Homework No. 3.13

Please calculate the following properties of the member of Homework No. 3.11 in the strong direction of the section, considering a shear span L_s=2m, for cyclic loading:

1. The ultimate curvature according to Sections 3.2.2.4, 3.2.2.10, using as ultimate strength properties of the longitudinal reinforcement: ε_{su}=0.12 and f_t=530MPa;
2. the chord rotation at yielding, using the values computed in Homework No. 3.11;
3. the secant stiffness at yielding;
4. the plastic hinge length from Eqs. (3.73)
5. the ultimate chord rotation, θ_u from Eqs. (3.72), using values computed in 1, 2 and 4 above and in Homework No. 3.11,
6. the available value of chord rotation ductility factor μ_θ, using values computed in 5 and 2 above;
7. the ultimate chord rotation according to Eqs. (3.78).

You may assume that slippage of longitudinal bars from their anchorage zone beyond the member end section is feasible:

Homework No. 3.14

Please compute the shear resistance in the strong direction, x, of the member of Homework No. 3.11, 3.13:

(1) For monotonic, non-seismic loading:
   a) on the basis of the variable strut inclination method and the upper and lower limits of the strut inclination δ according to Eurocode 2: $22^o \leq \delta \leq 45^o$;
   b) According to the method in the AIJ Guidelines outlined in Section 3.2.4.2.

(2) For cyclic loading due to seismic action that drives the member beyond yielding and to a peak value of the chord rotation (or displacement) ductility ratio $\mu_\Delta=\mu_\theta=5$
   a) according to the AIJ Guidelines (see Section 3.2.4.2);
   b) according to Biskinis et al [2004], Eqs. (3.109).

For simplicity only the perimeter stirrup may be considered to contribute to shear resistance in direction x. Calculations should use the actual material strengths, without material partial factors.