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Report

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Test report

Bending test on large-scale GLT beams with well-known beam setup

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2021

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GL24h-11m-1





Fig. 1: Illustrations of beam GL24h–11m–1 (central area): (left) before testing, (right) after testing.



(a) front side $(l\approx 5.3~{\rm m})$



(b) back side $(l\approx 5.4~{\rm m})$



(c) lowest lamella $(l\approx 5.3~{\rm m})$



(d) lowest and 2nd lowest lamella $(l\approx 5.3~{\rm m})$



(e) 3rd lowest lamella $(l\approx 4.5~{\rm m})$



(f) 4th lowest lamella $(l\approx 6.5~{\rm m})$





Fig. 3: Setup of GL24h–11m–1: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 4: Setup of GL24h–11m–1: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL24h-11m-2





Fig. 5: Illustrations of beam GL24h–11m–2 (central area): (left) before testing, (right) after testing.



(a) front side $(l\approx 6.7~{\rm m})$



(b) back side $(l\approx 6.4-6.8~{\rm m})$



(c) lowest lamella $(l\approx 6.8~{\rm m})$



(d) 2nd lowest lamella $(l\approx 6.6~{\rm m})$



(e) 3rd lowest lamella $(l\approx 5.0-5.8~{\rm m})$



(f) 4th lowest lamella $(l\approx 4.7~{\rm m})$

Fig. 6: Illustrations of the failure of GL24h–11m–2.



Fig. 7: Setup of GL24h–11m–2: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 8: Setup of GL24h–11m–2: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL24h-11m-3





Fig. 9: Illustrations of beam GL24h–11m–3 (central area): (left) before testing, (right) after testing.



(a) front side $(l \approx 5.5 \text{ m})$



(b) back side $(l \approx 5.7 \text{ m})$



(c) lowest lamella $(l\approx 3.5~{\rm m})$



(d) 2nd lowest lamella $(l\approx 5.7~{\rm m})$



(e) 3rd lowest lamella $(l\approx 5.5~{\rm m})$



(g) 4th lowest lamella $(l\approx 5.2~{\rm m})$



(f) 3rd lowest lamella ($l \approx 6.0 - 6.5$ m)



(h) 4th lowest lamella $(l\approx 7.0~{\rm m})$

Fig. 10: Illustrations of the failure of GL24h–11m–3. 10



Fig. 11: Setup of GL24h–11m–3: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 12: Setup of GL24h–11m–3: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL24h-11m-4





Fig. 13: Illustrations of beam GL24h–11m–4 (central area): (left) before testing, (right) after testing.



(a) front side $(l\approx 6.8~{\rm m})$



(b) back side $(l\approx 6.3~{\rm m})$



(c) lowest lamella $(l\approx 6.8~{\rm m})$



(d) 2nd lowest lamella $(l\approx 6.3~{\rm m})$



(e) 3rd lowest lamella $(l\approx 4.6~{\rm m})$



(f) 3rd lowest lamella $(l\approx 5.4~{\rm m})$

Fig. 14: Illustrations of the failure of GL24h–11m–4.



Fig. 15: Setup of GL24h–11m–4: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 16: Setup of GL24h–11m–4: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL24h-19m-1



Fig. 17: Illustration of GL24h–19m–1: after testing.



Fig. 18: Illustration of beam GL24h-19m-1 after testing (area between central buckling stabilisers)



(a) lowest lamella



(b) 2nd lowest lamella $(l\approx 8.5~{\rm m})$





(c) 3rd lowest lamella $(l\approx 9.0~{\rm m})$

(d) sixth lowest lamella $(l\approx7.3~{\rm m})$

Fig. 19: Illustrations of the failure of GL24h-19m-1.



Fig. 20: Setup of GL24h–19m–1: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 21: Setup of GL24h–19m–1: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL24h-19m-2



Fig. 22: Illustration of GL24h–19m–2: after testing.



(a) front side ($l\approx 6.3-8.5{\rm m}),$ upper crack from 2nd failure cycle



(c) lowest lamella $(l\approx 6.1-8.5~{\rm m})$



(e) lowest lamella $(l \approx 6.1 - 7.5 \text{ m})$



(b) back side ($l\approx 5.0-6.1$ m), upper crack from 2nd failure cycle



(d) 3rd lowest lamella $(l \approx 6.9 - 8.0 \text{ m})$



(f) 3rd and 4th lowes lamella $(l \approx 6.6 - 6.9 \text{ m})$



(g) 4th lowest lamella $(l\approx 6.6-8.5~{\rm m})$

(h) 5th lowest lamella $(l\approx 11.2~{\rm m})$

Fig. 23: Illustrations of the failure of GL24h–19m–2.



Fig. 24: Setup of GL24h–19m–2: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 25: Setup of GL24h–19m–2: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL32h-11m-1





Fig. 26: Illustrations of beam GL32h–11m–1 (central area): (left) before testing, (right) after testing.



(a) front side $(l \approx 4.7 - 5.0 \text{ m})$



(c) lowest lamella $(l\approx 4.7-4.8~{\rm m})$



(b) back side $(l\approx 4.8-4.9~{\rm m})$



(d) lowest and 2nd lowest lamella $(l\approx 4.8~{\rm m})$



(e) 3rd lowest lamella $(l\approx 4.9~{\rm m})$



(f) 3rd lowest lamella $(l\approx 4.9~{\rm m})$

Fig. 27: Illustrations of the failure of GL32h–11m–1.



Fig. 28: Setup of GL32h–11m–1: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 29: Setup of GL32h–11m–1: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL32h-11m-2





Fig. 30: Illustrations of beam GL32h–11m–2 (central area): (left) before testing, (right) after testing.



(a) front side $(l\approx 5.5~{\rm m})$





(c) lowest lamella $(l\approx 4.8-5.8~{\rm m})$

(d) lowest and 2nd lowest lamella $(l\approx 4.8-5.8~{\rm m})$



(e) 2nd lowest lamella $(l\approx 4.2~{\rm m})$



(f) 2nd lowest lamella $(l\approx 5.5~{\rm m})$





Fig. 32: Setup of GL32h–11m–2: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 33: Setup of GL32h–11m–2: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL32h-11m-3





Fig. 34: Illustrations of beam GL32h–11m–3 (central area): (left) before testing, (right) after testing.



(a) front side $(l\approx 3.9~{\rm m})$



(b) back side $(l\approx 3.9~{\rm m})$



(c) lowest lamella $(l\approx 3.9~{\rm m})$



(d) lowest and 2nd lowest lamella $(l\approx 3.9~{\rm m})$



(e) 3rd lowest lamella $(l\approx7.4~{\rm m})$



(f) 3rd lowest lamella $(l\approx7.4~{\rm m}),$ back side

Fig. 35: Illustrations of the failure of GL32h–11m–3.



Fig. 36: Setup of GL32h–11m–3: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 37: Setup of GL32h–11m–3: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL32h-11m-4





Fig. 38: Illustrations of beam GL32h–11m–4 (central area): (left) before testing, (right) after testing.



(a) front side $(l\approx 5.0~{\rm m})$



(b) back side $(l\approx 5.0~{\rm m})$



(c) lowest lamella $(l\approx 5.0~{\rm m})$



(d) CS next to failed section $(l\approx 4.7~{\rm m})$



(e) failed section $(l \approx 4.8 \text{ m})$



(g) 3rd lowest lamella $(l\approx 5.2~{\rm m})$



(f) failed section ($l \approx 5.0$ m), back side



(h) 4th lowest lamella ($l\approx 3.2$ m), partly from 2nd failure cycle

Fig. 39: Illustrations of the failure of GL32h–11m–4.



Fig. 40: Setup of GL32h–11m–4: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).



Fig. 41: Setup of GL32h–11m–4: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL32h-19m-1





Fig. 42: Illustrations of GL32h–19m–1: (left) after first rupture, (right) after ultimate failure.



Fig. 43: Illustration of GL32h–19m–1 after first rupture (area between central buckling stabilisers).



Fig. 44: Illustration of GL32h–19m–1 after ultimate failure (area between central buckling stabilisers).

(a) lowest lamella $(l\approx 9.8-8.5~{\rm m})$

(b) lowest lamella $(l\approx 5.0~{\rm m})$

(d) 2nd lowest lamella $(l\approx 7.1~{\rm m})$

(e) 3rd lowest lamella $(l\approx 6.3~{\rm m})$

(f) 3rd lowest lamella ($l\approx 6.4$ m), back side

(g) 4th lowest lamella $(l\approx 8.8~{\rm m})$

Fig. 45: Illustrations of the failure of GL32h–19m–1.

Fig. 46: Setup of GL32h–19m–1: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).

Fig. 47: Setup of GL32h–19m–1: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).

GL32h-19m-2

Fig. 48: Illustration of GL32h–19m–2: after testing.

Fig. 49: Illustration of beam GL32h–19m–2 after testing (area between central buckling stabilisers).

(a) lowest lamella $(l\approx 7.8~{\rm m})$

(b) lowest lamella ($l \approx 7.8$ m)

(c) 2nd lowest lamella $(l\approx 9.7-10.8~{\rm m})$

Fig. 50: Illustrations of the failure of GL32h–19m–2 (1).

(a) 3rd lowest lamella $(l\approx 9.5-10.5~{\rm m})$

(c) 4th lowest lamella $(l\approx 7.0~{\rm m})$

(b) 3rd lowest lamella $(l\approx 11.9~{\rm m})$

(d) 6th lowest lamella ($l\approx 8.0$ m), back side

(e) 7th lowest lamella $(l\approx 10.3~{\rm m})$

(f) 8th and 9th lowest lamella $(l\approx 6.0~{\rm m}),$ back side

Fig. 51: Illustrations of the failure of GL32h–19m–2 (2).

Fig. 52: Setup of GL32h–19m–2: Knot-profile ($K_{\rm m}$ -values from GoldenEye-706).

Fig. 53: Setup of GL32h–19m–2: Dynamic modulus of elasticity ($E_{\rm m}$ -values from GoldenEye-706).