StM1 B-STR Assignment check values. 2017-18 ILF

Q1 T_{GF} = 83.8 kN Compressive.

$I > 477 \times 10^3 mm^4$

$t \sim 3.5$ mm - (rounding with some margin)

↳ P_{crit} = 88.4 kN

Buckling RF = 1.05

Yielding RF = 4.2

Q2 Hoop loading intensity q = 120 N/mm

Rivet pitch < 34 - (rounded)

Then consider guidelines for std. spacings (see lec. notes).

Q3

UDL: q = 2.5 kN/m

S_{max} = 2.5 kN @ end

M_{max} = 0.83 kNm @ end

$I \geq 2.889 \times 10^5 mm^4$

flange width b_f = 40mm ie $b_w/2$ half web height.

$t \simeq \sim 2$ mm with slight margin.

Flange stress $\sigma = \pm 146$ N/mm² ↳ RF = 3.0

Web shear stress τ = 23.4 N/mm² ↳ RF = 10.9

Joint check:

Max fastener load = 2.5 kN ↳ RF = 1.24

Q4 Hardwood : $E = 12$ GPa (typically)

Approx ellipse $I = 76.7 \times 10^3$ mm^4

$P_{crit} = 9.1$ kN

Joint: For trial scheme: pin dia = 5mm, inner lug = 4mm (outer lugs 2mm)

Pin shear stress $\tau = 232$ N/mm^2 ↳ RF = 2.2

lug bearing stress $\sigma_{br} = 455$ N/mm^2 ↳ RF = 2.0

Q5 Wing load = 65.75 kN

Root bending moment = 131.5 kNm @ limit.

Spar cap couple load = 438.3 kN @ limit

Spar cap stress $\sigma = 182.6$ N/mm^2 @ ultimate ↳ RF = 2.46

Bolt shear stress $\tau = 523.2$ N/mm^2 " ↳ RF = 1.45

Spar cap bearing stress $\sigma_{br} = 273.9$ N/mm^2 " ↳ RF = 1.39

Q6 Values without acc'n load factor, i.e. @ 1.0g steady level flight as limit values, ie. no ultimate safety factor applied.*

Assuming: wing mass and fuel is uniformly distributed along wing.
wing attachment to centre box @ side of fuselage.

Net wing UDL = 3.215 kN/m UDL = Uniform Distributed Loading

	@ tip	@ wing root	@ fus ℄
Shear force kN	0	-25.72, 3.22	0
Bending moment kNm	0	102.9	101.3

Factors could be applied to these loads to account for other load cases and ultimate loading condition.