

Recent research activities at the Structural Laboratory

Department of Structural Engineering,
Budapest University of Technology and Economics



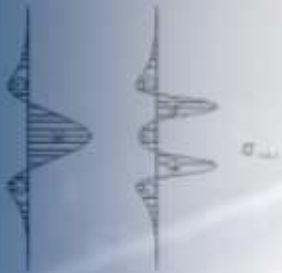
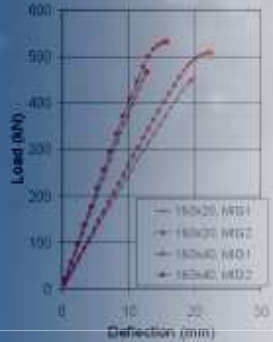
Laszlo Gergely Vigh, (aka Geri)

*Asst. Prof., Budapest University of Technology and Economics,
Dept. Of Structural Engineering, Hungary*



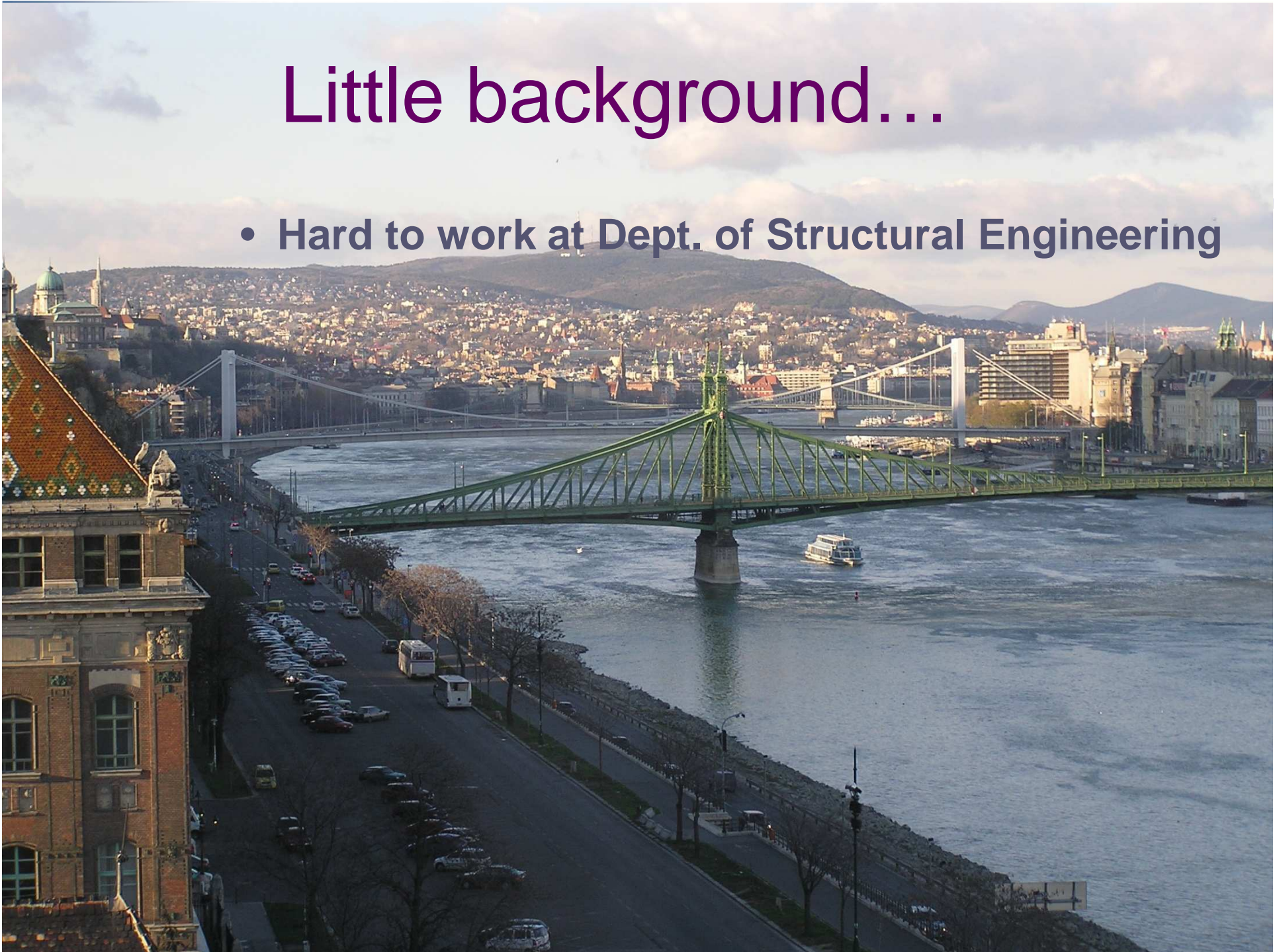
Little background...

- Hard to work at Dept. of Structural Engineering



Little background...

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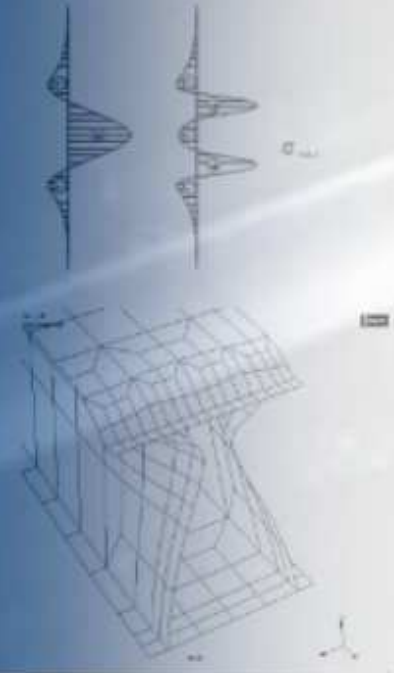
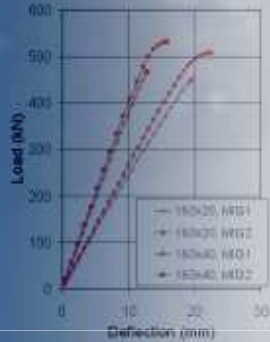
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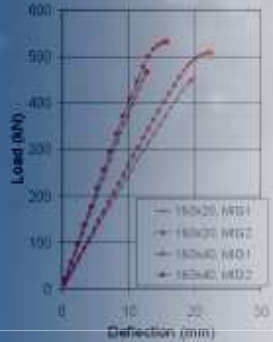
Little background...

- Budapest University of Technology and Economics



Little background...

- Budapest University of Technology and Economics



Little background...

- **Budapest University of Technology and Economics:**

- 8 faculties and several innovation centers

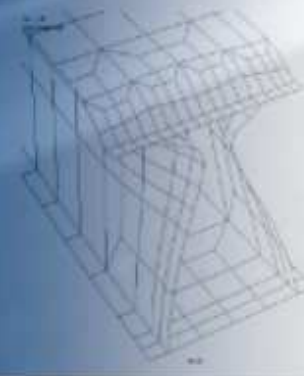
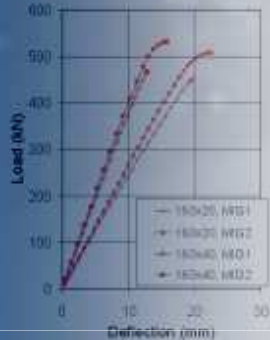
- **Faculty of Civil Engineering:**

- 10 departments

- **Dept. of Structural Engineering:**

- staffs: 57 (incl. appr. 25 of asst. prof – prof)

- 22 BSc, 16 MSc courses + optionals



Little background...

- **Dept. of Structural Engineering**

- 1. Education**

- 2. Research – national research funds, and ‘selfish’ researches**

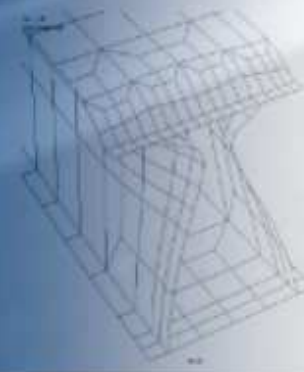
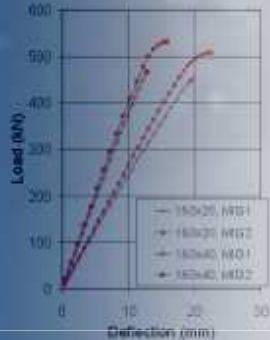
- 3. Industry & University**

- **R&D**
- **Co-designer**
- **Expert**
- **Independent checks**
- **Laboratory and site testing – Accredited laboratory**

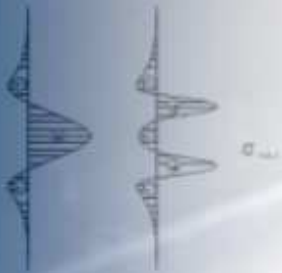
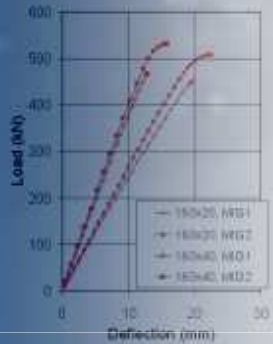
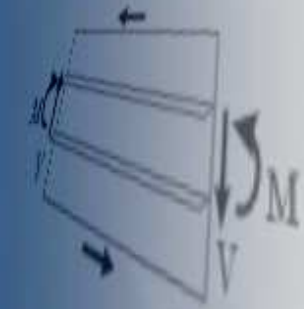
- 4. Conferences: SDSS, IABSE2006, Eurosteel 2011**

- 5. International committees (EC, COST, etc.)**

- 6. Student life...**

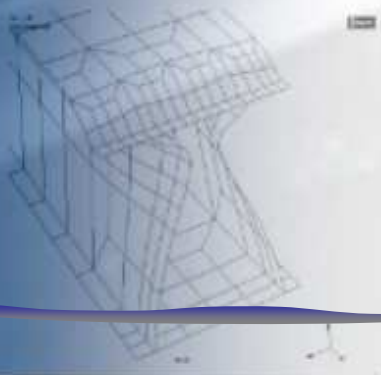
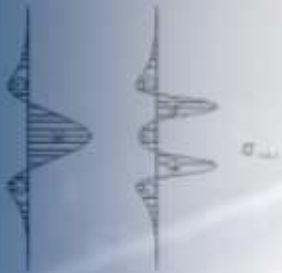
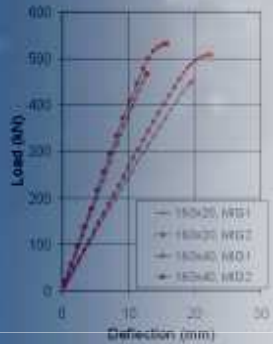


The Structural Laboratory

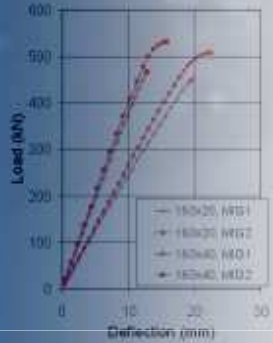
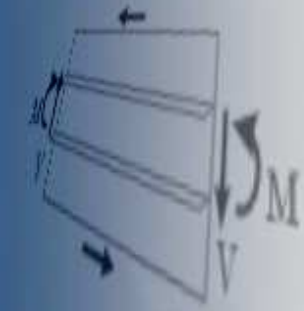




- **founded: 1975**
- **equipments:**
 - max. static pres.: 600 t
 - actuators
 - (very) small shaking table
 - etc.
- **accredited laboratory:**
 - small-specimen tests
 - load testing of bridges
 - etc.

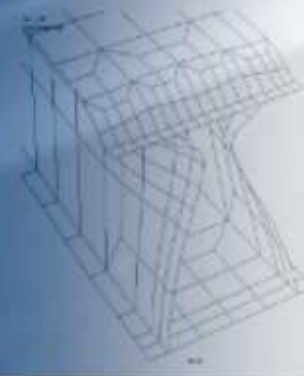
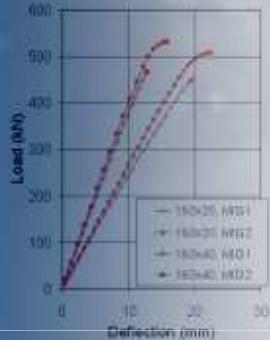


Current cold-formed projects

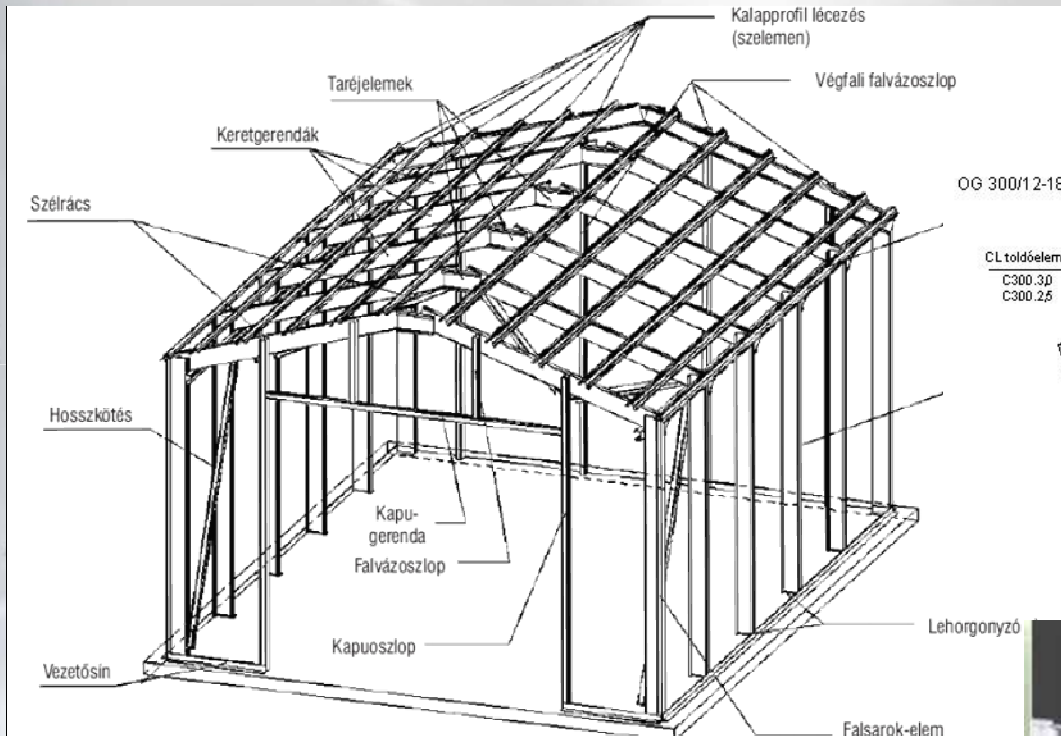
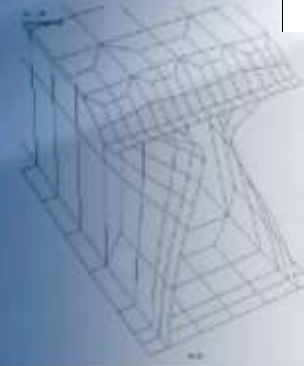
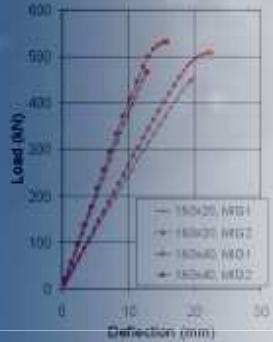


Recent research activities

- period: 2006-2008
- project manager: Prof. Laszlo Dunai
- projects:
 - 1) Lindab SBS frames
 - 2) Lindab truss system
 - 3) cold-formed compression members
 - 4) perforated deep trapezoidal profiles
 - 5) overlapped Z-purlins
- group:
 - Sándor Ádány
 - István Kotormán
 - Tamás Futó
 - Csaba Monyók
 - Gábor Jakab
 - Zoltán Kósa
 - Mansour Kachichian
 - Attila László Joó

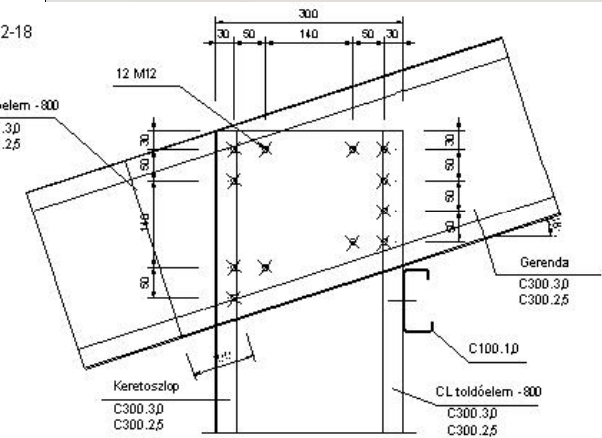


Lindab SBS frame



OG 300/12-18

CL toldóelem - 800
C300.3D
C300.2.5



LINDAB SBS frame



Lindab truss system

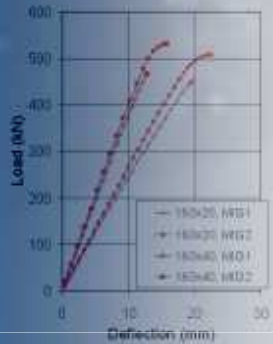


Figure 5: Elastic local buckling (left) and failure in the compression chord (right) in test 1

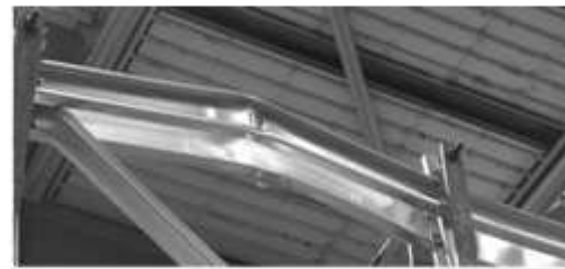
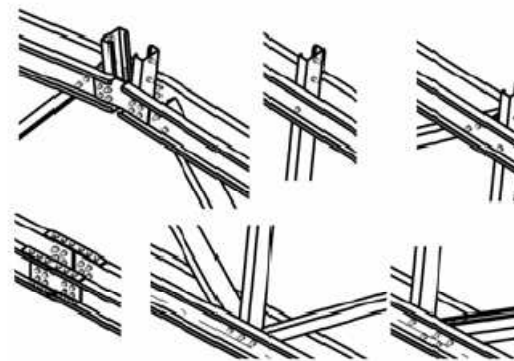


Figure 6: Elastic local buckling (left) and failure in the compression chord (right) in test 5

Perforated deep trapezoidal profiles

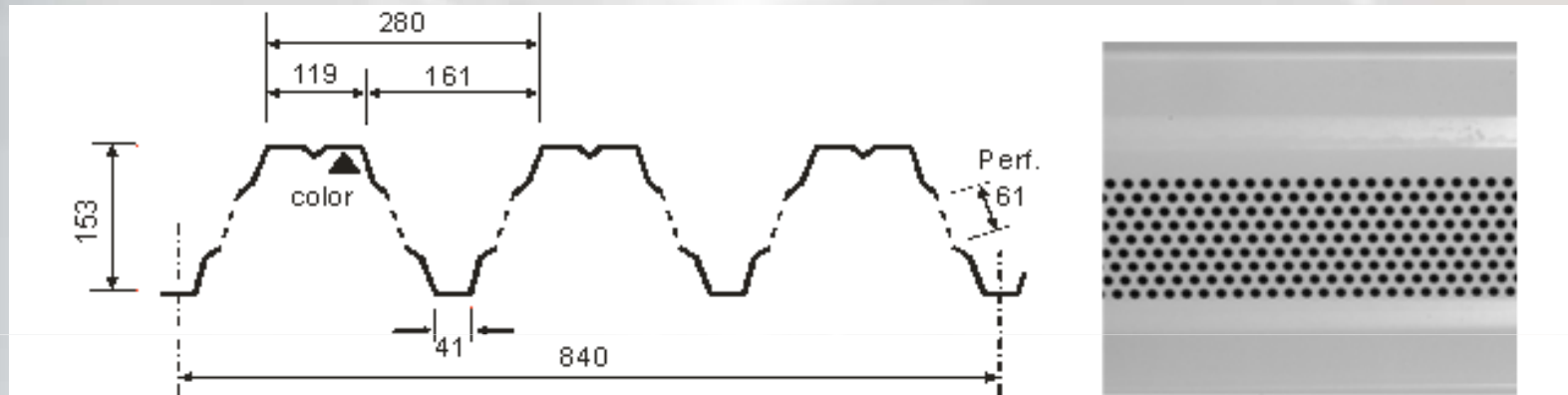
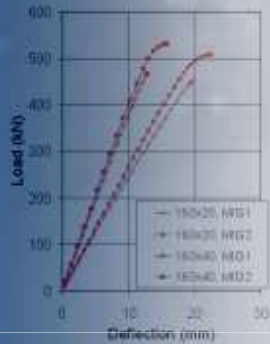
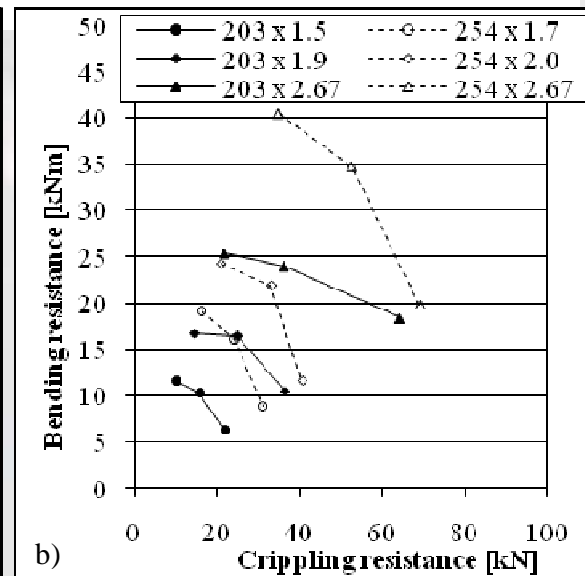
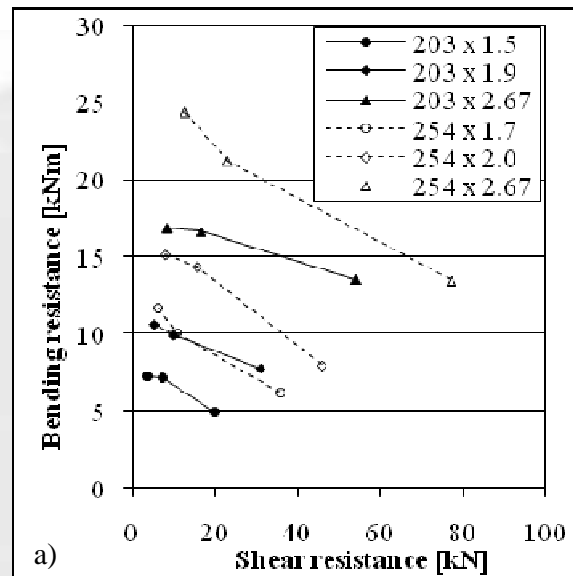
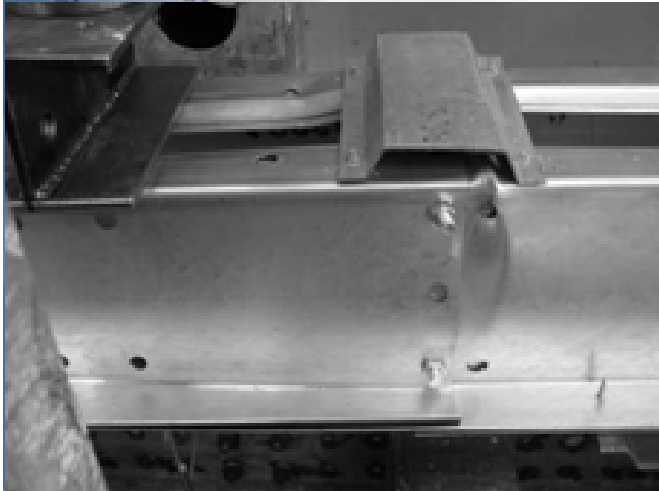
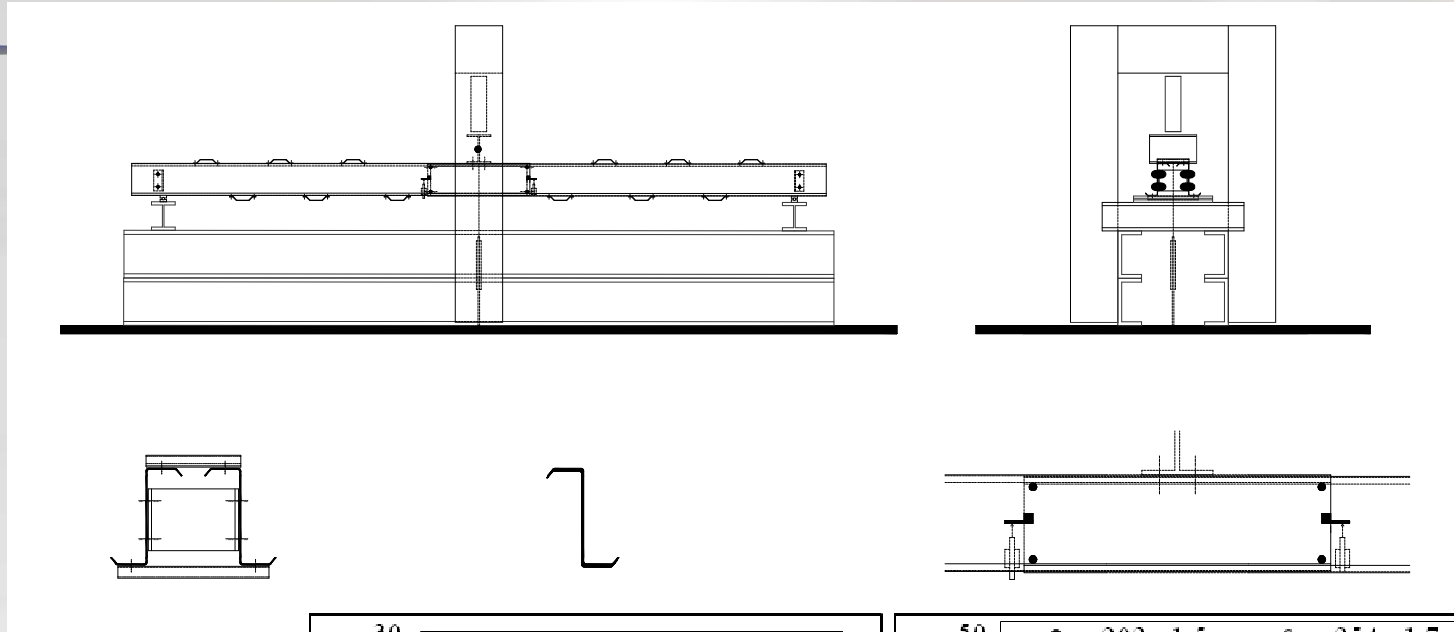
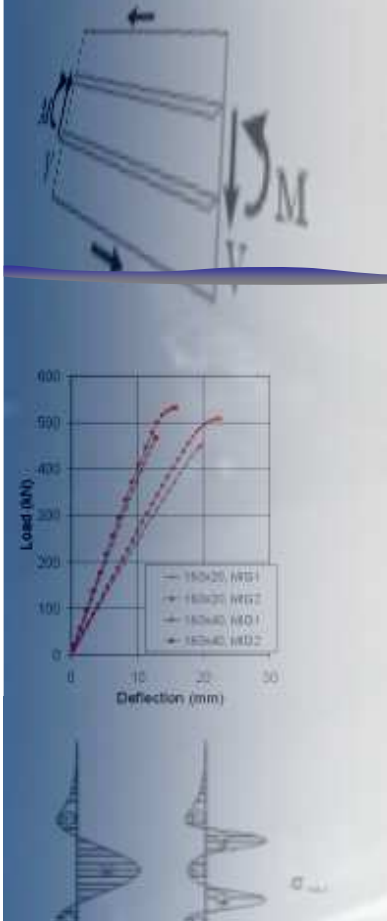


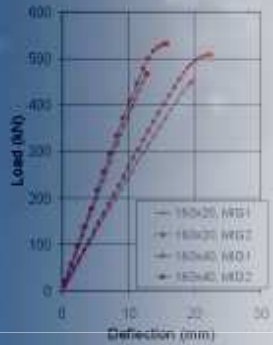
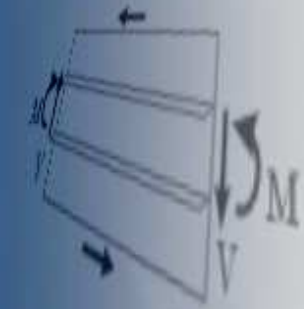
Table 2. Proposed reduction factors

Bending resistance	0.93
Shear resistance	1.00
Resistance to direct transverse force far from panel end (e.g., internal support)	0.79
Resistance to direct transverse force close to panel end (e.g., external support)	0.65
Moment of inertia (or: bending rigidity) in serviceability limit state	0.90

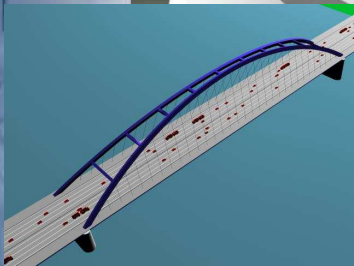
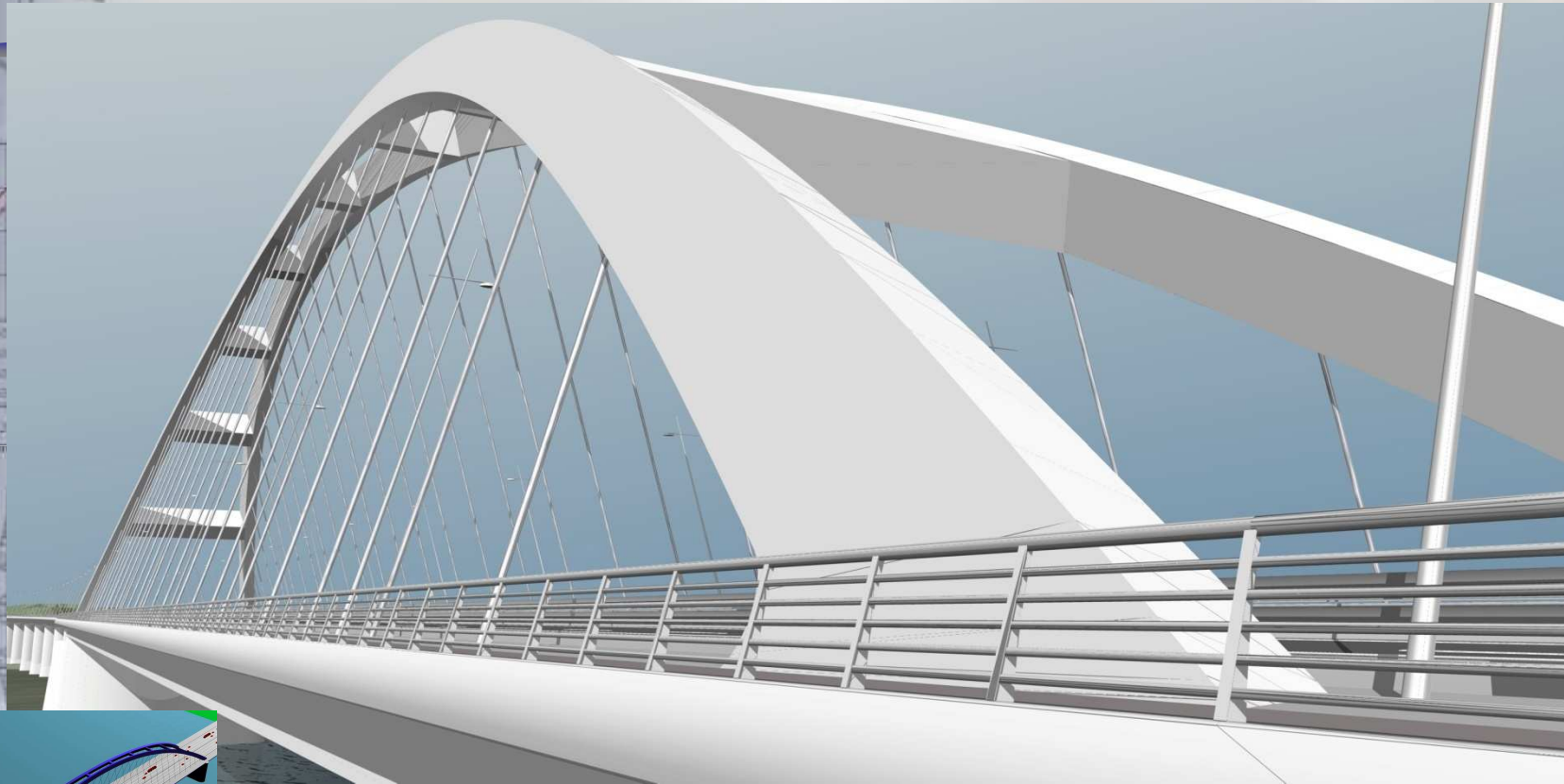
Overlapped Z-purlins



Other major projects



Pentele Bridge



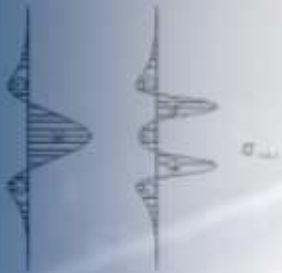
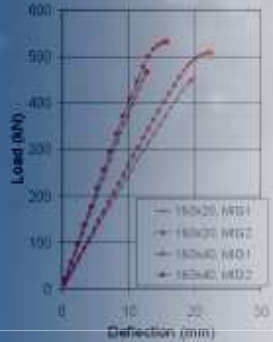
Total length of the bridge: 1780 m

Main span (arch bridge) : 307.8 m

Arch height: 48 m, section: steel box (~2 x 3 m)

Pentele Bridge

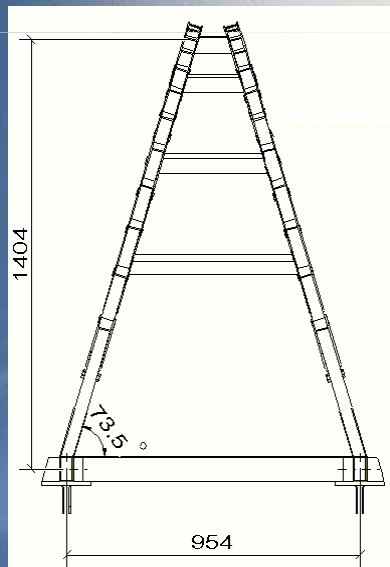
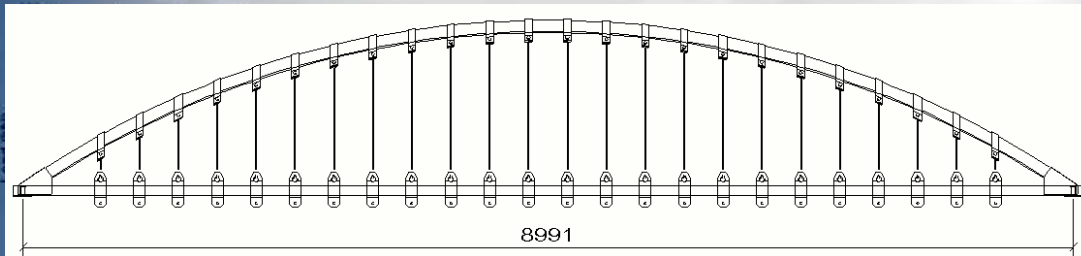
- co-designer
- independent checks
- seismic analysis / design
- testing

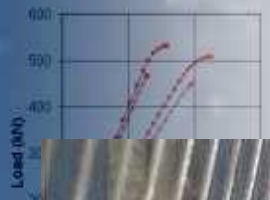
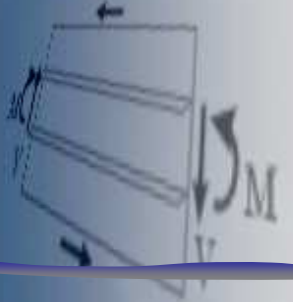




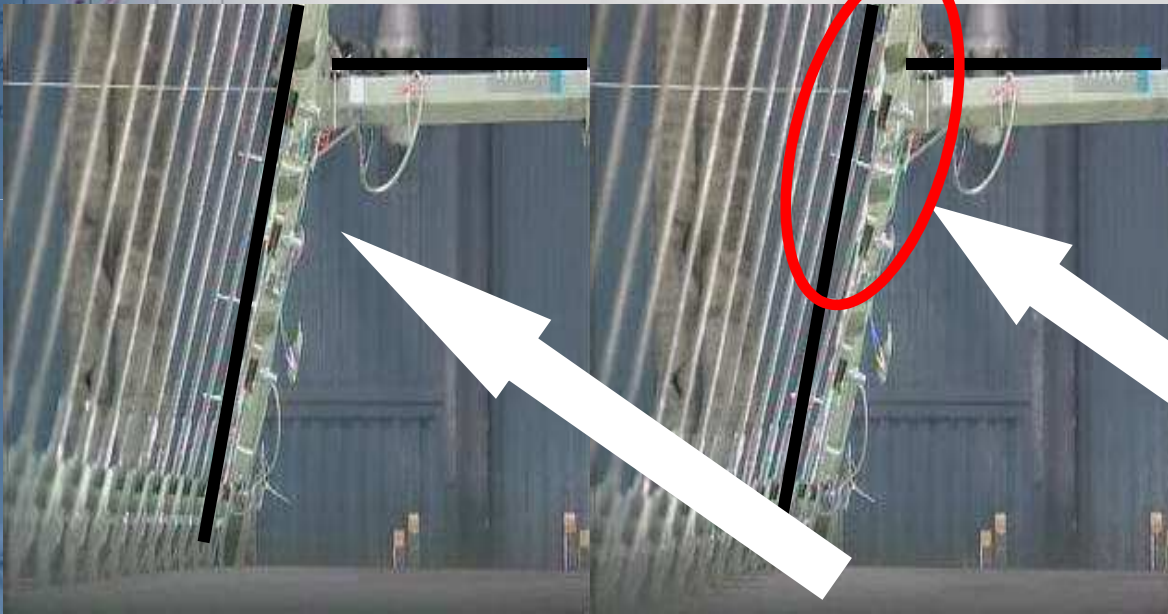
DUNAÚJVÁROS, HUNGARY, 6th December 2006

Bridge model M=1:34





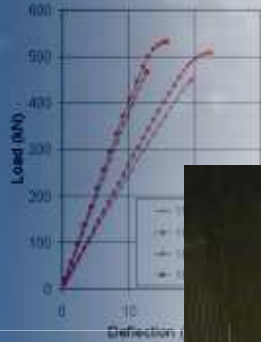
total loading: 320 kN out-of-plane buckling



local plate buckling



out-of-plane buckling of the arch



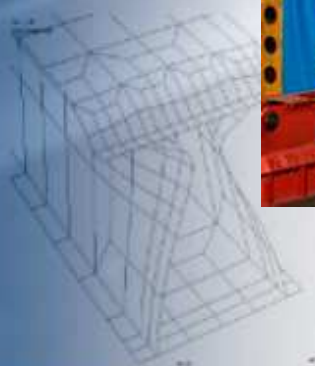
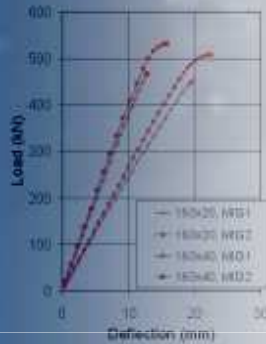
half-sided loading: 110 kN



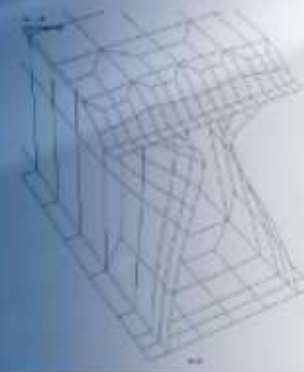
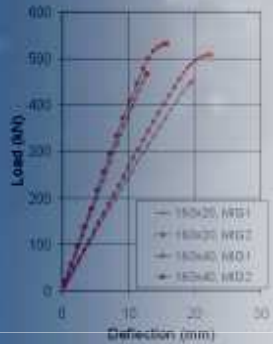
in-plane buckling of the arch



Research group

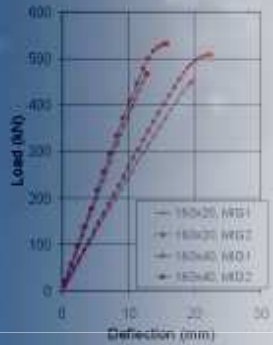


Megyeri Bridge

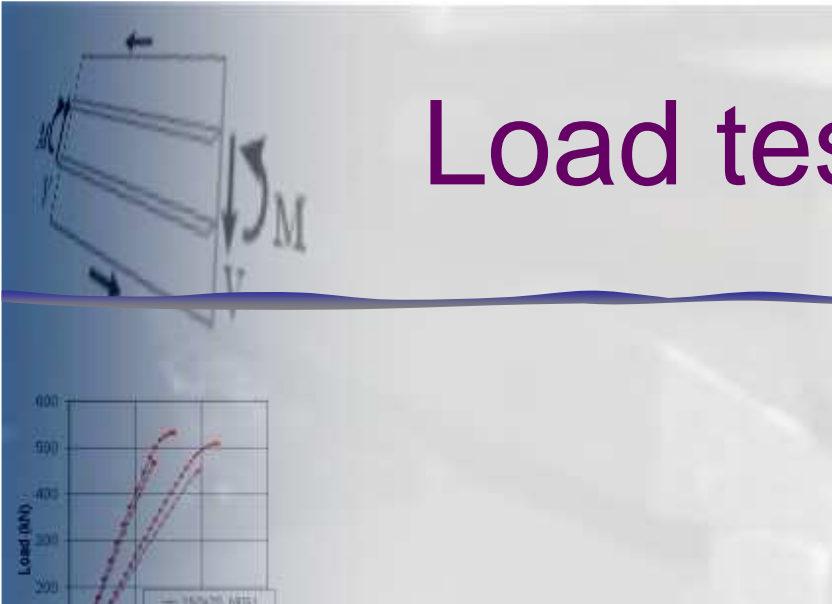


- independent checks
- seismic analysis / design
- special detailed analysis

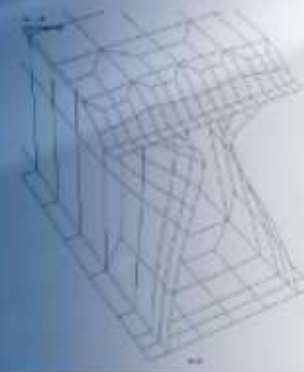
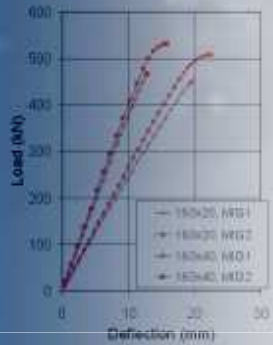
Load testing of bridges



Load test

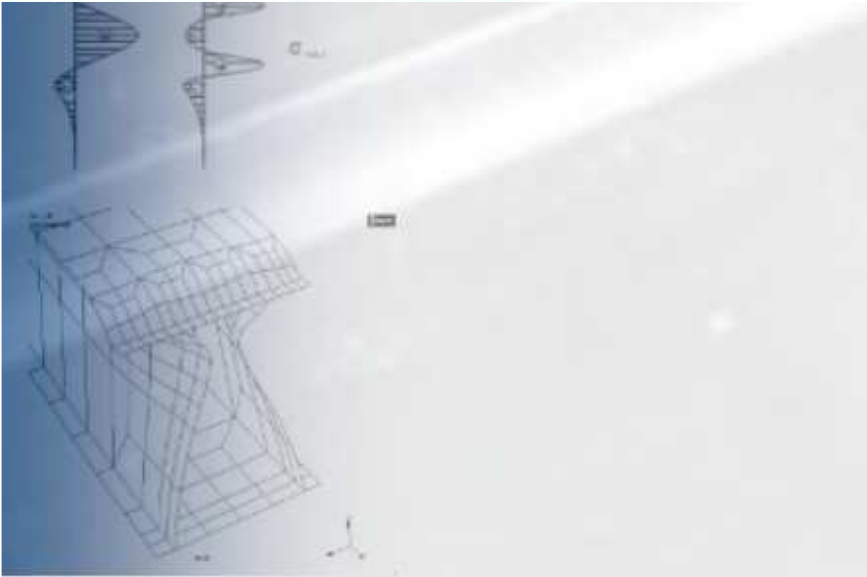


Load testing of bridges



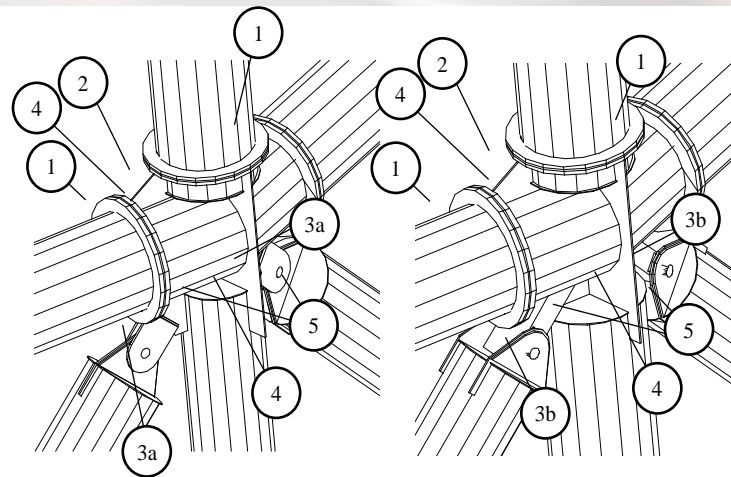
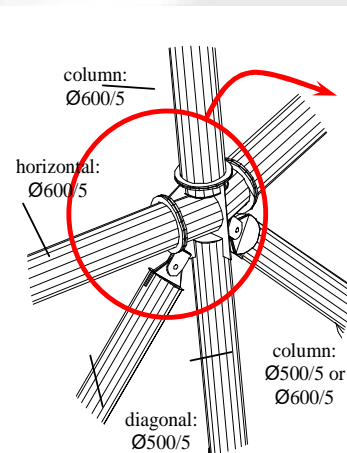
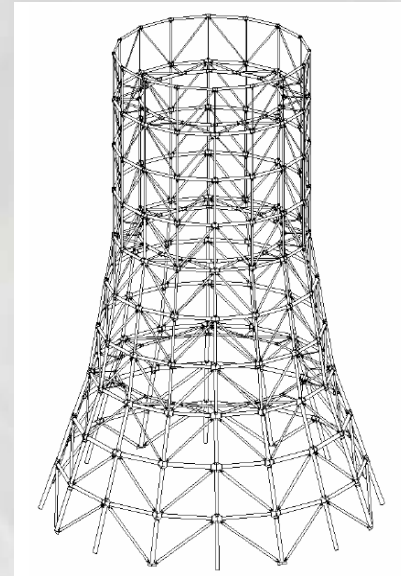


f bridges

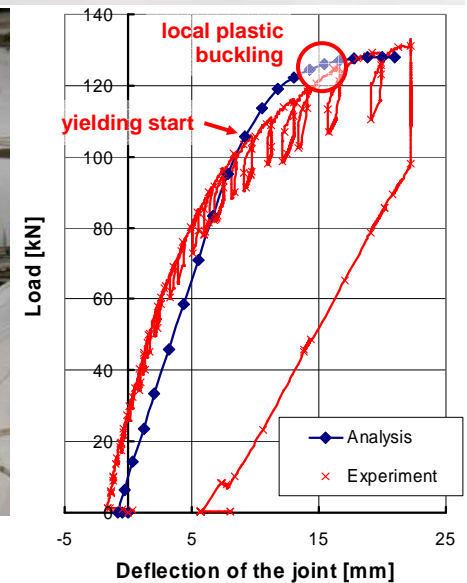
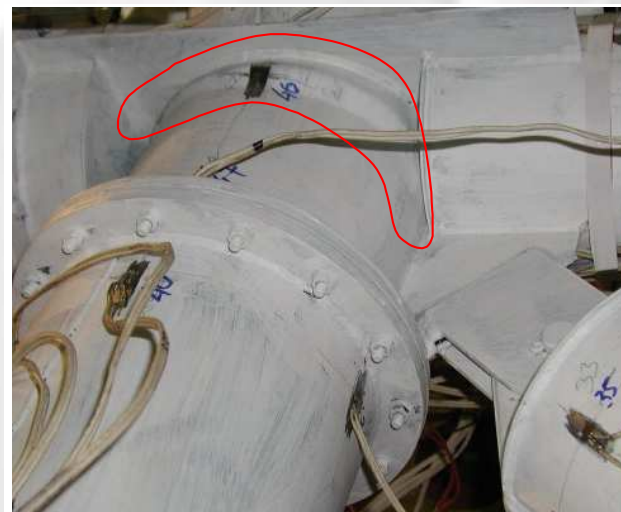
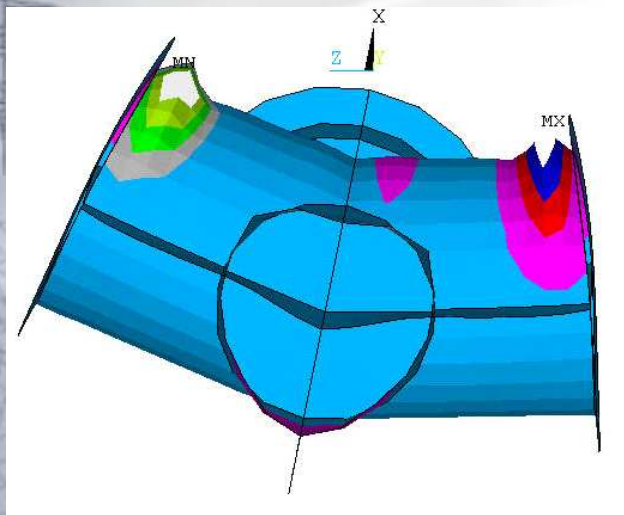
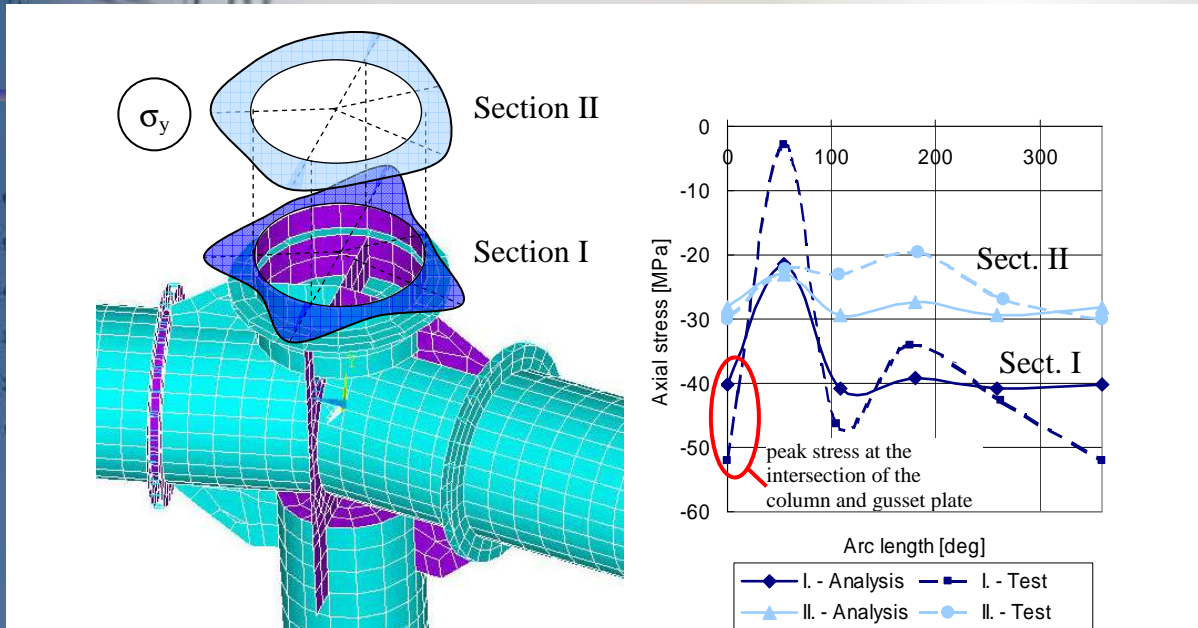


Complex 3D joint of thin-walled steel tubular structures

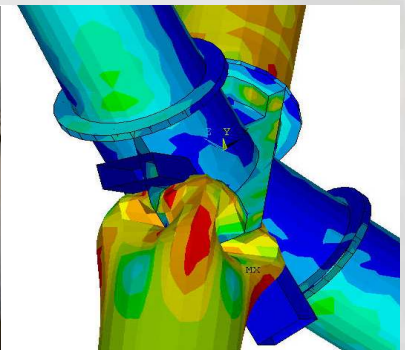
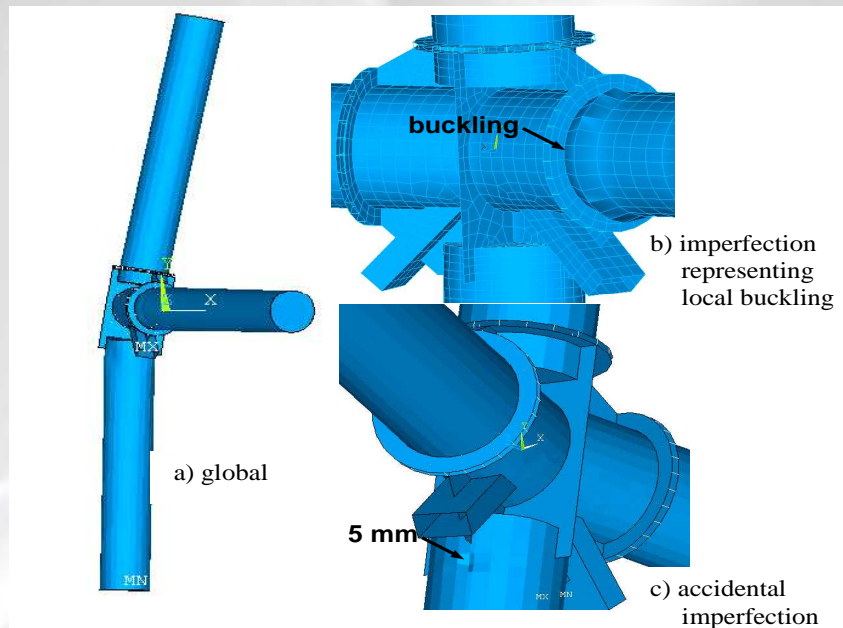
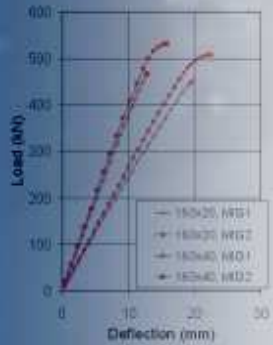
Cooling tower



- **Complex joint – virtual and real experiments**
 - elastic and ultimate behaviour

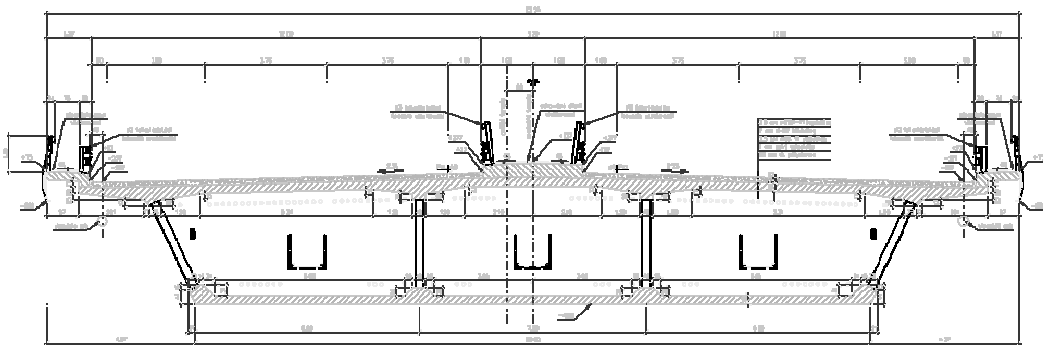
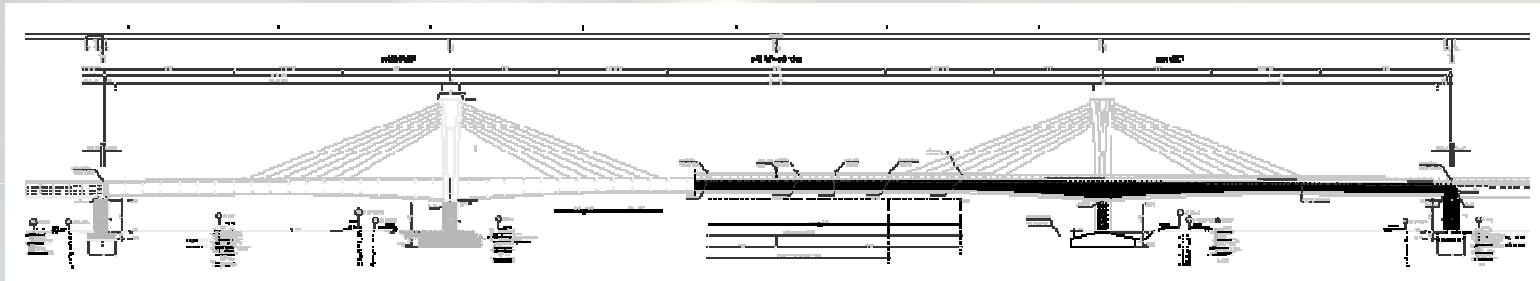
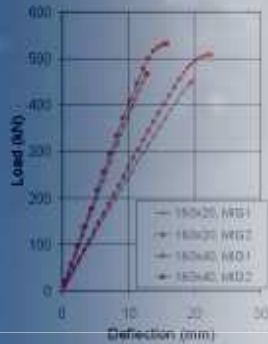


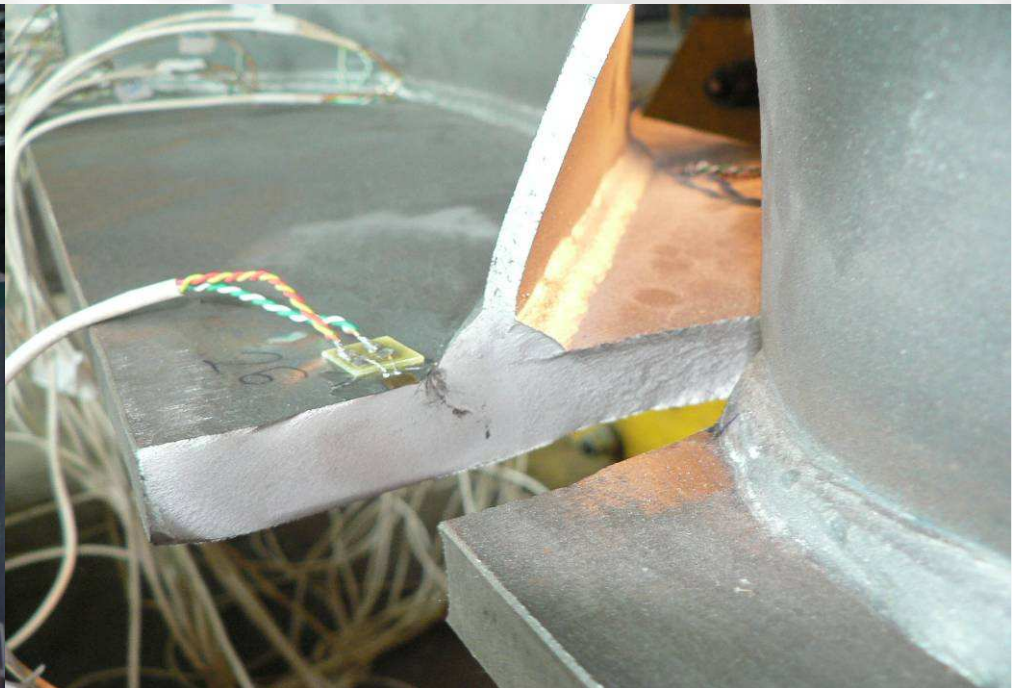
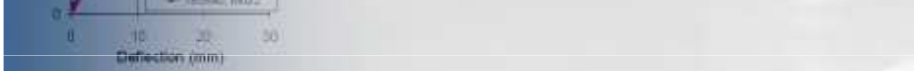
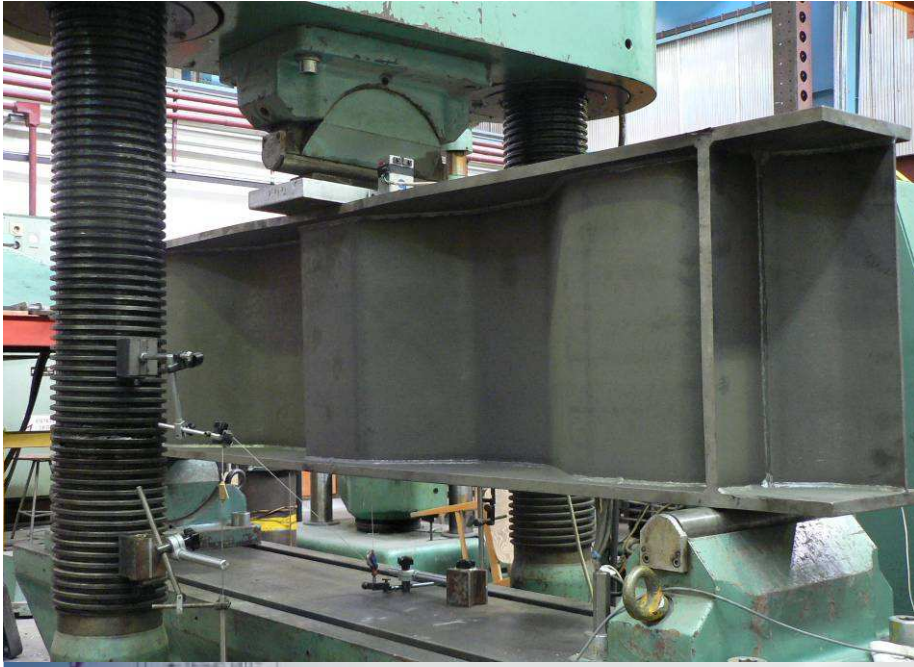
• Complex joint – imperfection sensitivity

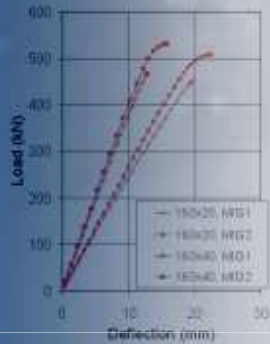
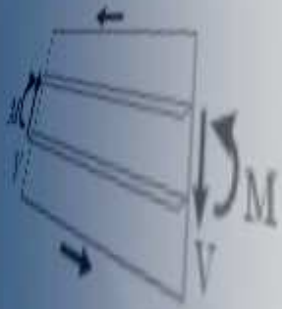


Corrugated web girders

- related to actual bridge design (extradosed bridge)
- fatigue
- web crippling (also in cooperation with Stuttgart University)







Further cooperations

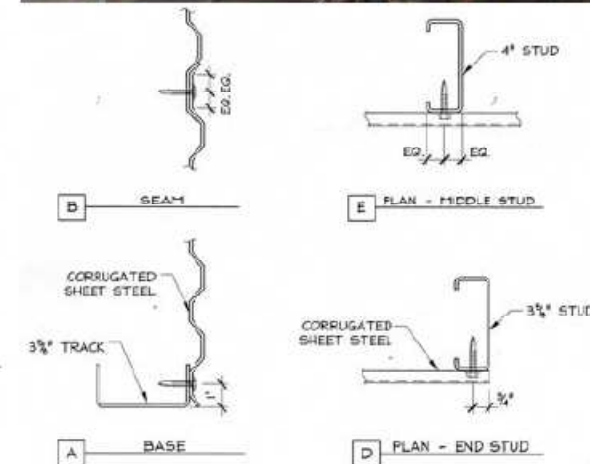
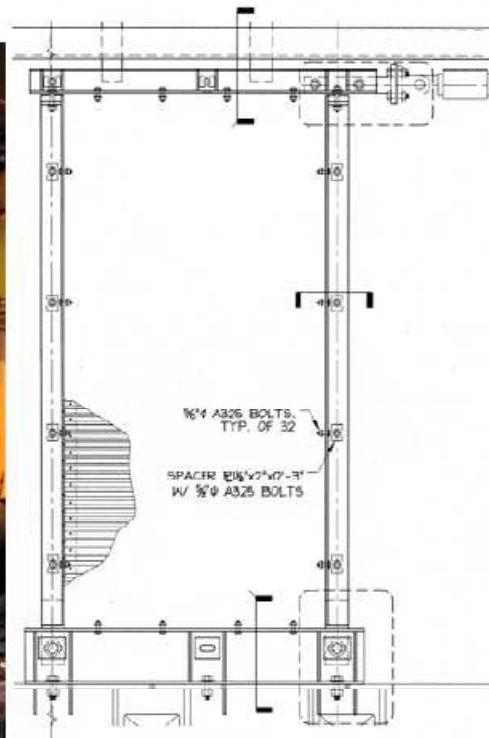
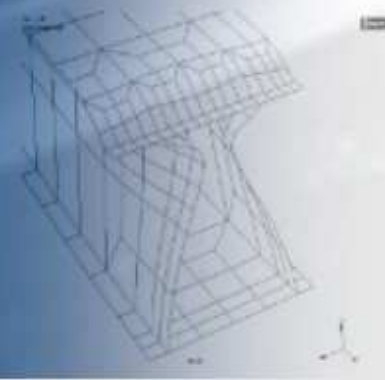
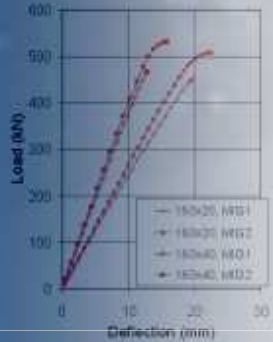
- **Stanford University:** seismic performance quantification of steel corrugated shear wall by ATC-63
- **Osaka University:** aluminum structures, multi-stiffened plates
- **Technical University of Lisbon:** composite columns, connections in seismic design
- **Stuttgart University:** corrugated web plate girders
- etc.



Shear wall system

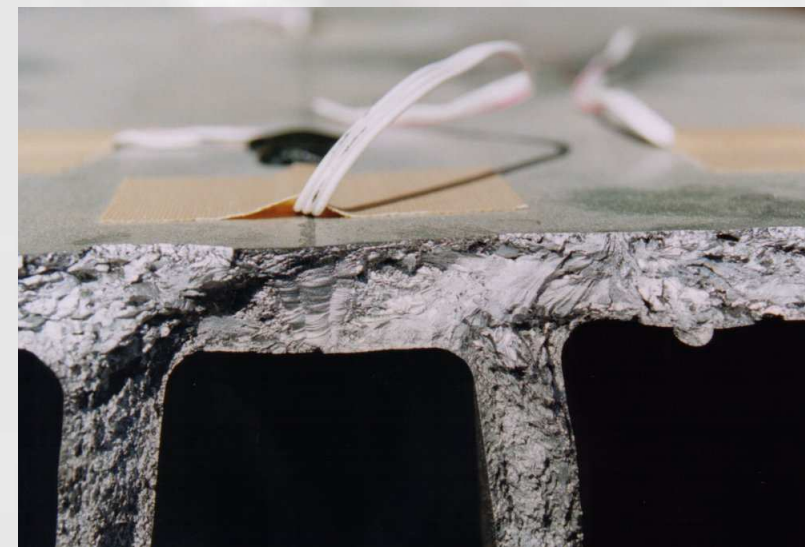
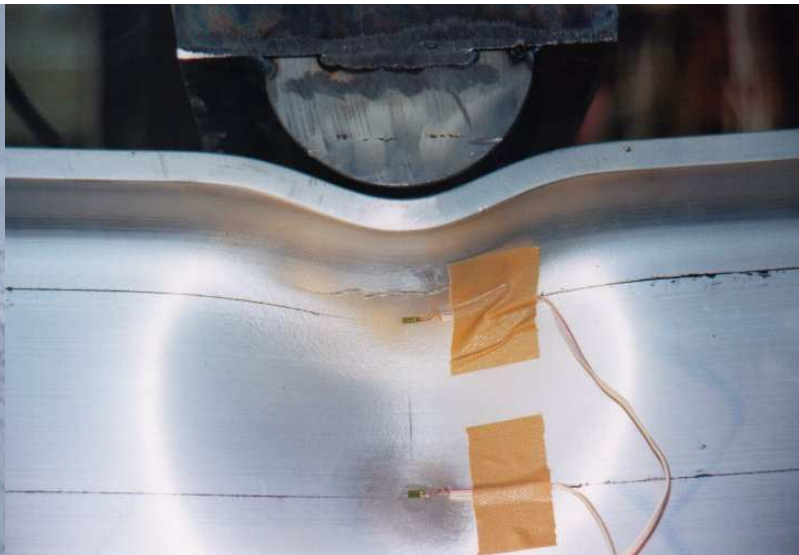
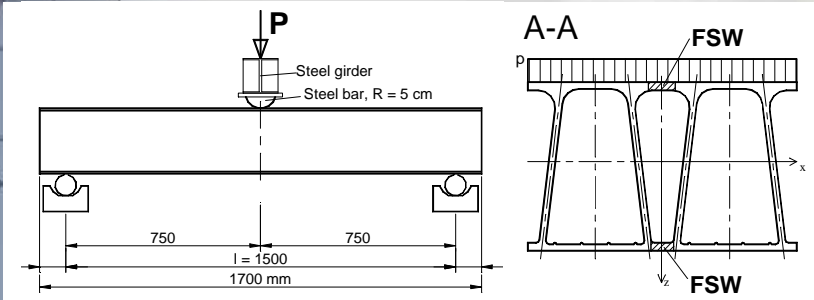
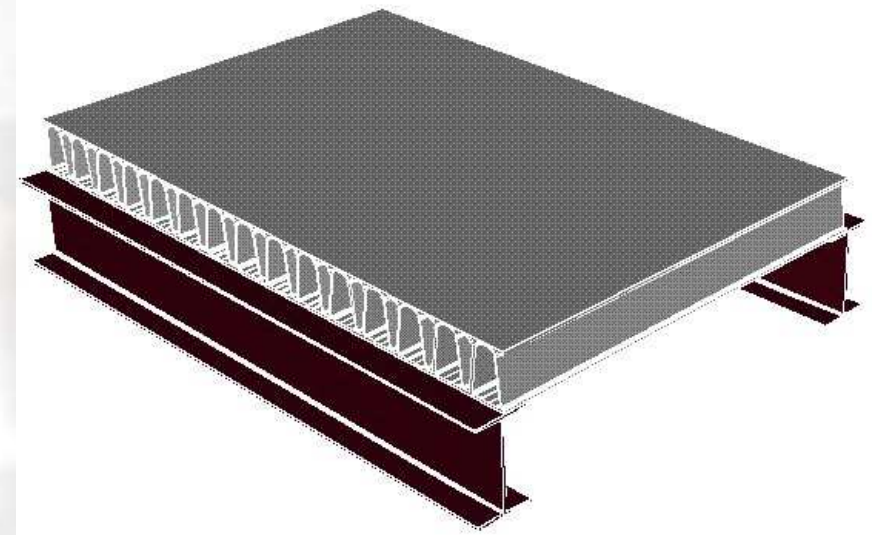
- corrugated sheet
- boundary elements
- screwed connection

Tipping Mar and Associates, Berkeley, CA
UC Berkeley – Stanford

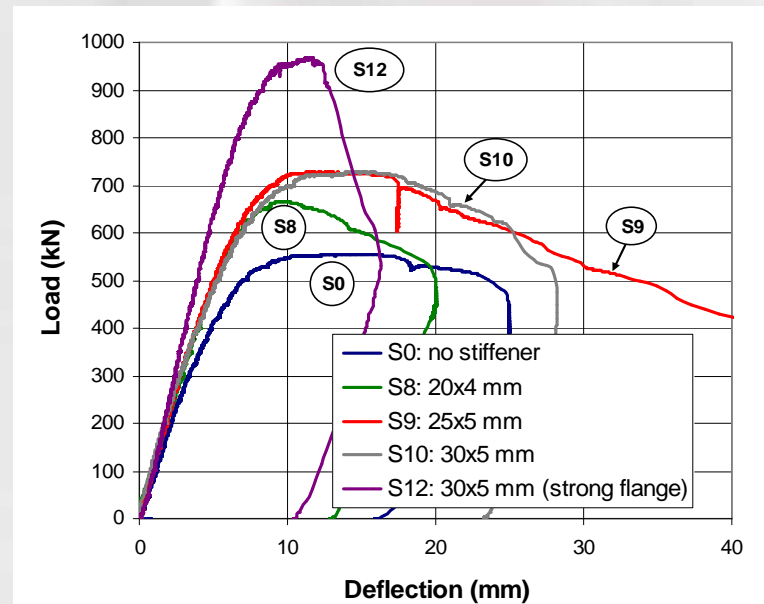
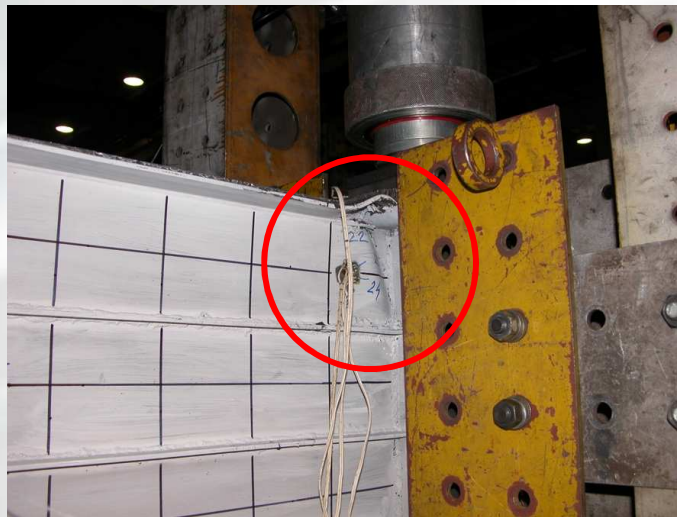
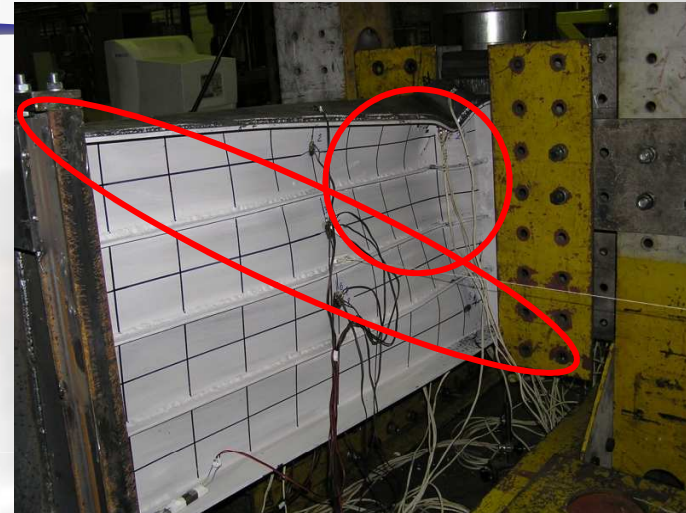
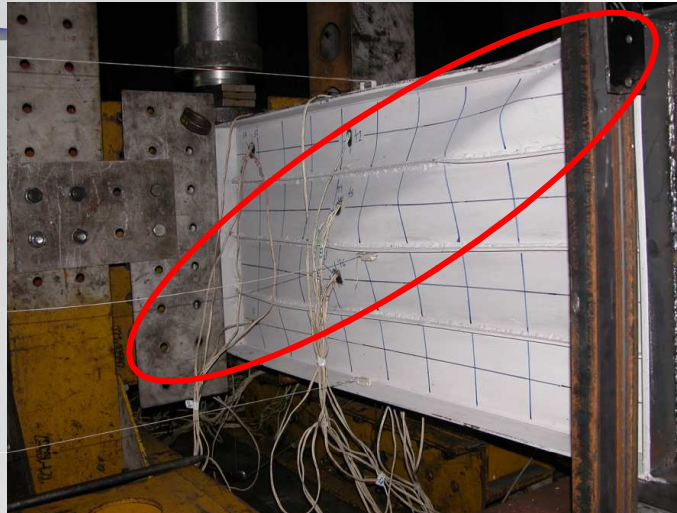
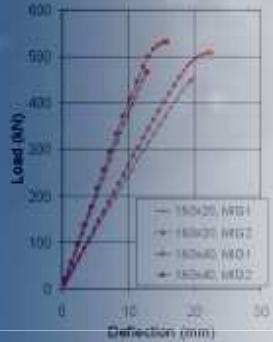


Aluminum bridge deck

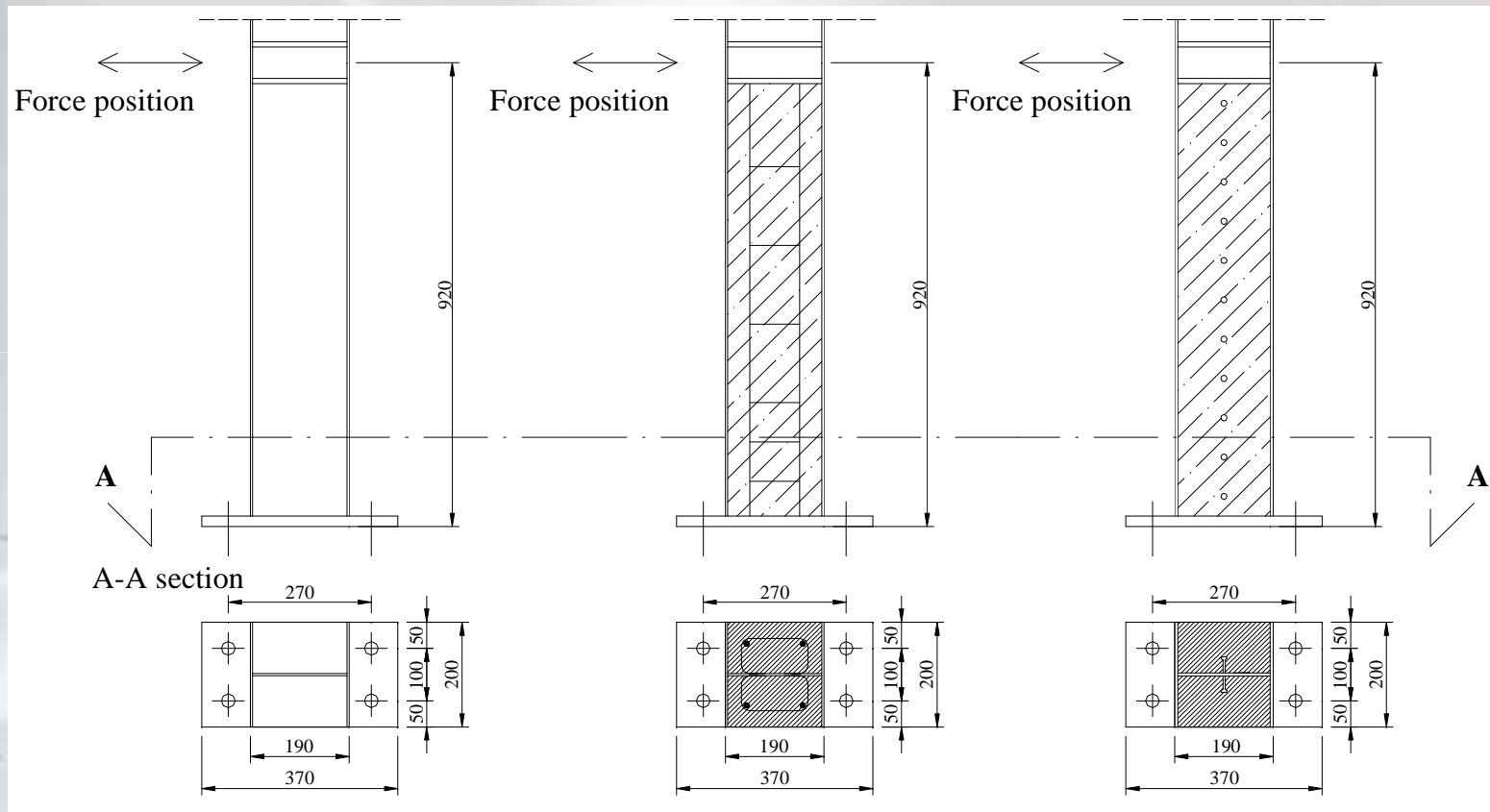
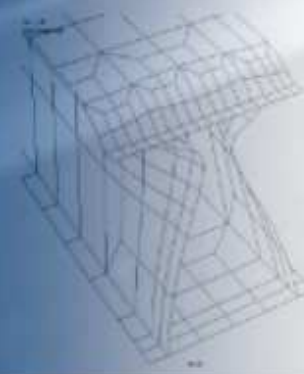
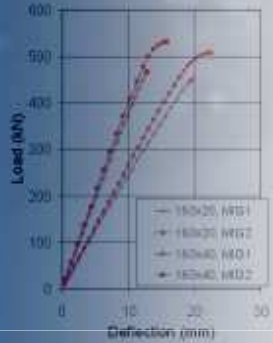
- Osaka University



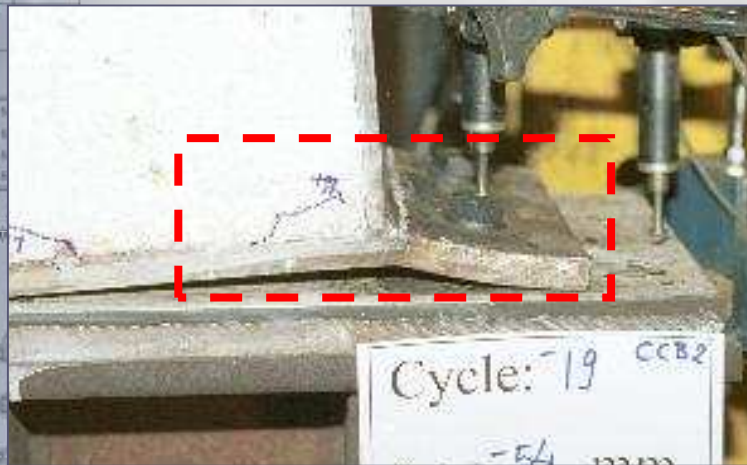
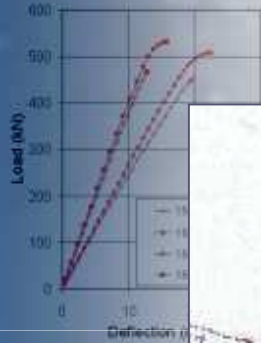
Multi-stiffened plates



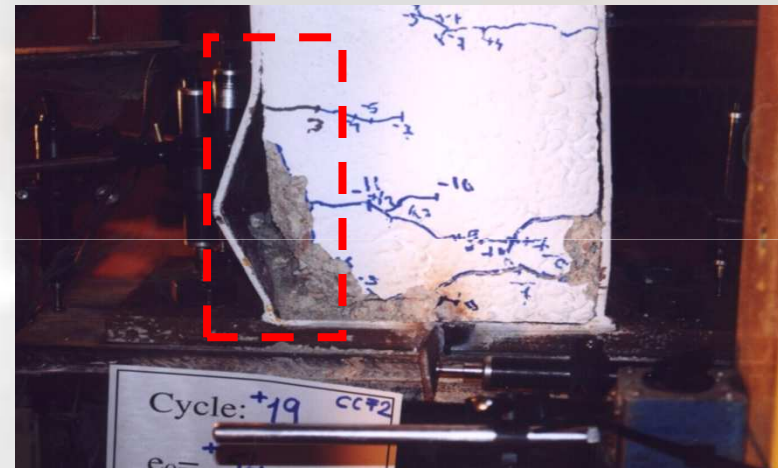
Composite columns



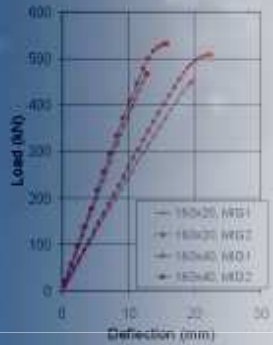
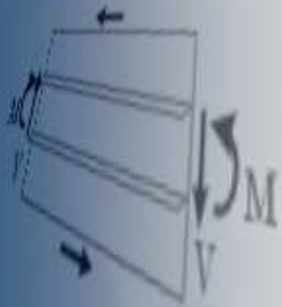
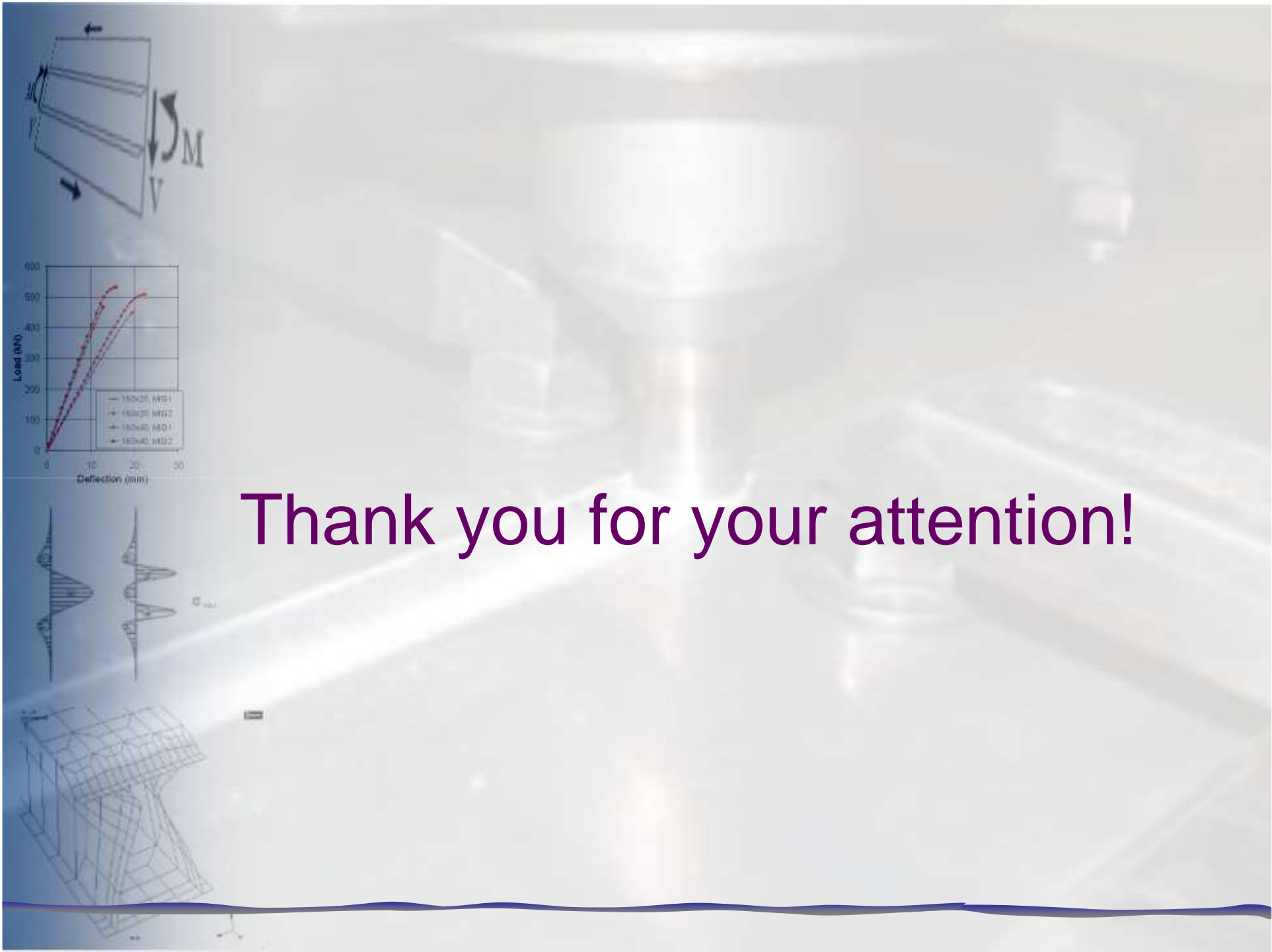
Composite columns



9 tests



5 tests



Thank you for your attention!

