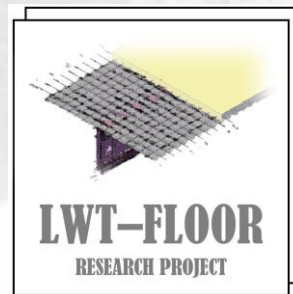


Design and fabrication of steel and composite girder specimens

Ivan Ćurković, Ivan Lukačević, Andrea Rajić, Vlaho Žuvelek

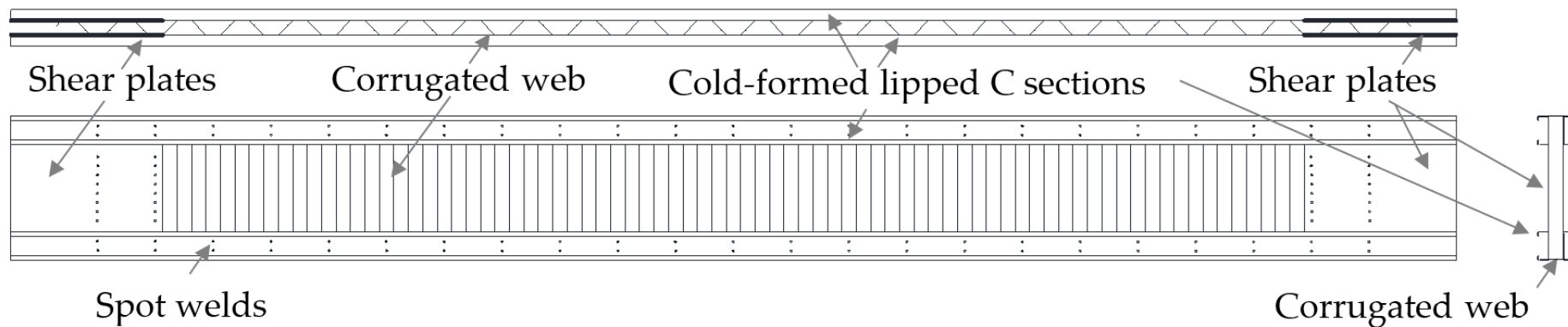


Contents

- LWT FLOOR idea
- Laboratory capabilities/constraints
- Design
 - Steel specimens
 - Composite steel and concrete specimens
- Fabrication
 - Steel specimens
 - Composite steel and concrete specimens

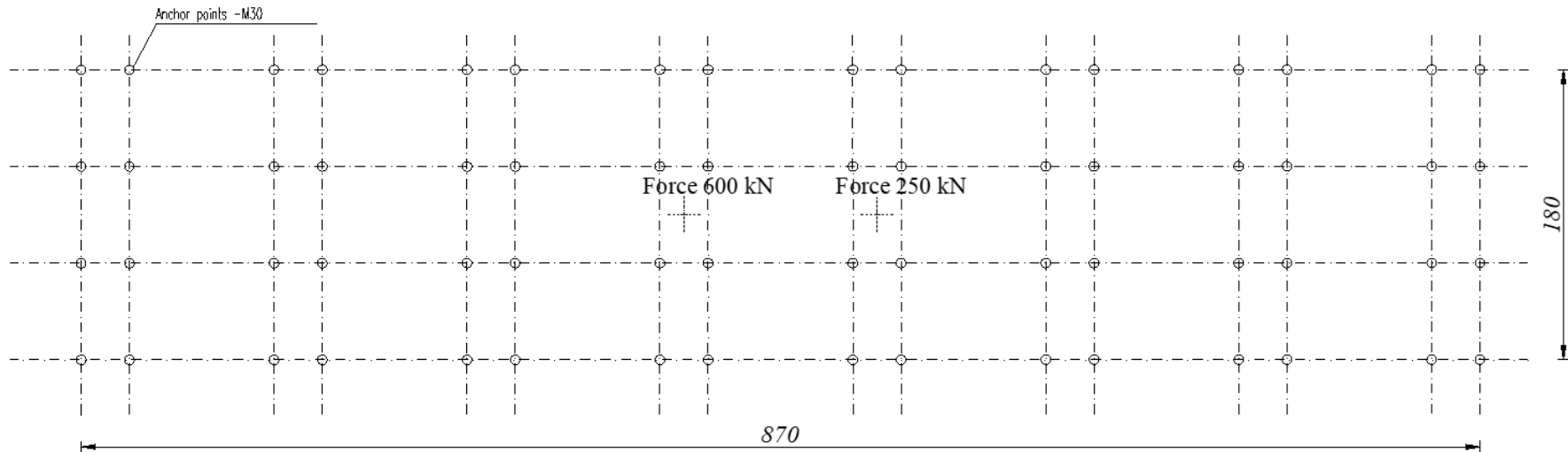
LWT FLOOR idea

- Ungureanu et al.



Laboratory capabilities/constraints

Floor Plan

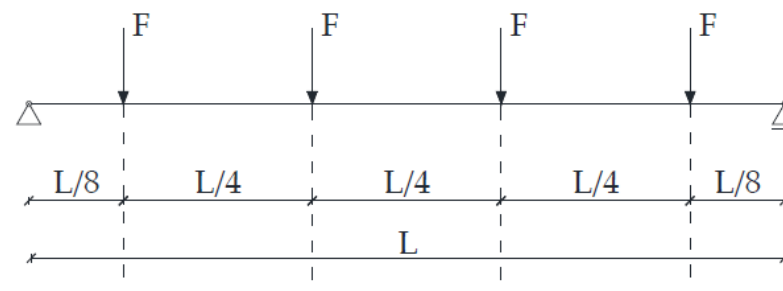
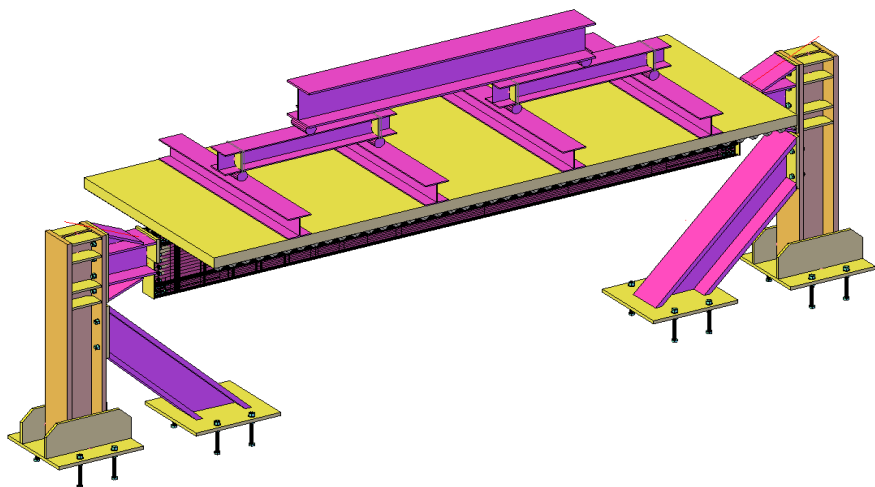
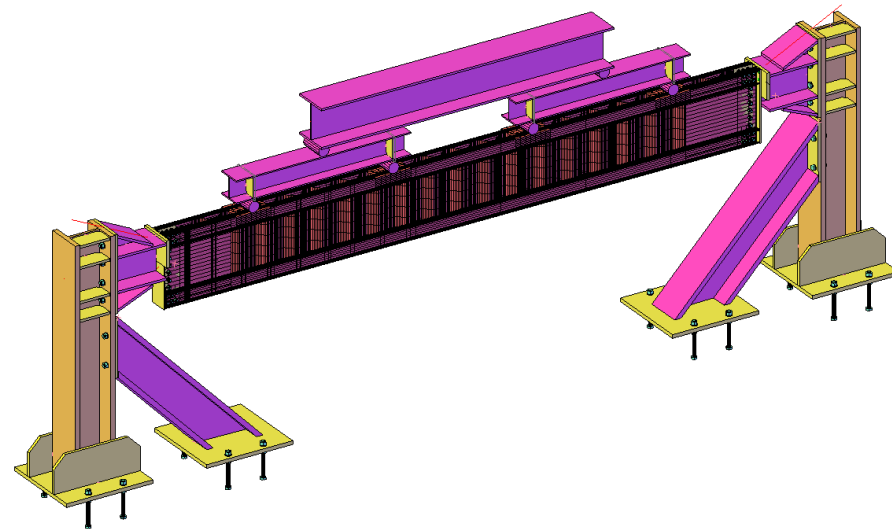


- Max. force 600 kN
- Max. displacement +/- 125 mm
- Overall height (deflection + specimen + load introduction system)
- Work/manipulation/storage area
- Singlegirder bridge crane / forklift payloads

Laboratory capabilities/constraints

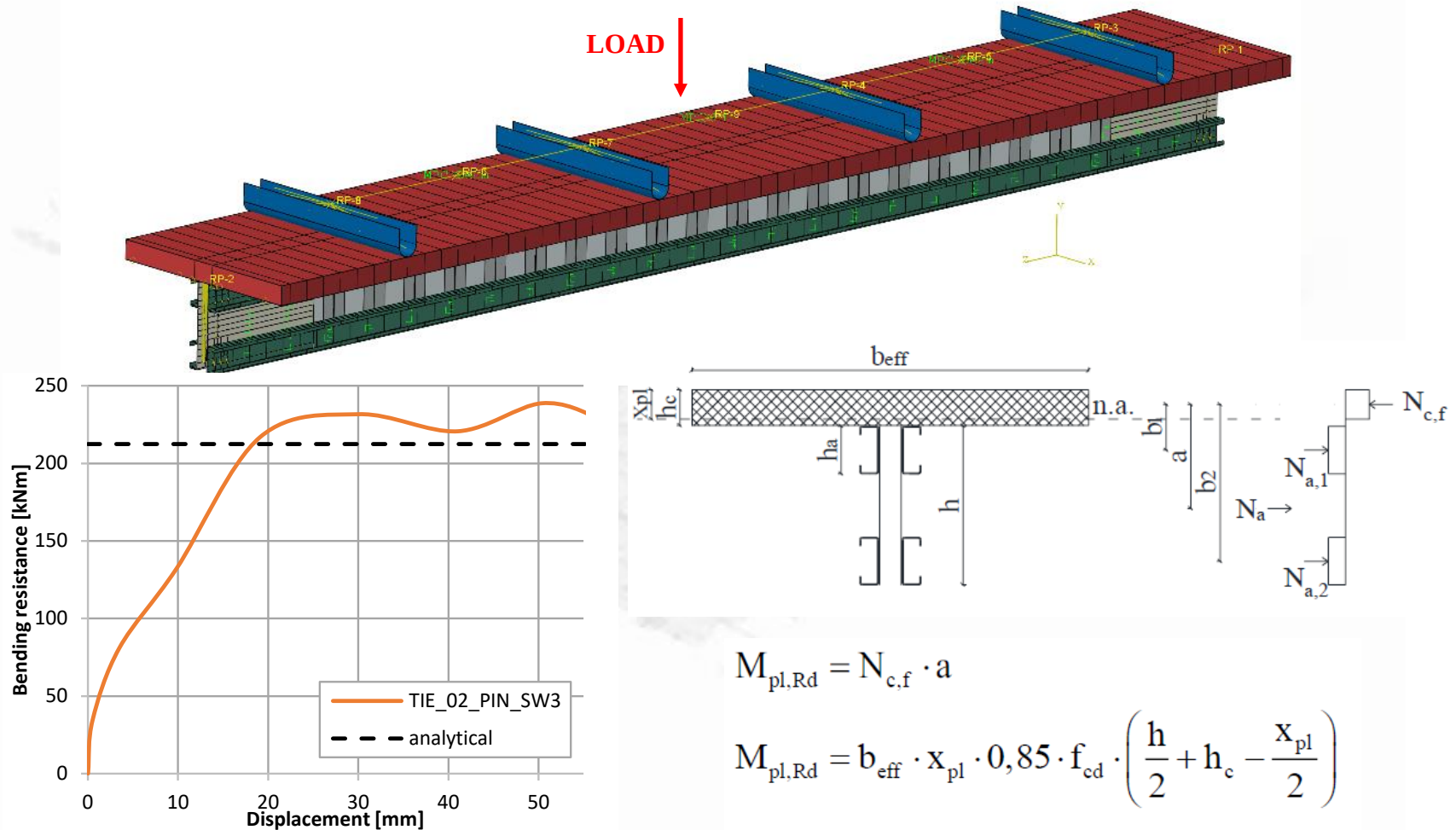
- Project application - idea

- Steel girder span: 6000 mm
- RC slab width: 1500 mm
- 4 load introduction points



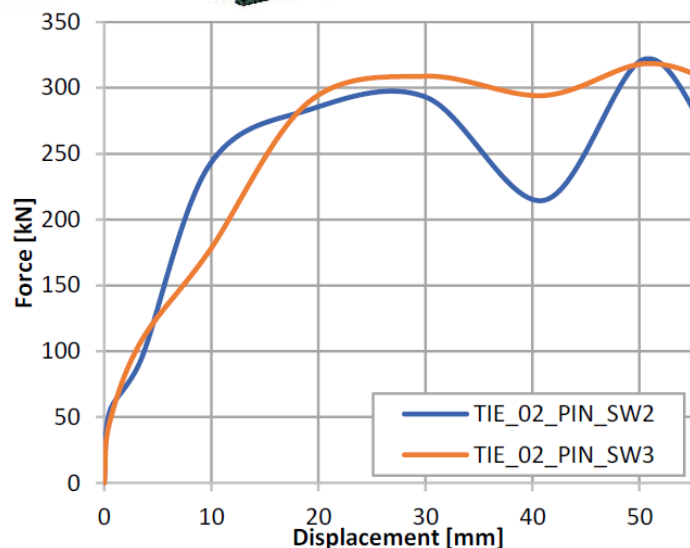
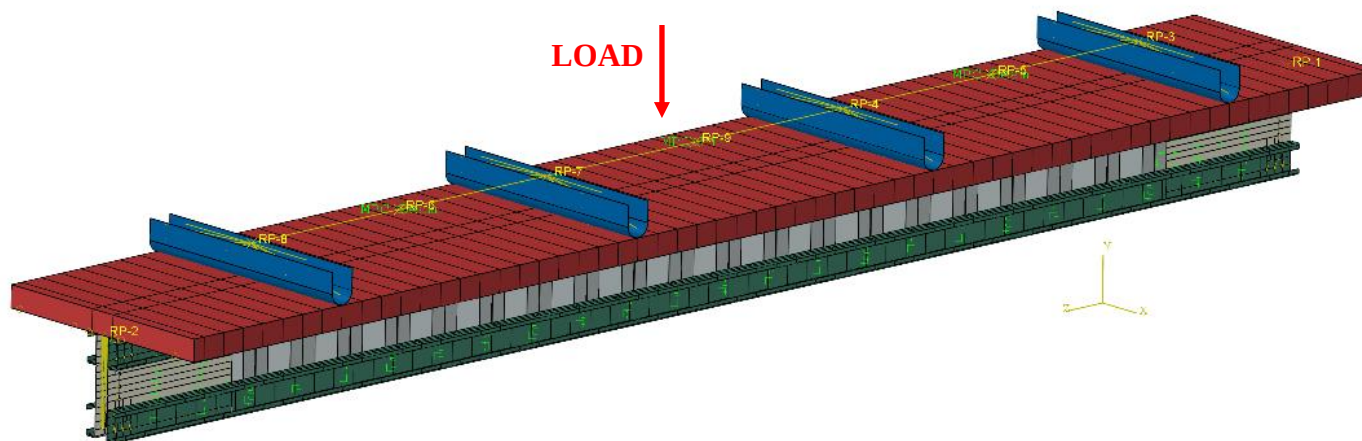
Laboratory capabilities/constraints

- Project application - idea
Preliminary FEM calculations of 400 mm composite girder (full slab; tie)

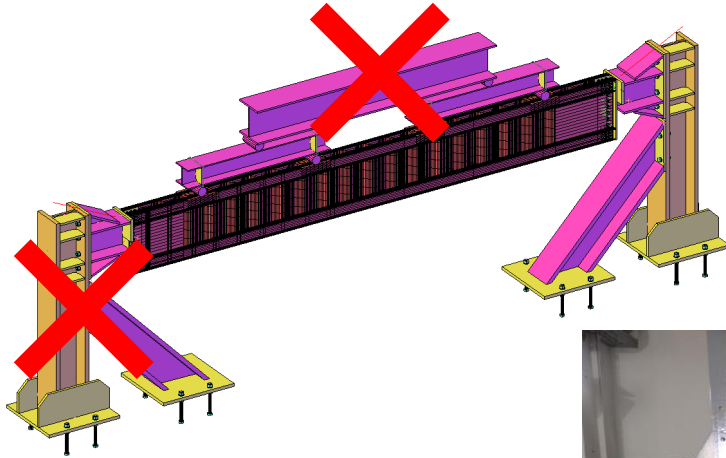


Laboratory capabilities/constraints

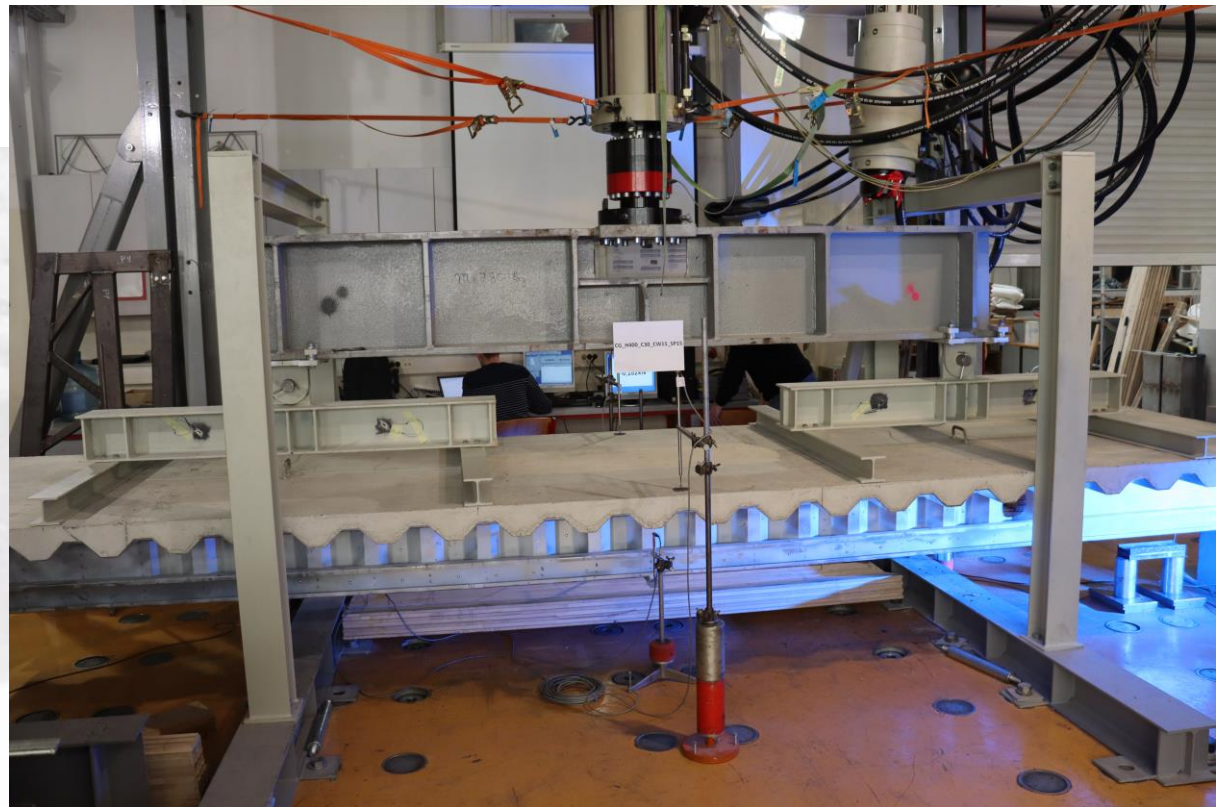
- Project application - idea
Preliminary FEM calculations of 400 mm composite girder (full slab; tie)

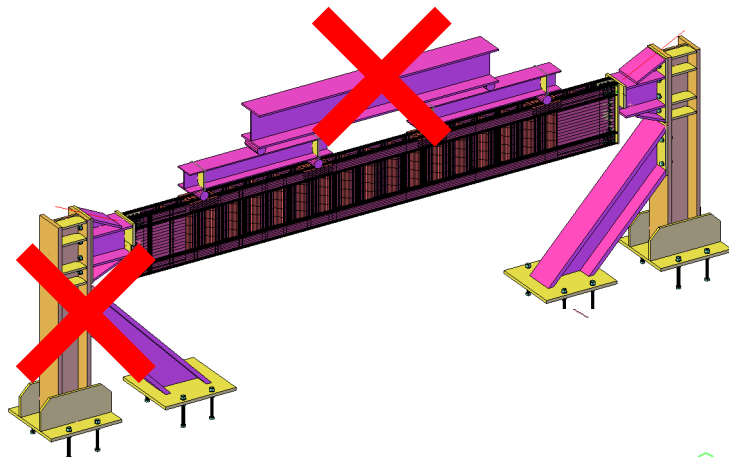


Lukačević, Ivan ; Čurković, Ivan ; Rajić, Andrea ; Čudina, Ivan // Numerical analysis of lightweight cold-formed steel- concrete composite floor system // 3rd International Conference on Lightweight Materials & Engineering Structures LIMAS – 2021 Proceedings / Das, Purnendu (ur.). Glasgow: ASRANet Ltd, 2021. str. 20-28

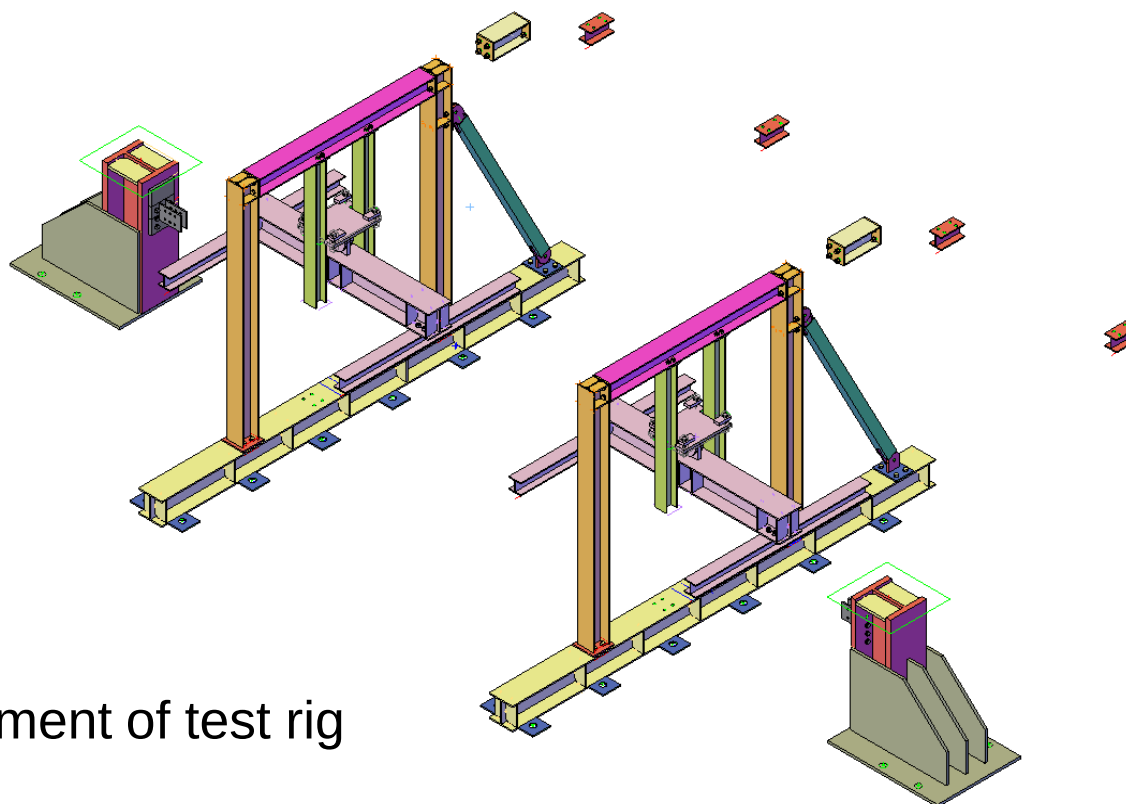


- Steel girder span: 6000 mm
- RC slab width: 1500 mm
- 4 load introduction points





- Steel girder span: 6000 mm
- RC slab width: 1500 mm
- 4 load introduction points



Final arrangement of test rig

Clear area in-between test rig
elements

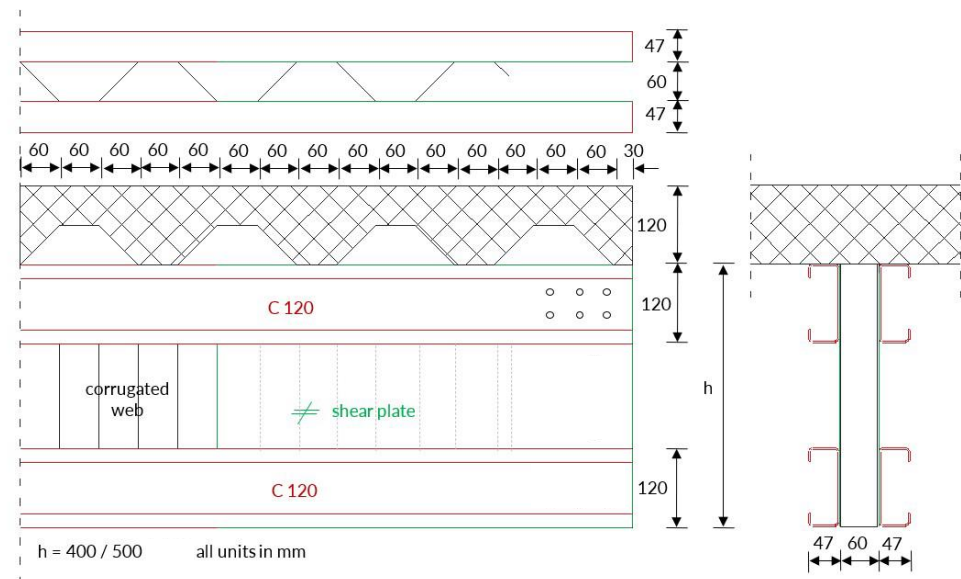


CFS girder height 400 - 500 mm

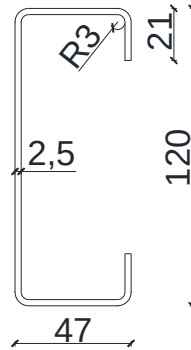
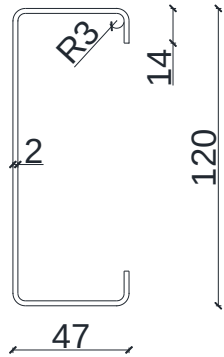
+

RC slab with ribs 120 mm

Simple support
(Nominally pinned)

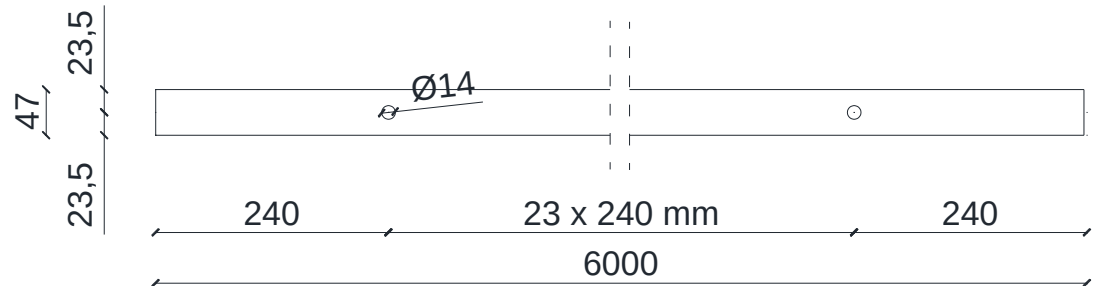


- CFS C profiles



- Geometry according to available profile catalogue
- 4 equal C profiles used for girder formation

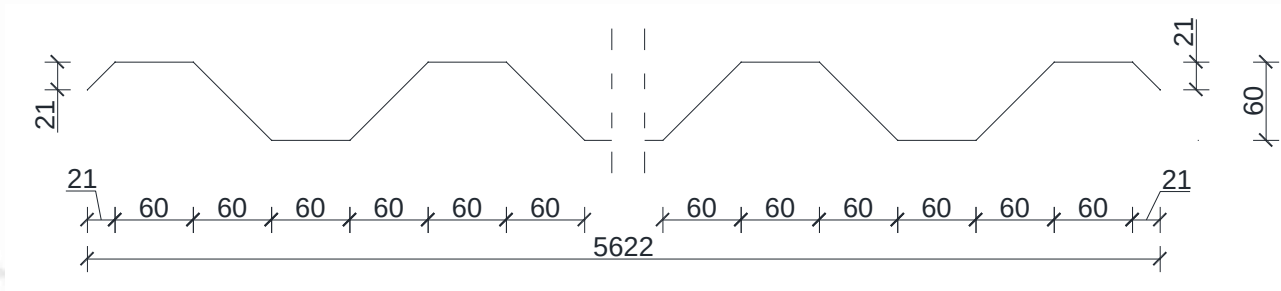
- Holes arrangement for girder top flange profiles



Side view

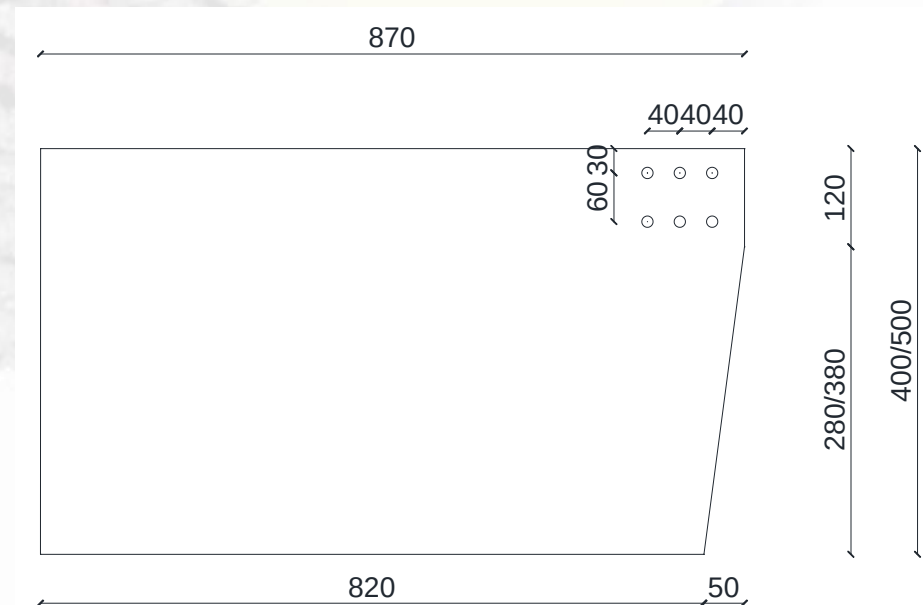


- CW sheeting



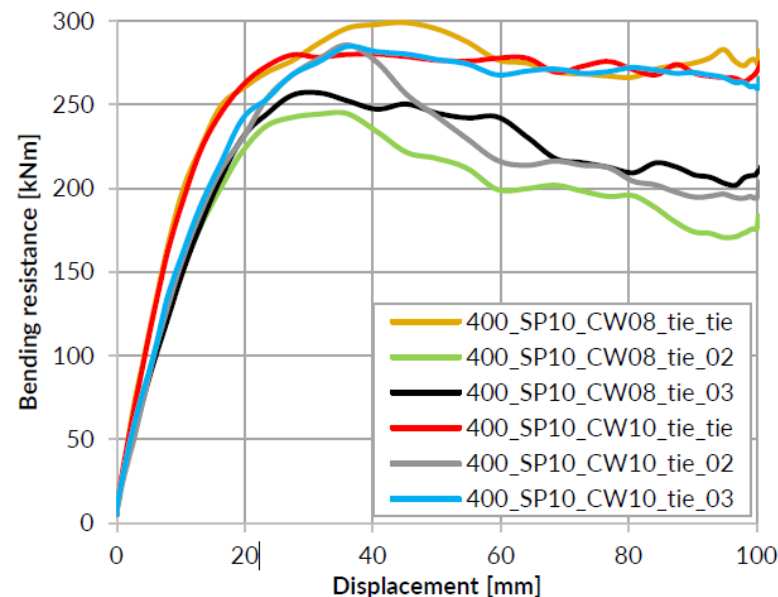
➤ Thickness: 1,0 mm; 1,5 mm

- Shear plate



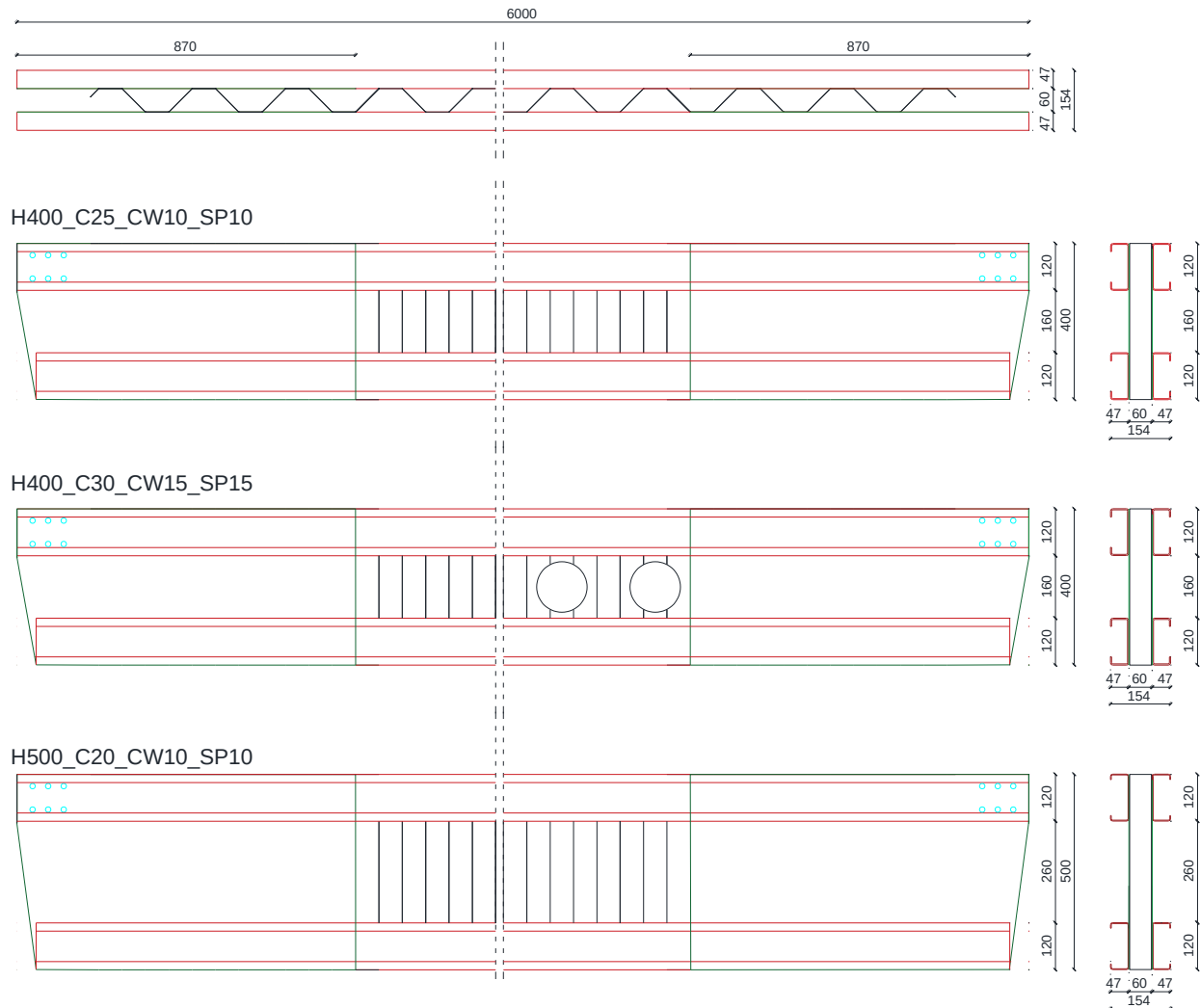
➤ Thickness: 1,0 mm; 1,5 mm

- Steel girder assembly
 - Connected to CW and shear plate using spot welds
 - 3 spot welds per CFS profile height
 - 6 girders in total (3 pairs of nominally different specimens)



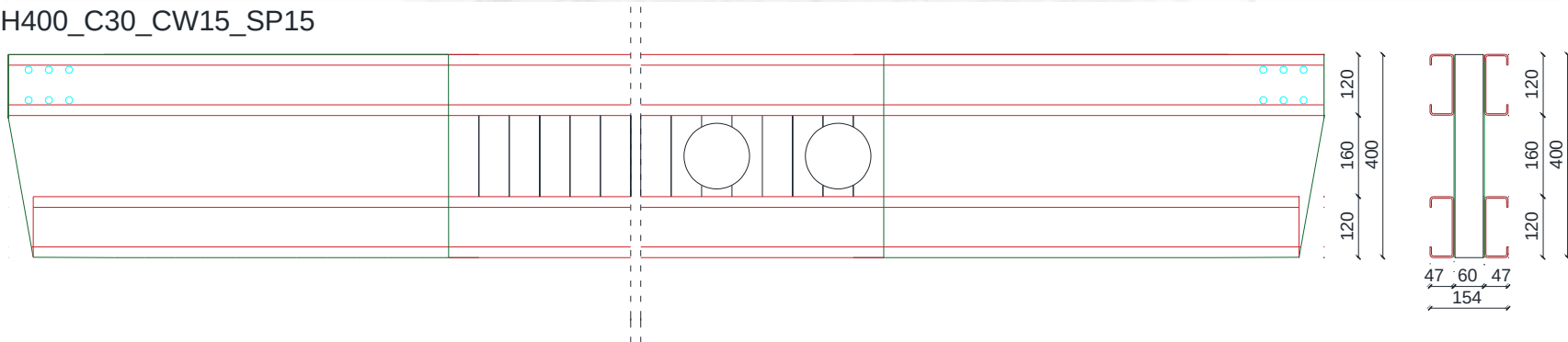
Lukačević, Ivan ; Ćurković, Ivan ; Rajić, Andrea ; Žuvelek, Vlaho, Parametric Finite Element Analyses of Lightweight Cold-formed Steel-concrete Composite Floor Beams // ce/papers, 5 (2022), 4; 836-846. doi: 10.1002/cepa.1826

- Steel girder assembly



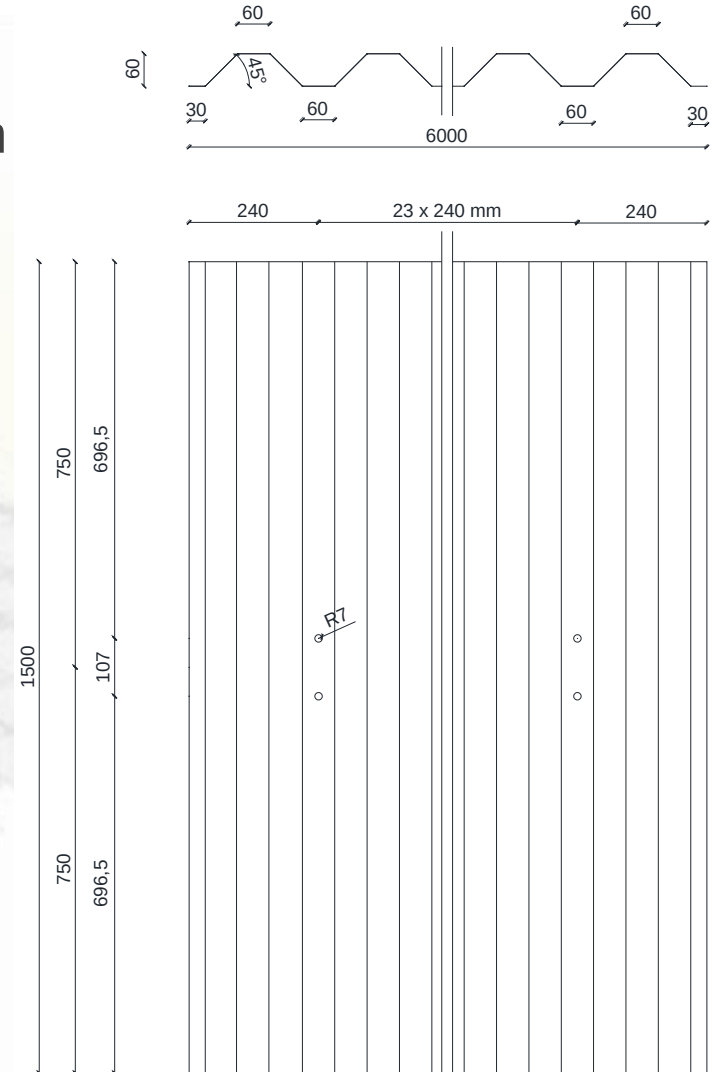
- Steel girder assembly
 - Two circular web openings (130 mm diameter)
 - Do not require stiffening
 - Position: one CW end (high shear force)
 - One steel and one composite specimen

H400_C30_CW15_SP15



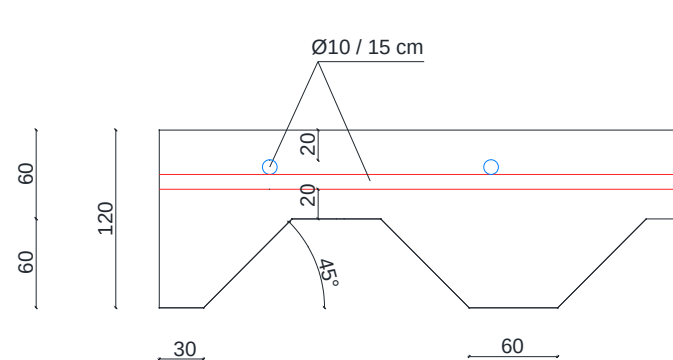
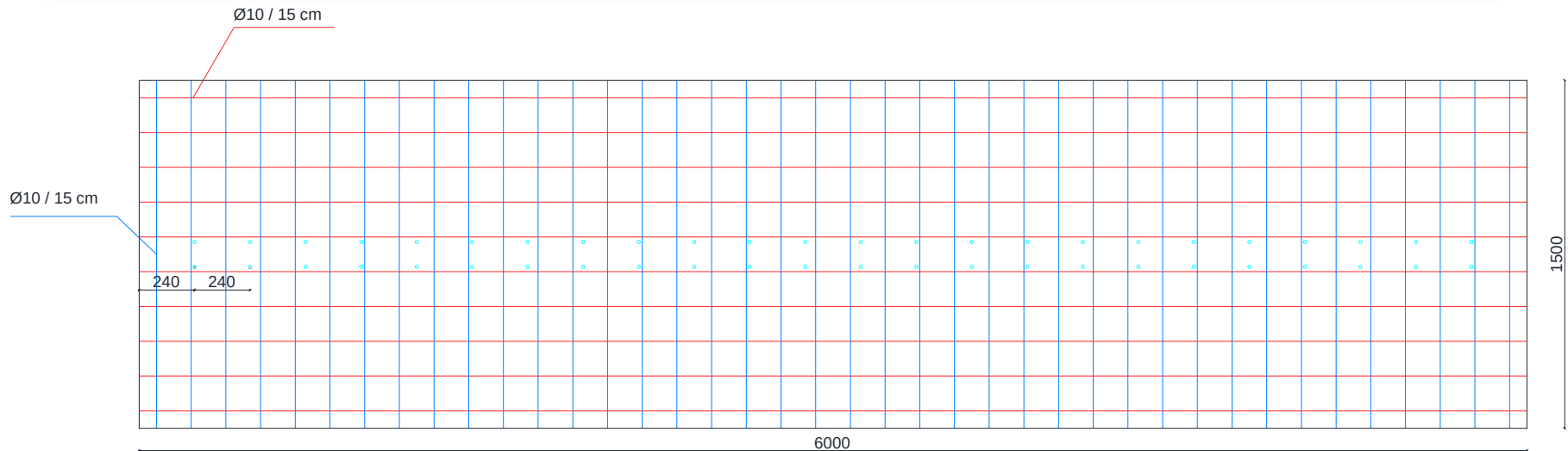
- RC slabs

- Profiled sheeting – 6000 x 1500 x 1 mm
- 2 holes per rib spaced 107 mm apart
- Hole diameter 14 mm



- RC slabs

- Reinforcement - bars

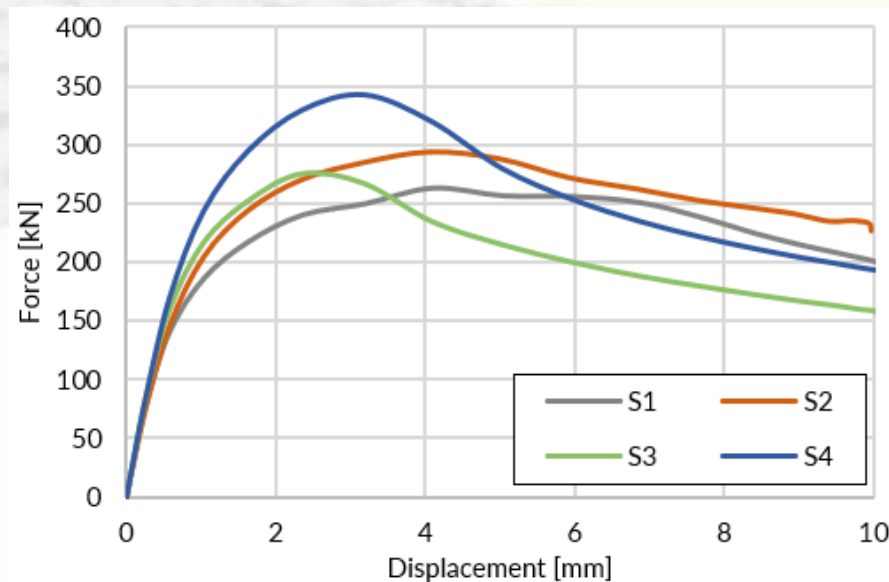


- RC slabs

- Shear connection

- M12 bolts, 8.8, $h_b = 110$ mm

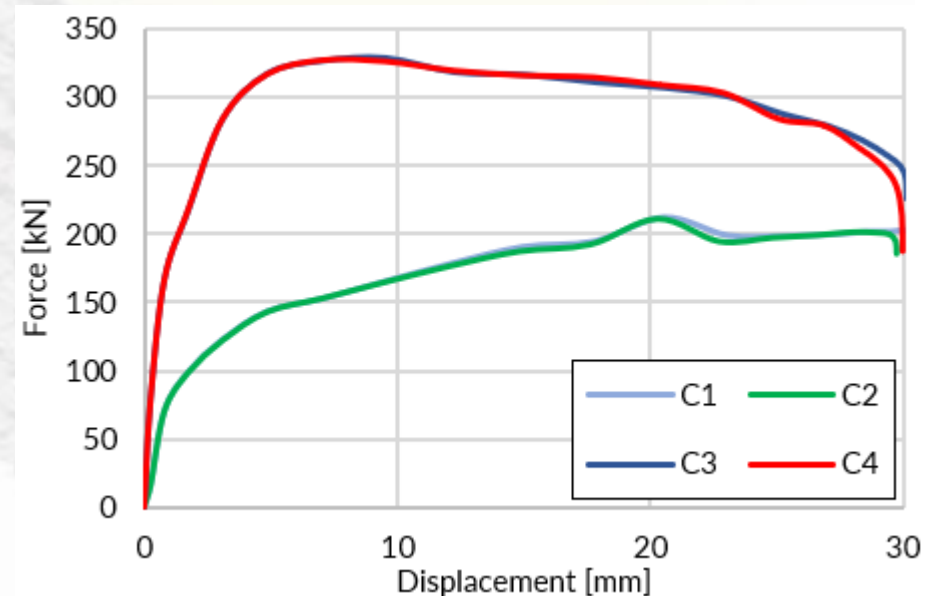
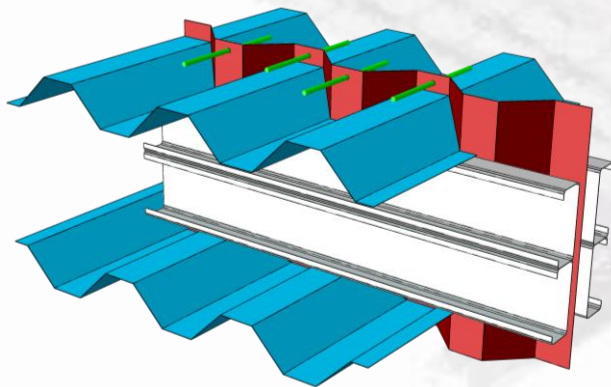
- $h_{sc} \geq 84$ mm (= 60 mm + 2d)



Ćurković, Ivan ; Lukačević, Ivan ; Žuvelek, Vlaho ; Rajić, Andrea Numerical Investigation of Shear Connection in Cold- formed Steel-concrete Composite Beam // ce/papers, 5 (2022), 4; 847-856. doi: 10.1002/cepa.1827

- RC slabs

- Reinforced concrete
 - Lightweight floor system
 - LC 25/28



Ćurković, Ivan ; Lukačević, Ivan ; Žuvelek, Vlaho ; Rajić, Andrea Numerical Investigation of Shear Connection in Cold- formed Steel-concrete Composite Beam // ce/papers, 5 (2022), 4; 847-856. doi: 10.1002/cepa.1827

- Corrugated web (CW)
 - Bending length limit
 - Each CW – three piece part
 - Connected using spot welds – 4/5 per height



Fabrication

- Shear plate (SP)
 - Connected using spot welds – 4/5 per height



Fabrication

- Steel girder assembly

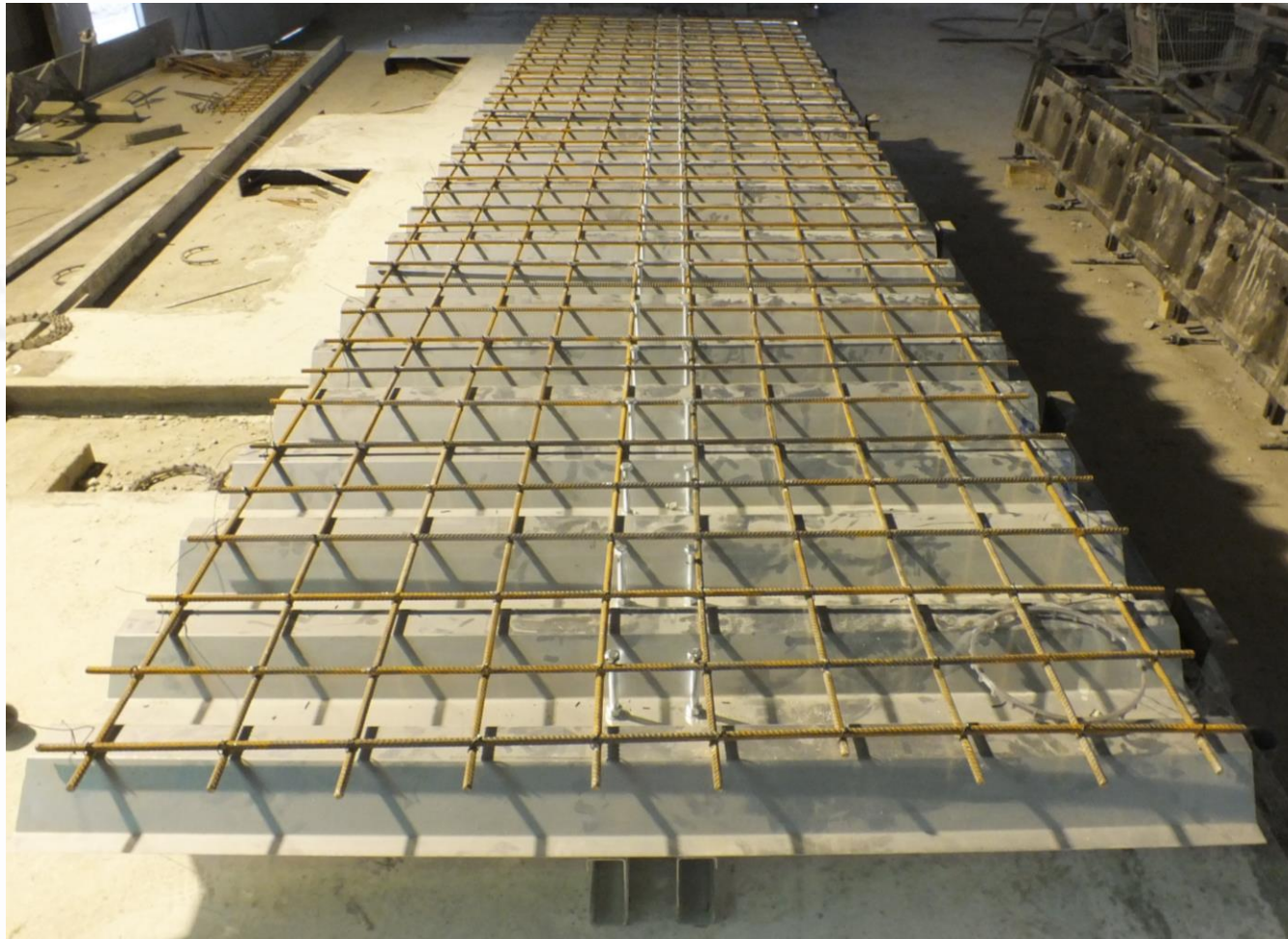


Fabrication

- Steel girder assembly
 - 3 spot welds per CFS
 - C profile height

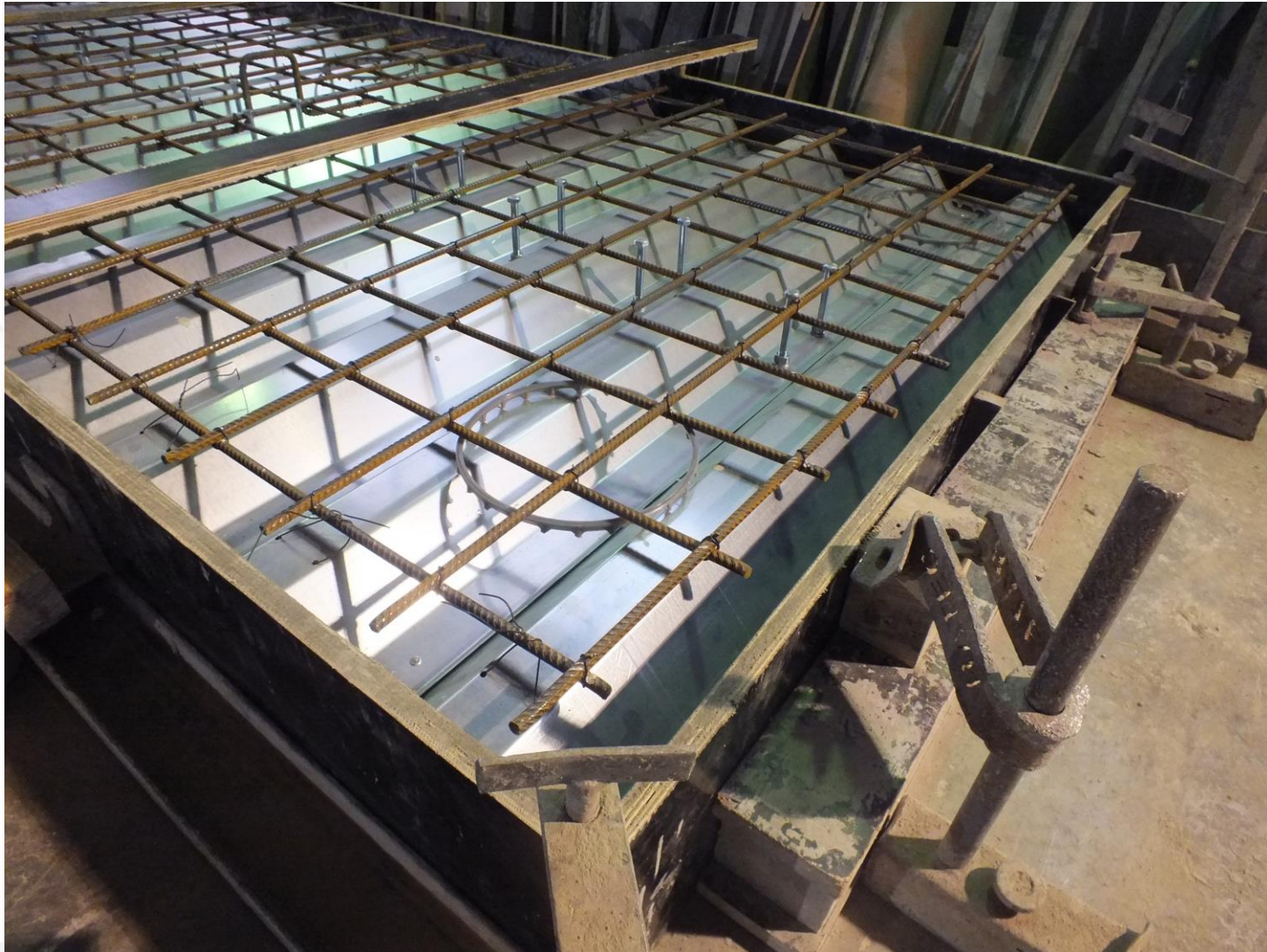


- RC slab



Fabrication

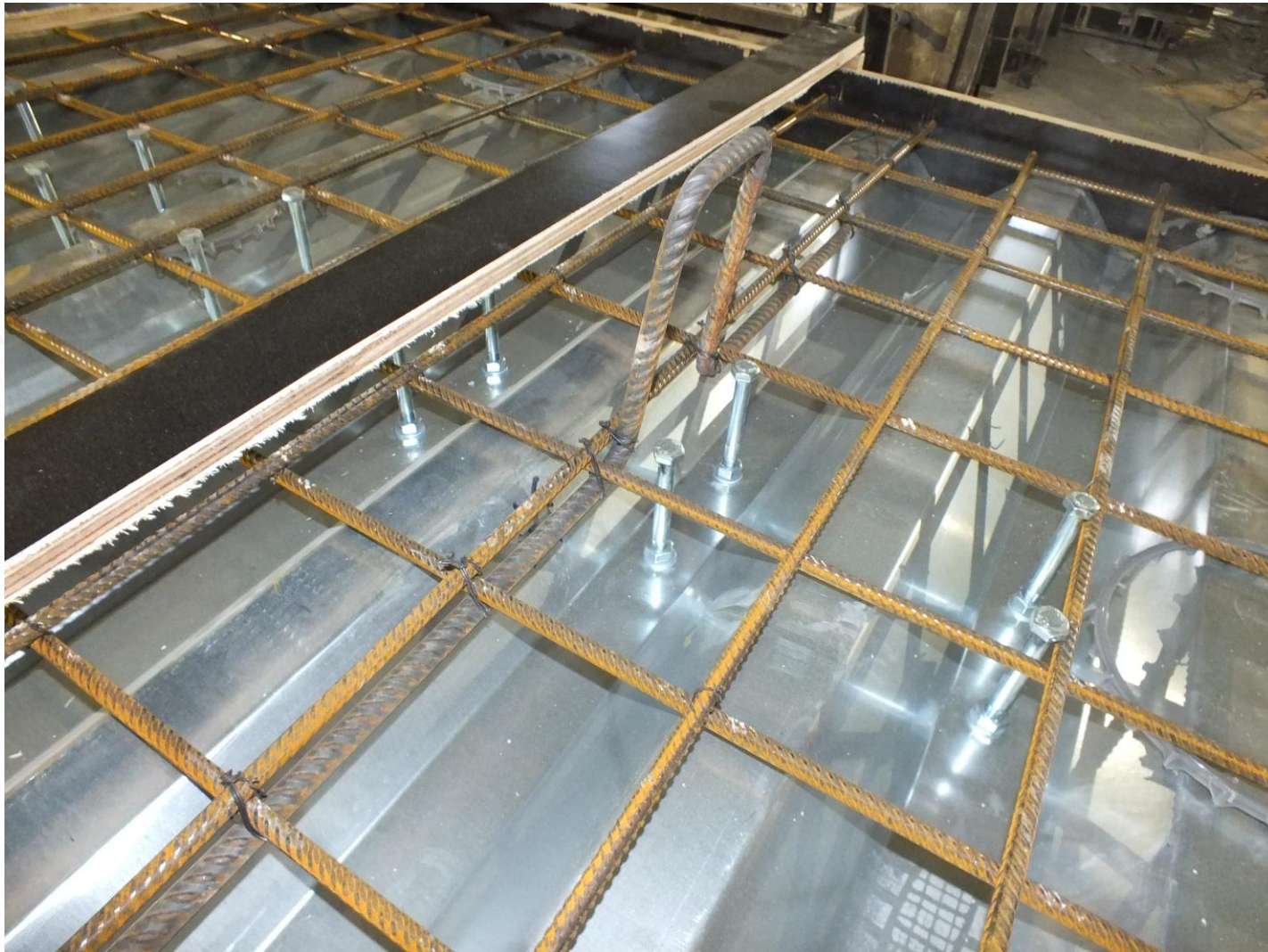
- RC slab



- RC slab



- RC slab



Fabrication

- RC slab
 - LC 25/28 preparation



Fabrication

- RC slab



Fabrication

- RC slab

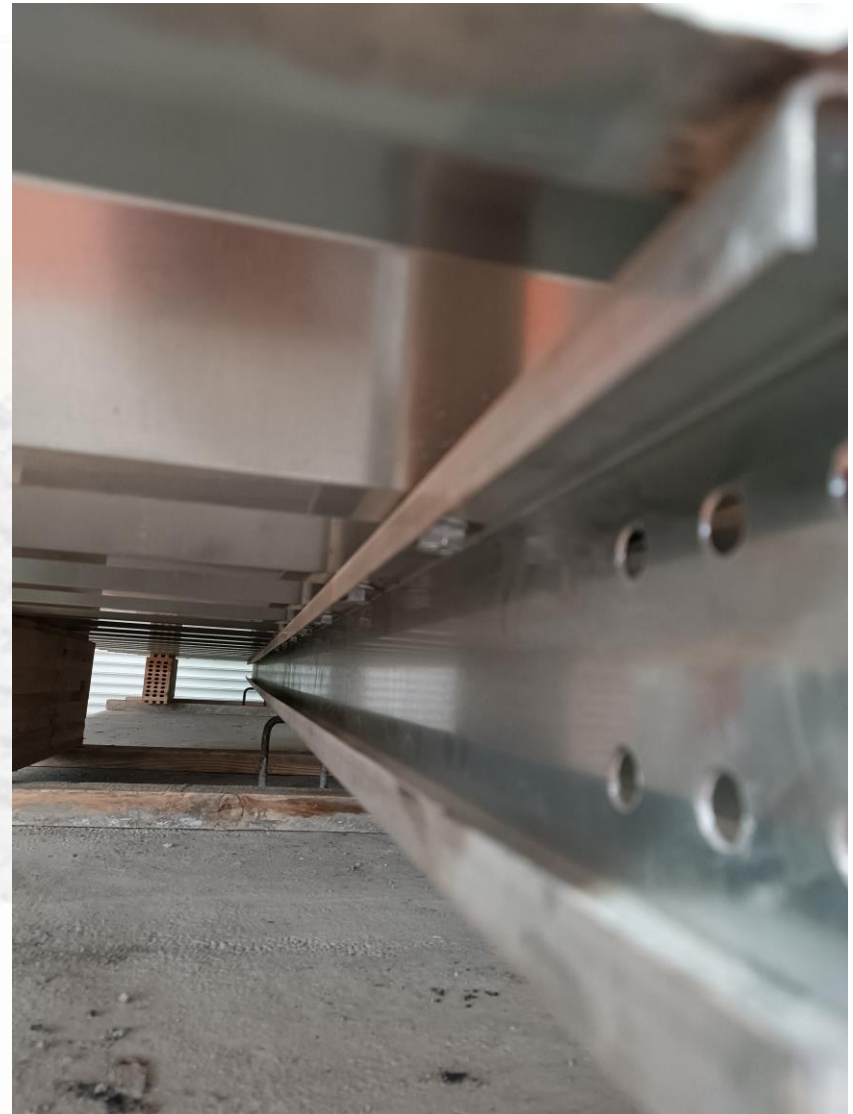
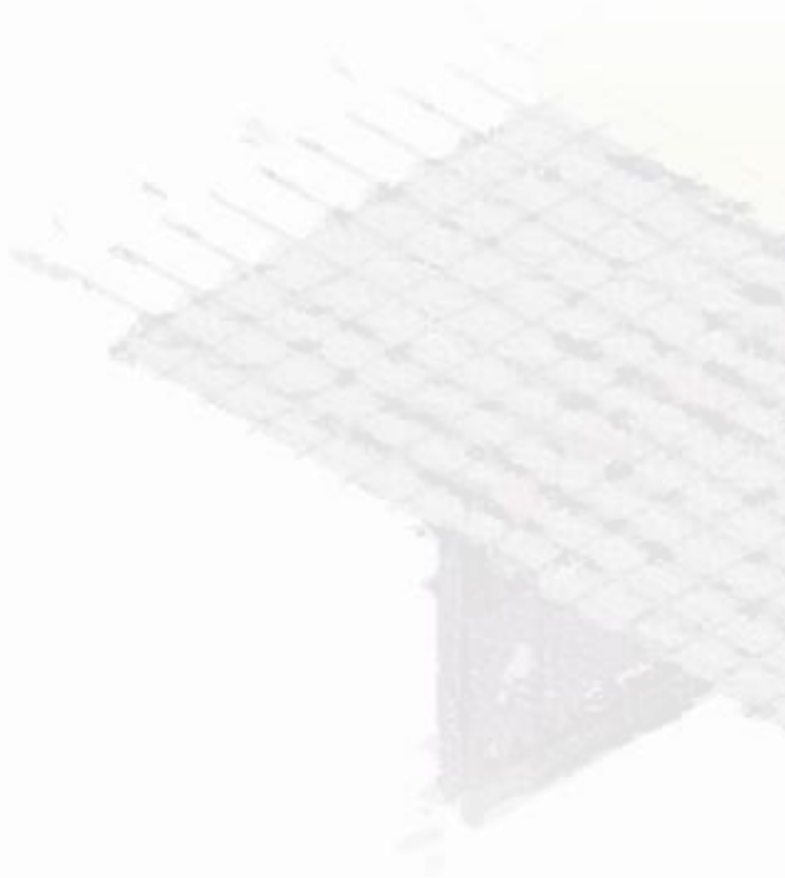


Fabrication

- RC slab



- LWT-FLOOR assembly



Fabrication

- LWT-FLOOR assembly



Fabrication

- LWT-FLOOR assembly



- LWT-FLOOR



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