TWP Timber and Wood Products Research Centre

REPORT ON FLEXURE TESTS OF TWO SCARF & BUTT JOINTED GLULAM BEAMS

for

WILSON HART & CO. LTD.
MARYBOROUGH

CQU - ROCKHAMPTON
1001174491

TWP REPORT NO. 108
C.G. McDowall, A.I.W.Sc.
February, 1984

620.1244
1

CIAE, ROCKHAMPTON, AUSTRALIA 4700. TELEPHONE (079) 361177 TELEX AA49176

2296274

REPORT ON FLEXURE TESTS OF TWO SCARF & BUTT JOINTED GLULAM BEAMS

for

WILSON HART & CO. LTD.
MARYBOROUGH

TWP REPORT NO. 108

C.G. McDowall, A.I.W.Sc., M.I.E.Aust.

February, 1984

CENTRAL QUEENSLAND
UNIVERSITY - LIBRARY

SUMMARY

This report briefly outlines the test procedure and presents the results of three point loading flexure tests carried out on two finger jointed glulam beams of dimensions 190 x 66 to determine their Modulus of Rupture (MOR), Modulus of Elasticity (MOE), and failure mode.

FLEXURE TESTS ON GLULAM BEAMS

1. INTRODUCTION

Two glulam beams supplied by Wilson Hart & Co. Ltd., Maryborough, were tested in three point flexure in the Heavy Structures Laboratory, Department of Civil Engineering, CIAE on the 14th December, 1983.

The testing programme was performed to determine the Modulus of Rupture (MOR) and Modulus of Elasticity (MOE) of the two beams.

2. TEST ARRANGEMENT

Plate 1 shows the general method of loading the beams which were simply supported on rollers at each end. Also shown is portion of the 10 tonne jack which was activated by a hand-operated hydraulic ram. A 5 tonne load cell located between the jack and the beam facilitates monitoring of the applied load to an estimated accuracy of within ± 5%. Mid-span deflections were measured by a dial gauge attached to steel yoke which is connected to the neutral axis of the beam. The dial gauge was positioned such as to contact a small steel bracket attached to the beam neutral axis thus eliminating the effect of beam embedment at supports.

3. TESTING PROCEDURE

The testing procedure followed as closely as practicable that described for prototype testing in Section 9 of AS1720 - Timber Engineering Code.

A test load of 9.6 kN was applied to the beam in increments of 1.6kN. During loading the deflections were recorded and results are tabulated in Data Sheets 1 & 2. The test load was held for 5 minutes then released and the residual deflections noted.

Each beam was then loaded to initial failure, and further to final destruction, with deflections only being recorded to a stage such that damage to the dial gauge would not occur.

4. TEST BEAM SPECIFICATIONS

The two beams tested were cut from a single beam consisting of scarf and butt joints. Resorcinol glue was used to interconnect the laminates both at the scarf joints and laminate interfaces.

The beams were nominally 3m long and their cross-sectional dimensions were 190 x 66 mm.

In the first test a scarf joint was purposely positioned such that it was subjected to fairly high shear and moment producing tension in the laminate.

In the second test the scarf joint was positioned on the compression side of the beam close to a support.

5. TEST RESULTS

Data sheets 1 and 2 present the load/deflection data for the two beams, the failure loads being as follows:

WH - GBSJ No. 1 = 40 kN
WH - GBSJ No. 2 = 60 kN

Figure 1 shows a plot of the load/deflection data for both beams. MOR's and MOE's for each beam have also been calculated and appear on Figure 1 thus:

WH-GBSJ No. 1	WH-GBSJ No. 2
MOR = 63 MPa	MOR = 94 MPa
MOE = 18,852 MPa	MOE = 23,206 MPa

6. FAILURE MODES

The following points were noted concerning the beam failure modes during loading the beams:

(i) For WH-GBSJ No. 1 the first "creak" was heard at approximately 28 kN and initial failure occurred at a load of 28.6 kN.

The final failure is shown in Plate 1 with initial failure taking the form of a tension failure across the scraf joint.

Continued application of load resulted in the propagation of the crack along the full length of the scarf and into the laminate interfaces at either end.

(ii) For WH-GBSJ No. 2 the first "creak" was also heard at approximately 28 kN. At this load the tendency of the beam to want to buckle laterally was also observed. The load was released and the 5 tonne load cell was replaced by one of 10 tonne capacity and a device to restrain the beam against lateral movement was constructed.

Initial failure of the beam occurred at a load of 31 kN once again taking the form of a tension failure between the second and third laminates from the tension face directly under the jack. Plate 2 shows the position of this initial failure.

The crack at the position of initial failure propogated along the glue line and terminated near a butt joint located near a support.

The shear failure between the second and third laminates from the top shows considerable timber failure with unbonded patches. This failure is also shown in Plate 2.

7. CONCLUSIONS

Results of the tests indicate positioning scarf joint on the tension side of the beam in a region of relatively high moment and shear reduces the utlimate strength of the beam significantly.

It would also appear that the initial failure strength is not seriously affected by the positioning of the scarf joint. For both beams the initial failure load was about 28 kN to 31 kN.

CAPRICORNIA INSTITUTE OF ADVANCED EDUCATION

DEPARTMENT OF CIVIL ENGINEERING

DATA SHEET NO. 1 OF 2

FLEXURE TEST: Determination of MOR & MOE of scarf jointed Glulam beam

FIRM: Wilson Hart & Co. Ltd, Maryborough

TESTING LAB: Heavy Structures Laboratory, Dept. of Civil Engineering, CIAE

DATE OF TEST: 14 - 12 - 83

LOAD TYPE: 3 - POINT FLEXURE

Nominal Beam Length: 3000 mm

Support Span: 2500 mm

Jack Capacity: 1 @ 10 tonnes

Load Cell: 1 @ 5 tonnes

BEAM IDENTIFICATION: WH - GBSJ No 1, 190 x 66 mm.

LOAD (kN)	TIME TO LOAD (min)	MID-SPAN DEFLN. (mm) UP	MID-SPAN DEFLN. (mm) DOWN
0.0		0.0	0.37
1.6		0.57	
3.2		1.15	
4.8	4½ min	1.89	
6.4		2.66	
8.0		3.43	
9.6		4.16	
	Held 5 min		4.19
0.0		0.0	0.0
1.6		0.66	
3.2		1.37	
4.8		2.17	
6.4		2.89	
8.0		3.65	
9.6		4.36	
12.8		5.81	
16.0	~12	7.27	
19.2	min.	8.74	
22.4	to fail.	10.16	
25.6		11.55	
First creak 28.6		D.G. removed.	
Failure ~40.0			

CAPRICORNIA INSTITUTE OF ADVANCED EDUCATION

DEPARTMENT OF CIVIL ENGINEERING

DATA SHEET NO. 2 OF 2

FLEXURE TEST: Determination of MOR & MOE of scarf jointed Glulam beam

FIRM: Wilson Hart & Co. Ltd., Maryborough

TESTING LAB: Heavy Structures Laboratory, Dept. of Civil Engineering, CIAE

DATE OF TEST: 14-12-83.

LOAD TYPE: 3-POINT FLEXURE

Nominal Beam Length: _____ mm

Support Span: _____ mm

Jack Capacity: 1 @ 10 tonnes

Load Cell: ___ @ ___ tonnes

BEAM IDENTIFICATION: WH-GBSJ No2 190x66 mm

	LOAD (kN)	TIME TO LOAD (min)	MID-SPAN DEFLN. (mm) UP	MID-SPAN DEFLN. (mm) DOWN
	0.0			
	1.6			
	3.2	3 min.	Dial Gauge fouled during loading	
	4.8			
	6.4			
	8.0			
	9.6			
		Held 5 min.		
	0.0			
	1.6		0.65	
	3.2		1.28	
	4.8		1.90	
	6.4		2.42	
	8.0		3.01	
	9.6		3.60	
	12.8	~1½ hrs. to failure. Had to be laterally supported.	4.79	
	16.0		5.94	
	19.2		7.12	
	22.4		8.32	
	25.6		9.52	
First Creak	30.4		11.43	D.G. removed.
Failure	~60.0			

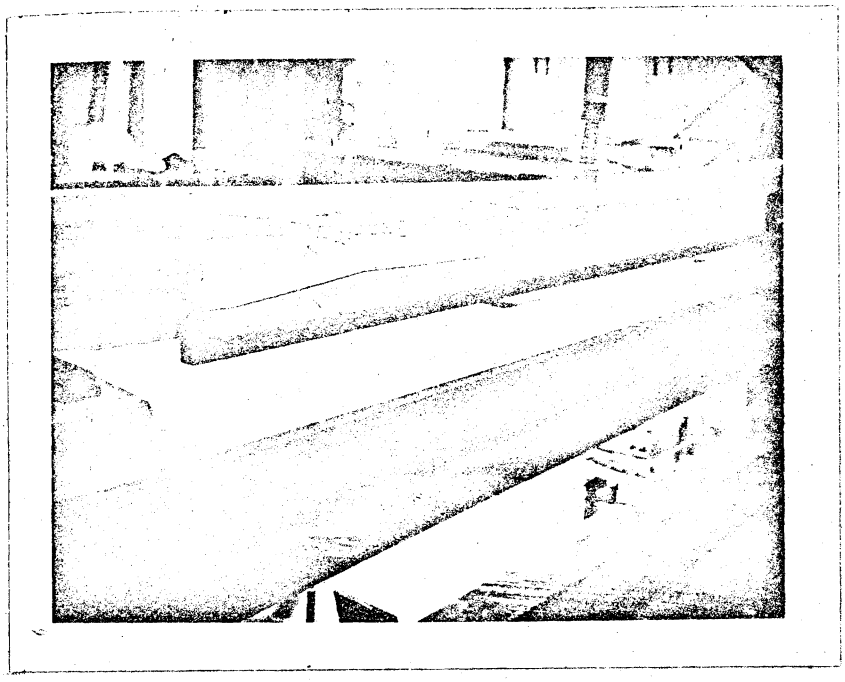

PLATE 1: WH - GBSJ No. 1

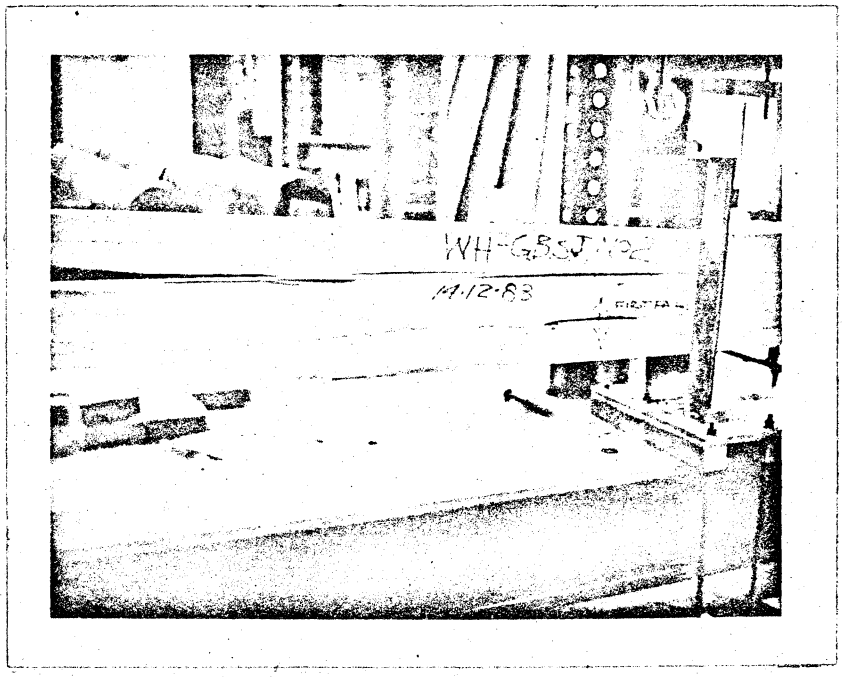

PLATE 2: WH - GBSJ No. 2

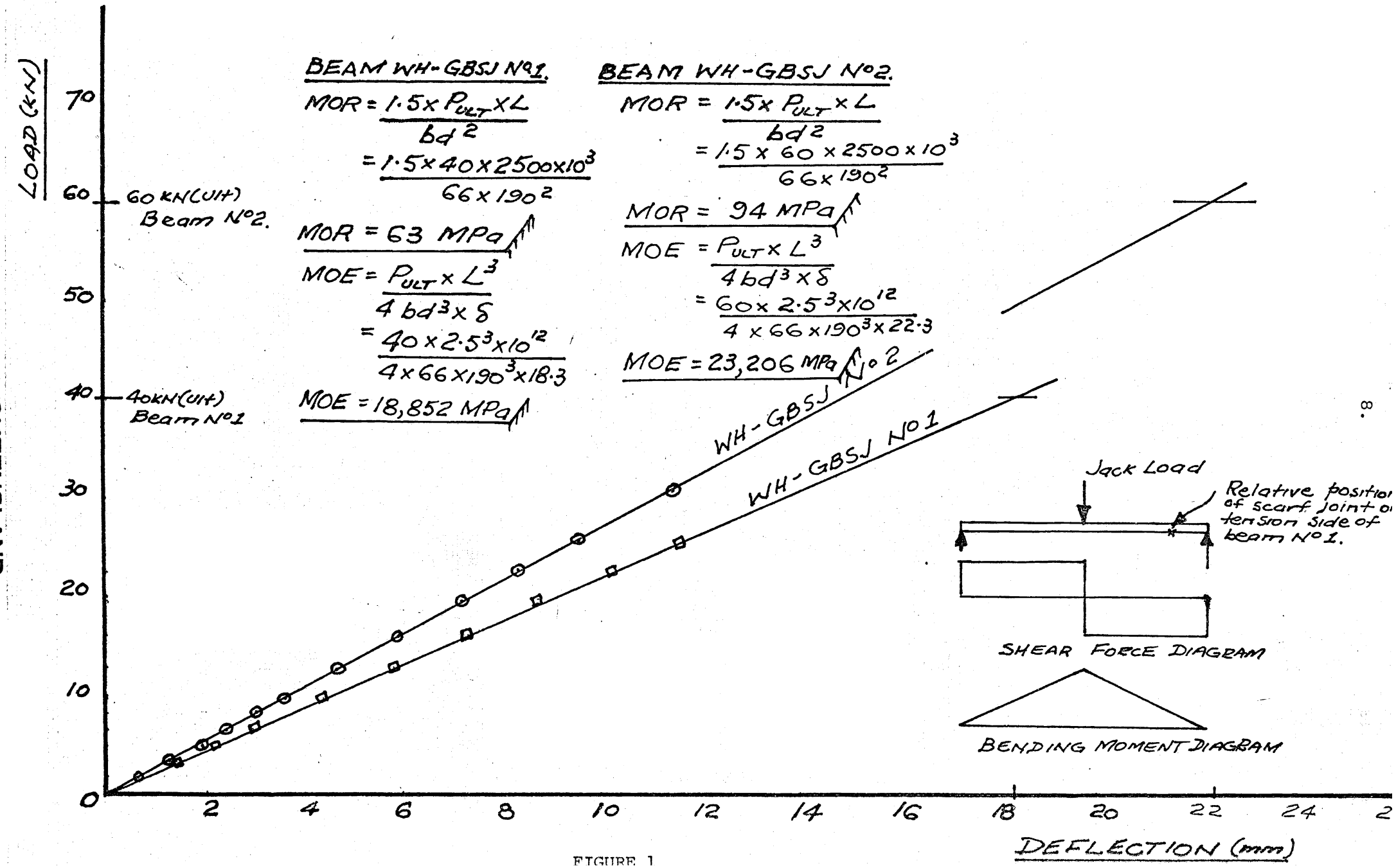

FIGURE 1

CENTRAL QUEENSLAND UNIVERSITY LIBRARY