The Second Generation Eurocodes

Key changes and benefits through design examples

Online, 3-5 June 2025

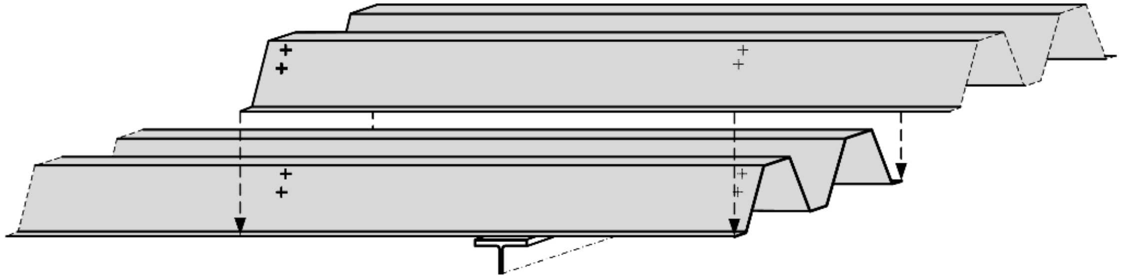
EN 1999 ‘Eurocode 9: Design of aluminium structures –
Part 1-4 Cold-formed structural sheeting’

New clause: Trapezoidal sheeting with overlap at the supports

Torsten Höglund

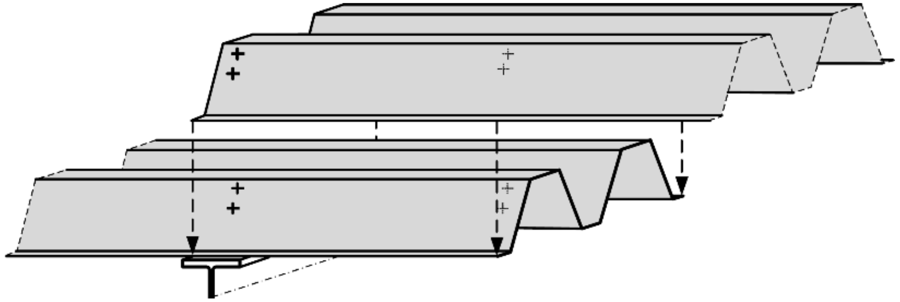
Static overlapping system of sheeting, two main systems

double overlap



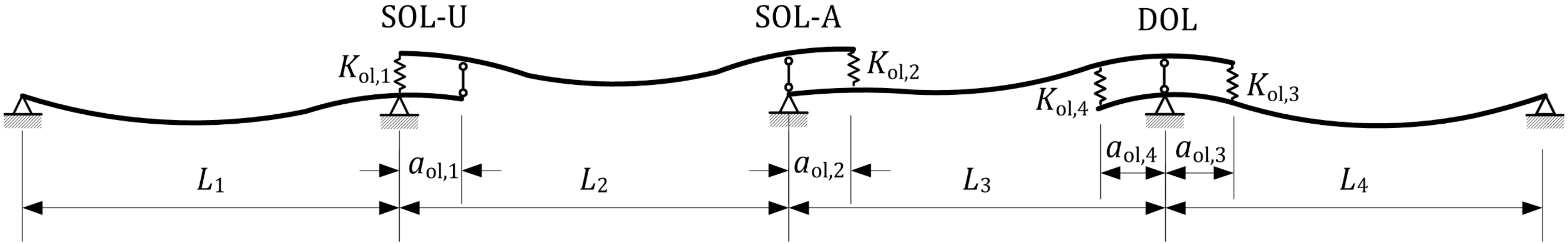
DOL

single overlap



SOL-U

Static system for trapezoidal sheeting with overlapping at the supports

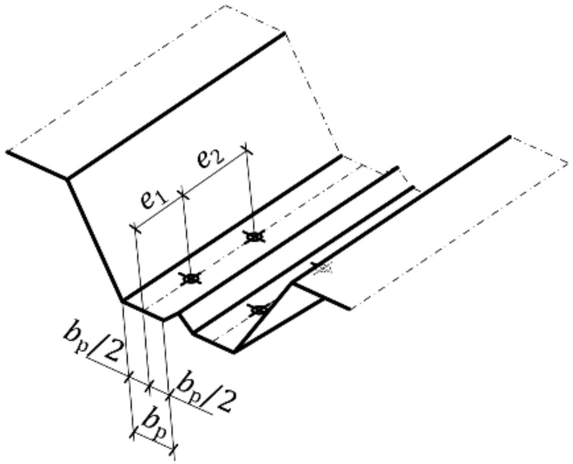


The overlapping region may be considered similar as that of a continuous sheeting. However, the support moment is increased due to the double sheeting but decreased due to deformations in the fastenings. The spring is defined by the stiffness

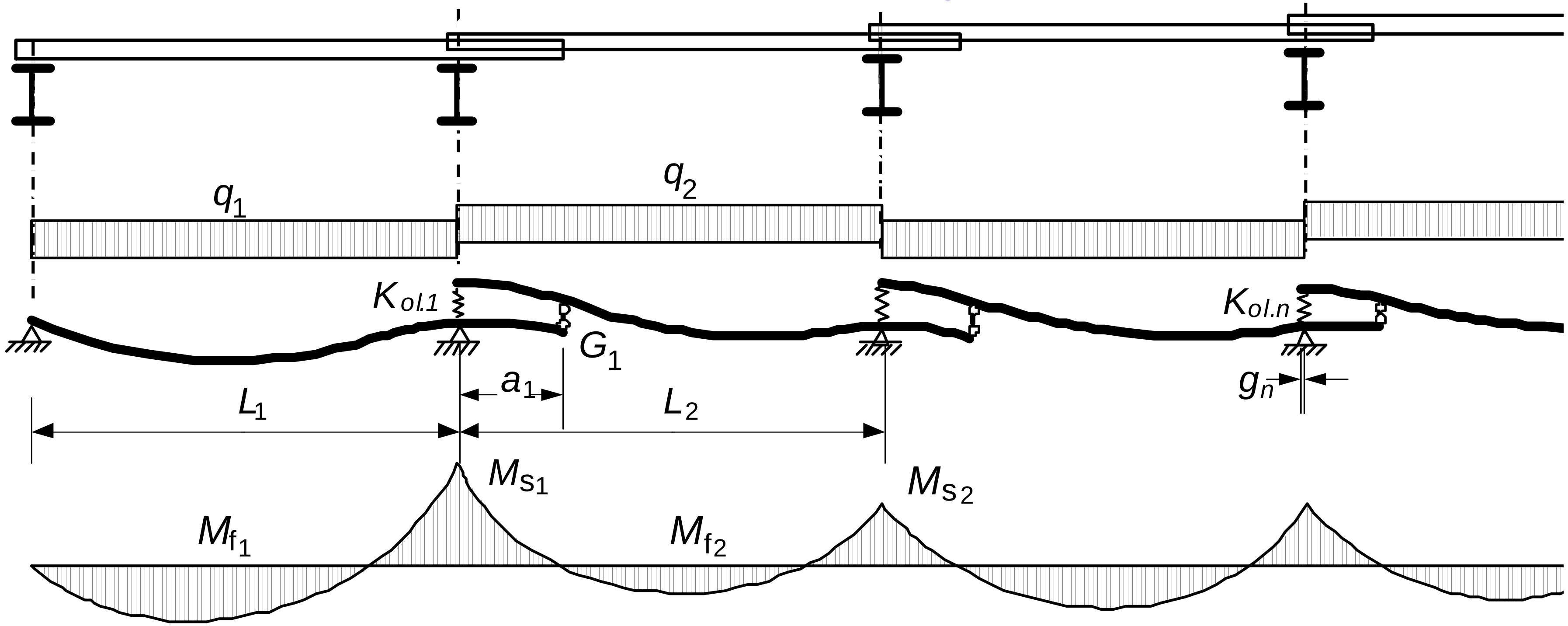
fasteners in the profile bottom $$K_{ol} = 0,5 k_{ol} E \sqrt{\frac{t^3 d_w}{h_w b_p}}$$

fasteners in the profile top $$K_{ol} = 0,5 K_{ol}$$

fasteners in the webs $$K_{ol} = \infty$$

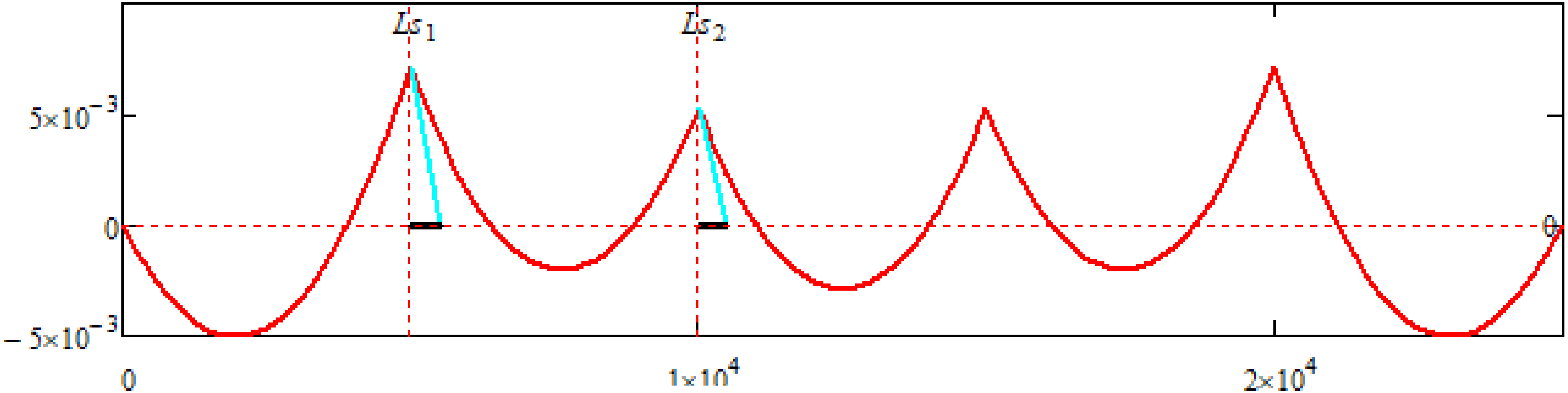


Moment distribution may be calculated …



- with FEM
- analytical
- approximated as continuous sheeting

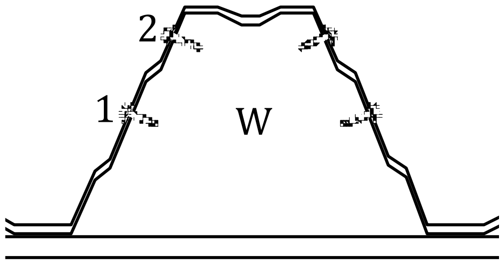
Example: Moment distribution for trapezoidal sheeting with single overlaps at the supports



total moment
moment in the overlap
overlap

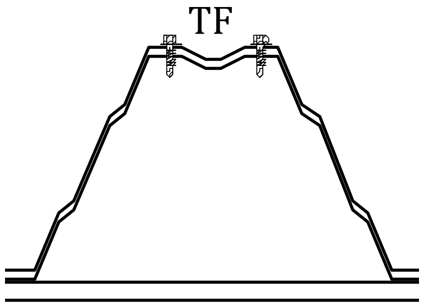
Placement of the screws at the end of the overlap

Double overlap, fasters in the webs



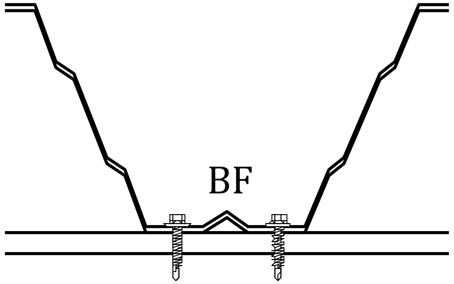
Small deformations in screw connection → increased support moment

Single overlap, fasteners in the profile top



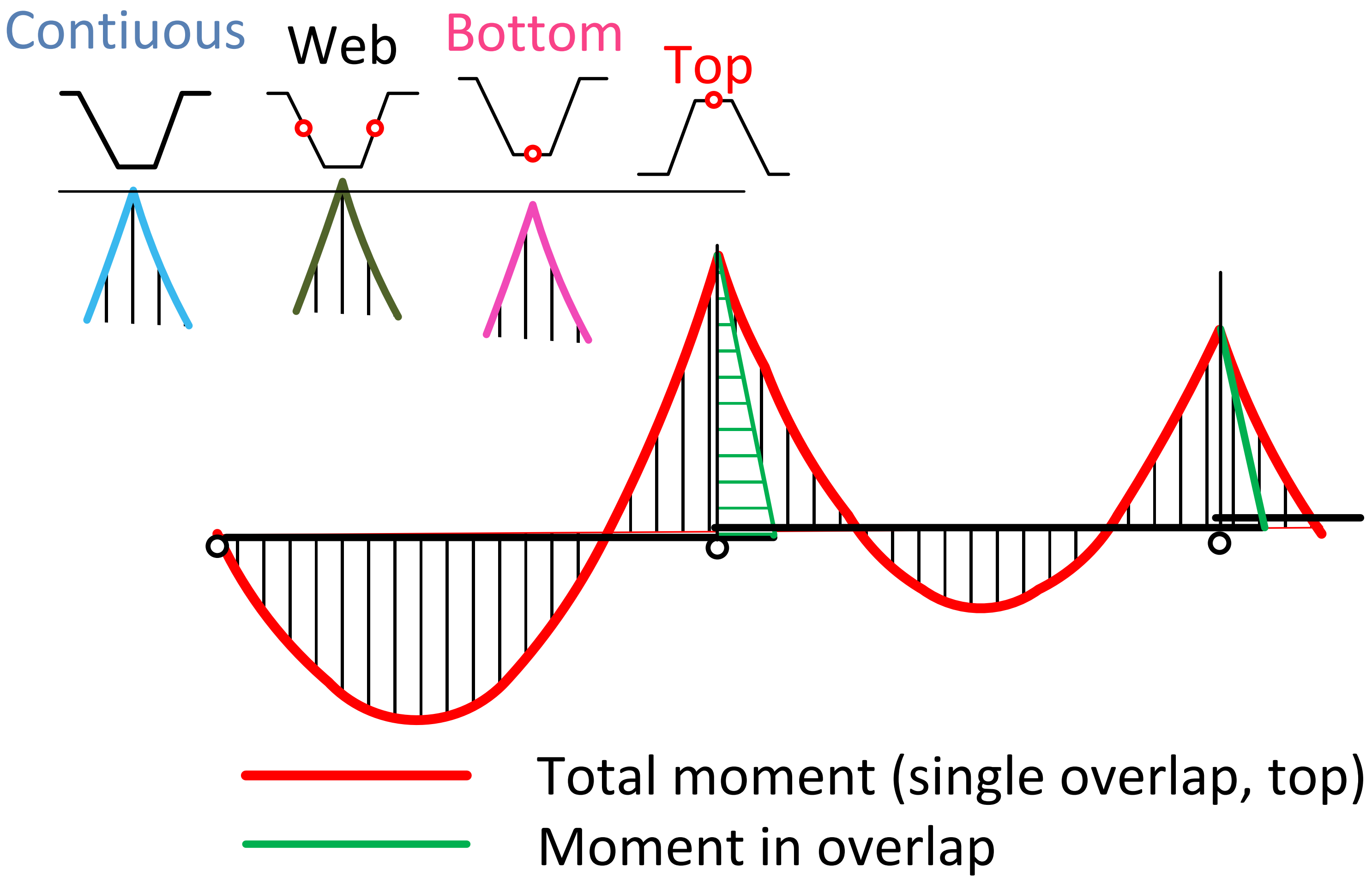
Large deformations in the screw connection → decreased support moment

Single overlap, fasteners in the profile bottom



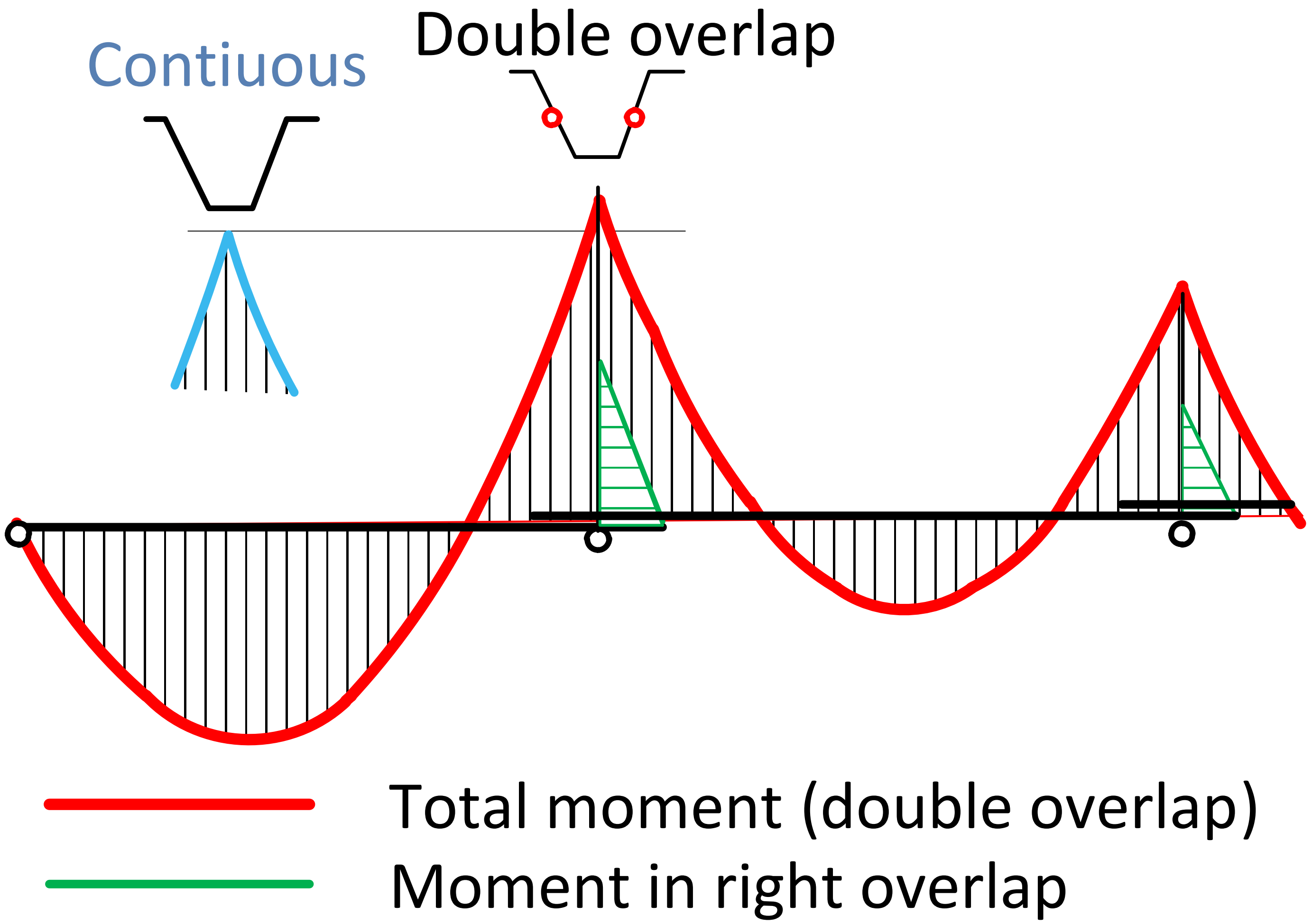
Some deformations in the screw connection → small influence on support moment

Moment for **single** overlap and continuous plate



The moment distribution depends on position of the screws:
- Single overlap with fasteners in the webs is about the same as for continuous sheeting.
- Fasteners in the top gives smaller support moments.

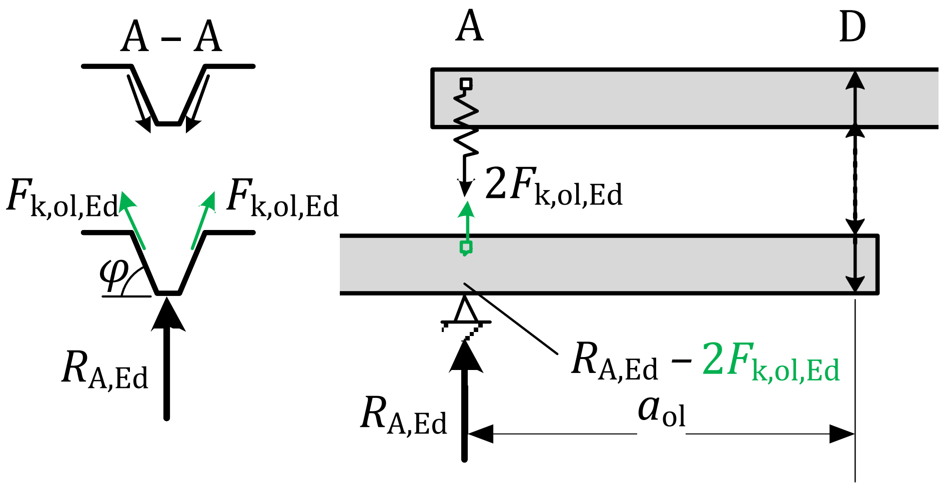
Support moment for **double** overlap



Double overlap give up to 10% larger moment at the support than for the continuous case

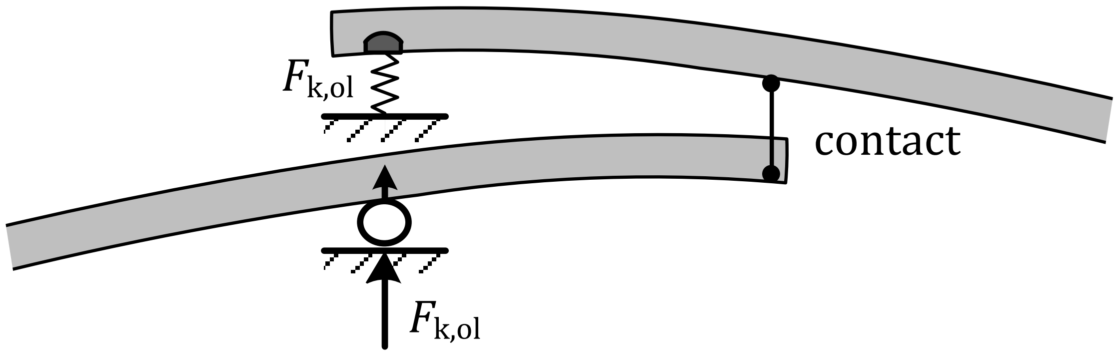
Forces in single overlap

Screws in the profile top or the webs



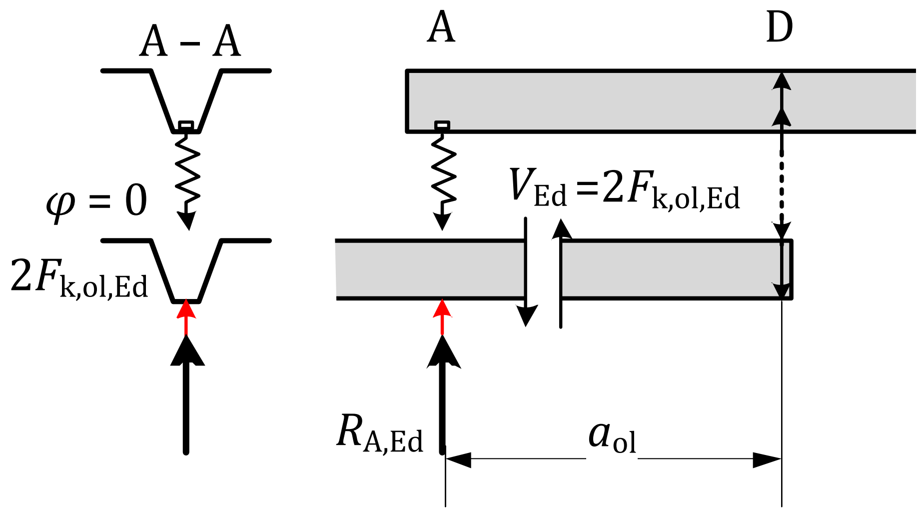
The upper sheeting lifts the lower in the webs thus decrease the support reaction force

Screws in the profile bottom



The bottom sheet is not lifted by the top sheet. Therefore, the bottom sheet must alone take the prying force $F_{\mathrm{k,ol}}$ which increase the support reaction force.

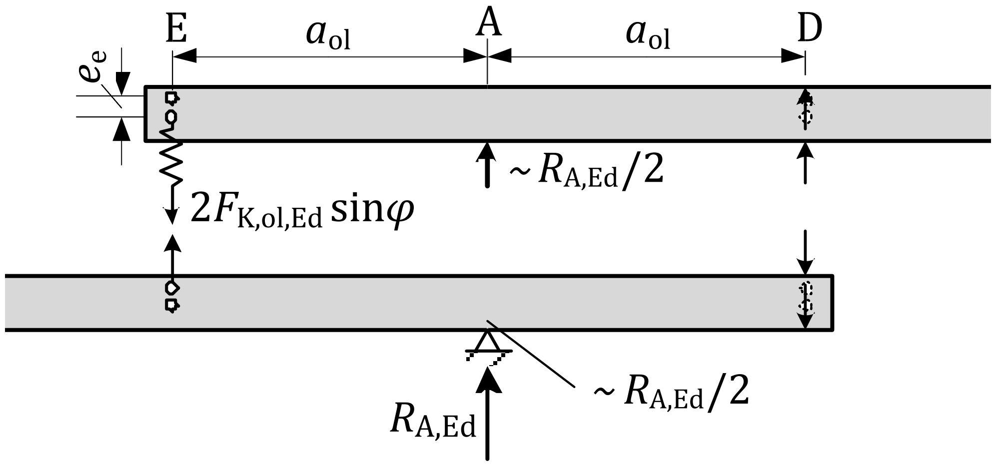
Shear forces in small overlap



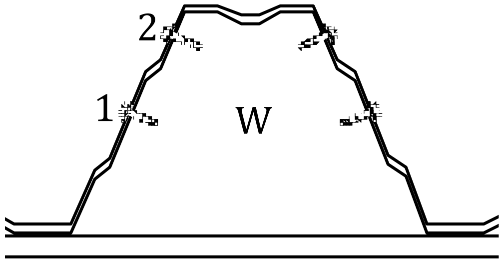
Shear force is almost never decisive for the trapezoidal profile sheet. An exception is the overlaps at high-profile sheets where the overlap restriction is sometimes not sufficient. Separate check may be needed in this case.

The fastener should be spread over the depth of the web to follow the shear stress distribution as much as possible. Otherwise there is a risk of failure as in Figure c. Of ergonometric reason, in practise, the

Double overlap



a)

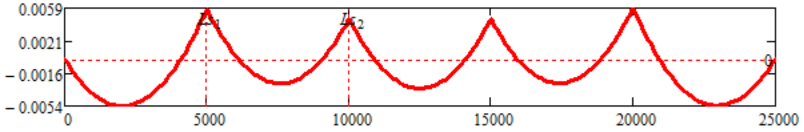


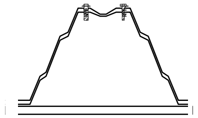
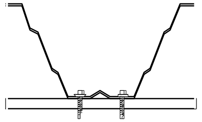
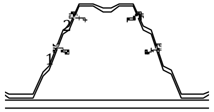
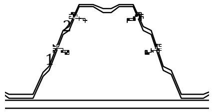
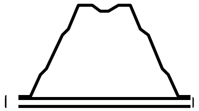
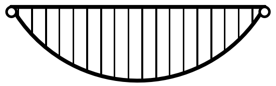
b)

c)

The fastener should be spread over the depth of the web to follow the shear stress distribution as much as possible, fig b). Otherwise, there is a risk of failure as in the figure c). Of ergonometric reason, in practise, the screws are set in between the web stiffeners, see Figure b.

Resistance depending on overlaps and screws



		Utilization interaction	ranking	Utilization end span	deflection
	Single overlap, profile top	0,61	**2**	0,75	0,62
	Single overlap, profile bottom	0,94	**5**	0,71	0,56
	Single overlap, webs	0,59	**3**	0,67	0,51
	Double overlap, webs	0,44	**1**	0,68	0,49
	Continuous sheeting	0,84	**4**	0,77	0,53
	Simply supported	-	-	1,09	1,04

Possible advantages with overlap systems

- thicker metal in the outer spans;
- double overlap at the outermost inner supports, simple otherwise;
- large spans;
- extra side overlaps (or double sheeting) in selected spans.

Thank you!

EUROCODES