NEPAL NATIONAL BUILDING CODE

NBC 111 : 1994

STEEL

His Majesty's Government of Nepal
Ministry of Physical Planning and Works
Department of Urban Development and Building Construction
Babar Mahal, Kathmandu, NEPAL
2060

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This publication represents a standard of good practice and therefore takes the form of recommendations. Compliance with it does not confer immunity from relevant legal requirements, including bylaws

श्री ५ को सरकार (मन्त्रिपरिषद्) को मिति २०६०।४।१२ को निर्णयानुसार स्वीकृत

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Preface

This Nepal Standard was prepared during 1993 as part of a project to prepare a draft National Building Code for Nepal.

In 1988 the Ministry of Housing and Physical Planning (MHPP), conscious of the growing needs of Nepal's urban and shelter sectors, requested technical assistance from the United Nations Development Programme and their executing agency, United Nations Centre for Human Settlements (UNCHS).

A programme of Policy and Technical Support was set up within the Ministry (UNDP Project NEP/88/054) and a number of activities have been undertaken within this framework.

The 1988 earthquake in Nepal, and the resulting deaths and damage to both housing and schools, again drew attention to the need for changes and improvement in current building construction and design methods.

Until now, Nepal has not had any regulations or documents of its own setting out either requirements or good practice for achieving satisfactory strength in buildings.

In late 1991 the MHPP and UNCHS requested proposals for the development of such regulations and documents from international organisations in response to terms of reference prepared by a panel of experts.

This document has been prepared by the subcontractor's team working within the Department of Building, the team including members of the Department and the MHPP. As part of the proposed management and implementation strategy, it has been prepared so as to conform with the general presentation requirements of the Nepal Bureau of Standards and Metrology.

The subproject has been undertaken under the aegis of an Advisory Panel to the MHPP.

The Advisory Panel consisted of :

Mr. UB Malla, Joint Secretary, MHPP	**Chairman**
Director General, Department of Building (Mr. LR Upadhyay)	**Member**
Mr. AR Pant, Under Secretary, MHPP	**Member**
Director General, Department of Mines & Geology (Mr. PL Shrestha)	**Member**
Director General, Nepal Bureau of Standards & Metrology (Mr. PB Manandhar)	**Member**
Dean, Institute of Engineering, Tribhuvan University (Dr. SB Mathe)	**Member**
Project Chief, Earthquake Areas Rehabilitation & Reconstruction Project	**Member**
President, Nepal Engineers Association	**Member**
Law Officer, MHPP (Mr. RB Dange)	**Member**
Representative, Society of Consulting Architectural & Engineering Firms (SCAEF)	**Member**

Representative, Society of Nepalese Architects (SONA) Member
Deputy Director General, Department of Building,
(Mr. JP Pradhan) Member-Secretary

The Subcontractor was BECA WORLEY INTERNATIONAL CONSULTANTS LTD. of New Zealand in conjunction with subconsultants who included :

Golder Associates Ltd., Canada
SILT Consultants P. Ltd., Nepal
TAEC Consult (P.) Ltd., Nepal
Urban Regional Research, USA

Principal inputs to this standard came from :

Mr. RD Jury, BECA

Revisions and Updated to this code came from :

Mr. Purna P. Kadariya, DG, DUDBC
Mr. Kishore Thapa, DDG, DUDBC
Mr. Mani Ratna Tuladhar, Sr. DIV. Engineer, DUDBC
Mr. Jyoti Prasad Pradhan, Ex.DG, DOB
Mr. Bhubaneswor Lal Shrestha, Ex. DDG, DOB
Mr. Uttam Shrestha, Architect, Architects' Module Pvt. Ltd.
Mr. Manohar Lal Rajbhandhari, Sr. Structural Engineer, Mr Associates
Mr. Amrit Man Tuladhar, Civil Engineer, DUDBC

TABLE OF CONTENTS

0 Foreword

This Nepal Standard comprises the Indian Code IS 800-1984 Code of practice for General Construction in Steel (Second Revision) with amendments as set out herein. These amendments have been necessary to ensure compatibility with the Nepal Standard- Seismic Design of Buildings in Nepal.

References to Indian material codes have been left unaltered until such time as appropriate Nepal Standards are developed.

Extensive use of the New Zealand Standard NZS 3404 : 1977 Code for Design of Steel Structures have been made in the preparation of Section 13.

1 Scope

NEPAL AMENDMENTS TO IS 800 – 1984

Section 0 *Delete clauses* **0.1** through to **0.5** inclusively

Section 1 - General

1.1.1 *Delete* **1.1.1** and *substitute :*

1.1.1 This standard applies to general construction in steel. This standard does not apply to the following structures and materials:

(a) bridges
(b) cranes
(c) tanks
(d) transmission towers
(e) materials less than 3 mm thick
(f) cold-formed light gauge sections

1.1.2 *Replace* "code" with "standard"

1.1.3 *Replace* "code" with "standard"

Replace IS 875-1964 with NBC 103-2050 and NBC 104-2050

1.1.4 *Add* new clause :

1.1.4 In this standard the word "shall" indicates a requirement that must be adopted in order to comply with the Standard.

1.2 *Replace* "code" with "standard".

1.3 *Replace* "code" with "standard".

1.4 Replace IS 456-1976 with NBC 110-2050
Replace IS 1893-1975 with NBC 105-2050

1.5 *Delete* **1.5** and substitute :

1.5 Units and Conversion Factors – The SI system of units is applicable to this standard.

1.7 Delete 1.7 and substitute :

1.7 Design and supervision

1.7.1 Design

The design of a structure or part of a structure to which this standard is applied shall be the responsibility of a engineer (referred herein as Design Engineer or his representative) experienced in the design of such structures.

1.7.2 Supervisor

All stages of construction of a structure or part of a structure to which the standard is applied shall be adequately supervised to ensure that all requirements of the design are satisfied in the completed structure.
Supervision shall be the responsibility of either :

(a) the Design Engineer, or
(b) an engineer experienced in such supervision.

Section 2 – Materials

2.1 *Replace* "code" with "standard"

2.1.2 *Add* new clause :

2.1.2 The maximum value of f_y to be used in application of this Standard shall be 450 MPa.

Section 3 – General Design Requirements

3.1.1.1 Replace "IS 875 – 1964" with NBC 103-2050 and NBC 104-2050.

3.1.1.4 Replace "IS 1893 – 1975" with NBC 105-2050 and NBC 104-2050.

3.2.1 8th line, *replace* "code" with "standard".

3.2.2 4th line, *replace* "India" with "Nepal".

[Will require preparation of maps for Nepal to replace those in Appendix A]

3.4.2.2 *Delete* **3.4.2.2** and substitute :

3.4.2.2 Wind loads and earthquake loads need not be assumed to act simultaneously.

3.4.5 9th line, *replace* "code" with "standard".

3.4.6 9th line, *replace* "code" with "standard".

3.9.2.1 *Delete* and *substitute* :

3.9.2.1 Wind and Earthquake Loads

(a) *Structural steel and steel castings* – when the effect of wind or earthquake load is taken in to account, the permissible stresses specified may be increased by not more than 33.3 percent except for the permissible shear stresses which shall not be exceeded by more than 25 percent. The values of the expressions given in Section 7 shall not exceed 1.33.

(b) Rivets and bolts – when the effect of wind or earthquake load is taken in to account, the permissible stresses specified may be increased by not more than 25 percent.

3.11 *Delete* and substitute :

3.11.1 Earthquake forces

The design of structures to resist earthquakes shall be in accordance with the Nepal Standard – Seismic Design of Buildings in Nepal and Section 13 of this Standard.

3.11.2 Lateral Restraint

In buildings where high-speed traveling cranes are supported by the structure, or where a building or structure is otherwise subjected to vibration or sway, triangulated bracing, rigid portal systems or other suitable systems shall be provided to reduce vibration or sway to suitable minimum.

3.11.3 Foundations

The foundations of a building or other structure shall be designed to provide the lateral rigidity and strength assumed in the design of the superstructure and to transfer the lateral forces to the soil.

3.12.1.2 *Correct* spelling of "repair".

Add a new clause :

3.12.1.3 Eccentric Loading

Where a load is applied eccentrically on a flange of a supporting steel beam, the beam and its connections shall be designed for torsion; unless the beam is encased in concrete and reinforced in combination with an adjoining floor slab in such a way as to present the beam from deforming torsionally.

3.13.2 *Add* an additional clause :

3.12.2.3 Deflection Limits

Under the application of the earthquake design forces the deflections shall not exceed the limits given in NBC 105-2050, Seismic Design of Buildings in Nepal.

3.14 *Add* additional clause :

3.14.4 Separate Structures

All parts of a structure separated by expansion joints shall be considered as separate structures for the purposes of providing lateral restraint to resist earthquake frames.

Section 10 Add after the heading a sentence reading :

This Section shall apply only to secondary (i.e. non seismic resisting) members.

Section 12 After Section 12 add a new section :

Section 13 - Provisions for Seismic Design

13.1 Ductile Moment-Resisting Frames

13.1.1 General

Moment-resisting frames for which a value of $K = 1.0$ is to be used in the assessment of the earthquake design forces shall be detailed in accordance with 13.1.

13.1.2 Steels

Steel with a specified minimum yield stress not exceeding 360 MPa shall be used. Cold-formed sections which have not been normalised shall not be used.

13.1.3 Plastic Hinge Formation in Beams

For the purposes of 13.1, plastic hinges in beams shall be assumed to form be used. Cold-formed sections which have not been normalised shall not be used.

13.1.4 Lateral Restraint

Positions of beams where plastic hangs may form during inelastic displacements of the frame, and all columns shall comply with 9.2.10. The remaining portions of the beams shall comply with 6.6.

13.1.5 Effective Lengths of Columns and Stability

The effective length used in determining the slenderness ratio of a loaded column shall be based on the assumption that the frame depends on its own bending stiffness to provide the lateral stability of the structure, as specified in 5.2.2, even if bracing or shear walls are provided elsewhere in the structure.

13.1.6 Plastic Hinge Formation and Column Strength

Multi-storey frames should be designed so as to ensure that plastic hinge formation in the columns is minimised. To this end, it is suggested that in frames over five storeys in height columns should be proportioned for actions calculated in accordance with the Nepal Standard – Seismic Design of Buildings in Nepal, taking K = 1.25. This will provide some reserve in the columns but will not necessarily prevent some plastic hinging in the columns.

13.1.7 Connections

Each beam connected to a column shall be designed either to resist 1.25 times the design actions in the connected members, or the actions resulting from applications of design forces calculated using K = 4, whichever is less. Clause 9.2.1 shall apply, except that stiffeners shall extend over the full depth between flanges and shall be butt-welded to both flanges.

13.1.8 Concrete Encasement of Steel Frames

The effects of concrete-encasement and floor slabs on frame stiffness shall be considered.

13.1.9 Column Splices

Splices in columns should be located within the middle half of the storey height.

13.1.10 Weld Testing

All tension butt-welds between members shall be non-destructively tested unless the rejection rate of completed welds is consistently less than 5 percent, in which case the testing rate may be reduced to 25 percent of the welds.

13.2 Ductile Braced Frames

13.2.1 General

Diagonally-braced frames for which a value of $K = 2.0$ or a steel bracing member for which a value of $K = 1.0$ is to be used in the assessment of the earthquake design forces shall be detailed in accordance with 13.2.

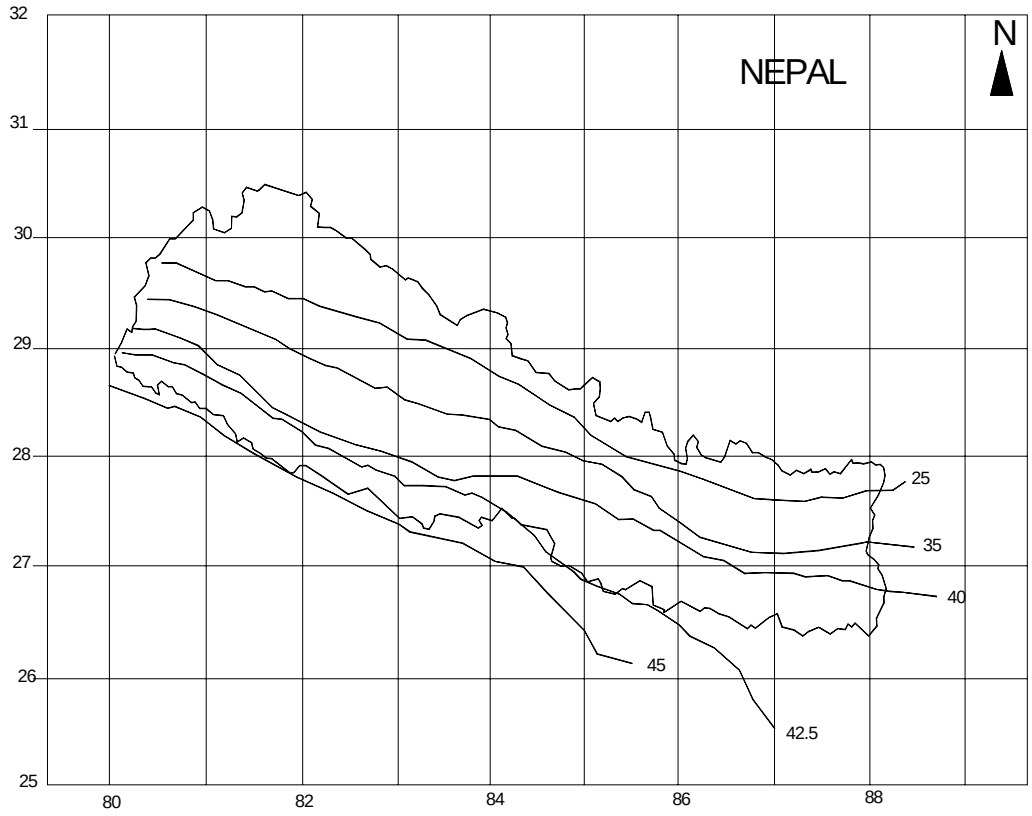
13.2.2 Relative Strengths

Members, connections and foundations should be designed and proportioned so that the bracing reaches its actual yield load with an appropriate allowance for strain hardening before the associated columns reach their buckling load or before any connections between members and the foundations reach their ultimate strength. However, under no circumstances shall either the columns or the connections be designed for less than 1.25 times the design actions in the braces, provided that these actions need not be taken larger than those resulting from the use of $K = 4$.

13.2.3 Mixed Systems

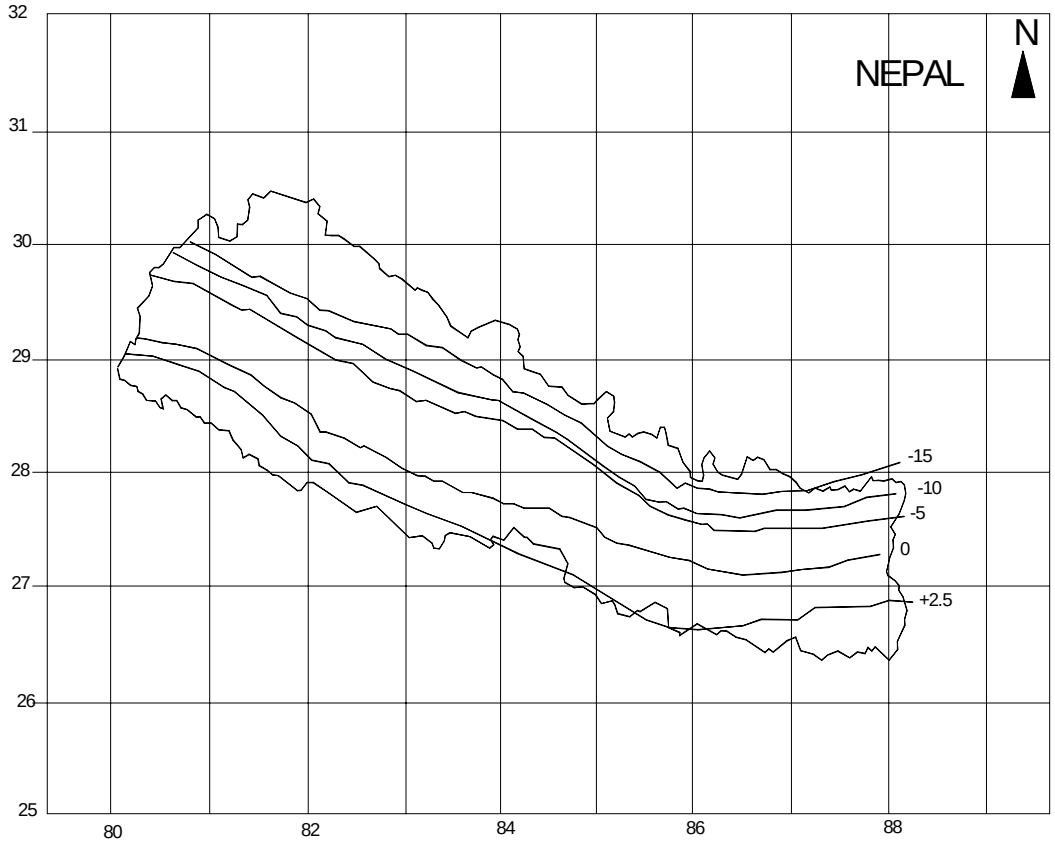
Frames which resist horizontal loads by a mixed system of axially loaded members and flexural members shall also comply with the requirements of 13.1.

APPENDIX A



MAP SHOWING HIGHEST MAXIMUM TEMPERATURE

APPENDIX B



MAP SHOWING LOWEST MINIMUM TEMPERATURE