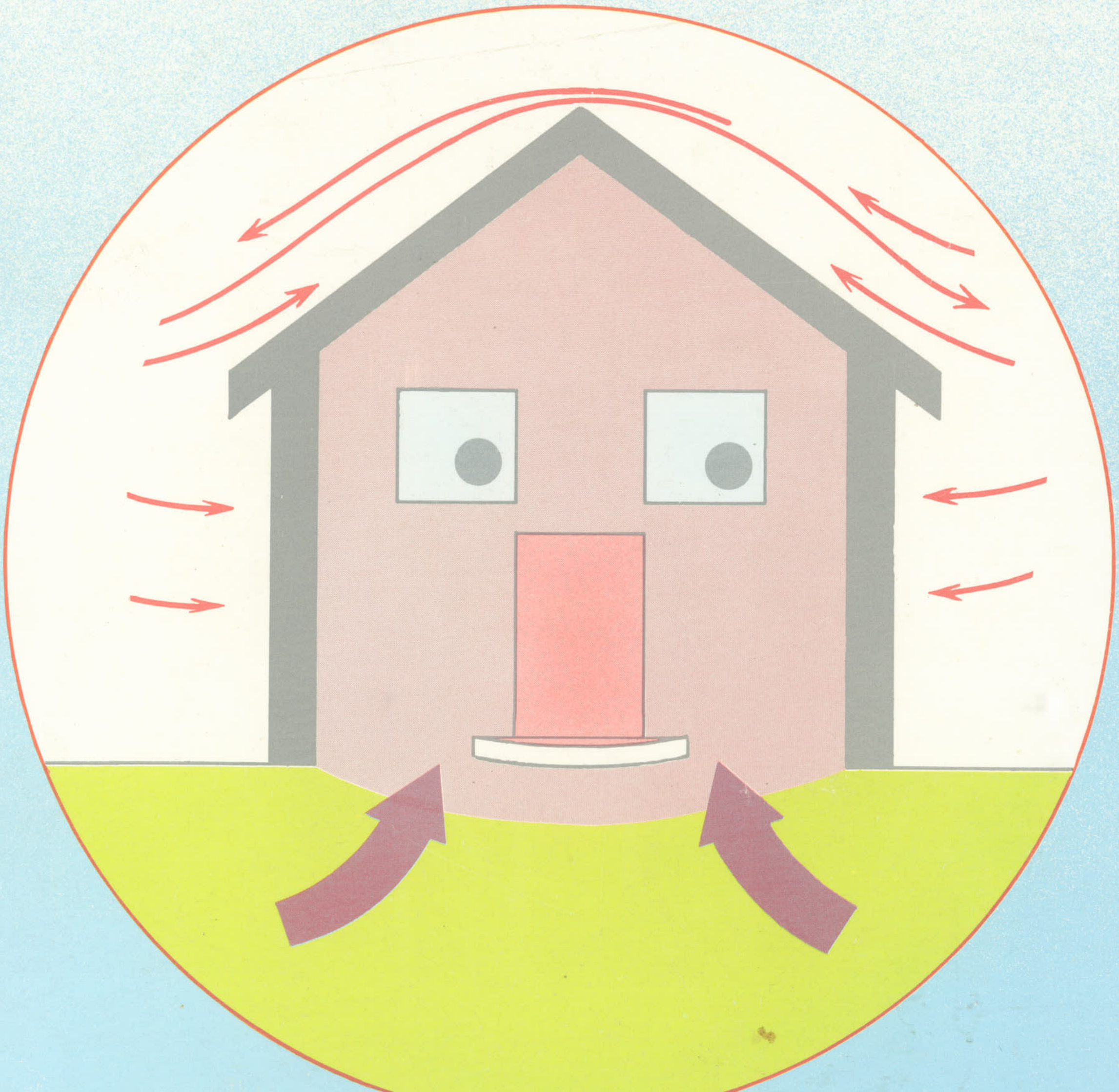
HOME BUILDING MANUAL



Vanuatu

HOME BUILDING MANUAL

VANUATU

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PREFACE

Houses have been built around the world for hundreds of years without the benefit of any formal structural analysis and design. It was only in the recent past, from about 20 years ago that many began to question the wisdom of this practice. Recurring cases of death and large-scale destruction of houses through natural disasters in many parts of the world began to demand urgent remedial action. There were two main reasons for the absence of any engineering design input for houses. Firstly, a house is an extremely complex structural system, far more complex than many other engineering structures. Secondly, the cost of performing the detailed structural design of an individual house is very substantial when compared to the rest of the cost.

The structural complexity of houses has been partially overcome by experimental research. Such research has progressively established a number of increasingly reliable mathematical relationships between the forces (such as from cyclonic winds) acting on a house and the resulting effect on various components of the house. Further, it is possible to spread the cost of detailed structural design by performing the design for a variety of systems in terms of a limited number of modular sub-systems. We have taken advantage of these to produce this Manual.

Similar manuals have been prepared by other ingenious individuals and organisations in the recent past. Well-known examples are the very popular TRADAC Manuals in Queensland, Australia and the New Zealand Standard for masonry buildings not requiring specific design. In the Pacific region the first such manual was the Fiji Pine Code. We have gratefully borrowed ideas and diagrams from these pioneers. However this Manual has for the first time in a single publication included extensive details of conventional timber and masonry construction, prepared to cater to the specific environmental constraints of Vanuatu. The Manual fully conforms to the structural requirements of the National Building Code of Vanuatu.

In preparing the Manual we have tried to retain as far as possible the current local building practices. We have also tried to ensure that the use of the Manual does not contribute to any material increase in the cost of houses. Where there is any marginal increase it will be substantially offset by an increase in the safety and durability of the house. Further, we have attempted to include some details for low-cost houses. We have not been able to give the structural details for vernacular forms of construction. Some useful advice is available in this connection in "Disaster-Resistant Construction for Traditional Bush Houses" prepared by Solomon Islands Architect Mr Charles Boyle and published by the Australian Overseas Disaster Response Organisation.

A manual such as this can only be useful within certain stated limitations. This one is no exception. However within these limitations it should be possible to use the Manual for the construction of safe, architecturally pleasing houses to reasonable levels of individual requirements.

Kris Ayyar

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Suva : September 1990

ACKNOWLEDGEMENT

We have received substantial assistance from many sources in the preparation of this Manual. For obvious reasons we are unable to acknowledge the help given by each of them. The following persons and the organisations they represent provided outstanding help.

IN VANUATU

George Pakoa, First Secretary Ministry of Finance and Housing, and Chairman Building Advisory Committee and David Blaikie, Physical Planning Adviser and Secretary of the Committee made all the arrangements for the Committee meetings and detailed discussions. The members of the Committee actively encouraged us for the early completion of the Manual.

David Wood, Forest Utilisation Officer Department of Forestry gave us details of the properties of building timber produced in Vanuatu. He and Toby Whitworth, Small scale Sawmill Programme Manager were readily available for discussions.

Tony Lee, Principal Design Engineer and Martin Quaile, Chief Architect Public Works Department, and Peter Fagan, Engineer National Housing Corporation showed me details of typical houses in Port Vila, Santo and Tanna. Further, Peter espoused the cause of housing for the poor very strongly.

Andre François, Managing Director SELB, Geoffrey Feast, Resident Partner James Ferrie & Partners, and Ray Saunders, Structural Engineer Cameron McNamara were available for detailed discussions on the Manual.

IN FIJI

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IN AUSTRALIA

Neville Keating, Executive Director Timber Research and Development Advisory Council of Queensland (TRADAC) granted us permission for the use of several diagrams from their TRADAC Manuals.

Colin MacKenzie, Engineer TRADAC who had pioneered their Manuals advised us on many issues.

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Cathy Bennett, Keith Joyce and Greg Brooke, Secretaries, Development Assistance in Suva and their staff gave detailed day-to-day support and took us safely across several stretches of bureaucractic quicksand.

The Manual is essentially the result of exceptionally dedicated team work by the Project staff. Rohit Singh, Deputy Project Manager did the bulk of the technical work and led the team with single minded persistence. He was ably assisted in the production of the Manual by Hem Rao, Project Engineer who, apart from doing other work, did all the calculations for masonry construction. For a short time we also had the assistance of Isikeli Tuituku as a Project Engineer. The highly demanding task of laying out and editing the multitude of tables and diagrams was handled by Saras Prasad and Raveena Dutt for a good part of the time and Sashi Lata Pal for the full duration of the Project. Wati Ledua and Michael Arun Shankar performed all the administrative tasks including the production of several hundreds of bound copies of the Manual when it was in draft form.

Kris Ayyar

INTRODUCTION

Objective

The Manual is intended for the use of para-professionals and professionals in the building industry for the speedy design of simple houses which conforms to the structural requirements of the National Building Code. Approval authorities may use the Manual for the confirmation of the adequacy of the structural details given in the proposals submitted to them. The use of the Manual is subject to the limitations stated in Clauses A1 and C1 and C2.

What is in the Manual?

The Manual gives simple directions in Section A to determine the design windspeed applicable to any specific location of a house. The applicable earthquake zones are shown in a map of Vanuatu. A knowledge of the design windspeed and of the earthquake zone number are necessary to use the Manual. Section B gives several tables and diagrams based on the design windspeed and/or the earthquake zone factor, to facilitate the design of timber framed houses and parts of houses. Section C does the same for masonry houses. Section D gives foundation details for both timber and masonry houses. Typical construction details are shown in Section E. Possible modes of failure of houses during cyclones or earthquakes are illustrated in Section F. These diagrams also explain how to prevent such damage.

Miscellaneous details such as for the design of window shutters, retaining walls, lean-to houses, window glass selection, etc. are given in Section G. Section H gives some details for the construction of low-cost houses. The room sizes in this section are kept small enough to avoid the use of purlins for the roof. The small sizes also permit the use of partially grouted masonry walls in all earthquake zones and for design windspeeds of up to 55 m/s. The Manual ends with an Appendix giving the design criteria used, typical calculations and details of timber classifications.

How to use the Manual?

The several tables and diagrams might seem quite daunting to begin with. Simple flow charts are included in the Manual to guide the new user.

Knowledge of the following basic information is necessary in order to use the Manual :

(i) The stress grades of the available timber. Where this information is not provided by the supplier or stamped on the pieces of timber an assessment of the stress grade can be made by using table B2. However in order to use this table sufficiently reliable information on the density of the timber must be available.

(ii) A knowledge of the joint groups of different timber species used is required for designing bracing and/or tie-down systems. There is no simple relationship between joint groups and other basic properties such as density. Therefore where the joint group is not known advice must be sought from the Department of Forestry or a conservative estimate made.

Further, the user must gain practical familiarity with the simple rules given for determining the design windspeed. Once a few practical examples are tackled this should be relatively easy.

Where manufacturers of proprietary products are able to give test-based information on their products it may be used with the appropriate tables in the Manual.

Format of the Manual

The Manual has been prepared with plenty of diagrams and tables and a minimum of text. These should convey the intent far more easily than words.

ERRATA

We have discovered a few mistakes in the Manual after it was printed. Please correct all affected pages as follows:

The following corrections apply to the Clauses, Figures or Tables as given below:

1	CLAUSE A4.4	"FIFURE A4.4 (a) should read "FIGURE A4.4(a)
2	TABLE 4 - 57	For a stress grade of F8, stud spacing 900 mm and stud height of 2700 mm, the size of member in the table should be 100 x 75 instead of 100 x 57. For a stress grade of F17, stud spacing 900 mm and stud height of 3000 mm, the size of member in the table should be 100 x 75 instead of 100 x 57.

3 TABLES 10 - 1 - 49, 10 - 1 - 53, 10 - 1 - 57 For a stress grade of F8, rafter spacing 1500 mm and rafter span of 4800 mm, the size of member in the table should be 220 x 45 instead of 220 x 54

4	CLAUSE B9.3.3 Line 2	"sotrey" to read "storey"
5	FIGURE B9.4.3 (A), (B), (C)	"weatherbard" should read "weatherboard"
	FIGURE B9.4.3 (A)	"ELE ENTS" should read "ELEMENTS"
6	FIGURES B9.4.3 (A - D)	Values in the table are given in kilonewtons (kN)
7	TABLE B10.5.4	For the aspect ratio given, the value for roof pitch should be 10° instead of 25°
8	TABLE B10.6.3	for aspect ratio 0.5 the value for roof pitch should be = 10° for aspect ratio 1.0 the value for roof pitch should be = 15°
9	TABLE D3.3	heading TABLE D3.3 SIZE OF REINFORCED CONCRETE AND MASONRYPILES
	should be	TABLE D3.3 SIZE OF REINFORCED CONCRETE AND MASONRY PILES
10	FIGURE E2.3	notes (ii) "....... smaller than 100 x 50" should read "....... smaller than 50 x 100"
11	FIGURE E3.7	the size of Top plate should be 50 x 100 instead of 100 x 50
12	FIGURE E3.14	"Continuous .... Tables C3.6 or B ..." should read "Continuous .... Tables C3.6A or C3.6B........."
13	CLAUSE G3, B part 5	"Tie beam to footing .... B10.9(D)(II)" should read "Tie post to footing....... B10.9(D)(III)".
14	CLAUSE H7.4	The last sentence should read "...... the bedroom must be of timber or masonry construction."