



Shear Panel Components in the Vicinity of Beam-column Connections in Fire

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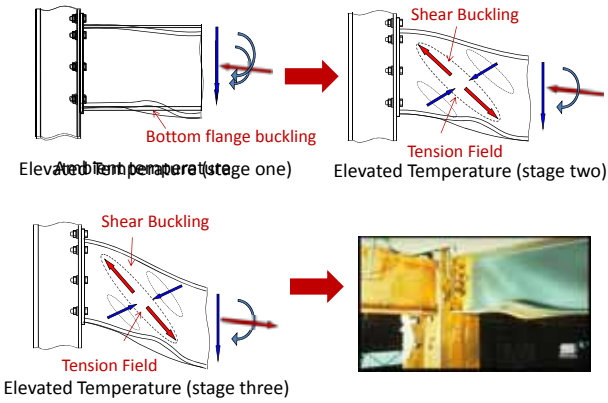
What is Shear Buckling?



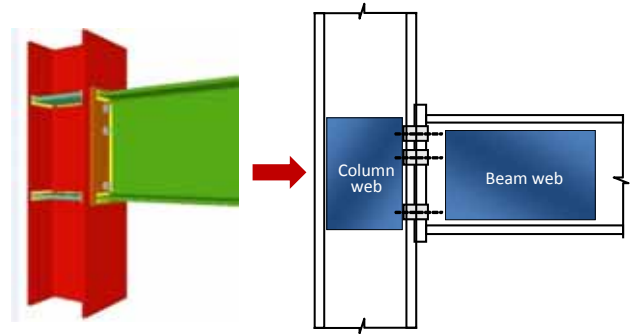
Shear Buckling Near the Beam-Column Connection
Primary Beam Shear Buckling
Secondary Beam Shear Buckling



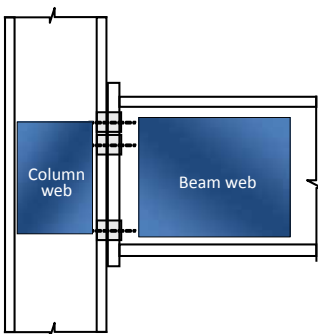
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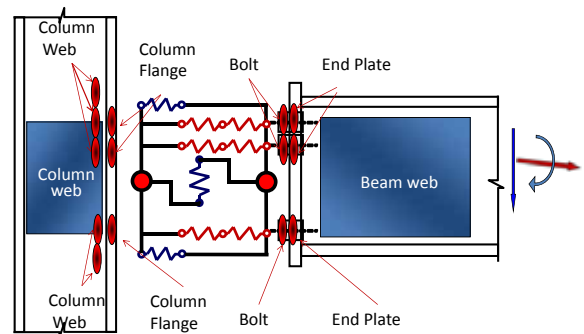
Why Create Shear Panel Elements?



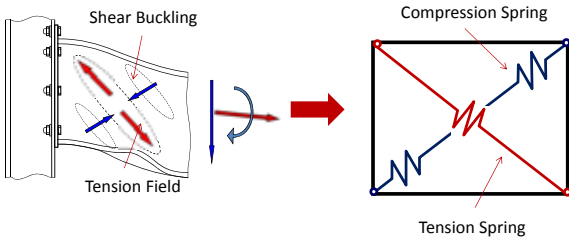
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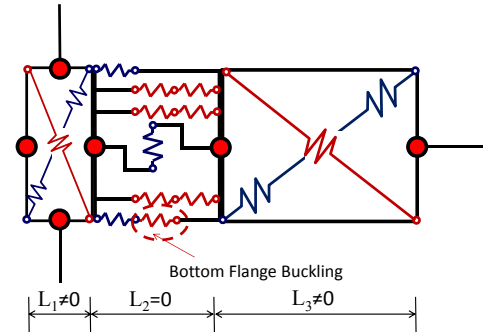
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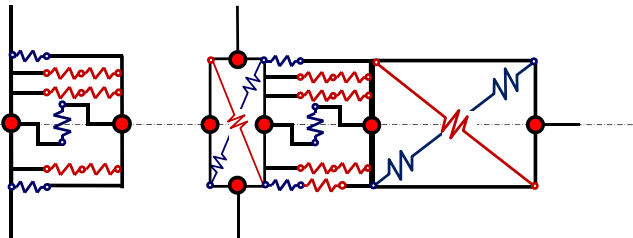


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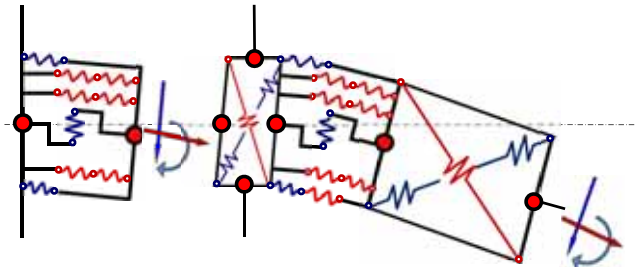
Why Create Shear Panel Elements?

- > Influence deflection
- > Stress redistribution



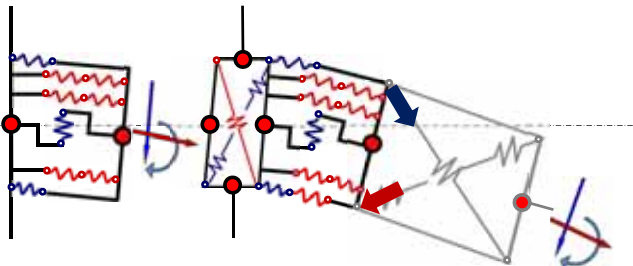
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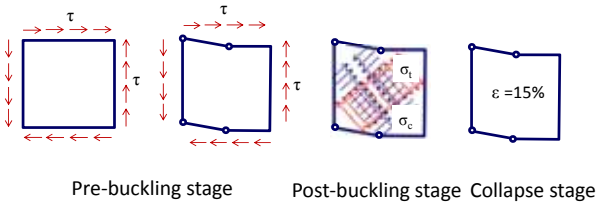


How to Create Shear Panel Elements?

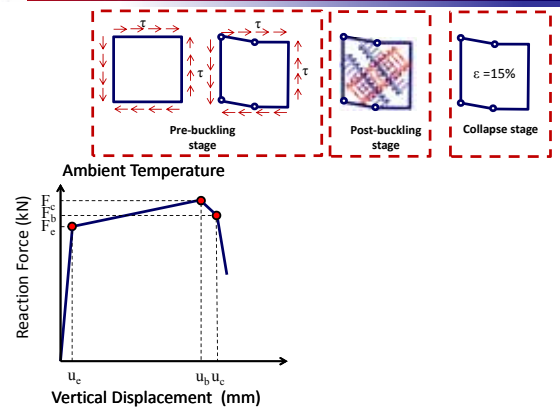
**Newly Defined Shear Panel Model
at Ambient Temperature**



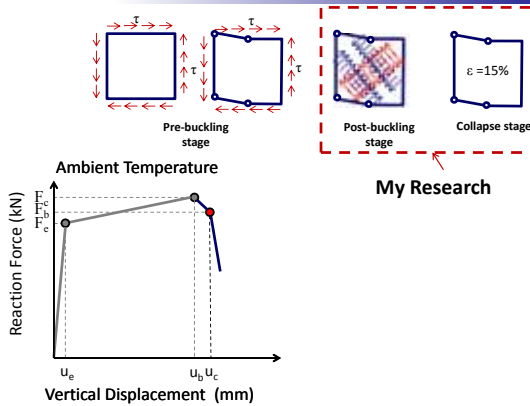
How to Create Shear Panel Elements?



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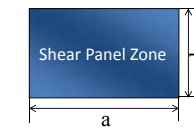
How to Create Shear Panel Elements?



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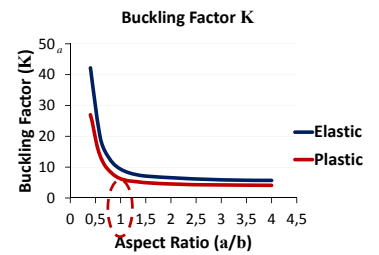
The Length of Shear Panel

Shear Panel is a Square Panel



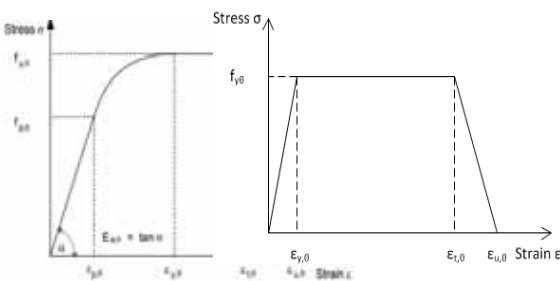
$$\tau_{cr} = K \frac{\pi^2}{12(1-\nu^2)} \left(\frac{t}{b}\right)^2$$

t : web thickness
 b : web height



How to Create Shear Panel Elements?

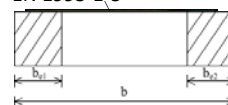
Post-buckling Stage



How to Create Shear Panel Elements?

The Internal Work of Web

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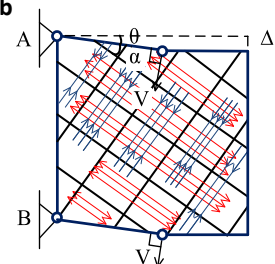


$$\sigma_x = 0.461\sigma_y \quad \sigma_z = 0.667\sigma_y$$

$$W_w = W_c + W_T$$

$$= \frac{0.687\sigma_y t d \sin \alpha \cos(\alpha + \theta) + 0.461\sigma_y t d \cos \alpha \sin(\alpha + \theta)}{\cos \theta}$$

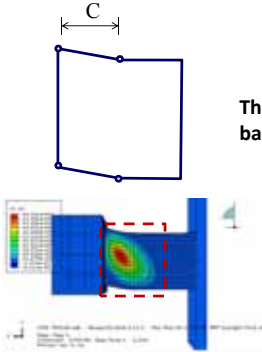
$$= \frac{\sigma_y t d}{\cos \theta} (0.574 - 0.113 \sin \theta) \Delta$$





How to Create Shear Panel Elements?

The Internal Work of Flanges



$$M = \frac{1}{4} \sigma_y b_f t_f^2$$

The influence of moment on
bending capacity of flanges

$$M' = M_f \left[1 - \left(\frac{M_x}{M_y} \right)^2 \right]^{1/2}$$

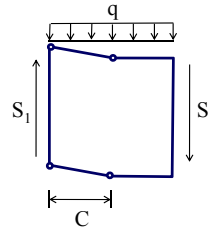
Reduction Factor

$$W_f = 4M'\theta$$



How to Create Shear Panel Elements?

External Work



$$W_q = q \left(L - \frac{1}{2}C \right) \Delta$$

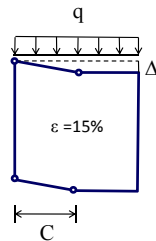
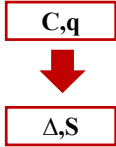
L: Half length of the beam



How to Create Shear Panel Elements?

Collapse stage

Internal work = External work

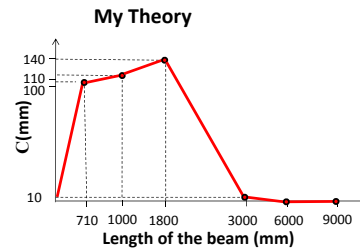


Collapse stage

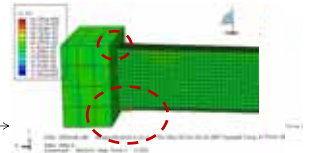


Results and Validation

Ambient Temperature

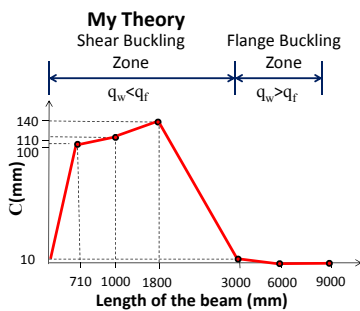


ABAQUS Model

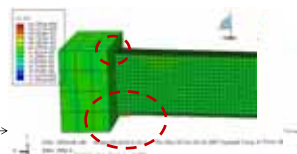


Results and Validation

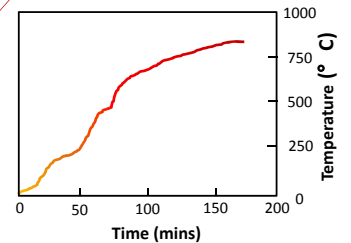
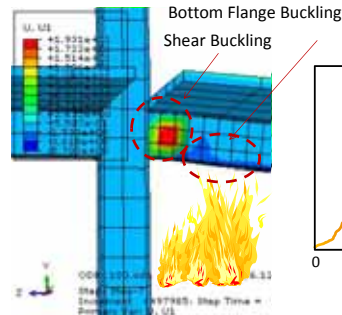
Ambient Temperature



ABAQUS Model

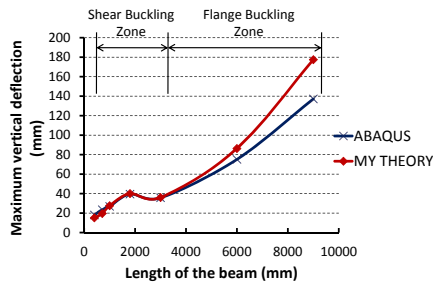


Results and Validation



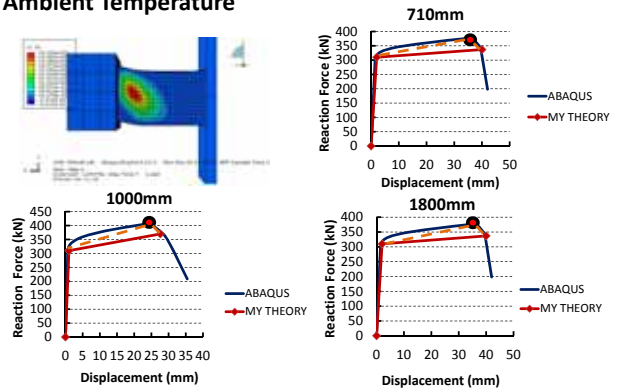
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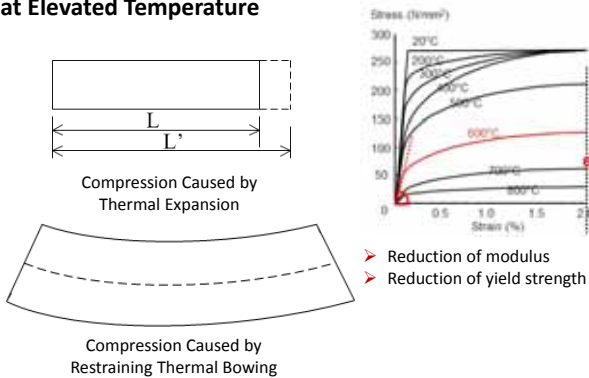
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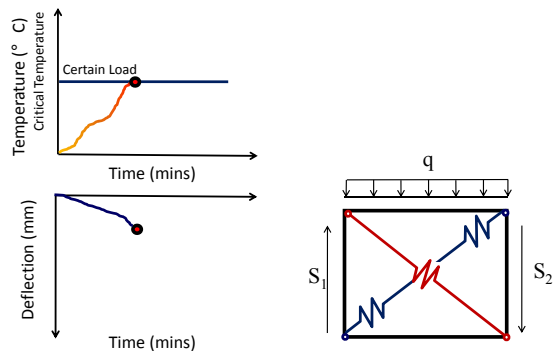
Next Step

Modelling Shear Panel Elements at Elevated Temperature



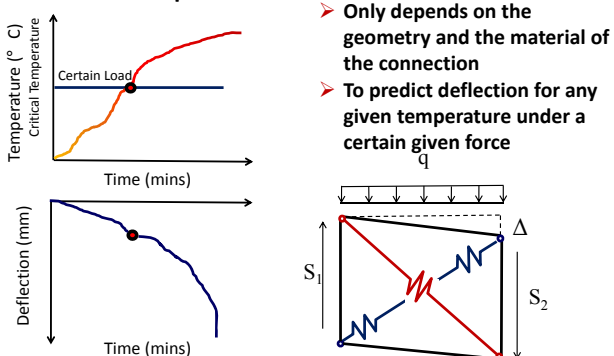
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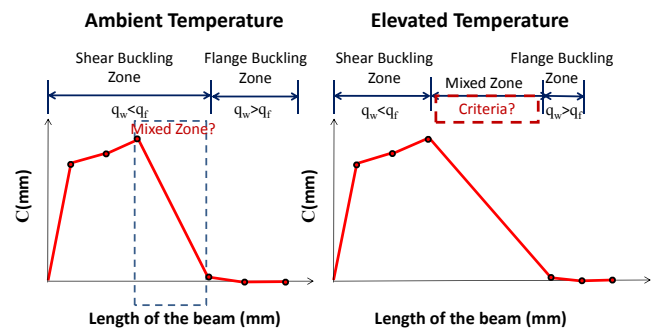


Next Step

Modelling Shear Panel Elements at Elevated Temperature



Problems and Discussions





Thanks for your attention!

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