HELSINKI UNIVERSITY OF TECHNOLOGY
Wood Technology

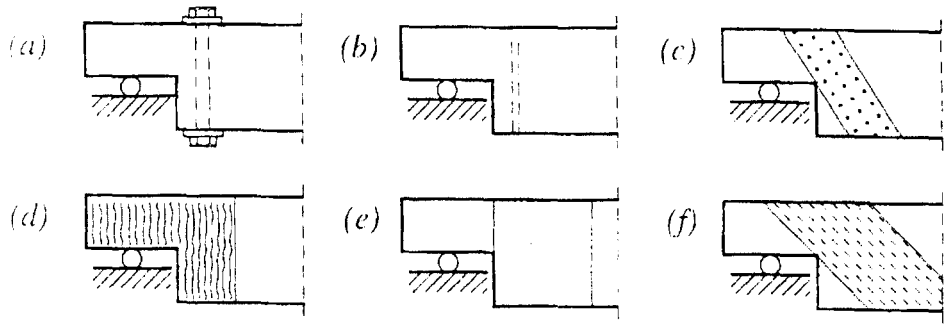
Puu-28.3050 Wooden Structural Joints Exam *13.5.2008*

Please read these instructions:

- *The participant may take only his or her ID certificate, calculator, previously given EC5 standard and writing material to the exam.*
- *Paper handed out by the supervisor is the only acceptable stationary to be used in the exam.*
- *All paper handed out must be returned. The paper containing answers must be clearly marked and separated from any scrap paper.*
- *The identity of the exam participant will be verified when he or she hands in the answers.*
- *This exam has four exercises. The exercises 1 and 2 are both worth 6 points and exercises 3 and 4 are both worth 8 points. Maximum points are 6+6+8+8 = 28 points.*
- *Good luck!*

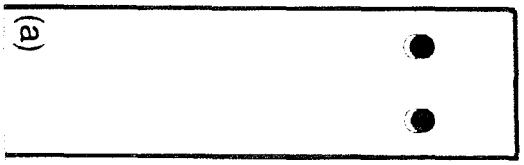
1.

i. Figure below shows six different ways to reinforce the end of the notched beam. Are they all acceptable and if not, what is the reason?



a) bolt and nut reinforcement
b) glued rod, bolt or screw
c) nailed steel plate
d) glue plywood
e) glass fibre
f) punched metal plate

ii. In dowelled timber to timber joint, the timber part of the joint can fail in five different ways. (Five failure modes). In figure below one of these failure modes, embedment failure, is shown. Make a drawing about four other timber failure modes and explain the reasons for failure in each case. (Only timber failure modes, not dowel yielding failures)



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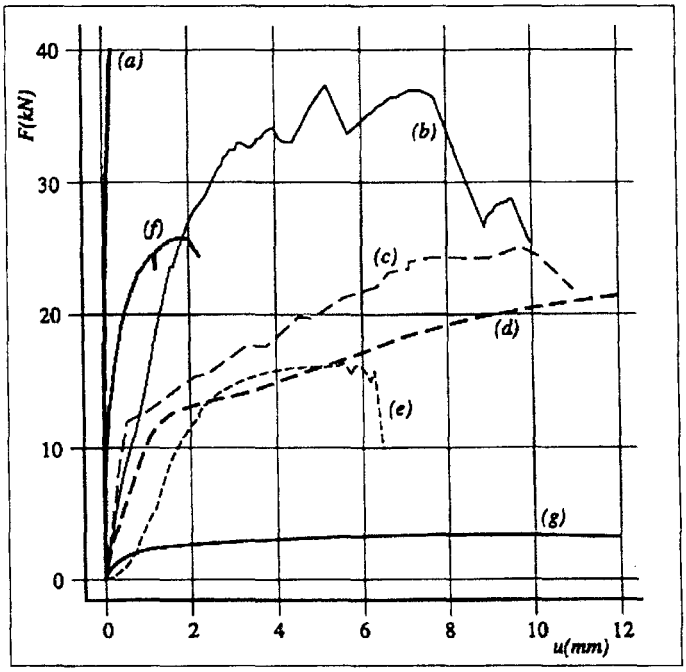
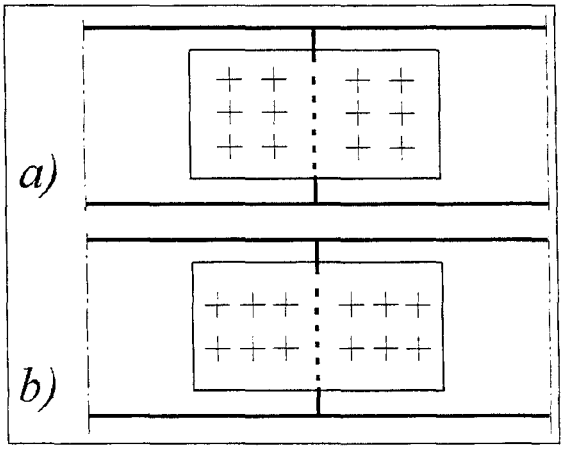
2. Examine figures and answer shortly to the questions.

iii. Figure below shows experimental load-slip curves of different fasteners where the load is defined per shear plane. Which of these joints behave like glued, nail, dowel, bolt or punched plate joint? Why?



iv. Figure below shows two nailing patterns of plywood-to-timber tension splice joint. If postulated that spacing of nails is adequate in these otherwise similar joints, which of joints has more capacity due to EC5? Why?



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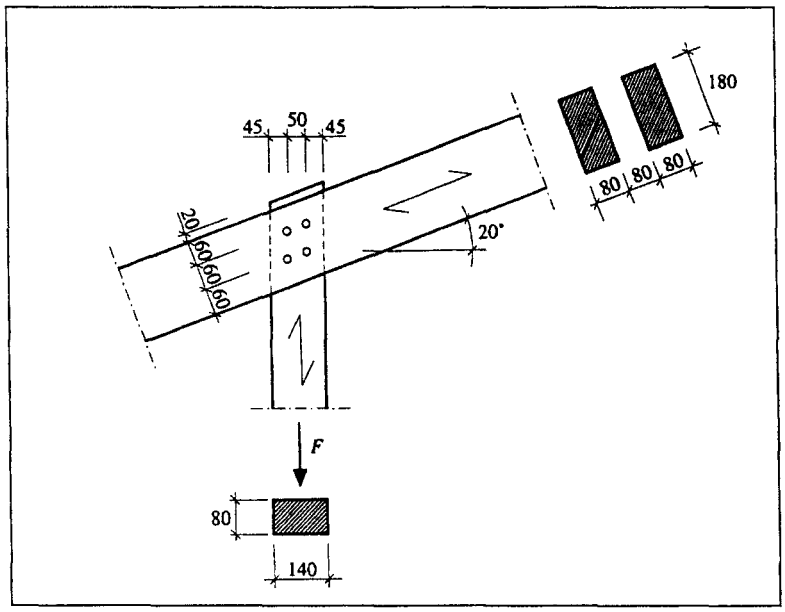
3. Figure below describes dowelled timber-to-timber joint.

i. Examine capacity of joint when:
- Dowels are steel, d = 12 mm and $F_{u,k}$ = 360 N/mm^2
- Wood is structural timber with density ρ_k = 360 kg/m^3
- Service class is 2 and duration class short-term

ii. Calculate instantaneous slip, when permanent load is 8 kN and variable load is 10 kN.



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4. Figure below describes carpenter joint. Design the joint by

i. designing the frontal area of the strut, so that the angle between force and grain is lowest possible for both the chord and strut.

ii. calculating compression capacity for joint

iii. determining the required length l_v

- Angle between the chord and strut is $\alpha = 50$
- $t_v = 50$ mm

- Duration class short time
- Service class 2
- Force $S_d = 35$ kN is design force
- cross sections of the strut100 mm x 100 mm
- cross sections of the chord 150 mm x 100 mm
- Sawed timber C27
  - Compression strengths of C27 fc.0.k= 22 MPa, fc.90.k= 5,6MPa
  - Shear strength of C27 fv.0.k= 2,8 MPa