



EXPERIMENTAL STUDIES OF Z-PURLIN OVERLAPPED JOINT

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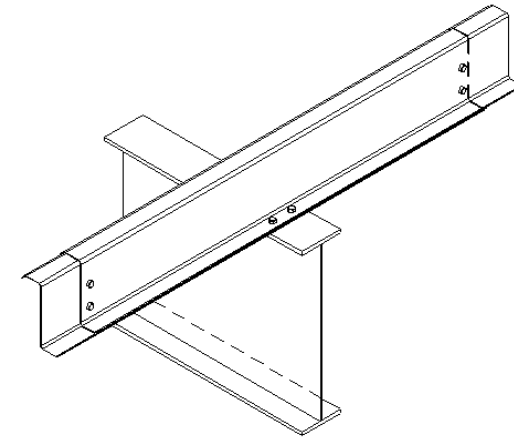
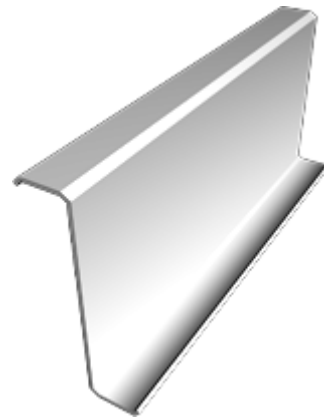


Introduction

Z-purlin

Cold-formed

Thin-walled



Application: continuous purlin

Sleeve system



Overlap



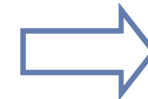
complex behaviour



test based design



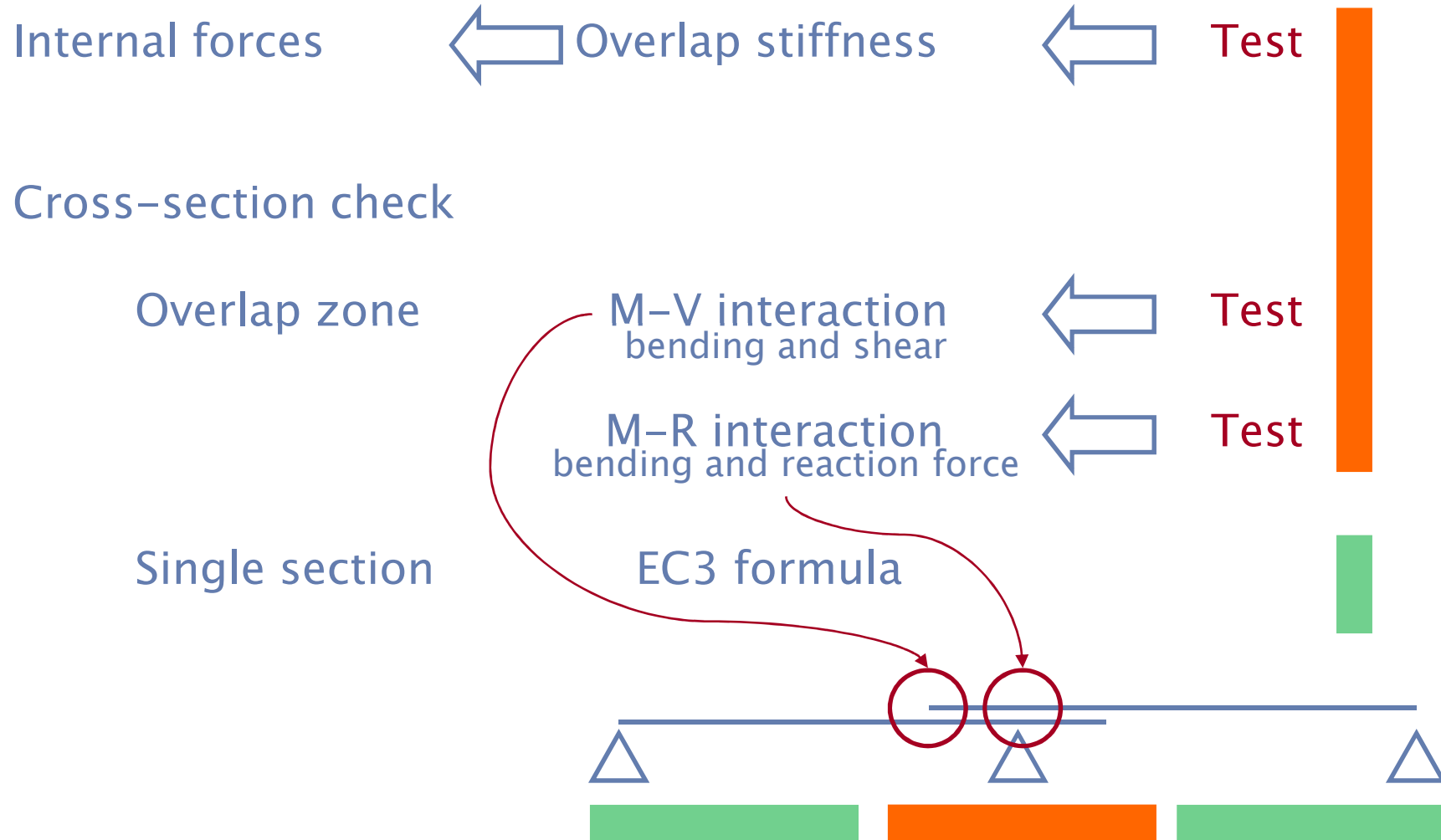
real test



virtual test



Eurocode 3 design method





Test program

*M–V interaction tests and
overlap stiffness*

2 purlin heights

3 thicknesses

3 spans

2x statistical reason

36 tests

M–R interaction tests

2 purlin heights

3 thicknesses

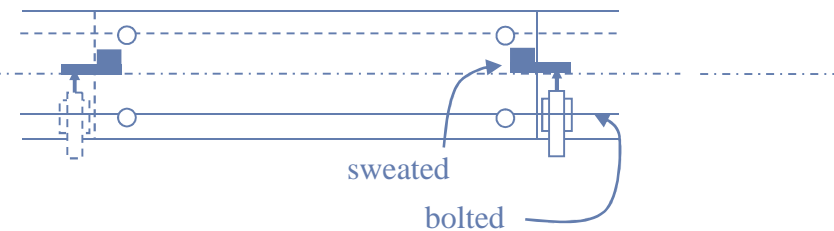
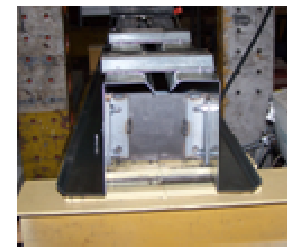
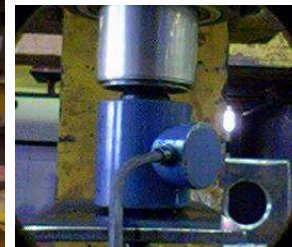
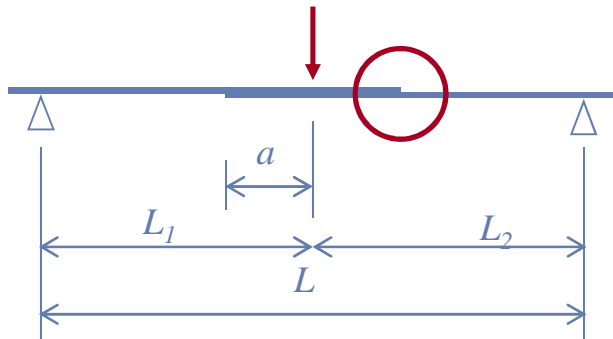
3 spans

2x statistical reason

36 tests

End of overlap test arrangement

M-V interaction tests and overlap stiffness



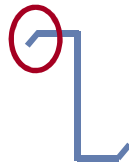


M-V interaction

EC3 is **unsafe ~20%**

compared to single section

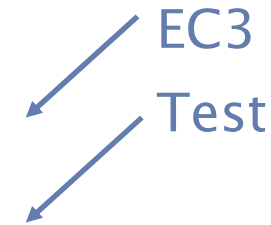
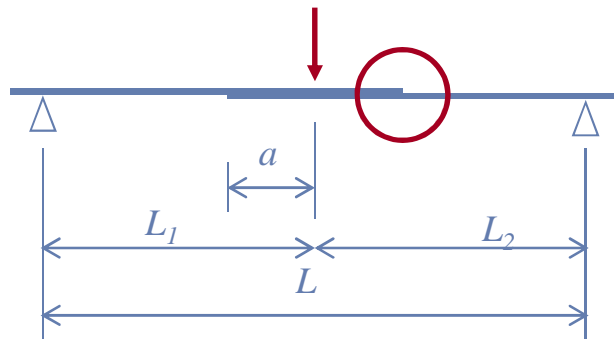
- small stiffener



- statistical reason (# tests)

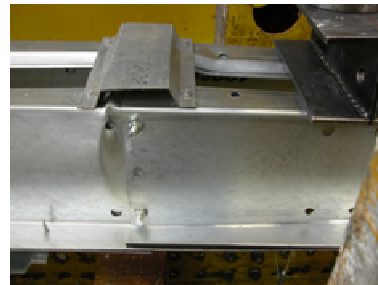
- holes

- overlap



Test results

*M–V interaction tests and
overlap stiffness*



Plastic plate buckling
(yield mechanism)

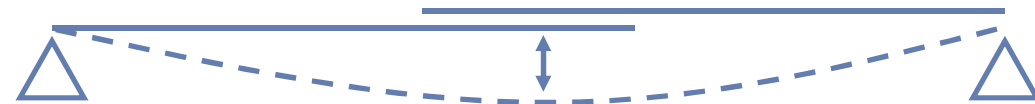
Eurocode test based design  design values: M_{Rd} , V_{Rd} , R_{Rd}



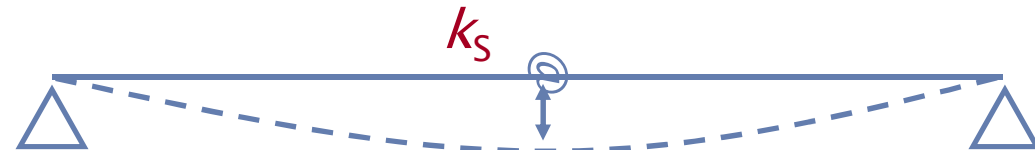
Stiffness results

same deflection

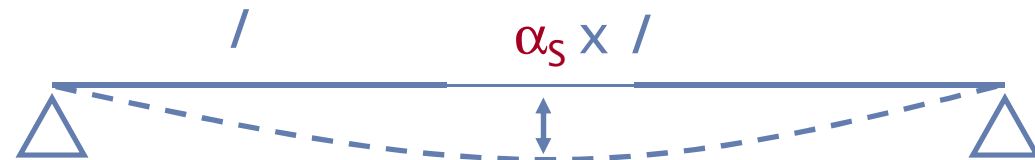
Test



Rotational stiffness: k_S



Inertia factor: α_S

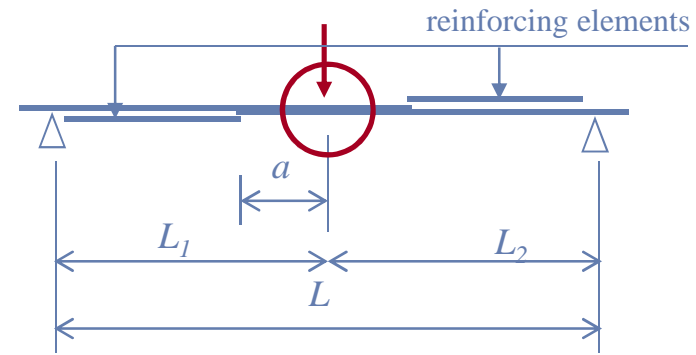


$$\alpha_S \sim 0.5$$



Overlap support test arrangement

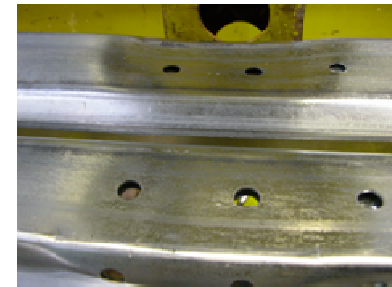
M-R interaction tests





Test results

M-R interaction tests



Web crippling

Eurocode test based design



design values: M_{Rd} , V_{Rd} , R_{Rd}

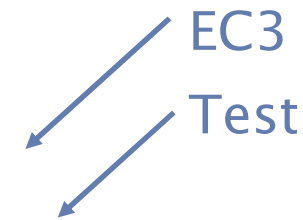


M-R interaction

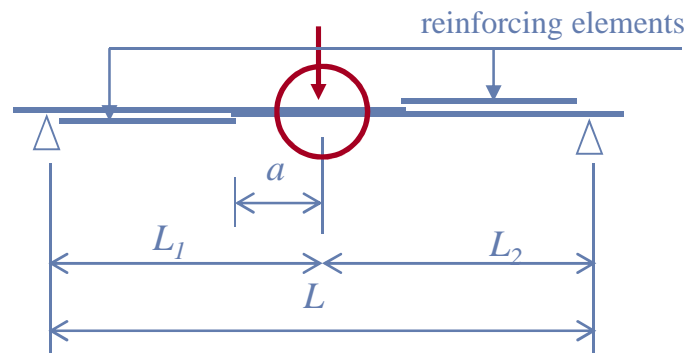
EC3 **good correlation**

compared to single section

pure support failure



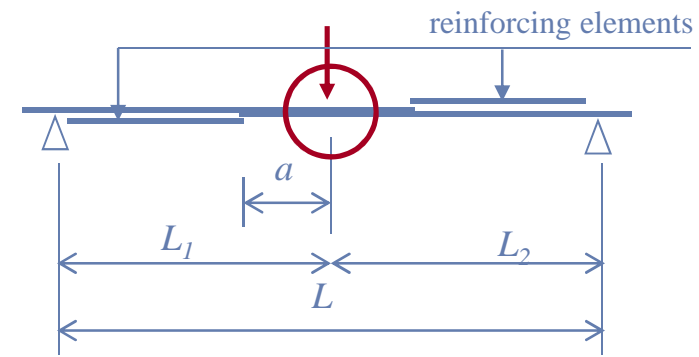
↑ interaction of end-of-overlap and support failure





End support test arrangement

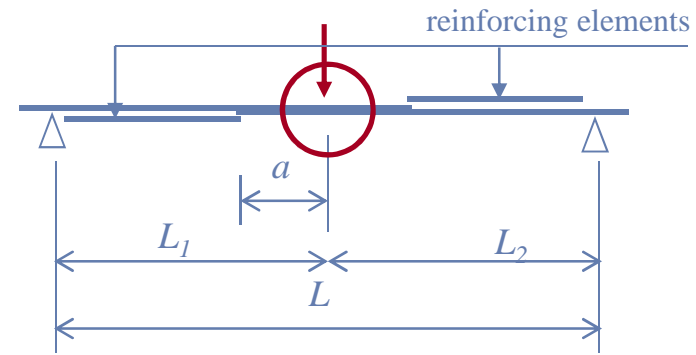
M-R interaction tests





Overlap support test arrangement

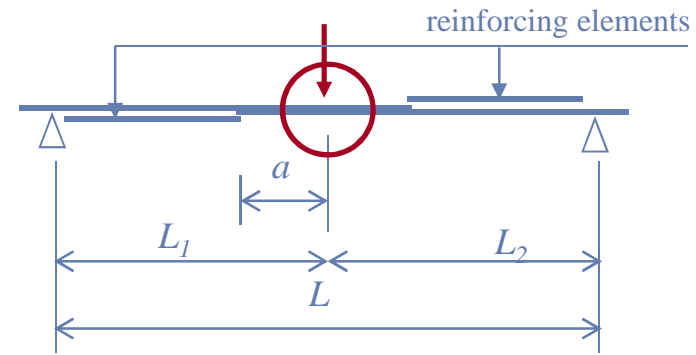
M-R interaction tests





Overlap support test arrangement

M-R interaction tests





Summary and conclusions

Test: 72 overlap tests

- overlap stiffness
- end of overlap interaction curves
- support interaction curves

Numerical modeling

- simplified model for end of overlap failure
- simplified model for web crippling
- effect of stiffener and overlap => small stiffener => EC3 is unsafe
- effect of imperfections
 - => yield mechanism => higher ultimate load
 - => web crippling => 30% less ultimate load
- effect of holes => 3%
- extension of interaction curves => good correlation

Further studies

- complex model



Thank you for your kind attention!