Image-based monitoring and damage detection in materials and structures

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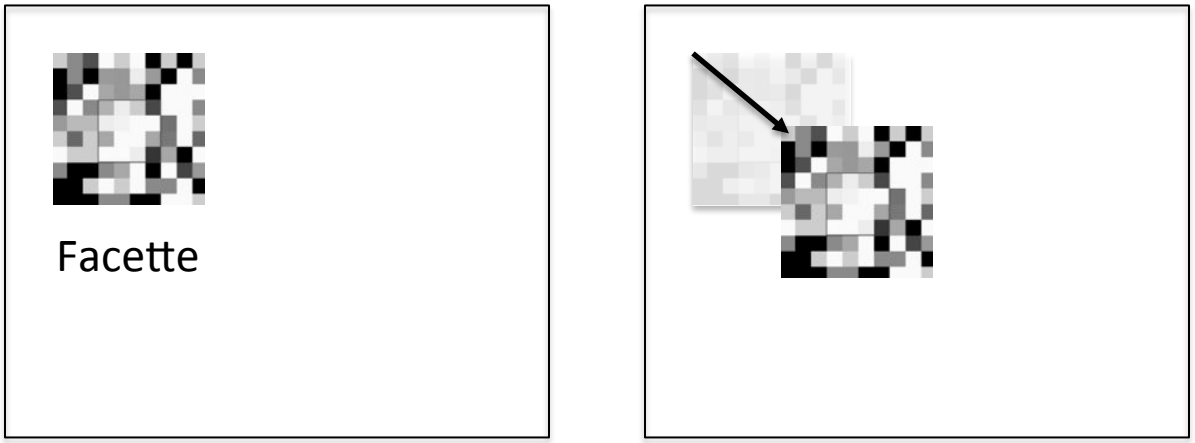
Overview

- Working principle
- Specimen preparation, equipment and processing
- Examples

- Fatigue resistance of high strength steel cables
- Inspection of span 42 at Størstromsbridge
- Prospective monitoring of Marmorkirken

Digital image correlation (DIC)



Initial stage

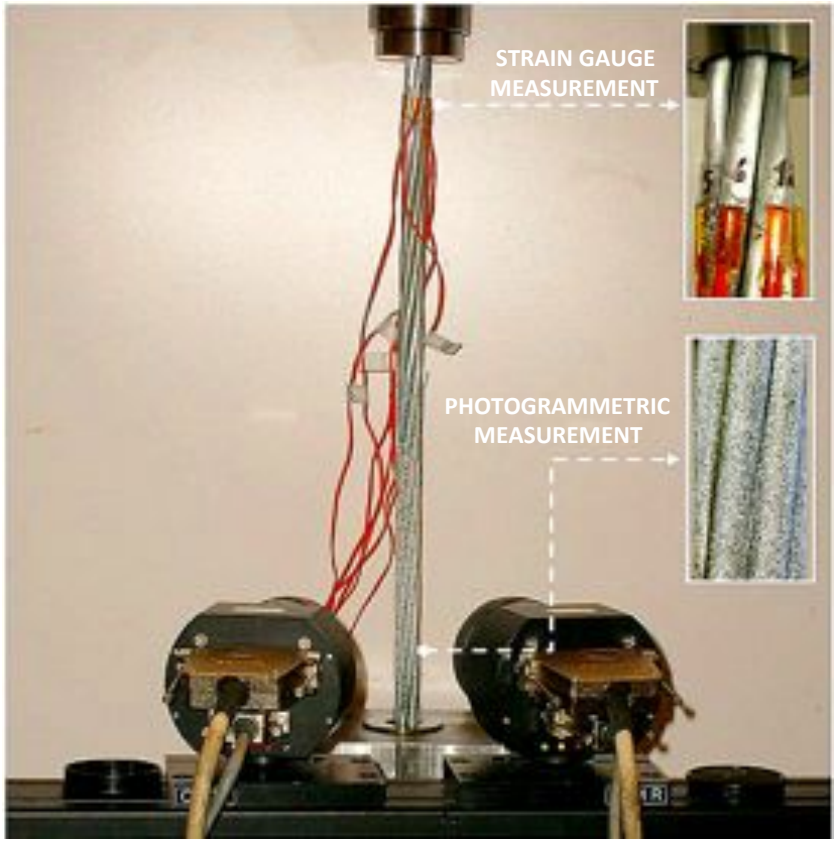
Deformed stage

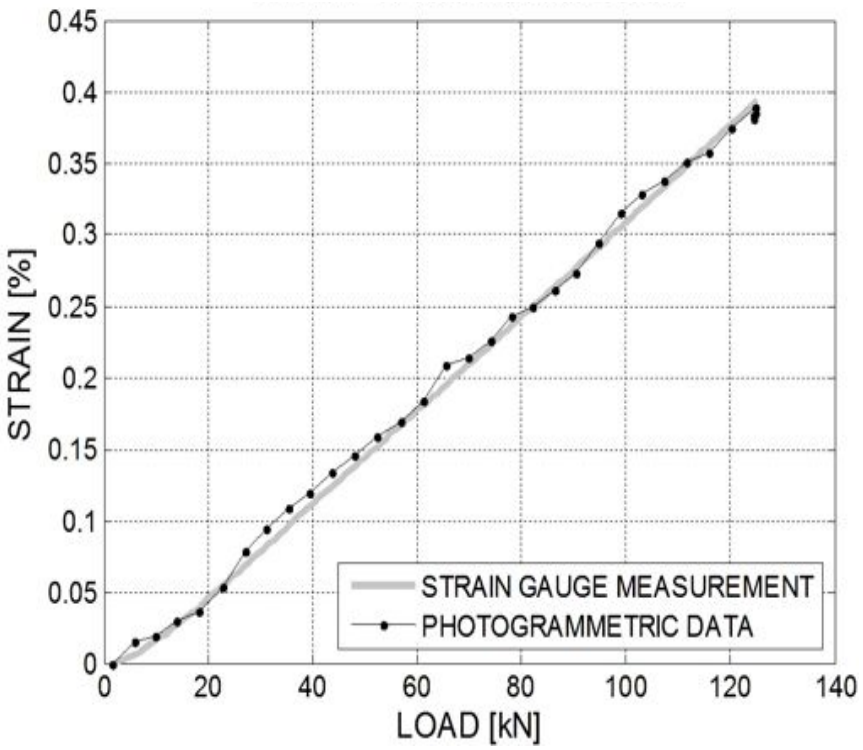
Equipment

- High resolution camera or flatbed scanner
- Two cameras for 3-D imaging
- High speed camera
- Microscope
- Computer processing (CPU, RAM, video card)
- Software (open source, commercial)

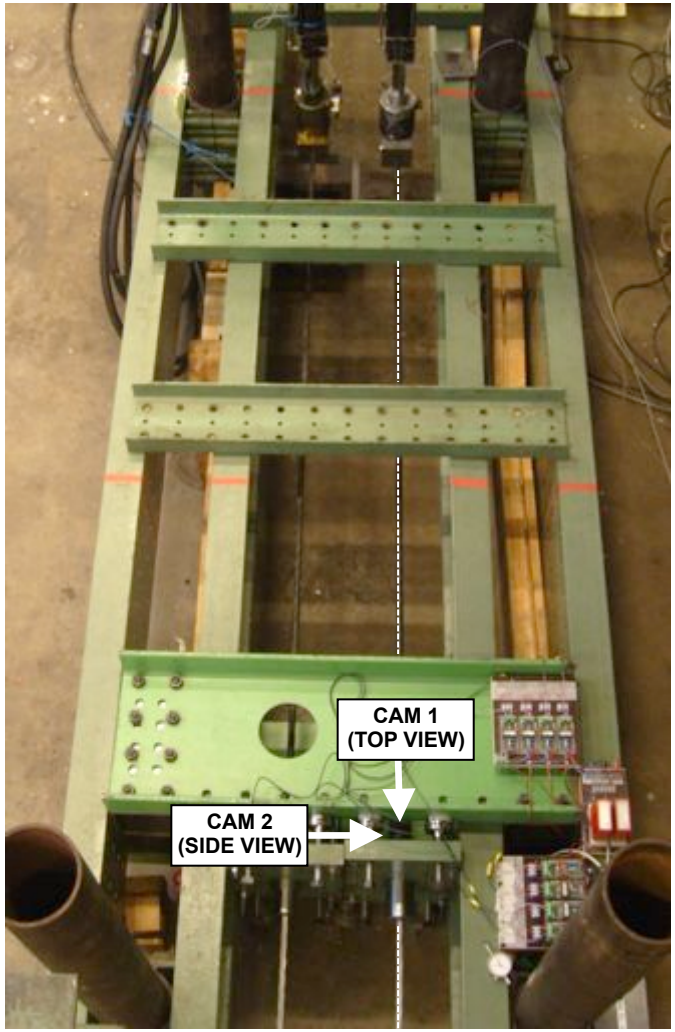
Steel monostrand in tension

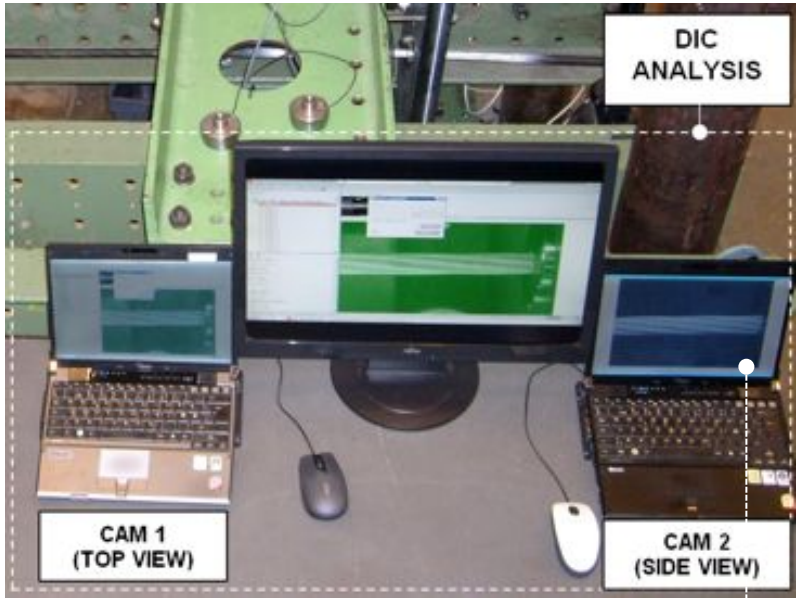
Strain gauge measurement vs. Photogrammetric data

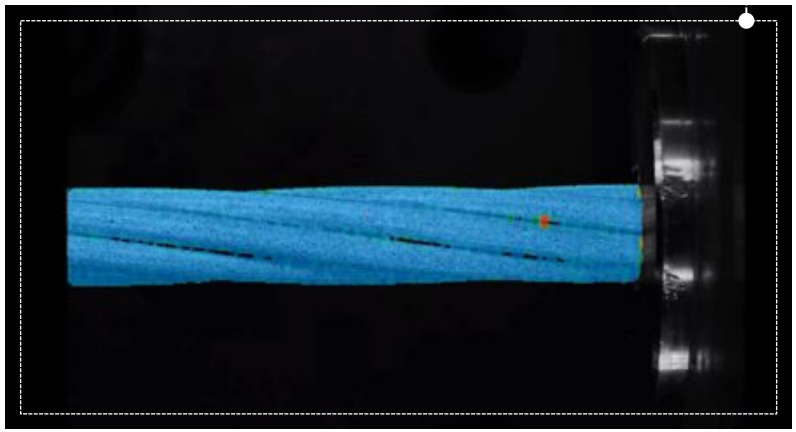




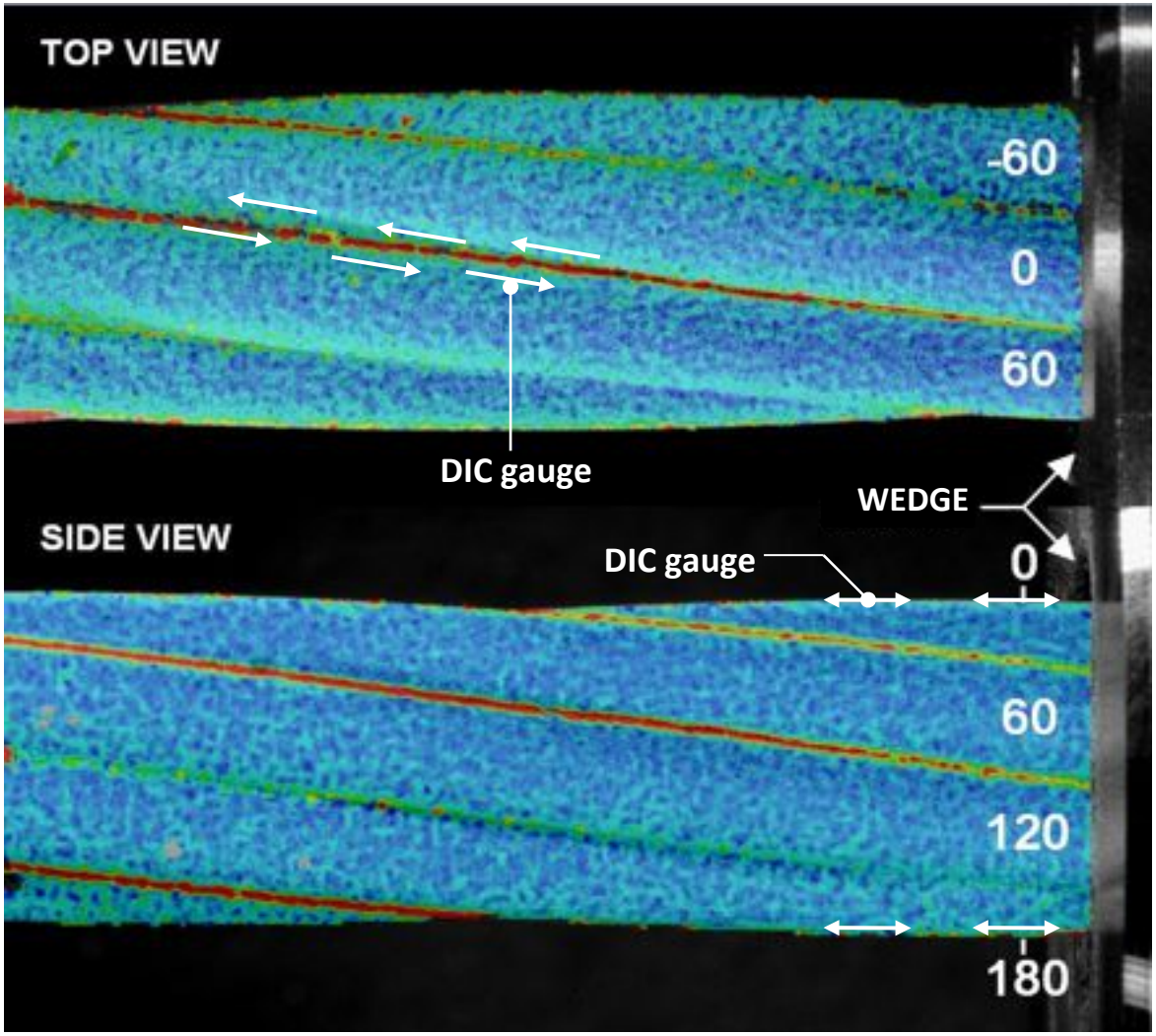
Bending fatigue of steel monostrands

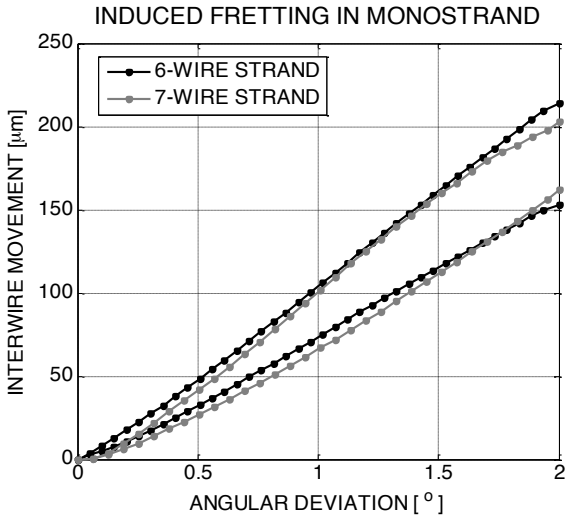


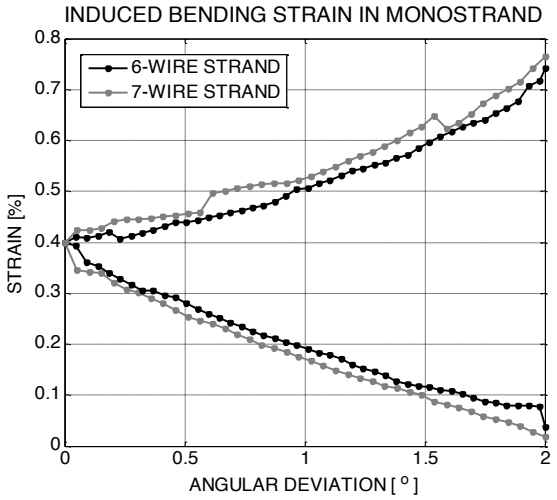




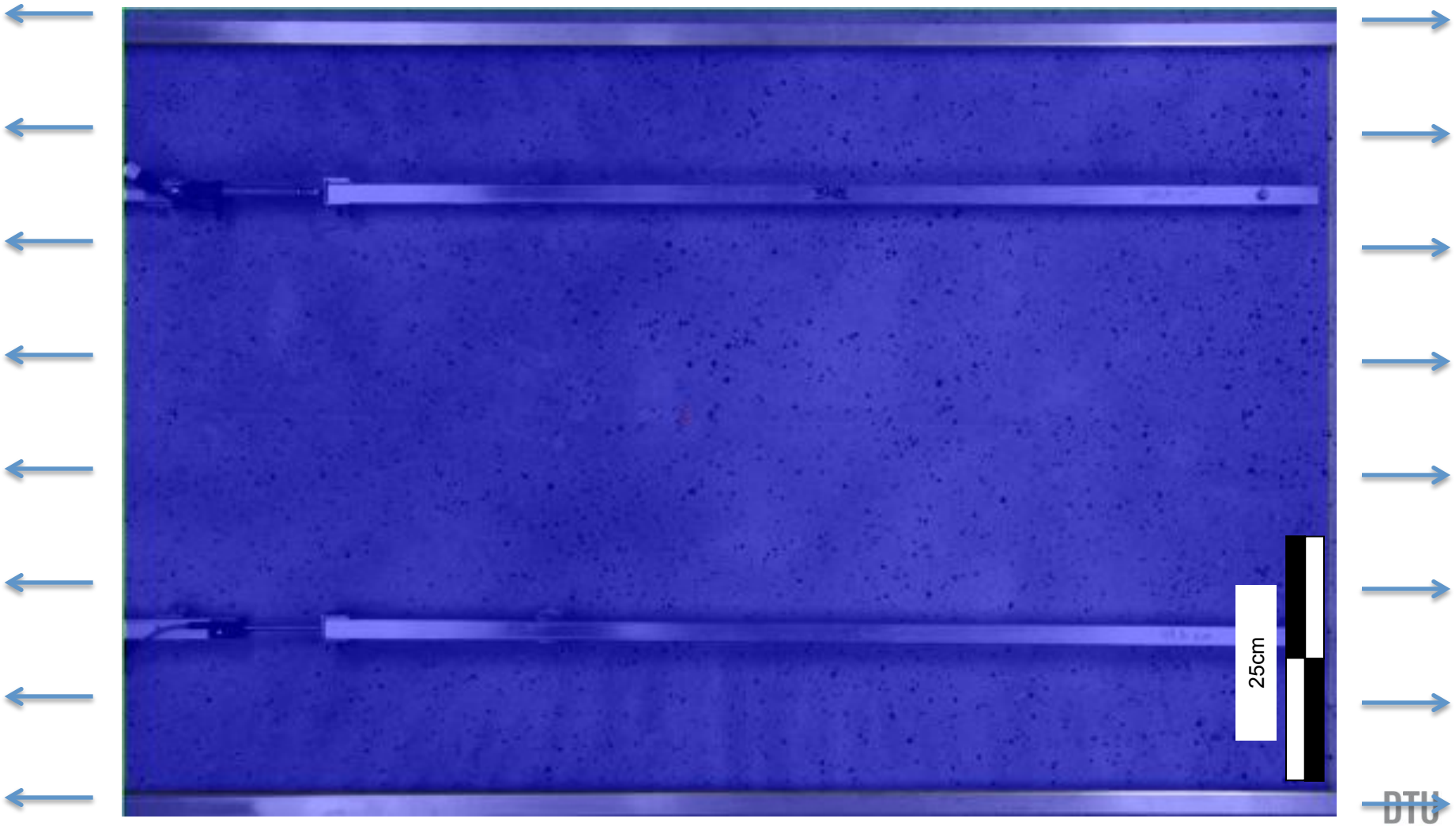
Strain and slip induced by cable bending







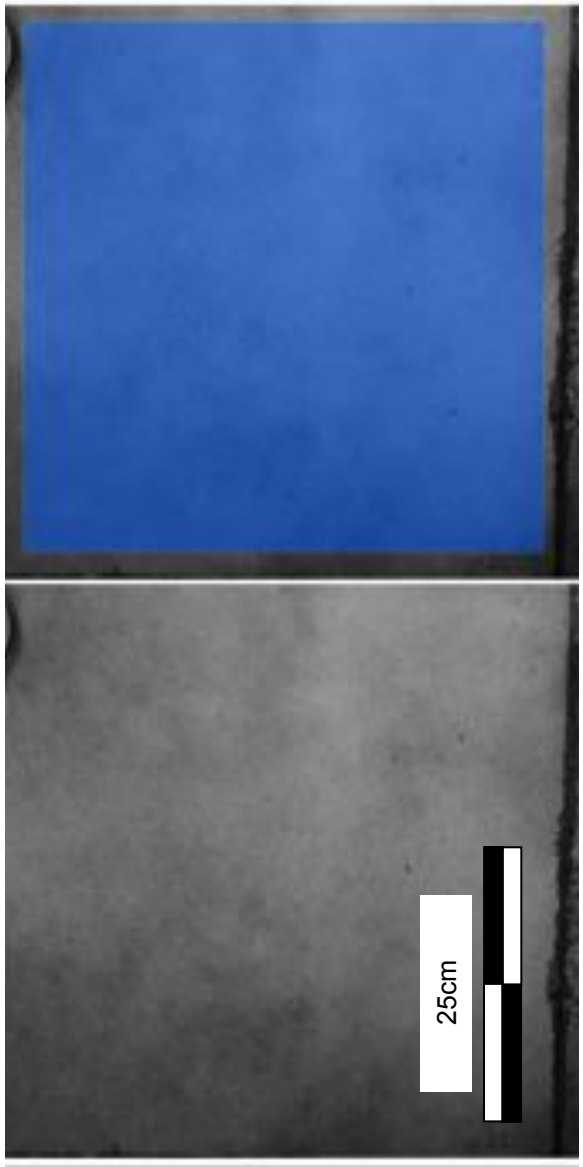
Bridge slab cracking in cyclic tension



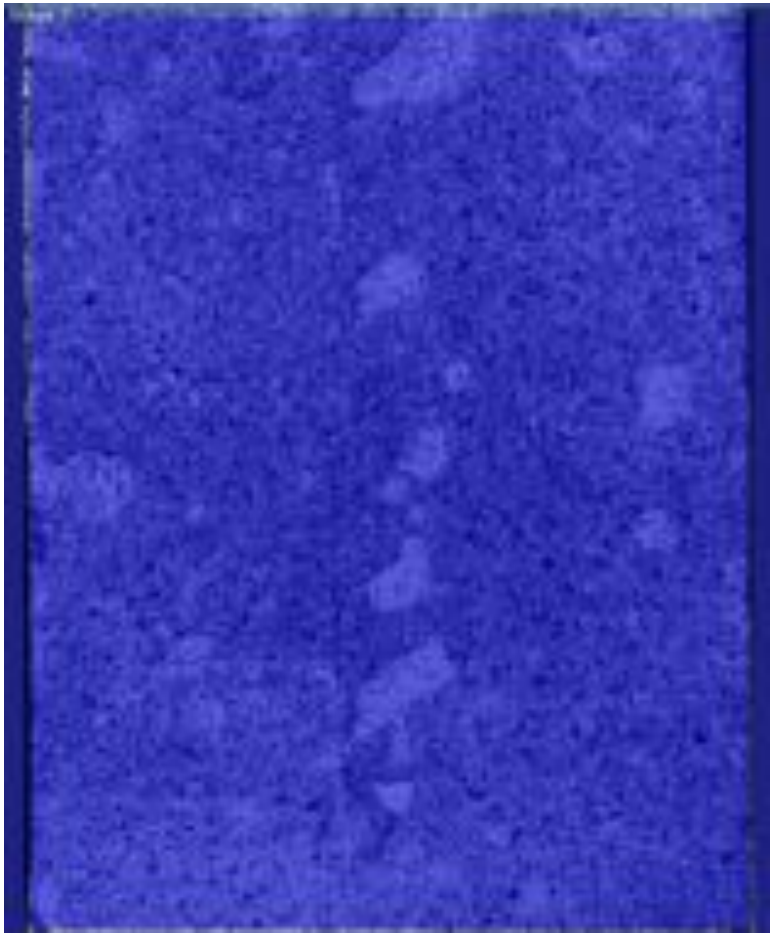
Crack formation in concrete overlay

DIC analysis of concrete surface

Visual of concrete surface



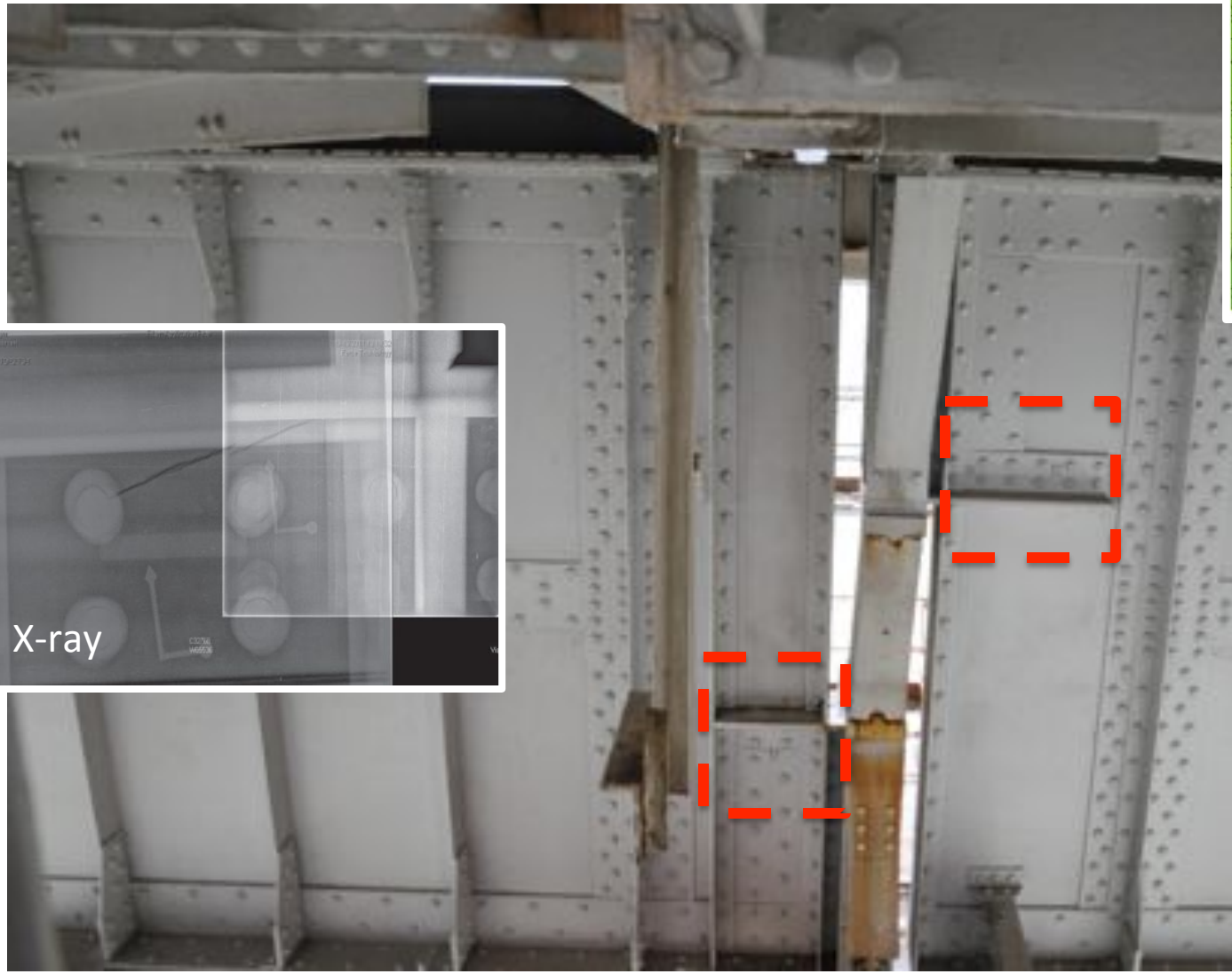
Concrete-reinforcement interface

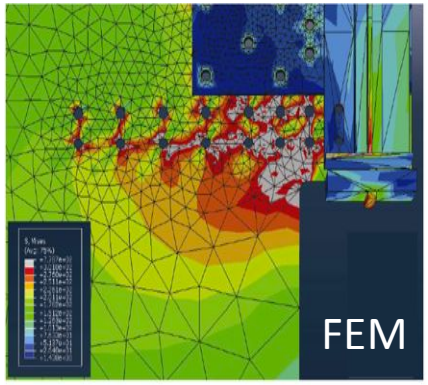


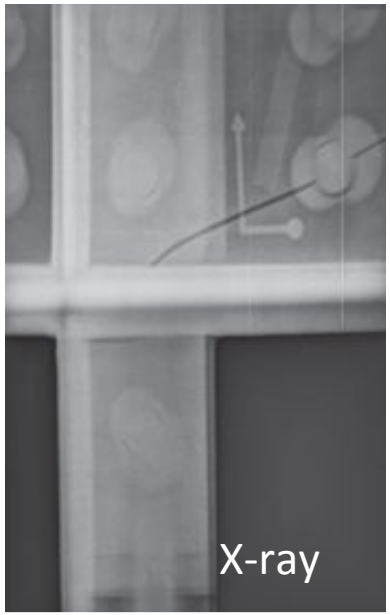
Inspection of span 42 at Størstromsbridge

Inspection of span 42 at Størstromsbridge

Critical locations

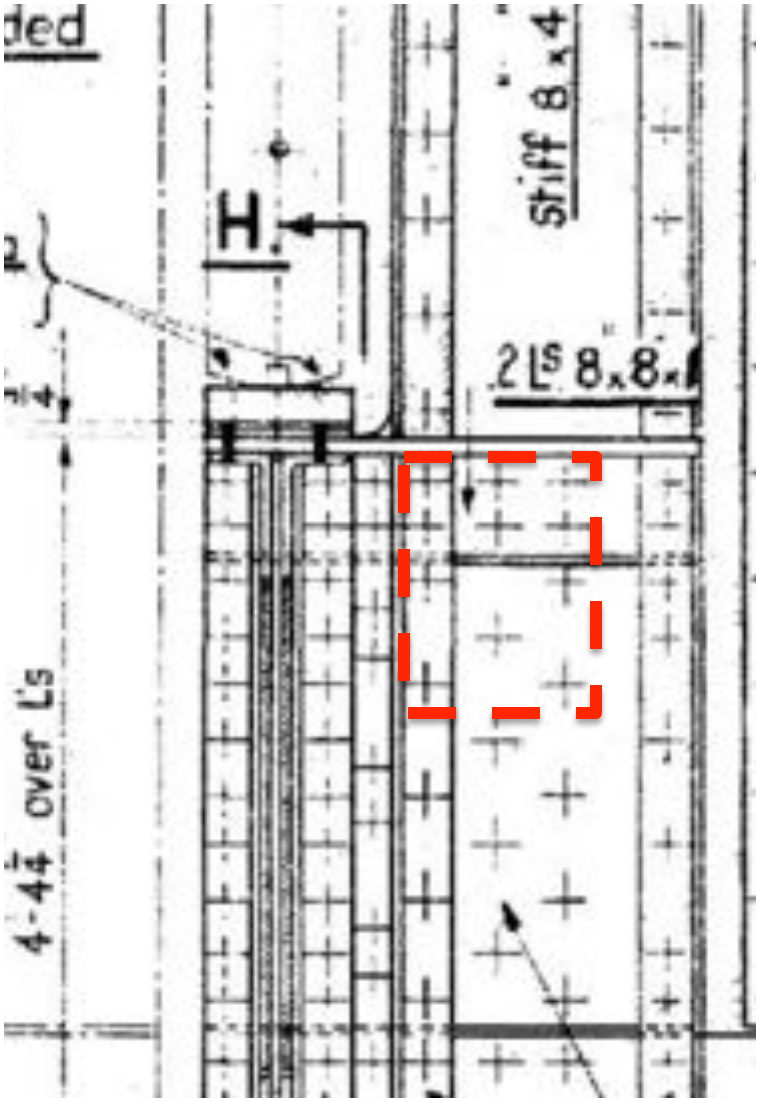


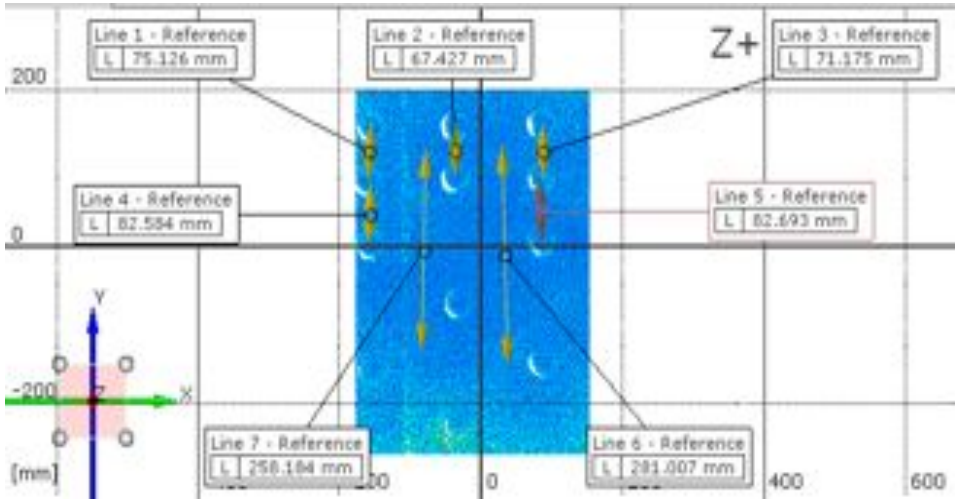


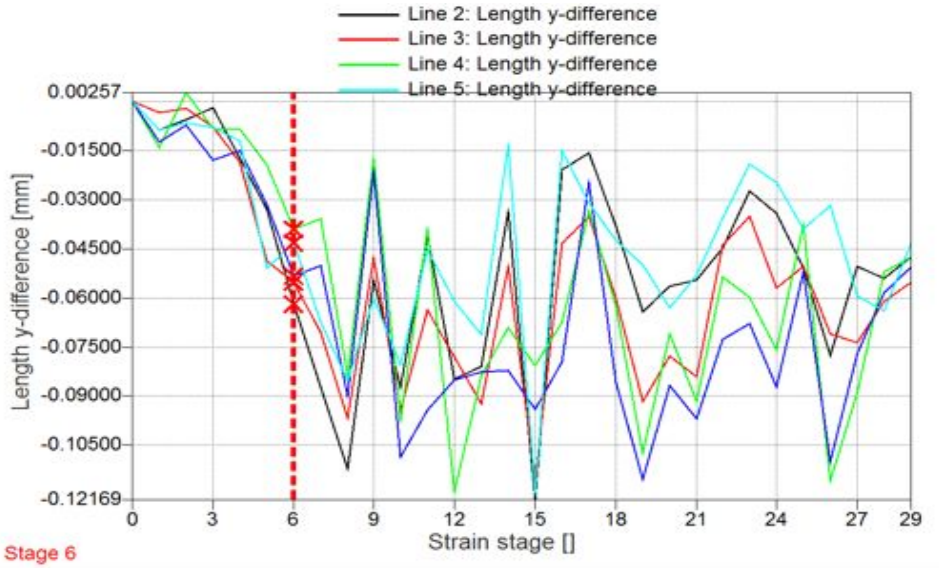


Loading during observation of joints

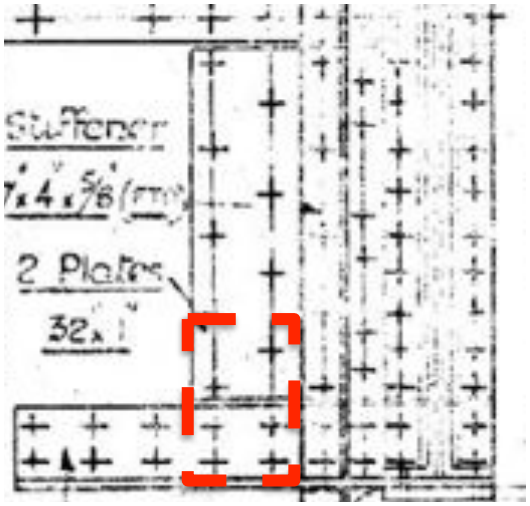
Relative displacement between rivets

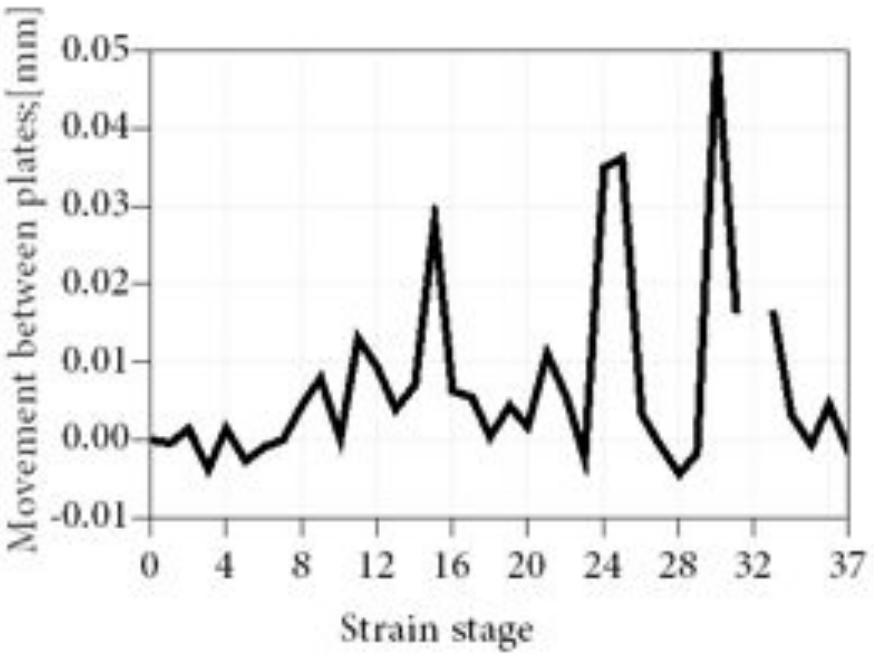


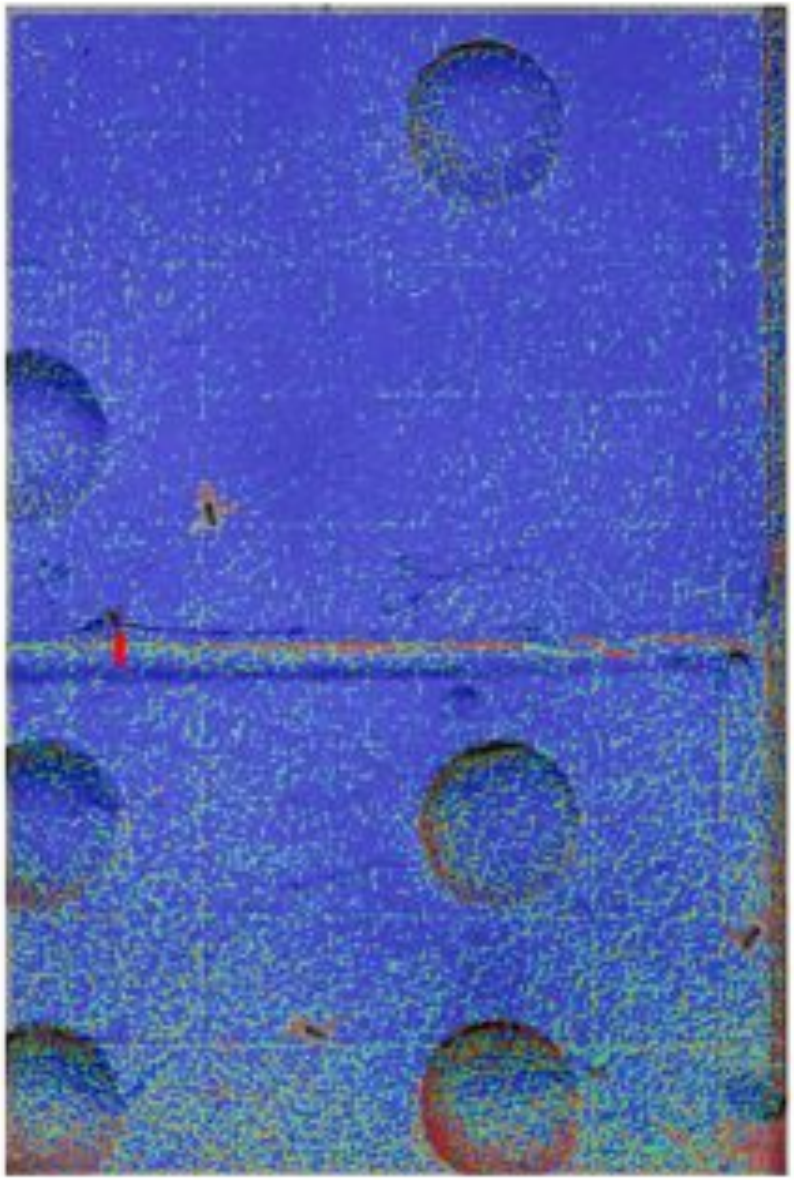




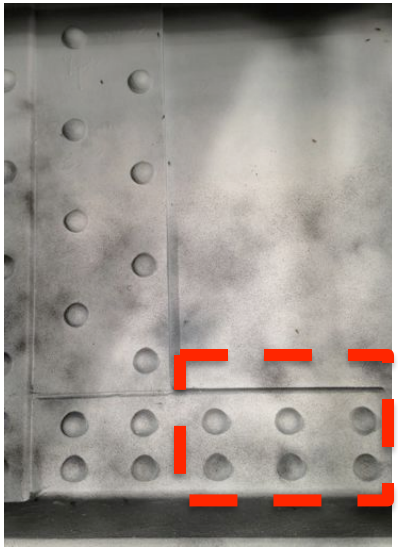
Deformations in plate joints

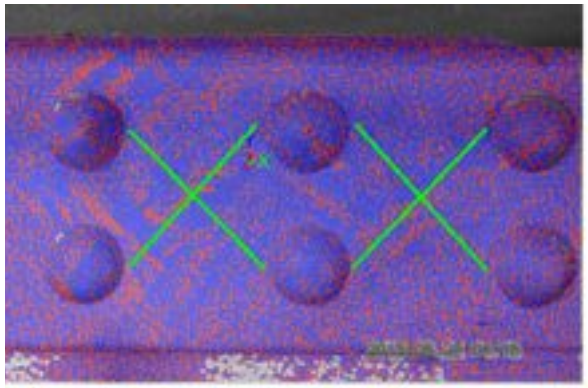


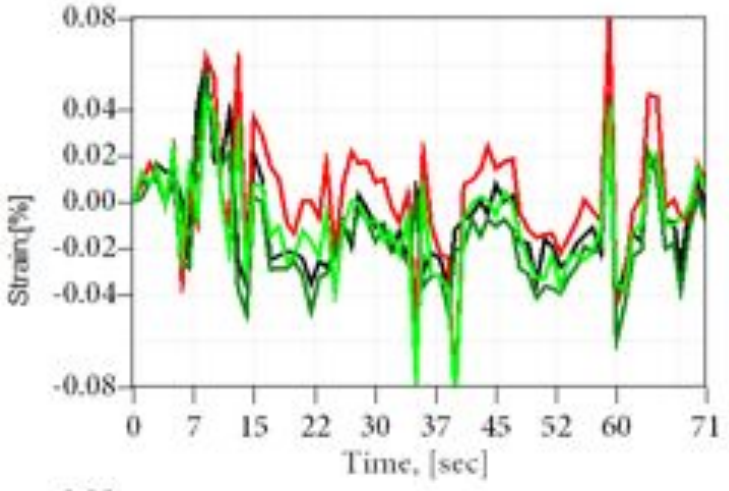


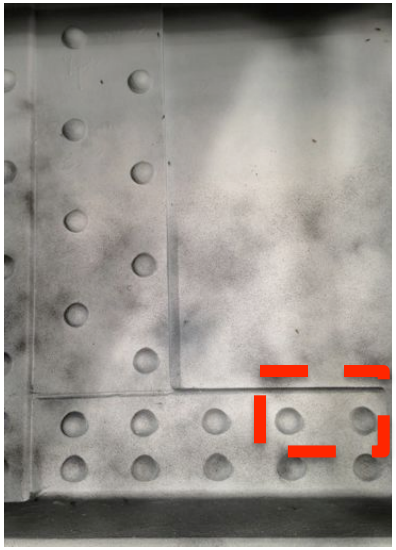


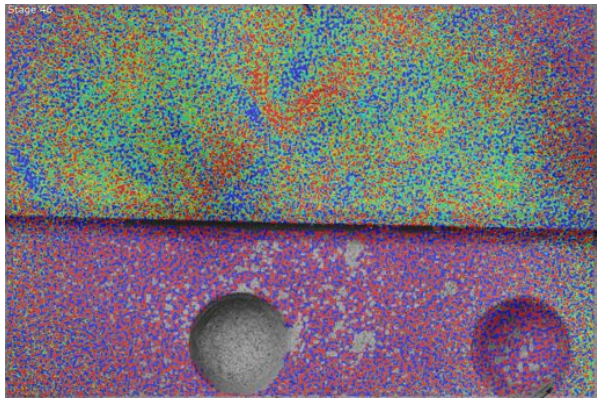
Deformations in steel plates

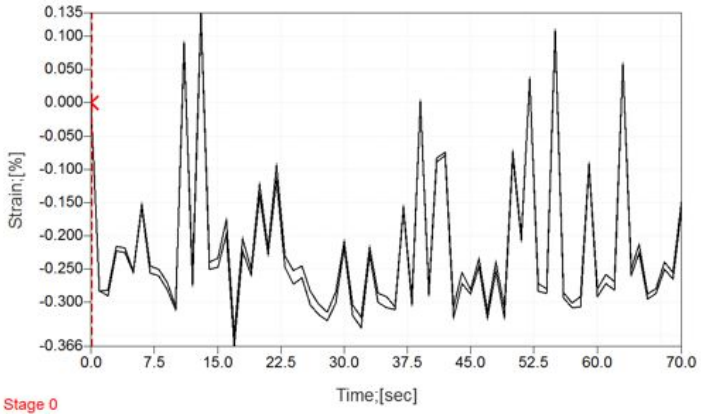




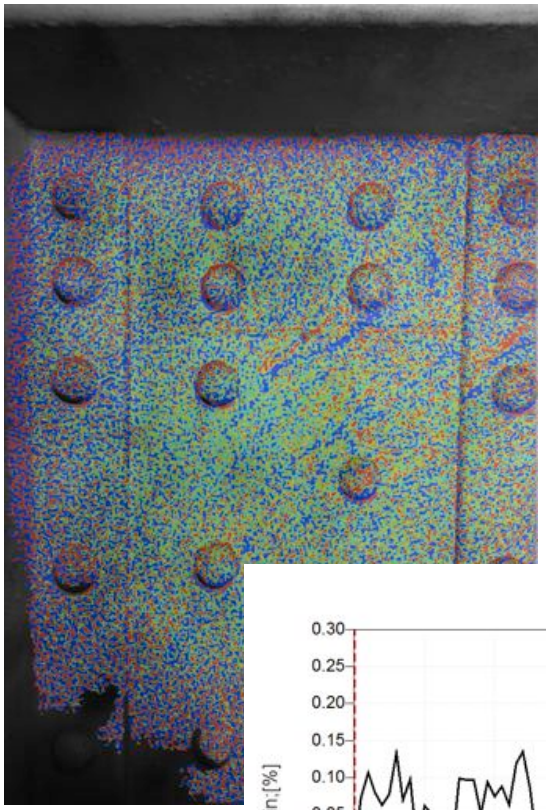


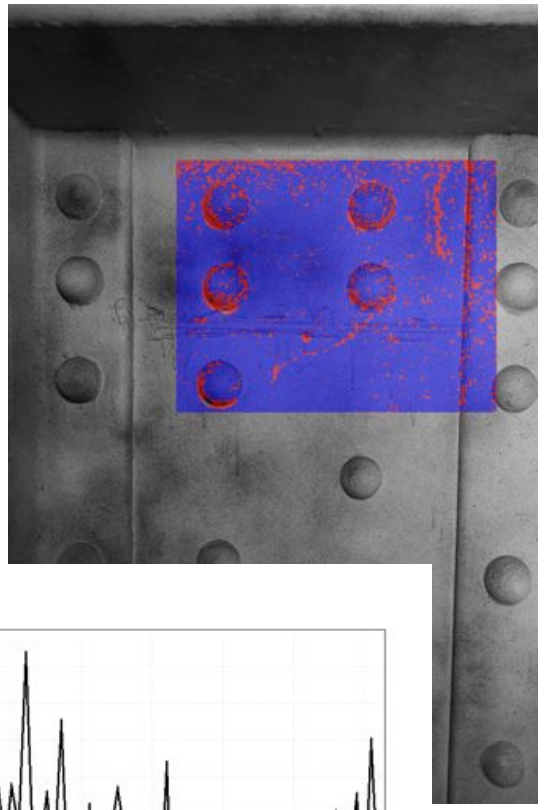


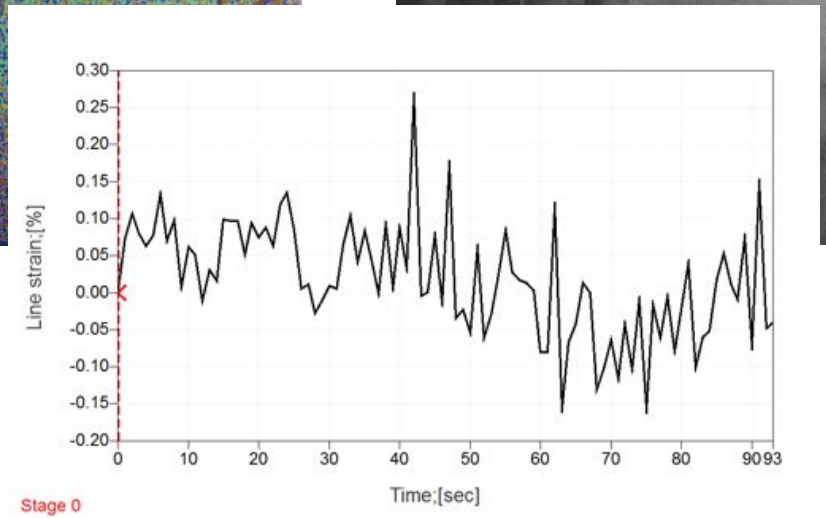




Localized deformations

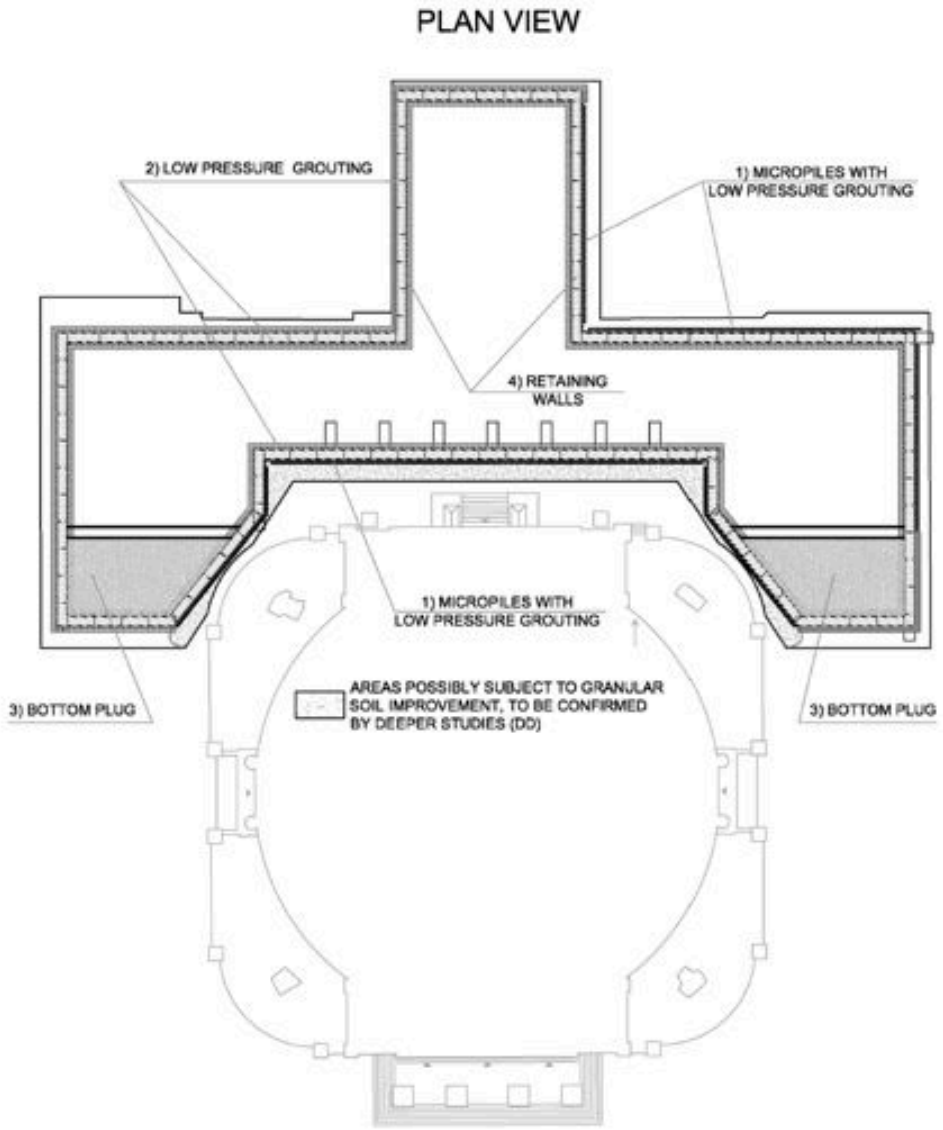




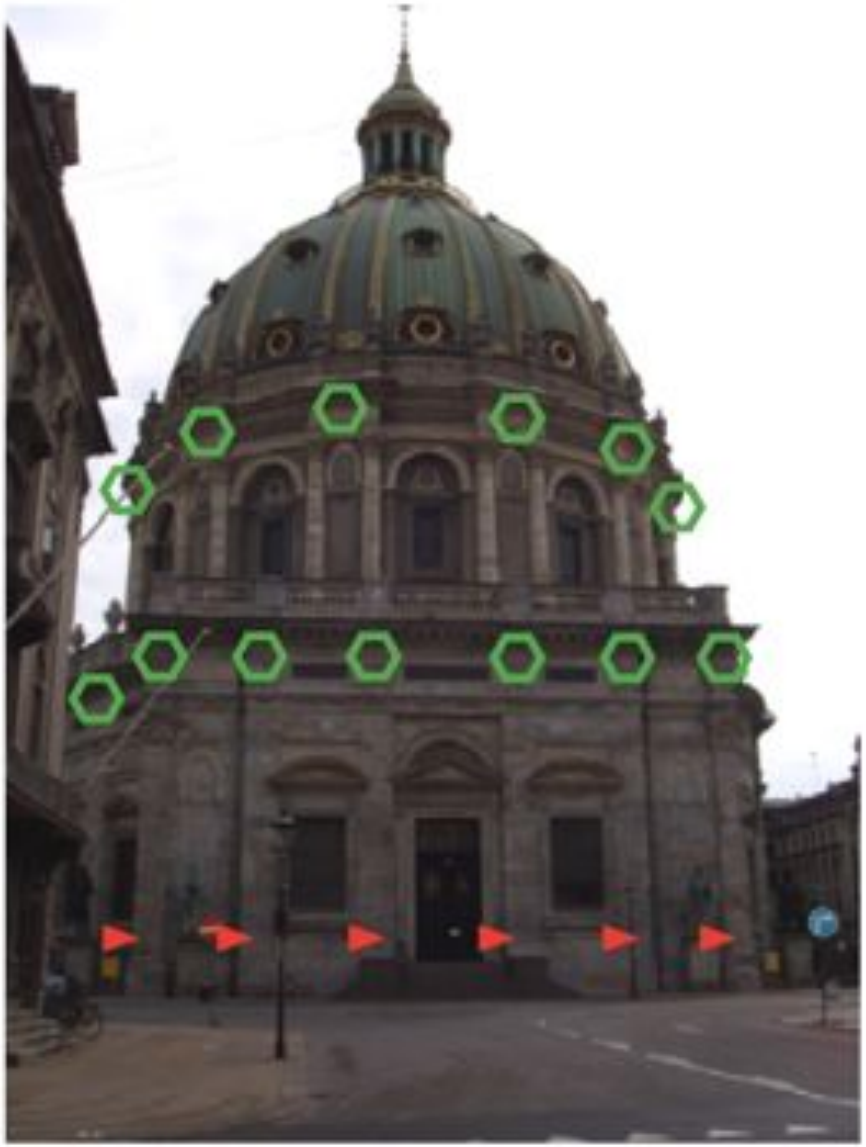


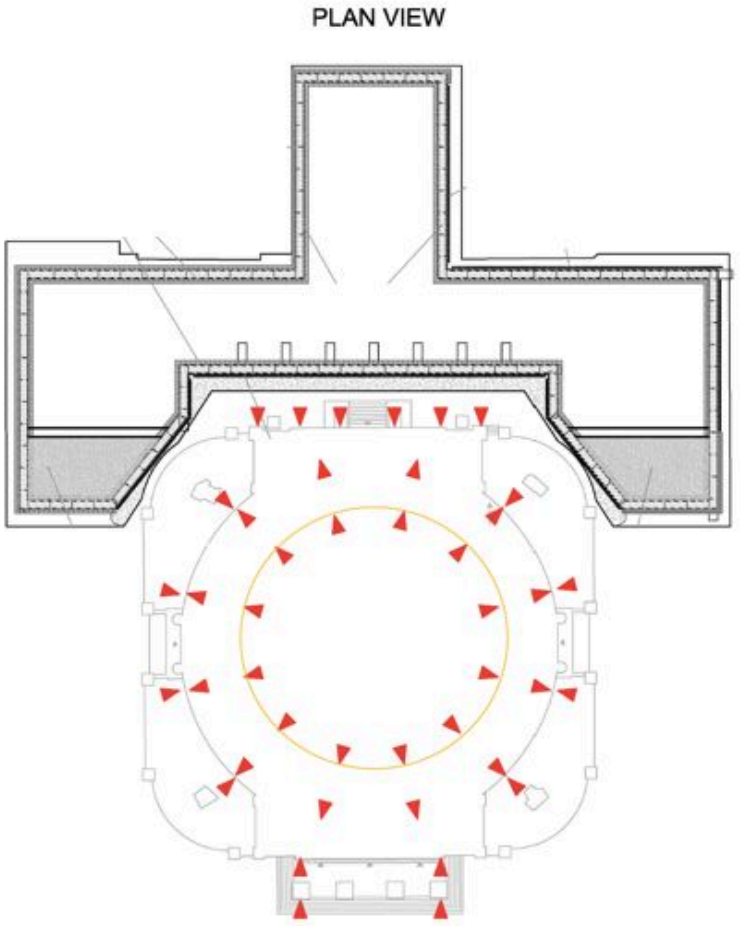
Monitoring of deformations at Marmorkirken

Excavation for Metro station

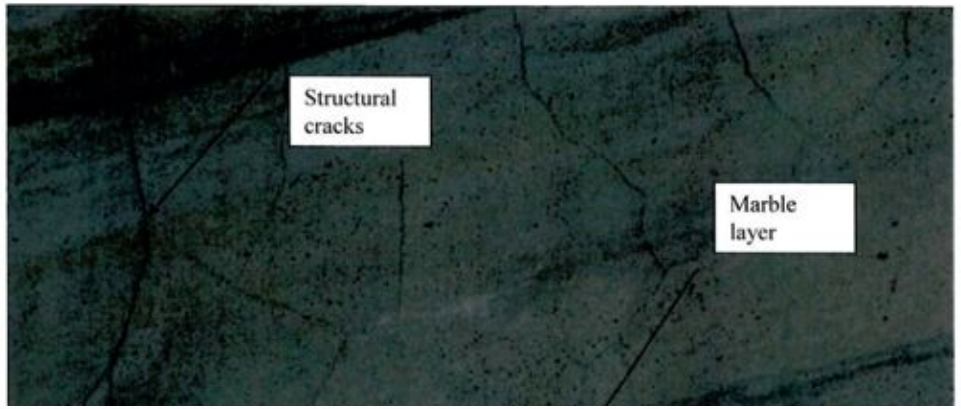


Planned monitoring





Survey of existing cracks



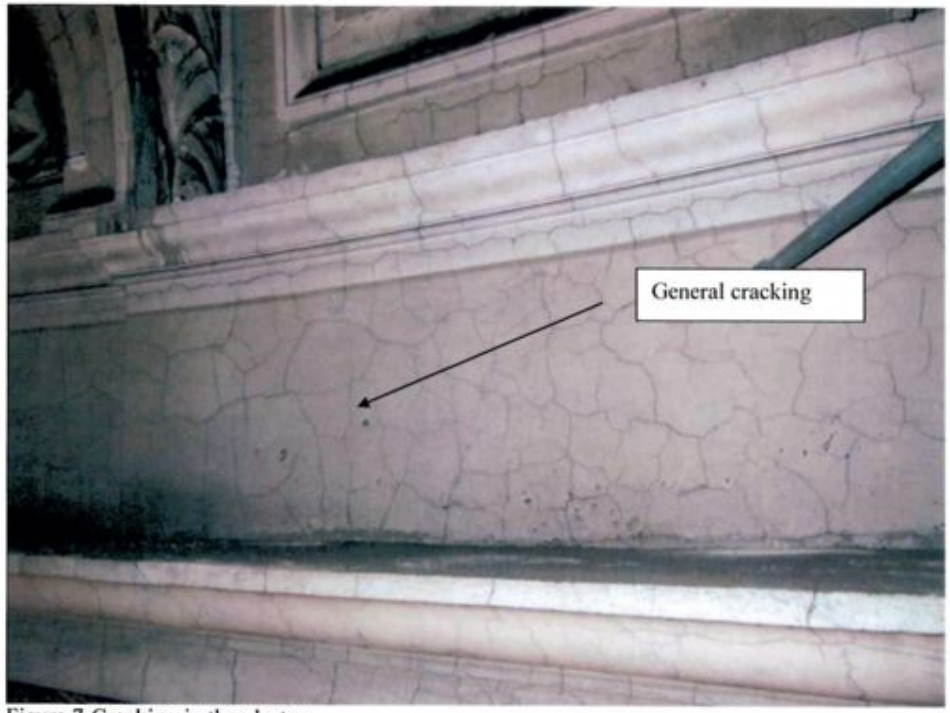


Figura 7-Cracking in the plaster

DIC for crack monitoring