

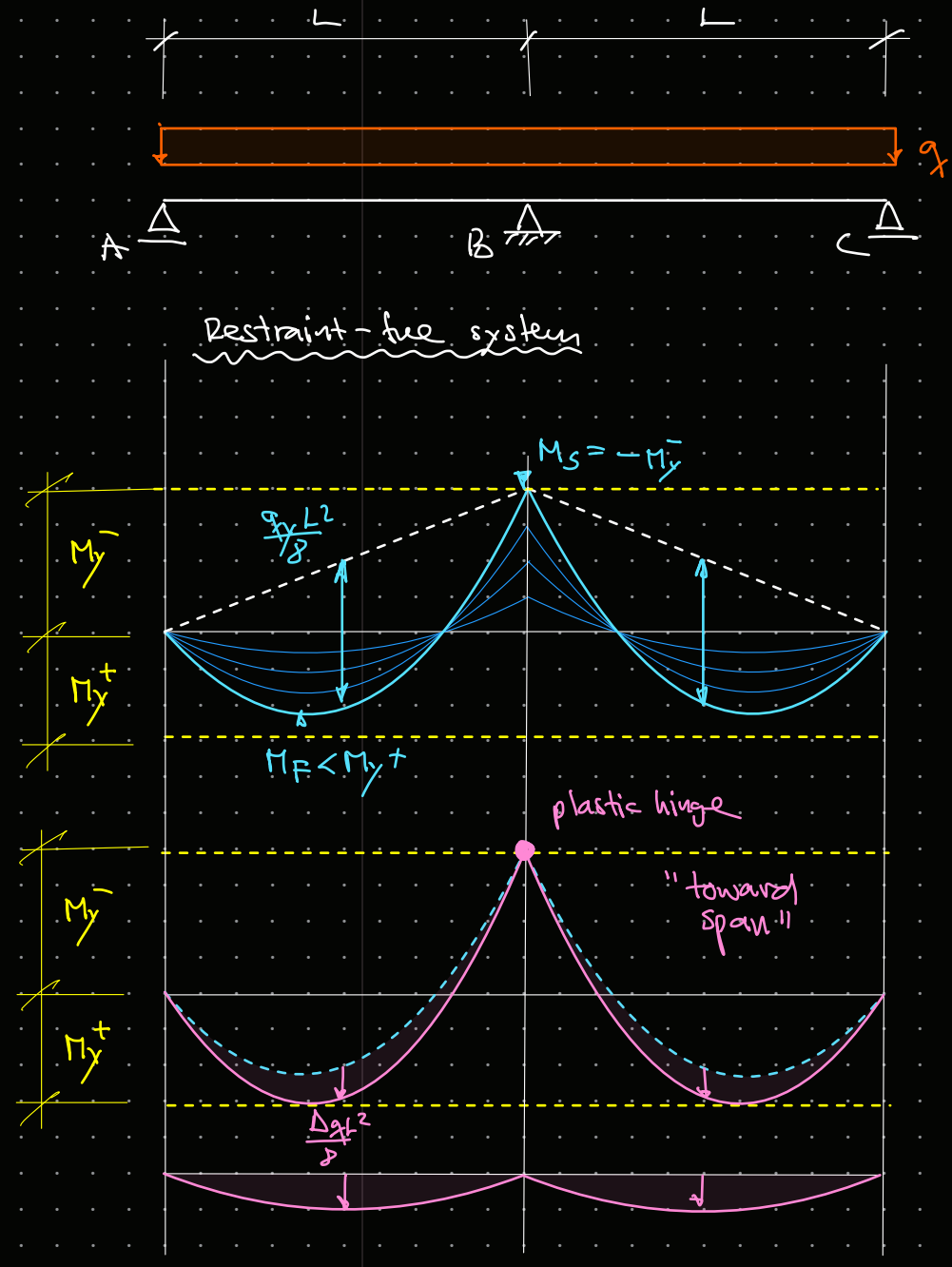
Moment redistribution

$[V = \frac{dM}{dx} \text{ changes accordingly}]$

Plastic design for $q = q_u$

Elastic bending moment profiles
valid up to $q = q_y$

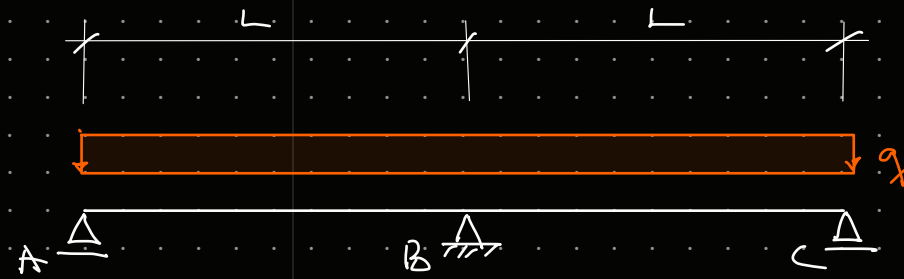
Moment redistribution
for $q_y \rightarrow q_u$



Alternative: select $\frac{M_y^-}{M_y^+} \sim \frac{M_s(q_u)}{M_F(q_u)} \rightarrow$ "elastic design"

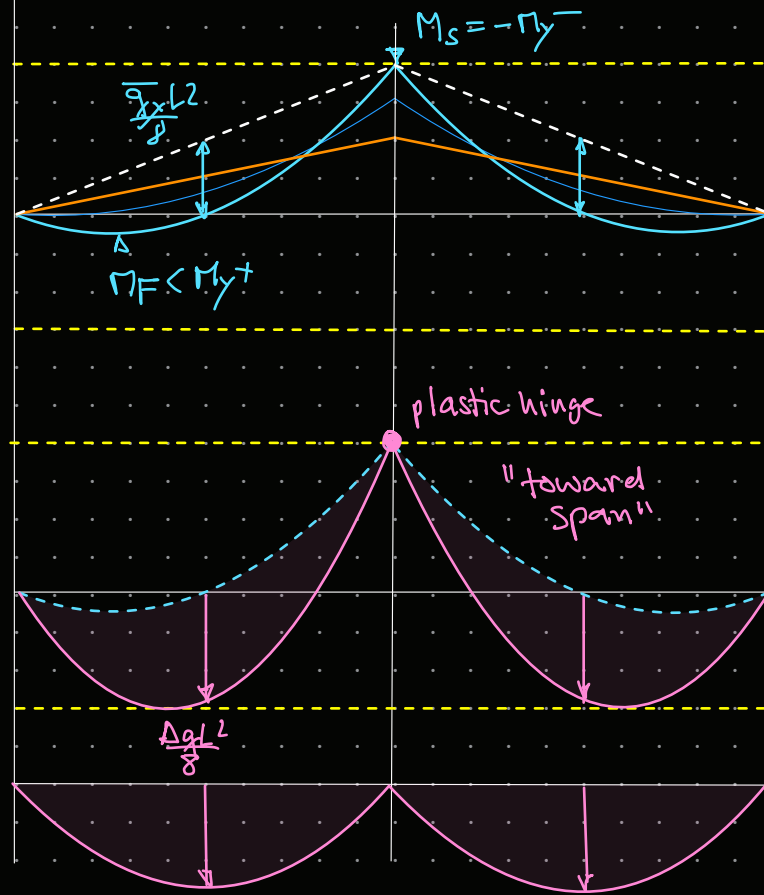
Moment redistribution

$[V = \frac{dM}{dx} \text{ changes accordingly}]$



System with negative initial restraint

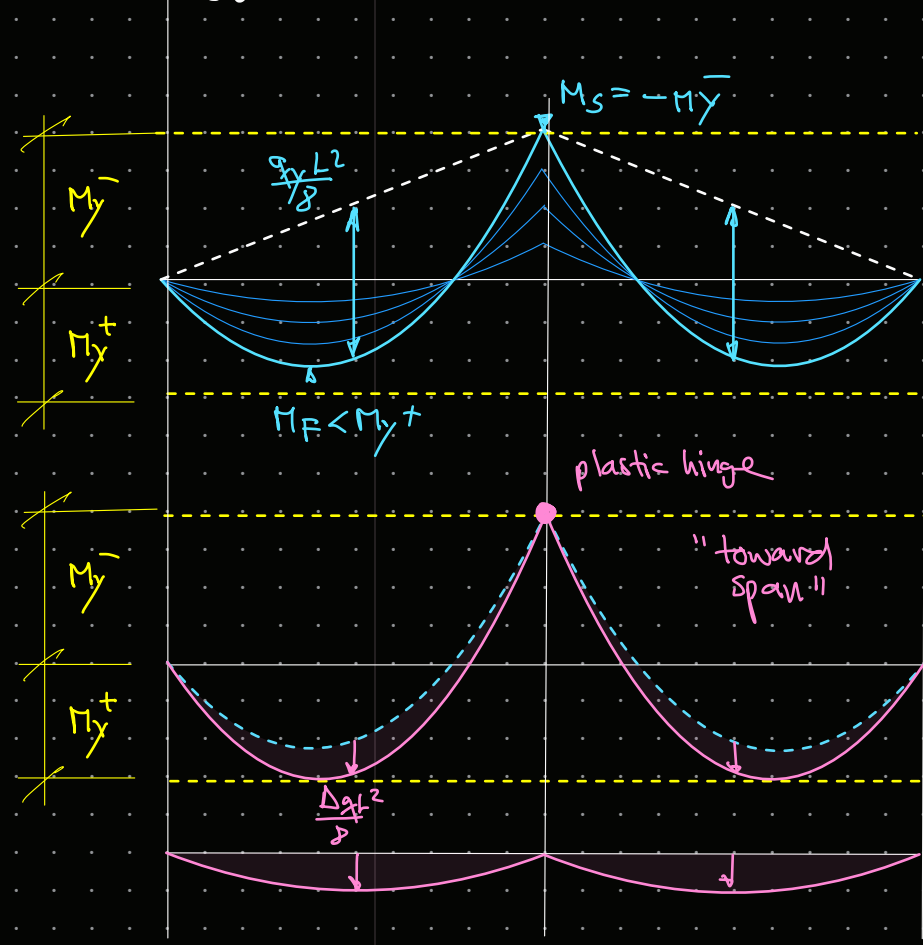
e.g. settlement of A, C



Elastic bending moment profiles valid up to $q = q_y$

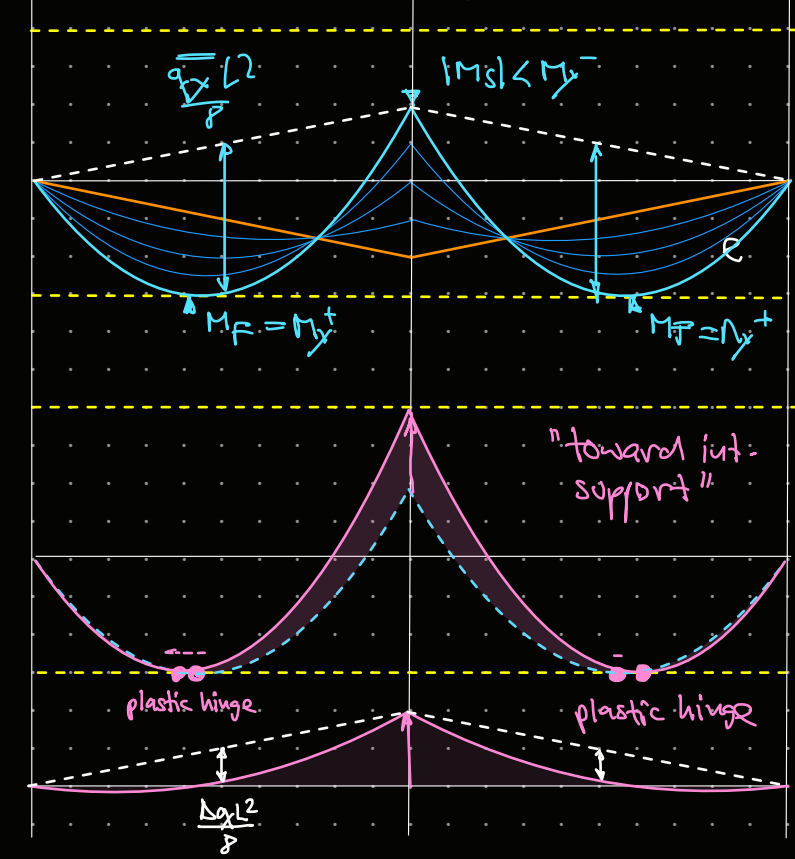
Moment redistribution for $q_y \rightarrow q_u$

Restraint-free system



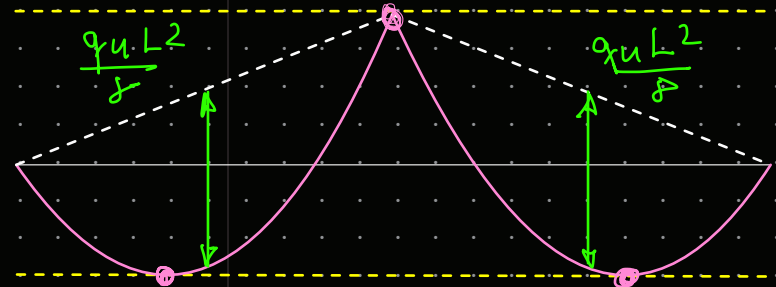
System with positive initial restraint

e.g. settlement of B or secondary moments due to prestressing



Limit analysis:

$q_u (= q_y + \Delta q)$ independent of initial restraint

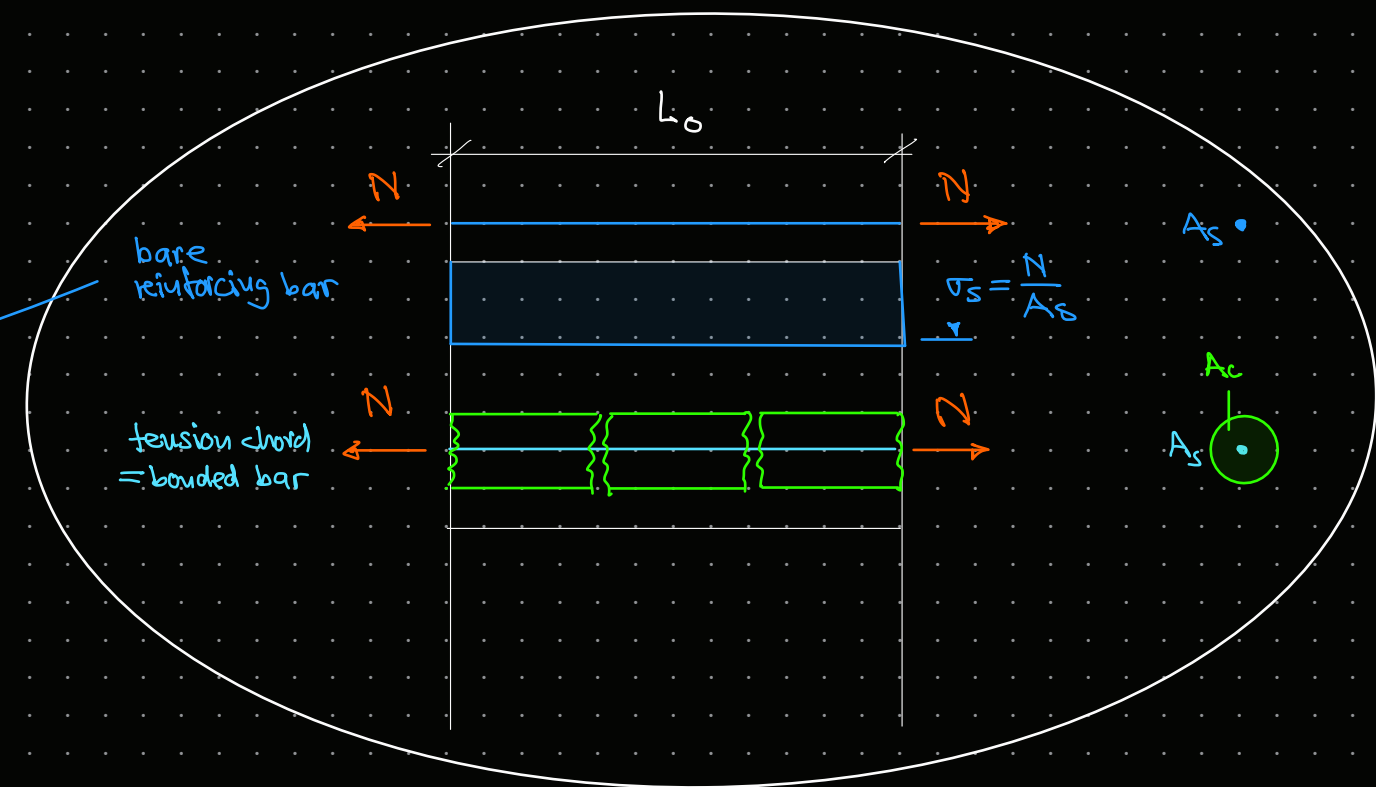
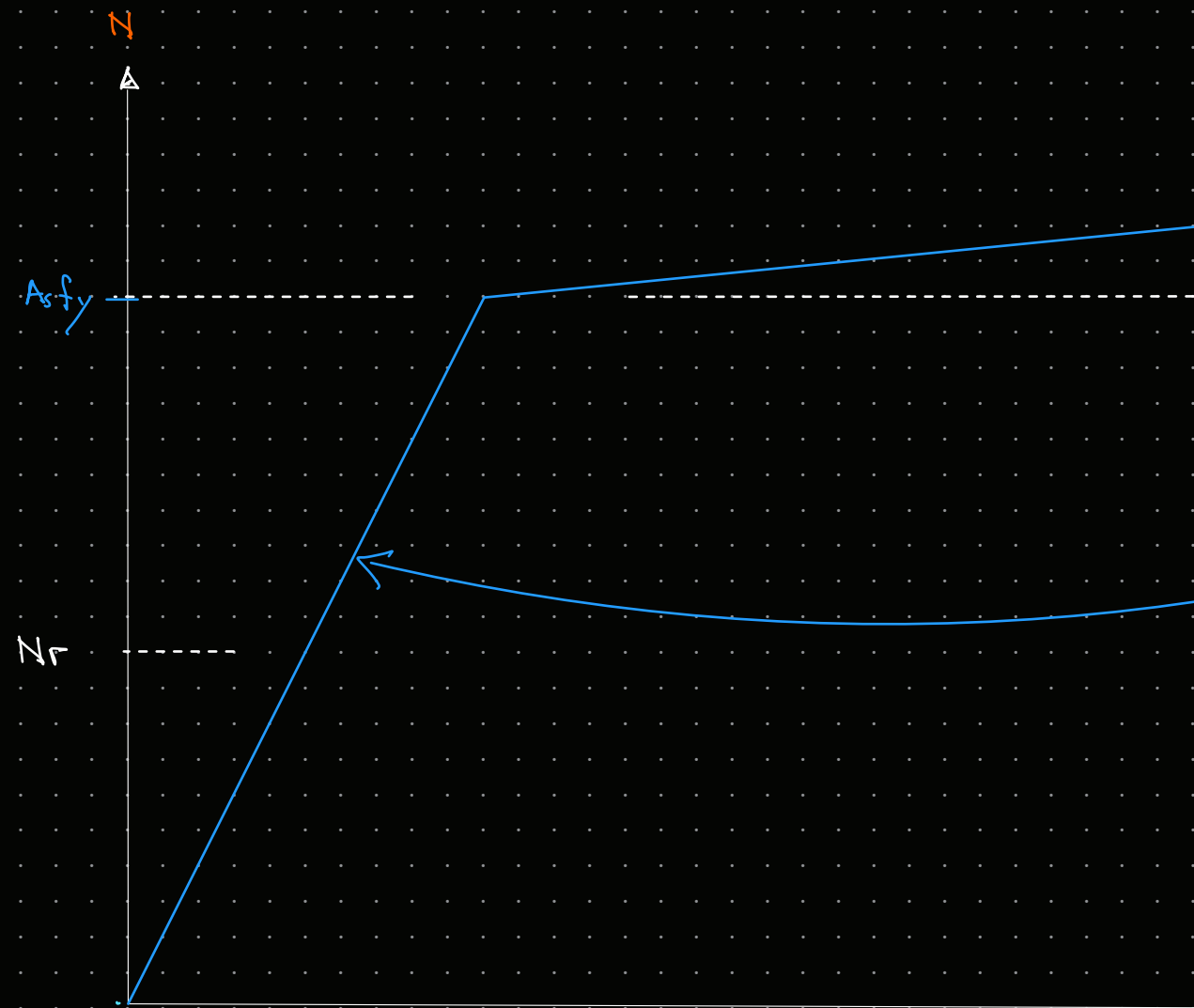


if the plastic hinges have sufficient ROTATION CAPACITY

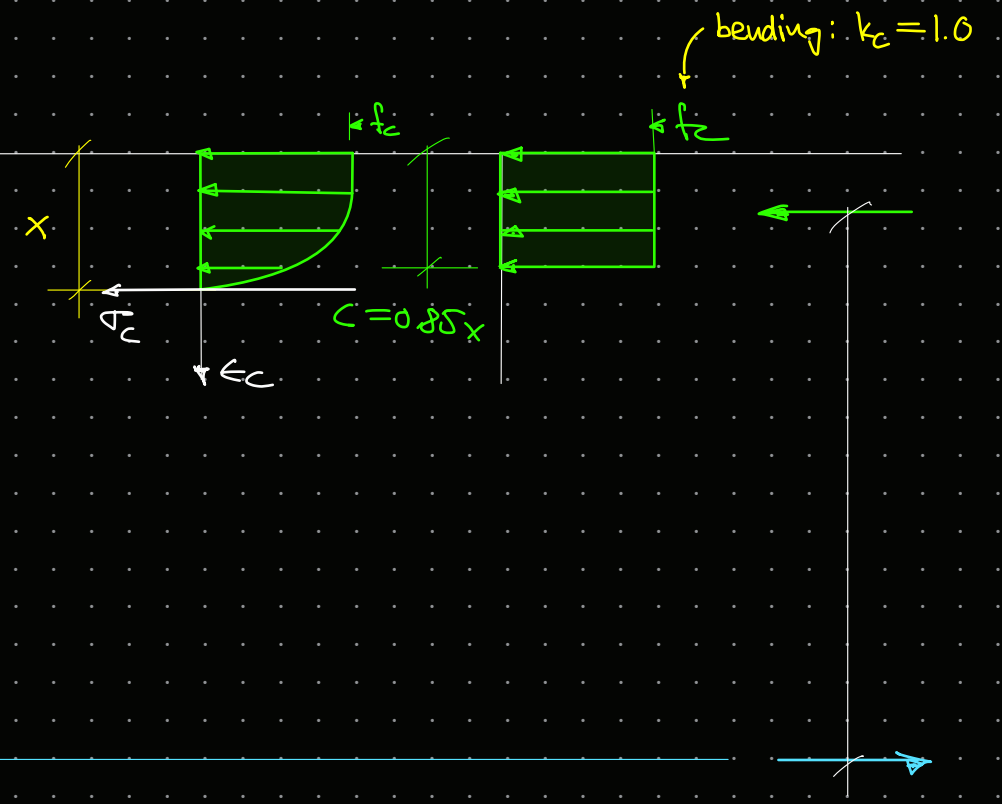
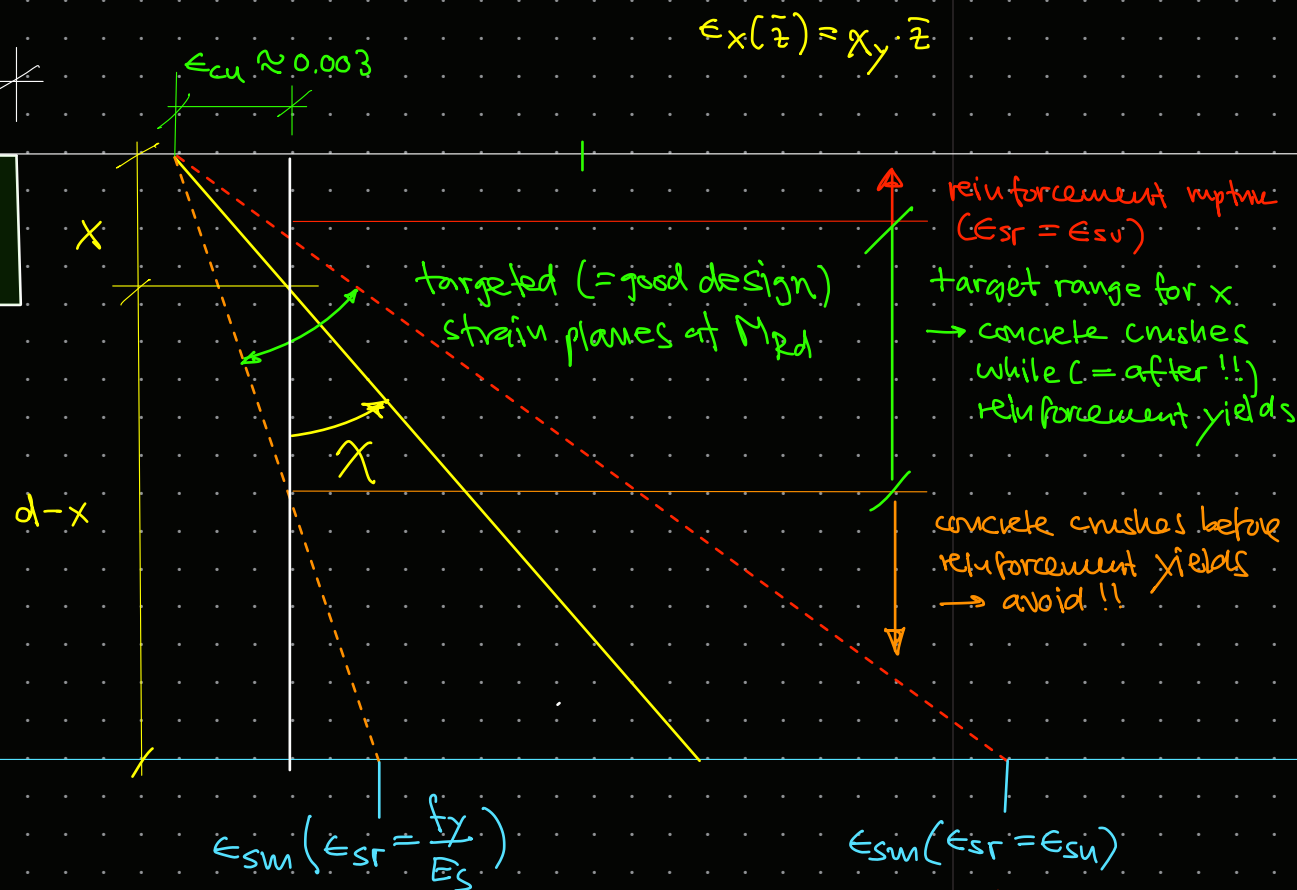
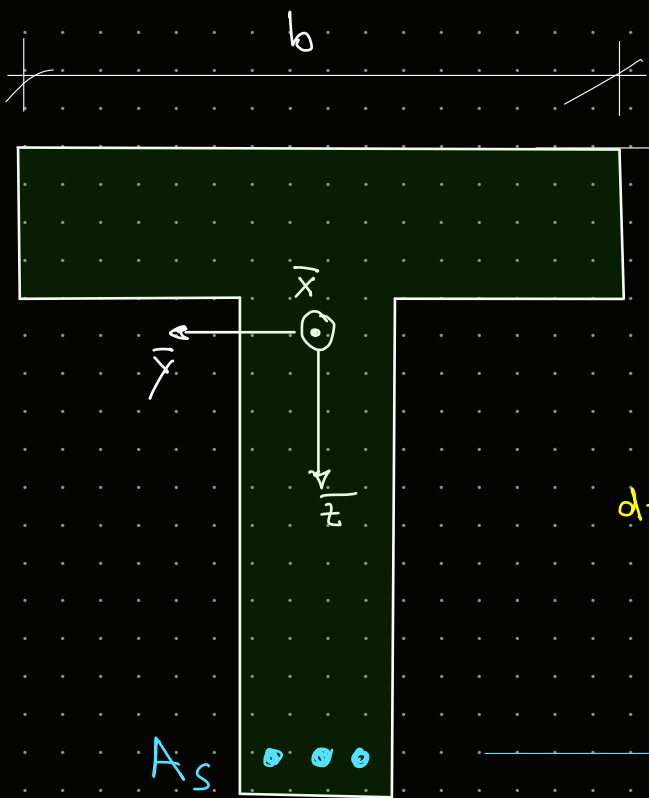
otherwise: premature failure at $q_y < q < q_u$ due to
 - concrete crushing or
 - steel rupture

Tension stiffening

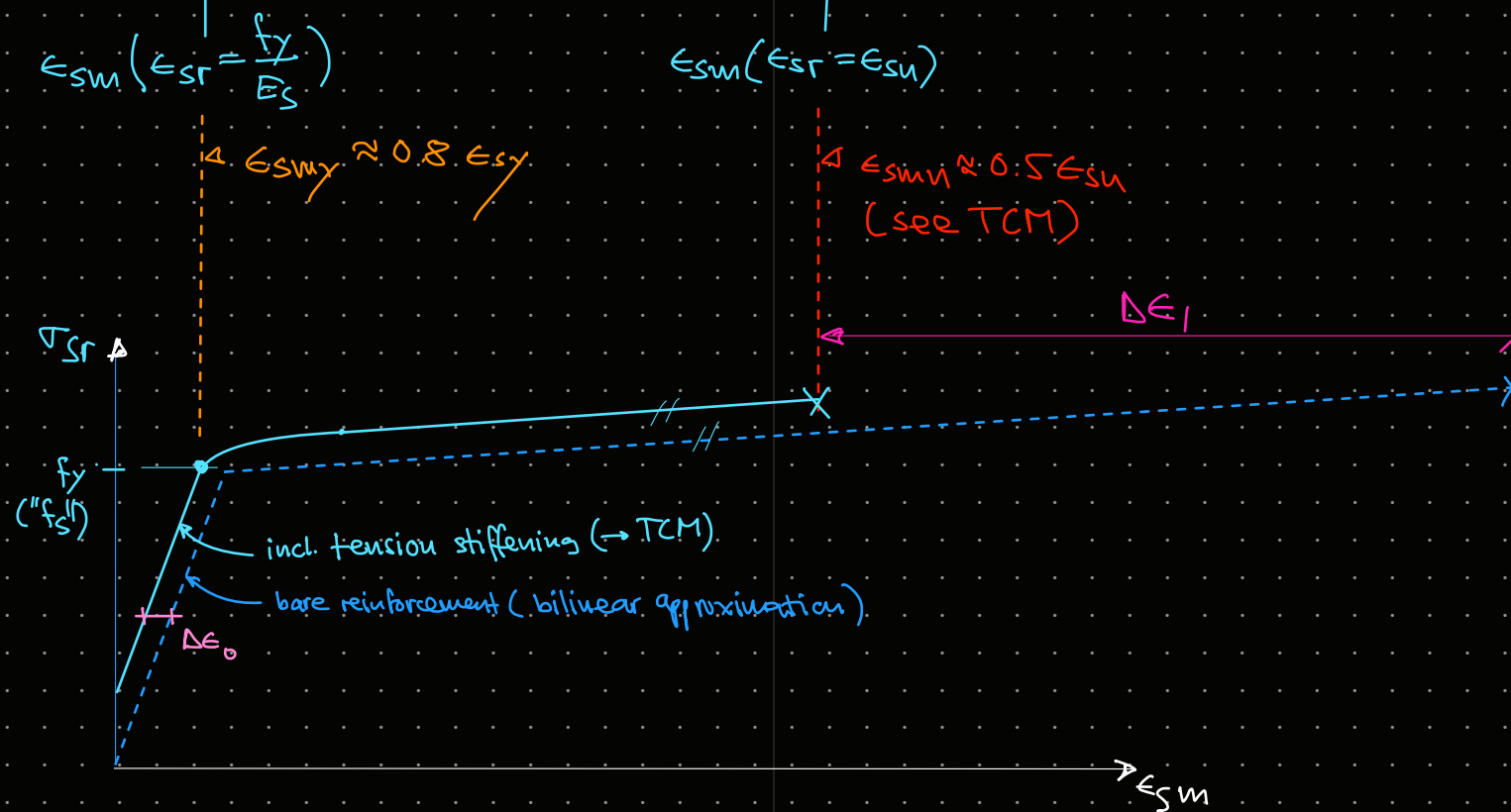
$r = \text{crack / cracking}$



Bending (recap) → rotation capacity (Navier-Bernoulli → ϵ_x linear in z)



d : static depth
 x : depth of neutral axis
 χ : curvature



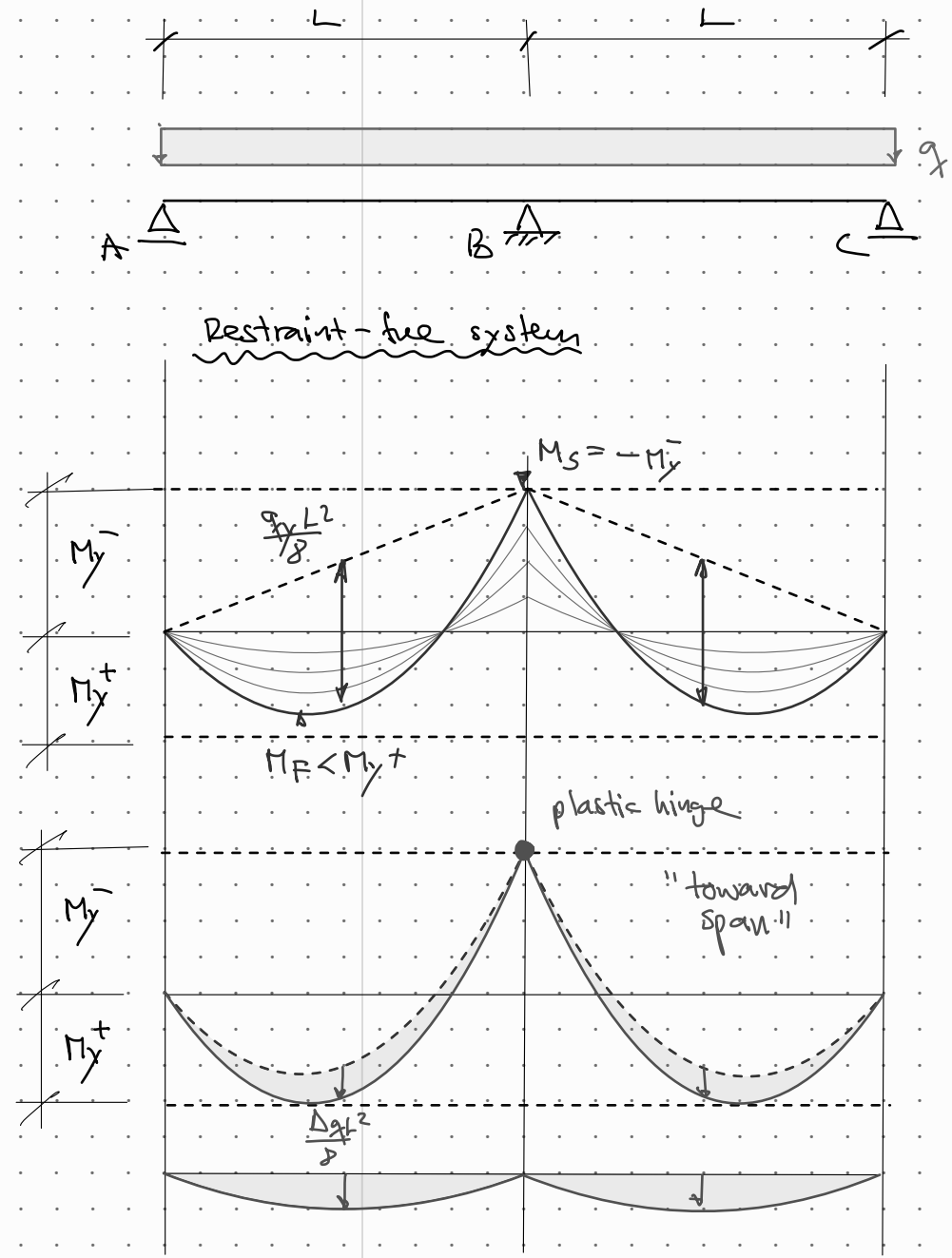
Moment redistribution

$[V = \frac{dM}{dx} \text{ changes accordingly}]$

Plastic design for $q = q_u$

Elastic bending moment profiles
valid up to $q = q_y$

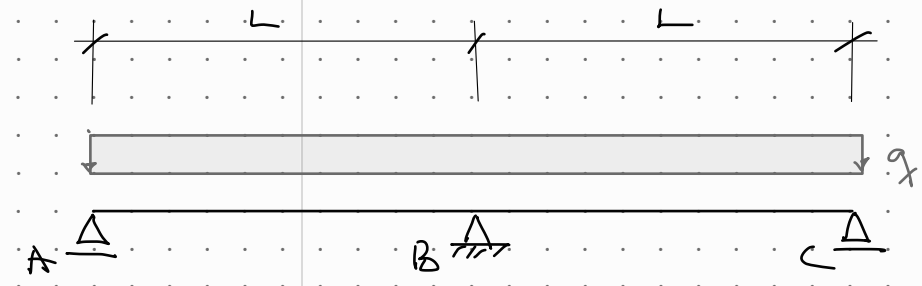
Moment redistribution
for $q_y \rightarrow q_u$



Alternative: select $\frac{M_y^-}{M_y^+} \sim \frac{-M_s(q_u)}{M_F(q_u)} \rightarrow$ "elastic design"

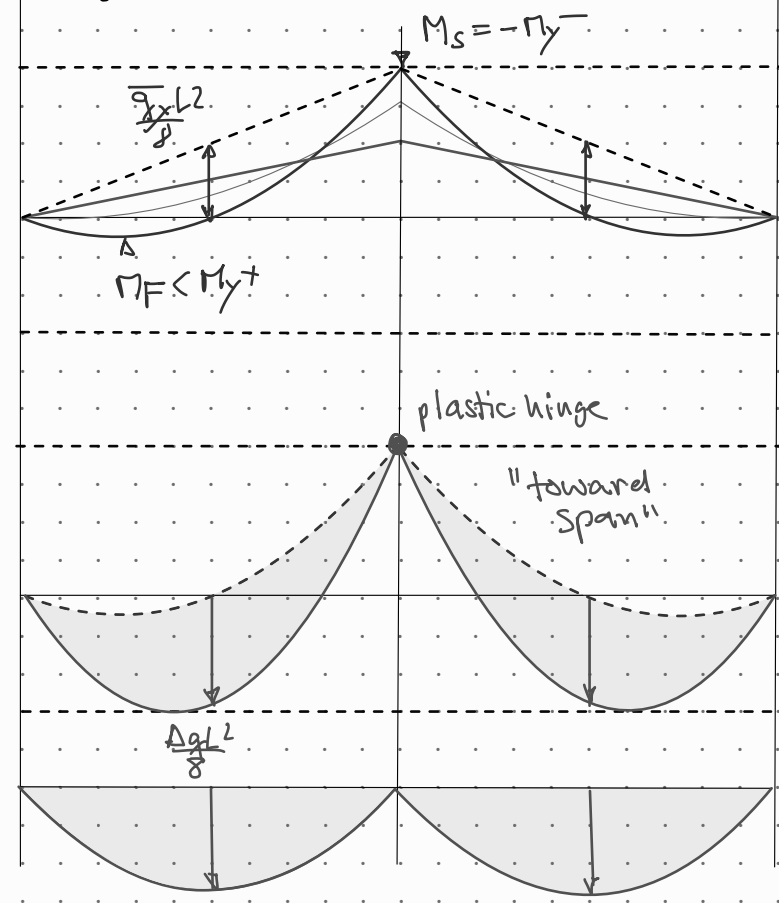
Moment redistribution

$[V = \frac{dM}{dx} \text{ changes accordingly}]$



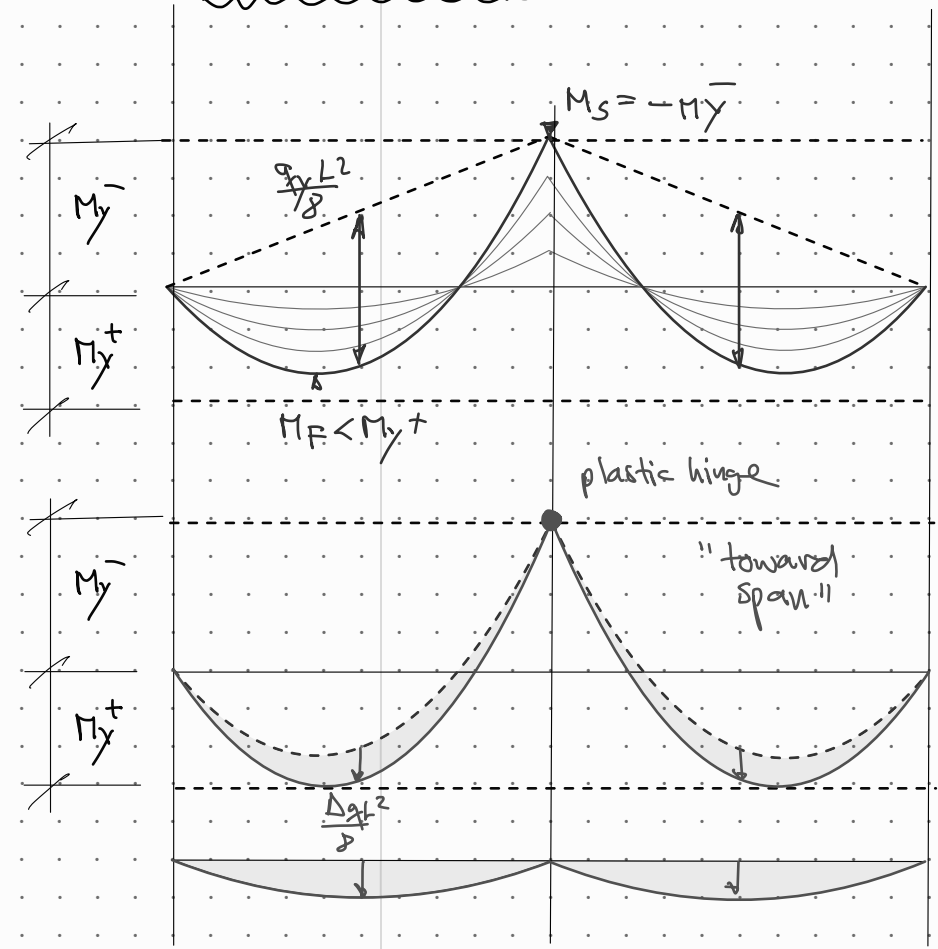
Elastic bending moment profiles
valid up to $q = q_y$

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e.g. settlement of A, C

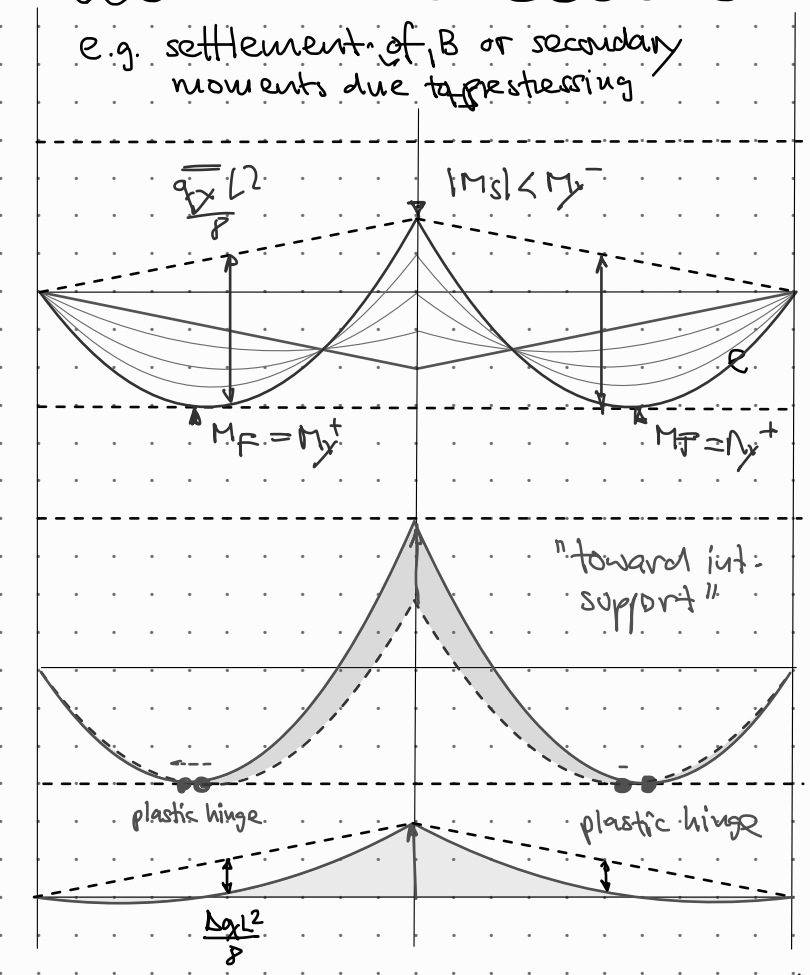


Moment redistribution
for $q_y \rightarrow q_u$

Restraint-free system

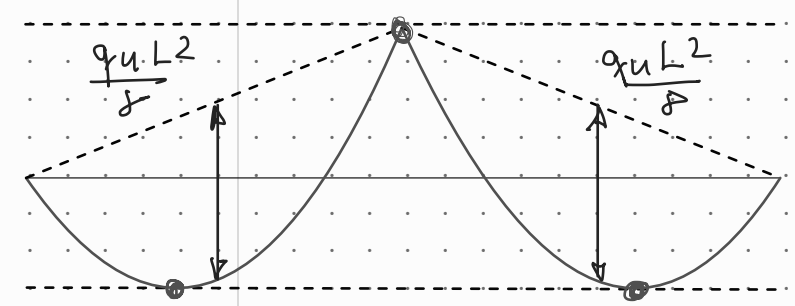


System with positive initial restraint
e.g. settlement of B or secondary moments due to prestressing



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$q_u (= q_y + \Delta q)$ independent of initial restraint



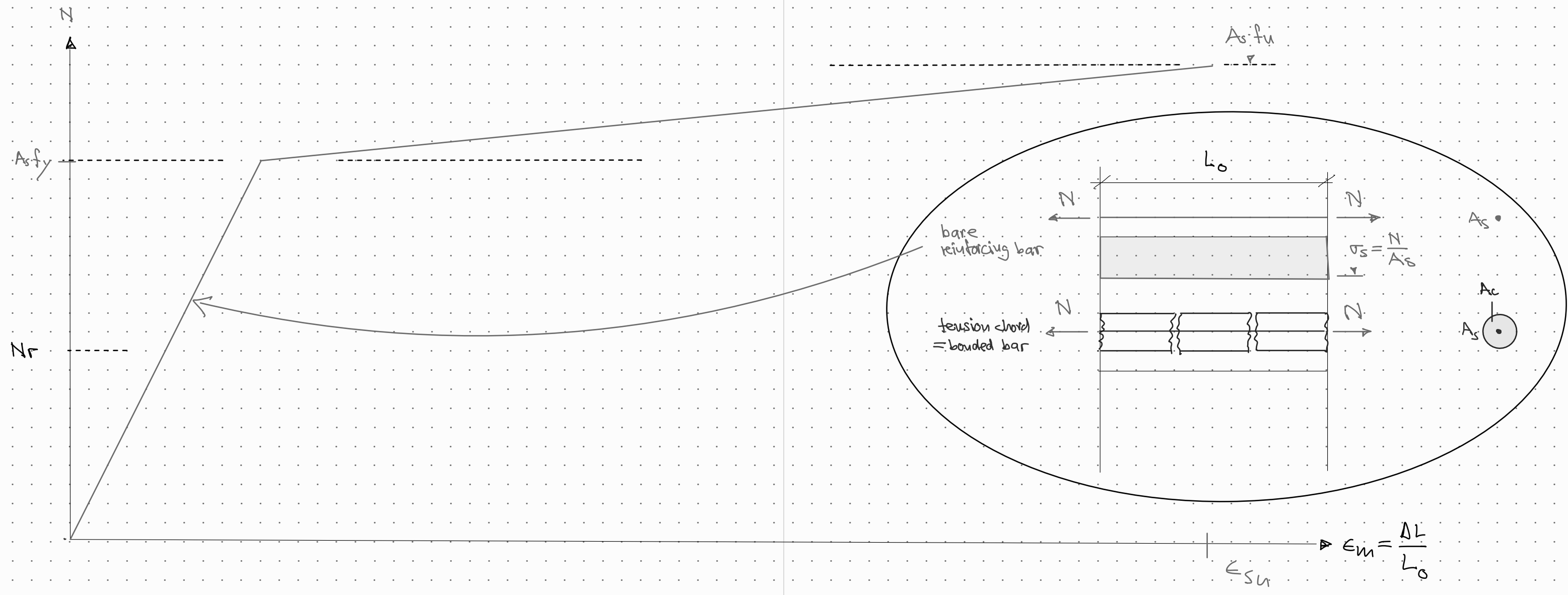
if the plastic hinges have sufficient ROTATION CAPACITY

otherwise: premature failure at $q_y \leq q \leq q_u$ due to:

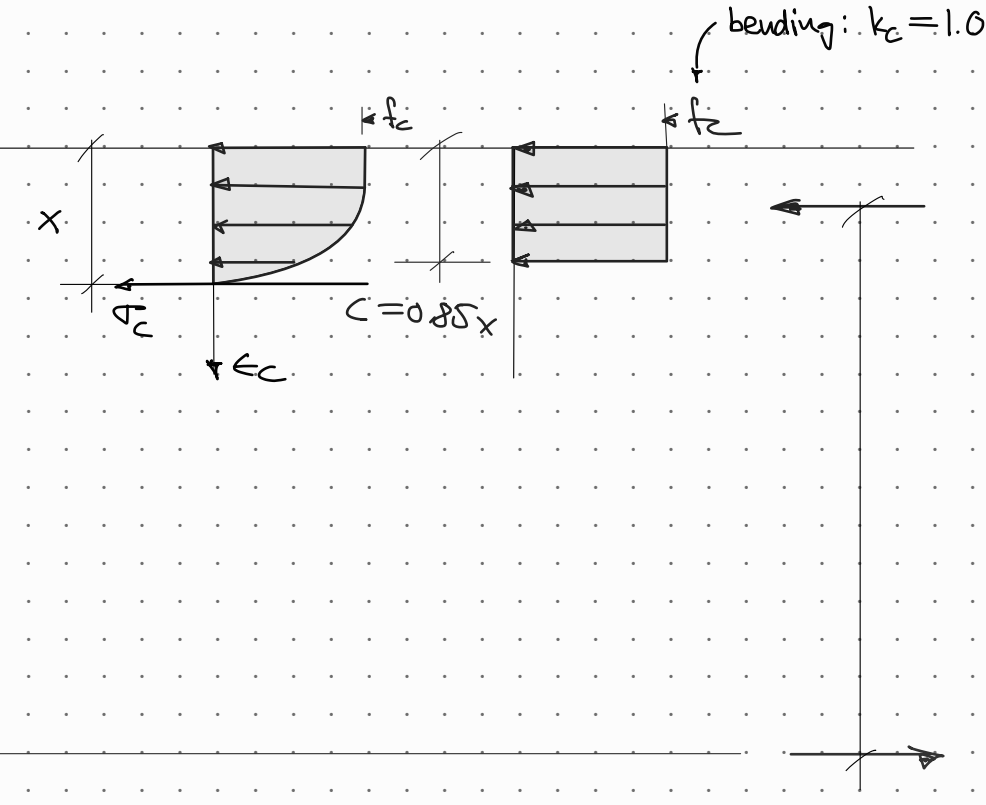
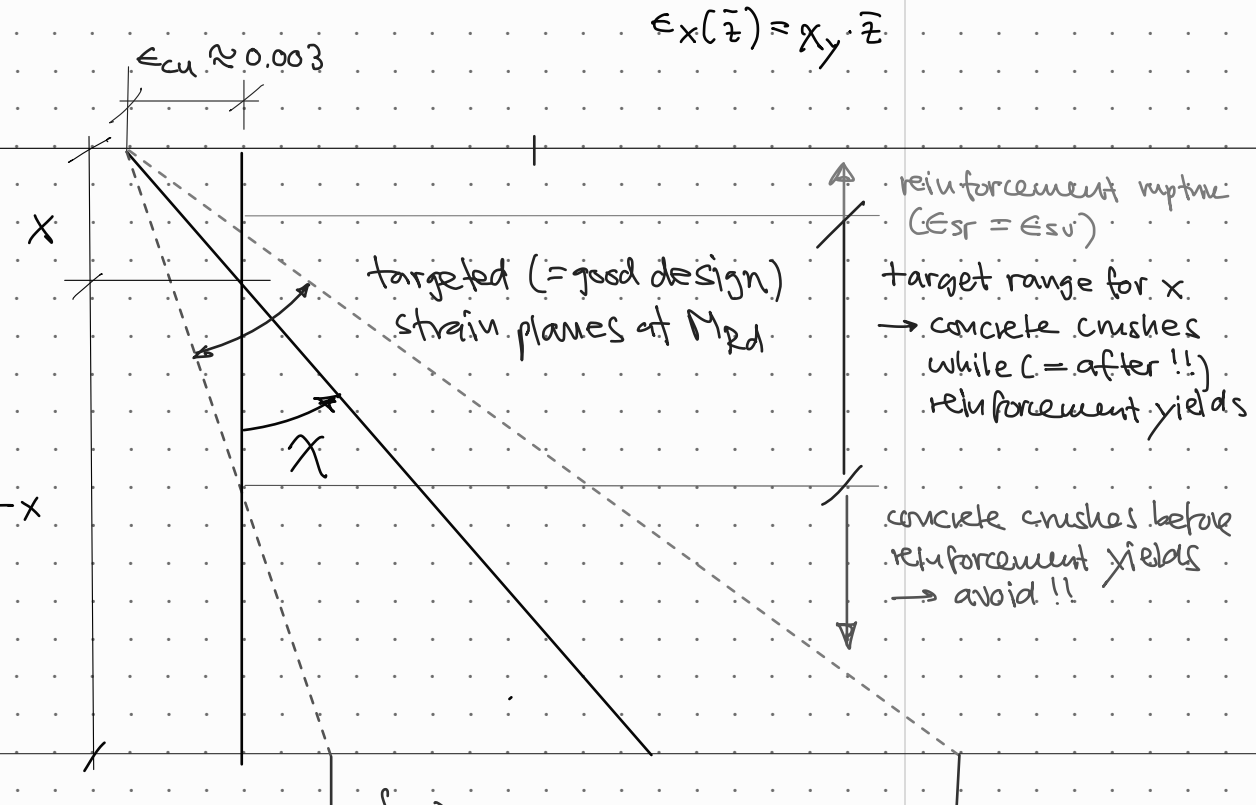
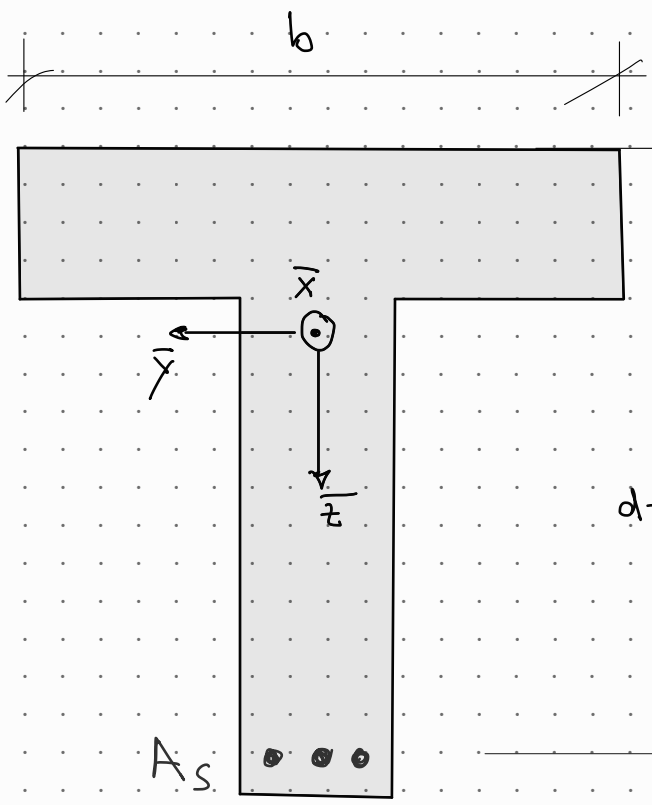
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