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Application of 3D digital image correlation for calibration of FEM model of graded metal plate arches

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Outline

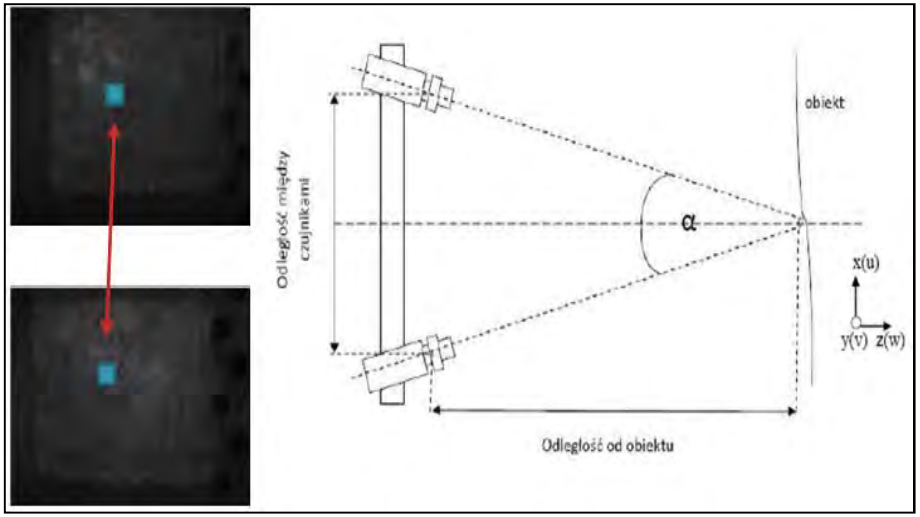
- Motivation and goal
- Digital Image Correlation (DIC)
- FEM model calibration steps
- Analysis of the segments
- Measurement data
- Future works

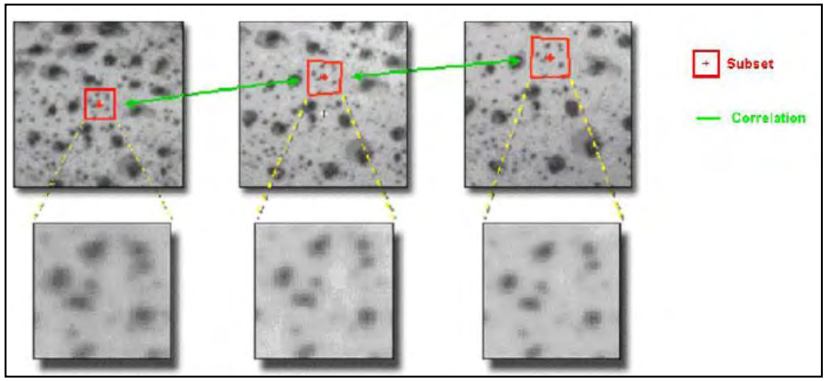
Motivation and goal

- Avoid of building failure
- Formal regulation
  guidelines for granting European technical approvals
- Admission for public use

Digital Image Correlation

Universal and high accuracy method for non-contact measurements of displacements and strains





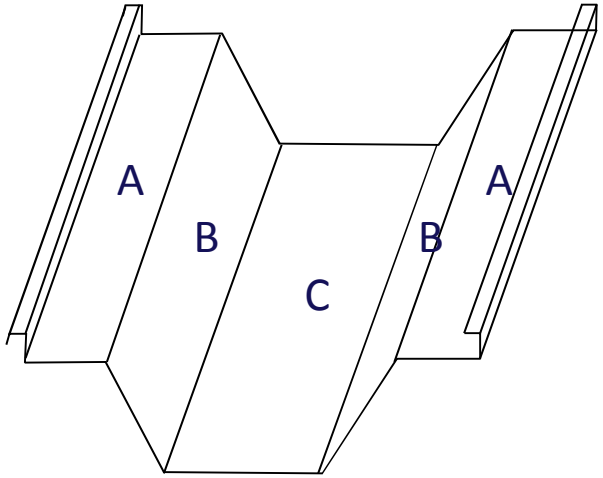
FEM model calibration steps

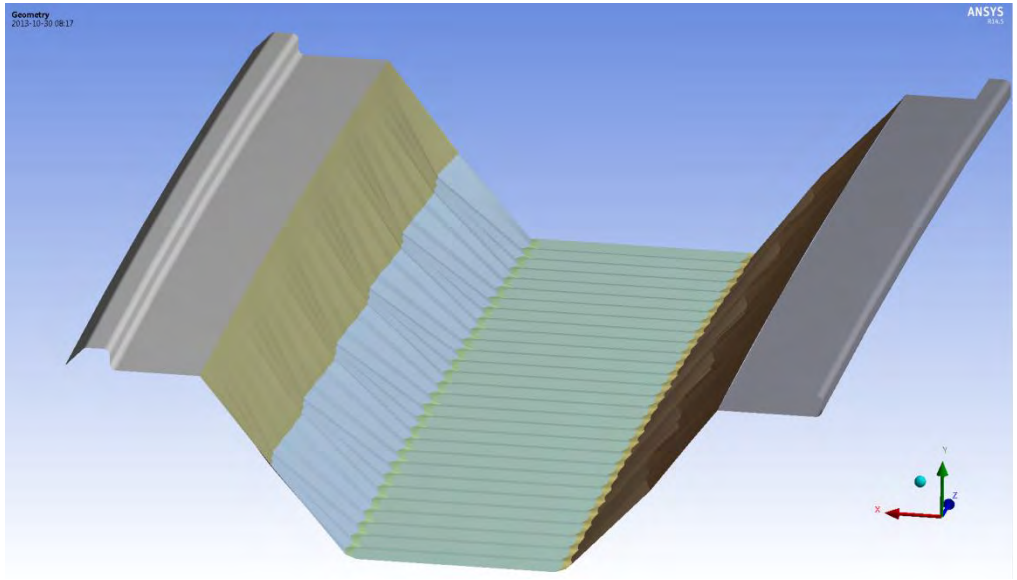
Correction of stiffness matrices

1. Analysis of the segments (1 m high) of different kinds of graded metal plate arches (in progress)
2. Laboratory analysis of the full-dimensional elements
3. *In-situ* analysis of the multi-segment, full-dimensional object

FEM model calibration steps

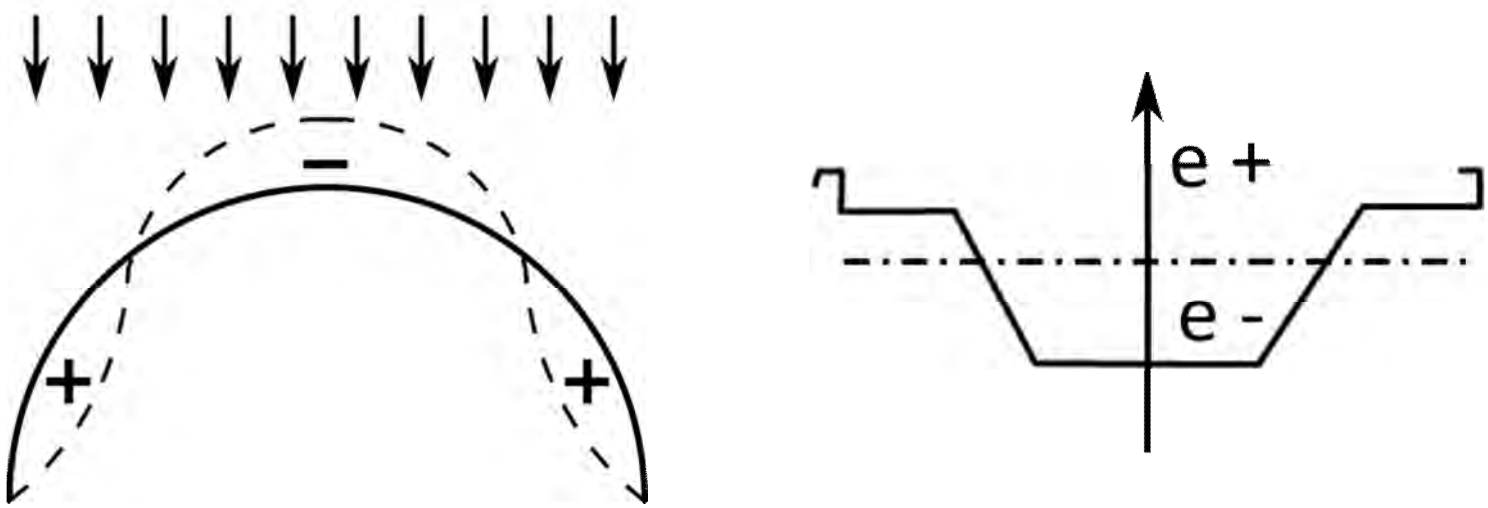
FEM model





Analysis of the segments

Goal: Obtainment of material properties for FEM model.

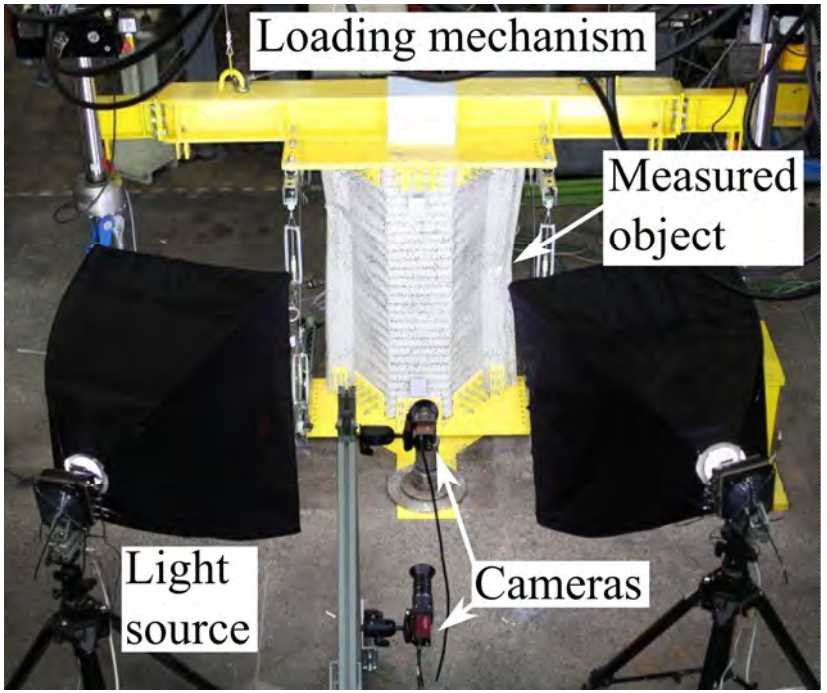


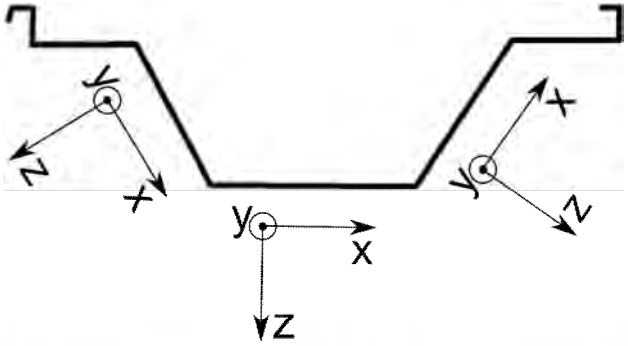
Measurements of the segments (1 m high) of different kinds of graded metal plate arches, with eccentricity of force load

Analysis of the segments

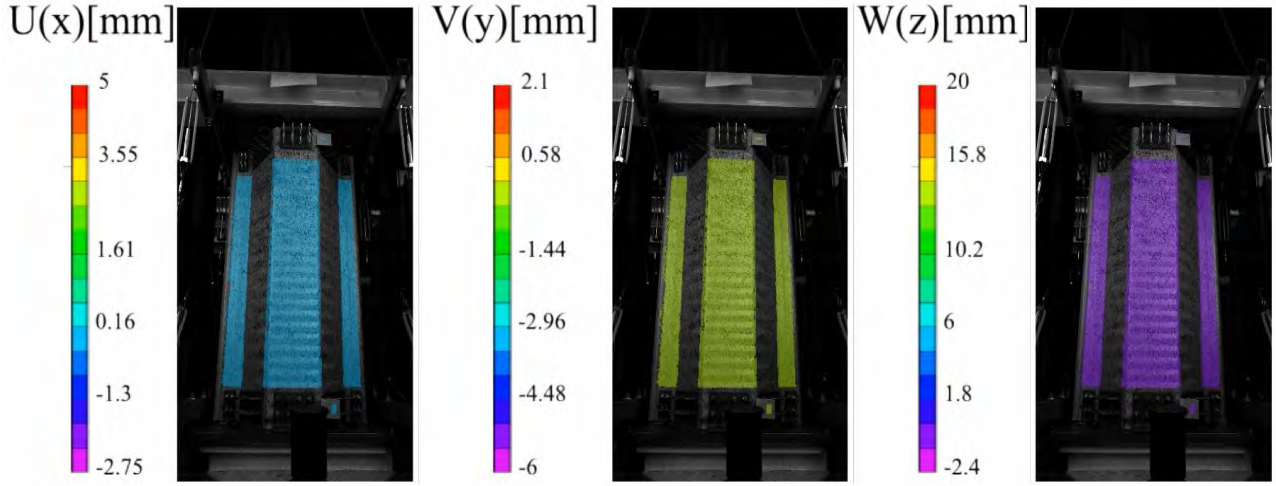
Measurement setup:

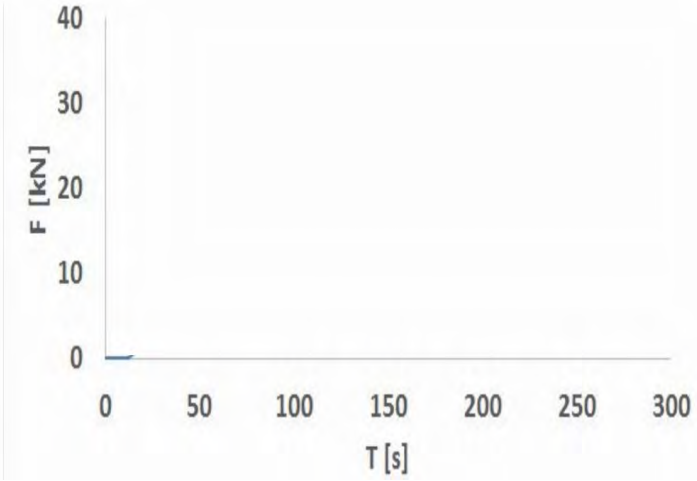
- Actuators (maximum load 100 kN)
- AVT Pike F-1600 (16 MPx)
- LED lamps (100 MW) with softbox



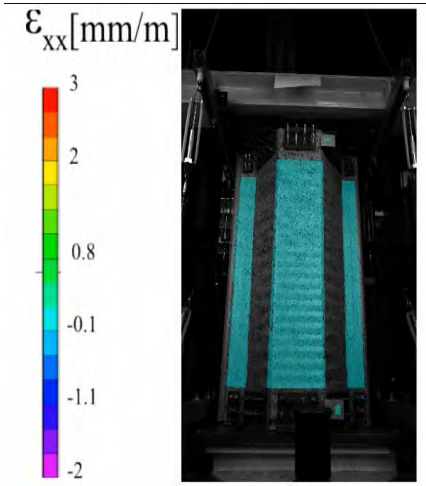


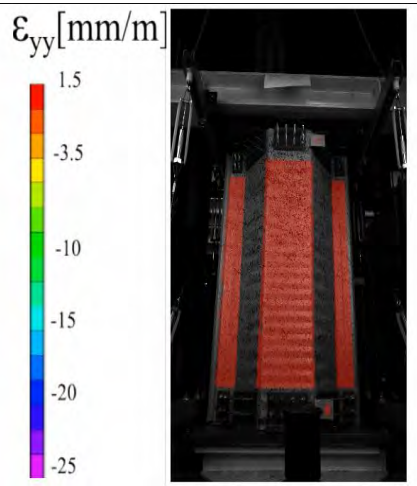
Analysis of the segments

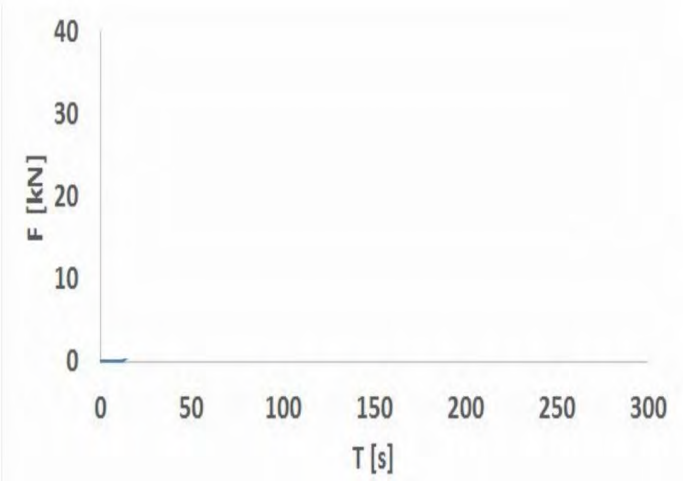




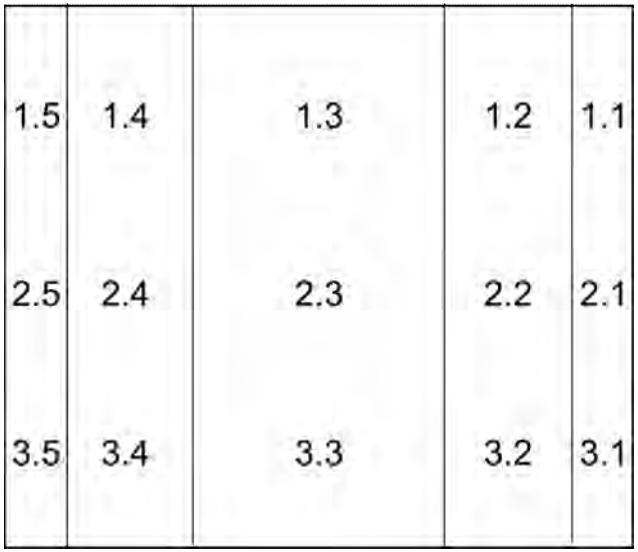
Analysis of the segments

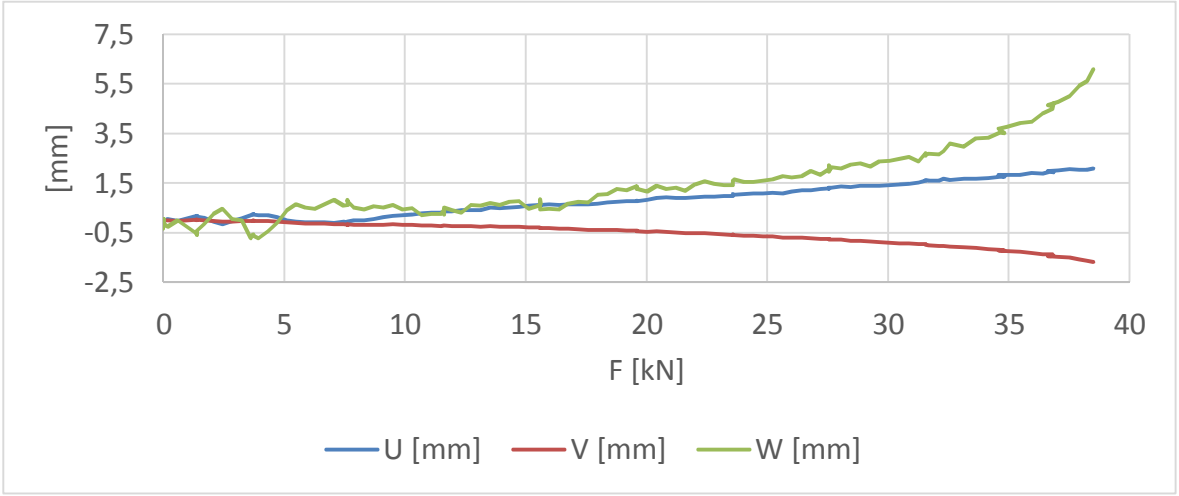


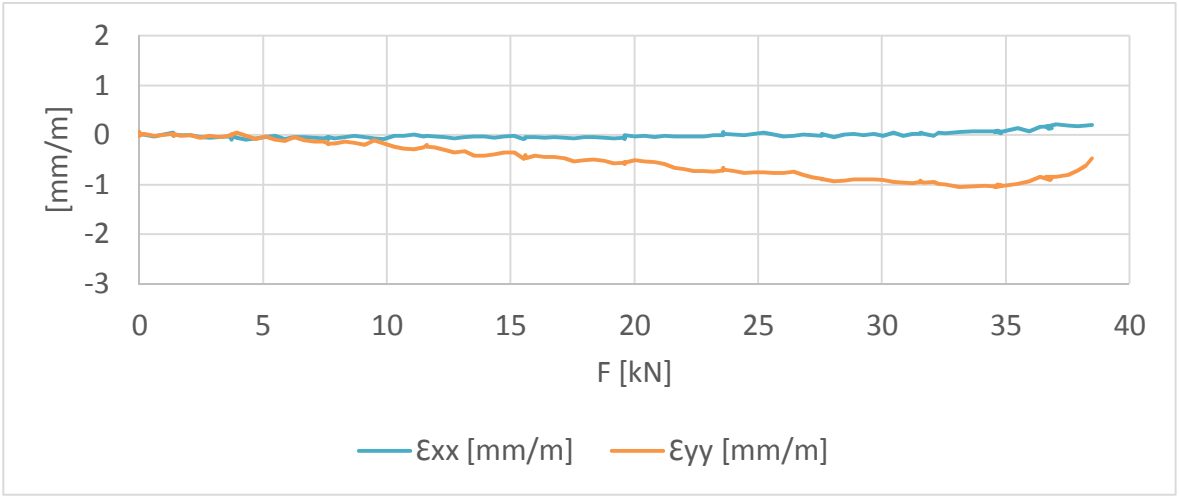




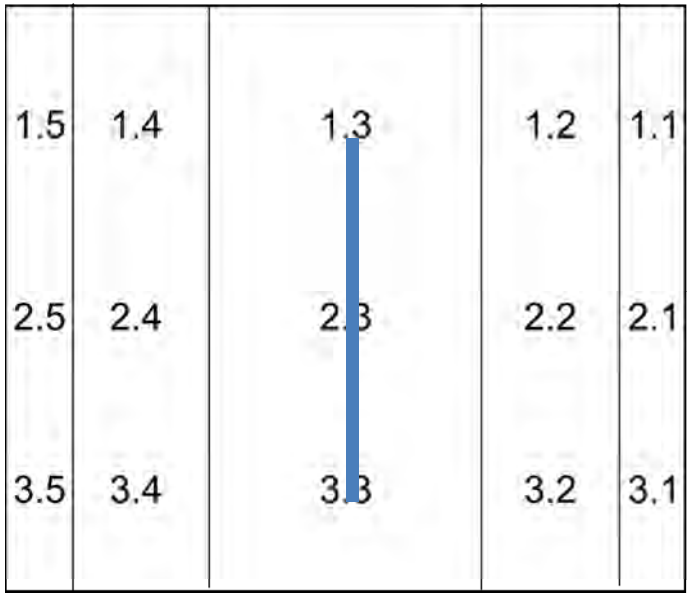
Analysis of the segments

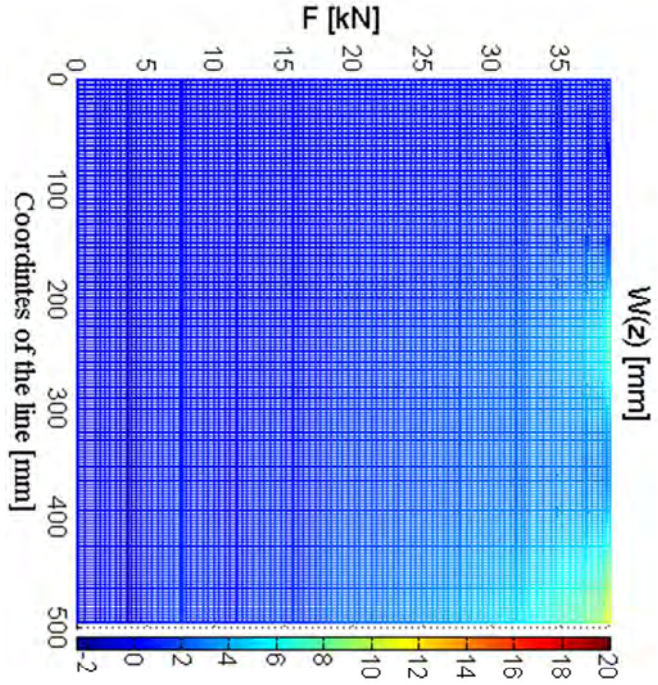




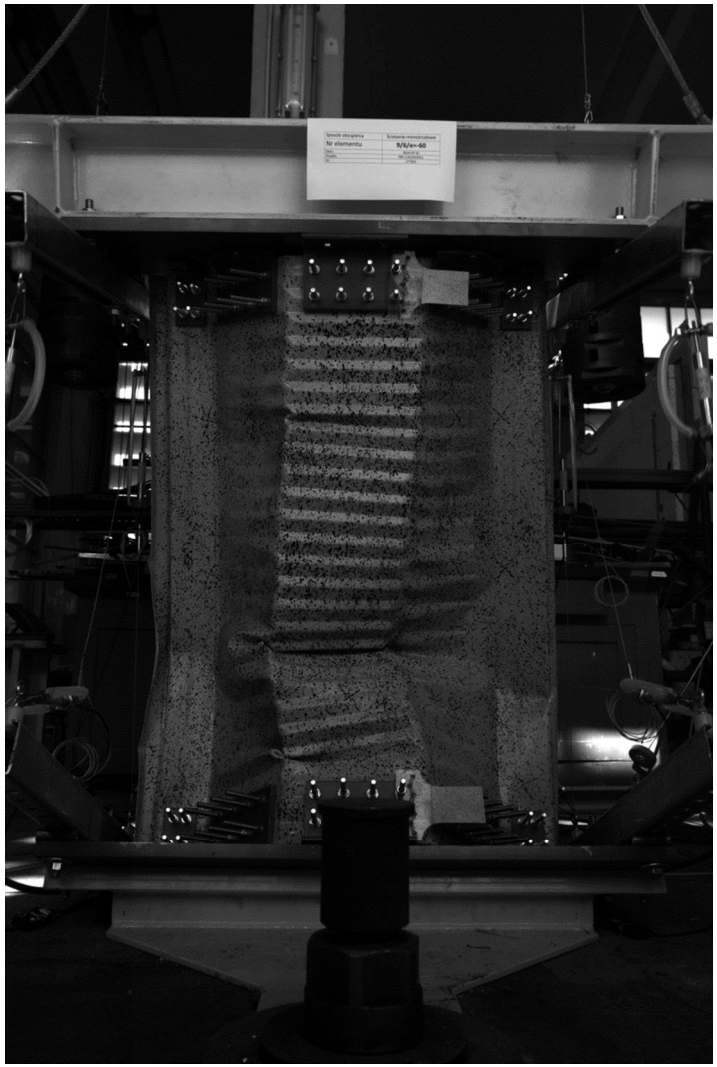


Analysis of the segments





Analysis of the segments



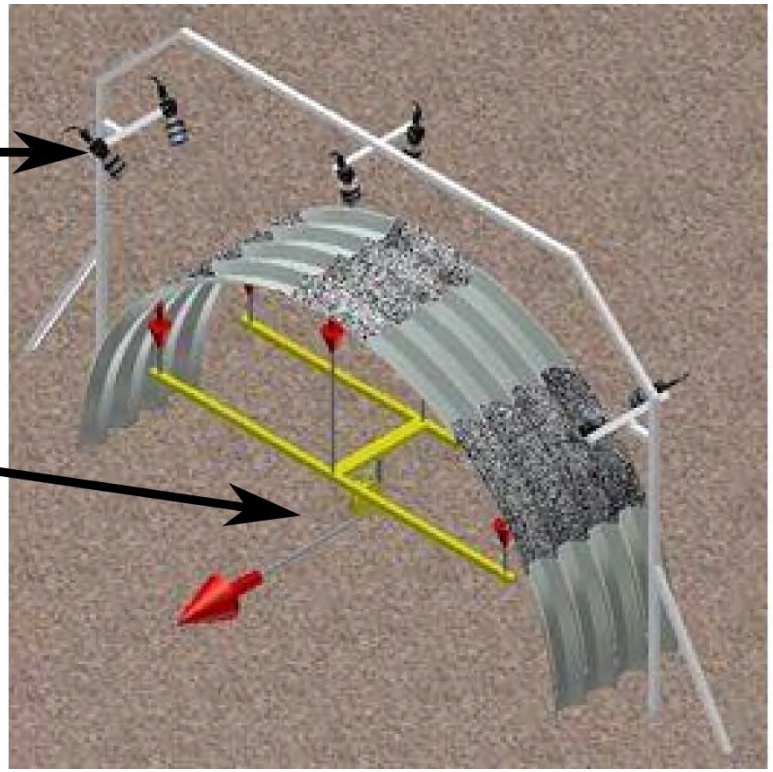
Analysis of the full-dimensional elements

Piekarczuk A, Malesa M, Kujawinska M, Malowany K (2012), Application of Hybrid FEM-DIC Method for Assessment of Low Cost Building Structures, Experimental Mechanics, 52 (9), pp. 1297-1311

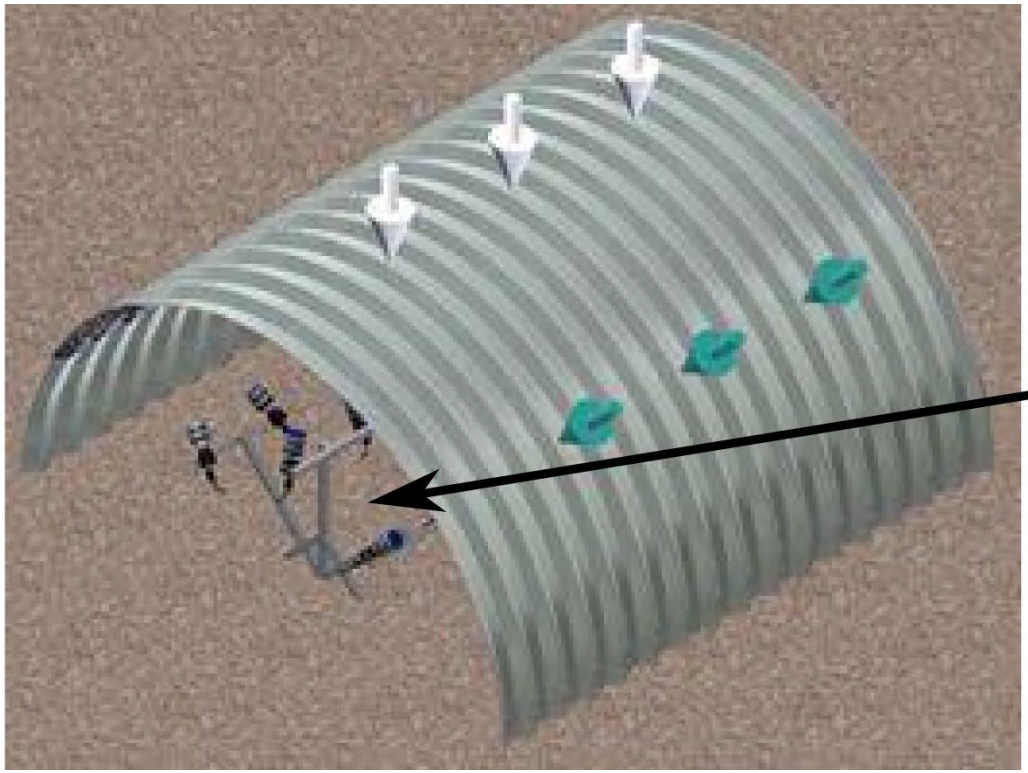
Analysis of the full-dimensional elements

external setup
of multi-camera
3D DIC system

loading
mechanism



In-situ measurements



internal setup
of multi-camera
3D DIC system

Thank you for your attention