IS 4983 (1968): Code of Practice for Design and Construction of Nailed Laminated Timber Beams [CED 13: Building Construction Practices including Painting, Varnishing and Allied Finishing]

BLANK PAGE

IS : 4983 - 1968

(Reaffirmed 2010)

Indian Standard

CODE OF PRACTICE FOR DESIGN AND CONSIRUCTION OF NAILED LAMINATED TIMBER BRAMS

Second Reprint AUGUST 1983

(Incorporating Amendment No,1)

UDC 694 : 624·072·2

INDIAN STANDARDS INSTITUTUIN

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG

NEW DELHI 110002

Gr 4

June 1969

Indian Standard

(*Continued from page* 1)

Members	*Representing*
Shri T. R. Mehandru	Institution of Engineers (India), Calcutta
Col O. P. Narula	Engineer-in-Chief's Branch, Army Headquarters
Shri K. P. Ghosh (*Alternate*)	
Shri A. P. Paracer	Central Public Works Department
Shri D. J. Patel	Hindustan Housing Factory Ltd, New Delhi
Senior Architect (B) I, Central Public Works Department	Indian Institute of Architects, Bombay
Shri J. D. Shastri	Directorate General of Health Services, New Delhi
Shri T. N. Subbarao	Gammon India Ltd, Bombay
Shri P. M. Apte (*Alternate*)	
Superintending Engineer, Design and Marine Works Circle	Public Works Department, Government of Madras
Executive Engineer, Building Centre Division (*Alternate*)	
Shri R. Nagarajan, Director (Civ Engg)	Director General, ISI (*Ex-officio Member*)

Secretary

Shri C. K. Bebarta
Assistant Director (Civ Engg), ISI

Timber Engineering Subcommittee, BDC 13 : 4

Convener	
Shri N. J. Masani	Forest Research Institute and Colleges, Dehra Dun
Members	
Shri A. N. Bajaj (*Alternate* to Shri N. J. Masani)	
Shri P. M. Abdul Rahiman	Structural Engineering Research Centre (CSIR), Roorkee
Dr S. M. K. Chetty	Central Building Research Institute (CSIR), Roorkee
Dr Joseph George (*Alternate*)	
Shri Daljit Singh	Oriental Building and Furnishing Co Private Ltd, New Delhi
Shri J. Durai Raj	Hindustan Housing Factory Ltd, New Delhi
Shri K. G. Salvi (*Alternate*)	
Shri P. R. Rijhsinghani	Engineer-in-Chief's Branch, Army Headquarters
Senior Architect (I)	Central Public Works Department (Architectural Wing)
Shri P. C. Shah	National Buildings Organization (Ministry of Works, Housing & Supply)
Shri R. K. Bhartari (*Alternate*)	
Superintending Engineer (Delhi Central Circle IV)	Central Public Works Department
Superintending Engineer (Planning)	Public Works Department, Government of Madhya Pradesh
Shri J. Vasudev	Railway Board (Ministry of Railways)

Indian Standard
CODE OF PRACTICE FOR DESIGN AND CONSTRUCTION OF NAILED LAMINATED TIMBER BEAMS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 12 December 1968, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Due to non-availability of seasoning plant facilities for large sized timbers, skilled workmanship, equipment for glued laminated work and facilities for proper application of synthetic resin glues, nailed laminated timber construction may be used at a much lesser cost in the field of timber construction using different fasteners. The nailed laminated timber beams are built up using ordinary wire nails to join together short pieces of planks of normal thicknesses and widths in vertical position. The thickness of such beam may be a multiple of the individual planks. The short length planks shall be so arranged as to form a beam of required span.

0.2.1 Research has been carried out on various types of nailed laminated timber beams at the Timber Engineering Branch of the Forest Research Institute, Dehra Dun, to arrive at the efficiency in stiffness and on the basis of the same the recommendations in this standard are specified.

0.3 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.4 This code of practice represents a standard of good practice and, therefore, takes the form of recommendations.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the design and construction of nailed laminated timber beams.

2. METHOD OF ARRANGEMENT

2.1 The beam is made up of 2 to 3 cm (*see* **4.1**) thick planks placed vertically with joints staggered in the adjoining planks with a minimum distance of 30 cm. The planks are laminated with the help of wire nails at regular intervals to take up horizontal shear developed in the beam besides keeping the planks in position (*see* Fig. 1).

3. MATERIALS

3.1 Species of Timber — The nailed laminated beams are generally fabricated from species of timber which are used for solid beams and purlins (*see* IS : 883-1966*). Mixed species from different groups may also be used for fabrication of nailed laminated beams, for which the strength properties (working stresses) shall be taken of the lower grade species.

3.1.1 The specification of timber shall be structural timber conforming to IS : 3629-1966†. Care shall be taken that serious knots do not occupy the tension zone of beams. For permissible defects like knots, shakes, etc, in nailed laminated timber beams, details given in IS : 3629-1966† shall be followed.

3.2 Nails — Nails used for laminated planks shall conform to IS : 723-1961‡. In case of coastal areas with saline climates, galvanized wire nails shall be used instead of ordinary wire nails.

3.2.1 In some of the soft wood species it is possible to drive the nails without any prebore, but in all the hard wood and other soft woods, prebore is essential to avoid splitting of planks. In such cases the diameter of prebore shall be lesser than the nominal diameter of nail by at least 0·5, 1 and 1·5 mm in very hard woods, hard woods and soft woods, respectively.

4. SIZE OF PLANKS AND BEAMS

4.1 The plank thicknesses for fabrication of nailed laminated beams recommended are 2·0, 2·5 and 3·0 cm.

4.2 In case of nailed laminated beam the maximum depth and length of the plank shall be limited to 25 cm and 200 cm respectively.

*Code of practice for design of structural timber in building (*second revision*). (Since revised).

†Specification for structural timber in building.

‡Specification for mild steel wire nails. (Since revised).

4.3 In order to obtain different overall thicknesses of the beam, the number and thickness of the planks to form vertical nailed laminated beams, and also type and size of wire nail shall be as mentioned in Table 1. The protruding portion of the nail shall be cut off or clenched across the grains.

TABLE 1 NUMBER AND SIZE OF PLANKS AND NAILS FOR NAILED LAMINATED BEAMS

Sl No.	Overall Thickness of Beam	No. of Planks	Thickness of Each Plank	Type and Size of Nail to be Used
(1)	(2)	(3)	(4)	(5)
i)	5	2	2·5	75 mm long and 3·75 mm dia
ii)	6	3	2·0	do
iii)	7	3	{ 2 × 2·5 1 × 2·0 }	do
iv)	8	4	2·0	100 mm long and 4·0 mm dia
v)	9	3	3·0	do
vi)	10	4	2·5	125 mm long and 5·0 mm dia
vii)	11	4	{ 3 × 3·0 1 × 2·0 }	do
viii)	12	4	3·0	do
ix)	15	5	3·0	150 mm long and 5·0 mm dia

Note — A number of combinations of the different thicknesses of planks may be adopted as long as the minimum and maximum thickness of the planks are adhered to.

5. DESIGN CONSIDERATION

5.1 Nailed laminated beams shall be designed in accordance with IS : 883-1966*.

5.2 Deflection — The deflection in case of nailed laminated beams, joists, purlins, battens and other flexural members supporting brittle materials like gypsum, ceiling slates, tiles and asbestos sheets shall not exceed 1/480 of the span. The deflection in case of other flexural members shall not exceed 1/360 of the span in case of beams and joists and 1/225 of the freely hanging length in case of cantilevers.

*Code of practice for design of structural timber in building (*second revision*). (Since revised).

5.3 Effective Span

5.3.1 *Freely Supported Beam* — In case of freely supported beams, the effective span shall be the distance between the centres of supports, or the clear distance between supports plus effective depth of beam whichever is smaller.

5.3.2 *Continuous Beam* — In case of continuous beam, if the width of the support is less than 1/12 of the clear span, the effective span shall be as given in **5.3.1**. If the supports are wider than 1/12 of clear span or 600 mm whichever is less, the effective span shall be taken as under:

a) For end span with one end fixed and the other continuous or for intermediate spans, the effective span shall be the clear span between the supports; and

b) For end span with one end free and the other continuous, the effective span shall be equal to the clear span plus half the effective depth of beam or the clear span plus half the width of the continuous supports, whichever is less.

5.4 Permissible lateral strength of mild steel wire nails shall be as given in Table 2 for Indian species of timber, which will apply to nails that have their points cut flush with the faces. For nails clenched across the grains the strength may be increased to 20 percent over the values for nails with points cut flush.

5.5 A worked example for method of design of nailed laminated beam is included in Appendix A.

6. FABRICATION

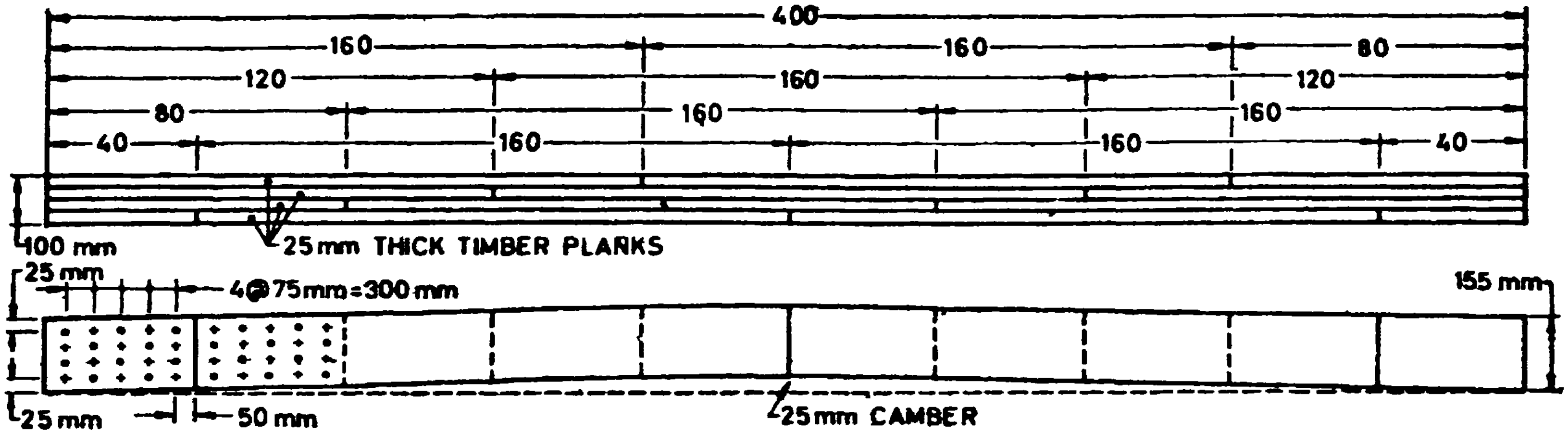
6.1 An initial camber of 1/160 of the span shall be given to the beam to prevent undue sagging due to creep of timber and slip of nails. Camber shall be obtained by number of intersecting straight lines giving a simple curve.

6.2 Joints in the planks on the adjacent rows shall be staggered at a minimum distance of 30 cm and maximum distance of 60 cm, preferably the distance may be kept at 45 cm.

6.3 Spacing of Nails

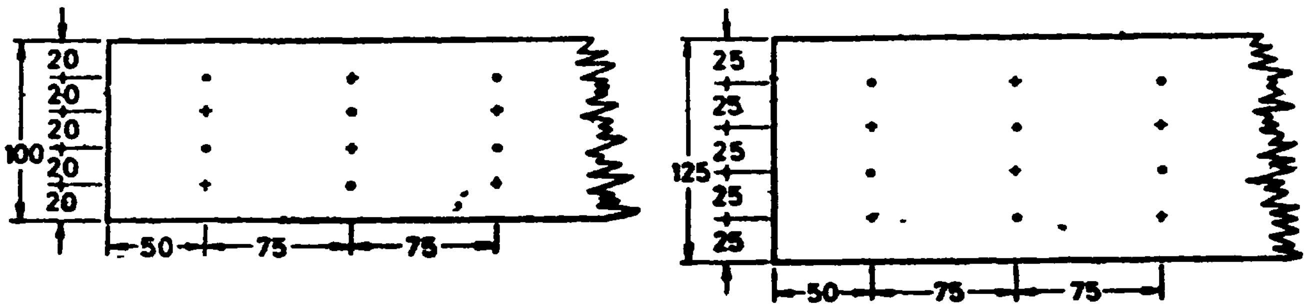
6.3.1 A minimum number of four nails in a vertical row at regular interval not exceeding 7·5 cm to take up horizontal shear as well as to keep the planks in position shall be used. Near the joints of the planks this distance may, however, be limited to 5 cm instead of 7·5 cm.

6.3.2 Shear shall be calculated at various points of the beam and the number of nails required shall be accommodated within the distance equal to the depth of the beam, with a minimum of four nails in a row at a standard horizontal spacing as shown in Fig. 2.



All dimensions, other than those specified, are in centimetres.

FIG. 1 PLAN AND ELEVATION OF A TYPICAL NAILED LAMINATED TIMBER BEAM



2A For 3·75 and 4 mm Diameter Nails

2B For 5 mm Diameter Nails

All dimensions in millimetres.

FIG. 2 STANDARD LENGTHWISE SPACING IN NAILED LAMINATED BEAM

6.3.3 If the depth of the beam is more, then the vertical intermediate spacing of nails may be increased proportionally.

6.3.4 If the nails required at a point is more than that can be accommodated in a row, then these shall be provided lengthwise of the beam within the distance equal to the depth of the beam at standard lengthwise spacing.

6.3.5 For nailed laminated beam minimum depth of 10 cm for 3·75 mm and 4 mm dia nails and 12·5 cm for 5 mm dia nails shall be provided.

TABLE 2 SHEAR STRENGTH VALUE OF NAILS FOR DESIGN OF NAIL LAMINATED BEAMS

(*Clause* 5.4)

Sl No.	Species		Strength per Nail in kg	
	Trade Names	Botanical Names	3·75 and 4 mm dia Nails 75 and 100 mm Long	5 mm dia Nails 125 and 150 mm Long
(1)	(2)	(3)	(4)	(5)
1	**amari**	*Amoora wallichii* King.	190	275
2	**axle wood (bakli)**	*Anogeissus latifolia* Wall.	200	290
3	**babul**	*Acacia arabica* Willd.	155	255
4	**bahera**	*Terminalia bellirica* (Gaertn.) Roxb.	100	145
5	**bijasal**	*Pterocarpus marsupium* Roxb.	150	220
6	**birch**	*Betula* spp.	130	190
*7	**black chuglam**	*Terminalia manii* King.	225	325
8	**black siris**	*Albizzia odoratissima* Benth.	140	205
*9	**bonsum**	*Phoebe* spp.	120	175
*10	**champ**	*Michelia* spp.	130	190
*11	**camphor (cinnamon)**	*Cinnamomum* spp.	120	175
12	**chickrassy (andaman)**	*Chukrasia tabularis* A. Juss.	245	355
13	**chilauni**	*Schima wallichii* Korth.	175	255
*14	**chir**	*Pinus roxburghii* Sargent.	110	160
15	**cypress**	*Cupressus torulosa* D. Don.	60	90
*16	**deodar**	*Cedrus deodara* D. Don.	140	205
*17	**dhaman** (M.P.)	*Grewia tiliaefolia*, Vahl.	280	405
18	**dhaman** (U.P.)	*Grewia vestita*, Vahl.	130	190
19	**eucalyptus**	*Eucalyptus eugenioides*	165	240

*Species require no preboring for nail penetration.

(*Continued*)

TABLE 2 SHEAR STRENGTH VALUE OF NAILS FOR DESIGN OF NAIL LAMINATED BEAMS — *Contd*

Sl No.	Species: Trade Names	Species: Botanical Names	Strength per Nail in kg: 3·75 and 4 mm dia Nails 75 and 100 mm Long	Strength per Nail in kg: 5 mm dia Nails 125 and 150 mm Long
(1)	(2)	(3)	(4)	(5)
*20	**fir**	*Abies pindrow* Royle.	80	115
21	**gamari**	*Gmelina arborea* Roxb.	80	115
*22	**gendhalipoma** (Assam)	*Cedrela* spp.	110	160
23	**gurjan** (Andaman)	*Dipterocarpus* spp.	185	270
24	**hollock**	*Terminalia myriocarpa* Heurck et Muell. Arg.	130	190
25	**hollong**	*Dipterocarpus macrocarpus* Vesquet	170	250
26	**irul**	*Xylia xylocarpa* Taub.	235	340
27	**jaman**	*Eugenia* spp.	150	220
*28	**kail**	*Pinus excelsa* Wall.	70	120
29	**karani**	*Cullenia excelsa* Wight	115	165
30	**kokko**	*Albizia lebbeck* Benth.	200	290
31	**kusum**	*Schleichera trijuga* Willd.	230	335
32	**lampati**	*Duabanga sonneratioides* Buch.-Ham.	150	220
33	**lendi**	*Lagerstroemia parviflora* Roxb.	190	275
*34	**mango**	*Mangifera indica* Linn.	100	145
35	**mesua**	*Mesua ferrea* Linn.	260	375
36	**oak** (Assam)	*Quercus* spp.	280	405
37	**oak** (U.P.)	*Quercus* spp.	110	160
38	**padauk** (Andaman)	*Pterocarpus dalbergioides* Roxb.	190	275
*39	**poon**	*Calophyllum* spp.	160	230
40	**sain**	*Terminalia tomentosa* Wight et Arn.	160	230
41	**salai**	*Boswellia serrata* Roxb.	120	175
42	**sal** (U.P.)	*Shorea robusta* Gaertn. f.	100	145
43	**sandan**	*Ougeinia dalbergioides* Benth.	170	250
44	**silver oak**	*Grevillea robusta* A. Cunn.	120	175
45	**teak** (U.P.)	*Tectona grandis* Linn. f.	140	205
*46	**toon**	*Cedrela* spp.	150	220
47	**uriam**	*Bischofia Javanica*, Blume	130	190
48	**white chuglam**	*Terminalia bialata* Steud.	180	260

NOTE — The shear strength values of 125 and 150 mm nail are tentatively based on limited tests, that is,45 percent above those of 75 mm or 100 mm nail of 3·75 mm dia.

*Species require no preboring for nail penetration.

APPENDIX A

(*Clause* 5.3)

DETERMINATION OF STANDARD SECTION OF NAILED LAMINATED TIMBER BEAMS

A-1. PROBLEM

A-1.1 To determine a suitable section of nailed laminated timber beam of 'kokko' timber (*Albizia lebbeck* Benth) for an effective span of 4·0 m and spaced 1 m apart in a single joisted floor with floor boards of 25 mm thickness.

A-2. DESIGN DATA

A-2.1 The design data is given below:

a) Modulus of elasticity of timber = 112 tonnes/cm² = 112 000 kg/cm²

b) Intensity of liveload as given in IS : 875-1964* = 75 kg/m²

c) Intensity of deadload for timber beams and planks = 640 kg/m³

d) Safe working stresses for 'kokko' timber as given in IS : 883-1966†:

1) Extreme fibre stresses in bending and tension

f_t = 134 kg/cm²

2) Compression parallel to grains

f_c = 88 kg/cm²

3) Horizontal shear stress

h_s = 11 kg/cm²

A-3. CALCULATIONS

A-3.1 Referring to **7.8** of IS : 3629-1966‡, for seasoned timber having moisture content not more than 18 percent and minimum thickness below 10 cm, an increase of 20 percent in strehgth values listed in Table 1 of IS : 883-1966† may be allowed for bending and compression values for inside locations only.

Therefore, permissible working stresses for bending and tension

= 134 + (20 percent),

≐ 161 kg/cm², and

---

*Code of practice for structural safety of building: loading standards (*revised*).

†Code of practice for design of structural timber in building (*second revision*). (Since revised).

‡Specification for structural timber in buildings.

for compression parallel to grain,

$$f_c = 88 + (\text{ 20 percent })$$
$$= 105{\cdot}6 \text{ kg/cm}^2$$

A-3.1.1 Referring to **5.2.2** of IS : 883-1966*, the permissible liveload shall be reduced to three-fourth of the value given in IS : 875-1964† which is equal to three-fourth × 75 = 56 kg/m².

A-3.1.2 Restricting width of the beam to 1/50 of span as recommended, the minimum width required shall be 8 cm.

Therefore, the assumed beam size shall be 100 × 155 mm (*see* Fig. 1)

Therefore, the sectional modulus:

$$Z = 1/6 \times 10 \times 15{\cdot}5 \times 15{\cdot}5 \text{ cm}^2$$
$$= 400{\cdot}4 \text{ cm}^3$$

A-4. LOAD FOR A PANEL

A-4.1 Deadload — It shall be calculated as given below:

a) Self-weight of 25 mm thick timber planks = 64 kg

b) Self-weight of timber beam of assumed size 100 × 155 mm = 46 kg

Total dead load = 110 kg

$$\text{Dead load per cm length of beam} = \frac{110}{400} = 0{\cdot}28 \text{ kg/cm}$$

A-4.2 Liveload — It shall be calculated as given below:

Intensity of liveload = 56 kg/m²

Total liveload = 224 kg

Liveload per cm length of beam = 224/400 = 0·56 kg/cm

Total load acting per cm length of beam = 0·84 kg/cm

A-4.3 Check for Permissible Deflection — In case of simply support condition, formula for calculating deflection is

$$\delta = \frac{5 \times wl^4}{384\, EI}$$

where

δ = maximum deflection occurring in beam in cm, and

w = load per cm length in kg (in this case 2 dead load + ¾ liveload as given in 5.3.6.1 of IS : 883-1966*).

*Code of practice for design of structural timber in building (*second revision*). (Since revised).

†Code of practice for structural safety of building: loading standards (*revised*).

l = span of the beam in cm,

E = modulus of elasticity in kg/cm², and

I = moment of inertia of the section in cm⁴

$$= \frac{(\text{breadth}) \times (\text{depth})^3}{12}$$

Here $w = 2 \times 0{\cdot}28 + 0{\cdot}56 = 1{\cdot}12$

Therefore, deflection $\delta = \dfrac{5 \times 1{\cdot}12 \times (400)^4}{384 \times 112\,000 \times 1/12 \times 10\,(15{\cdot}5)^3}$

$= 1{\cdot}08$ cm

A-4.3.1 Deflection allowed for stiffness of nailed laminated beam as given in **5.2** will be 1/360 of the span

$$= \frac{400}{360}$$

$$= 1{\cdot}11 \text{ cm}$$

Hence the beam is safe against deflection.

A-4.4 Check for Permissible Stresses in Bending

Maximum bending moment $= \dfrac{w_1{}^2}{8}$

where

w_1 = the actual load per cm length of the beam.

Therefore, maximum bending moment $= \dfrac{400 \times 400 \times 0{\cdot}84}{8}$

$= 16\,800$ kg cm

Therefore, bending stress will be $= \dfrac{16\,800}{400{\cdot}4}$

$= 41{\cdot}93$ kg/cm²

This value is far less than the permissible value of fibre stress in bending. Hence the section is safe in bending.

A-4.4.1 This value is far less than the permissible value of fibre stress in bending. Hence the section is safe in bending.

A-4.5 Check for Permissible Shear Stress — Maximum horizontal shear stress (h_s) will be

$$h_s = \frac{1 \cdot 5 \times v}{bd}$$

where

v = vertical reaction in kg,

b = breadth of beam in cm, and

d = depth of beam in cm.

$$\text{Therefore, } h_s = \frac{1 \cdot 5 \times \cdot 84 \times 200}{10 \times 15 \cdot 5}$$

$$= 1 \cdot 63 \text{ kg/cm}^2 \text{ at the supports.}$$

A-4.5.1 This value is far less than the permissible value of 11 kg/cm².

A-4.5.2 Since the beam is fabricated such that joints in individual planks occur at 40 cm intervals, the shear stress at the first joint from the support shall be checked as follows:

Total shear at the 40 cm from the end

$$= 0 \cdot 84 \times 200 \times \frac{4}{5}$$

Area of the section resisting the shear = $10 \times 15 \cdot 5 \times 3/4$

$$\text{Therefore, maximum shear stress} = \frac{1 \cdot 5 \times 0 \cdot 84 \times 200 \times 4/5}{10 \times 15 \cdot 5 \times 3/4}$$

= 1·73, which is less than the permissible value

A-4.5.2.1 Hence the section is safe against shear.

A-4.5.2.2 Hence the section 100 × 155 mm is safe against bending, shear and deflection and hence adopted.

A-4.6 Arrangement of Planks — Initial camber of 1/160 of the span, that is, 400/160 = 25 mm at centre shall be provided through fabrication.

A-4.6.1 According to recommendations, 4 planks each 25 mm × 160 mm shall be used to form the required section of 100 × 155 mm, and 5 mm diameter nails each 125 mm long shall be used.

A-4.6.1.1 Extra depth of plank 5 mm is sufficient in all cases where the length of plank is less than 200 cm, to give the desired camber. 5 mm is the tolerance in the depth of plank.

A-4.6.2 *Shear Nails* — Maximum shear force occurring in a beam = 168 kg

Lateral strength value of shear in ' kokko ' timber = 200 kg.

A-4.6.2.1 Therefore one nail will be enough.

A-4.6.2.2 Provide minimum of four nails at 75 mm apart to take horizontal shear force as well as to keep the integrity of planks as recommended. Nails near the joints shall be provided at 50 mm. This will provide adequate strength combined with stiffness within permissible limits.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31 Telegrams : Manaksanstha

Regional Offices:

			Telephone
Western :	Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern :	5 Chowringhee Approach	CALCUTTA 700072	27 50 90
Southern :	CIT Campus	MADRAS 600113	41 24 42
Northern :	B69, Phase VII	S. A. S. NAGAR (MOHALI) 160051	

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	22 48 05
Gangotri Complex, Bhadbhada Road, T.T. Nagar	BHOPAL 462003	6 27 16
22E Kalpana Area	BHUBANESHWAR 751014	5 36 27
5-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 83
R 14 Yudhister Marg, C Scheme	JAIPUR 302005	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	4 72 92
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27

Printed at Simco Printing Press, Delhi, India