Cost Action E55 – Meeting in Zagreb

Working group 2 – Joint Ductility

Evaluation of the overstrength factors of timber connections

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BACKGROUND:

- **Eurocode 8 does not provide any value of the overstrength factor for timber connection**

- **The overstrength factor is needed for ductile design (behaviour factor q > 1) to ensure brittle failure will not occur before plasticization of ductile regions (capacity design)**

- **Currently, this is an important piece of information missing in the seismic design of timber structures**

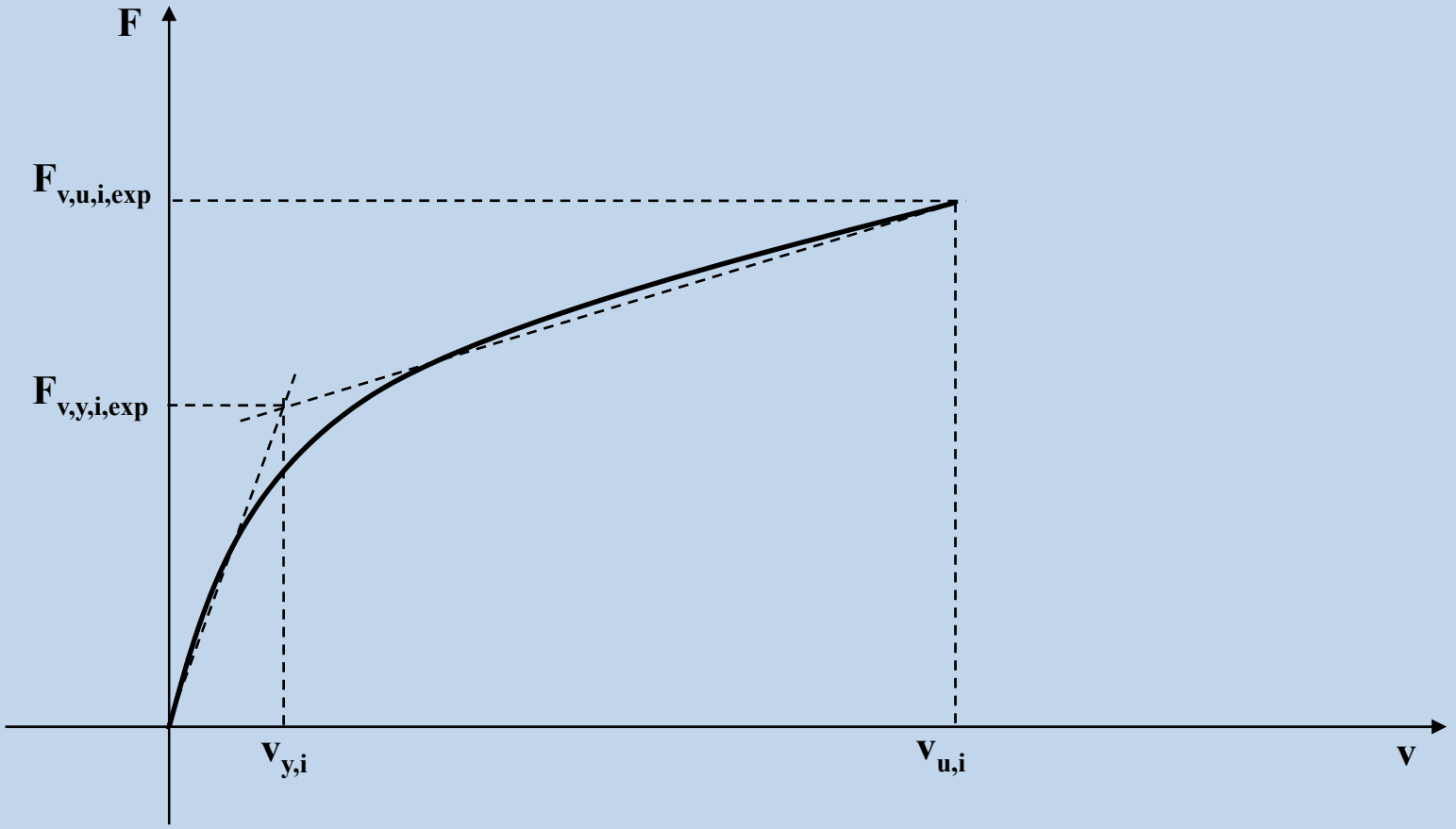
RESEARCH PROPOSAL:

Based on the experimental data available on monotonic tests of timber joints to failure, the following quantities should be calculated for every type of joint of interest:

- **The experimental failure ($F_{v,u,i,exp}$, $v_{u,i}$) of each specimen i should be defined in accordance with EN26891 (either the maximum load, or the load corresponding to a maximum slip of 15 mm, whichever occurs first).**

- **The yielding ($F_{v,y,i,exp}$, $v_{y,i}$) of each specimen i should be defined in accordance with EN12512 for cyclic tests.**

RESEARCH PROPOSAL:



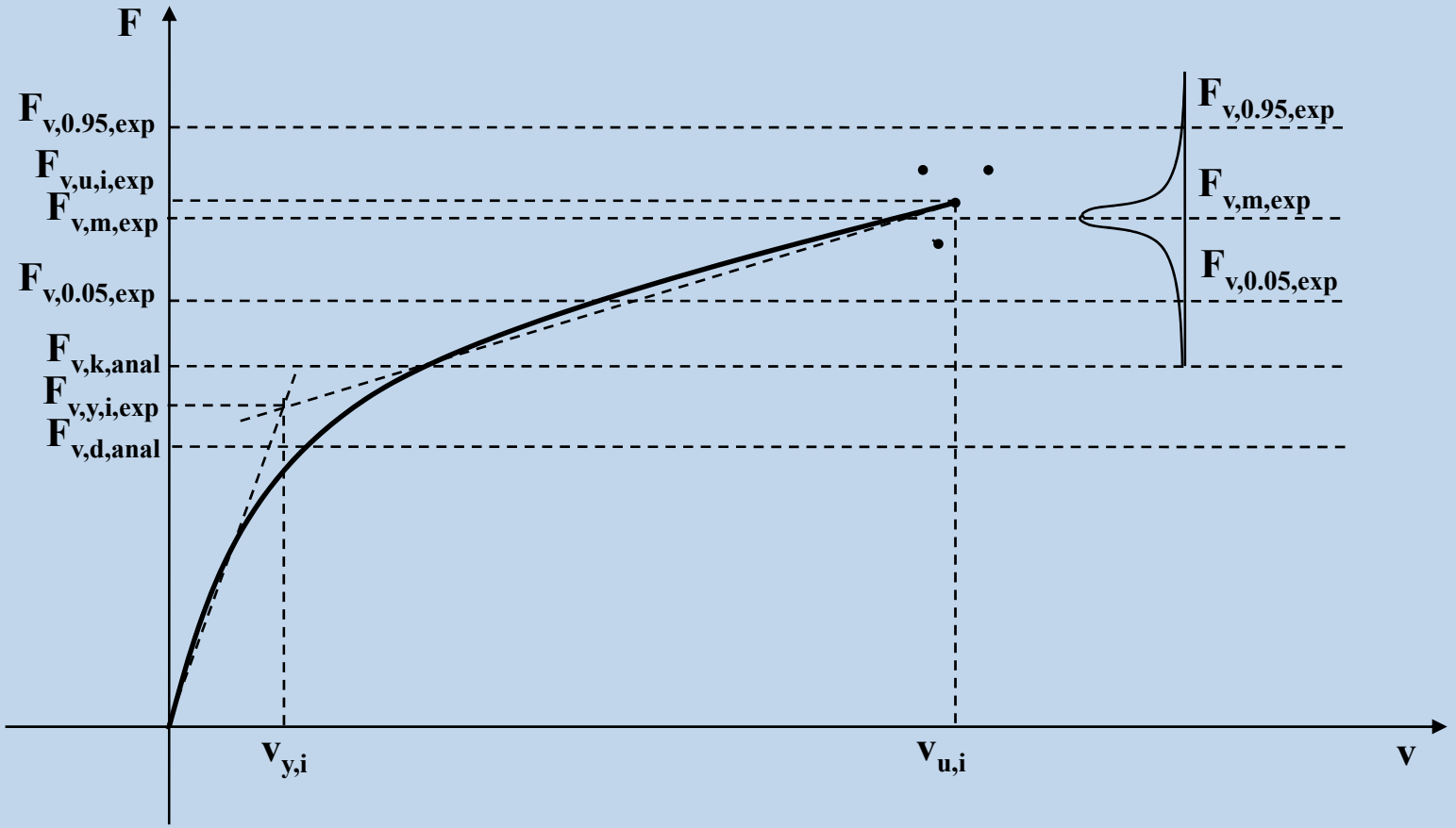
RESEARCH PROPOSAL:

- **The statistical values of the ultimate ($F_{v,u,0.05,exp}$, $F_{v,u,m,exp}$, $F_{v,u,0.95,exp}$) and yielding loads ($F_{v,y,0.05,exp}$, $F_{v,y,m,exp}$, $F_{v,y,0.95,exp}$) should be estimated, as well as for the ultimate (v_u) and yielding (v_y) slips.**

- **The analytical values of the characteristic ultimate shear load ($F_{v,k,anal}$) should be calculated using the Johanssen's equations, with the embedding strengths $f_{h,k}$ and yielding moment $M_{y,k}$ of the fasteners calculated using the analytical relationships proposed by the Eurocode 5, NOT the experimental values.**

- **The analytical values of the design shear load ($F_{v,d,anal}$) can be calculated assuming k_{mod}=1 and γ_m=1 as for ductile seismic design, the material safety coefficient is assumed equal to 1 (therefore, $F_{v,d,anal} = F_{v,k,anal}$).**

RESEARCH PROPOSAL:



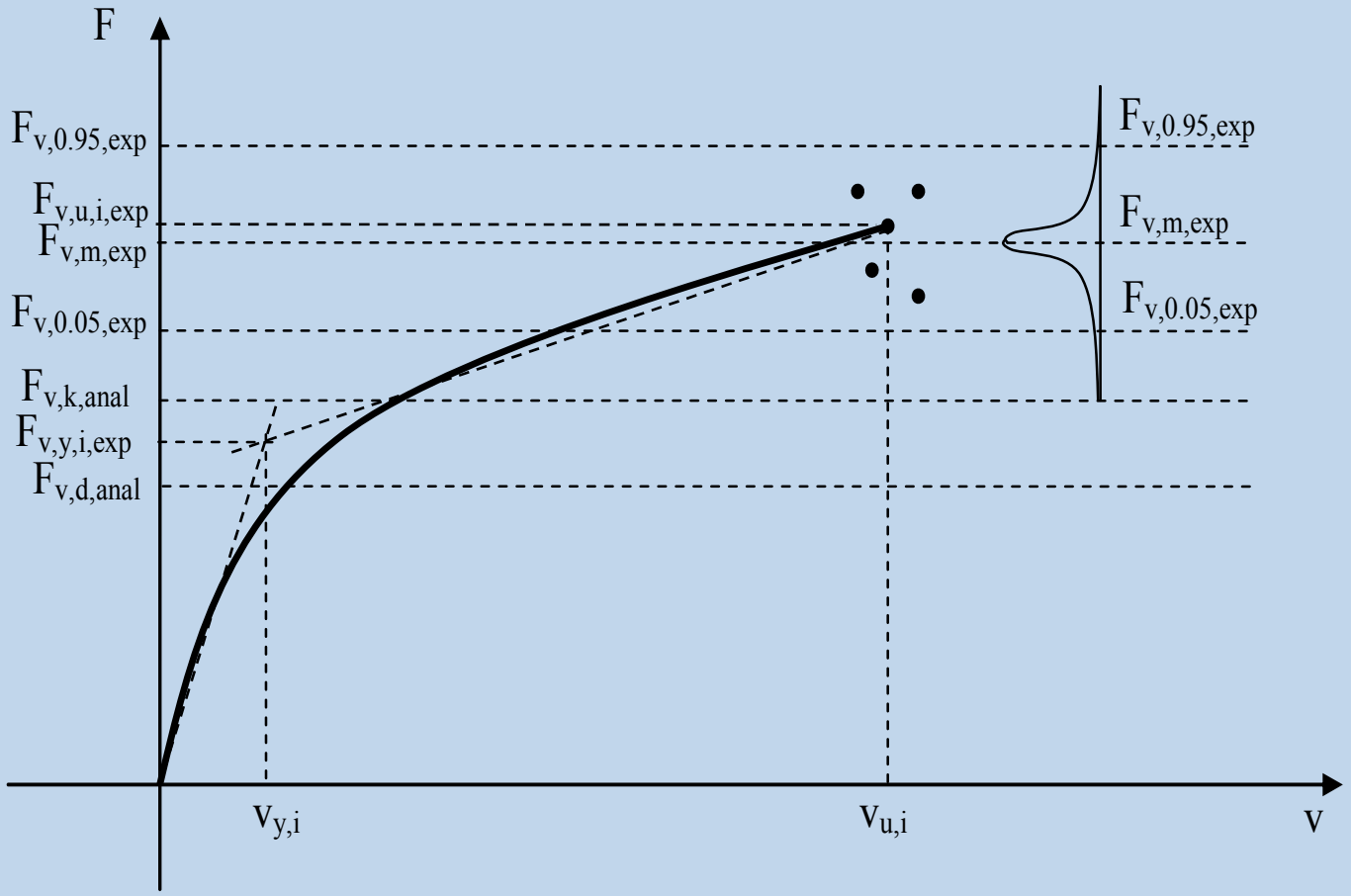
RESEARCH PROPOSAL:

- **The ductility ratio can be obtained with the formula:** $\mu = \frac{v_u}{v_y}$
- **The statistical values of μ ($\mu_{0.05}$, μ_m, $\mu_{0.95}$) can then be calculated.**
- **The overstrength factor can be obtained with the formula:**

$$\gamma_{Rd} = \frac{F_{v,0.95,\exp}}{F_{v,0.05,\exp}} \cdot \frac{F_{v,k,\exp}}{F_{v,k,anal}} \cdot \frac{F_{v,k,anal}}{F_{v,d,anal}} = \gamma_{R,stat} \cdot \gamma_{R,anal} \cdot \frac{\gamma_m}{k_{\mathrm{mod}}}$$

(γ_m=1 for ductile seismic design)

RESEARCH PROPOSAL:



RESEARCH PROPOSAL:

The research should be carried out:

- **first for single connectors or connection with few fasteners loaded in shear**
- **then for connections subjected to bending moment**
- **finally, for entire members such as ply shear walls**

COMMENTS, PLEASE

Thank you!