CHAPTER IV

FABRICATION AND ANALYSIS OF MAIN BEAM

4.1 Size of Main Beam

The span length of main beam was selected at 3.60 meter long nearly as general usage for beam of local building. The cross-section of beam at the middle span is 5.50 x 21.00 cm. at two ends of the beam as shown in figure (4.1). The reason of the larger cross-section at the ends of the beam was to eliminate the possible of shear failure at the supports.

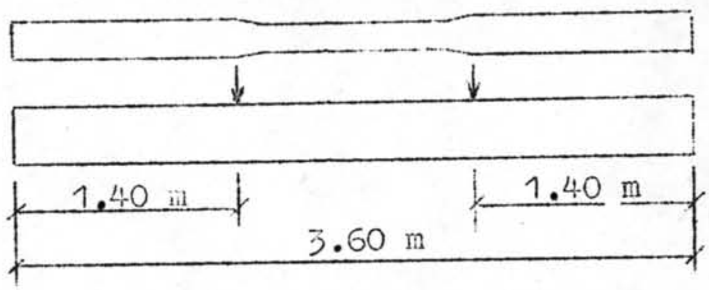


Fig. 4.1 Position of loading on main beam.

Due to the larger size than standard commercial size of the main beam, and due to it shall be consisted of a large number of knots and defects. The models then were prepared as glue laminated wood beams to reduce the influence of unvoidable defects in the large size member as mentioned above. The three small section of woods 7.00 x 7.00 cm. were selected to be laminated as main beam of 7.00 x 21.00 cm. cross-section.

4.3 Fabrication of Main Beam

The timber used in fabricating the glue-laminated beam must be properly selected and adequately prepared for gluing. Timber with a high moisture content can not be glue-fabricated because excessive moisture produces low shear strength of glue surface. It is recommended by the United State Department of Agriculture that suitable moisture content of timber to be glued is between 7 and 15 percent.

In this experimental study, the woods used in lamination were seasoned woods of average moisture content 12 percent. The dressing size of woods 7.0 x 7.0 x 400 cm. were selected to be laminated as main beam. The surface of woods to be glued were smooth and should be cleaned without dust. Resorcinal glue at the proportion by weight of 80 percent liquid resin to 20 percent catalyst powder was used as adhesive. Glue was spread evenly by brush on both mating surfaces. After that each piece of wood was assembled in the position to form the beam shape. Then gluing pressure was applied by 3 hydraulic jacks up to average gluing pressure of 14 ksc. (200 psi.) as suggested by Chongleuswarawong (8). The beam was left under the gluing pressure for a period of 24 hours. After releasing the pressure, the beam was kept in the room for more than 7 days in order to obtain full joint strength. The beams were then sawed to the finished cross-sectional dimension of 5.0 x 21.0 cm. at the middle span.

4.3 Analysis of Main Beam

The analysis of main beam is base on the assumption of second degree parabola approximation as suggested by Borislav D. Zakic. The compressive strength and tensile strength of main beams were taken from the test result of small specimens which were the same piece of wood as were laminated to the position of compression and tension. The "n" ratio of tensile strength and compressive strength then was computed. When substituting "n" value into equations (19) and (23) respectively.

$$\xi = \frac{3n}{3n+4} \qquad \text{------(19)}$$

$$R = \left(\frac{5}{12}\xi^2 + \frac{1}{3}n(1-\xi)^2\right)\sigma_c \qquad \text{------(23)}$$

then the theoretical ultimate moments M_{UL} were obtained by equation (22).

$$M_{UL} = Rbh^2$$

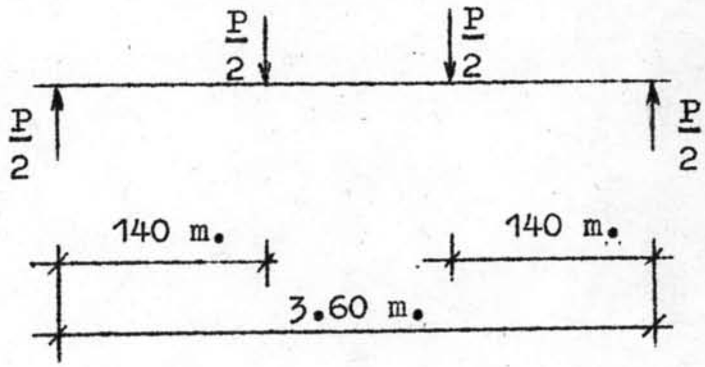
in which b = width of beam

h = depth of beam

The calculations of ultimate moments (M_{UL}) of main beams are shown in table (4.1)

Checking for Shear Failure

For table (4.1) ultimate moment of main beam DA is 439,250 kg-cm.



$$\text{max. moment} = \frac{P}{2} \times 140 = 439{,}250 \quad \text{kg-cm.}$$

$$\text{max. shear } V = \frac{P}{2} = \frac{439{,}250}{140} \quad \text{kg.}$$

Max. shear stress at N.A. $v = \frac{V}{Ib} Q$

For rectangular cross-sectional beam $v = \frac{3V}{2bh}$

$$= \frac{3}{2} \times \frac{439{,}250}{140} \times \frac{1}{7 \times 21} \text{ ksc.}$$

$$= 32 \text{ ksc.}$$

The maximum shear flow is less than shear strength of hard wood as given by EIT (13), also less than shear strength test of small specimen as stated at table (3.1). So that shear failure should not occur.

TABLE 4.1 CALCULATION OF ULTIMATE MOMENT OF MAIN BEAMS

Main Beam		DA	DB	KA	KB	TA	TB
Section bh	cm.	5.4 x 21	5.3 x 21	5.5 x 21	5.5 x 21	5.2 x 21	5.25 x 21
Tensile Strength	KSC	1,488	1,340	1,161	1,318	813	1,419
Compressive Strength	KSC	704	599	690	612	620	651
$n = \frac{\sigma_t}{\sigma_c}$		2.114	2.237	1.683	2.154	1.311	2.180
$\xi = \frac{3n}{3n+4}$		0.613	0.626	0.558	0.618	0.496	0.620
$\frac{5}{12}\xi^2 + \frac{1}{3}n(1-\xi)^2$		0.262	0.267	0.240	0.264	0.213	0.265
$R = \left[\frac{5}{12}\xi^2 + \frac{1}{3}n(1-\xi)^2\right]\sigma_c$		184.45	159.93	165.60	161.57	132.06	172.51
$M_{UL} = Rbh^2$	Kg-cm	439,250	373,810	401,660	391,890	302,840	399,400
Ultimate Load $\frac{P}{2} = \frac{M_{UL}}{140}$	Kg	3,137	2,670	2,869	2,799	2,163	2,853

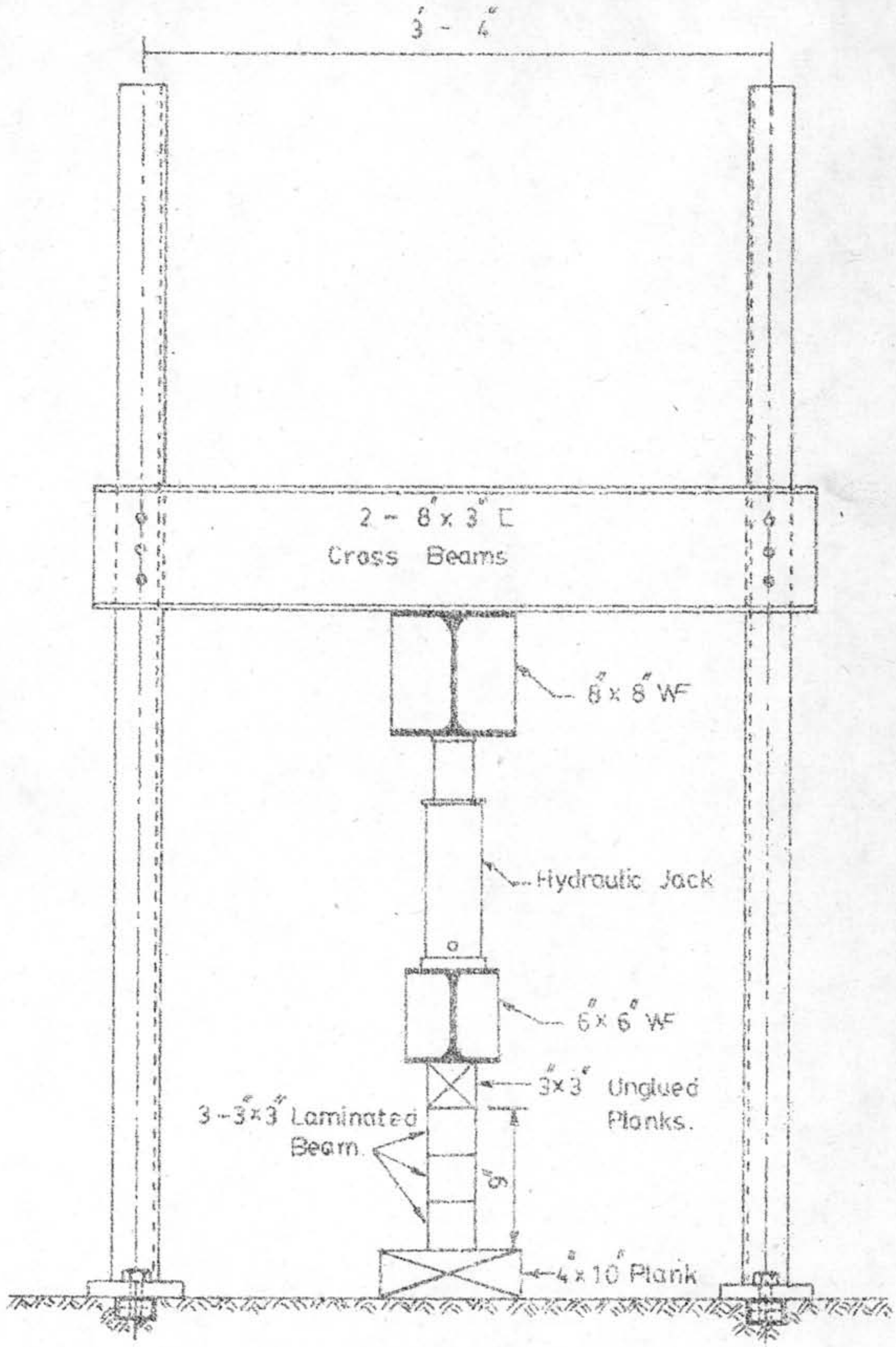


FIG. 4.2 DETAIL SKETCH OF FABRICATION SET UP