Tensile cracking of ventilated rendered rain-screen cladding systems

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Ventilated rendered rain-screen cladding systems (VRRC)

- Increasing market shares in the Nordic countries due to moisture problems encountered with ETICS
- Available technical information is limited – lack of understanding among practitioners
- Cracks undesired from both moisture and aesthetic point of view
Components in a ventilated rendered rain-screen cladding system

1. Lath – metal or wood
2. Weather barrier
3. Cement based board
4. Render
5. Surface reinforcement
6. Exterior finish
7. Joint filler and reinforcing strip

Source: Knauf Danogips

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Tensile cracking at joints on timber laths

• Questions treated in the present paper:

  - At what levels of imposed deformations will cracks occur?

  - Do joints act as areas prone to cracking?

  - How do deviations from standard execution influence cracking of VRRCs?
Experimental details
Experimental details

Specimens
- Cement boards with surface reinforcement of glass fibre mesh
- Render of premixed cement mortar with dispersed fibre reinforcement and additives of plastic dispersion
- Joint reinforcement – strip of glass fibre mesh
- Surface reinforcement – glass fibre mesh
- Joint gap – partially filled with filler material

Testing machine
- MTS – displacement control (0.005 mm/s)

Measurement
- Linear variable displacement transducers (LVDT) – attached in the vicinity of the joint

Test plan
- Standard execution – 3 specimens
- Omitted joint reinforcement – 4 specimens
- Omitted surface reinforcement – 4 specimens

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Results:
Series 1 - standard execution

- Elasto-plastic behaviour of the joint area, without visible cracks at low levels of imposed strain
- The surface reinforcement results in limited crack width and cracks distributed over the entire specimen
Results:
Series 2 – specimens with omitted joint reinforcement

- Omitted joint reinforcement make cracks appear earlier in the vicinity of the joint
- Over-all crack pattern is similar to that observed on standard specimens
Results:
Series 3 – specimens with omitted surface reinforcement

- Omitted surface reinforcement results in fewer and wider cracks
- Higher stiffness due to homogeneous (undisturbed) render layer
Discussion

- Risk of cracking in VRRCs executed according to standard procedures
  - Moisture movement in cement based boards ~0.8 mm/m
  - Moisture movement in render > 0.7 mm/m
  - Future research – simulation of temperature and moisture conditions and related movements

- Joint areas are not more prone to cracking than the remainder of the façade – when properly detailed

- Certain deviations from standard execution can have a detrimental effect on cracking properties of VRRCs
  - Omitting surface reinforcement results in large cracks

- Research design
  - Loading through steel plates induces stress concentrations
  - Long term effects, such as creep, might be significant – not investigated in this study
  - The beneficial effect of plastic additives might diminish with time – more brittle render?
Possible practical implications

- Joint reinforcement might be omitted – fasten all board extremities to lath
  - Shorter production process
  - Lower costs?

- Standard renders can replace renders with dispersed fibre reinforcement – surface reinforcement can be sufficient
  - Lower costs
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