Norwegian Bending Tests with Glued Laminated Beams Comparative Calculations with the "Karlsruhe Calculation Model"

F. Colling, J. Ehlbeck, R. Görlacher

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1   Introduction

In 1990 and 1991 extensive and systematic studies on the strength of glued laminated beams (glulam beams) have been carried out at the "Norwegian Institute of Wood Technology" in Oslo/Norway. It was aimed to obtain given strength values by variation of the properties of the laminations (density and modulus of elasticity).

The investigations described in this report were performed to estimate and to predict the bending strengths of these glulam test beams with the "Karlsruhe calculation model". The calculations were based on the informations made available and described in section 2. The test results (bending strength and modulus of elasticity) obtained in Oslo were unknown before finalizing the calculations and publishing the results.

2   Informations on the properties of the test beams and of the laminations

2.1   Properties of the test beams

Altogether, three different combinations of different build-up have been studied. In all cases the beam depth was 300 mm with nine laminations of 33,3 mm nominal thickness. The three beam combinations are shown in **Fig. 1.** The lamination properties (strength classes C30 - 12E and C37 - 14E, respectively) are described in section 2.2. The test set-up is illustrated in **Fig. 2.**

| LH40	LH35	LC38*
C37-14E	C30-12E	C37-14E
C37-14E	C30-12E	C37-14E
C37-14E	C30-12E	C30-12E
C37-14E	C30-12E	C30-12E
C37-14E	C30-12E	C30-12E
C37-14E	C30-12E	C30-12E
C37-14E	C30-12E	C30-12E
C37-14E	C30-12E	C37-14E
C37-14E	C30-12E	C37-14E
Type I	Type II	Type III
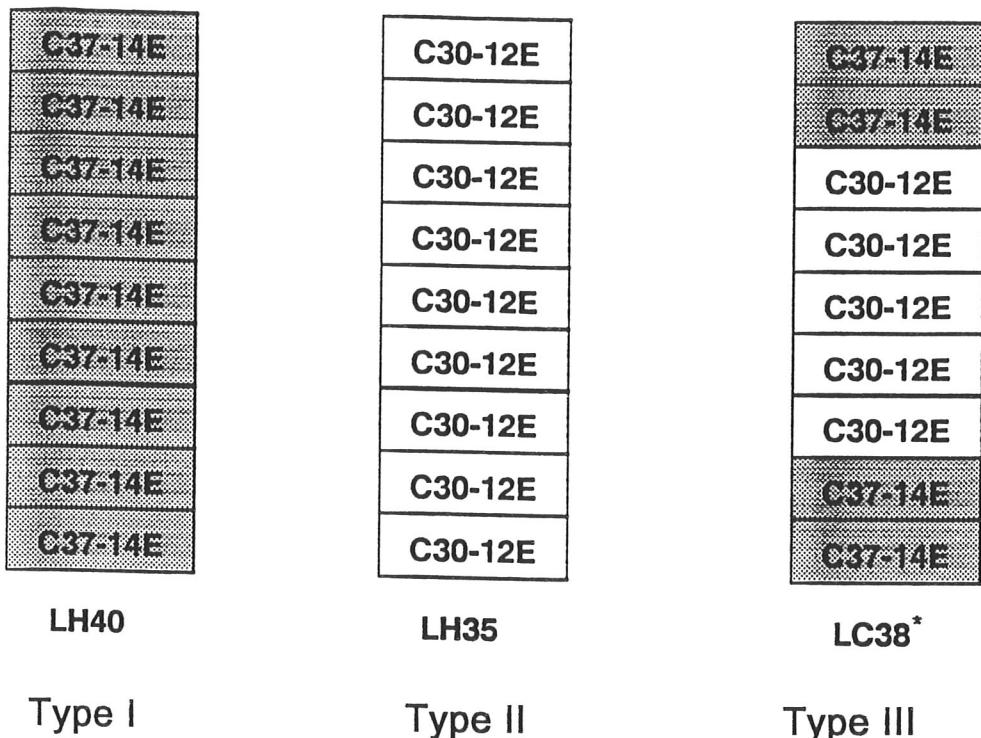
Fig 1: Beam combinations tested
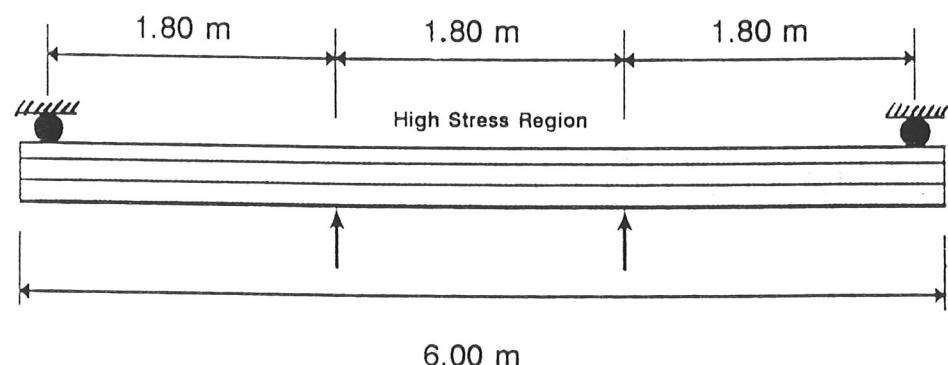
Fig 2: Beam test configuration

2.2   Properties of the laminations

2.2.1 Density

Density in this context is defined as the mean density of the board at a 12 % moisture content.

Laminations of class C30 - 12E
Fig. 3 illustrates the density distribution. The best fitting distribution function is a 3-parametric lognormal distribution with a mean value of 5,586, a standard deviation of 0,1358 and a location value of 208,92.
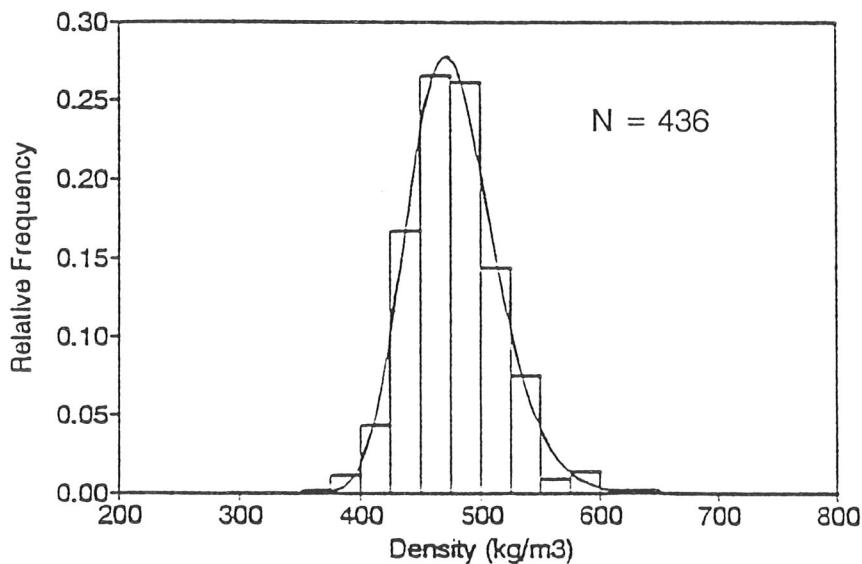

Fig 3: Distribution of density for the C30 - 12E grade (u = 12%)

Laminations of class C37 - 14E
Fig. 4 illustrates the density distribution. The best fitting distribution function is a 3-parametric lognormal distribution with a mean value of 5,739, a standard deviation of 0,1308 and a location value of 208,86.
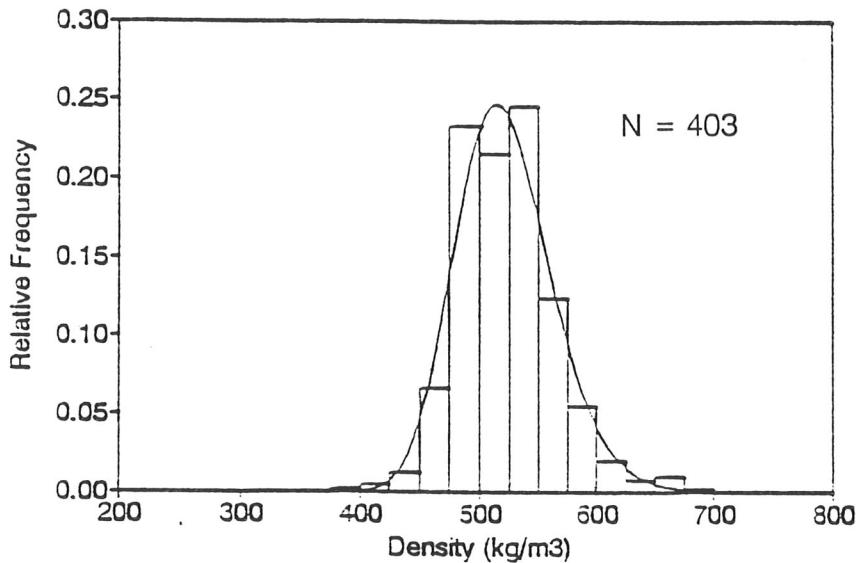
Fig 4: Distribution of density for the C37 - 14E grade (u = 12%)

2.2.2 Modulus of elasticity (MOE)

For determination of MOE of the laminations all laminations were machine-graded in that way that under flatwise bending the MOE-values were obtained in sections. MOE in this context is defined, however as the mean MOE of the board, calculated from the single values of the board sections.

Laminations of class C30 - 12E

Fig. 5 illustrates the MOE-distribution. The best fitting distribution function is a 3-parametric Weibull-distribution with an exponent of 7,141, a scale factor of 8639,29 and a location value of 2316,45.
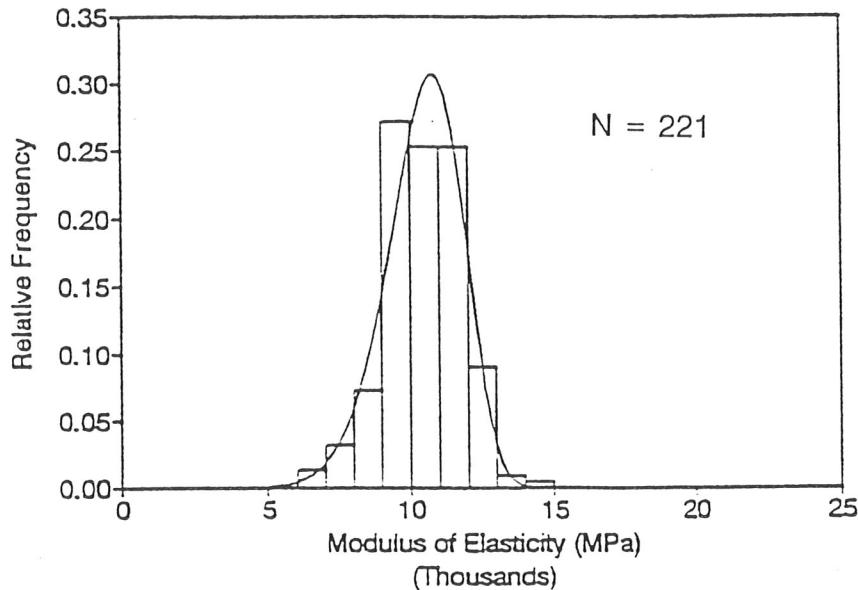
Fig 5: Distribution of modulus of elasticity for the C30 - 12E grade

Laminations of class C 37 - 14 E

Fig. 6 illustrates the MOE-distribution. The best fitting distribution function is a 3-parametric lognormal distribution with a mean value of 8,871, a standard deviation of 0,2282 and a location value of 6077,97.
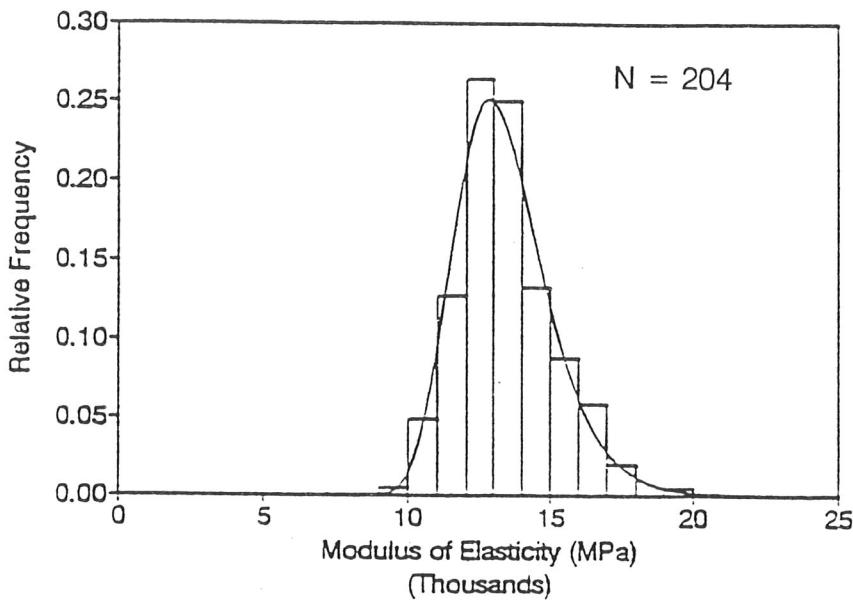

Fig 6: Distribution of modulus of elasticity for the C 37 - 14 E grade

2.2.3 Board length

The distribution of the lengths of the boards used is shown in **Fig. 7.**
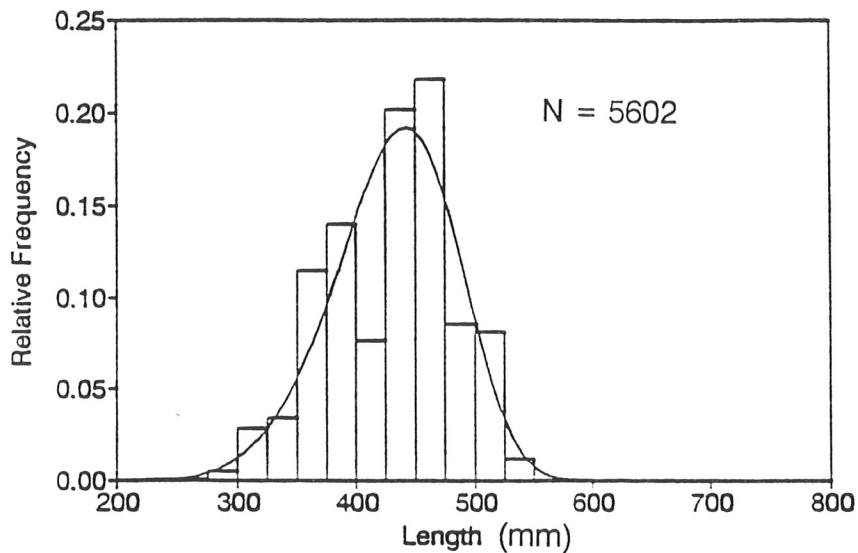
Fig 7: Distribution of board length

2.2.4 Finger joints

The bending strength of glulam beams is not only governed by the properties of the lamellations, but also significantly by the strength properties of the finger-joints. Therefore, the tensile strengths of the finger-joints of the laminations of both strength classes were tested.

Fig. 8 illustrates the test set-up and the test specimens. The length of the finger-joints was 15 mm in all cases.
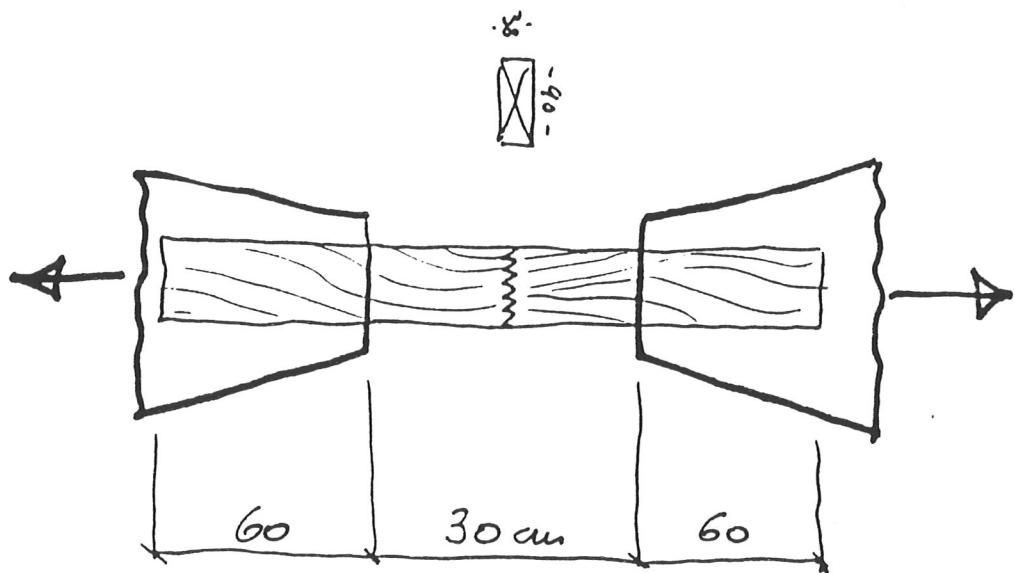
Fig 8: Finger-joint tension test configuration

Laminations of class C 30 - 12 E

Fig. 9 illustrates the distribution of the finger-joint tensile strength. The best fitting distribution function is a 3-parametric Weibull distribution with an exponent of 3,484, a scale factor of 17,673 and a location value of 17,91 (mean value of the sample: 33,8 N/mm^2, coefficient of variation: 15 %).

Laminations of class C 37 - 14 E

Fig. 10 illustrates the distribution of the finger-joint tensile strength. The best fitting distribution function is a 3-parametric Weibull distribution with an exponent of 4,631, a scale factor of 24,37 and a location value of 15,37 (mean value of the sample: 37,7 N/mm^2, coefficient of variation: 15 %).
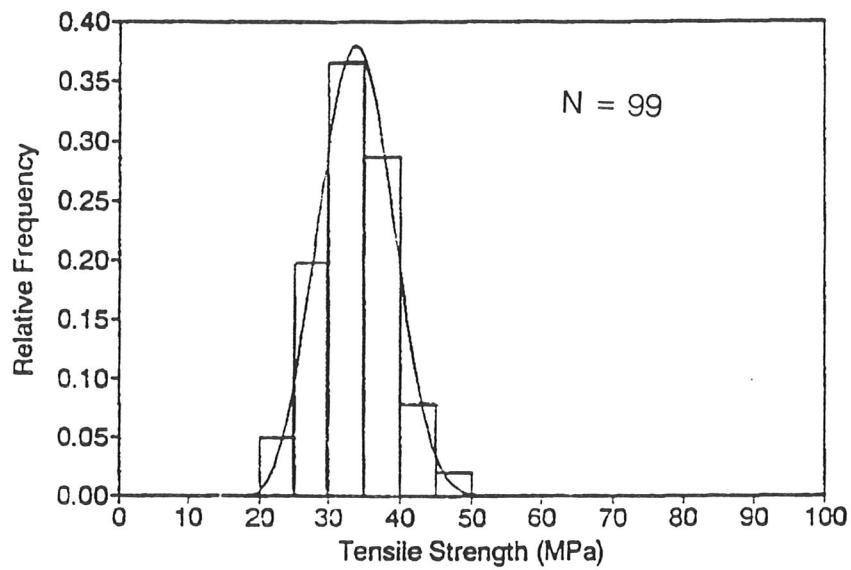
Fig 9: Distribution of finger-joint tensile strength for the C 30 - 12 E grade (tests)
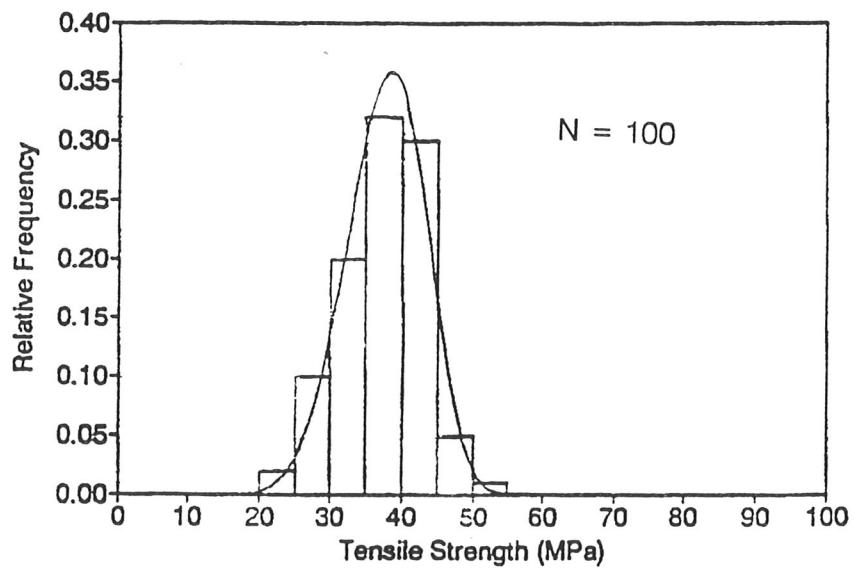
Fig 10: Distribution of finger-joint tensile strength for the C 37 - 14 E grade (tests)

3 Input data for the calculation model

3.1 Knots

No information has been submitted about the knots and their distribution along the board length. Therefore it was assumed that the KAR-values (KAR = Knot Area Ratio) within the board sections (cells) correspond to a minimum quality given by the S 10-grade of the German standard DIN 4074. Thus, is was fixed a value of max KAR = 0,55.

3.2 Density

The "Karlsruhe calculation model" is based on regression equations including the oven-dry density of board sections (called "cells") of 15 cm length, but not on the overall mean density of the board at a moisture content of 12 %.

In the simulation calculations performed a constant density along the whole length of each board was assumed, i.e. for simplification it was assumed that all cells of one board have the same density (equal to the overall mean density of the board).
For each board a value of DEN_{12} (density at 12 % m.c.) was randomly chosen from the given density distribution function of the appertaining strength class. From this value the DEN_0-value (oven-dry density) - which was needed for the simulation calculation - was calculated from the expression:

$$DEN_0 = \frac{DEN_{12}}{1 + m.c. - 0,00085 \cdot DEN_{12} \cdot m.c.} \qquad \text{with m.c.} = 0,12 \qquad (1)$$

3.3 Modulus of elasticity (MOE)

As described in section 2.2.2, the mean values of the MOE in bending of each board were calculated from the single MOE-values for bending of the board sections. In the Karlsruhe calculation model the MOE-values in tension of each cell are calculated on the basis of regression equations; from these equations single values of the mean MOE of the board in tension are obtained. This simulated MOE-value of each board is compared with a preconceived value; in case this value does not fit into a certain tolerance limit (± 5 %) the

simulation calculation for this board shall be repeated. This presumes that the procedures to simulate as well as to preconceive the MOE-value correspond to each other. This is, however, not the case with the test material under scrutiny.

In **Fig. 11** the MOE over mean density is shown. The data came from investigations in Karlsruhe with more than 1000 boards taken from several German glulam production plants. The MOE-values were obtained from a procedure based on measuring the longitudinal vibration time of the boards. Multiplying the Norwegian data of MOE - determined with a machine stress grader in Norway - with a factor of 1,27 results in a regression line practically identical with the regression line obtained with the Karlsruhe test procedure (see Fig. 11).

$$MOE = 1{,}27 \cdot (29010 \cdot DEN_{12} - 3094{,}3)$$
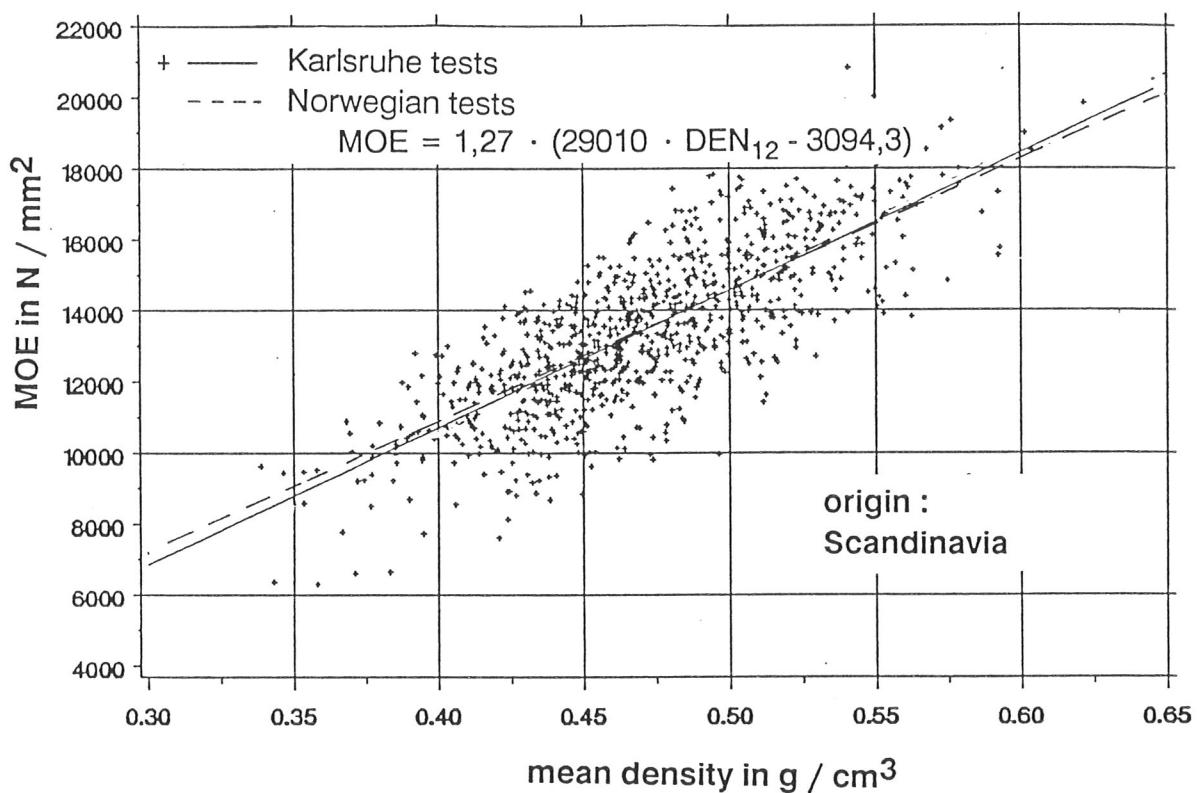
Fig 11: Regression between average density and MOE

For this reason, in the simulation calculations for the boards of series no. XXX-MOE-YYY (see section 4) in each case one value was chosen from the distribution function of the MOE of the appertaining strength class and multiplied by a factor of 1,27 before using it in the subsequent strength calculations.

3.4 Board length

The simulation of the board lengths happened by chance using the frequency distribution given in Fig. 7.

3.5 Finger-joint strength

For the simulation calculations the finger-joint tensile strength was simulated in two different manners:

- on the one hand to each finger-joint a tensile strength value was assigned by using the distribution given in Fig. 9 or Fig. 10, respectively,
- on the other hand the finger-joint tensile strength values were calculated by means of existing regression correlations.

The reason for this was as follows:
The Norwegian tests to obtain the finger-joint tensile strength values were carried out by using a test set-up following Fig. 8 (see section 2.2.4) with the clamping device being hinge-mounted fastened to the cross-head of the testing machine. Thus, any lateral deformations due to structural imperfections of the boards were inevitably possible. These lateral deformations cause additional moments in the test piece and lead to a reduction of the tensile strength by way of simplified calculation.

The regression equations used in the "Karlsruhe calculation model" were found out, however, by using a test set-up which prevents any lateral deformation by means of a rigid clamping device. This test method simulates the situation in a glulam beam in which the single laminations are prevented to deform laterally by the adjacent lamellations rigidly glued.

Based on tests performed in Karlsruhe and Munich the finger-joint tensile strength can be calculated by using the following relationship:

$$\ln(f_{t,fj}) = 2{,}72 + 6{,}14 \cdot 10^{-5} \cdot MOE_{t,fj} \qquad (2)$$

The variation of the residuum is taken into account for the simulation calculations by assuming a Gaussian distribution with a mean of zero and a standard deviation of 0,195.

This equation (2) was derived from 235 test results with finger-joint profiles of 20 mm length. Recent investigations in Germany have proved a 5 to 10 % strength increase for profiles of 15 mm length. Therefore, the strength values obtained from equ. (2) were multiplied by a factor of 1,07 assuming a 7 % strength increase.

A regression equation for determining the tensile MOE of finger-joints was derived as follows:

$$\ln(MOE_{t,fj}) = 8,407 + 2,63 \cdot 10^{-3} \cdot DEN_{0,min} \tag{3}$$

with $DEN_{0,min}$ in kg/m^3 as the smaller of the two oven-dry densities of the two pieces (boards) jointed by the finger-joint.

The variation of the residuum is taken into account by assuming a Gaussion distribution with a mean of zero and a standard deviation of 0,135.

In **Fig. 12** and **13** the simulated (calculated) frequency distributions of the finger-joint tensile strength is shown for both lamination strength classes (C30 - 12E and C37 - 14E). These distributions arise out of the density frequency according to Fig. 3 and 4 and equ. (2) and (3), respectively.

Comparing the results of estimated tensile strength values by simulation calculations (Fig. 12 and 13) with those obtained from tests (Fig. 9 and 10) it can be realized that there are considerable differences. Calculated values lead to increased mean values and increased variability. In the range of the lower 5-percentile, however, this deviation seems to be of small influence.

In order to estimate the effect of these different distributions of the finger-joint tensile strengths on the simulation calculations of the glulam beam strengths, the calculations were carried out by using equs. (2) and (3) as well as by randomly assigning the finger-joint tensile strength values from the distributions given in Fig. 9 and 10, respectively.
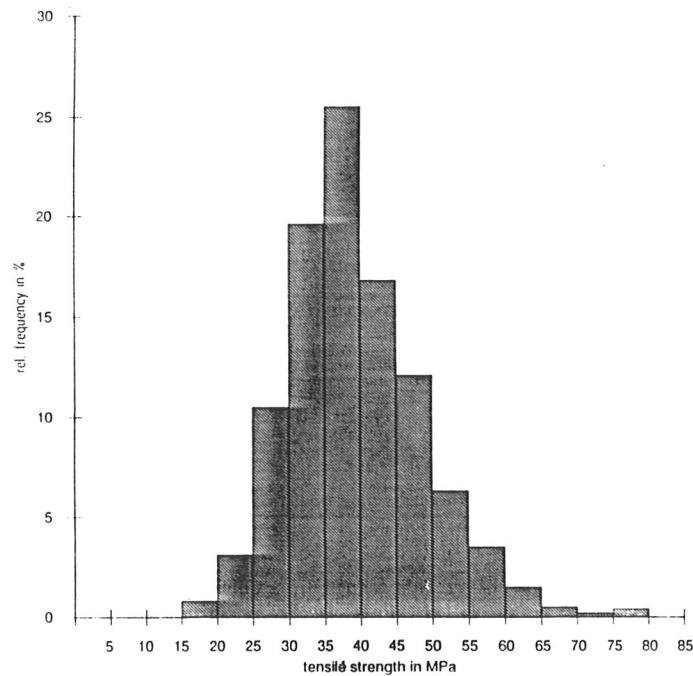
Fig 12: Estimated tensile strength of finger-joints (C30 - 12E, N = 500, m = 39,6 N/mm^2, v = 23 %, x$_5$ = 26,3 N/mm^2)
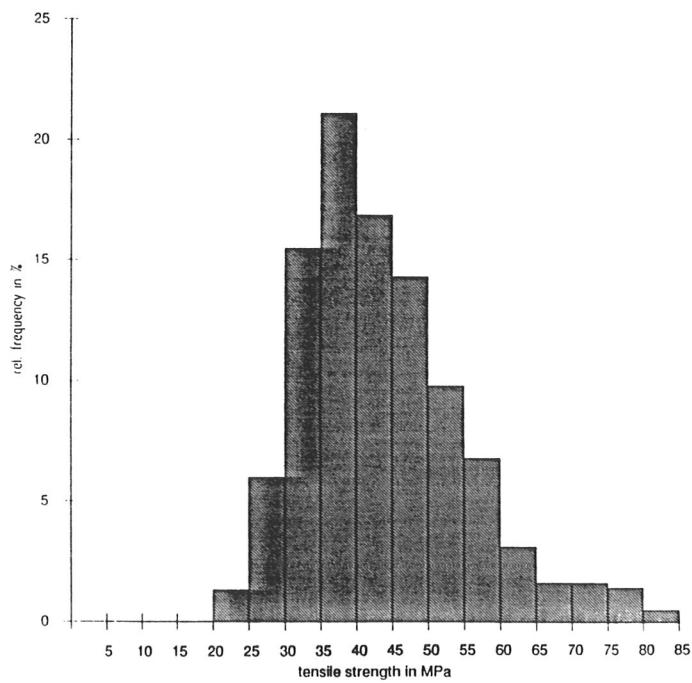
Fig 13: Estimated tensile strength of finger-joints (C37 - 14E, N = 500, m = 43,7 N/mm^2, v = 26 %, x$_5$ = 29,1 N/mm^2)

4 Simulation calculations

4.1 Beam combinations and size of calculations

The following parameters were varied:

- *Beam combination*

  As shown in Fig. 1 three different combinations were studied

- *Density, modulus of elasticity*

  For each lamination class the appertaining boards were simulated by assuming only the density (DEN) distribution as well as by assuming the density and the MOE distribution (MOE). This was done to check the influence of different assumptions on the prediction of the beam strengths

- *Finger-joint strength*

  The tensile strength of the finger-joints was taken into account once on the basis of the test results (TEST) and on the other hand by using the regression analysis (REG), see section 3.5.

Consequently, in total $3 \cdot 2 \cdot 2 = 12$ different variants were checked, as tabulated in **Table 1**.

In the Norwegian test programme in total 100 bending tests were carried out with each beam combination. Therefore, for each beam combination and variant a sample of 100 beams was simulated and the bending strength of each beam was predicted by the "Karlsruhe calculation model". In order to check in which range the test results may vary, for each of the 12 variants three series of 100 beams were simulated. In total this led to a simulation calculation of $12 \cdot 3 \cdot 100 = 3600$ glulam beams.

Table 1: Variants under scrutiny

series	beam combination (see Fig. 1)	assumption of		finger-joint strength	
		DEN	DEN + MOE	TEST	REG
I-DEN-TEST	I	x		x	
I-DEN-REG	I	x			x
I-MOE-TEST	I		x	x	
I-MOE-REG	I		x		x
II-DEN-TEST	II	x		x	
II-DEN-REG	II	x			x
II-MOE-TEST	II		x	x	
II-MOE-REG	II		x		x
III-DEN-TEST	III	x		x	
III-DEN-REG	III	x			x
III-MOE-TEST	III		x	x	
III-MOE-REG	III		x		x

4.2   Simulation results

4.2.1 Representation of the results

Strength values

The results gained for all twelve variants (see Table 1) are presented in Annex A, **Figs. A.1 to A.12** by means of histograms. In addition it was differentiated between those beams with wood failure and those with finger-joint failure. A beam is assumed to fail in a finger-joint if the failure can causally be assigned to a break-down of a finger-joint. All individual beam strength values are listed in **Tables A 1 to A 12** in Annex A.

An outline of the results is given in **Tables 2 to 4** with the 5-percentiles calculated assuming a Gaussian distribution. This was justified in all cases (Kolmogorov-test).

Table 2: Simulation results

simulations series	all beams			beams with finger-joint failure			beams with wood failure		
	m	v	x₅	N	m	v	N	m	v
	N/mm^2	%	N/mm^2		N/mm^2	%		N/mm^2	%
I-DEN-TEST	46,9	16,7	34,0	47	42,8	16,7	53	50,5	13,1
	45,1	18,6	31,3	50	43,0	21,4	50	47,2	14,7
	46,9	18,1	32,9	52	44,6	20,0	48	49,4	14,7
I-DEN-REG	48,6	17,2	34,9	34	44,7	22,9	66	50,7	12,6
	48,2	18,0	33,9	42	46,2	18,5	58	49,7	17,1
	49,2	16,2	36,1	36	46,1	15,0	64	50,9	15,7
I-MOE-TEST	47,8	17,9	33,7	68	45,7	18,3	32	52,2	14,1
	48,5	16,8	35,1	50	45,7	18,5	50	51,4	13,3
	46,7	19,3	31,9	57	43,5	17,7	43	50,9	17,7
I-MOE-REG	51,6	16,4	37,7	39	49,0	19,8	61	53,2	13,6
	52,4	16,2	38,4	35	50,4	18,7	65	53,5	14,6
	51,8	17,4	37,0	34	47,4	17,6	66	54,0	15,7

Table 3: Simulation results

simulations series	all beams			beams with finger-joint failure			beams with wood failure		
	m	v	x₅	N	m	v	N	m	v
	N/mm^2	%	N/mm^2		N/mm^2	%		N/mm^2	%
II-DEN-TEST	42,0	17,2	30,1	48	39,5	17,7	52	44,3	15,1
	40,8	19,4	27,8	42	38,6	21,9	58	42,4	16,9
	40,4	18,1	28,4	56	37,9	17,8	44	43,5	15,7
II-DEN-REG	43,6	17,1	31,3	36	42,0	20,4	64	44,5	15,0
	43,0	16,7	31,2	29	43,5	17,9	71	42,8	16,2
	43,9	12,6	34,8	32	43,9	15,7	68	43,9	11,0
II-MOE-TEST	40,4	15,1	30,4	54	39,4	15,8	46	41,6	14,0
	40,4	17,0	29,1	58	39,4	19,2	42	41,7	13,4
	41,5	15,4	31,0	45	39,8	18,0	55	43,0	12,5
II-MOE-REG	41,6	15,8	30,8	36	38,3	16,6	64	43,4	13,8
	43,0	15,8	31,8	33	40,9	16,3	67	44,0	15,2
	43,3	14,6	32,9	33	41,4	15,7	67	44,2	13,7

Table 4: Simulation results

simulations series	all beams			beams with finger-joint failure			beams with wood failure		
	m	v	x5	N	m	v	N	m	v
	N/mm²	%	N/mm²		N/mm²	%		N/mm²	%
III-DEN-TEST	46,4	17,0	32,4	46	42,3	16,8	54	49,8	13,8
	43,9	18,3	30,7	50	42,0	20,2	50	45,7	15,0
	45,9	17,9	32,4	53	43,2	17,7	47	48,9	15,9
III-DEN-REG	47,6	17,1	34,0	32	43,1	22,8	68	49,8	13,0
	47,1	16,5	34,3	40	44,4	17,0	60	48,9	15,3
	47,5	16,6	34,5	36	44,6	15,4	64	49,2	16,3
III-MOE-TEST	44,8	18,4	31,2	60	41,6	17,9	40	49,7	13,9
	45,7	18,7	31,6	61	42,6	18,0	39	50,5	15,1
	47,4	20,0	31,8	65	44,8	20,8	35	52,2	15,2
III-MOE-REG	49,6	16,8	35,9	41	46,9	18,7	59	51,4	14,7
	50,5	16,7	36,6	36	49,3	18,8	64	51,1	15,5
	49,9	16,3	36,5	34	47,1	18,9	66	51,3	14,4

Modulus of elasticity (MOE) of the beams

In addition to the strength values also the individual MOE's of all beams were determined using the classic bending theory by means of the displacements of the nodal points. In order to eliminate the influence of any shear deflections, the real MOE-values were determined only by taking into account the displacements within the area between the individual loads (see Fig. 2), i.e. the high stress region without shear forces.

Within one simulation series there was a rather small variation of the MOE-values. Therefore, the individual values are not tabulated. The results of this study are given in **Table 5**.

Table 5: Simulations results, MOE of the beams

simulation series	all beams		beams with finger-joint failure		beams with wood failure	
	m	v	m	v	m	v
	N/mm^2	%	N/mm^2	%	N/mm^2	%
I-DEN-TEST	15990	7,4	16180	7,2	15810	7,3
I-DEN-REG	16080	7,7	16230	7,9	15990	7,7
I-MOE-TEST	17150	4,5	17270	4,5	17030	4,1
I-MOE-REG	17260	5,1	17420	4,8	17200	5,3
II-DEN-TEST	13880	7,7	14050	7,3	13730	7,9
II-DEN-REG	13900	7,4	14010	7,7	13860	7,2
II-MOE-TEST	13510	5,0	13580	5,1	13410	4,8
II-MOE-REG	13410	5,2	13450	4,9	13390	5,4
III-DEN-TEST	15600	8,0	15790	8,3	15400	7,5
III-DEN-REG	15650	7,7	15790	7,9	15570	7,5
III-MOE-TEST	16630	5,2	16790	4,9	16390	5,4
III-MOE-REG	16600	5,1	16680	4,9	16550	5,2

4.2.2 Opinions on the simulation results

Possible influence of the failure modes taken as a basis.

A detailed description of the failure modes has been described by COLLING (1990). These failure modes were established on the basis of beam tests with exactly defined preconditions. The following difference was observed between wood failure (in knot areas) and finger-joint failure:

- when a crack occurred in a knot area, due to slope of grain, in most cases the load could be increased before final collapse,
- when a finger-joint failed in the outermost tension lamination, final collapse occurred immediately.

Due to this experience, in case of finger-joint failure in the outermost lamination the simulation calculation was based on a brittle failure criterion.

The FE-simulation programme includes a comparison of the individually assumed tensile or compressive strengths, respectively, with the calculated stresses in the centre of the elements. This leads to the effect that for small glulam beams with a reduced number of laminations and a considerable portion of bending stresses an increased strength of laminations under combined bending and normal stresses is not taken into account. Therefore, it is possible that the bending strength of glulam beams with finger-joint failures as well as those with a small number of laminations is slightly underestimated. This underestimation is, however, very small because the failure criteria are calibrated to the test results. Moreover, this influence is on the so-called safe side.

Comparison of the series TEST against REG

A comparison of the series belonging together, e.g. series I-DEN-TEST and I-DEN-REG, leads to the following tendencies:

- beams belonging to TEST-series demonstrate lower mean values as well as 5-percentiles of the bending strength,
- beams belonging to TEST-series give more finger-joint failures as those belonging to REG-series.

These findings can be explained with the differently assumed distributions of the finger-joint tensile strengths as described in section 3.5.

Comparison of the series DEN against MOE

The strength of timber and finger-joints is more closely correlated to the MOE than to the density. Therefore, a prediction based on simulation calculations with density distribution of the boards only (series DEN) must lead to a certain inaccuracy in the strength prediction. In order to estimate this effect, in the simulation calculations of the MOE-series each board was assigned with a modulus of elasticity - taken from the appertaining distribution - in addition to the assigned density value.

A comparison of the series belonging together, e.g. series I-DEN-REG and I-MOE-REG, leads to the following tendencies:

- for beams belonging to series TEST an influence of different assignments in connection with density and MOE can not be recognized. The reason for this is that the finger-joint strength values have been selected randomly from the distribution gained from tests; thus, the narrow correlation between finger-joint strength and MOE of the boards was not taken into account. Because the characteristic bending strength of all beams considerably depends on the finger-joint strength (this can be seen from tables A.1 to A.12, showing that beams with lower strength values predominantly fail in the finger-joints), a further assignment of MOE-values of the boards had no significant influence on the simulated beam strengths.

- beams belonging to series MOE-TEST demonstrate significantly more frequent finger-joint failures than those beams belonging to series DEN-TEST. This can be explained by the narrow correlation between timber strength and MOE which is taken into account to predict the lamination strength values. This leads to an increase of the timber strength, whereas the finger-joint strength values do not change. Consequently, more finger-joint failures must occur with beams of series MOE-TEST.

- a different behaviour was observed with beams belonging to series REG. In this case also for the finger-joints the narrow correlation between strength and MOE is taken into account. This results in increasing timber strengths as well as finger-joint strengths. The probability of finger-joint failure or wood failure does not change.

- the calculated strength values of beams belonging to series MOE-REG are higher than those of beams belonging to series DEN-REG. This tendency is more distinct with the beam combinations I and III.

5 Summary and conclusion

In this study the bending strength of glulam beams was predicted by means of the "Karlsruhe calculation model". Basis for these simulation calculations are the properties of the beams and their laminations as described in section 2 and the input data derived from these properties.

As a conclusion, the strength values given in **Table 6** can be expected for the three beam combinations tested.

The data presented in Table 6 are based on the simulation calculations of the series called MOE-REG, because in this case the narrow correlation between strength and MOE is taken into account for the boards (laminations) as well as for the finger-joints. Moreover, any imponderabilities in connection with the determination of the finger-joint tensile strength by means of the test device used are excluded.

Table 6: Predicted beam bending strengths

beam combination	mean value	c.o.v.	5-percentile (Gaußian distr.)	5-percentile (non-parametric)
	N/mm^2		N/mm^2	N/mm^2
I	51,9	0,166	37,7	38,7
II	42,6	0,155	31,8	32,7
III	49,6	0,166	36,1	37,5

Literature

Colling, F.
Bending strength of glulam beams - a statistical model. IUFRO 1990, Saint John/ New Brunswick, Canada. 1990

Results

Table A.1:   Simulation results, series I-DEN-TEST, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	28.33	27.70	33.09	28.33	27.70	33.09	34.66	34.09	34.37
2	28.79	27.96	34.33	28.79	27.96	34.33	39.17	34.37	34.74
3	31.13	29.97	34.37	31.13	29.97	34.52	39.87	36.33	35.68
4	31.60	31.26	34.52	31.60	31.26	34.81	42.21	36.84	37.92
5	33.63	32.70	34.74	33.63	32.70	34.91	42.50	38.26	38.27
6	34.66	32.73	34.81	34.85	32.73	35.18	42.76	38.41	38.67
7	34.85	32.74	34.91	35.57	32.74	35.32	43.58	38.57	39.23
8	35.57	32.97	35.18	36.33	32.97	35.36	43.88	40.66	41.18
9	36.33	33.92	35.32	36.53	33.92	35.84	43.93	41.16	42.18
10	36.53	34.09	35.36	36.90	34.96	36.03	44.48	41.25	43.26
11	36.90	34.37	35.68	37.08	35.35	36.45	44.83	42.81	43.57
12	37.08	34.96	35.84	37.41	36.19	36.99	45.05	42.99	43.93
13	37.41	35.35	36.03	37.47	36.22	37.54	45.35	43.00	44.62
14	37.47	36.19	36.45	37.59	36.64	38.10	45.37	43.29	44.65
15	37.59	36.22	36.99	39.23	37.15	38.51	45.50	43.38	46.50
16	39.17	36.33	37.54	39.33	37.34	39.22	46.13	43.46	46.68
17	39.23	36.64	37.92	39.62	37.57	39.24	46.59	44.14	46.83
18	39.33	36.84	38.10	40.84	37.58	40.65	46.80	44.58	47.06
19	39.62	37.15	38.27	41.03	37.60	40.71	47.11	44.80	47.67
20	39.87	37.34	38.51	41.67	38.23	40.74	47.60	44.91	48.40
21	40.84	37.57	38.67	41.85	38.42	40.86	48.30	45.43	48.52
22	41.03	37.58	39.22	42.49	38.81	40.94	48.50	45.43	48.83
23	41.67	37.60	39.23	42.60	40.72	41.25	48.67	45.85	49.44
24	41.85	38.23	39.24	42.69	41.65	41.43	49.12	45.90	49.86
25	42.21	38.26	40.65	42.71	41.98	41.44	49.18	46.52	50.58
26	42.49	38.41	40.71	43.27	42.65	41.62	49.67	47.30	50.67
27	42.50	38.42	40.74	43.29	42.89	43.12	50.09	47.49	51.42
28	42.60	38.57	40.86	43.36	44.07	43.46	50.81	48.03	51.49
29	42.69	38.81	40.94	43.86	44.29	44.40	50.85	48.07	52.77
30	42.71	40.66	41.18	44.93	44.33	44.49	51.06	48.37	53.60
31	42.76	40.72	41.23	45.26	45.74	44.55	51.88	48.86	53.61
32	43.27	41.16	41.43	46.09	45.86	44.95	52.20	49.30	53.94
33	43.29	41.25	41.44	46.12	46.01	44.95	52.32	49.31	54.03
34	43.36	41.65	41.62	46.38	47.23	45.14	53.01	49.43	54.06
35	43.58	41.98	42.18	46.53	47.48	45.92	53.21	49.60	54.23
36	43.86	42.65	43.12	47.15	47.87	46.16	53.28	49.85	54.33
37	43.88	42.81	43.26	47.74	48.20	46.25	53.33	50.29	55.66
38	43.93	42.89	43.46	48.20	50.17	47.50	53.47	51.21	56.61
39	44.48	42.99	43.57	50.68	50.78	47.96	54.46	51.29	56.77
40	44.83	43.00	43.93	51.48	52.07	48.81	54.66	51.59	56.88
41	44.93	43.29	44.40	51.98	52.13	49.34	54.75	53.96	56.97
42	45.05	43.38	44.49	52.66	52.20	51.58	54.79	54.07	57.16
43	45.26	43.46	44.55	52.74	52.22	53.18	55.03	54.20	57.55
44	45.35	44.07	44.62	53.10	54.02	53.38	56.51	55.29	58.46
45	45.37	44.14	44.65	53.62	54.08	53.90	57.66	55.73	58.79
46	45.50	44.29	44.95	56.52	54.52	55.20	58.99	57.89	58.84
47	46.09	44.33	44.95	58.18	54.54	57.63	60.65	58.05	59.10
48	46.12	44.58	45.14		54.60	58.47	61.37	58.52	62.19
49	46.13	44.80	45.92		61.32	58.65	61.58	60.87	
50	46.38	44.91	46.16		72.56	64.63	61.81	67.03	

N	all beams			beams with finger-joint failure	beams with wood failure
51	46.53	45.43	46.25	65.31	61.98
52	46.59	45.43	46.50	73.71	62.14
53	46.80	45.74	46.68		62.52
54	47.11	45.85	46.83		
55	47.15	45.86	47.06		
56	47.60	45.90	47.50		
57	47.74	46.01	47.67		
58	48.20	46.52	47.96		
59	48.30	47.23	48.40		
60	48.50	47.30	48.52		
61	48.67	47.48	48.81		
62	49.12	47.49	48.83		
63	49.18	47.87	49.34		
64	49.67	48.03	49.44		
65	50.09	48.07	49.86		
66	50.68	48.20	50.58		
67	50.81	48.37	50.67		
68	50.85	48.86	51.42		
69	51.06	49.30	51.49		
70	51.48	49.31	51.58		
71	51.88	49.43	52.77		
72	51.98	49.60	53.18		
73	52.20	49.85	53.38		
74	52.32	50.17	53.60		
75	52.66	50.29	53.61		
76	52.74	50.78	53.90		
77	53.01	51.21	53.94		
78	53.10	51.29	54.03		
79	53.21	51.59	54.06		
80	53.28	52.07	54.23		
81	53.33	52.13	54.33		
82	53.47	52.20	55.20		
83	53.62	52.22	55.66		
84	54.46	53.96	56.61		
85	54.66	54.02	56.77		
86	54.75	54.07	56.88		
87	54.79	54.08	56.97		
88	55.03	54.20	57.16		
89	56.51	54.52	57.55		
90	56.52	54.54	57.63		
91	57.66	54.60	58.46		
92	58.18	55.29	58.47		
93	58.99	55.73	58.65		
94	60.65	57.89	58.79		
95	61.37	58.05	58.84		
96	61.58	58.52	59.10		
97	61.81	60.87	62.19		
98	61.98	61.32	64.63		
99	62.14	67.03	65.31		
100	62.52	72.56	73.71		

Table A.2: Simulation results, series I-DEN-REG, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	30.09	29.68	32.04	30.09	29.68	32.04	35.70	33.68	36.03
2	30.73	31.18	32.69	30.73	31.18	32.69	37.57	34.13	36.07
3	31.26	33.23	33.32	31.26	33.23	33.32	40.42	35.23	37.23
4	33.02	33.68	36.03	33.02	34.14	36.31	40.94	35.36	37.40
5	33.46	34.13	36.07	33.46	34.96	39.60	41.84	35.88	37.90
6	33.62	34.14	36.31	33.62	35.23	40.04	42.66	38.94	41.00
7	33.99	34.96	37.23	33.99	35.67	40.59	42.68	39.07	41.01
8	34.37	35.23	37.40	34.37	36.07	40.72	43.57	39.12	42.81
9	34.85	35.23	37.90	34.85	36.81	41.06	43.69	39.94	43.23
10	34.91	35.36	39.60	34.91	37.67	41.80	43.97	41.48	43.43
11	35.70	35.67	40.04	35.89	37.86	42.14	44.04	41.96	44.51
12	35.89	35.88	40.59	39.41	39.93	42.30	44.18	43.45	44.86
13	37.57	36.07	40.72	40.81	40.48	43.40	44.71	43.56	44.87
14	39.41	36.81	41.00	41.18	40.91	43.95	45.16	44.31	45.45
15	40.42	37.67	41.01	41.53	41.71	44.08	46.00	45.06	45.47
16	40.81	37.86	41.06	41.92	44.22	44.51	46.18	45.11	45.72
17	40.94	38.94	41.80	42.85	44.61	44.64	46.20	45.13	45.77
18	41.18	39.07	42.14	45.53	45.14	44.91	46.46	46.02	46.28
19	41.53	39.12	42.30	46.18	45.20	46.36	46.78	46.19	46.31
20	41.84	39.93	42.81	46.24	46.76	46.75	46.86	46.52	46.91
21	41.92	39.94	43.23	47.90	48.28	47.76	47.16	46.69	47.25
22	42.66	40.48	43.40	48.07	48.76	47.96	47.23	47.52	47.35
23	42.68	40.91	43.43	48.48	49.24	49.00	47.35	47.84	47.57
24	42.85	41.48	43.95	48.86	49.48	49.76	47.47	47.93	48.16
25	43.57	41.71	44.08	48.94	49.50	50.15	47.54	48.16	48.23
26	43.69	41.96	44.51	50.46	49.71	50.44	48.18	48.40	48.90
27	43.97	43.45	44.51	54.20	50.43	51.01	48.30	48.51	49.01
28	44.04	43.56	44.64	55.45	51.18	51.74	48.67	48.74	49.10
29	44.18	44.22	44.86	56.21	51.26	52.32	48.78	50.15	49.17
30	44.71	44.31	44.87	59.05	51.72	52.81	48.95	50.17	49.20
31	45.16	44.61	44.91	59.72	52.50	53.17	49.31	50.18	49.39
32	45.53	45.06	45.45	60.60	52.69	53.33	49.83	50.19	49.79
33	46.00	45.11	45.47	62.24	52.96	53.59	50.03	50.25	50.10
34	46.18	45.13	45.72	66.66	53.03	54.97	50.22	50.79	50.78
35	46.18	45.14	45.77		53.15	58.32	51.78	51.01	51.00
36	46.20	45.20	46.28		53.81	60.46	51.83	51.08	51.41
37	46.24	46.02	46.31		54.15		52.16	51.12	51.43
38	46.46	46.19	46.36		54.64		52.32	51.48	51.76
39	46.78	46.52	46.75		58.91		52.36	51.91	52.31
40	46.86	46.69	46.91		59.54		52.58	52.62	52.58
41	47.16	46.76	47.25		61.41		52.61	54.12	52.68
42	47.23	47.52	47.35		61.57		52.83	54.18	52.98
43	47.35	47.84	47.57				52.89	54.43	53.37
44	47.47	47.93	47.76				52.91	54.70	53.54
45	47.54	48.16	47.96				53.11	54.85	53.73
46	47.90	48.28	48.16				53.23	54.99	54.78
47	48.07	48.40	48.23				54.10	56.85	55.18
48	48.18	48.51	48.90				54.54	57.15	55.89
49	48.30	48.74	49.00				55.44	57.22	56.06
50	48.48	48.76	49.01				55.94	57.86	56.23

N	all beams			beams with finger-joint failure	beams with wood failure		
51	48.67	49.24	49.10		56.51	58.16	56.82
52	48.78	49.48	49.17		56.66	60.34	57.35
53	48.86	49.50	49.20		56.80	60.60	57.78
54	48.94	49.71	49.39		56.96	61.17	58.07
55	48.95	50.15	49.76		56.98	61.64	58.12
56	49.31	50.17	49.79		57.40	65.75	59.48
57	49.83	50.18	50.10		58.28	70.43	60.70
58	50.03	50.19	50.15		58.41	73.45	60.72
59	50.22	50.25	50.44		58.68		61.77
60	50.46	50.43	50.78		58.79		62.84
61	51.78	50.79	51.00		58.86		63.01
62	51.83	51.01	51.01		60.88		63.86
63	52.16	51.08	51.41		60.95		68.67
64	52.32	51.12	51.43		61.60		79.14
65	52.36	51.18	51.74		62.07		
66	52.58	51.26	51.76		66.34		
67	52.61	51.48	52.31				
68	52.83	51.72	52.32				
69	52.89	51.91	52.58				
70	52.91	52.50	52.68				
71	53.11	52.62	52.81				
72	53.23	52.69	52.98				
73	54.10	52.96	53.17				
74	54.20	53.03	53.33				
75	54.54	53.15	53.37				
76	55.44	53.81	53.54				
77	55.45	54.12	53.59				
78	55.94	54.15	53.73				
79	56.21	54.18	54.78				
80	56.51	54.43	54.97				
81	56.66	54.64	55.18				
82	56.80	54.70	55.89				
83	56.96	54.85	56.06				
84	56.98	54.99	56.23				
85	57.40	56.85	56.82				
86	58.28	57.15	57.35				
87	58.41	57.22	57.78				
88	58.68	57.86	58.07				
89	58.79	58.16	58.12				
90	58.86	58.91	58.32				
91	59.05	59.54	59.48				
92	59.72	60.34	60.46				
93	60.60	60.60	60.70				
94	60.88	61.17	60.72				
95	60.95	61.41	61.77				
96	61.60	61.57	62.84				
97	62.07	61.64	63.01				
98	62.24	65.75	63.86				
99	66.34	70.43	68.67				
100	66.66	73.45	79.14				

Table A.3:   Simulation results, series I-MOE-TEST, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	27.01	26.52	25.09	27.01	26.52	25.09	38.53	34.24	30.79
2	30.97	30.83	29.36	30.97	30.83	29.36	38.94	40.69	31.68
3	31.36	32.21	29.80	31.36	32.21	29.80	41.42	40.98	33.26
4	32.35	34.24	30.79	32.35	34.55	31.75	42.46	41.32	36.54
5	32.46	34.55	31.68	32.46	35.90	32.21	43.88	42.29	37.68
6	32.85	35.90	31.75	32.85	36.08	32.66	44.59	43.60	41.51
7	33.49	36.08	32.21	33.49	38.21	34.83	44.73	44.22	44.06
8	34.22	38.21	32.66	34.22	38.26	35.31	45.54	45.11	44.91
9	34.59	38.26	33.26	34.59	38.47	36.94	47.46	45.11	46.52
10	35.70	38.47	34.83	35.70	40.03	37.93	48.28	46.20	46.65
11	36.48	40.03	35.31	36.48	40.04	38.16	48.35	46.88	46.80
12	36.82	40.04	36.54	36.82	40.91	38.47	49.85	46.88	46.83
13	37.45	40.69	36.94	37.45	40.93	38.81	50.14	47.36	47.43
14	37.64	40.91	37.68	37.64	41.35	38.87	50.93	47.59	47.92
15	38.53	40.93	37.93	38.70	41.52	39.57	52.08	47.81	48.28
16	38.70	40.98	38.16	39.90	41.84	39.83	53.44	48.69	48.44
17	38.94	41.32	38.47	41.12	42.24	39.86	53.75	49.24	48.74
18	39.90	41.35	38.81	41.34	42.34	40.04	53.78	49.29	49.13
19	41.12	41.52	38.87	41.95	42.48	40.09	54.02	49.34	49.29
20	41.34	41.84	39.57	42.12	42.85	40.71	54.57	49.35	49.54
21	41.42	42.24	39.83	42.96	43.16	40.99	55.55	49.58	49.99
22	41.95	42.29	39.86	43.03	43.69	41.49	56.13	50.04	50.21
23	42.12	42.34	40.04	43.06	44.60	41.55	56.29	50.75	50.44
24	42.46	42.48	40.09	43.07	44.73	41.64	57.61	51.16	51.02
25	42.96	42.85	40.71	43.76	44.83	41.65	57.68	51.23	51.54
26	43.03	43.16	40.99	43.78	45.02	41.73	57.70	51.64	52.39
27	43.06	43.60	41.49	44.24	45.02	42.45	57.87	51.68	52.46
28	43.07	43.69	41.51	44.24	45.47	42.60	59.48	52.15	52.86
29	43.76	44.22	41.55	44.62	46.12	42.69	60.64	52.53	53.03
30	43.78	44.60	41.64	44.84	46.32	42.71	61.38	52.71	53.93
31	43.88	44.73	41.65	44.93	46.65	43.46	64.89	53.13	54.42
32	44.24	44.83	41.73	44.96	47.15	43.86	68.74	53.35	55.05
33	44.24	45.02	42.45	45.21	47.29	44.23		53.48	55.12
34	44.59	45.02	42.60	45.39	47.55	44.58		53.70	56.57
35	44.62	45.11	42.69	46.42	47.57	44.73		53.70	59.68
36	44.73	45.11	42.71	46.47	47.97	44.87		53.92	60.35
37	44.84	45.47	43.46	47.14	48.80	46.10		54.37	61.84
38	44.93	46.12	43.86	47.38	48.93	46.95		54.45	62.00
39	44.96	46.20	44.06	47.43	49.08	47.31		54.85	63.36
40	45.21	46.32	44.23	47.69	50.22	47.36		54.96	63.61
41	45.39	46.65	44.58	47.80	51.17	47.49		56.01	65.54
42	45.54	46.88	44.73	48.08	52.50	47.53		56.34	66.32
43	46.42	46.88	44.87	48.15	54.45	48.41		57.42	70.62
44	46.47	47.15	44.91	48.42	54.74	48.55		58.24	
45	47.14	47.29	46.10	48.57	58.30	48.93		58.31	
46	47.38	47.36	46.52	48.70	60.36	49.53		59.38	
47	47.43	47.55	46.65	48.89	61.62	49.79		60.07	
48	47.46	47.57	46.80	49.12	63.44	50.12		61.15	
49	47.69	47.59	46.83	49.51	64.97	50.15		67.73	
50	47.80	47.81	46.95	49.69	66.22	50.45		73.49	

N	all beams			beams with finger-joint failure		beams with wood failure
51	48.08	47.97	47.31	50.02	50.83	
52	48.15	48.69	47.36	50.14	51.51	
53	48.28	48.80	47.43	50.51	51.95	
54	48.35	48.93	47.49	50.85	52.89	
55	48.42	49.08	47.53	51.13	57.87	
56	48.57	49.24	47.92	51.77	64.55	
57	48.70	49.29	48.28	51.94	65.45	
58	48.89	49.34	48.41	53.27		
59	49.12	49.35	48.44	54.11		
60	49.51	49.58	48.55	54.14		
61	49.69	50.04	48.74	54.50		
62	49.85	50.22	48.93	54.84		
63	50.02	50.75	49.13	60.10		
64	50.14	51.16	49.29	60.46		
65	50.14	51.17	49.53	60.51		
66	50.51	51.23	49.54	62.00		
67	50.85	51.64	49.79	64.33		
68	50.93	51.68	49.99	67.24		
69	51.13	52.15	50.12			
70	51.77	52.50	50.15			
71	51.94	52.53	50.21			
72	52.08	52.71	50.44			
73	53.27	53.13	50.45			
74	53.44	53.35	50.83			
75	53.75	53.48	51.02			
76	53.78	53.70	51.51			
77	54.02	53.70	51.54			
78	54.11	53.92	51.95			
79	54.14	54.37	52.39			
80	54.50	54.45	52.46			
81	54.57	54.45	52.86			
82	54.84	54.74	52.89			
83	55.55	54.85	53.03			
84	56.13	54.96	53.93			
85	56.29	56.01	54.42			
86	57.61	56.34	55.05			
87	57.68	57.42	55.12			
88	57.70	58.24	56.57			
89	57.87	58.30	57.87			
90	59.48	58.31	59.68			
91	60.10	59.38	60.35			
92	60.46	60.07	61.84			
93	60.51	60.36	62.00			
94	60.64	61.15	63.36			
95	61.38	61.62	63.61			
96	62.00	63.44	64.55			
97	64.33	64.97	65.45			
98	64.89	66.22	65.54			
99	67.24	67.73	66.32			
100	68.74	73.49	70.62			

Table A.4:   Simulation results, series I-MOE-REG, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	32.97	34.76	29.75	32.97	34.76	29.75	40.23	37.66	33.89
2	36.77	35.39	29.76	36.77	35.39	29.76	41.08	38.08	38.26
3	37.09	36.38	33.89	37.09	36.38	34.22	41.41	41.45	39.12
4	37.70	37.66	34.22	37.70	39.67	38.50	42.26	41.48	39.66
5	38.72	38.08	38.26	38.72	41.40	38.87	43.15	41.78	40.23
6	39.46	39.67	38.50	39.46	41.73	39.82	43.28	42.10	41.42
7	39.60	41.40	38.87	39.60	42.60	41.57	43.38	42.94	43.10
8	39.68	41.45	39.12	39.68	42.71	41.82	43.76	43.38	43.62
9	39.86	41.48	39.66	39.86	43.06	42.04	43.79	44.46	43.94
10	40.23	41.73	39.82	40.64	43.80	42.21	44.40	44.99	45.61
11	40.64	41.78	40.23	40.76	44.39	42.35	46.07	45.18	46.16
12	40.76	42.10	41.42	41.07	45.05	43.90	47.12	45.58	46.16
13	41.07	42.60	41.57	42.32	45.13	45.40	47.21	45.68	46.53
14	41.08	42.71	41.82	42.82	45.55	46.38	47.24	46.25	47.05
15	41.41	42.94	42.04	43.49	47.58	46.77	47.49	46.60	47.60
16	42.26	43.06	42.21	44.42	47.90	46.77	47.70	46.98	48.15
17	42.32	43.38	42.35	46.28	49.83	46.98	48.11	47.66	49.06
18	42.82	43.80	43.10	46.92	50.37	46.99	48.33	48.64	49.72
19	43.15	44.39	43.62	47.07	51.35	48.03	48.55	49.06	49.77
20	43.28	44.46	43.90	48.78	51.64	48.82	49.07	49.31	50.71
21	43.38	44.99	43.94	49.04	51.78	49.36	49.43	49.98	51.15
22	43.49	45.05	45.40	49.93	52.88	49.68	49.62	50.76	51.26
23	43.76	45.13	45.61	50.63	53.97	51.15	49.72	51.13	51.28
24	43.79	45.18	46.16	50.75	54.32	51.28	50.23	51.35	51.51
25	44.40	45.55	46.16	51.38	54.47	52.33	50.43	51.67	52.20
26	44.42	45.58	46.38	52.52	54.83	52.50	50.78	51.94	52.22
27	46.07	45.68	46.53	52.68	56.96	53.14	51.21	52.01	52.30
28	46.28	46.25	46.77	52.72	57.36	54.34	51.36	52.16	52.32
29	46.92	46.60	46.77	54.31	59.26	55.08	51.45	52.29	52.34
30	47.07	46.98	46.98	54.48	59.50	56.43	51.49	52.64	52.55
31	47.12	47.58	46.99	56.95	59.88	58.14	51.63	52.80	52.60
32	47.21	47.66	47.05	57.76	61.31	58.21	52.26	52.87	52.82
33	47.24	47.90	47.60	58.82	62.20	60.59	53.06	53.19	53.04
34	47.49	48.64	48.03	60.14	69.45	67.65	53.86	53.53	53.29
35	47.70	49.06	48.15	61.26	76.73		55.76	53.80	53.34
36	48.11	49.31	48.82	63.96			55.91	53.89	53.45
37	48.33	49.83	49.06	65.87			56.05	54.50	54.20
38	48.55	49.98	49.36	68.40			56.59	54.86	54.64
39	48.78	50.37	49.68	72.94			57.24	55.03	54.72
40	49.04	50.76	49.72				57.32	55.10	54.83
41	49.07	51.13	49.77				57.52	55.64	55.00
42	49.43	51.35	50.71				57.62	56.47	55.33
43	49.62	51.35	51.15				57.71	57.04	56.28
44	49.72	51.64	51.15				57.86	57.13	57.25
45	49.93	51.67	51.26				58.05	57.27	57.99
46	50.23	51.78	51.28				58.14	58.09	59.44
47	50.43	51.94	51.28				59.74	58.39	59.45
48	50.63	52.01	51.51				59.85	58.43	59.49
49	50.75	52.16	52.20				60.15	58.45	59.54
50	50.78	52.29	52.22				60.36	58.85	59.99

N	all beams			beams with finger-joint failure			beams with wood failure		
51	51.21	52.64	52.30				60.58	59.09	60.18
52	51.36	52.80	52.32				61.12	59.19	60.48
53	51.38	52.87	52.33				61.33	59.77	61.20
54	51.45	52.88	52.34				62.10	60.59	61.29
55	51.49	53.19	52.50				62.25	60.81	61.62
56	51.63	53.53	52.55				62.54	60.87	61.76
57	52.26	53.80	52.60				63.34	62.11	62.79
58	52.52	53.89	52.82				65.03	62.67	63.18
59	52.68	53.97	53.04				65.67	63.80	64.38
60	52.72	54.32	53.14				65.70	65.92	64.75
61	53.06	54.47	53.29				68.69	65.96	67.20
62	53.86	54.50	53.34					67.47	67.41
63	54.31	54.83	53.45					67.71	68.13
64	54.48	54.86	54.20					68.21	70.99
65	55.76	55.03	54.34					72.70	72.09
66	55.91	55.10	54.64						74.18
67	56.05	55.64	54.72						
68	56.59	56.47	54.83						
69	56.95	56.96	55.00						
70	57.24	57.04	55.08						
71	57.32	57.13	55.33						
72	57.52	57.27	56.28						
73	57.62	57.36	56.43						
74	57.71	58.09	57.25						
75	57.76	58.39	57.99						
76	57.86	58.43	58.14						
77	58.05	58.45	58.21						
78	58.14	58.85	59.44						
79	58.82	59.09	59.45						
80	59.74	59.19	59.49						
81	59.85	59.26	59.54						
82	60.14	59.50	59.99						
83	60.15	59.77	60.18						
84	60.36	59.88	60.48						
85	60.58	60.59	60.59						
86	61.12	60.81	61.20						
87	61.26	60.87	61.29						
88	61.33	61.31	61.62						
89	62.10	62.11	61.76						
90	62.25	62.20	62.79						
91	62.54	62.67	63.18						
92	63.34	63.80	64.38						
93	63.96	65.92	64.75						
94	65.03	65.96	67.20						
95	65.67	67.47	67.41						
96	65.70	67.71	67.65						
97	65.87	68.21	68.13						
98	68.40	69.45	70.99						
99	68.69	72.70	72.09						
100	72.94	76.73	74.18						

Table A.5:   Simulation results, series II-DEN-TEST, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	24.37	27.41	26.02	24.37	27.41	26.02	30.86	28.60	27.83
2	29.73	27.88	26.71	29.73	27.88	26.71	31.01	29.07	31.59
3	30.86	28.60	27.11	31.49	28.78	27.11	31.15	29.16	32.93
4	31.01	28.78	27.83	31.77	29.08	28.42	34.15	29.76	34.56
5	31.15	29.07	28.42	32.35	29.84	29.60	34.86	30.58	35.63
6	31.49	29.08	29.60	32.55	29.86	30.22	35.23	31.31	37.15
7	31.77	29.16	30.22	33.01	29.96	30.57	37.54	34.95	37.15
8	32.35	29.76	30.57	33.32	30.33	30.66	37.64	35.38	37.36
9	32.55	29.84	30.66	33.42	30.38	31.10	38.53	35.49	38.37
10	33.01	29.86	31.10	33.47	31.41	31.44	39.10	35.89	38.43
11	33.32	29.96	31.44	33.50	31.68	31.65	39.32	35.98	38.82
12	33.42	30.33	31.59	33.60	31.92	31.66	39.66	36.29	38.94
13	33.47	30.38	31.65	33.67	32.50	31.80	39.94	37.93	39.04
14	33.50	30.58	31.66	33.70	34.78	32.08	40.24	37.94	39.92
15	33.60	31.31	31.80	35.64	35.23	33.00	40.24	38.10	39.93
16	33.67	31.41	32.08	35.86	35.23	33.38	40.88	38.16	40.81
17	33.70	31.68	32.93	35.97	35.47	34.14	41.04	38.55	41.46
18	34.15	31.92	33.00	36.16	35.51	34.36	41.13	38.75	41.49
19	34.86	32.50	33.38	36.83	35.80	34.65	41.25	38.77	41.52
20	35.23	34.78	34.14	37.14	36.07	34.69	41.60	38.94	42.18
21	35.64	34.95	34.36	37.18	37.45	34.77	41.71	38.97	42.86
22	35.86	35.23	34.56	37.74	38.12	35.39	41.78	39.37	43.22
23	35.97	35.23	34.65	37.81	38.58	35.44	42.23	40.13	43.23
24	36.16	35.38	34.69	37.94	39.49	35.79	42.27	40.60	43.30
25	36.83	35.47	34.77	38.06	39.83	36.18	43.65	40.88	44.04
26	37.14	35.49	35.39	38.91	40.33	36.25	44.06	41.23	44.39
27	37.18	35.51	35.44	38.92	40.77	36.58	44.30	41.33	44.53
28	37.54	35.80	35.63	39.13	40.91	36.87	44.57	41.38	44.58
29	37.64	35.89	35.79	39.38	41.39	37.17	44.75	42.75	45.01
30	37.74	35.98	36.18	40.32	41.56	37.93	45.19	42.84	47.14
31	37.81	36.07	36.25	41.12	41.58	38.57	45.95	43.00	47.63
32	37.94	36.29	36.58	41.86	41.76	38.80	45.99	43.08	47.92
33	38.06	37.45	36.87	42.21	41.81	39.17	46.26	43.25	48.38
34	38.53	37.93	37.15	42.32	42.96	39.49	46.45	43.26	48.44
35	38.91	37.94	37.15	44.46	43.38	39.62	46.66	43.44	48.60
36	38.92	38.10	37.17	44.70	45.22	39.68	47.02	43.49	48.82
37	39.10	38.12	37.36	45.04	47.19	39.68	47.12	44.08	49.31
38	39.13	38.16	37.93	45.05	50.62	39.73	47.39	44.43	49.41
39	39.32	38.55	38.37	45.91	50.87	40.31	49.91	44.58	50.07
40	39.38	38.58	38.43	46.36	57.95	40.48	50.12	45.02	51.31
41	39.66	38.75	38.57	47.20	60.58	40.73	50.74	45.37	52.01
42	39.94	38.77	38.80	47.48	61.68	41.08	51.36	46.05	56.11
43	40.24	38.94	38.82	47.61		42.60	51.73	46.08	56.14
44	40.24	38.97	38.94	47.89		42.78	51.90	46.60	62.77
45	40.32	39.37	39.04	48.89		43.55	52.06	46.70	
46	40.88	39.49	39.17	49.37		43.67	52.20	46.77	
47	41.04	39.83	39.49	54.79		45.04	52.69	47.71	
48	41.12	40.13	39.62	60.97		45.69	53.66	48.79	
49	41.13	40.33	39.68			47.43	54.84	51.49	
50	41.25	40.60	39.68			47.71	55.57	51.85	

N	all beams			beams with finger-joint failure	beams with wood failure	
51	41.60	40.77	39.73	47.83	56.06	52.14
52	41.71	40.88	39.92	48.89	58.24	52.65
53	41.78	40.91	39.93	49.03		52.79
54	41.86	41.23	40.31	51.40		53.22
55	42.21	41.33	40.48	51.66		54.13
56	42.23	41.38	40.73	53.80		55.21
57	42.27	41.39	40.81			55.87
58	42.32	41.56	41.08			58.65
59	43.65	41.58	41.46			
60	44.06	41.76	41.49			
61	44.30	41.81	41.52			
62	44.46	42.75	42.18			
63	44.57	42.84	42.60			
64	44.70	42.96	42.78			
65	44.75	43.00	42.86			
66	45.04	43.08	43.22			
67	45.05	43.25	43.23			
68	45.19	43.26	43.30			
69	45.91	43.38	43.55			
70	45.95	43.44	43.67			
71	45.99	43.49	44.04			
72	46.26	44.08	44.39			
73	46.36	44.43	44.53			
74	46.45	44.58	44.58			
75	46.66	45.02	45.01			
76	47.02	45.22	45.04			
77	47.12	45.37	45.69			
78	47.20	46.05	47.14			
79	47.39	46.08	47.43			
80	47.48	46.60	47.63			
81	47.61	46.70	47.71			
82	47.89	46.77	47.83			
83	48.89	47.19	47.92			
84	49.37	47.71	48.38			
85	49.91	48.79	48.44			
86	50.12	50.62	48.60			
87	50.74	50.87	48.82			
88	51.36	51.49	48.89			
89	51.73	51.85	49.03			
90	51.90	52.14	49.31			
91	52.06	52.65	49.41			
92	52.20	52.79	50.07			
93	52.69	53.22	51.31			
94	53.66	54.13	51.40			
95	54.79	55.21	51.66			
96	54.84	55.87	52.01			
97	55.57	57.95	53.80			
98	56.06	58.65	56.11			
99	58.24	60.58	56.14			
100	60.97	61.68	62.77			

Table A.6: Simulation results, series II-DEN-REG, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	28.90	26.30	32.12	28.90	26.30	32.12	30.40	28.40	34.73
2	29.01	28.40	32.33	29.01	30.02	32.33	31.14	29.09	36.71
3	30.30	29.09	32.64	30.30	34.79	32.64	31.92	29.30	36.99
4	30.40	29.30	32.86	30.77	35.05	32.86	34.35	31.56	37.16
5	30.77	30.02	34.73	31.32	35.67	36.07	35.83	35.21	37.49
6	31.14	31.56	36.07	31.92	36.36	37.11	36.55	35.96	37.50
7	31.32	34.79	36.71	33.24	37.26	37.13	36.73	36.06	37.61
8	31.92	35.05	36.99	34.17	37.97	38.12	36.77	36.11	37.72
9	31.92	35.21	37.11	34.33	38.53	38.55	37.17	36.12	37.80
10	33.24	35.67	37.13	35.30	40.58	39.10	38.50	36.47	37.82
11	34.17	35.96	37.16	35.41	41.37	40.35	38.92	37.05	37.92
12	34.33	36.06	37.49	36.08	41.67	40.96	39.10	37.05	38.50
13	34.35	36.11	37.50	37.19	41.67	42.92	39.22	37.09	38.55
14	35.30	36.12	37.61	39.47	41.69	43.11	39.36	37.18	38.97
15	35.41	36.36	37.72	39.57	42.55	44.25	39.40	37.57	39.12
16	35.83	36.47	37.80	41.12	43.60	44.32	39.74	38.02	39.15
17	36.08	37.05	37.82	42.18	45.17	44.53	40.60	38.12	39.63
18	36.55	37.05	37.92	42.66	46.36	44.54	40.69	38.38	39.91
19	36.73	37.09	38.12	42.79	46.80	44.89	40.71	38.80	40.04
20	36.77	37.18	38.50	43.07	46.94	45.46	41.14	38.81	40.09
21	37.17	37.26	38.55	43.43	47.58	47.23	41.64	38.85	40.43
22	37.19	37.57	38.55	44.67	48.41	48.38	41.68	39.35	41.45
23	38.50	37.97	38.97	44.67	50.68	50.09	42.80	39.37	41.85
24	38.92	38.02	39.10	44.96	50.92	50.23	43.04	39.39	42.43
25	39.10	38.12	39.12	45.33	51.08	50.62	43.30	39.65	42.76
26	39.22	38.38	39.15	46.24	54.46	50.63	43.67	39.74	42.89
27	39.36	38.53	39.63	47.13	54.90	51.76	43.68	39.75	42.91
28	39.40	38.80	39.91	47.24	56.09	51.82	43.88	39.76	42.96
29	39.47	38.81	40.04	47.73	57.53	52.20	43.98	40.13	43.23
30	39.57	38.85	40.09	48.23		52.49	44.36	40.37	43.29
31	39.74	39.35	40.35	51.78		53.55	44.46	40.84	43.40
32	40.60	39.37	40.43	53.60		54.87	44.46	41.44	43.59
33	40.69	39.39	40.96	53.84			44.57	41.45	43.74
34	40.71	39.65	41.45	54.21			44.66	41.67	43.92
35	41.12	39.74	41.85	57.34			44.83	42.02	44.05
36	41.14	39.75	42.43	63.22			45.05	42.31	44.30
37	41.64	39.76	42.76				45.16	42.58	44.47
38	41.68	40.13	42.89				45.20	42.61	44.48
39	42.18	40.37	42.91				45.36	42.87	44.89
40	42.66	40.58	42.92				45.41	42.93	44.96
41	42.79	40.84	42.96				45.41	43.54	45.08
42	42.80	41.37	43.11				45.42	43.56	45.10
43	43.04	41.44	43.23				45.51	43.78	45.13
44	43.07	41.45	43.29				46.61	43.97	45.25
45	43.30	41.67	43.40				46.80	44.18	45.57
46	43.43	41.67	43.59				46.90	44.23	45.76
47	43.67	41.67	43.74				47.54	44.37	46.71
48	43.68	41.69	43.92				47.58	44.47	46.72
49	43.88	42.02	44.05				47.60	44.77	46.75
50	43.98	42.31	44.25				48.09	45.06	46.79

N	all beams			beams with finger-joint failure	beams with wood failure		
51	44.36	42.55	44.30		49.96	45.08	46.88
52	44.46	42.58	44.32		50.18	45.22	46.93
53	44.46	42.61	44.47		50.53	45.34	47.00
54	44.57	42.87	44.48		50.63	46.23	47.30
55	44.66	42.93	44.53		50.96	46.77	47.36
56	44.67	43.54	44.54		51.27	46.87	47.40
57	44.67	43.56	44.89		51.27	47.37	47.44
58	44.83	43.60	44.89		51.43	48.22	48.02
59	44.96	43.78	44.96		52.25	48.28	49.41
60	45.05	43.97	45.08		52.65	48.66	49.47
61	45.16	44.18	45.10		54.17	49.07	49.59
62	45.20	44.23	45.13		54.81	49.16	50.39
63	45.33	44.37	45.25		60.65	50.98	51.09
64	45.36	44.47	45.46		69.17	51.16	51.99
65	45.41	44.77	45.57			52.15	52.67
66	45.41	45.06	45.76			52.20	52.94
67	45.42	45.08	46.71			54.21	55.37
68	45.51	45.17	46.72			54.96	56.54
69	46.24	45.22	46.75			58.25	
70	46.61	45.34	46.79			60.58	
71	46.80	46.23	46.88			67.48	
72	46.90	46.36	46.93				
73	47.13	46.77	47.00				
74	47.24	46.80	47.23				
75	47.54	46.87	47.30				
76	47.58	46.94	47.36				
77	47.60	47.37	47.40				
78	47.73	47.58	47.44				
79	48.09	48.22	48.02				
80	48.23	48.28	48.38				
81	49.96	48.41	49.41				
82	50.18	48.66	49.47				
83	50.53	49.07	49.59				
84	50.63	49.16	50.09				
85	50.96	50.68	50.23				
86	51.27	50.92	50.39				
87	51.27	50.98	50.62				
88	51.43	51.08	50.63				
89	51.78	51.16	51.09				
90	52.25	52.15	51.76				
91	52.65	52.20	51.82				
92	53.60	54.21	51.99				
93	53.84	54.46	52.20				
94	54.17	54.90	52.49				
95	54.21	54.96	52.67				
96	54.81	56.09	52.94				
97	57.34	57.53	53.55				
98	60.65	58.25	54.87				
99	63.22	60.58	55.37				
100	69.17	67.48	56.54				

Table A.7:   Simulation results, series II-MOE-TEST, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	24.40	26.30	20.51	26.68	26.30	20.51	24.40	31.50	33.75
2	26.68	29.22	24.56	27.77	29.22	24.56	31.59	32.98	33.88
3	27.77	29.24	24.88	27.85	29.24	24.88	32.80	33.29	33.89
4	27.85	29.99	31.29	28.05	29.99	31.29	32.97	33.55	34.52
5	28.05	30.53	32.72	30.16	30.53	32.72	33.66	33.90	35.38
6	30.16	31.23	33.12	32.84	31.23	33.12	35.10	35.91	35.62
7	31.59	31.36	33.75	33.14	31.36	34.06	35.45	36.09	36.01
8	32.80	31.40	33.88	33.27	31.40	34.80	35.99	37.46	36.31
9	32.84	31.50	33.89	33.49	31.53	35.00	36.46	37.52	36.99
10	32.97	31.53	34.06	33.64	31.58	35.36	37.53	37.80	37.01
11	33.14	31.58	34.52	33.70	32.01	35.70	37.72	37.83	38.64
12	33.27	32.01	34.80	34.00	32.70	36.36	37.75	37.88	38.76
13	33.49	32.70	35.00	34.88	32.82	36.88	37.91	38.16	38.97
14	33.64	32.82	35.36	35.98	32.83	37.09	38.10	38.20	39.11
15	33.66	32.83	35.38	36.58	33.11	37.12	38.53	39.30	39.16
16	33.70	32.98	35.62	36.93	33.13	37.45	38.75	40.09	39.19
17	34.00	33.11	35.70	37.01	34.45	37.53	38.79	40.29	40.14
18	34.88	33.13	36.01	37.04	35.11	37.77	39.67	40.59	40.20
19	35.10	33.29	36.31	37.20	35.56	37.91	39.69	40.68	40.22
20	35.45	33.55	36.36	37.57	35.60	38.74	39.89	40.86	40.50
21	35.98	33.90	36.88	37.68	35.68	38.76	41.28	40.96	40.64
22	35.99	34.45	36.99	37.70	36.44	39.03	41.33	41.57	40.66
23	36.46	35.11	37.01	38.14	36.57	39.45	41.65	41.58	40.86
24	36.58	35.56	37.09	38.62	36.98	40.10	42.45	41.64	41.44
25	36.93	35.60	37.12	38.96	37.50	40.68	43.17	41.77	41.51
26	37.01	35.68	37.45	38.99	37.99	40.83	43.25	42.16	41.83
27	37.04	35.91	37.53	39.14	38.14	41.17	43.51	42.17	42.01
28	37.20	36.09	37.77	40.00	38.25	41.96	44.01	42.90	42.68
29	37.53	36.44	37.91	40.24	38.84	42.37	44.01	42.96	43.30
30	37.57	36.57	38.64	40.40	38.94	42.40	44.13	43.80	43.30
31	37.68	36.98	38.74	40.56	39.43	42.91	44.26	44.96	43.84
32	37.70	37.46	38.76	40.86	39.57	43.00	44.60	45.58	44.02
33	37.72	37.50	38.76	41.01	39.72	43.18	45.70	45.89	44.37
34	37.75	37.52	38.97	41.01	39.80	43.28	46.81	46.98	44.65
35	37.91	37.80	39.03	41.15	39.99	43.91	46.87	47.30	44.82
36	38.10	37.83	39.11	41.35	40.11	45.20	46.95	47.51	45.00
37	38.14	37.88	39.16	41.97	40.32	45.50	47.11	47.89	45.13
38	38.53	37.99	39.19	42.10	40.73	45.75	47.40	48.26	46.37
39	38.62	38.14	39.45	42.85	41.85	46.01	47.70	50.17	46.57
40	38.75	38.16	40.10	43.04	42.16	46.40	47.77	52.91	46.63
41	38.79	38.20	40.14	43.10	42.18	48.97	47.96	53.08	46.72
42	38.96	38.25	40.20	43.12	43.06	48.99	48.74	54.33	46.89
43	38.99	38.84	40.22	43.37	43.44	50.26	49.01		46.95
44	39.14	38.94	40.50	43.46	43.51	54.70	49.17		47.10
45	39.67	39.30	40.64	44.09	44.02	57.91	49.61		48.17
46	39.69	39.43	40.66	44.24	45.00		52.86		48.94
47	39.89	39.57	40.68	44.40	45.34				49.04
48	40.00	39.72	40.83	44.71	45.66				49.08
49	40.24	39.80	40.86	45.71	46.21				49.13
50	40.40	39.99	41.17	45.79	46.64				49.36

N	all beams			beams with finger-joint failure		beams with wood failure
51	40.56	40.09	41.44	46.27	47.50	50.36
52	40.86	40.11	41.51	53.74	47.67	51.86
53	41.01	40.29	41.83	54.71	49.45	52.68
54	41.01	40.32	41.96	56.78	49.80	54.10
55	41.15	40.59	42.01		51.35	54.38
56	41.28	40.68	42.37		53.44	
57	41.33	40.73	42.40		57.12	
58	41.35	40.86	42.68		66.05	
59	41.65	40.96	42.91			
60	41.97	41.57	43.00			
61	42.10	41.58	43.18			
62	42.45	41.64	43.28			
63	42.85	41.77	43.30			
64	43.04	41.85	43.30			
65	43.10	42.16	43.84			
66	43.12	42.16	43.91			
67	43.17	42.17	44.02			
68	43.25	42.18	44.37			
69	43.37	42.90	44.65			
70	43.46	42.96	44.82			
71	43.51	43.06	45.00			
72	44.01	43.44	45.13			
73	44.01	43.51	45.20			
74	44.09	43.80	45.50			
75	44.13	44.02	45.75			
76	44.24	44.96	46.01			
77	44.26	45.00	46.37			
78	44.40	45.34	46.40			
79	44.60	45.58	46.57			
80	44.71	45.66	46.63			
81	45.70	45.89	46.72			
82	45.71	46.21	46.89			
83	45.79	46.64	46.95			
84	46.27	46.98	47.10			
85	46.81	47.30	48.17			
86	46.87	47.50	48.94			
87	46.95	47.51	48.97			
88	47.11	47.67	48.99			
89	47.40	47.89	49.04			
90	47.70	48.26	49.08			
91	47.77	49.45	49.13			
92	47.96	49.80	49.36			
93	48.74	50.17	50.26			
94	49.01	51.35	50.36			
95	49.17	52.91	51.86			
96	49.61	53.08	52.68			
97	52.86	53.44	54.10			
98	53.74	54.33	54.38			
99	54.71	57.12	54.70			
100	56.78	66.05	57.91			

Table A.8: Simulation results, series II-MOE-REG, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	26.66	29.70	30.06	26.66	30.96	30.06	32.51	29.70	35.19
2	29.43	30.39	30.53	29.43	31.00	30.53	32.72	30.39	35.25
3	30.10	30.96	32.36	30.10	31.62	32.36	33.95	32.61	36.23
4	30.14	31.00	32.77	30.14	34.32	32.77	34.12	33.01	36.65
5	31.11	31.62	33.66	31.11	34.70	33.66	35.50	33.45	36.70
6	32.51	32.61	34.66	32.80	34.96	34.66	35.88	34.22	36.80
7	32.72	33.01	35.03	33.33	35.89	35.03	36.01	35.93	36.81
8	32.80	33.45	35.19	33.74	35.93	35.28	36.07	35.97	36.85
9	33.33	34.22	35.25	33.93	35.99	36.37	36.46	36.84	36.93
10	33.74	34.32	35.28	34.18	36.04	36.97	36.51	37.90	36.93
11	33.93	34.70	36.23	34.43	37.07	37.78	37.17	38.32	37.09
12	33.95	34.96	36.37	34.56	38.29	38.86	37.27	38.84	37.31
13	34.12	35.89	36.65	35.02	39.47	38.96	37.40	39.34	37.32
14	34.18	35.93	36.70	35.40	40.29	39.41	38.10	39.41	37.70
15	34.43	35.93	36.80	35.55	40.36	40.16	38.51	39.78	37.93
16	34.56	35.97	36.81	35.99	40.83	41.02	38.57	39.85	38.04
17	35.02	35.99	36.85	36.19	40.87	41.15	38.82	39.99	38.31
18	35.40	36.04	36.93	36.81	40.98	41.47	38.85	40.15	39.00
19	35.50	36.84	36.93	36.93	41.20	42.31	38.91	40.43	39.50
20	35.55	37.07	36.97	37.28	41.79	42.39	39.73	40.57	39.74
21	35.88	37.90	37.09	38.62	42.00	43.06	39.91	40.78	40.08
22	35.99	38.29	37.31	38.80	42.54	43.70	40.10	41.04	40.83
23	36.01	38.32	37.32	39.35	43.12	45.10	40.22	41.17	41.35
24	36.07	38.84	37.70	40.21	43.97	46.36	40.30	41.22	41.46
25	36.19	39.34	37.78	40.70	44.23	46.76	40.78	41.29	41.54
26	36.46	39.41	37.93	42.58	44.64	48.25	40.94	41.34	41.90
27	36.51	39.47	38.04	42.61	44.85	48.47	41.04	41.40	42.05
28	36.81	39.78	38.31	43.44	45.32	48.95	41.61	41.85	42.86
29	36.93	39.85	38.86	44.22	46.02	49.02	41.84	41.98	42.97
30	37.17	39.99	38.96	44.45	46.68	49.53	41.99	42.07	43.03
31	37.27	40.15	39.00	45.04	46.86	50.85	42.23	42.35	43.10
32	37.28	40.29	39.41	45.11	50.62	52.32	42.69	42.40	43.13
33	37.40	40.36	39.50	45.75	65.89	52.96	43.72	42.51	43.19
34	38.10	40.43	39.74	49.04			43.84	42.84	43.32
35	38.51	40.57	40.08	51.73			43.92	42.87	43.70
36	38.57	40.78	40.16	53.88			43.94	43.53	44.29
37	38.62	40.83	40.83				44.34	43.61	44.34
38	38.80	40.87	41.02				44.47	43.82	44.41
39	38.82	40.98	41.15				45.51	43.99	45.03
40	38.85	41.04	41.35				45.93	44.63	45.72
41	38.91	41.17	41.46				45.99	44.71	45.90
42	39.35	41.20	41.47				46.34	44.75	45.95
43	39.73	41.22	41.54				46.72	45.06	46.02
44	39.91	41.29	41.90				46.75	45.45	46.03
45	40.10	41.34	42.05				47.26	46.00	46.55
46	40.21	41.40	42.31				47.38	46.04	46.73
47	40.22	41.79	42.39				47.62	46.07	46.76
48	40.30	41.85	42.86				47.72	46.93	46.97
49	40.70	41.98	42.97				47.88	47.94	48.05
50	40.78	42.00	43.03				48.15	48.17	48.30

N	all beams			beams with finger-joint failure	beams with wood failure		
51	40.94	42.07	43.06		48.48	48.18	49.07
52	41.04	42.35	43.10		49.86	48.72	49.34
53	41.61	42.40	43.13		50.41	49.59	49.72
54	41.84	42.51	43.19		50.45	50.07	49.79
55	41.99	42.54	43.32		50.85	51.35	50.10
56	42.23	42.84	43.70		51.03	51.75	50.30
57	42.58	42.87	43.70		51.97	52.90	50.61
58	42.61	43.12	44.29		52.05	52.96	50.95
59	42.69	43.53	44.34		52.33	53.17	51.10
60	43.44	43.61	44.41		52.73	53.19	51.20
61	43.72	43.82	45.03		52.92	54.24	52.47
62	43.84	43.97	45.10		53.18	54.72	52.68
63	43.92	43.99	45.72		53.33	55.27	52.99
64	43.94	44.23	45.90		56.38	55.72	53.60
65	44.22	44.63	45.95			56.08	54.28
66	44.34	44.64	46.02			57.52	59.93
67	44.45	44.71	46.03			57.82	61.34
68	44.47	44.75	46.36				
69	45.04	44.85	46.55				
70	45.11	45.06	46.73				
71	45.51	45.32	46.76				
72	45.75	45.45	46.76				
73	45.93	46.00	46.97				
74	45.99	46.02	48.05				
75	46.34	46.04	48.25				
76	46.72	46.07	48.30				
77	46.75	46.68	48.47				
78	47.26	46.86	48.95				
79	47.38	46.93	49.02				
80	47.62	47.94	49.07				
81	47.72	48.17	49.34				
82	47.88	48.18	49.53				
83	48.15	48.72	49.72				
84	48.48	49.59	49.79				
85	49.04	50.07	50.10				
86	49.86	50.62	50.30				
87	50.41	51.35	50.61				
88	50.45	51.75	50.85				
89	50.85	52.90	50.95				
90	51.03	52.96	51.10				
91	51.73	53.17	51.20				
92	51.97	53.19	52.32				
93	52.05	54.24	52.47				
94	52.33	54.72	52.68				
95	52.73	55.27	52.96				
96	52.92	55.72	52.99				
97	53.18	56.08	53.60				
98	53.33	57.52	54.28				
99	53.88	57.82	59.93				
100	56.38	65.89	61.34				

N	all beams			beams with finger-joint failure			beams with wood failure		
1	28.16	27.21	32.36	28.16	27.21	32.36	36.90	32.17	32.48
2	30.29	29.14	32.48	30.29	29.14	32.99	38.47	32.81	36.01
3	31.09	31.38	32.99	31.09	31.38	33.07	39.45	33.24	36.14
4	31.34	32.17	33.07	31.34	32.43	33.32	39.77	36.39	37.40
5	32.43	32.43	33.32	32.43	32.92	33.51	40.43	36.48	39.15
6	34.24	32.81	33.51	34.24	32.93	33.57	40.60	36.99	39.62
7	34.54	32.92	33.57	34.54	32.94	34.64	40.68	37.87	40.36
8	36.00	32.93	34.64	36.00	32.99	34.84	42.20	39.00	41.55
9	36.02	32.94	34.84	36.02	33.46	35.02	42.71	39.02	41.64
10	36.90	32.99	35.02	36.98	33.49	35.26	43.20	39.27	42.22
11	36.98	33.24	35.26	37.88	33.50	35.59	43.61	40.68	43.60
12	37.88	33.46	35.59	38.04	34.08	36.22	44.05	40.78	43.78
13	38.04	33.49	36.01	38.32	34.66	36.30	44.09	41.16	44.75
14	38.32	33.50	36.14	38.83	34.67	36.85	44.34	41.29	44.96
15	38.47	34.08	36.22	38.92	35.70	37.74	44.82	41.45	45.51
16	38.83	34.66	36.30	39.06	36.39	37.89	45.56	41.74	46.32
17	38.92	34.67	36.85	39.14	37.02	38.17	45.99	41.92	46.38
18	39.06	35.70	37.40	39.51	37.30	39.11	46.25	42.11	46.44
19	39.14	36.39	37.74	39.77	37.69	39.21	46.48	42.16	46.45
20	39.45	36.39	37.89	40.44	38.48	39.23	46.75	42.30	46.66
21	39.51	36.48	38.17	40.53	38.97	39.84	46.79	44.56	47.14
22	39.77	36.99	39.11	41.31	39.05	41.09	46.95	44.62	47.29
23	39.77	37.02	39.15	41.53	39.27	41.20	47.01	44.90	47.60
24	40.43	37.30	39.21	41.83	39.88	41.44	47.47	45.36	48.33
25	40.44	37.69	39.23	41.85	40.85	41.70	47.67	45.47	48.38
26	40.53	37.87	39.62	42.12	41.33	41.83	47.69	45.62	48.42
27	40.60	38.48	39.84	42.32	41.70	43.01	47.88	46.19	49.01
28	40.68	38.97	40.36	42.49	42.39	43.02	48.43	46.56	49.44
29	41.31	39.00	41.09	43.94	43.32	43.11	48.67	47.27	50.70
30	41.53	39.02	41.20	43.98	43.38	43.36	48.82	47.37	51.28
31	41.83	39.05	41.44	44.06	44.92	43.37	51.15	47.61	51.61
32	41.85	39.27	41.55	44.24	44.96	43.82	51.48	48.53	52.09
33	42.12	39.27	41.64	46.89	45.00	44.09	51.88	48.65	52.32
34	42.20	39.88	41.70	47.36	45.33	44.39	52.04	49.06	52.42
35	42.32	40.68	41.83	47.73	46.72	44.59	52.07	49.11	53.37
36	42.49	40.78	42.22	48.15	48.11	45.64	52.77	49.59	53.42
37	42.71	40.85	43.01	48.85	48.24	46.24	53.59	49.84	54.51
38	43.20	41.16	43.02	49.80	48.79	47.16	54.15	49.88	54.85
39	43.61	41.29	43.11	51.02	48.94	47.21	55.24	49.92	55.69
40	43.94	41.33	43.36	51.81	49.14	47.60	55.50	50.09	57.48
41	43.98	41.45	43.37	51.90	49.22	47.90	55.79	50.90	59.16
42	44.05	41.70	43.60	52.18	49.52	49.22	57.13	52.21	59.57
43	44.06	41.74	43.78	52.75	49.97	49.28	57.16	52.53	59.76
44	44.09	41.92	43.82	52.83	50.40	49.81	57.51	53.31	60.17
45	44.24	42.11	44.09	56.12	51.66	51.34	57.76	54.00	60.63
46	44.34	42.16	44.39	57.82	52.87	51.38	57.93	54.90	63.94
47	44.82	42.30	44.59		53.89	51.78	59.04	54.95	69.39
48	45.56	42.39	44.75		56.26	54.82	59.58	56.97	
49	45.99	43.32	44.96		61.77	56.57	59.77	57.63	
50	46.25	43.38	45.51		65.86	57.28	60.27	69.44	

N	all beams			beams with finger-joint failure	beams with wood failure
51	46.48	44.56	45.64	57.41	60.27
52	46.75	44.62	46.24	59.45	60.39
53	46.79	44.90	46.32	63.40	61.20
54	46.89	44.92	46.38		61.38
55	46.95	44.96	46.44		
56	47.01	45.00	46.45		
57	47.36	45.33	46.66		
58	47.47	45.36	47.14		
59	47.67	45.47	47.16		
60	47.69	45.62	47.21		
61	47.73	46.19	47.29		
62	47.88	46.56	47.60		
63	48.15	46.72	47.60		
64	48.43	47.27	47.90		
65	48.67	47.37	48.33		
66	48.82	47.61	48.38		
67	48.85	48.11	48.42		
68	49.80	48.24	49.01		
69	51.02	48.53	49.22		
70	51.15	48.65	49.28		
71	51.48	48.79	49.44		
72	51.81	48.94	49.81		
73	51.88	49.06	50.70		
74	51.90	49.11	51.28		
75	52.04	49.14	51.34		
76	52.07	49.22	51.38		
77	52.18	49.52	51.61		
78	52.75	49.59	51.78		
79	52.77	49.84	52.09		
80	52.83	49.88	52.32		
81	53.59	49.92	52.42		
82	54.15	49.97	53.37		
83	55.24	50.09	53.42		
84	55.50	50.40	54.51		
85	55.79	50.90	54.82		
86	56.12	51.66	54.85		
87	57.13	52.21	55.69		
88	57.16	52.53	56.57		
89	57.51	52.87	57.28		
90	57.76	53.31	57.41		
91	57.82	53.89	57.48		
92	57.93	54.00	59.16		
93	59.04	54.90	59.45		
94	59.58	54.95	59.57		
95	59.77	56.26	59.76		
96	60.27	56.97	60.17		
97	60.27	57.63	60.63		
98	60.39	61.77	63.40		
99	61.20	65.86	63.94		
100	61.38	69.44	69.39		

Table A.10: Simulation results, series III-DEN-REG, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	29.97	30.15	31.00	29.97	30.15	31.00	34.94	32.12	31.76
2	31.49	32.12	31.09	31.49	33.24	31.09	38.63	34.72	34.68
3	32.47	33.24	31.76	32.47	34.32	33.36	39.69	35.37	35.38
4	32.59	34.32	33.36	32.59	34.61	34.37	39.89	36.72	36.40
5	32.75	34.61	34.37	32.75	34.83	35.54	39.93	39.05	38.74
6	33.03	34.72	34.68	33.03	35.28	37.90	40.00	39.29	41.23
7	33.84	34.83	35.38	33.84	35.54	40.23	41.32	40.21	41.39
8	33.91	35.28	35.54	33.91	35.88	41.03	41.45	41.84	41.46
9	34.71	35.37	36.40	34.71	36.40	41.04	42.56	41.85	41.58
10	34.94	35.54	37.90	36.51	37.09	41.36	42.73	42.55	41.94
11	36.51	35.88	38.74	36.75	37.38	41.43	43.73	42.70	42.28
12	36.75	36.40	40.23	37.64	39.13	41.69	43.76	42.78	42.33
13	37.64	36.72	41.03	39.53	41.44	42.01	43.91	43.35	42.36
14	38.63	37.09	41.04	40.05	41.78	42.27	44.78	44.04	43.07
15	39.53	37.38	41.23	40.64	41.94	42.85	45.38	44.11	43.53
16	39.69	39.05	41.36	41.14	42.09	43.10	45.51	44.41	43.67
17	39.89	39.13	41.39	41.92	42.55	43.62	45.58	44.52	43.84
18	39.93	39.29	41.43	42.09	43.68	44.19	45.69	44.98	43.85
19	40.00	40.21	41.46	42.18	44.06	44.43	45.69	45.08	44.54
20	40.05	41.44	41.58	45.22	44.70	45.01	45.93	45.29	44.72
21	40.64	41.78	41.69	45.39	45.00	45.30	46.10	45.92	44.78
22	41.14	41.84	41.94	45.77	45.09	45.38	46.51	46.05	45.17
23	41.32	41.85	42.01	46.01	45.36	46.60	46.56	47.06	45.51
24	41.45	41.94	42.27	47.12	45.75	46.60	46.82	47.11	45.70
25	41.92	42.09	42.28	50.33	45.87	48.66	46.88	47.44	45.81
26	42.09	42.55	42.33	51.27	46.64	48.92	46.90	47.88	45.84
27	42.18	42.55	42.36	51.86	47.20	49.03	47.55	48.19	45.86
28	42.56	42.70	42.85	52.90	48.96	49.22	47.56	48.45	46.54
29	42.73	42.78	43.07	58.04	49.16	49.46	47.63	48.52	46.78
30	43.73	43.35	43.10	61.16	49.61	51.11	48.11	48.56	47.19
31	43.76	43.68	43.53	64.86	50.80	51.99	48.15	48.58	47.91
32	43.91	44.04	43.62	65.33	51.38	52.12	48.37	48.80	48.73
33	44.78	44.06	43.67		51.74	53.85	48.48	49.50	48.84
34	45.22	44.11	43.84		52.07	54.22	49.15	49.60	48.94
35	45.38	44.41	43.85		54.31	55.86	49.74	49.68	49.18
36	45.39	44.52	44.19		54.73	61.02	49.75	49.81	49.30
37	45.51	44.70	44.43		54.76		49.77	50.09	49.34
38	45.58	44.98	44.54		56.12		50.39	50.64	49.42
39	45.69	45.00	44.72		58.35		50.99	50.73	49.64
40	45.69	45.08	44.78		58.62		51.15	50.84	51.13
41	45.77	45.09	45.01				51.18	51.09	51.44
42	45.93	45.29	45.17				51.20	51.89	51.83
43	46.01	45.36	45.30				51.22	52.36	52.28
44	46.10	45.75	45.38				51.24	52.58	52.74
45	46.51	45.87	45.51				51.59	52.89	52.83
46	46.56	45.92	45.70				51.78	52.93	53.36
47	46.82	46.05	45.81				52.13	53.81	53.44
48	46.88	46.64	45.84				52.59	54.48	53.61
49	46.90	47.06	45.86				53.19	54.92	53.97
50	47.12	47.11	46.54				53.71	55.04	54.80

N	all beams			beams with finger-joint failure	beams with wood failure		
51	47.55	47.20	46.60		54.14	55.11	55.00
52	47.56	47.44	46.60		54.67	55.26	55.22
53	47.63	47.88	46.78		54.85	56.02	56.11
54	48.11	48.19	47.19		55.29	56.66	56.63
55	48.15	48.45	47.91		55.62	57.45	56.75
56	48.37	48.52	48.66		55.90	59.88	59.03
57	48.48	48.56	48.73		56.49	60.61	59.15
58	49.15	48.58	48.84		57.71	63.24	59.69
59	49.74	48.80	48.92		57.99	69.04	61.61
60	49.75	48.96	48.94		58.49	70.79	61.82
61	49.77	49.16	49.03		58.70		61.87
62	50.33	49.50	49.18		59.21		62.66
63	50.39	49.60	49.22		59.79		65.31
64	50.99	49.61	49.30		60.03		75.99
65	51.15	49.68	49.34		60.99		
66	51.18	49.81	49.42		61.13		
67	51.20	50.09	49.46		62.09		
68	51.22	50.64	49.64		65.49		
69	51.24	50.73	51.11				
70	51.27	50.80	51.13				
71	51.59	50.84	51.44				
72	51.78	51.09	51.83				
73	51.86	51.38	51.99				
74	52.13	51.74	52.12				
75	52.59	51.89	52.28				
76	52.90	52.07	52.74				
77	53.19	52.36	52.83				
78	53.71	52.58	53.36				
79	54.14	52.89	53.44				
80	54.67	52.93	53.61				
81	54.85	53.81	53.85				
82	55.29	54.31	53.97				
83	55.62	54.48	54.22				
84	55.90	54.73	54.80				
85	56.49	54.76	55.00				
86	57.71	54.92	55.22				
87	57.99	55.04	55.86				
88	58.04	55.11	56.11				
89	58.49	55.26	56.63				
90	58.70	56.02	56.75				
91	59.21	56.12	59.03				
92	59.79	56.66	59.15				
93	60.03	57.45	59.69				
94	60.99	58.35	61.02				
95	61.13	58.62	61.61				
96	61.16	59.88	61.82				
97	62.09	60.61	61.87				
98	64.86	63.24	62.66				
99	65.33	69.04	65.31				
100	65.49	70.79	75.99				

Table A.11:   Simulation results, series III-MOE-TEST, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	28.57	27.83	28.47	28.57	27.83	28.47	32.00	37.53	31.72
2	28.92	29.54	28.62	28.92	29.54	28.62	36.89	37.98	34.11
3	29.54	29.65	29.11	29.54	29.65	29.11	38.18	40.79	36.50
4	30.34	29.73	30.74	30.34	29.73	30.74	39.85	41.62	39.78
5	30.56	29.96	31.72	30.56	29.96	33.12	42.89	42.09	44.78
6	30.87	33.31	33.12	30.87	33.31	33.24	42.97	42.56	46.67
7	30.93	33.85	33.24	30.93	33.85	33.50	42.97	43.14	48.12
8	31.96	35.08	33.50	31.96	35.08	34.88	43.36	44.14	48.94
9	32.00	35.31	34.11	32.76	35.31	35.16	45.10	45.49	49.55
10	32.76	35.54	34.88	32.81	35.54	35.79	45.48	45.90	49.83
11	32.81	35.69	35.16	32.83	35.69	35.93	46.09	46.28	50.41
12	32.83	35.82	35.79	34.16	35.82	36.70	46.89	46.46	50.93
13	34.16	36.75	35.93	34.36	36.75	36.89	46.92	46.52	51.73
14	34.36	37.13	36.50	34.91	37.13	37.05	47.64	46.67	51.80
15	34.91	37.31	36.70	35.30	37.31	37.42	47.85	46.82	52.25
16	35.30	37.45	36.89	35.36	37.45	38.45	48.10	47.93	52.41
17	35.36	37.53	37.05	37.92	37.57	38.94	48.21	48.29	52.64
18	36.89	37.57	37.42	38.06	37.64	39.57	48.47	48.34	52.66
19	37.92	37.64	38.45	38.57	37.87	39.60	48.89	48.46	52.83
20	38.06	37.87	38.94	39.21	38.01	39.80	50.01	48.74	53.41
21	38.18	37.98	39.57	39.26	39.05	39.92	50.12	49.66	53.58
22	38.57	38.01	39.60	39.82	39.47	40.04	50.61	50.39	53.86
23	39.21	39.05	39.78	39.99	39.59	40.13	50.79	51.19	54.17
24	39.26	39.47	39.80	40.41	40.04	40.42	50.98	51.30	54.76
25	39.82	39.59	39.92	40.56	40.18	40.48	51.43	51.75	55.20
26	39.85	40.04	40.04	41.29	40.47	40.78	51.43	52.17	56.02
27	39.99	40.18	40.13	41.57	40.48	41.16	52.08	52.18	56.16
28	40.41	40.47	40.42	41.66	40.86	41.30	52.93	54.22	56.47
29	40.56	40.48	40.48	41.91	40.94	41.54	53.17	54.55	57.32
30	41.29	40.79	40.78	42.14	41.73	41.79	53.32	54.89	58.33
31	41.57	40.86	41.16	42.14	41.97	42.43	53.52	55.35	58.35
32	41.66	40.94	41.30	42.15	42.18	42.93	55.41	55.76	63.07
33	41.91	41.62	41.54	42.22	42.58	43.79	55.64	58.37	63.64
34	42.14	41.73	41.79	42.42	43.41	44.21	56.47	59.17	65.12
35	42.14	41.97	42.43	42.49	43.52	44.21	56.96	59.51	68.59
36	42.15	42.09	42.93	43.28	44.58	44.59	59.02	59.53	
37	42.22	42.18	43.79	43.40	44.59	45.39	59.51	62.51	
38	42.42	42.56	44.21	43.63	44.97	45.78	60.54	68.52	
39	42.49	42.58	44.21	44.11	45.60	46.05	62.27	71.79	
40	42.89	43.14	44.59	44.38	46.27	46.23	63.86		
41	42.97	43.41	44.78	44.59	46.27	46.38			
42	42.97	43.52	45.39	44.87	46.40	48.10			
43	43.28	44.14	45.78	45.01	46.45	48.44			
44	43.36	44.58	46.05	45.52	46.45	48.51			
45	43.40	44.59	46.23	45.65	47.28	48.82			
46	43.63	44.97	46.38	45.68	47.40	49.16			
47	44.11	45.49	46.67	46.14	47.89	49.47			
48	44.38	45.60	48.10	46.57	47.89	49.80			
49	44.59	45.90	48.12	46.63	47.96	50.21			
50	44.87	46.27	48.44	47.21	48.71	50.76			

N	all beams			beams with finger-joint failure			beams with wood failure
51	45.01	46.27	48.51	47.45	49.20	51.71	
52	45.10	46.28	48.82	48.55	49.43	51.85	
53	45.48	46.40	48.94	48.95	49.51	52.07	
54	45.52	46.45	49.16	51.20	49.83	53.06	
55	45.65	46.45	49.47	51.97	49.86	54.53	
56	45.68	46.46	49.55	54.03	51.13	55.97	
57	46.09	46.52	49.80	54.24	52.81	56.21	
58	46.14	46.67	49.83	54.74	53.35	57.18	
59	46.57	46.82	50.21	56.16	57.89	57.90	
60	46.63	47.28	50.41	63.34	62.76	58.02	
61	46.89	47.40	50.76		64.91	59.54	
62	46.92	47.89	50.93			60.30	
63	47.21	47.89	51.71			62.27	
64	47.45	47.93	51.73			64.74	
65	47.64	47.96	51.80			73.89	
66	47.85	48.29	51.85				
67	48.10	48.34	52.07				
68	48.21	48.46	52.25				
69	48.47	48.71	52.41				
70	48.55	48.74	52.64				
71	48.89	49.20	52.66				
72	48.95	49.43	52.83				
73	50.01	49.51	53.06				
74	50.12	49.66	53.41				
75	50.61	49.83	53.58				
76	50.79	49.86	53.86				
77	50.98	50.39	54.17				
78	51.20	51.13	54.53				
79	51.43	51.19	54.76				
80	51.43	51.30	55.20				
81	51.97	51.75	55.97				
82	52.08	52.17	56.02				
83	52.93	52.18	56.16				
84	53.17	52.81	56.21				
85	53.32	53.35	56.47				
86	53.52	54.22	57.18				
87	54.03	54.55	57.32				
88	54.24	54.89	57.90				
89	54.74	55.35	58.02				
90	55.41	55.76	58.33				
91	55.64	57.89	58.35				
92	56.16	58.37	59.54				
93	56.47	59.17	60.30				
94	56.96	59.51	62.27				
95	59.02	59.53	63.07				
96	59.51	62.51	63.64				
97	60.54	62.76	64.74				
98	62.27	64.91	65.12				
99	63.34	68.52	68.59				
100	63.86	71.79	73.89				

Table A.12: Simulation results, series III-MOE-REG, individual values

N	all beams			beams with finger-joint failure			beams with wood failure		
1	32.56	33.30	34.07	32.56	33.30	34.07	38.26	35.18	34.47
2	34.80	35.18	34.47	34.80	35.69	35.17	40.22	38.16	35.89
3	34.91	35.69	35.17	34.91	35.88	35.87	40.73	38.31	40.22
4	34.93	35.88	35.87	34.93	37.74	36.36	40.95	38.52	40.81
5	37.49	37.74	35.89	37.49	39.44	36.38	41.40	39.22	41.58
6	37.64	38.16	36.36	37.64	39.49	38.92	41.71	40.26	41.65
7	38.26	38.31	36.38	38.78	39.88	39.90	42.47	40.88	42.45
8	38.78	38.52	38.92	38.83	39.97	39.97	43.30	41.90	42.81
9	38.83	39.22	39.90	38.87	41.66	40.06	43.40	42.35	43.70
10	38.87	39.44	39.97	39.24	42.73	40.87	43.50	42.75	43.95
11	39.24	39.49	40.06	39.63	42.86	40.97	43.75	43.27	44.19
12	39.63	39.88	40.22	39.82	43.10	41.80	44.75	43.38	44.39
13	39.82	39.97	40.81	40.13	43.51	42.85	44.83	43.53	44.80
14	40.13	40.26	40.87	40.28	44.46	43.35	44.95	43.70	45.06
15	40.22	40.88	40.97	41.50	45.60	44.92	45.19	44.85	46.33
16	40.28	41.66	41.58	42.35	47.79	46.54	46.02	44.88	46.47
17	40.73	41.90	41.65	42.72	47.85	46.86	46.20	45.11	46.56
18	40.95	42.35	41.80	44.03	48.01	46.90	46.45	45.73	46.69
19	41.40	42.73	42.45	44.96	50.57	47.27	46.54	46.00	46.85
20	41.50	42.75	42.81	45.41	50.58	47.71	47.14	46.93	46.99
21	41.71	42.86	42.85	46.68	50.96	47.91	47.52	47.94	47.39
22	42.35	43.10	43.35	47.93	51.94	48.52	47.66	48.19	47.80
23	42.47	43.27	43.70	48.11	52.71	48.99	47.79	48.55	47.90
24	42.72	43.38	43.95	48.20	53.22	50.86	47.88	48.81	48.29
25	43.30	43.51	44.19	49.43	53.34	51.27	47.96	48.93	48.30
26	43.40	43.53	44.39	49.56	53.90	51.96	48.43	49.05	49.21
27	43.50	43.70	44.80	50.41	54.66	52.21	49.08	49.58	49.43
28	43.75	44.46	44.92	50.62	57.17	52.59	49.27	49.95	49.49
29	44.03	44.85	45.06	52.09	57.61	54.90	49.44	50.67	49.57
30	44.75	44.88	46.33	52.32	58.12	54.91	49.53	50.72	50.12
31	44.83	45.11	46.47	52.91	58.59	58.66	50.62	50.97	50.24
32	44.95	45.60	46.54	53.62	60.00	62.21	50.85	51.53	50.78
33	44.96	45.73	46.56	53.63	62.84	66.99	52.25	51.63	50.91
34	45.19	46.00	46.69	54.23	64.96	71.14	52.50	51.81	51.01
35	45.41	46.93	46.85	54.51	66.85		53.35	51.83	51.51
36	46.02	47.79	46.86	56.64	68.43		53.51	51.98	51.79
37	46.20	47.85	46.90	58.64			53.56	51.98	51.92
38	46.45	47.94	46.99	59.31			54.30	51.98	52.02
39	46.54	48.01	47.27	61.96			55.03	51.99	52.13
40	46.68	48.19	47.39	64.36			55.05	52.40	52.16
41	47.14	48.55	47.71	68.37			55.06	52.52	52.19
42	47.52	48.81	47.80				55.81	53.14	52.39
43	47.66	48.93	47.90				55.87	53.90	52.72
44	47.79	49.05	47.91				56.15	54.28	53.07
45	47.88	49.58	48.29				56.32	54.28	53.31
46	47.93	49.95	48.30				56.40	54.93	53.55
47	47.96	50.57	48.52				56.59	55.12	53.78
48	48.11	50.58	48.99				57.15	55.26	54.19
49	48.20	50.67	49.21				59.36	55.64	55.21
50	48.43	50.72	49.43				61.49	55.78	55.27

N	all beams			beams with finger-joint failure			beams with wood failure		
51	49.08	50.96	49.49				61.59	56.31	55.91
52	49.27	50.97	49.57				62.49	58.52	55.99
53	49.43	51.53	50.12				63.08	58.63	56.78
54	49.44	51.63	50.24				63.31	58.74	56.85
55	49.53	51.81	50.78				64.26	59.15	58.42
56	49.56	51.83	50.86				64.48	60.04	59.83
57	50.41	51.94	50.91				64.90	60.30	60.03
58	50.62	51.98	51.01				65.76	61.86	61.76
59	50.62	51.98	51.27				67.09	62.23	61.91
60	50.85	51.98	51.51					63.72	62.30
61	52.09	51.99	51.79					65.80	62.30
62	52.25	52.40	51.92					67.11	62.79
63	52.32	52.52	51.96					68.72	64.95
64	52.50	52.71	52.02					71.44	66.09
65	52.91	53.14	52.13						67.92
66	53.35	53.22	52.16						68.93
67	53.51	53.34	52.19						
68	53.56	53.90	52.21						
69	53.62	53.90	52.39						
70	53.63	54.28	52.59						
71	54.23	54.28	52.72						
72	54.30	54.66	53.07						
73	54.51	54.93	53.31						
74	55.03	55.12	53.55						
75	55.05	55.26	53.78						
76	55.06	55.64	54.19						
77	55.81	55.78	54.90						
78	55.87	56.31	54.91						
79	56.15	57.17	55.21						
80	56.32	57.61	55.27						
81	56.40	58.12	55.91						
82	56.59	58.52	55.99						
83	56.64	58.59	56.78						
84	57.15	58.63	56.85						
85	58.64	58.74	58.42						
86	59.31	59.15	58.66						
87	59.36	60.00	59.83						
88	61.49	60.04	60.03						
89	61.59	60.30	61.76						
90	61.96	61.86	61.91						
91	62.49	62.23	62.21						
92	63.08	62.84	62.30						
93	63.31	63.72	62.30						
94	64.26	64.96	62.79						
95	64.36	65.80	64.95						
96	64.48	66.85	66.09						
97	64.90	67.11	66.99						
98	65.76	68.43	67.92						
99	67.09	68.72	68.93						
100	68.37	71.44	71.14						
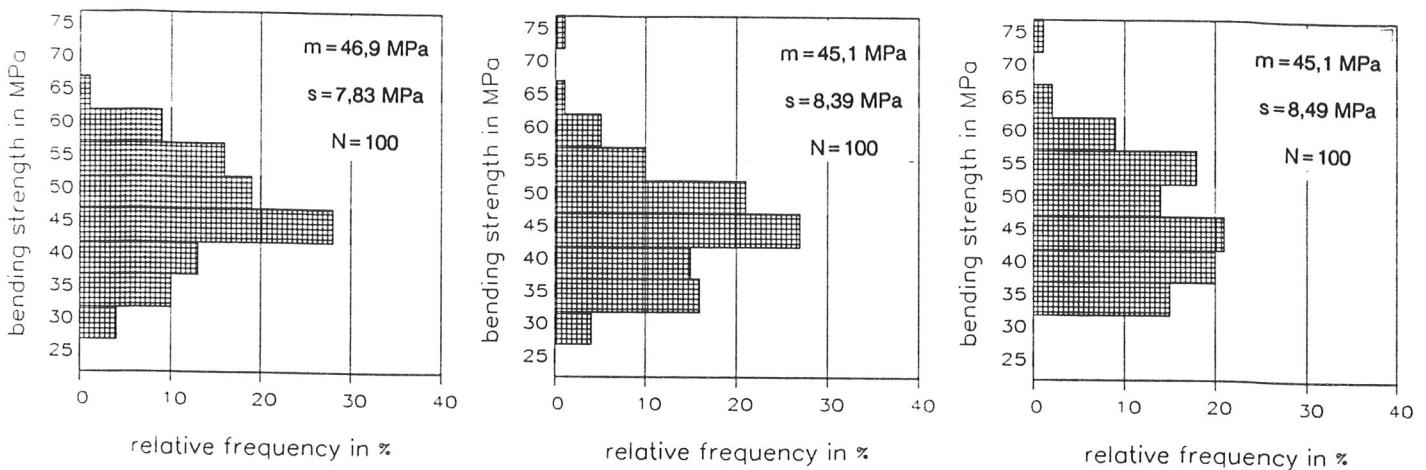
Fig. A.1a: Simulation results, series I - DEN - TEST, all beams
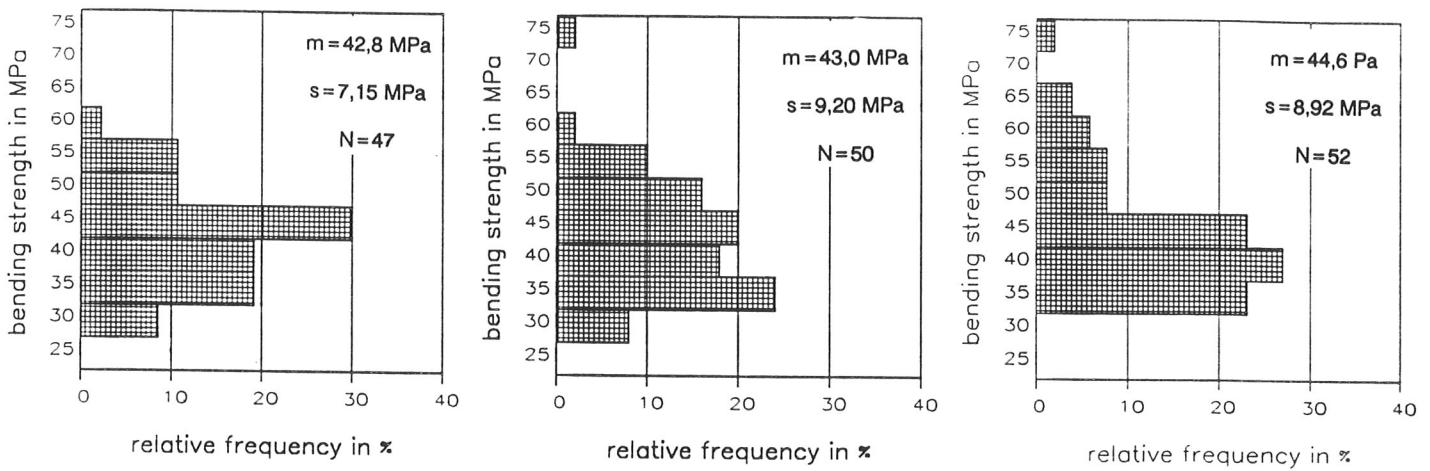
Fig. A.1b: Simulation results, series I - DEN - TEST, beams with fingerjoint failure
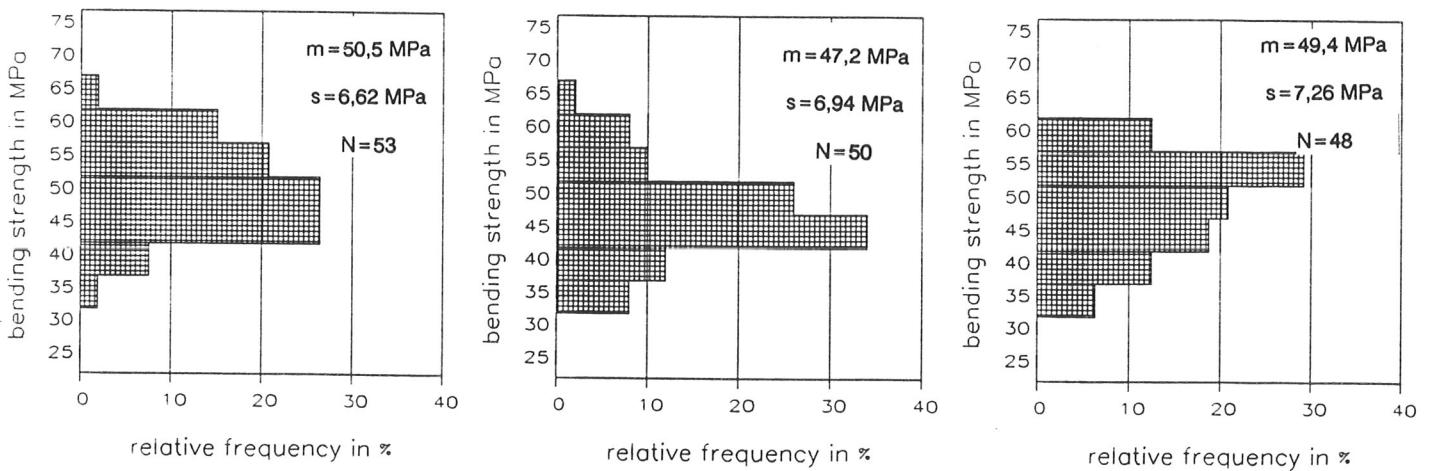
**Fig. A.1c:** Simulation results, series I - DEN - TEST, beams with wood failure
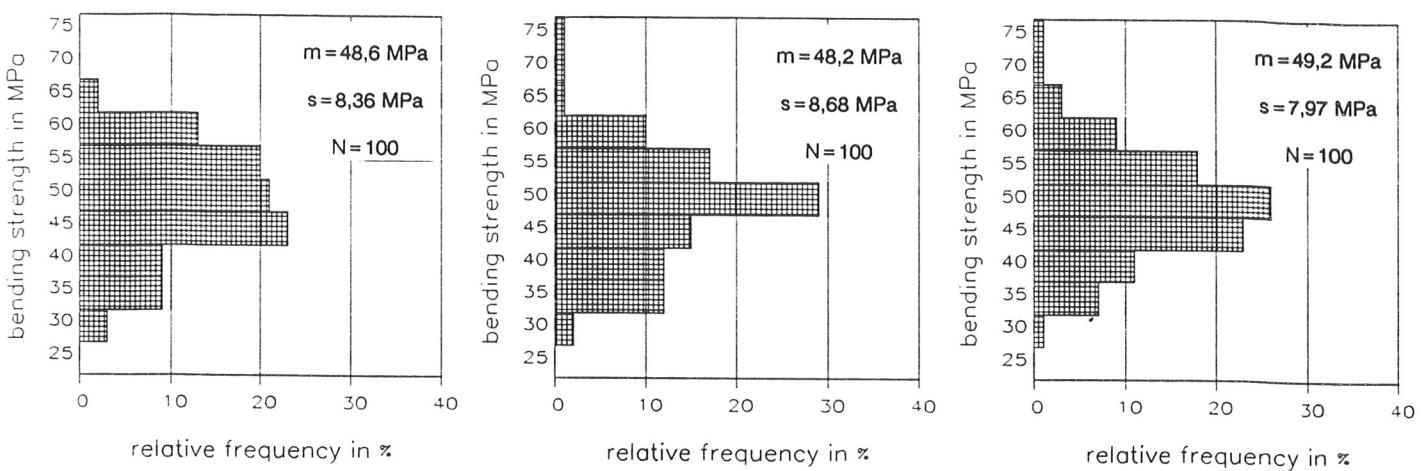
**Fig. A.2a:** Simulation results, series I - DEN - REG, all beams
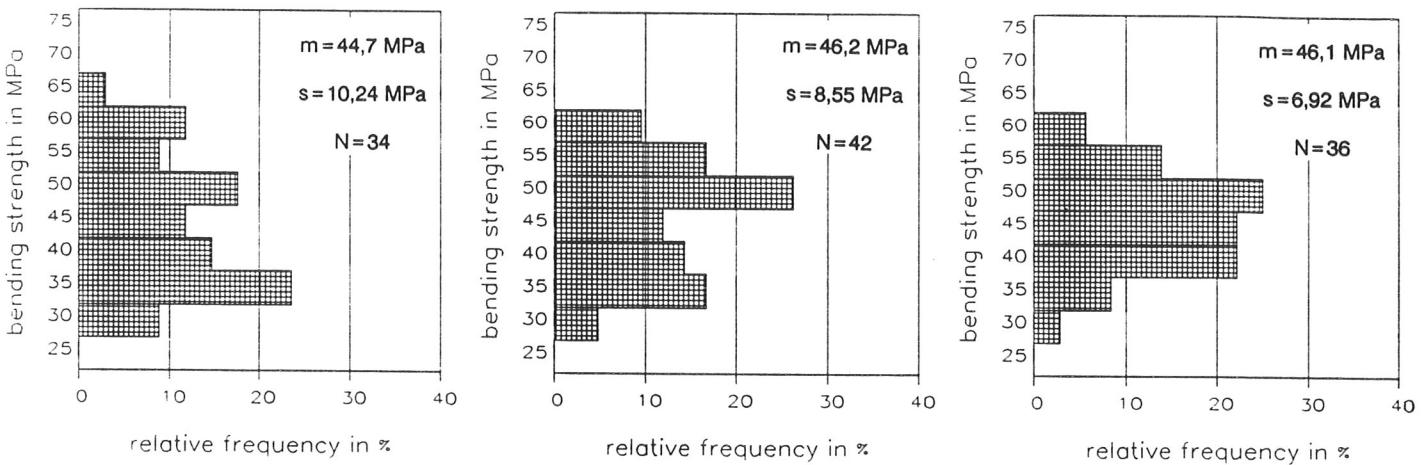
Fig. A.2b: Simulation results, series I - DEN - REG, beams with fingerjoint failure
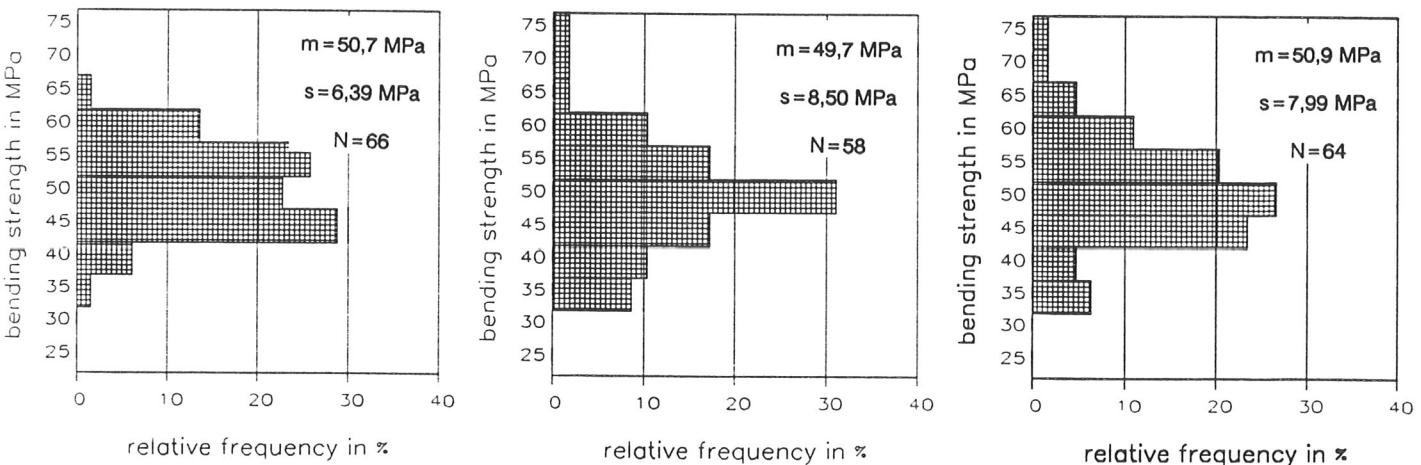
Fig. A.2c: Simulation results, series I - DEN - REG, beams with wood failure
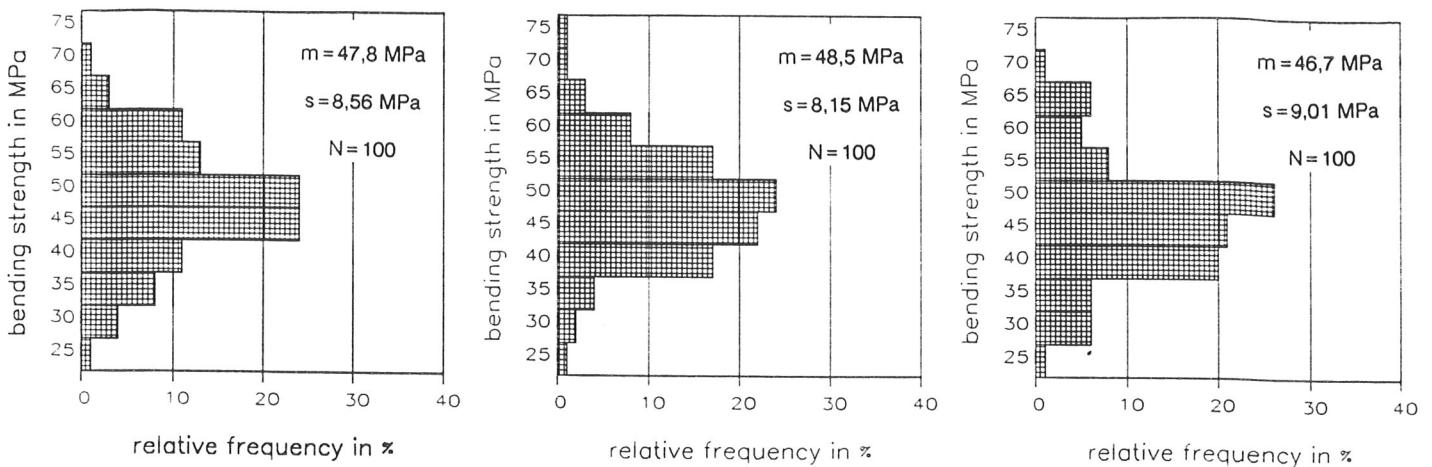
Fig. A.3a: Simulation results, series I - MOE - TEST, all beams
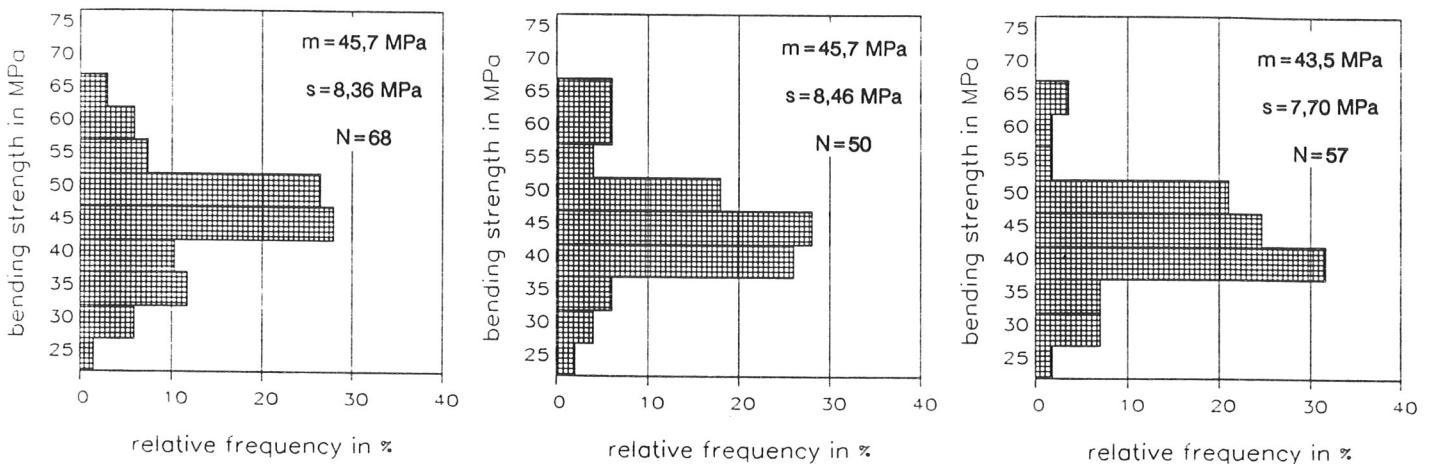
Fig. A.3b: Simulation results, series I - MOE - TEST, beams with fingerjoint failure
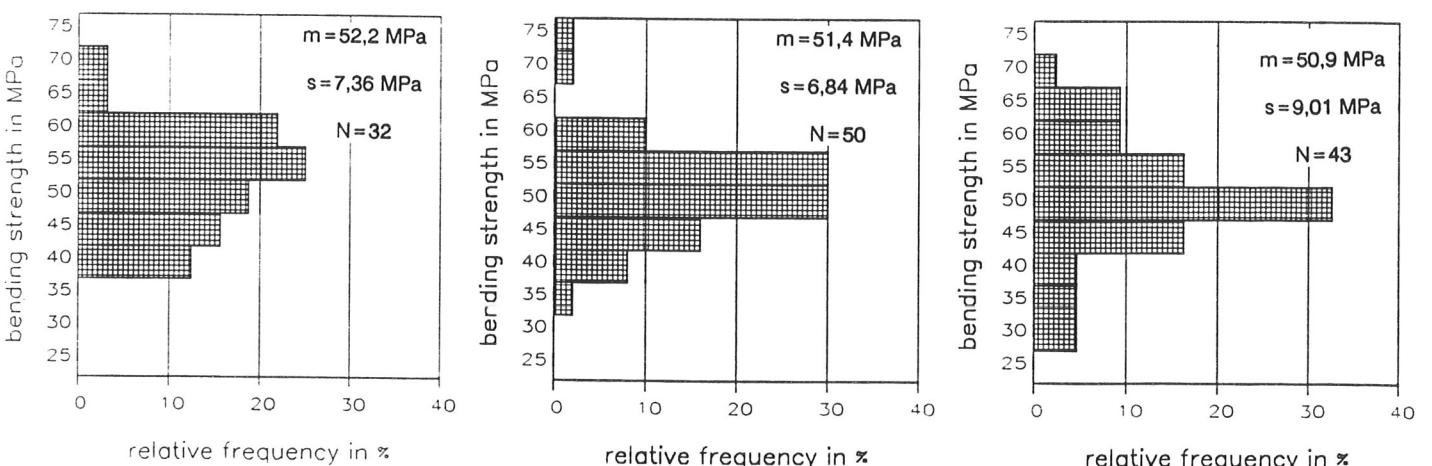
Fig. A.3c: Simulation results, series I - MOE - TEST, beams with wood failure
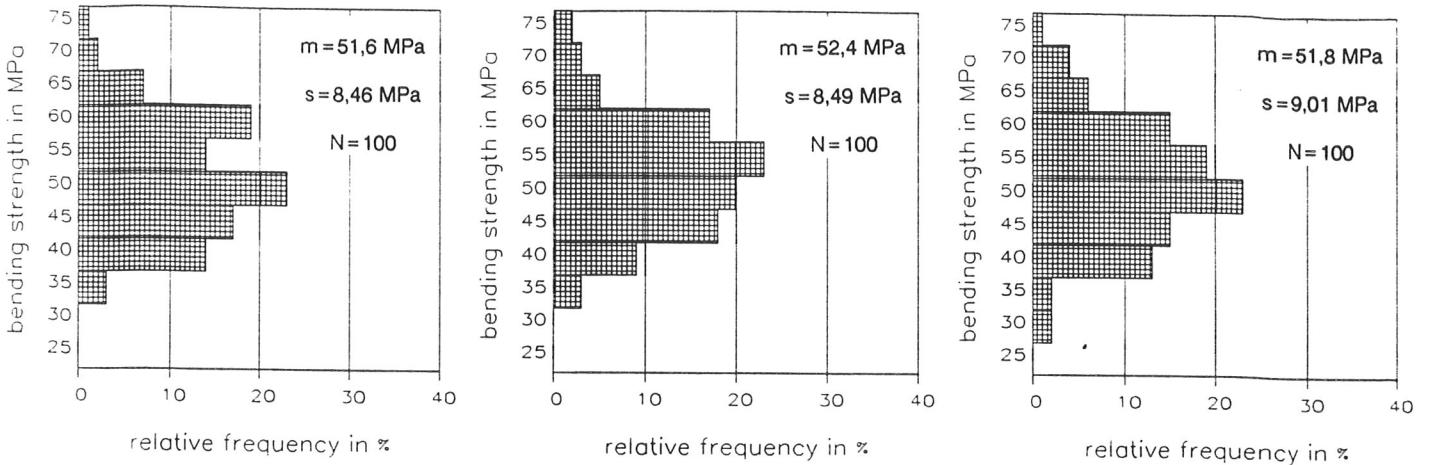
Fig. A.4a: Simulation results, series I - MOE - REG, all beams
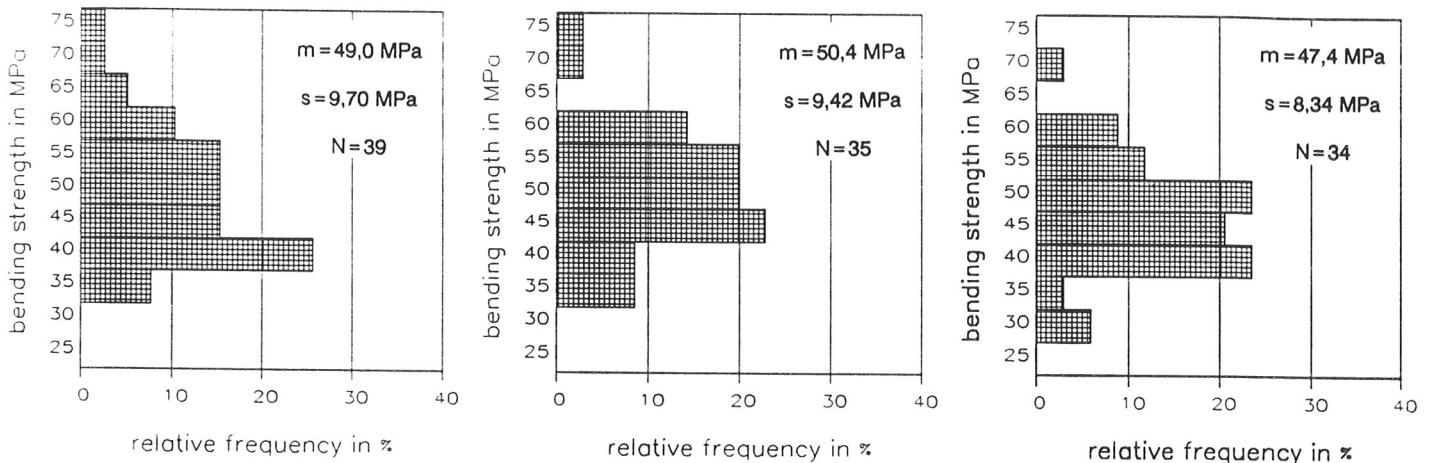
**Fig. A.4b:** Simulation results, series I - MOE - REG, beams with fingerjoint failure
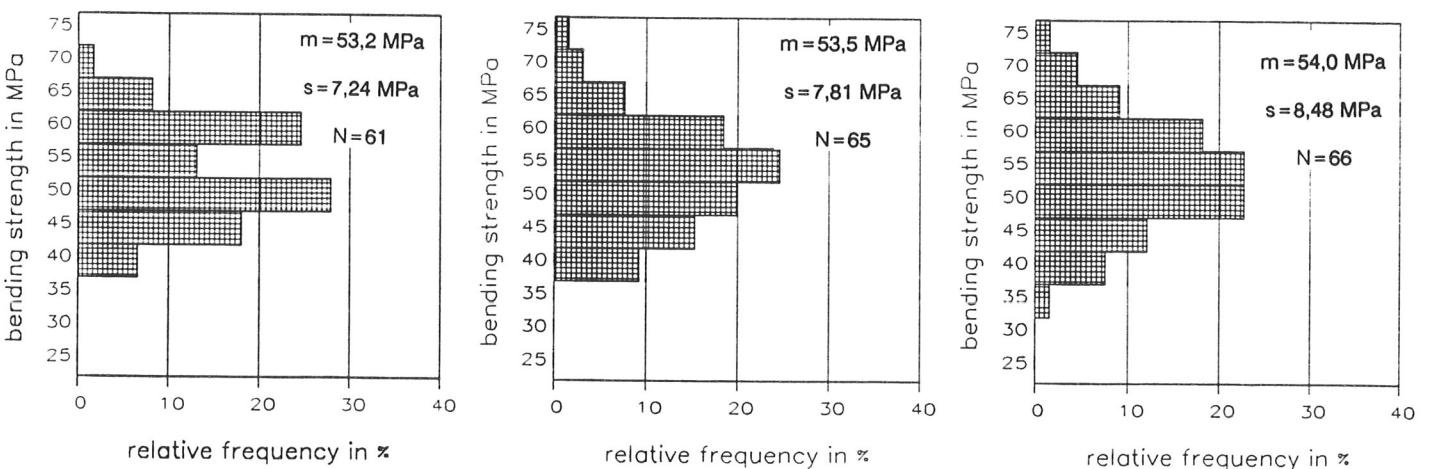
Fig. A.4c: Simulation results, series I - MOE - REG, beams with wood failure
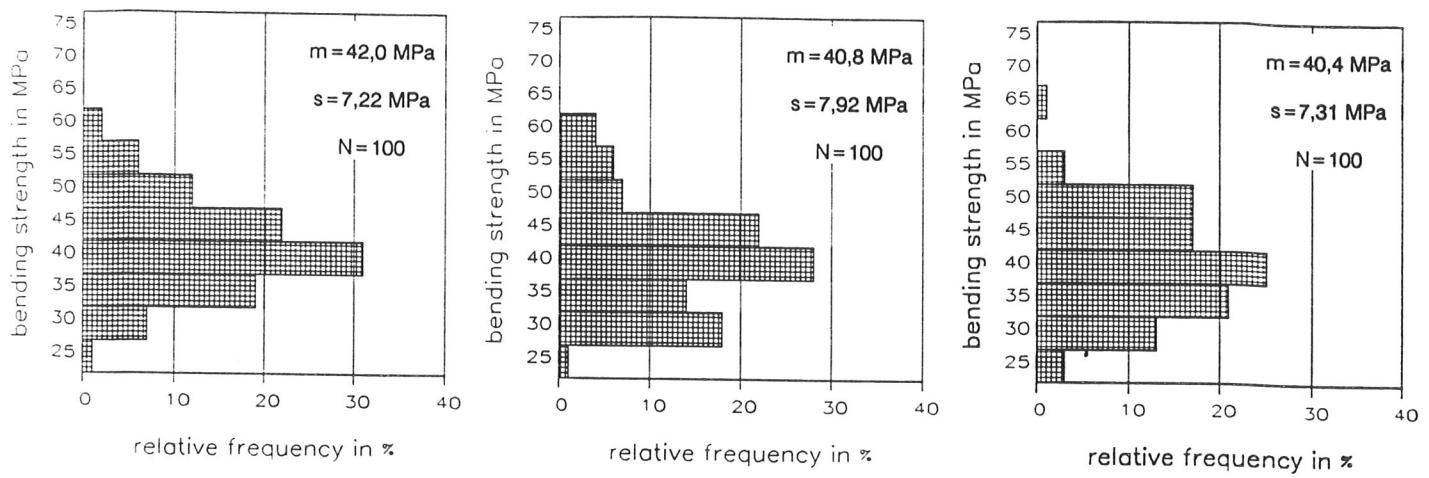
Fig. A.5a: Simulation results, series II - DEN - TEST, all beams
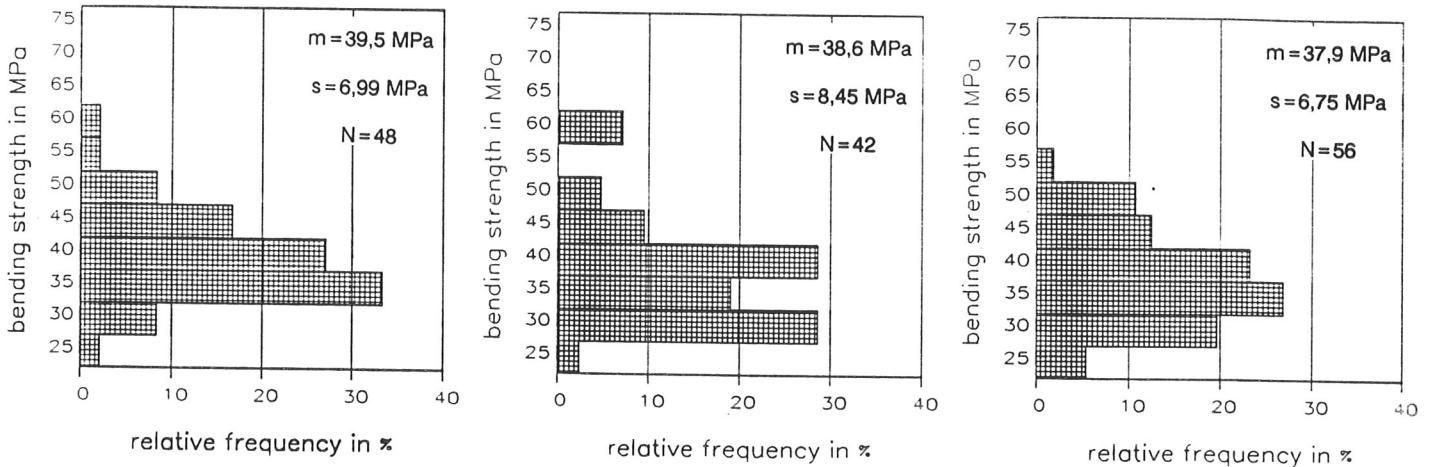
Fig. A.5b: Simulation results, series II - DEN - TEST, beams with fingerjoint failure
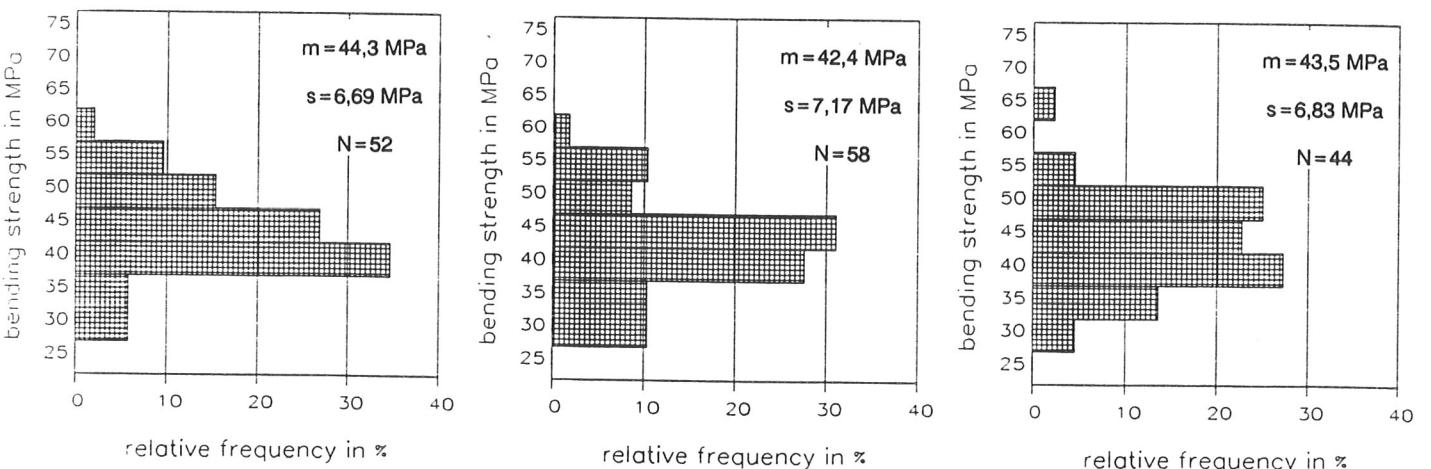
Fig. A.5c: Simulation results, series II - DEN - TEST, beams with wood failure
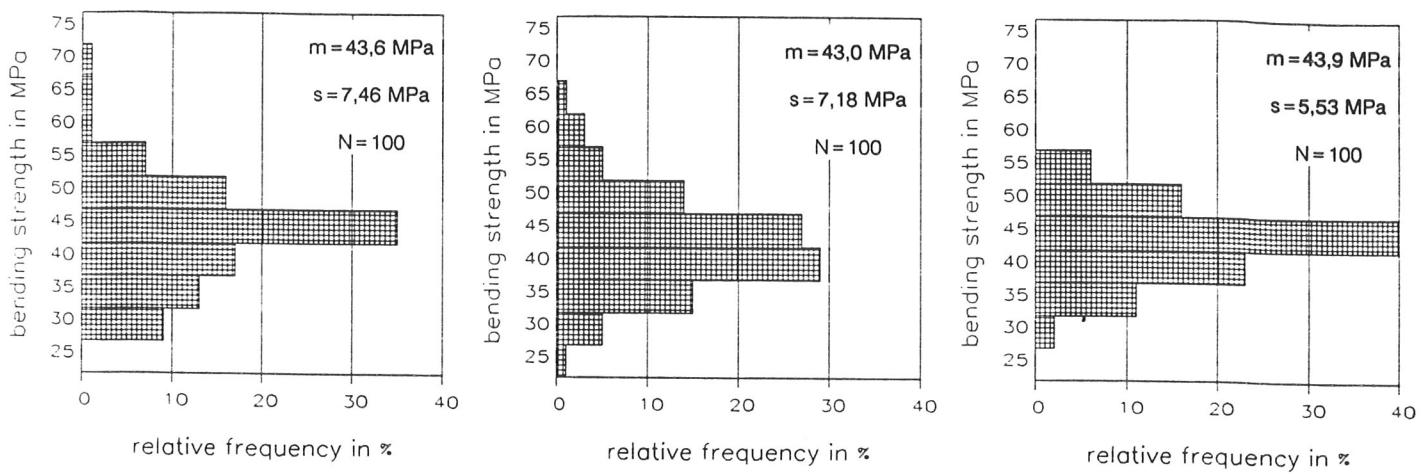
Fig. A.6a: Simulation results, series II - DEN - REG, all beams
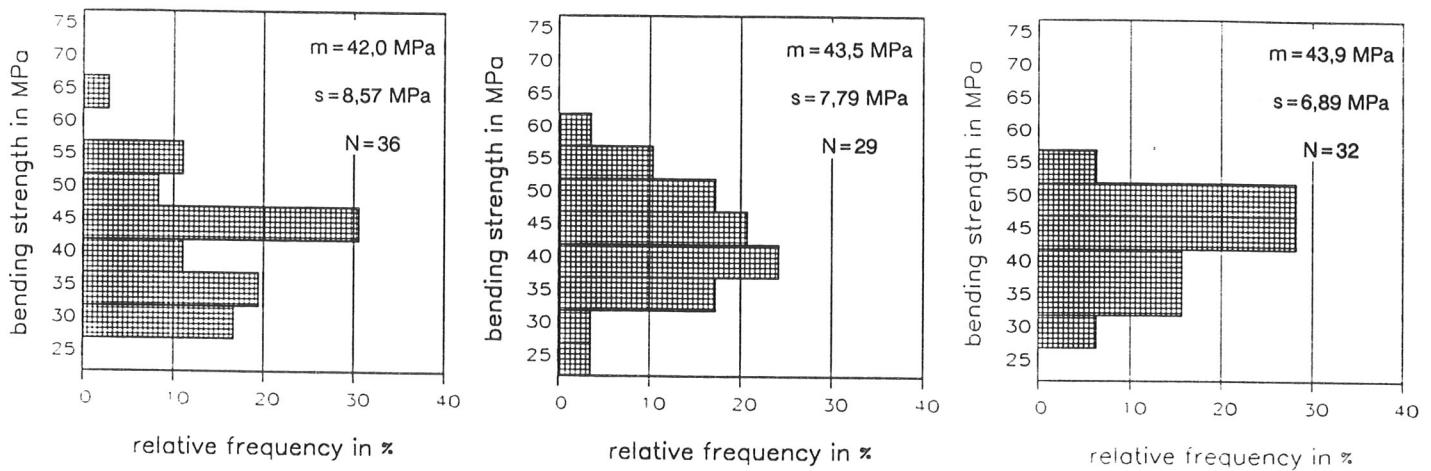
Fig. A.6b: Simulation results, series II - DEN - REG, beams with fingerjoint failure
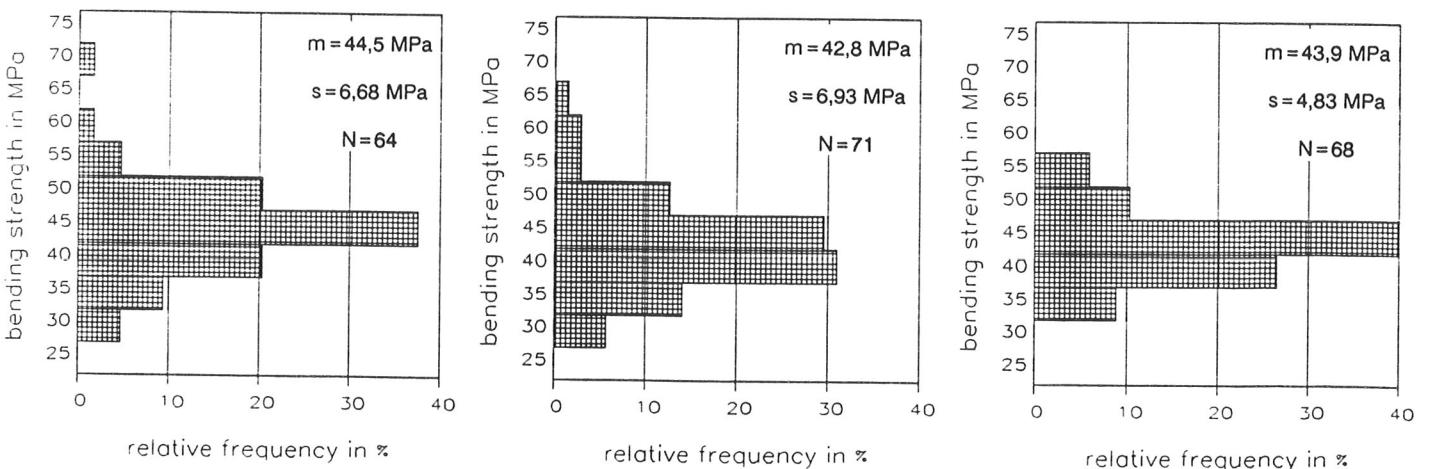
**Fig. A.6c:** Simulation results, series II - DEN - REG, beams with wood failure
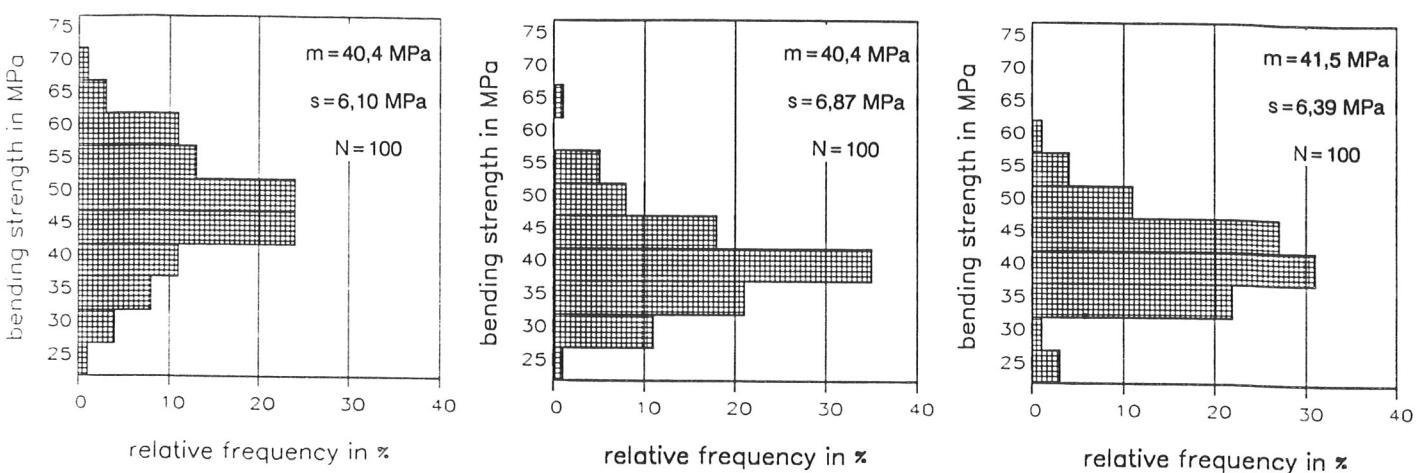
Fig. A.7a: Simulation results, series II - MOE - TEST, all beams
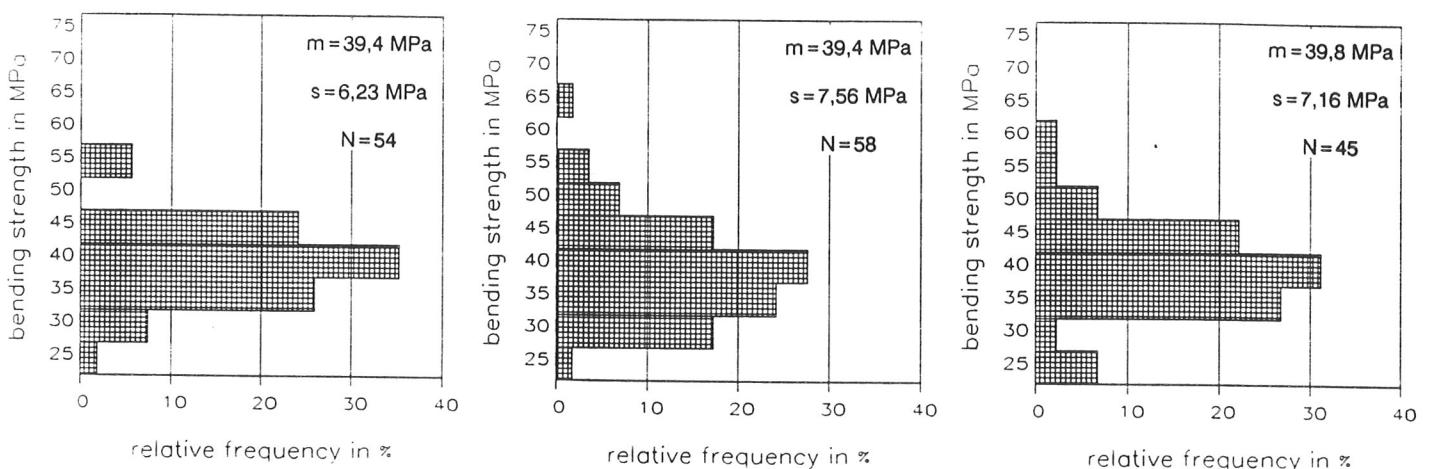

Fig. A.7b: Simulation results, series II - MOE - TEST, beams with fingerjoint failure
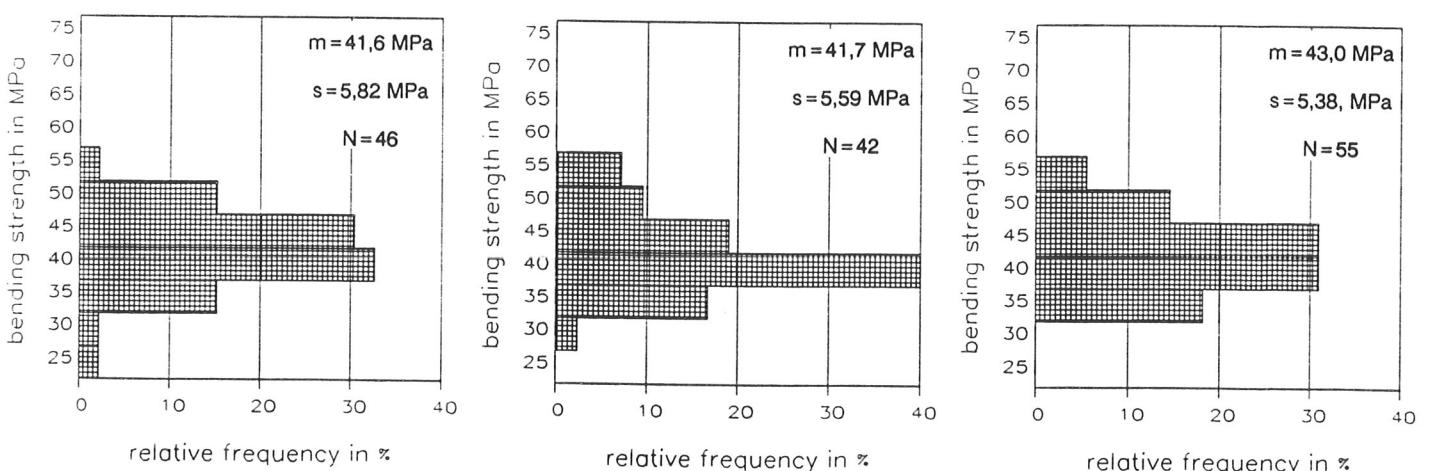
Fig. A.7c: Simulation results, series II - MOE - TEST, beams with wood failure
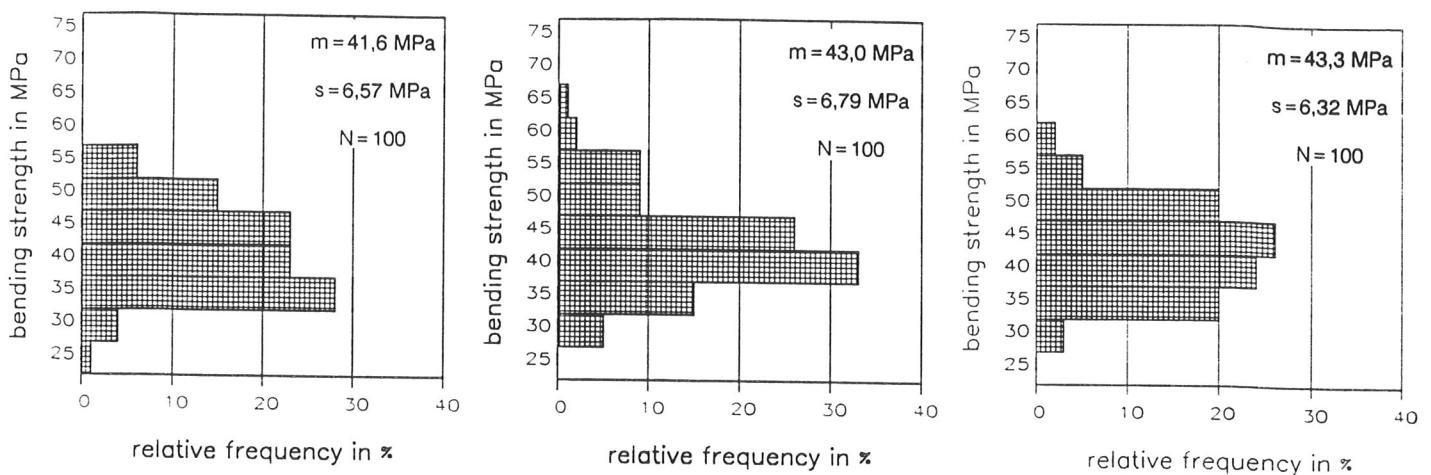
Fig. A.8a: Simulation results, series II - MOE - REG, all beams
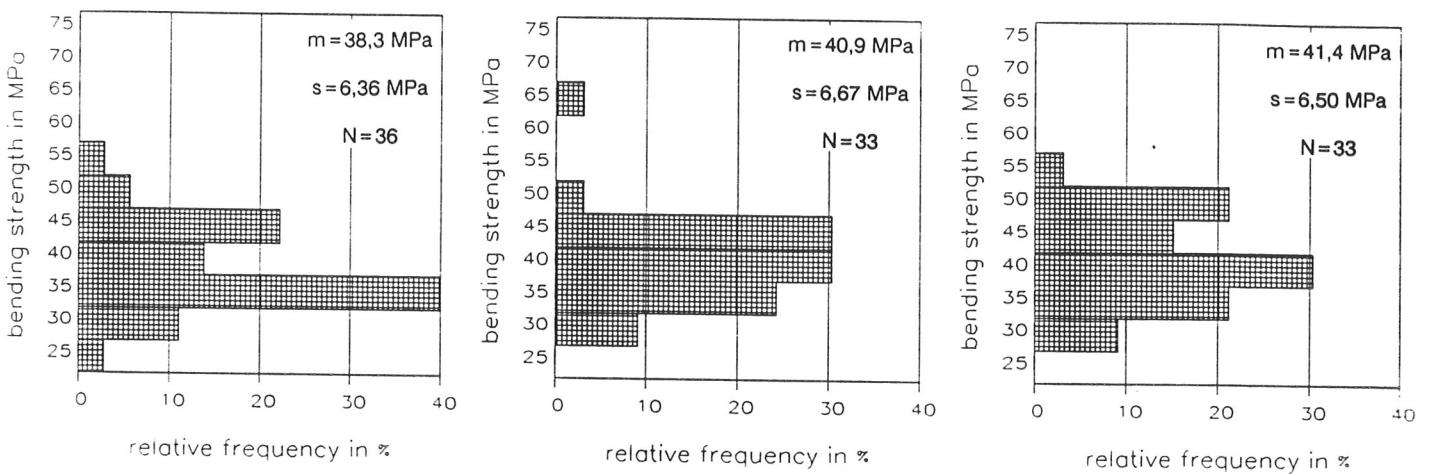
**Fig. A.8b:** Simulation results, series II - MOE - REG, beams with fingerjoint failure
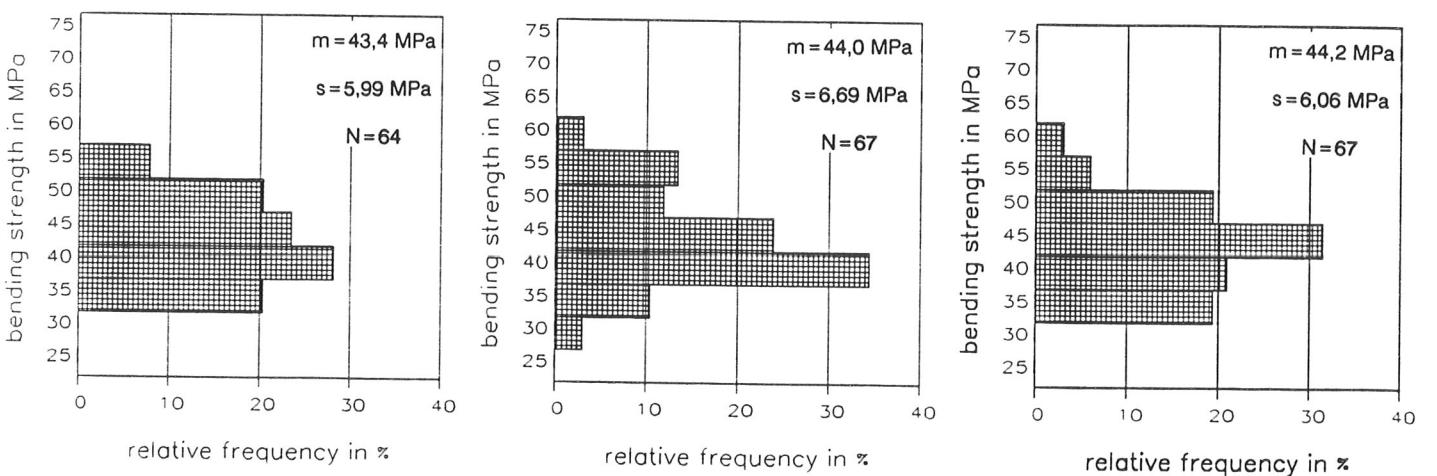
Fig. A.8c: Simulation results, series II - MOE - REG, beams with wood failure
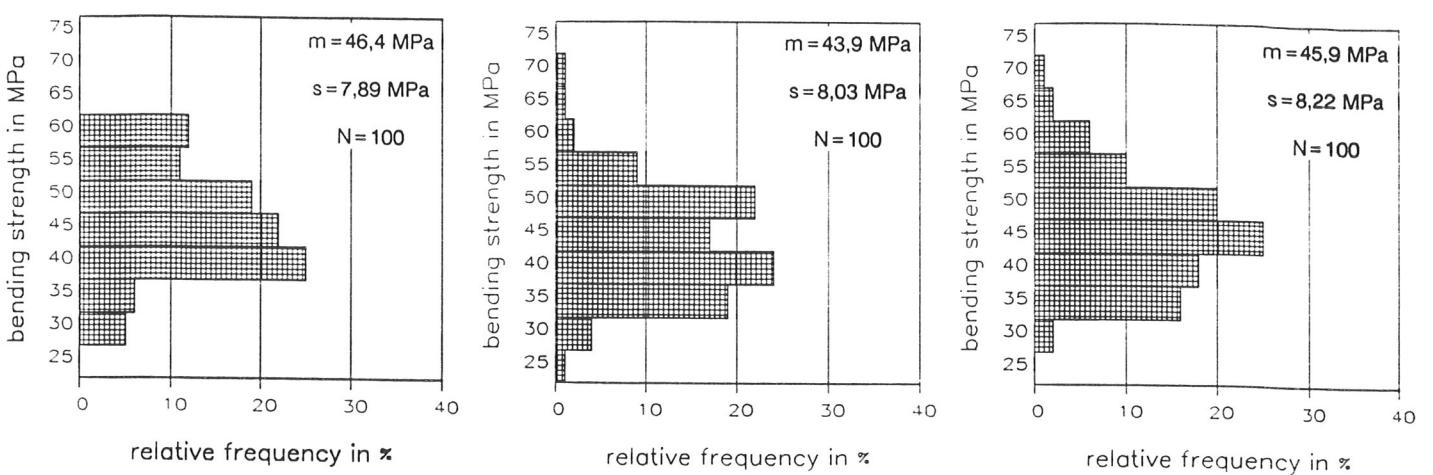
Fig. A.9a: Simulation results, series III - DEN - TEST, all beams
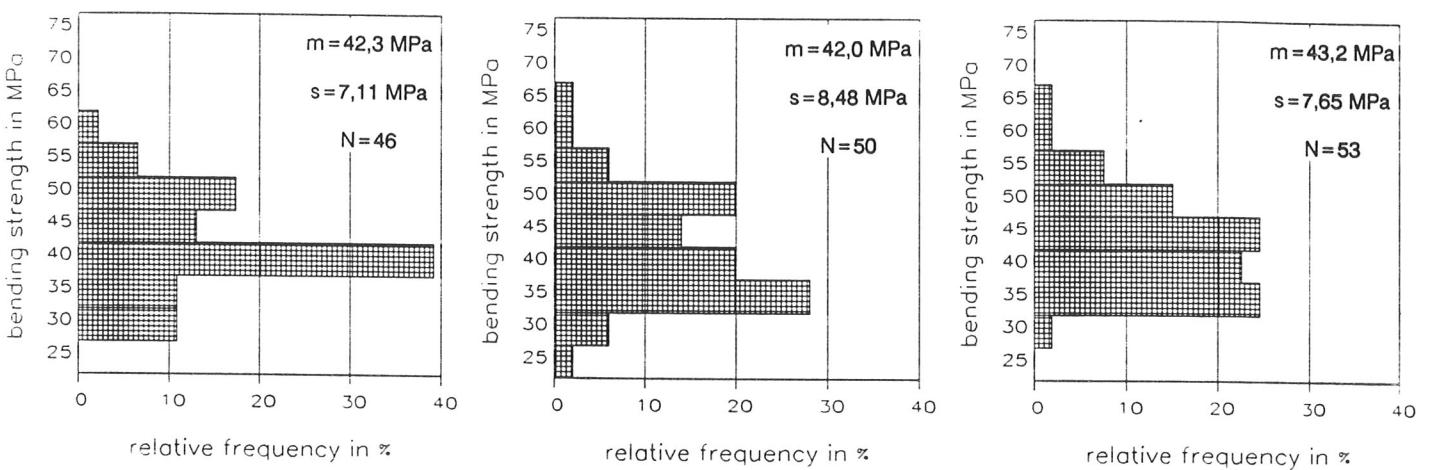
Fig. A.9b: Simulation results, series III - DEN - TEST, beams with fingerjoint failure
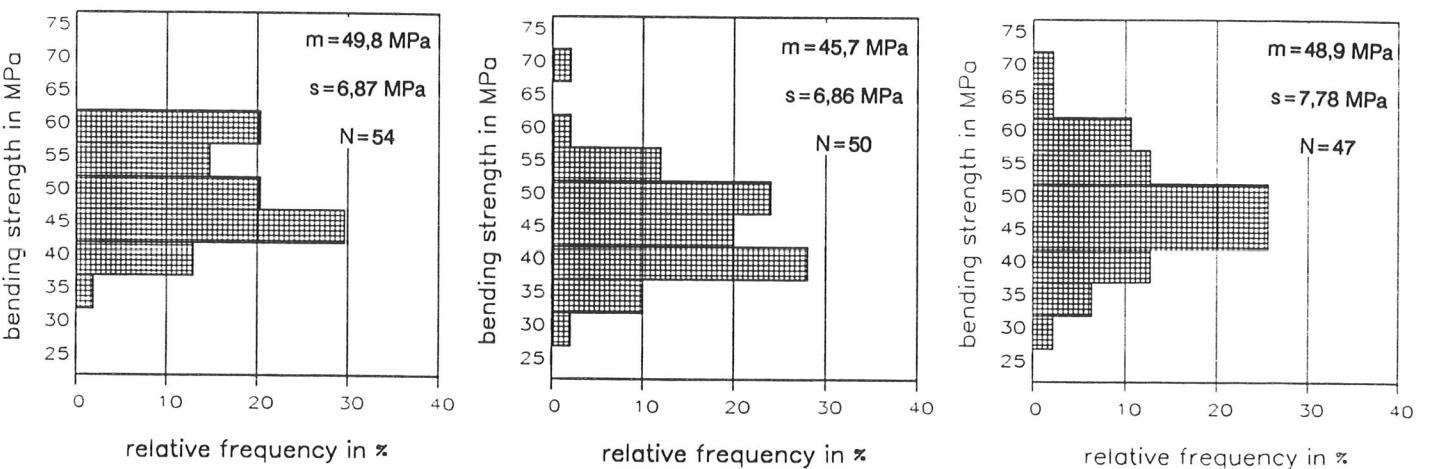
**Fig. A.9c:** Simulation results, series III - DEN - TEST, beams with wood failure
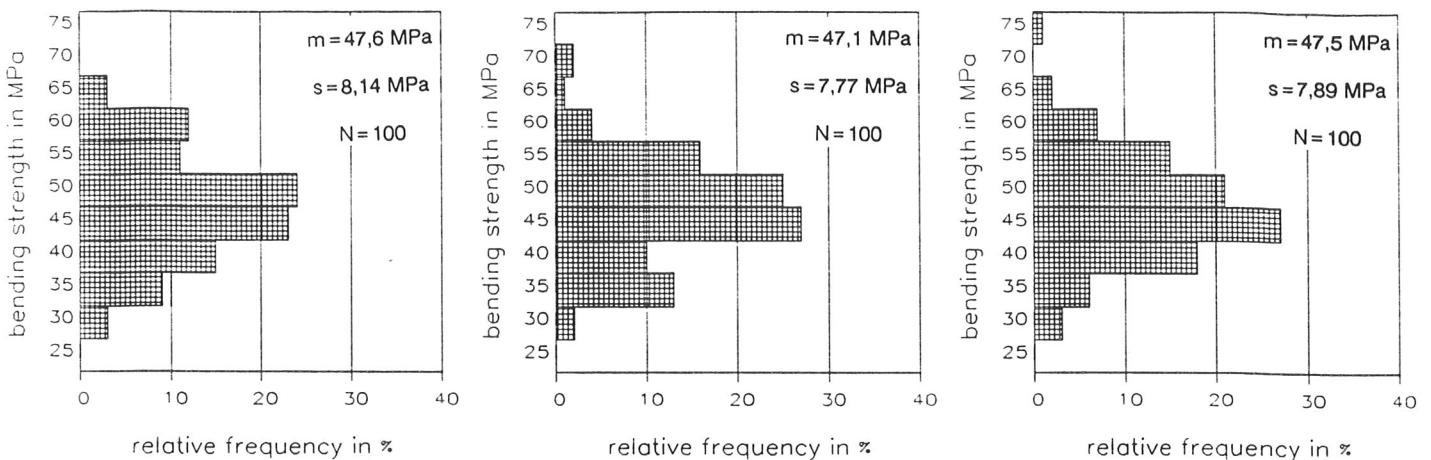
Fig. A.10a: Simulation results, series III - DEN - REG, all beams
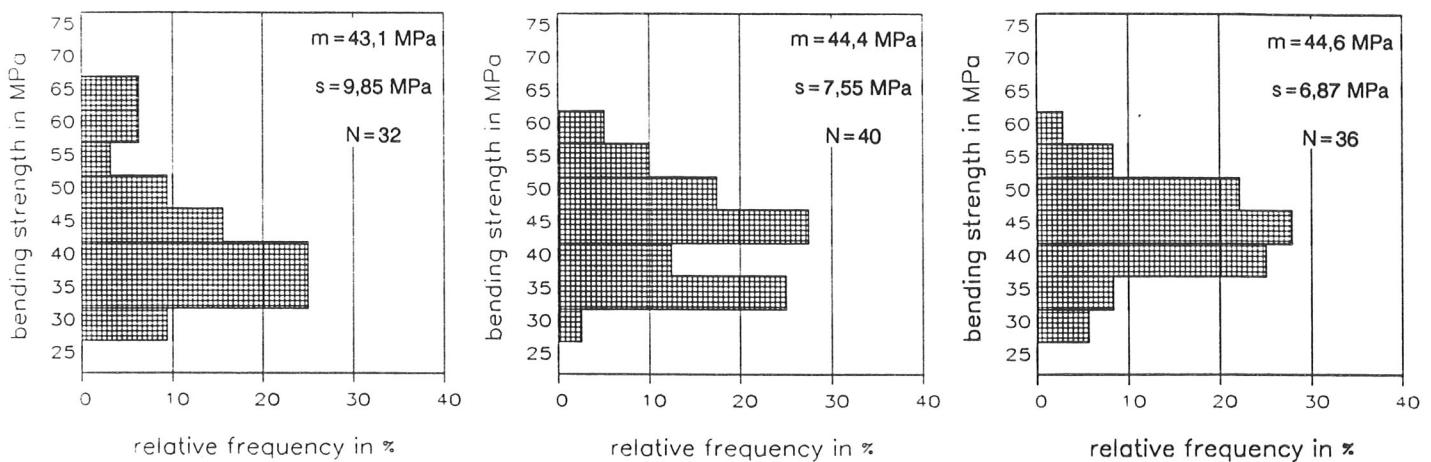
Fig. A.10b: Simulation results, series III - DEN - REG, beams with fingerjoint failure
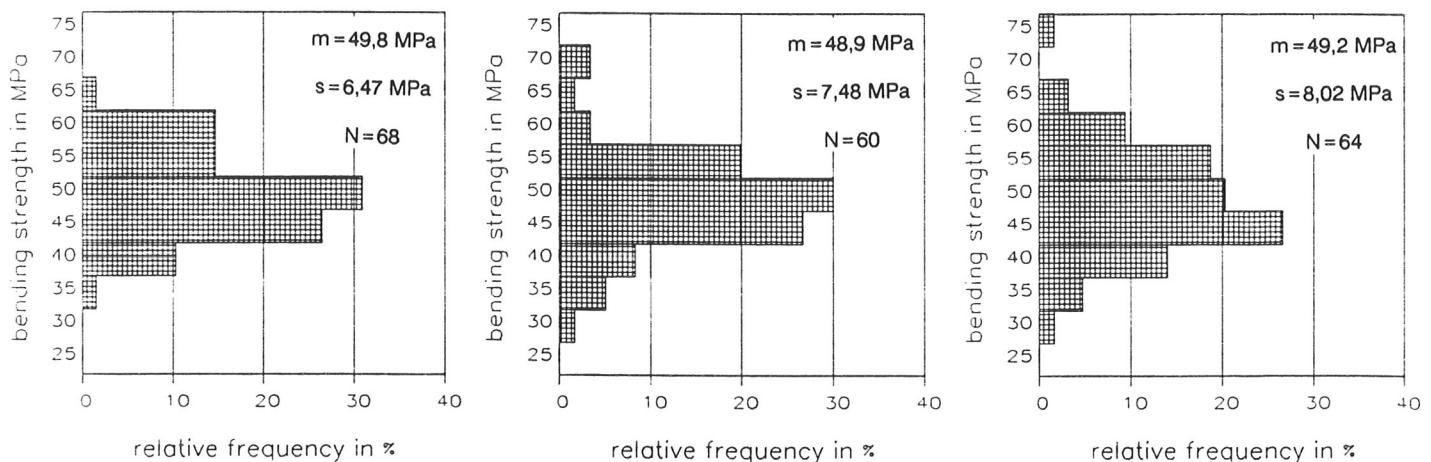
Fig. A.10c: Simulation results, series III - DEN - REG, beams with wood failure
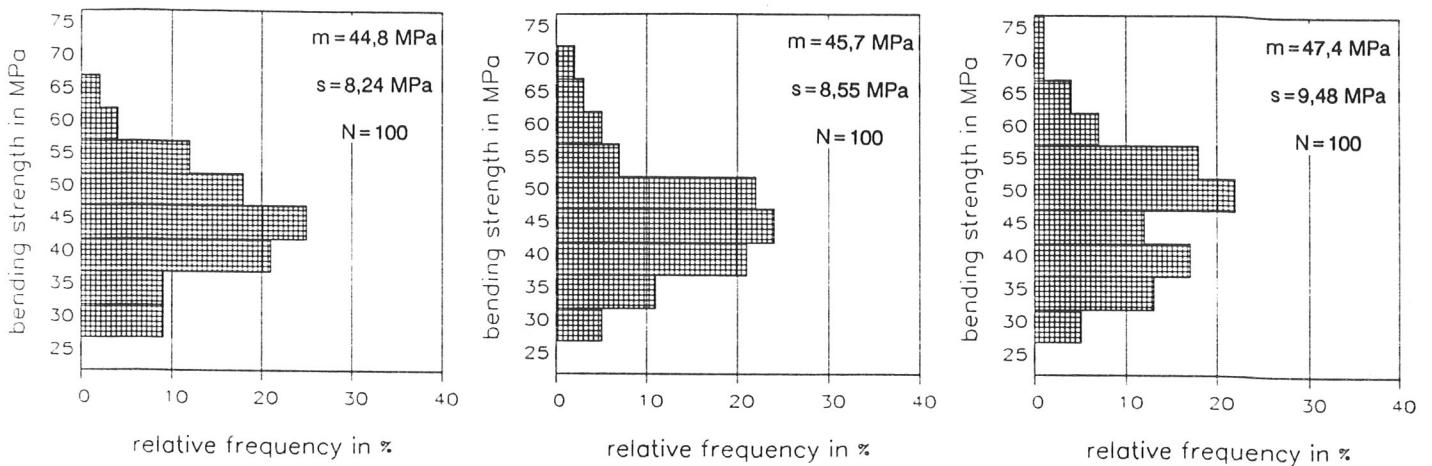
Fig. A.11a: Simulation results, series III - MOE - TEST, all beams
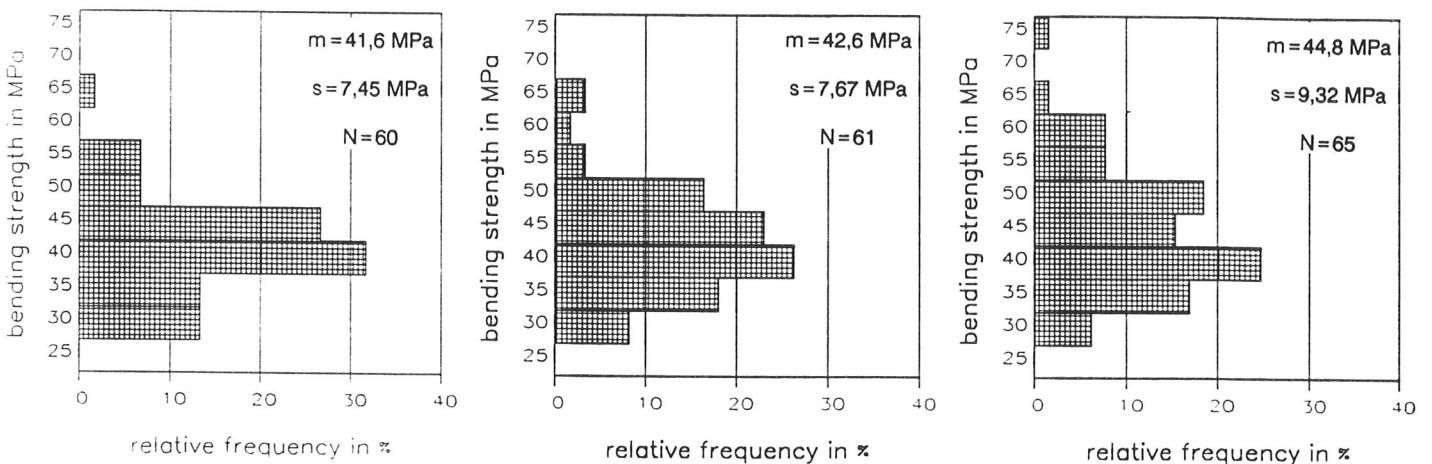
Fig. A.11b: Simulation results, series III - MOE - TEST, beams with fingerjoint failure
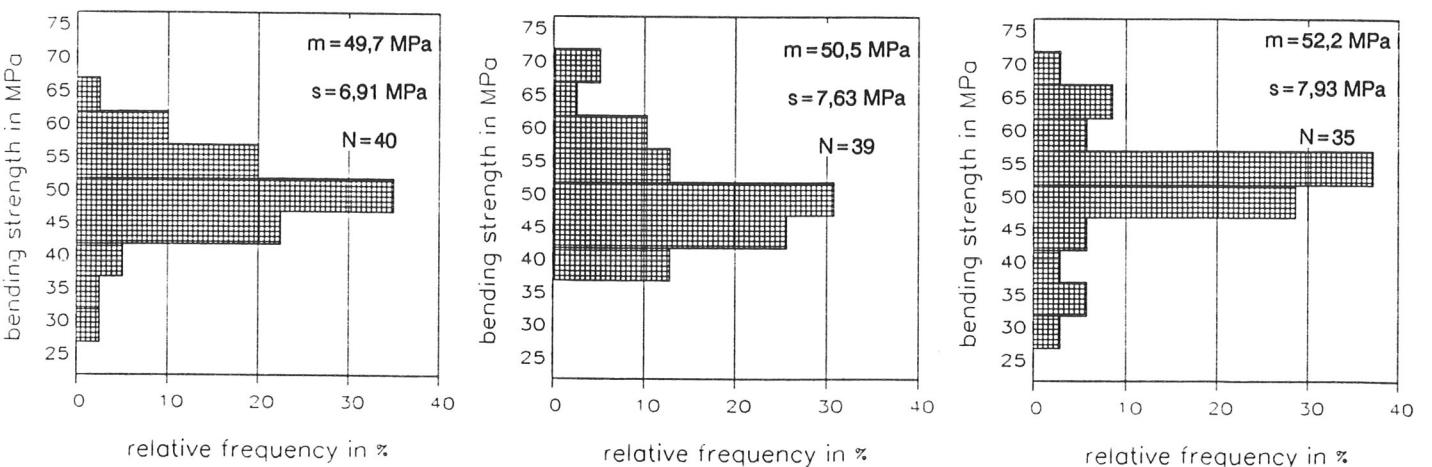
Fig. A.11c: Simulation results, series III - MOE - TEST, beams with wood failure
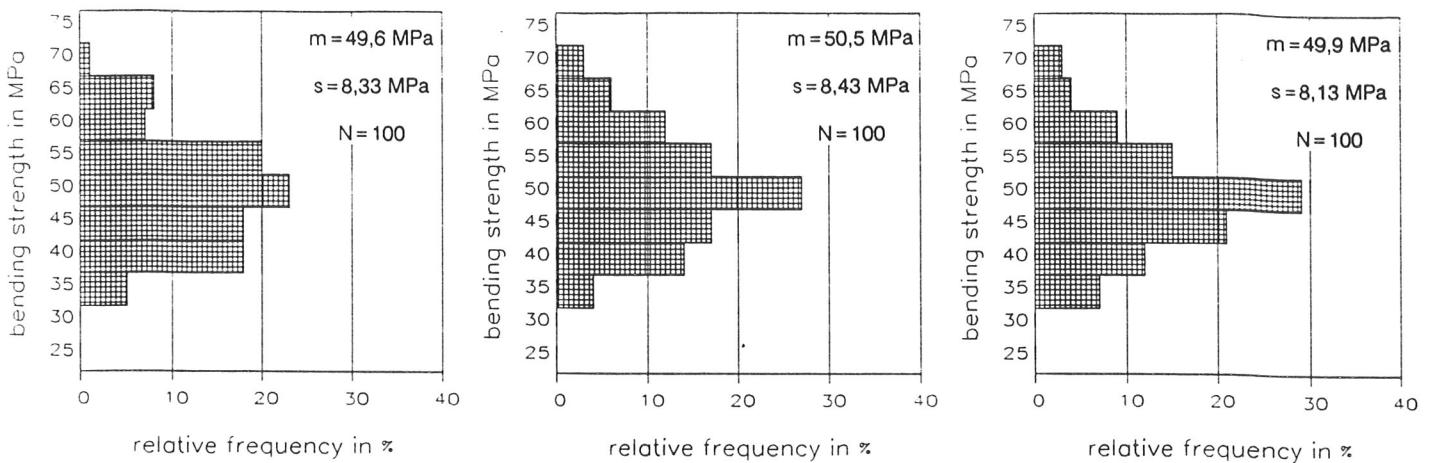
**Fig. A.12a:** Simulation results, series III - MOE - REG, all beams
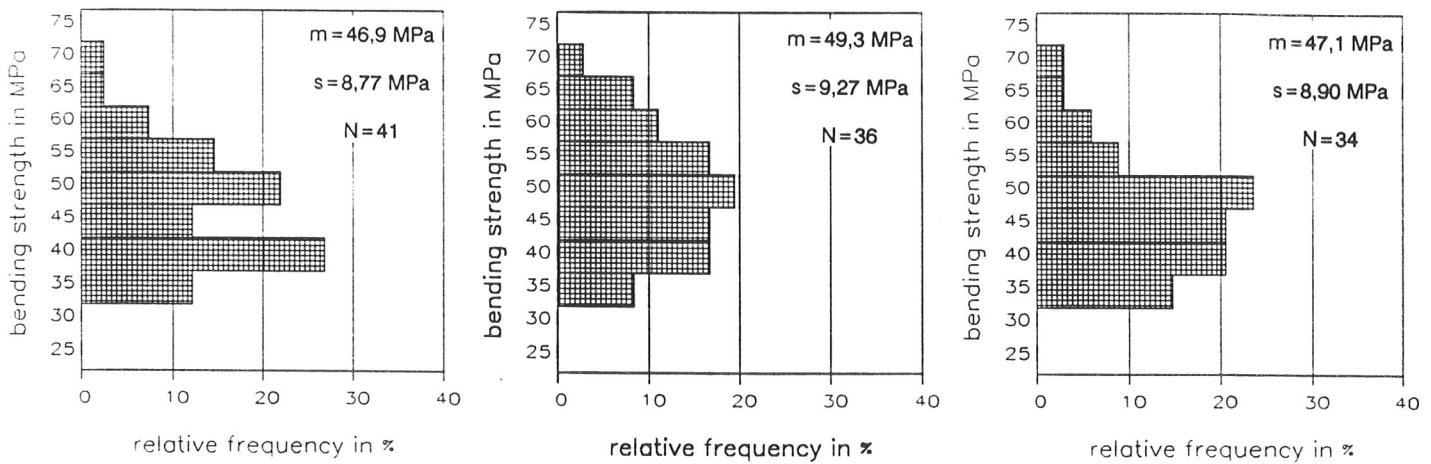
Fig. A.12b: Simulation results, series III - MOE - REG, beams with fingerjoint failure


Fig. A.12c: Simulation results, series III - MOE - REG, beams with wood failure