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A new component – based model for endplate connections

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Background

- The previous research focuses on development of a component-based model predicting rotational response of a connection
- Herein, present a new component-based model, including the performance of a connection in tension, shear and rotation under various loading conditions
- Development of new component-based models for partial depth endplate connections, capable of capturing the second stage performance
- Include the possible failure mechanism of brittle components into the component-based model

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How to create a component-based model

Identification of active components

a). Components in tension zone: welds, bolts and endplates

b). Components in compression zone: endplate compression component and beam flange compression component

c). Components in vertical shear: bolts and endplates

Evaluation of stiffness and strength for each individual component

Assembly of all the components

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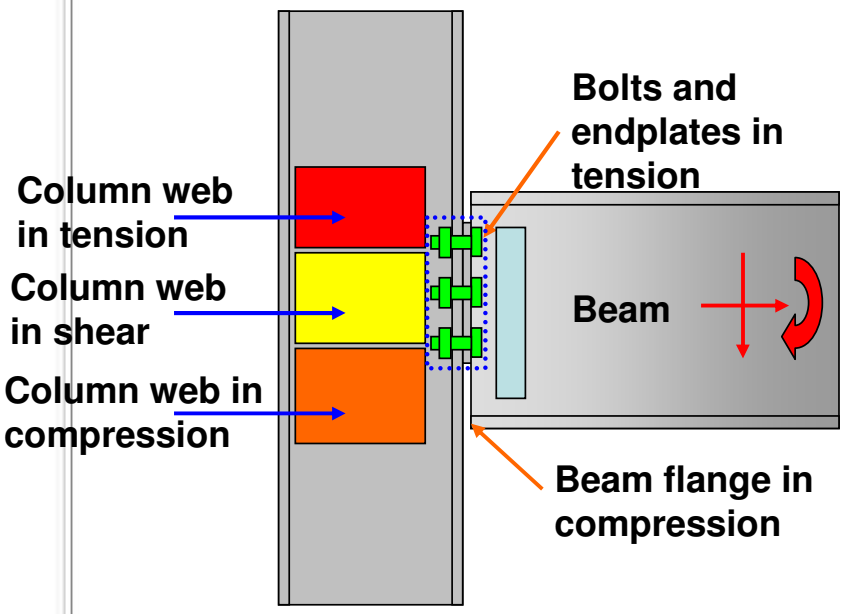

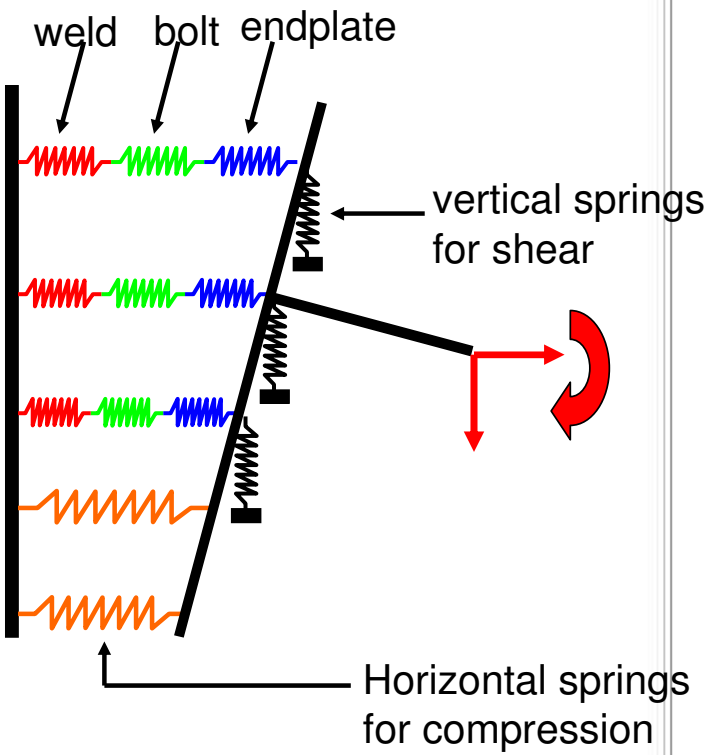

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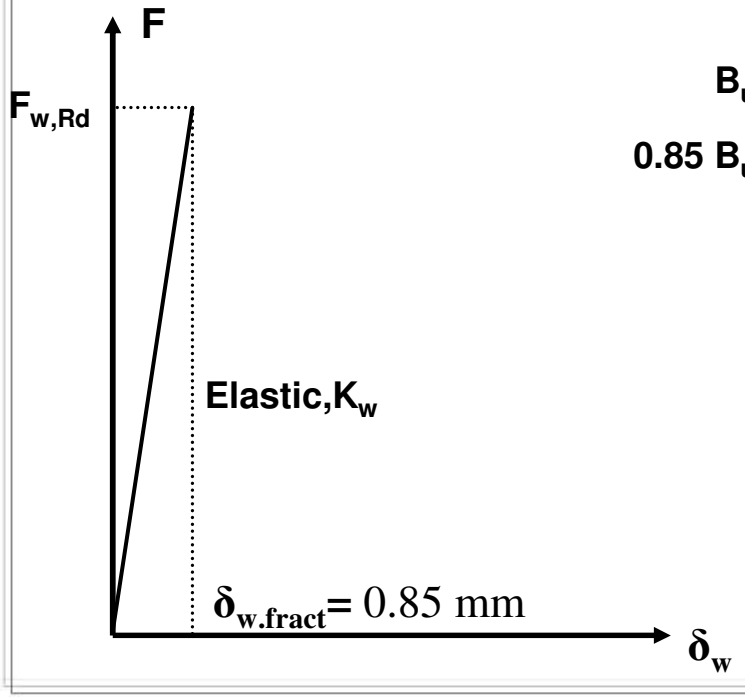
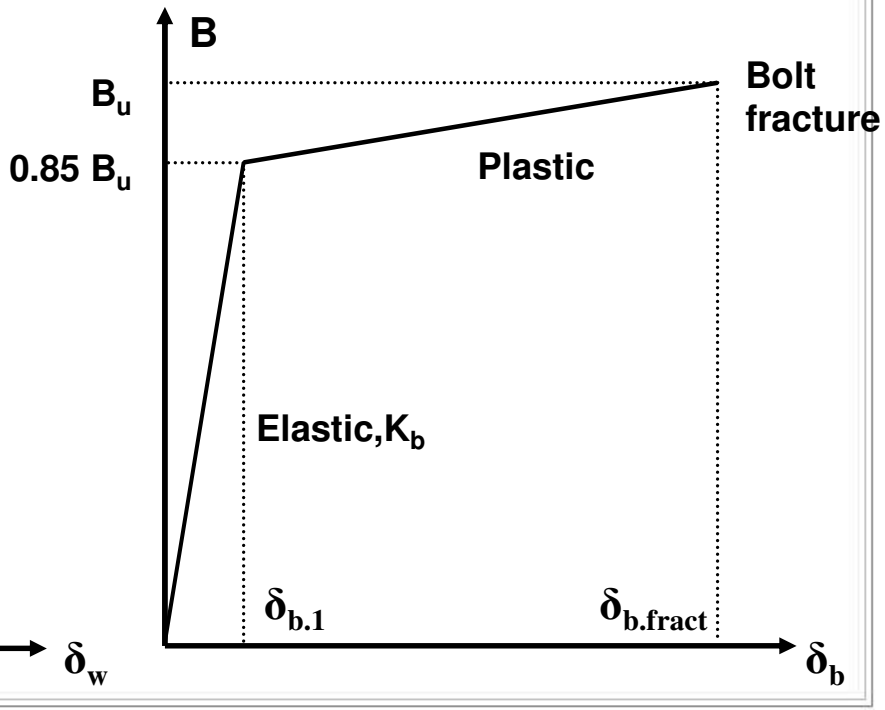
The mechanical response of a fillet weld



Elastic and plastic response of a single bolt



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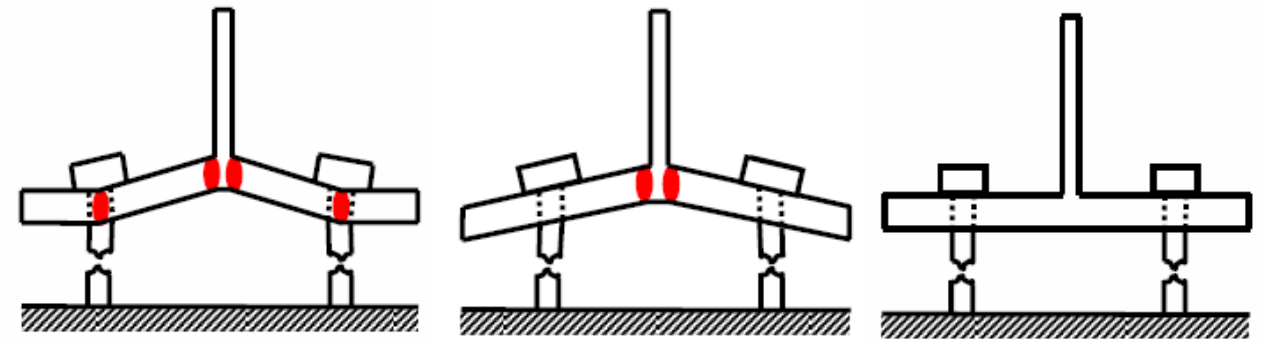
Failure mechanism of T-stubs



Failure Mode 1 Failure Mode 2 Failure Mode 3

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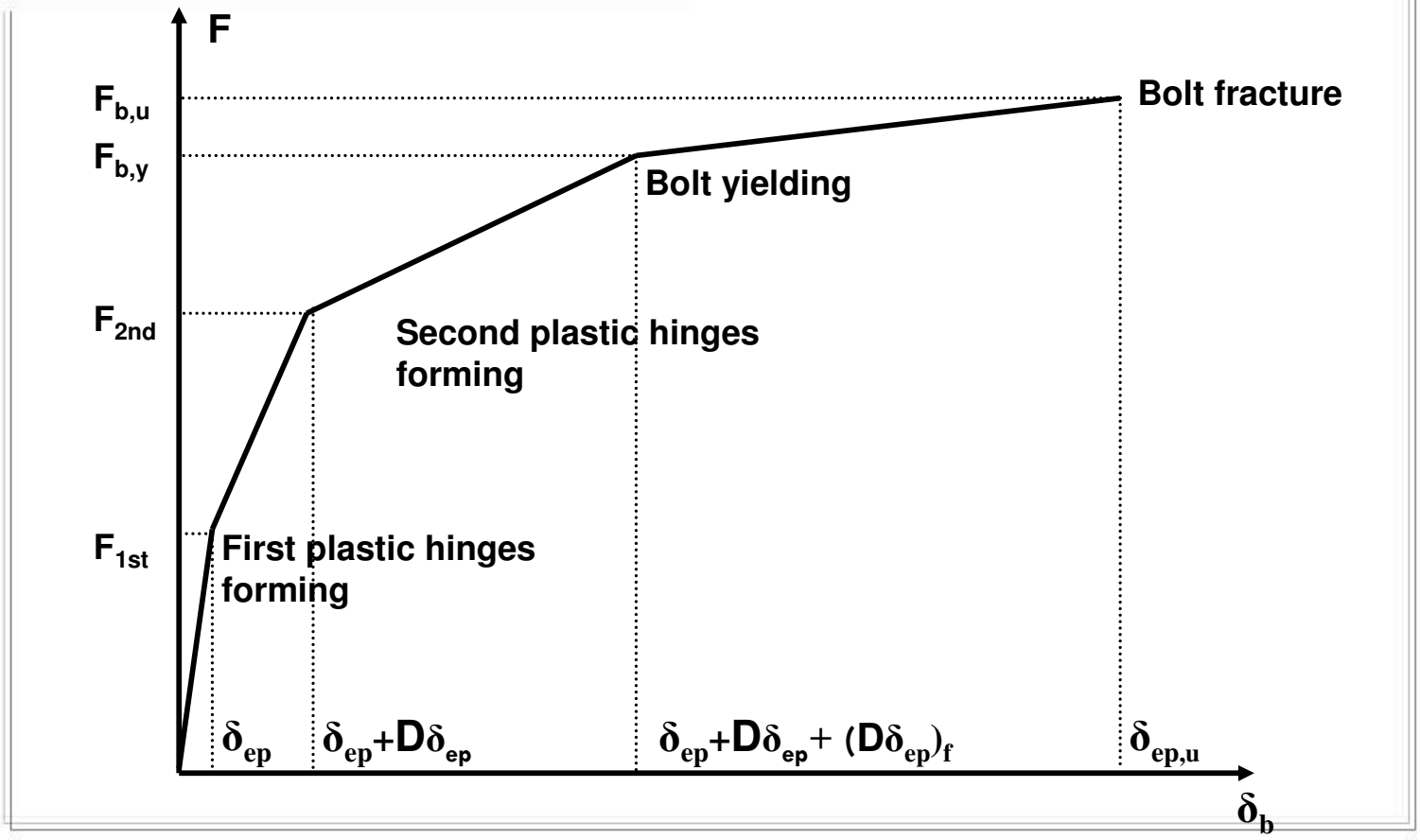
The mechanical response of a single T-stubs (failure mode I)



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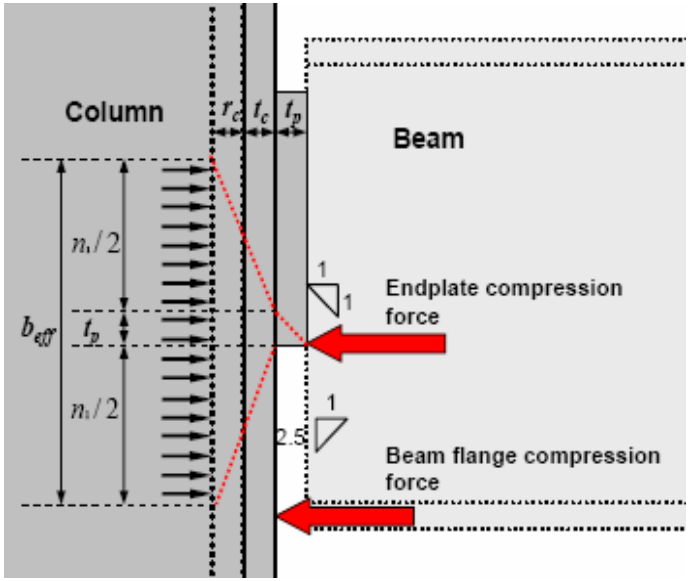
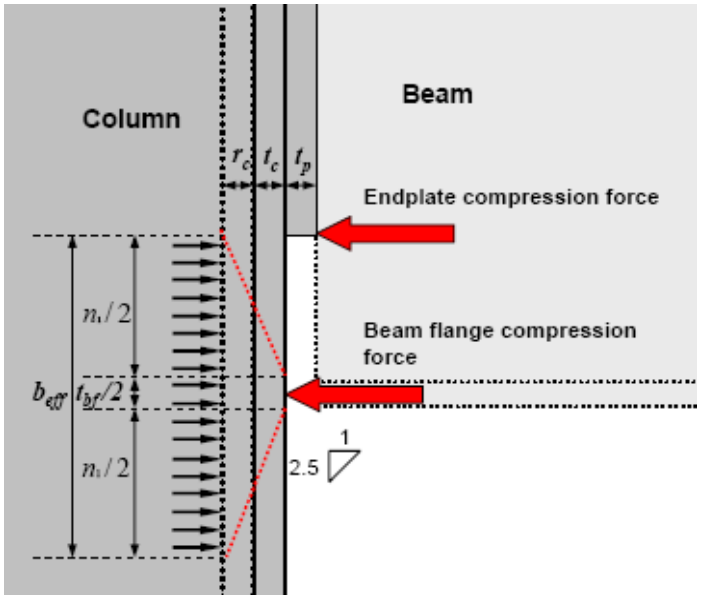
Compression components



a) End-plate compression component



b) Beam flange compression component

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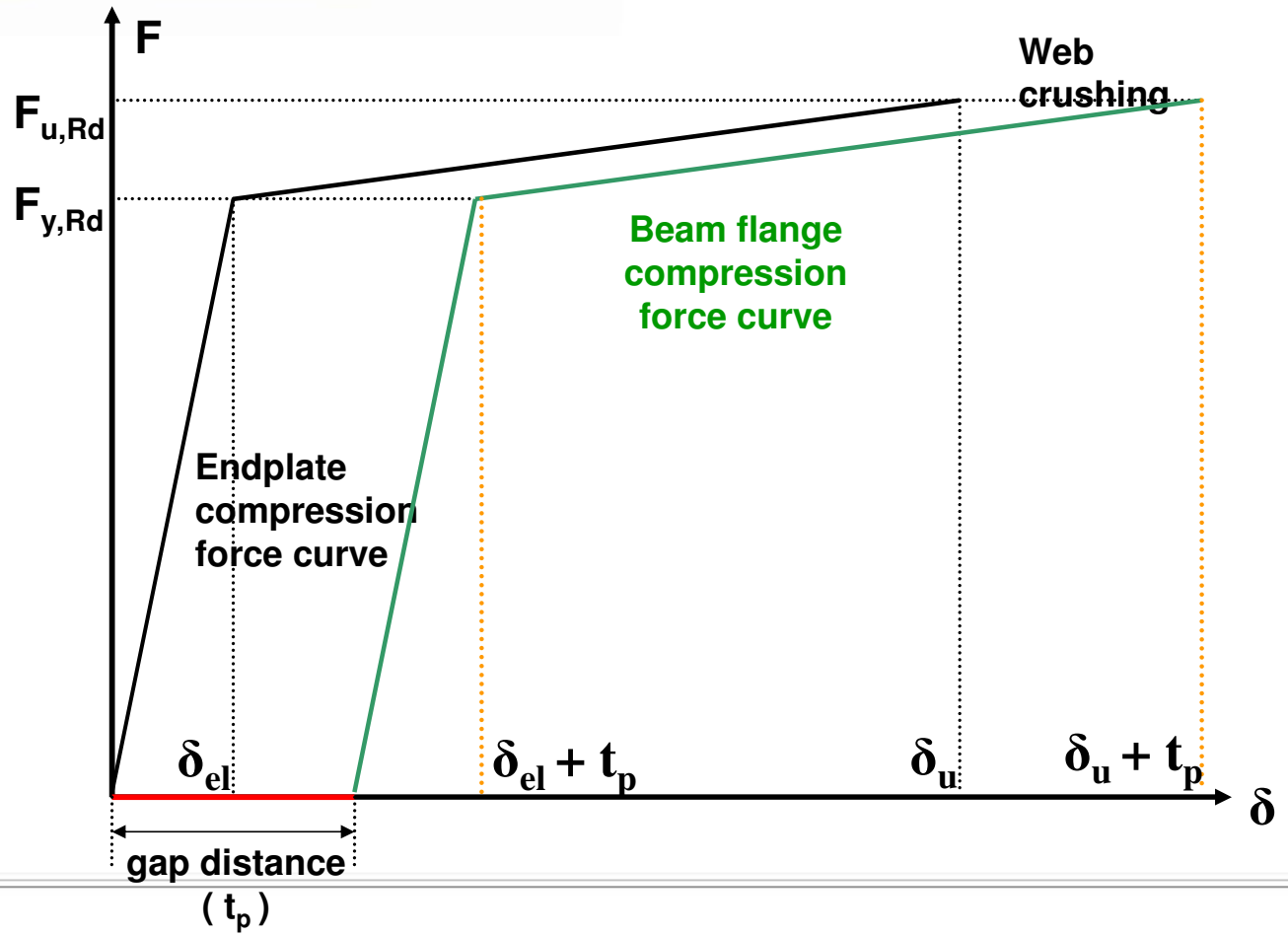

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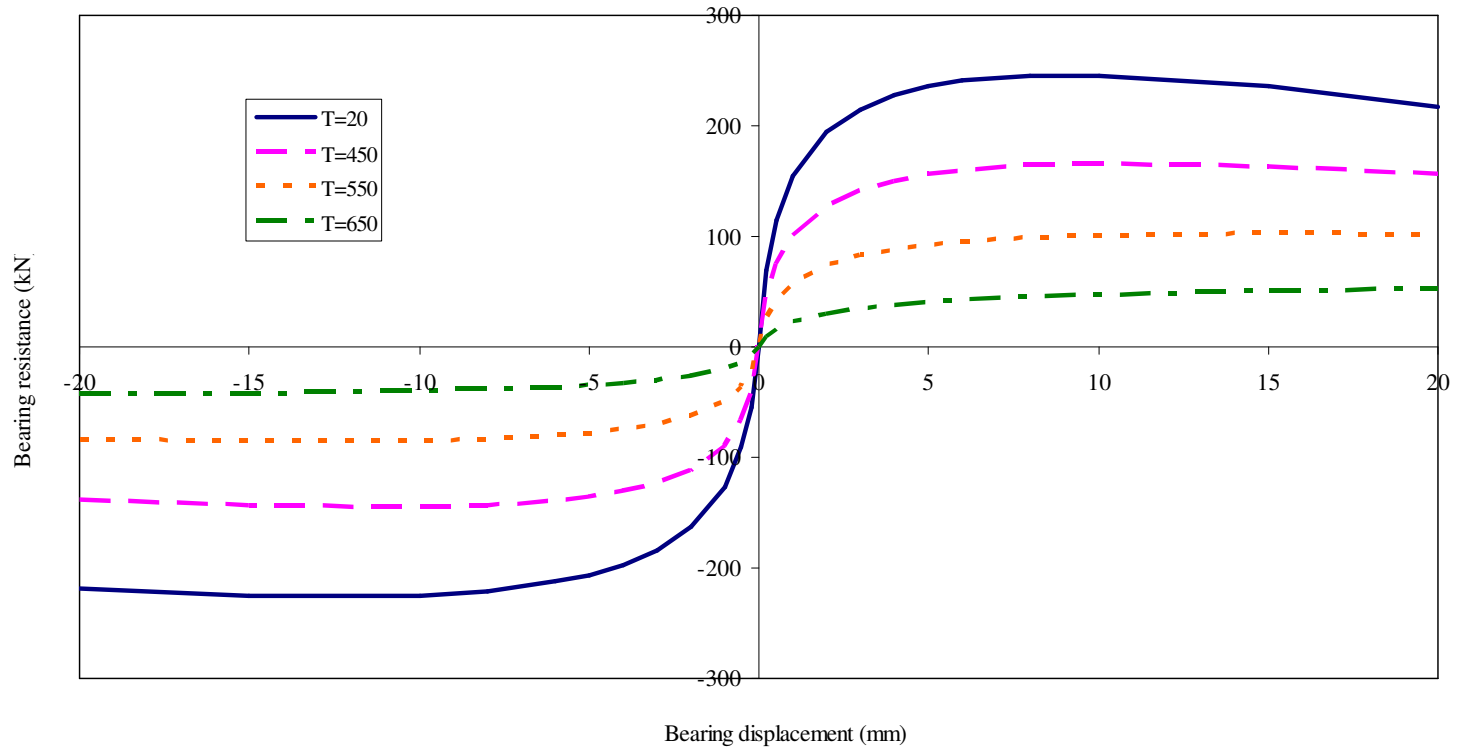
Vertical components in shear

Bearing components



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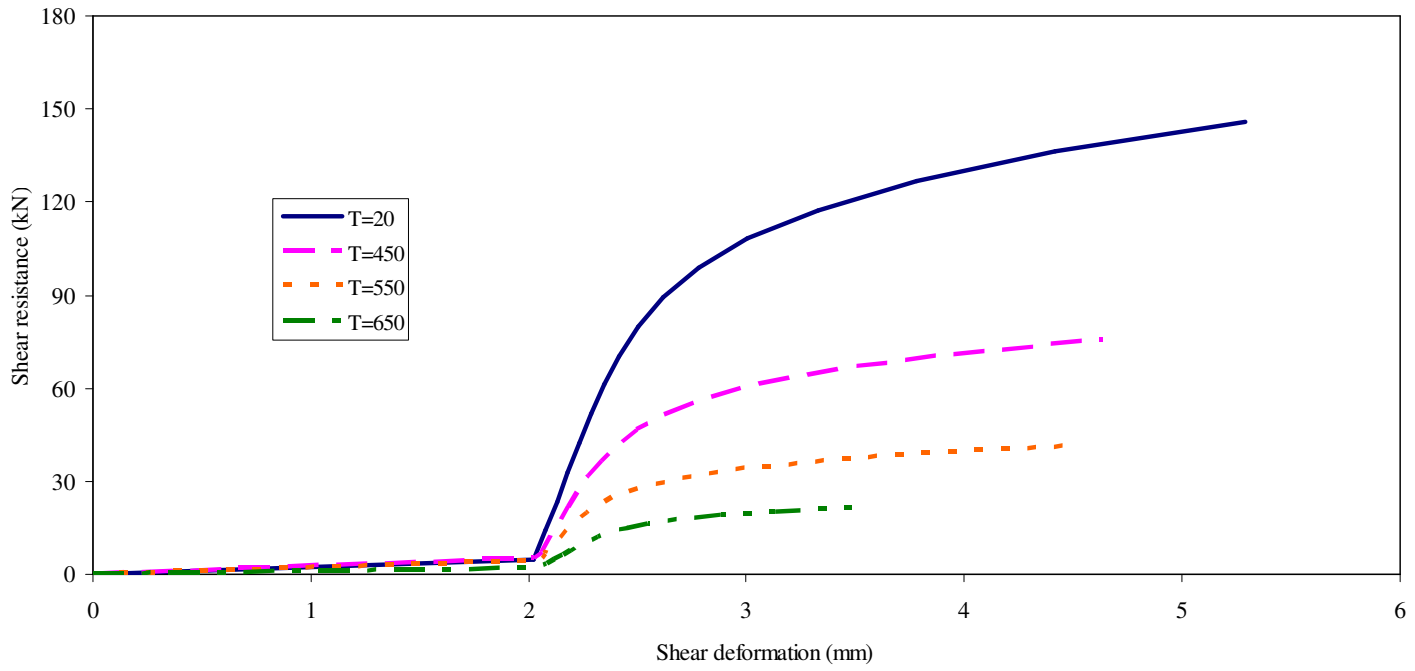
Bolts in shear



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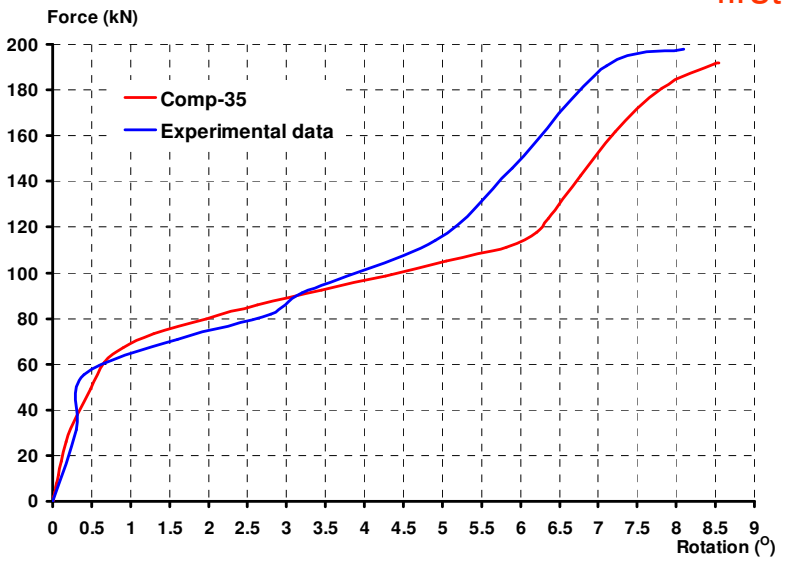
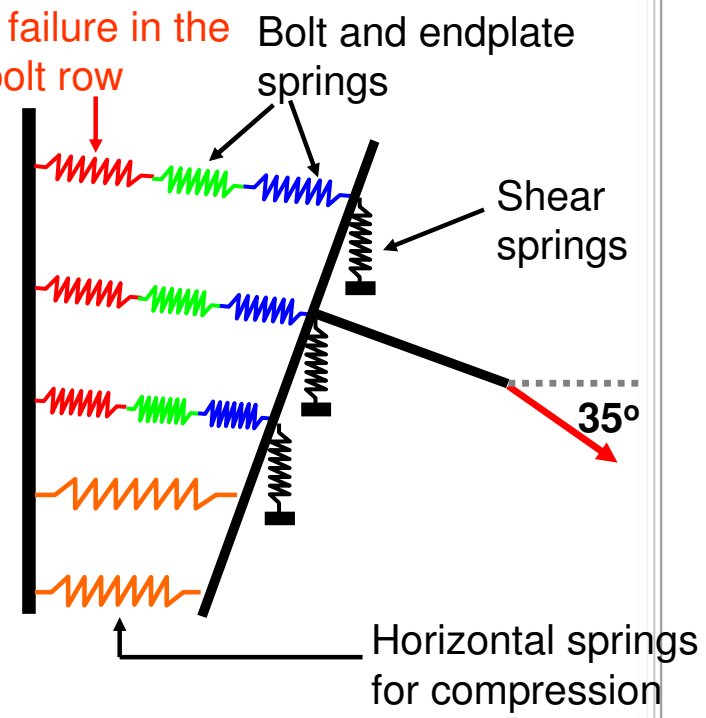
Validation of the component based model at ambient temperatures (co-35)





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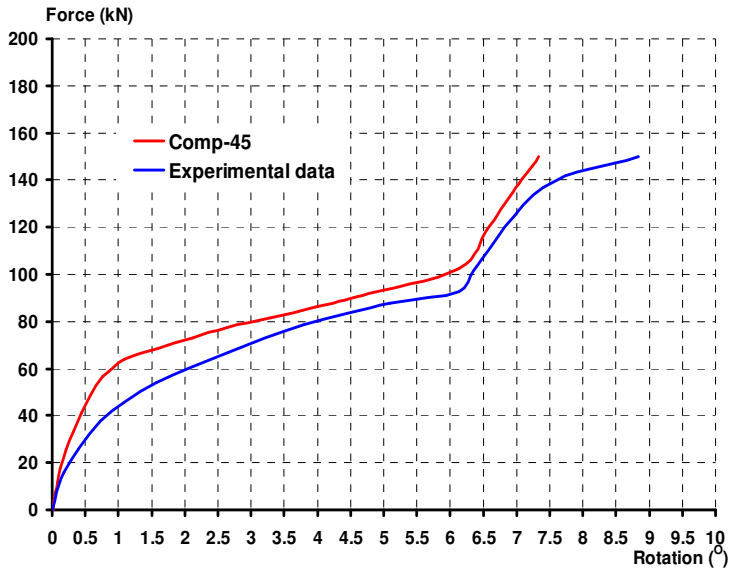
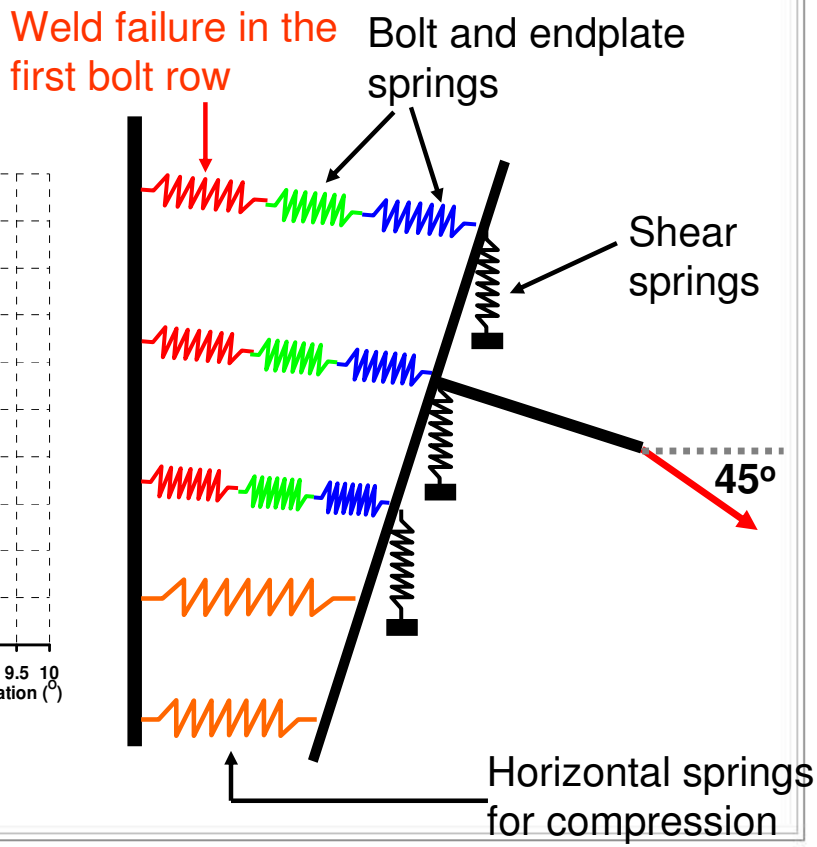
Validation of the component based model at ambient temperatures (co-45)





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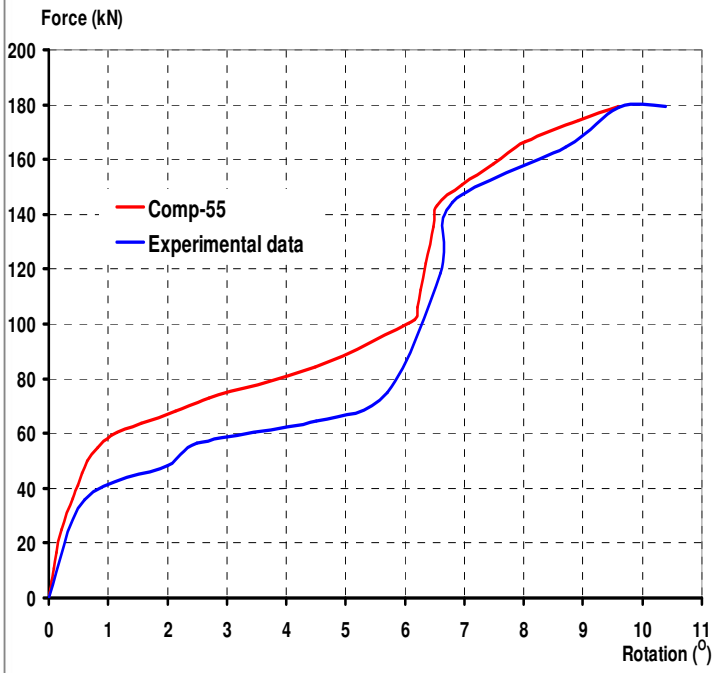
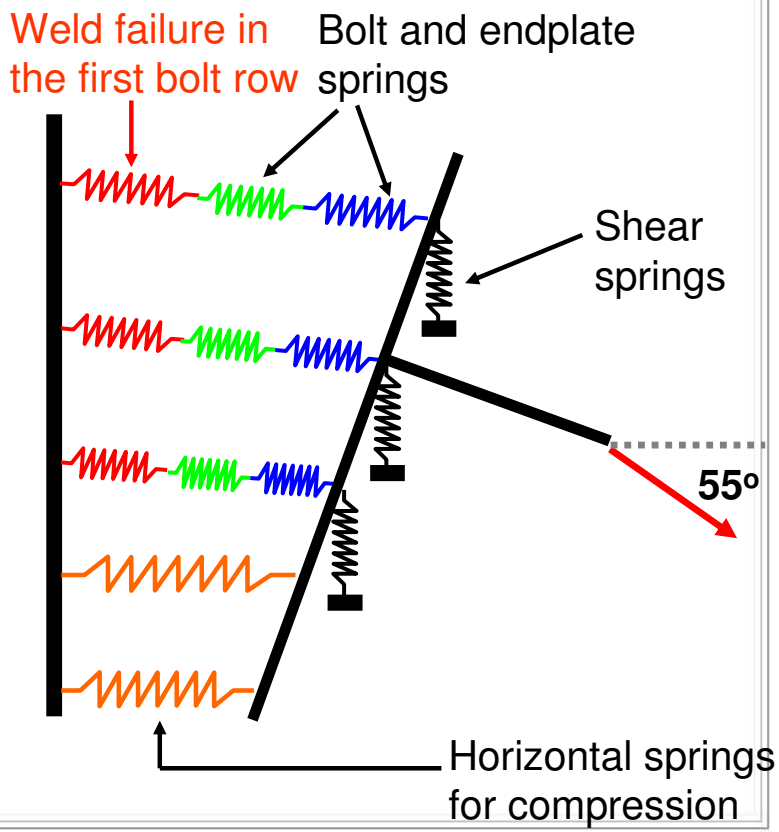
Validation of the component based model at ambient temperatures (co-55)





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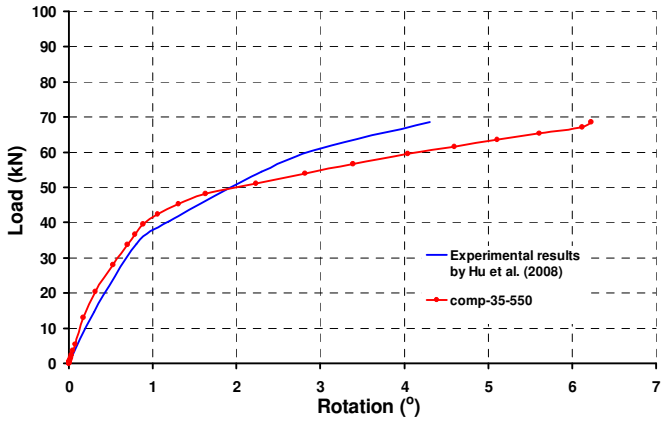
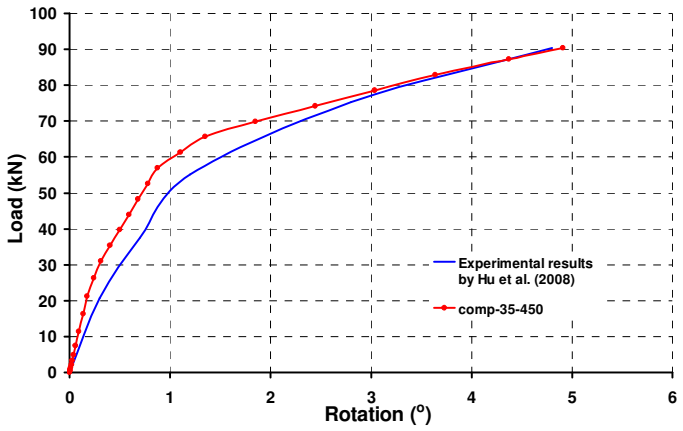
Validation at ambient temperatures

Component model-
nominal angle 35°

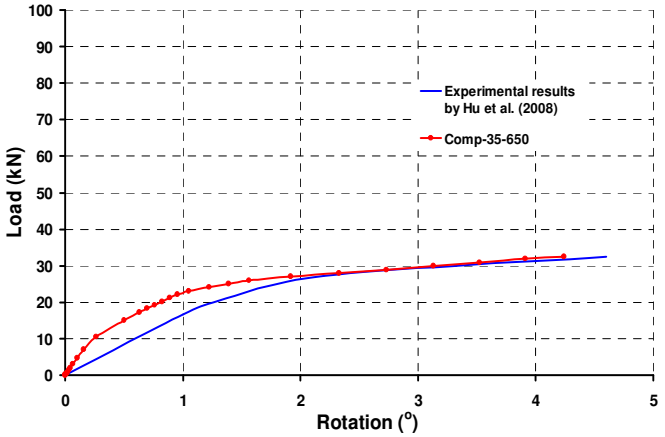
550°C



450°C



650°C



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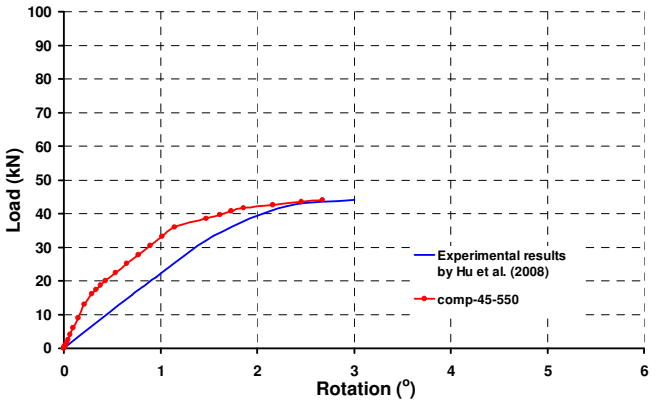
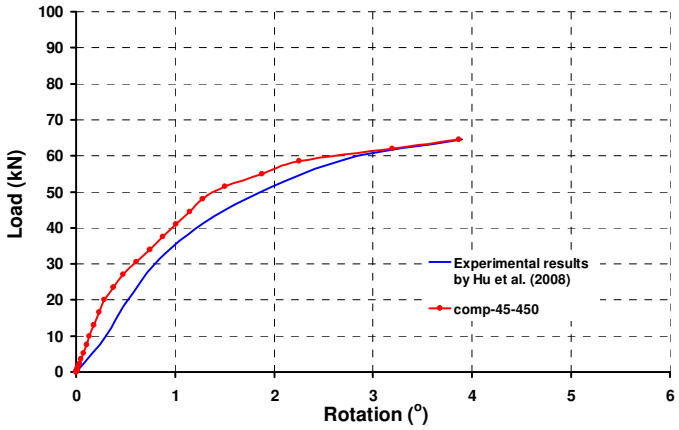
Component model- nominal angle 45°

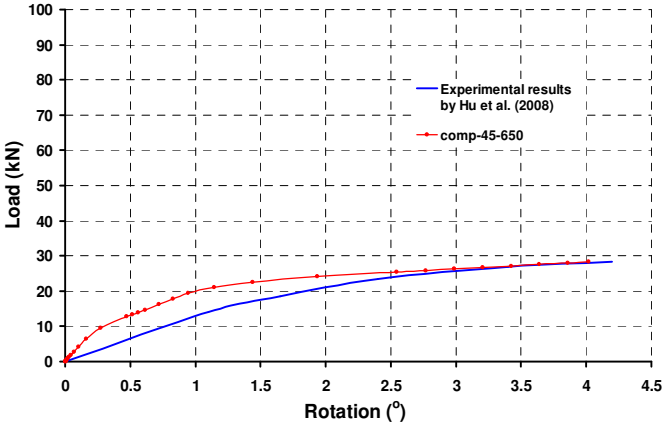
550°C



450°C



650°C



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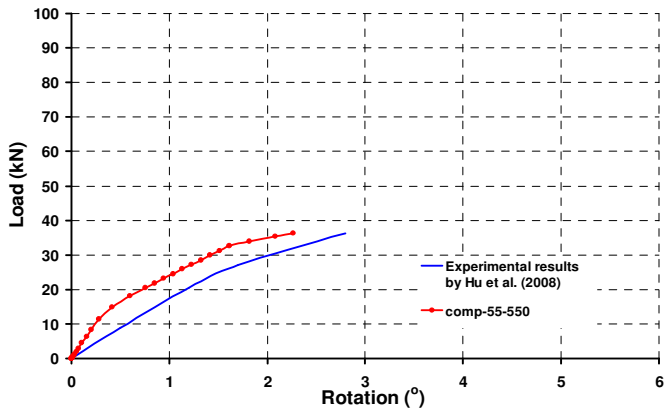
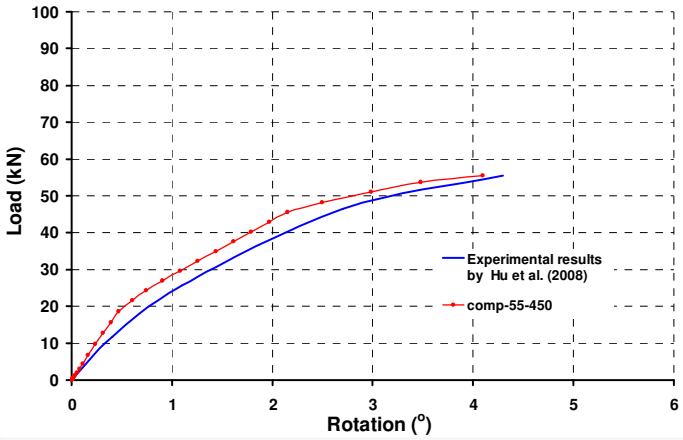
Component model- nominal angle 55°

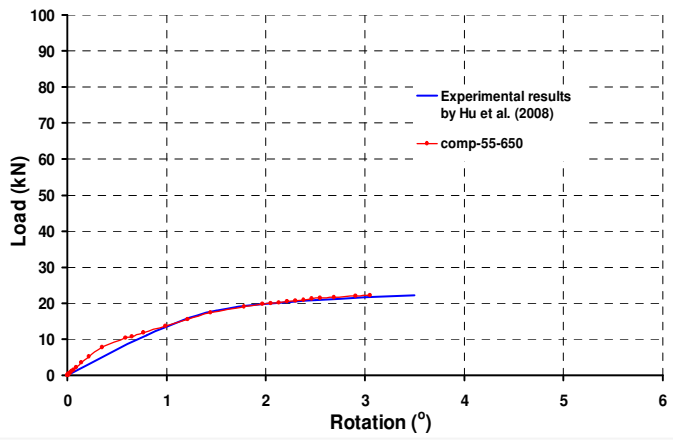
550°C



450°C



650°C



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Summary of failure mechanism

Table 3. Maximum displacements of the weld component

Specimen No	Weld components (mm)		Failure mechanism	
	Assumed max displacements	Maximum displacements	for component models	for experiments
Comp-35	0.85	1.196	failed	weld failure
Comp-45	0.85	0.954	failed	weld failure
Comp-55	0.85	3.970	failed	weld failure
Comp-35-450	0.85	0.875	failed	weld failure
Comp-35-550	0.85	0.958	failed	weld failure
Comp-35-650	0.85	0.952	failed	weld failure
Comp-45-450	0.85	0.793	close to failed	weld failure
Comp-45-550	0.85	0.815	close to failed	weld failure
Comp-45-650	0.85	0.945	failed	weld failure
Comp-55-450	0.85	0.773	close to failed	weld failure
Comp-55-550	0.85	0.796	close to failed	weld failure
Comp-55-650	0.85	0.880	failed	weld failure

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Conclusions

- The new component-based model is able to capture the connection performance under various loading conditions (including tension, shear and rotation).

- able to predict the failure mechanism of steel connections

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Thank You for Listening

Special thanks also given to my supervisors and my colleagues working in this co-operated project

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