Vigh L G, Tóth J

Test-based FE Model Development for Metal Structures

Proc. 4th International PhD Symposium in Civil Engineering, Vol. 2., Munich, 2002. pp. 397-402.

Abstract

When new structure is under development, it is required to work the corresponding design method out. For this purpose, conventionally, theoretical conceptions and/or experiments are needed. However, theoretical conception can easily lead to a difficult way, especially, when thinking of material or geometrical non-linearity, etc. On the other hand, experiment usually carries great cost. Recently, new ways appear, such as the usage of the so-called virtual experiments. By this, the question is how to build the numerical model up, how detailed it should be. The answer can be found by executing so-called “pilot-tests” meaning a few real experiments, which services the verification of the models. Then virtual experiments can be done by the developed model, which uprightly leads to the design method via parametric study. In contrast to the conventional way, this one consumes considerably less cost and time. In addition, wide-range possibilities are given to try various ideas or parameters.

This paper aims to summarize the steps of test-based numerical model development, presenting two cases: firstly, an extruded and welded aluminium girder, secondly, a complicated joint of a steel cooling tower.

Further info

This file contains the slides of the presentation.

If you are interested in the full paper, please email the author directly with the request:

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Vigh L G, Tóth J, Test-based FE model development for metal structures,
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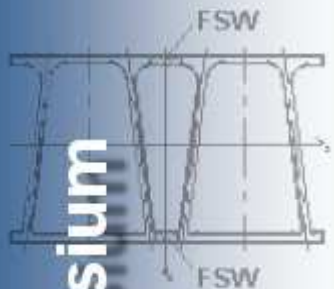
[2] DUNAI L, HORVÁTH L, KALTENBACH L, TÓTH J and VIGH L G, “Analysis of Steel Cooling Tower Joint” (in Hungarian), Research report #1, Budapest University of Technology and Economics, Budapest, 2001.

[3] VIGH L G, “Experimental and Numerical Analyses of Aluminum Structural Elements”, Diploma Thesis, Budapest University of Technology and Economics, Budapest, 2001.



4th International PhD Symposium in Civil Engineering

September 19th-21st, 2002

Test-based FE Model Development for Metal Structures

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Jozsef TOTH

PhD students
Budapest University of Technology and Economics,
Department of Structural Engineering

Introduction

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new structure

theoretical conceptions

- difficult

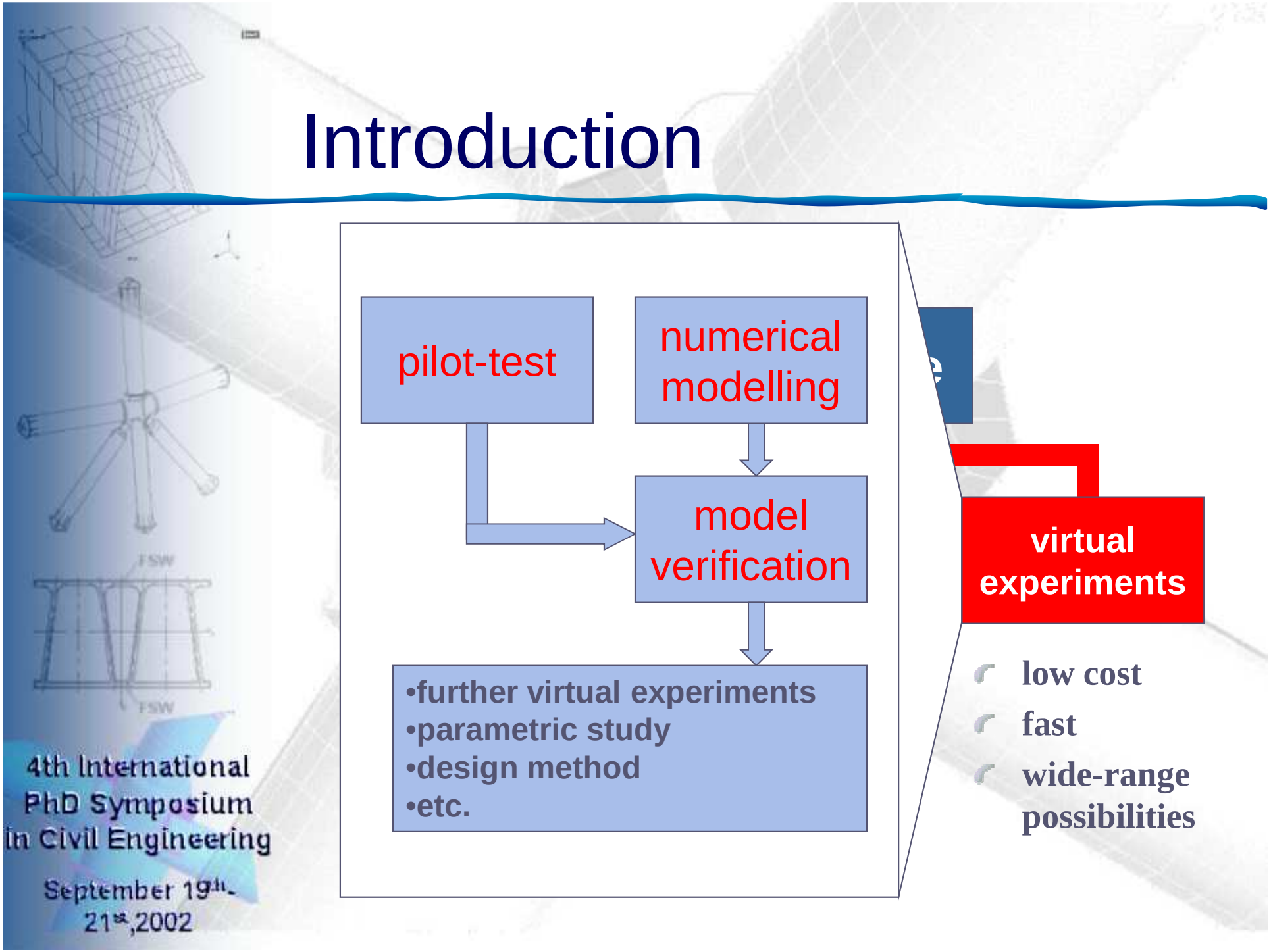
experiments

- expensive

virtual experiments

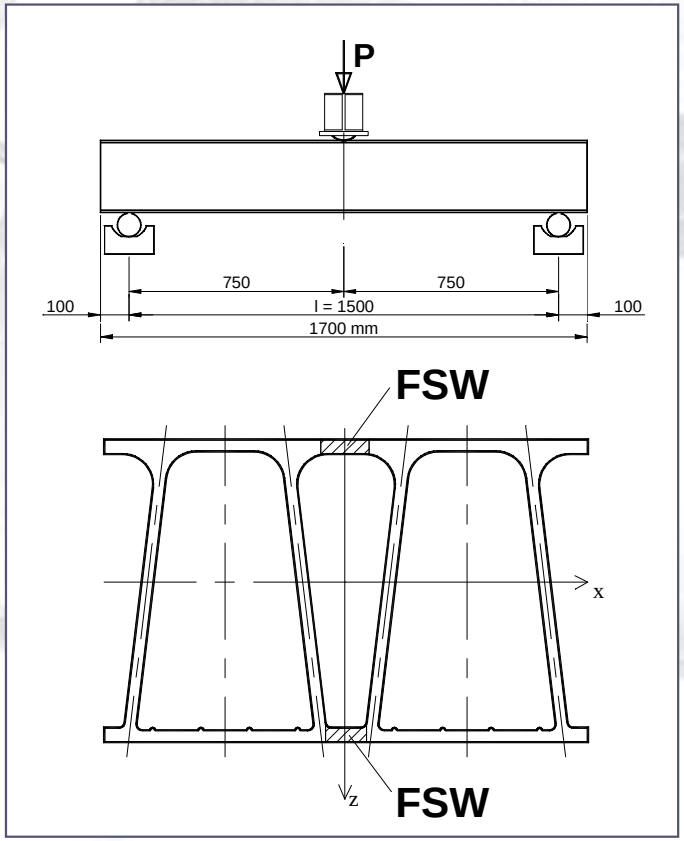
- low cost
- fast
- wide-range possibilities

Introduction



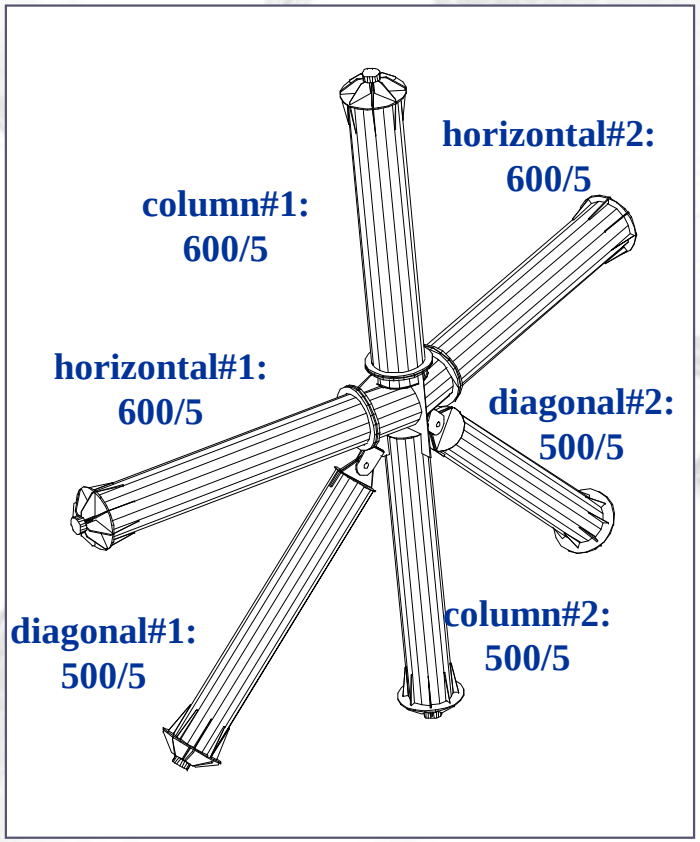
Investigated structures

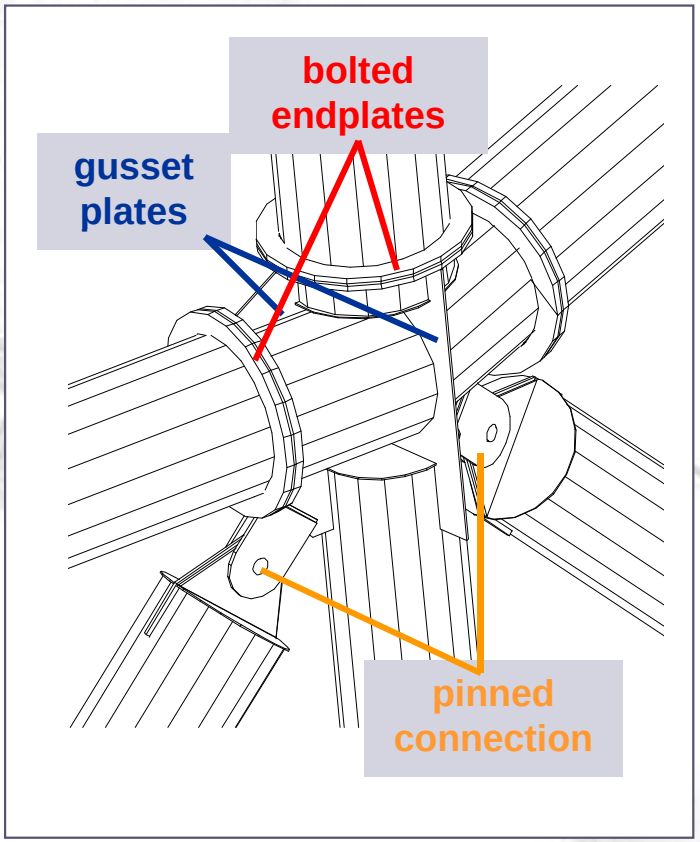
- FSW-fabricated aluminium girder



Investigated structures

- Joint of steel cooling tower





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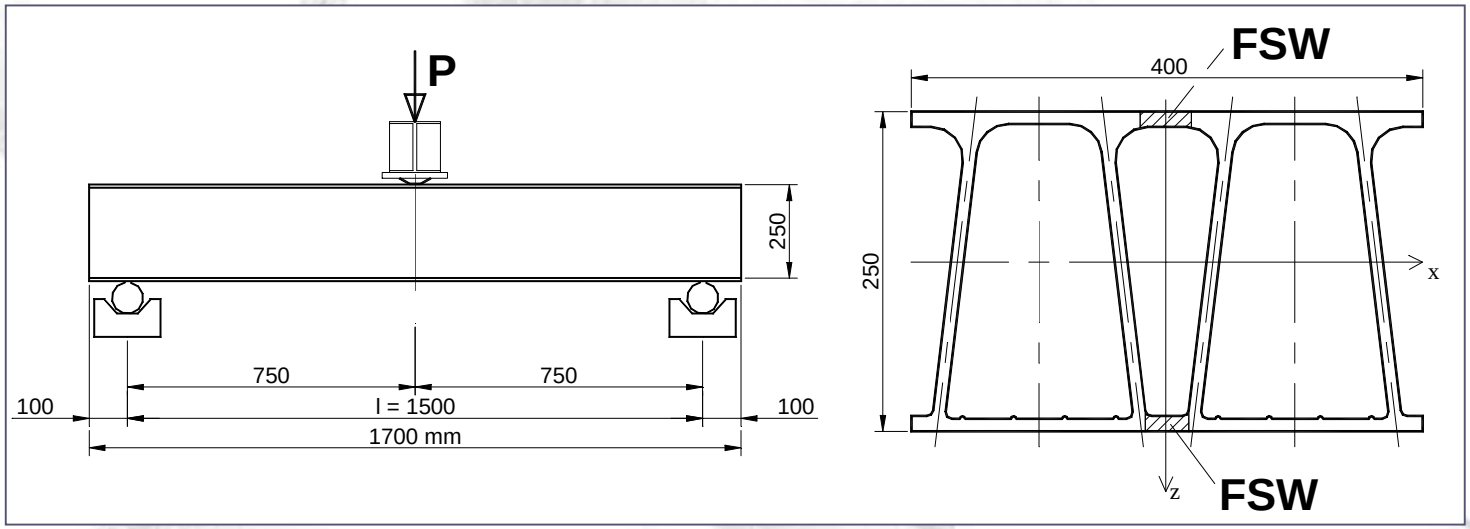
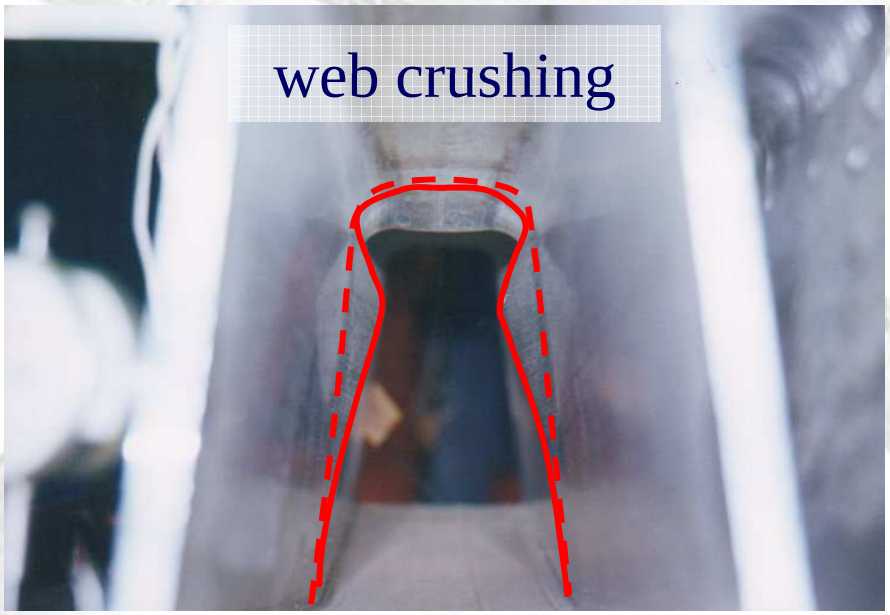
Aluminium girder
1. Pilot test

- configuration



Aluminium girder
1. Pilot test

- configuration
- results



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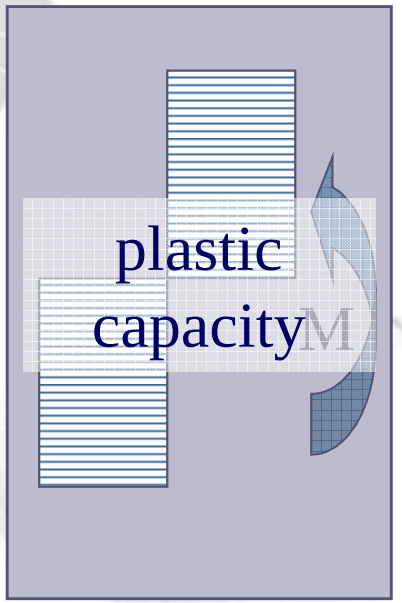

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Aluminium girder
1. Pilot test

- configuration
- results

contact problem

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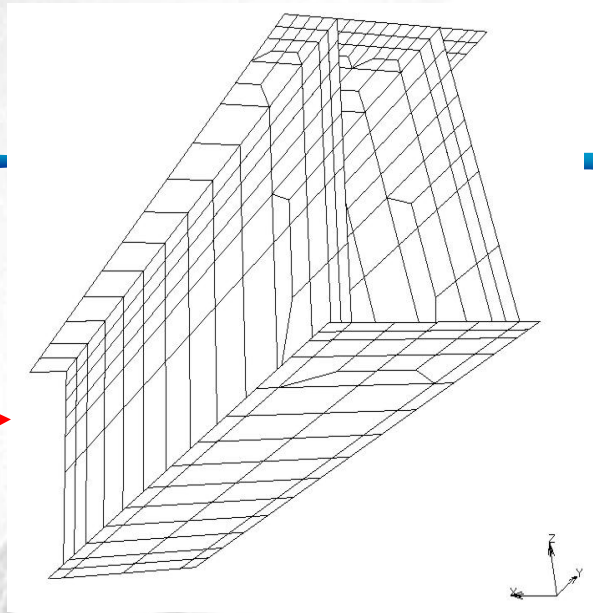
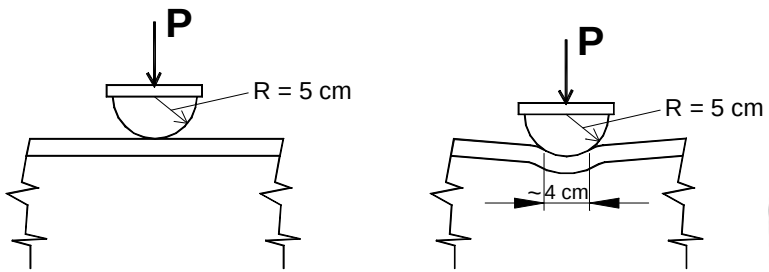
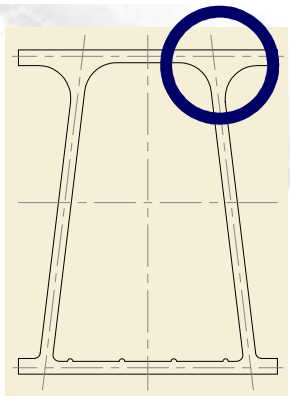
Aluminium girder
2. Modelling

- geometrical and material non-linearity
- mesh
- model-alternatives to investigate the importance of details:
  - effect of FSW
  - contact problem
  - modeling of curved corners







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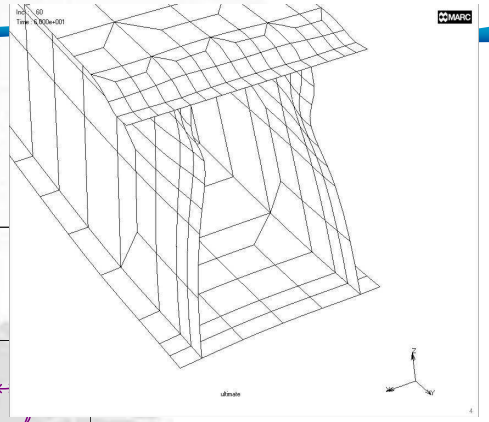
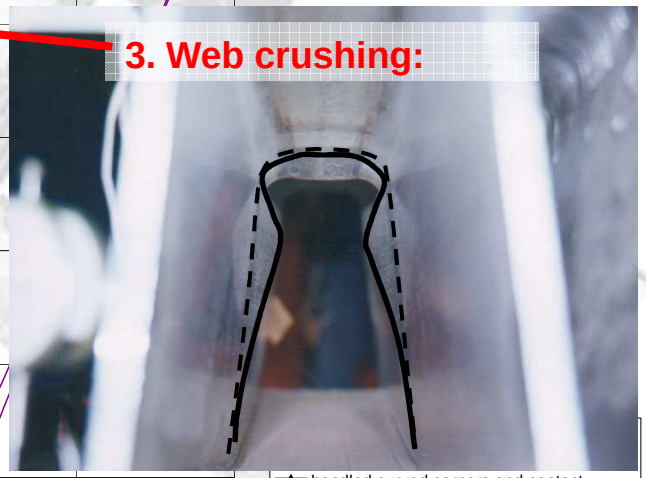
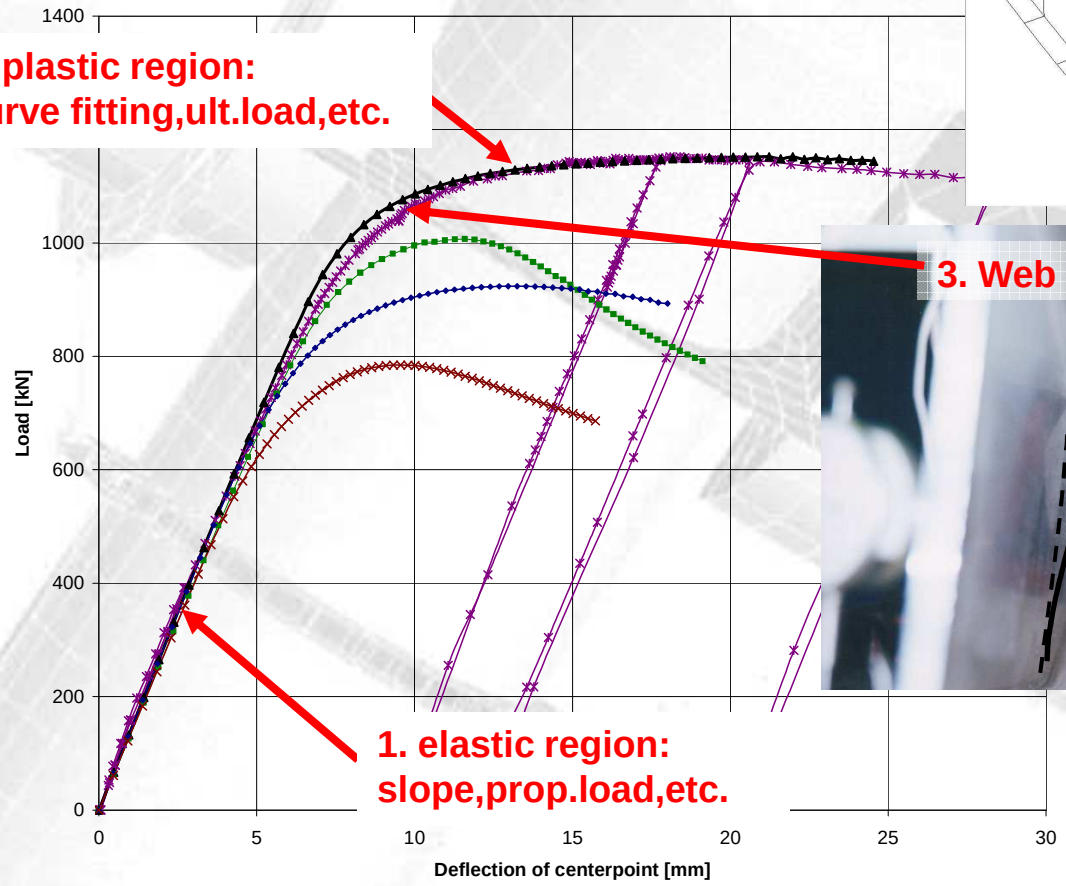
Aluminium girder
3. Verification



2. plastic region:
curve fitting,ult.load,etc.

3. Web crushing:





1. elastic region:
slope,prop.load,etc.

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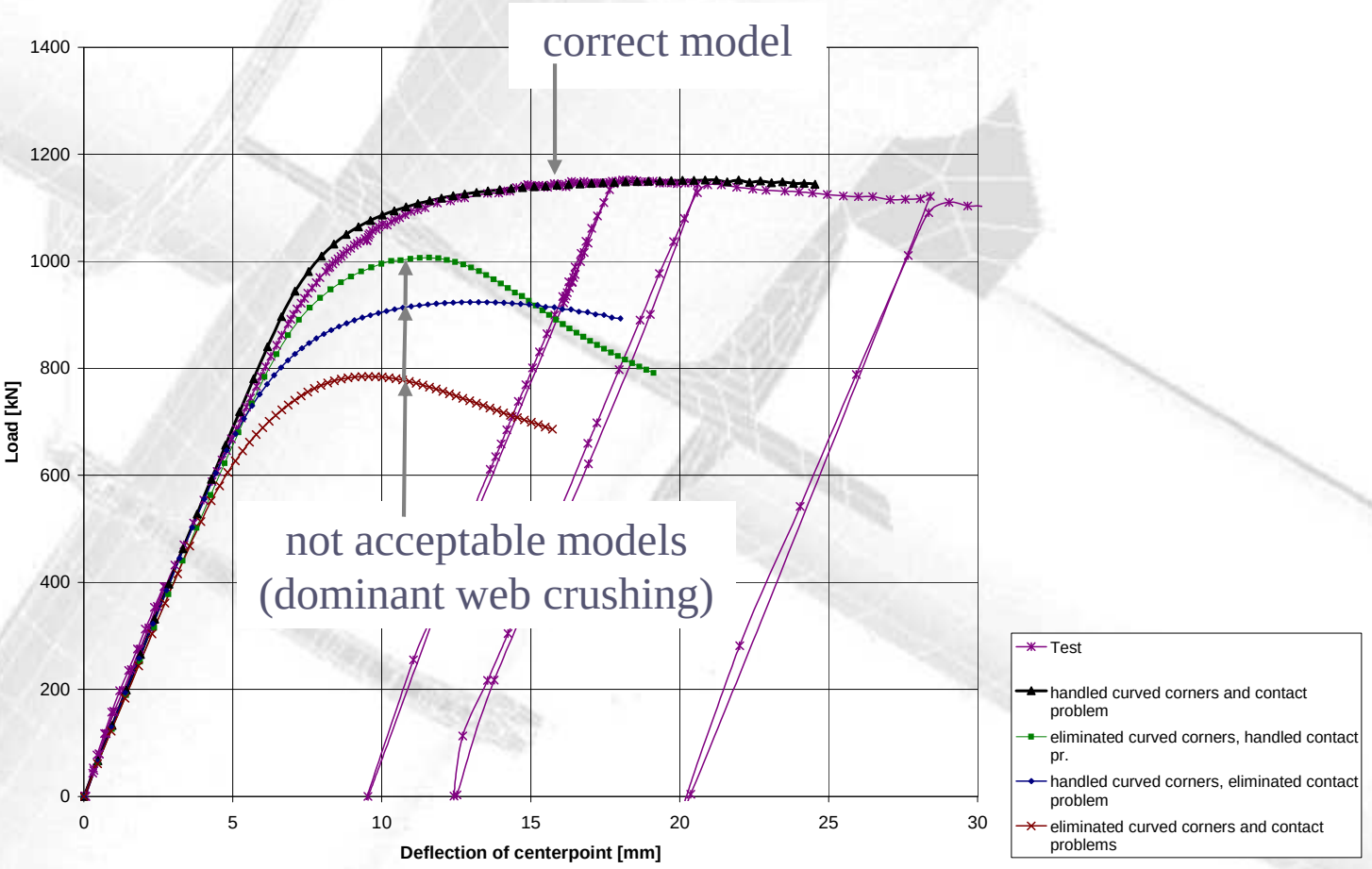
3. Verification



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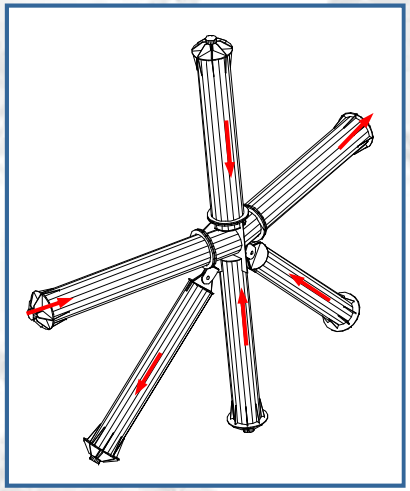
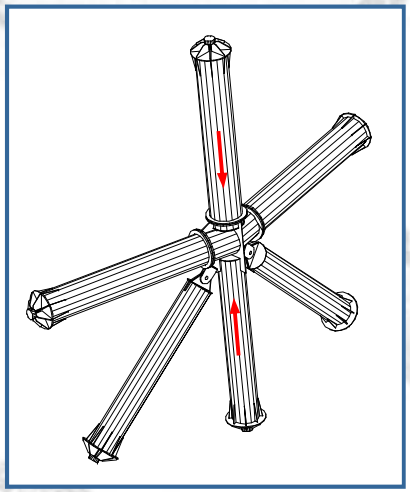
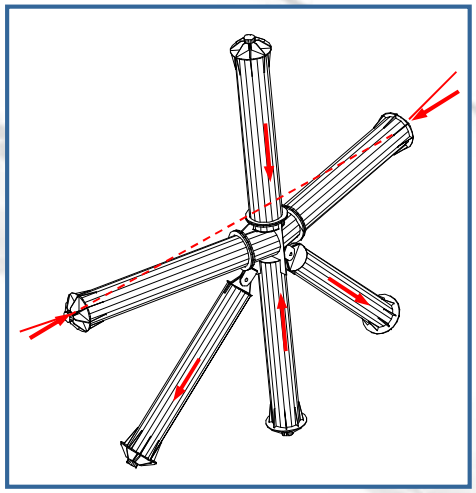
Cooling tower joint
1. Pilot test

- elastic stage; several loadcases
- ultimate tests







and so on…

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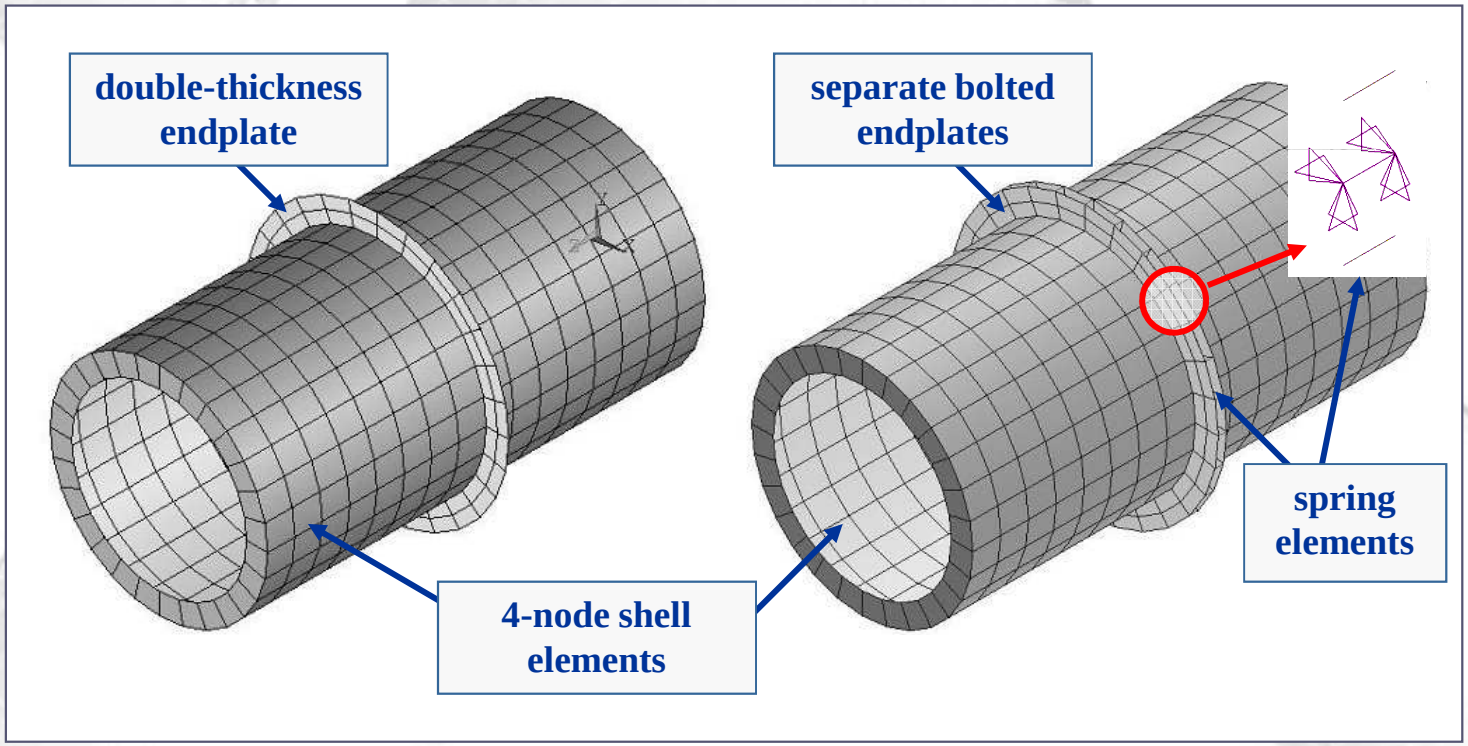
Cooling tower joint
2. Modelling

- local model of the bolted endplate connection



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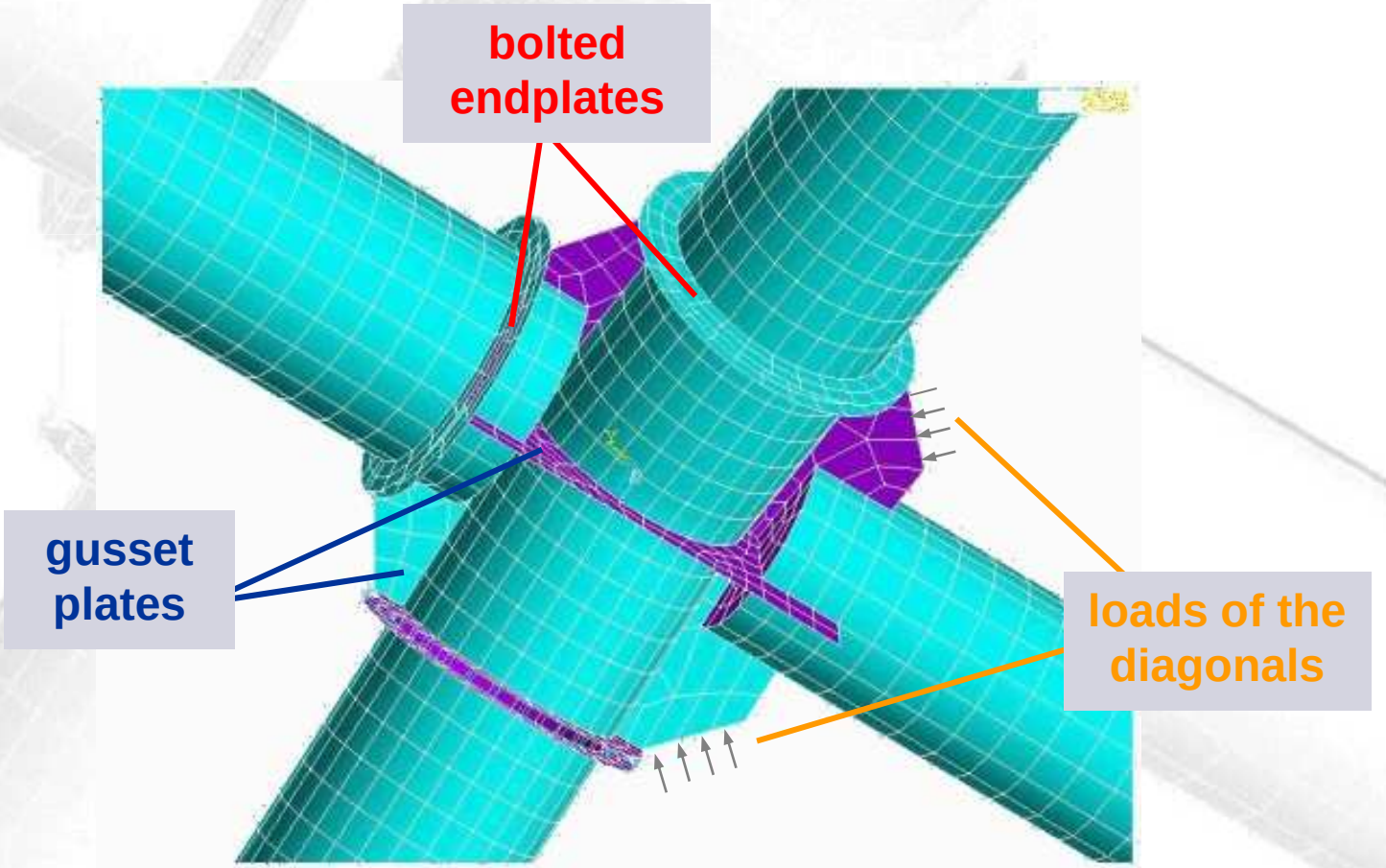
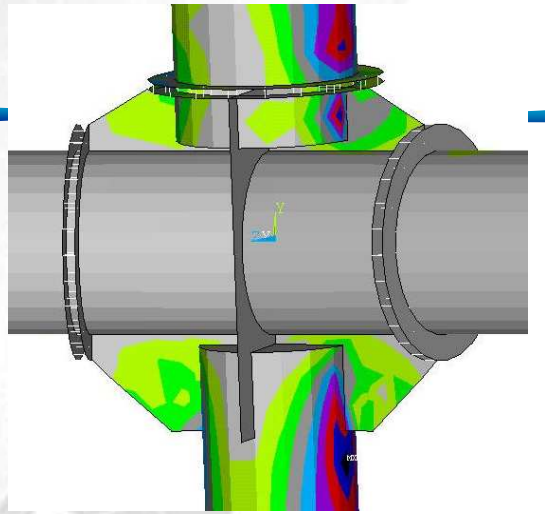
Cooling tower joint
2. Modelling

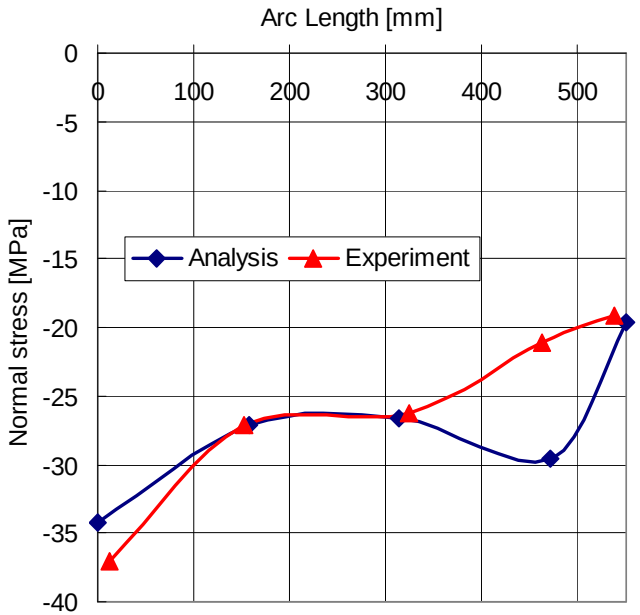
- global model of the joint

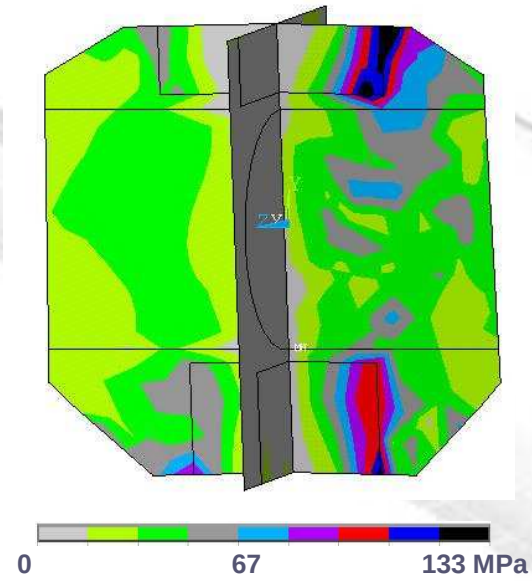


Cooling tower joint
3. Verification

- elastic stage:
  - reaction loads,
  - stress distribution







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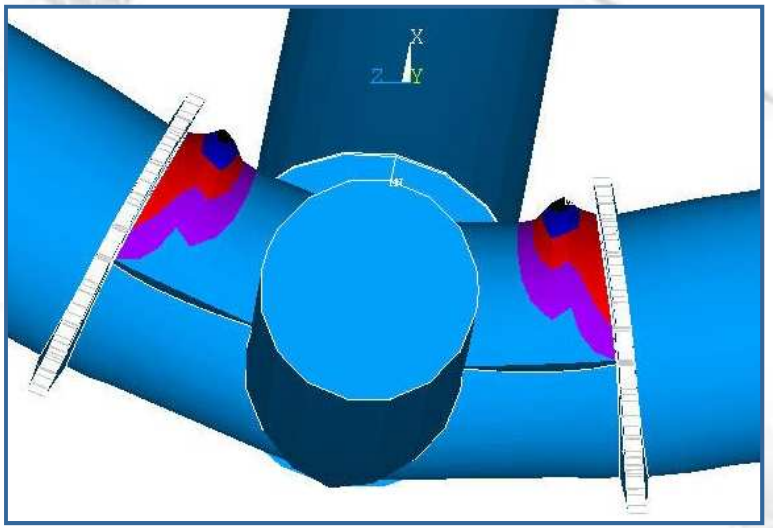
Cooling tower joint
3. Verification

- elastic stage:
  - reaction loads,
  - stress distribution
- ultimate behaviour:
  - failure modes and positions



Concluding remarks

- model developments:
  - pilot-test configuration
  - additional investigations
  - partial numerical models
  - numerical modelling
  - virtual experiments
  - verification
- parametric study
- optimisation
- design, structural checking
- design method development

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Thank you very much for your attention!