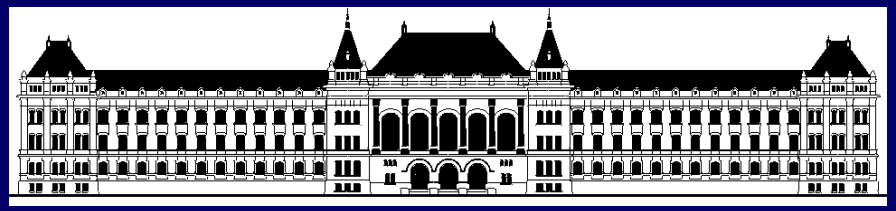
Department of Structural Engineering



Budapest University of Technology and Economics

CONTRIBUTION TO BRIDGE CONSTRUCTION OF THE DEPARTMENT OF STRUCTURAL ENGINEERING BME

György FARKAS, Miklós IVÁNYI, Géza TASSI, István VÖLGYI

6th International Conference on Bridges across the Danube

Budapest, 2007.

Brief history of BME

1782- Institutium Geometricum

1856- Royal Joseph Polytechnic

1860- Hungarian replaces Latin

1862- Royal Joseph University

– Department of Bridge Construction

1872- RJU gains full autonomy

1901- RJU is entitled to confer doctoral degree

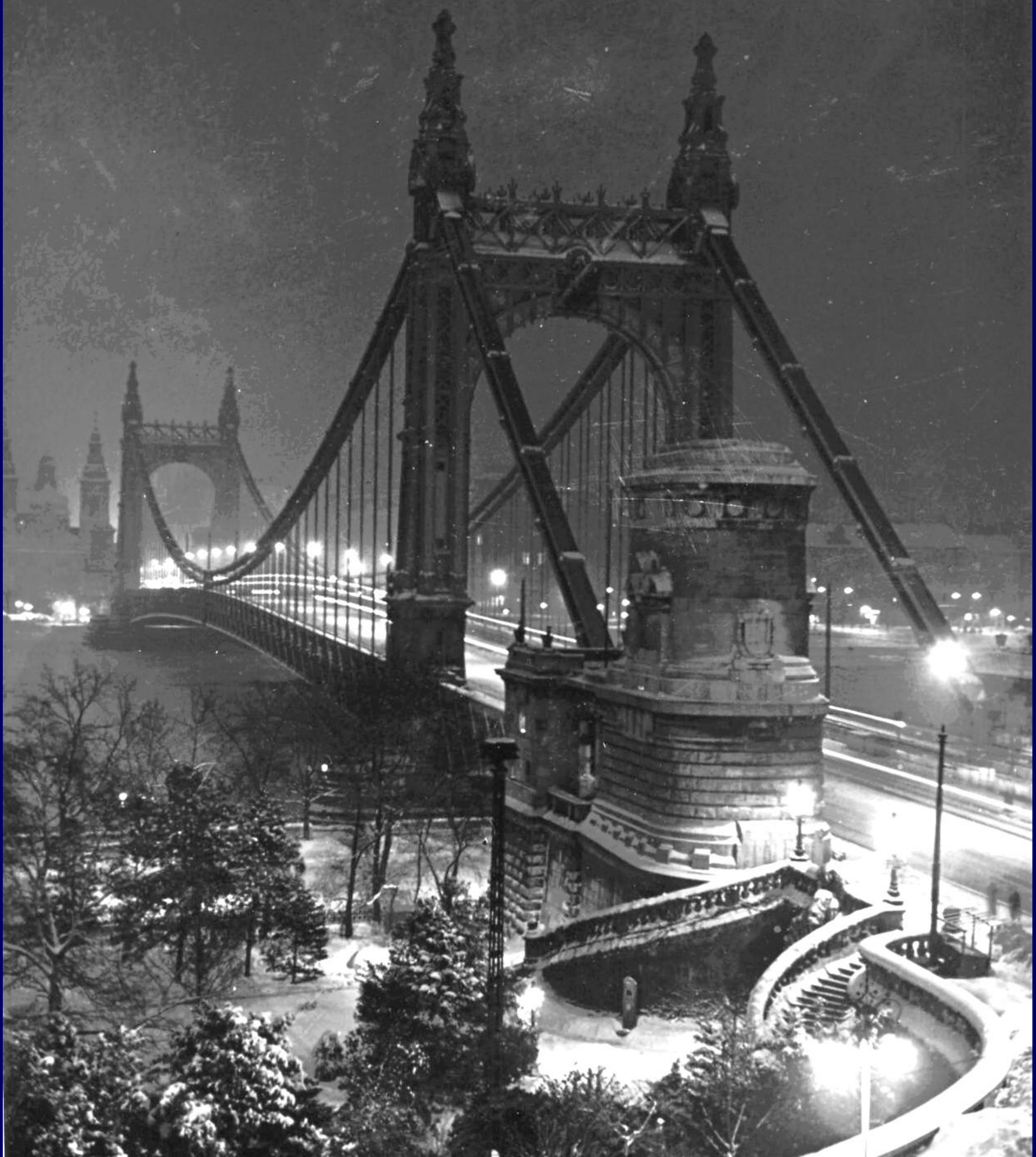
1949- Technical University of Budapest

2000- Budapest University of Technology and Economics

Antal Kherndl

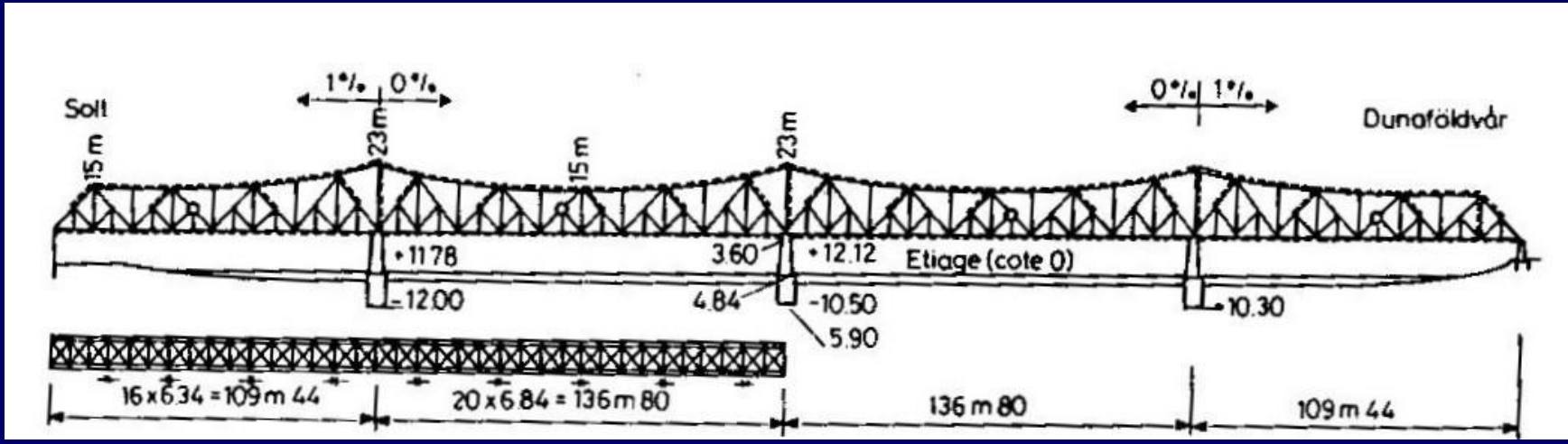
Before the II. WW

Old St. Elisabeth bridge



János Kossalka

Danube brige at Dunaföldvár



Pál Álgyai

Old Petőfi bridge

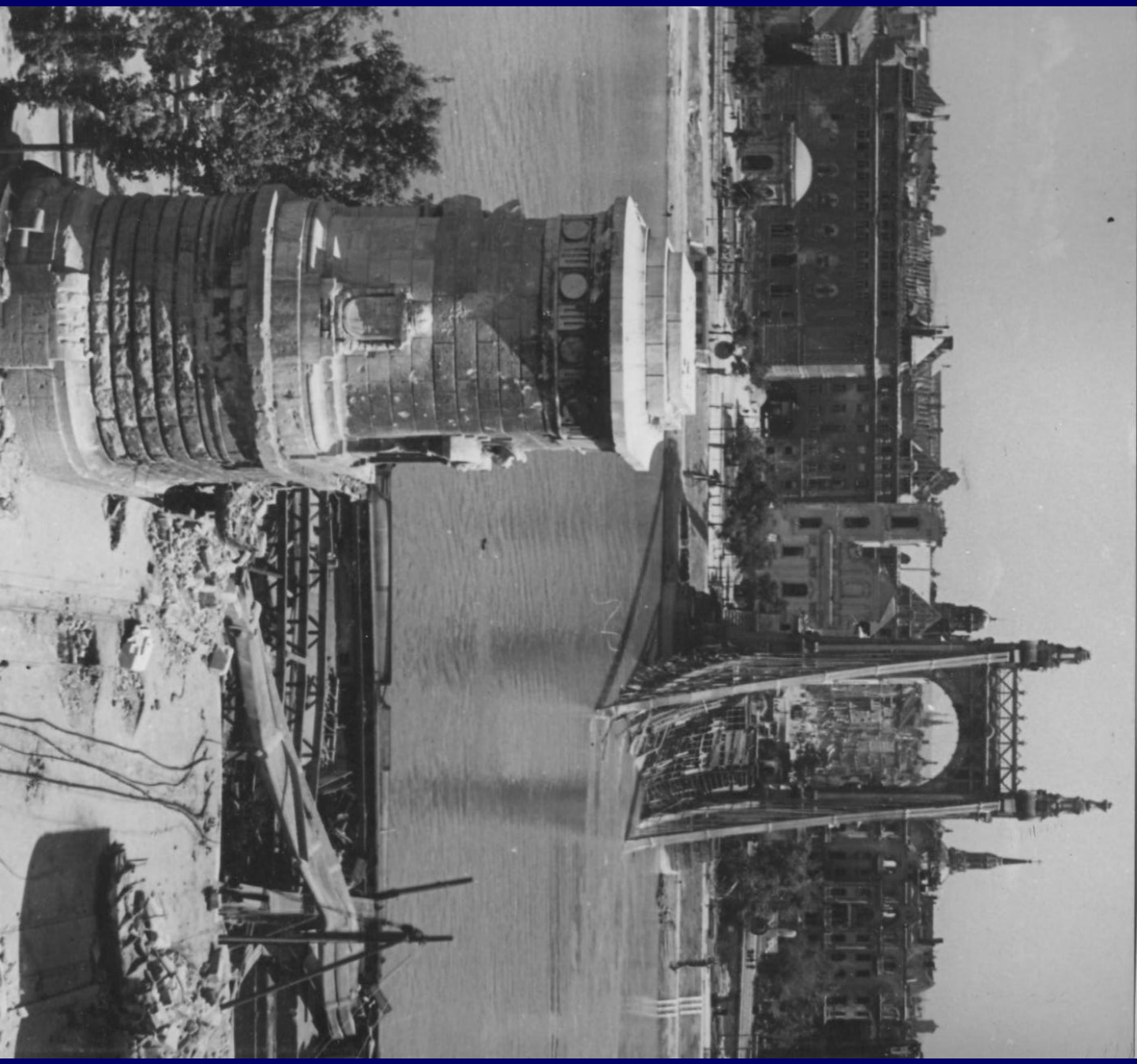
Győző Mihailich

The Ligetway bridge

Destroyed bridges in the II. WW

Destroyed bridges in the II. WW

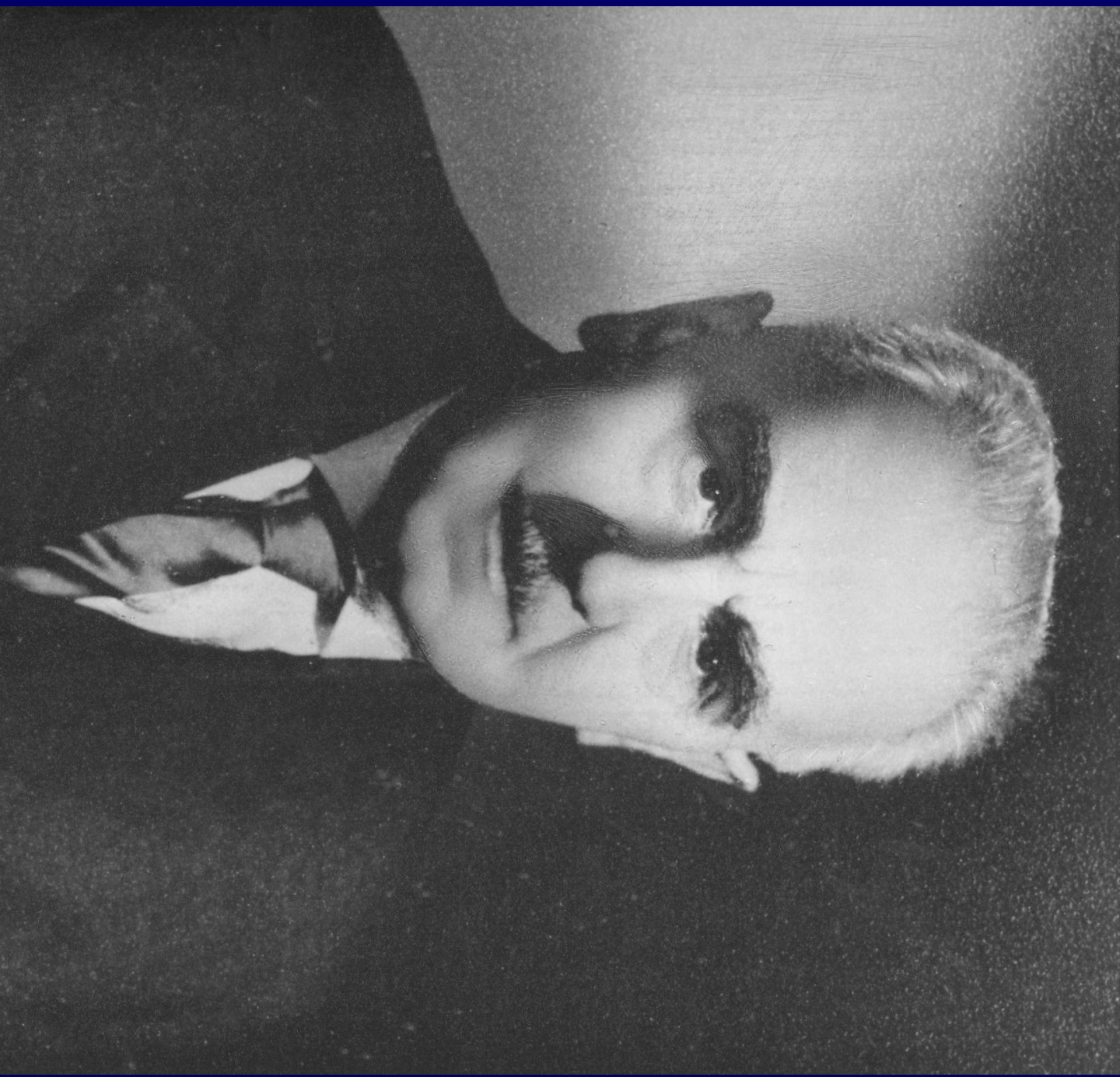
Destroyed bridges in the II. WW



Destroyed bridges in the II. WW

Destroyed bridges in the II. WW

Imre Korányi



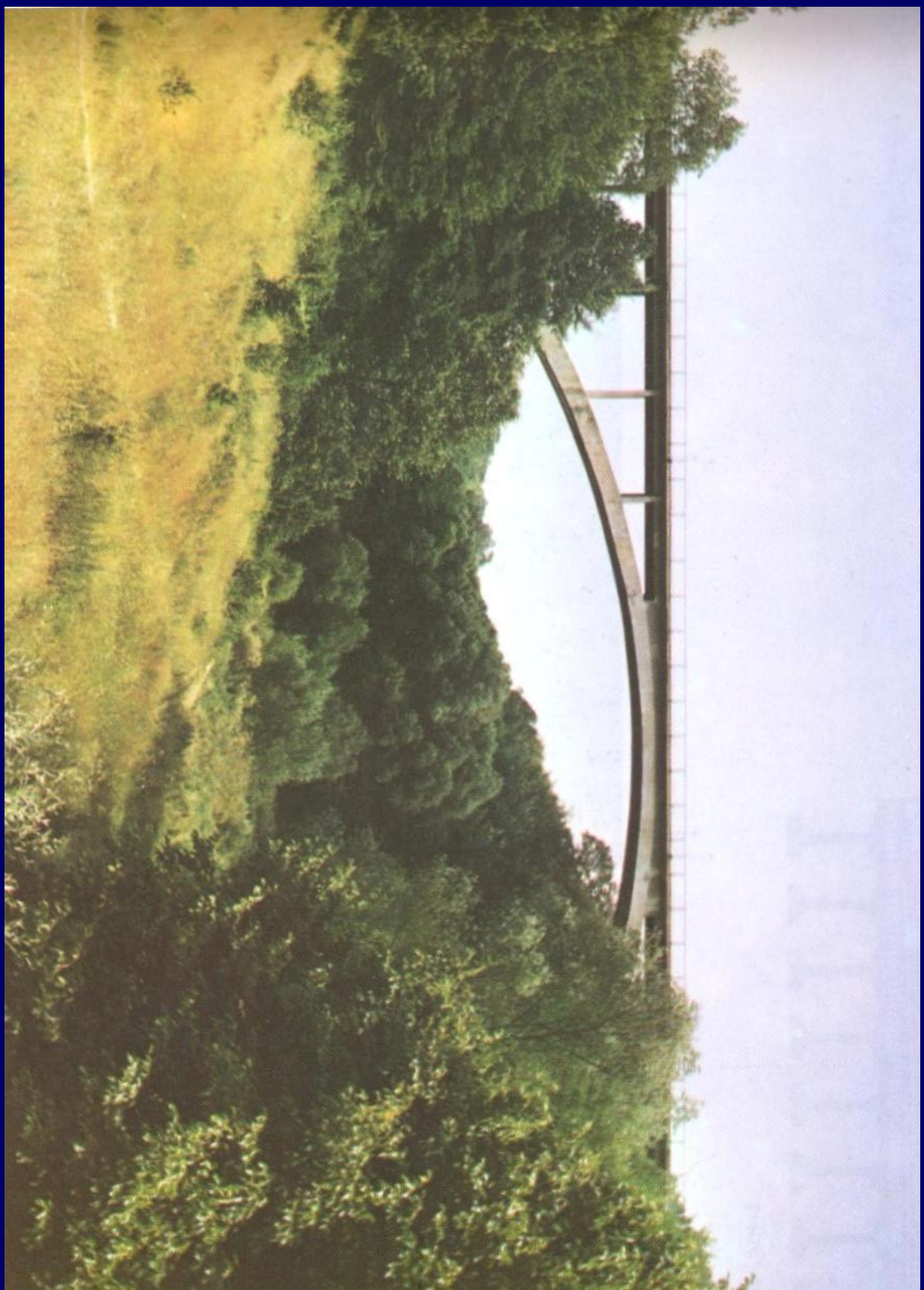
After the II. WW

Danube bridge at Baja

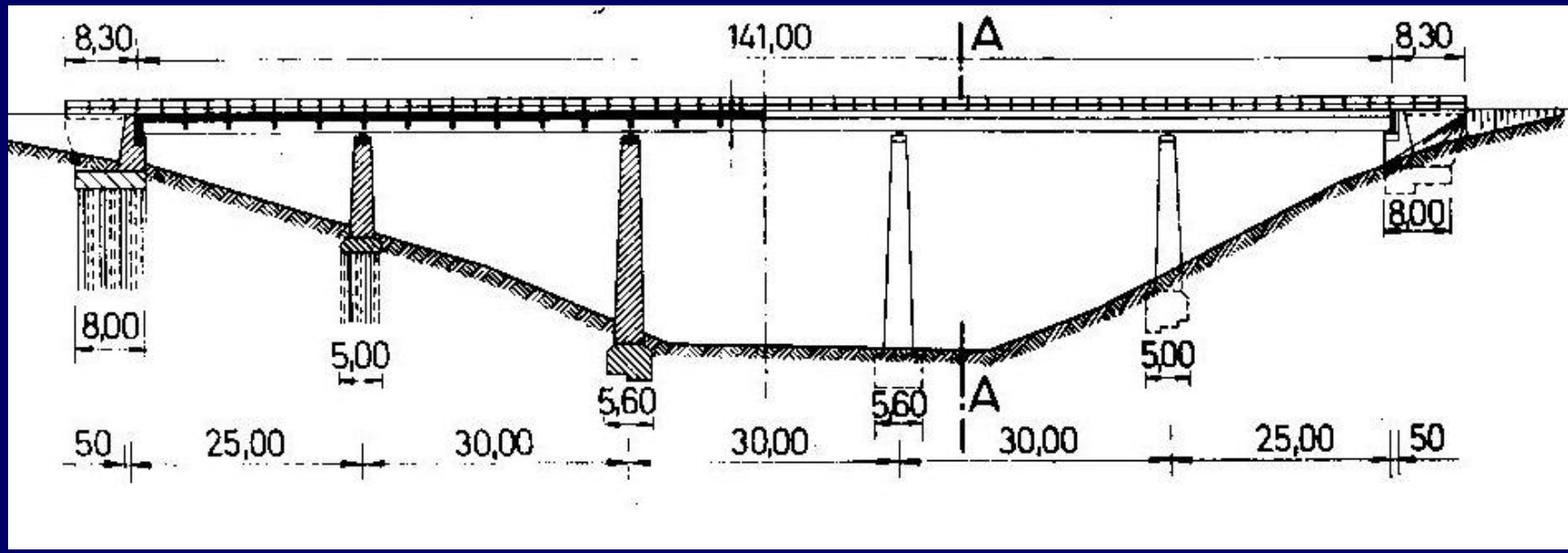
The new Elisabeth bridge

Elemér Bölcskei

Bridge at Mecseknádasd



Bridge II at Mecseknádasd



The V support bridge

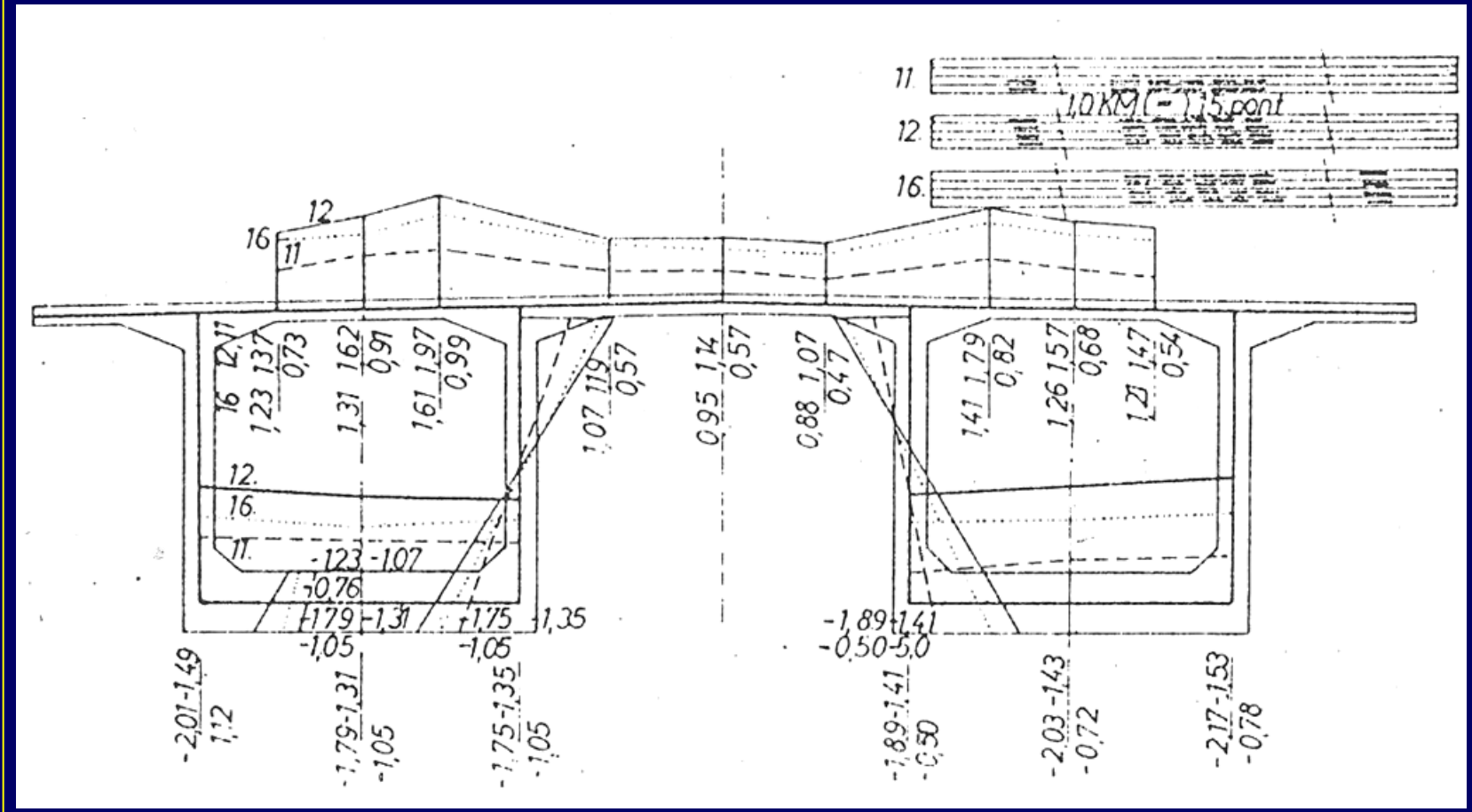
Ferenc Szépe

Ottó Halász

The Structural Laboratory

Moson bridge

- Prestressed, posttensioned, 45-90-45 m
- Measurement of stresses
- Comparison of deflection



Danube bridges until 2000

Komárom railway bridge

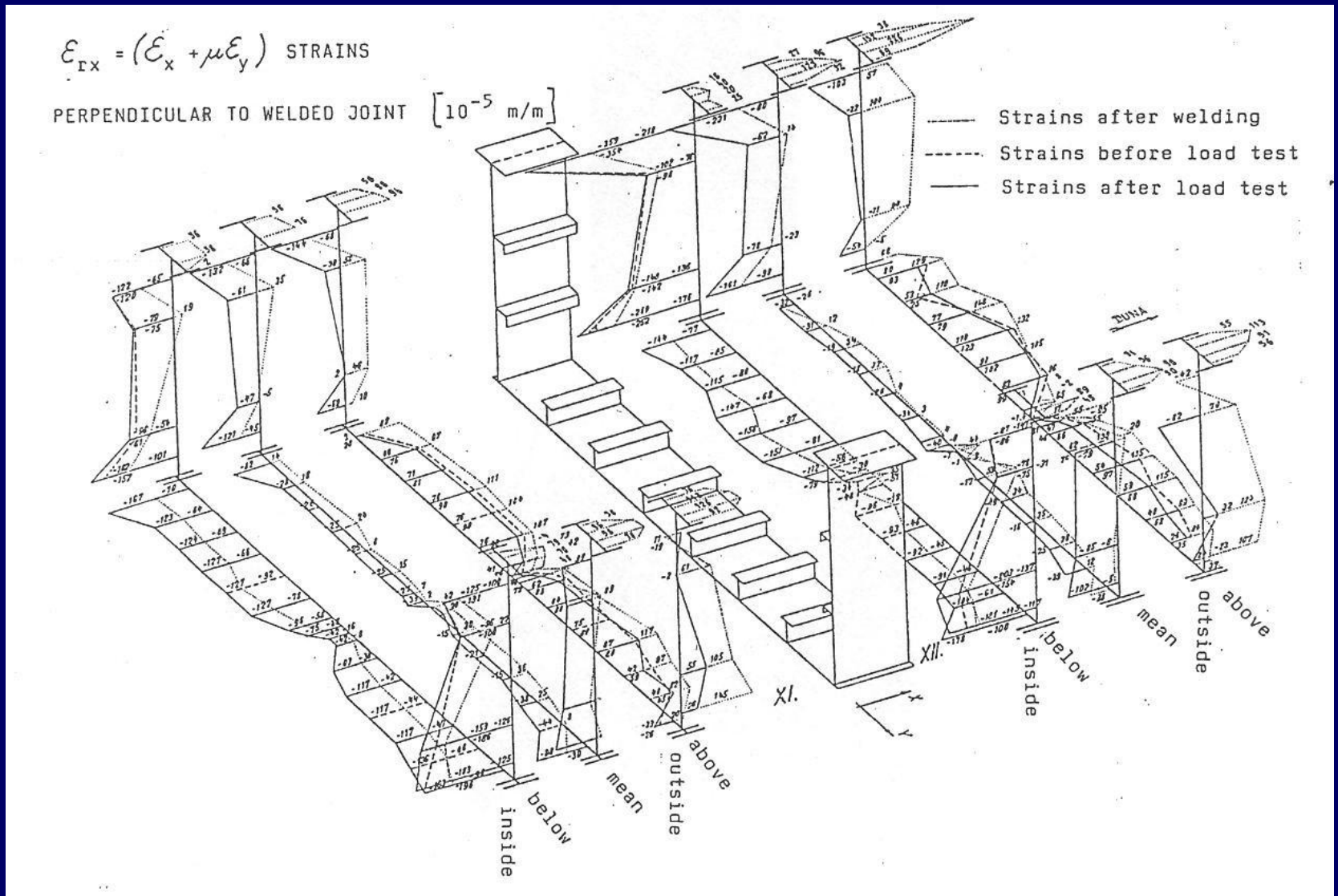
-Four-span trough-type truss, like Southern Railway bridge in Budapest

- Regular inspection

- Load test 1988.

Danube bridge at Tahitótfalu

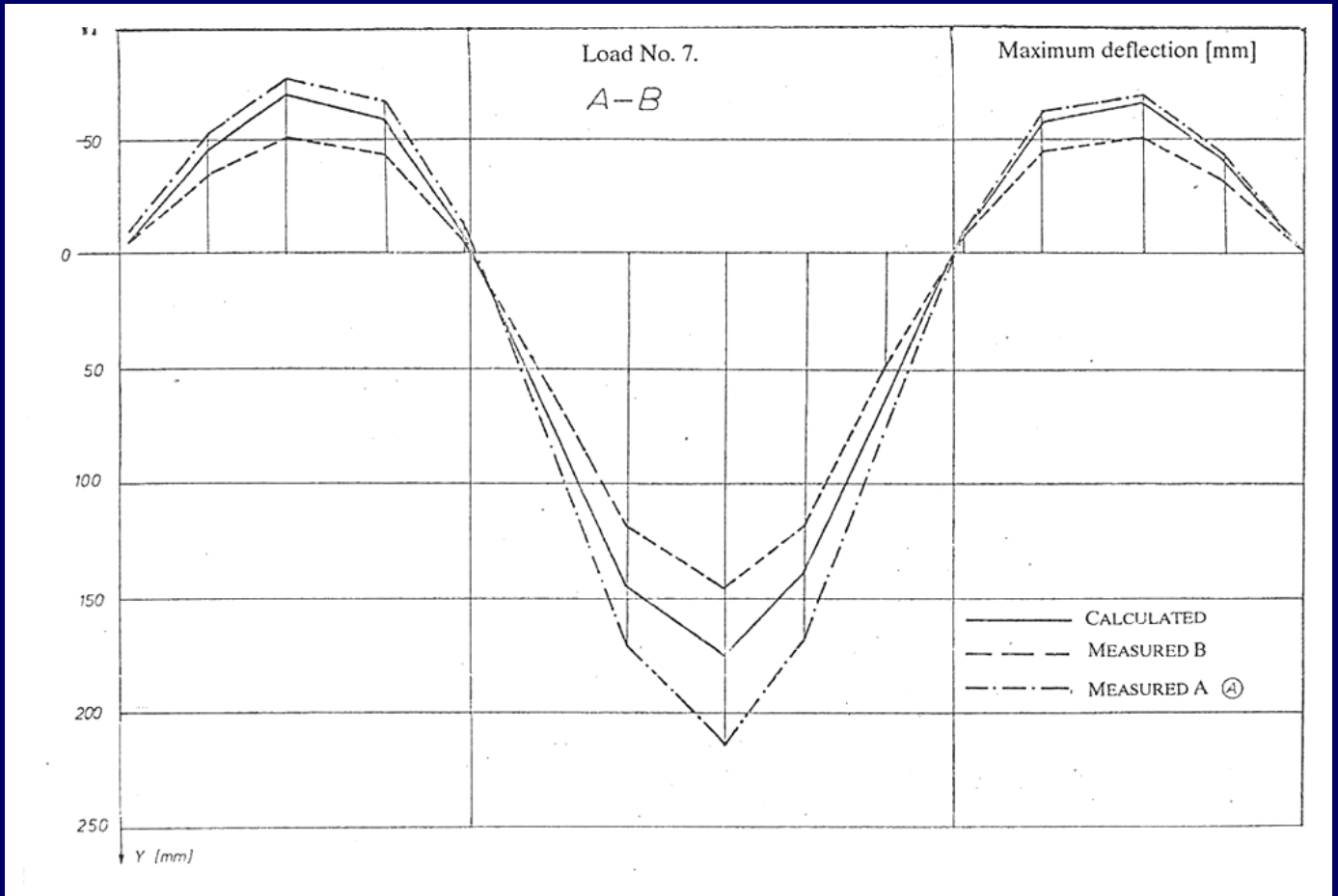
- New composite bridge; 60,3 + 80,4 + 60,3 m
- Constructed using 12-15 m elements
- Measurements of residual stress – as result of welding



Árpád bridge

- Modernized in 1980.
- Widening, replacement of tramway tracks
- Load tests of the three span (76 + 102 + 76 m)

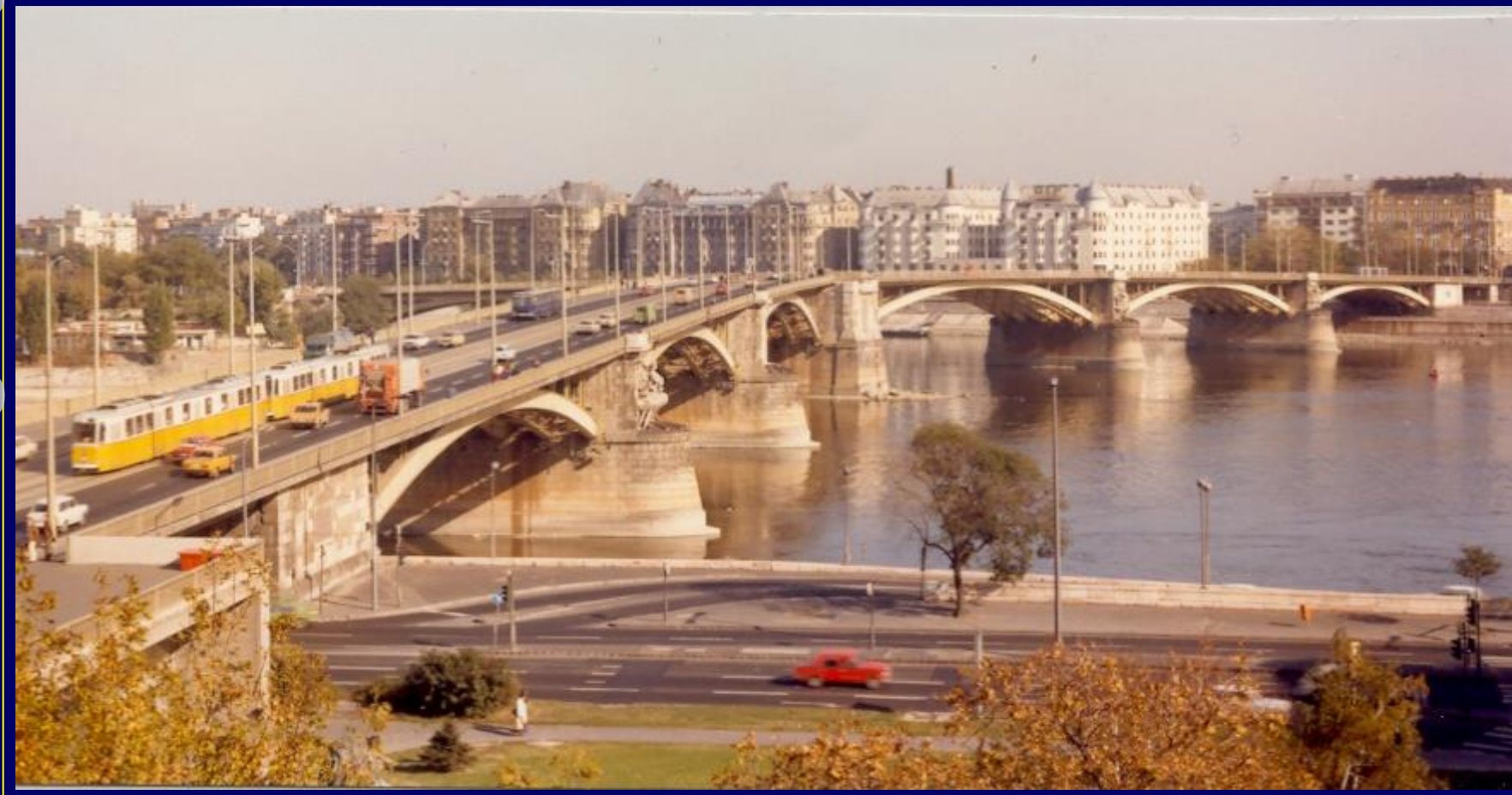
  full slab girder.



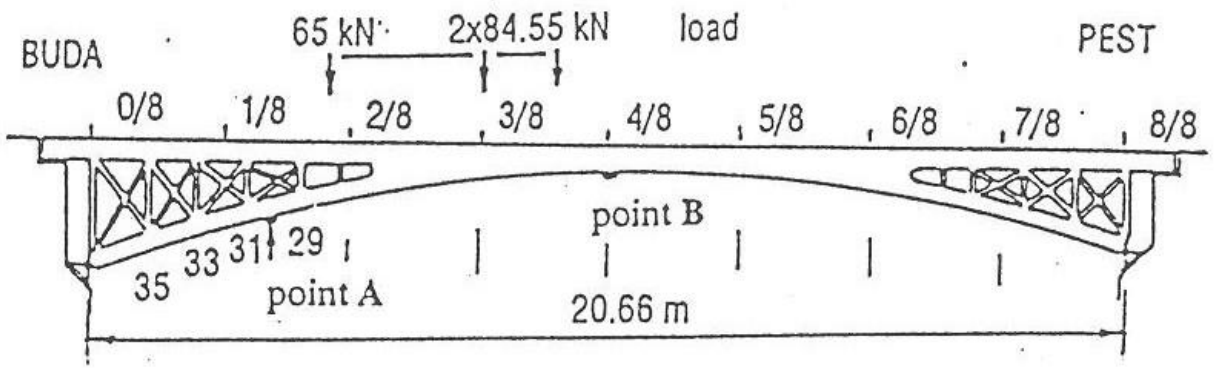
Árpád bridge

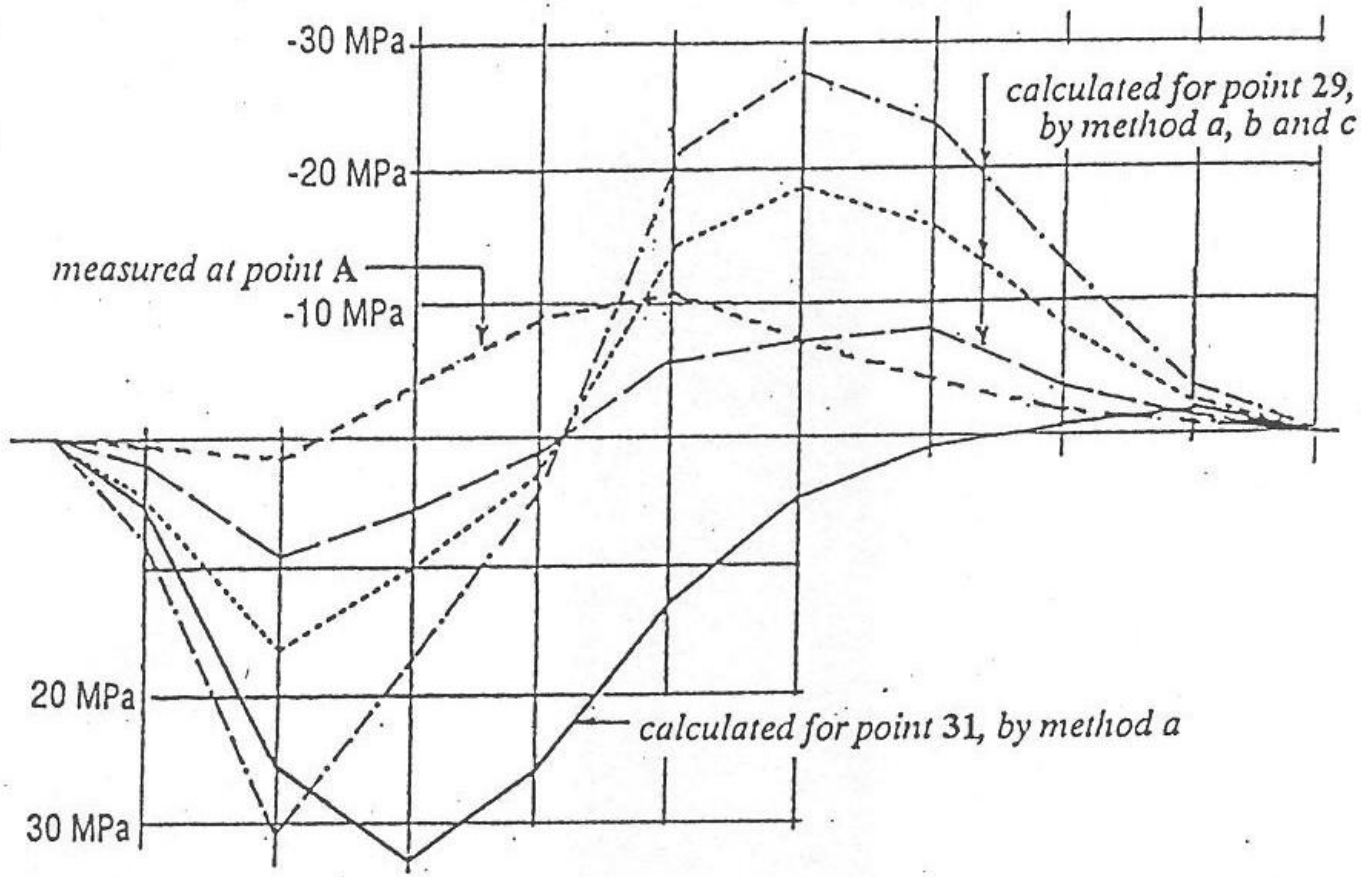
Margaret bridge

- Arch construction (12 parallel arches) with concrete deck.
- Reconstuction in 1974.
- Load test – deflection, strain measurement
  -- train influence line



Margaret bridge





Chain bridge

-The oldest bridge in Budapest, reopened in 1949.

- Inspection and maintenance in 1987. corrosion of chain elements in anchorage chamber.

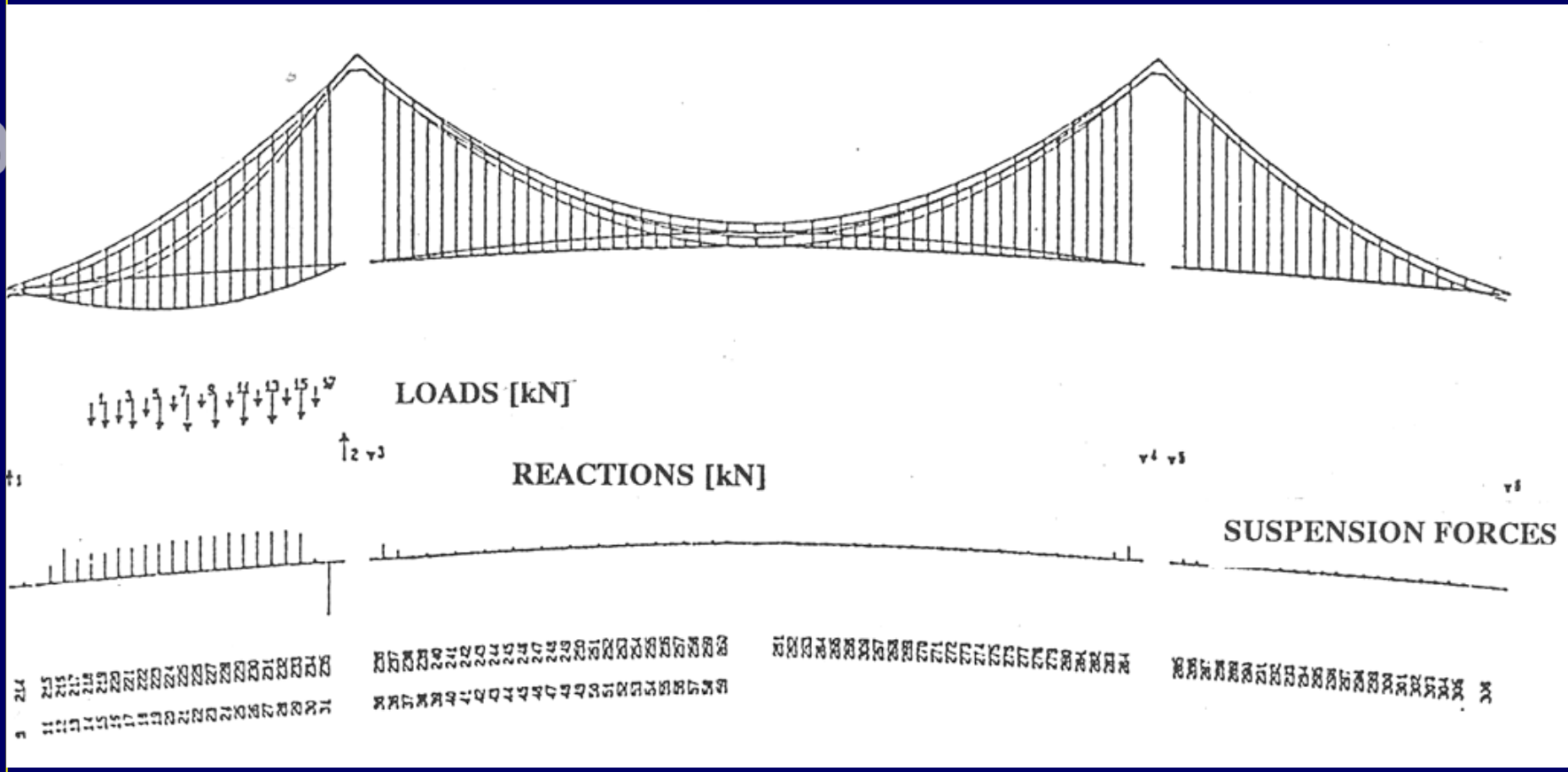
- Measurement of the thickness of the elements.

- 40000 data – 91-95% of the nominal value

- Two load tests

- Approximate calculation using computer simulation by planar-framework second order theory.

Chain bridge



Chain bridge

Elizabeth bridge

-Rebuilt in 1964 – cable suspension bridge

45 + 290 + 45 m

- Study of the structural system by experimental modelling, scale 1:50

- Load test of the completed bridge

- measurement of stresses at the pylons

Elizabeth bridge

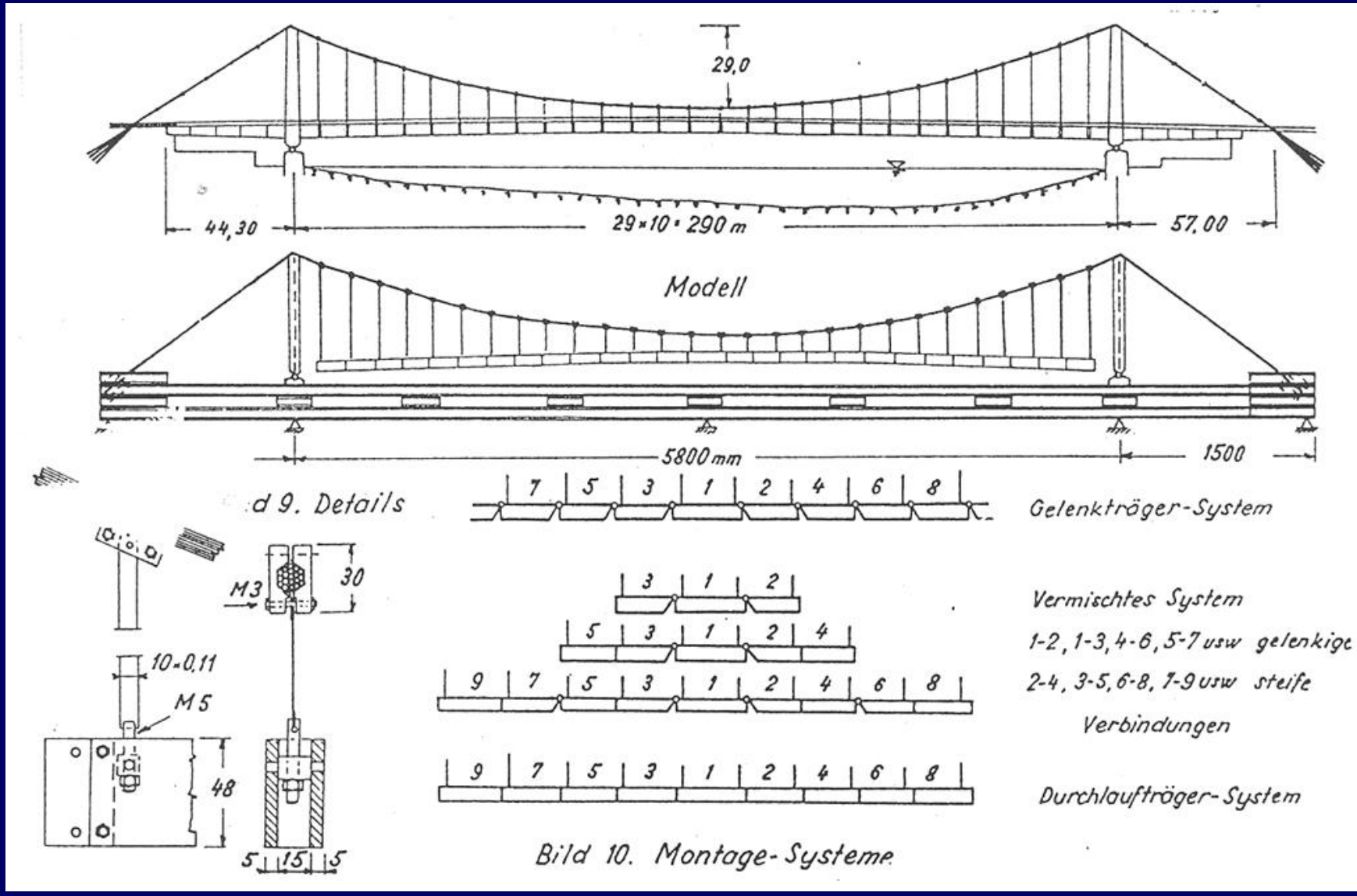


Bild 10. Montage-Systeme

Liberty bridge

- Reconstruction of the deck and the suspension system of contreweight 1979. Rehabilitation in 1985.

- Corrosion of diagonals around the slab region.

- Compressed column 6-6 broken.

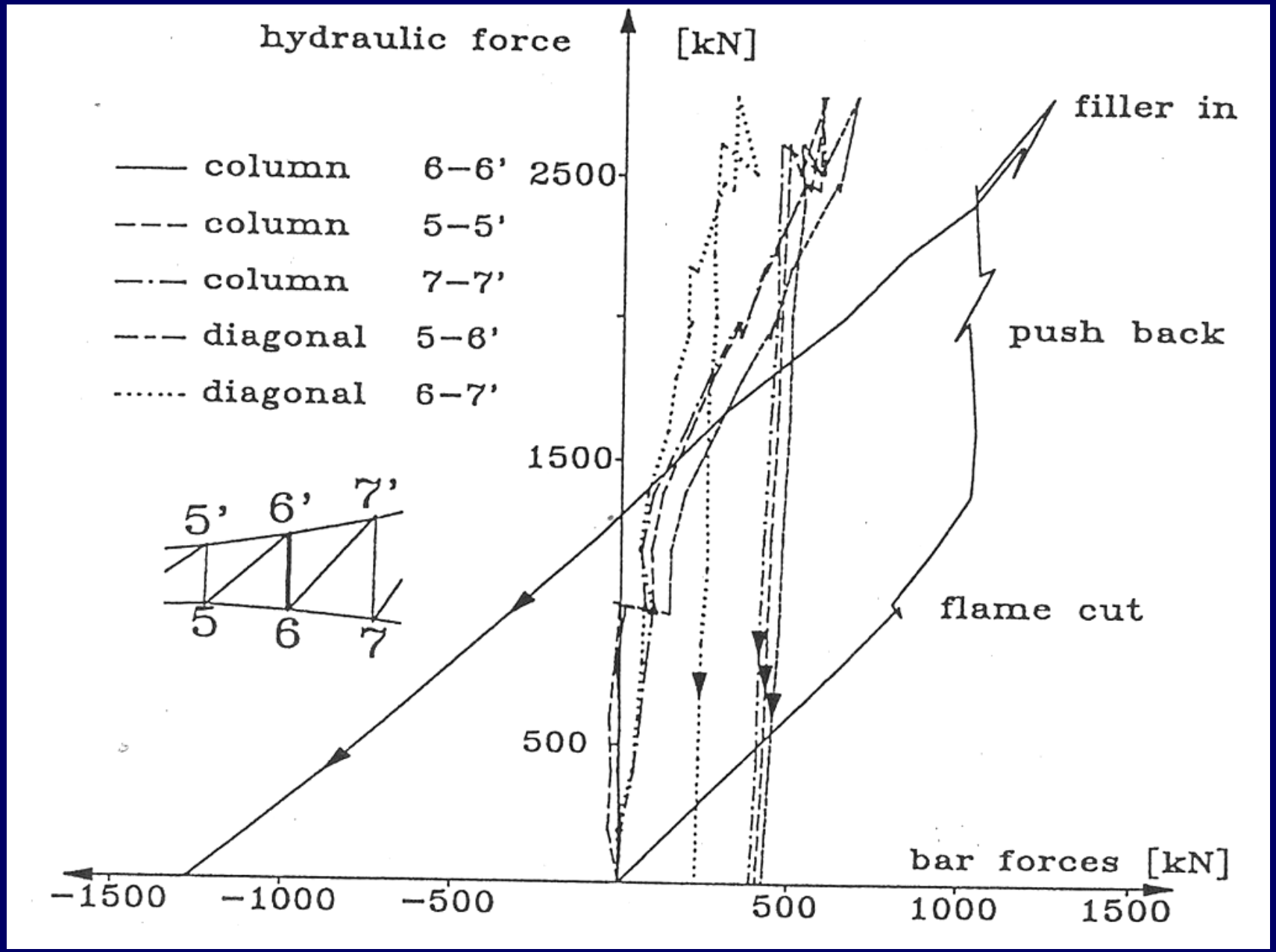
- Repair of main elements.

- Renovation of the broken bar.

- Measurement of transmission of the force to the repaired column.

- Load test after rehabilitation.

Liberty bridge



Liberty bridge

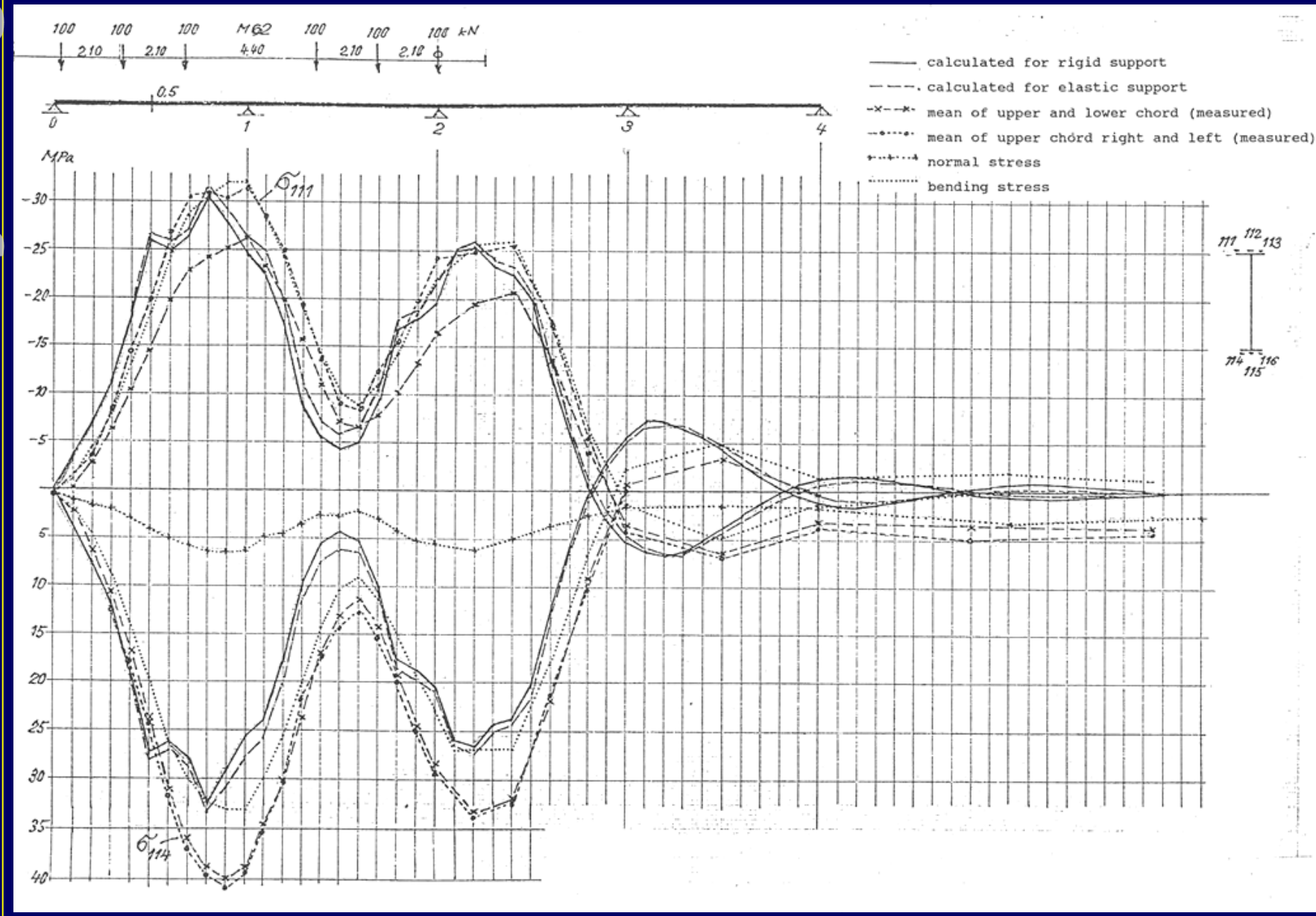
Petőfi bridge

- Continuous trussed girders 112 + 154 +112 m.
- Rebuilt in 1951, reconstruction in 1980.
- Replacement of the bearings.

Southern Railway bridge

Comparison of measured and calculated stresses

Southern Railway bridge

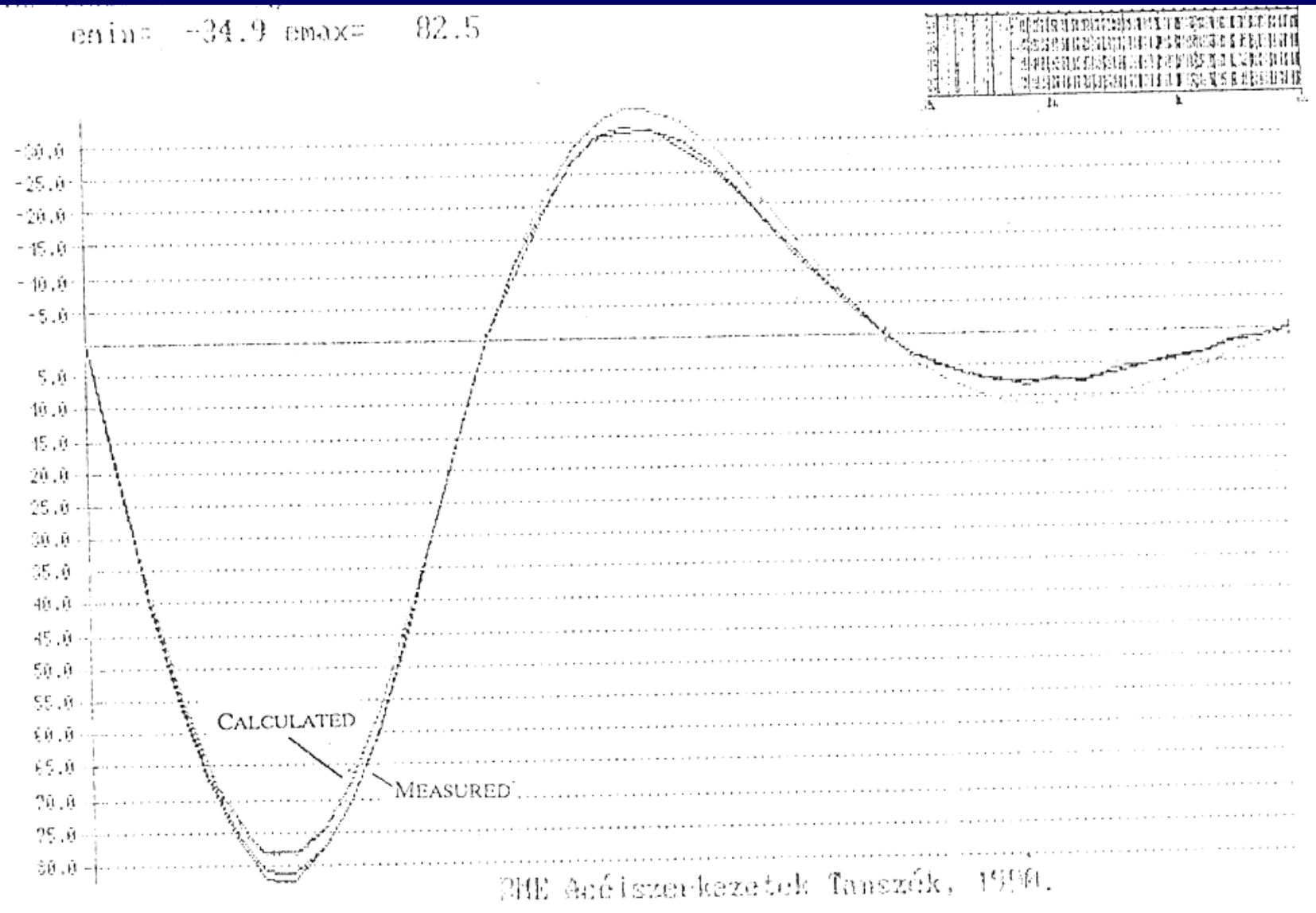


M0 Motorway bridge at Háros

-Composite steel box girder and RC slab.

- Load test in 1990.

M0 Motorway bridge at Háros



M0 Motorway bridge at Soroksár

-Free cantilevered prestressed concrete bridge.

- Load test in 1990.

Dynamic investigation on highway bridge

Other activities

Measurement of dynamic characteristics

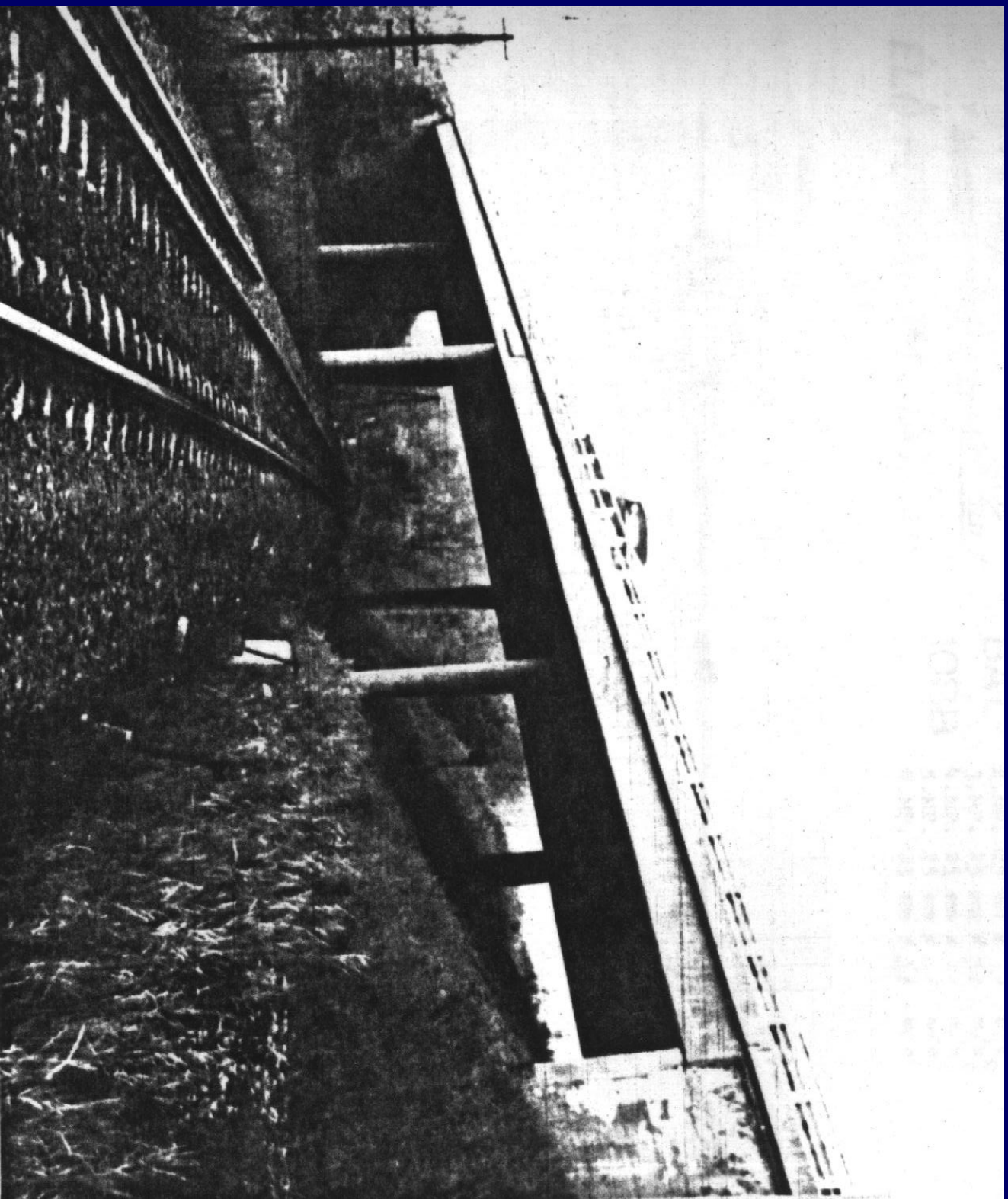
- frequency
- damping

-Excitation by normal traffic

- statistical analysis

- Conclusion to the condition of the bridge

Dynamic investigation on highway bridge



- Advantages:
  - high resistance
  - low permeability
  - protection against corrosion

-Laboratory tests for
  - composition
  - durability
  - applicability

Application of HPC to bridges

First application in Hungary on M0 motorway.

Strengthening of bridges

Development of increasing the load bearing capacity by external prestressing.

Strengthening by additional prestressing.

Strengthening of bridges

Strengthening by self compacting concrete.

Reinforced earth walls collapsed in 90's.

Strengthing by additional soil anchorages

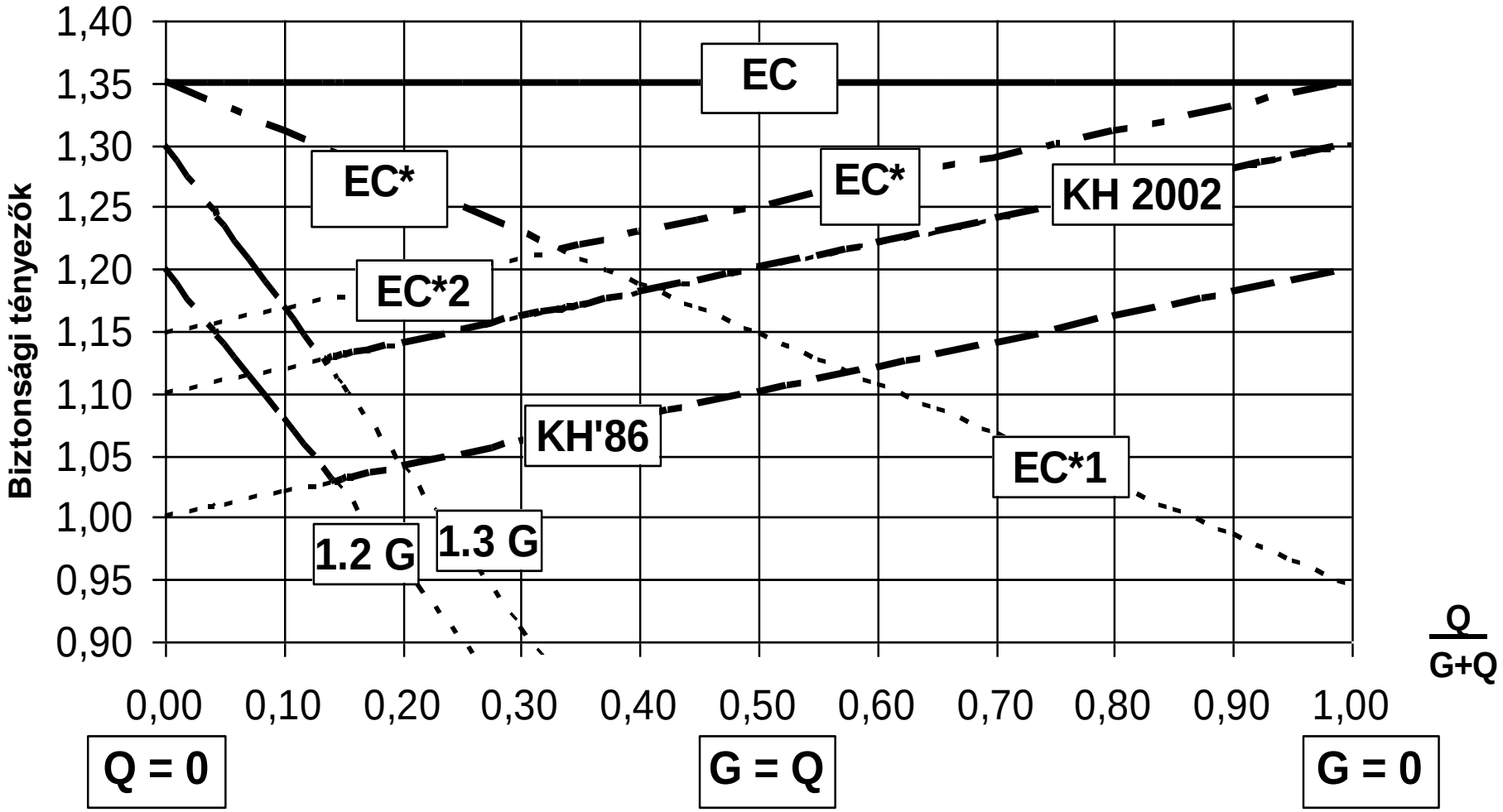
Participation in development of bridge design codes

Tradition from beginning of 19th century

- Korányi
- Menyhárt
- Bölcskei

Adoptation of EUROCODES

- translation
- development of NA-s
- comparison of HC and EC-s



Safety factors according to the EC and the Hungarian Code

Mária Valéria bridge

-5 spans simply supported lattice beam 83,5 + 102,0 + 119,0 + 102,0 + 83,5 m

- Reconstruction in 2001.

- Each simply supported steel truss beam built ready hoist as a hole into the final place ~600t.

- Erection technology developed

- erection from two floating platform

-elevation controlled by computer

- Innovation prize 2002.

Bridge activities after Millenium

Mária Valéria bridge

Szekszárd bridge

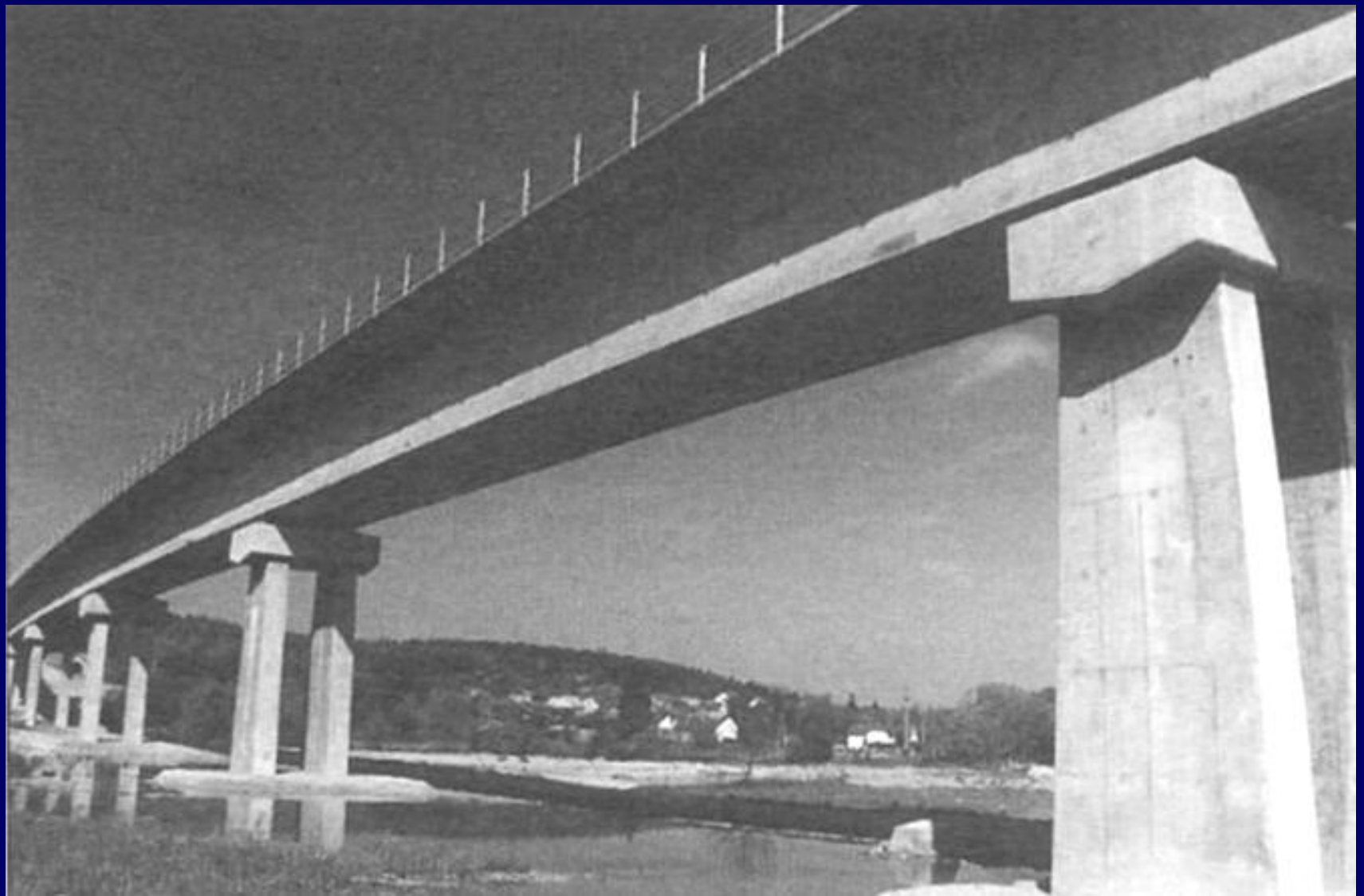
Same erection method, and load test.

Railway viaduct at Zalalövő

-Post-tensioned box girder bridge, total length 1399 m.

-Erected by incremental launching method.

-Load test in 2000.



Bridge at Dunaföldvár

- Continuous for span steel truss.
- Static and dynamic load test in 2001.

Elizabeth bridge at Dunaföldvár

- Reconstruction completed in 2006.
- Static and dynamic load test.

Liberty bridge in Budapest

- Static and dynamic load test

before recent reconstruction in 2007.

Pentele bridge at Dunaújváros

- Completed in 2007.

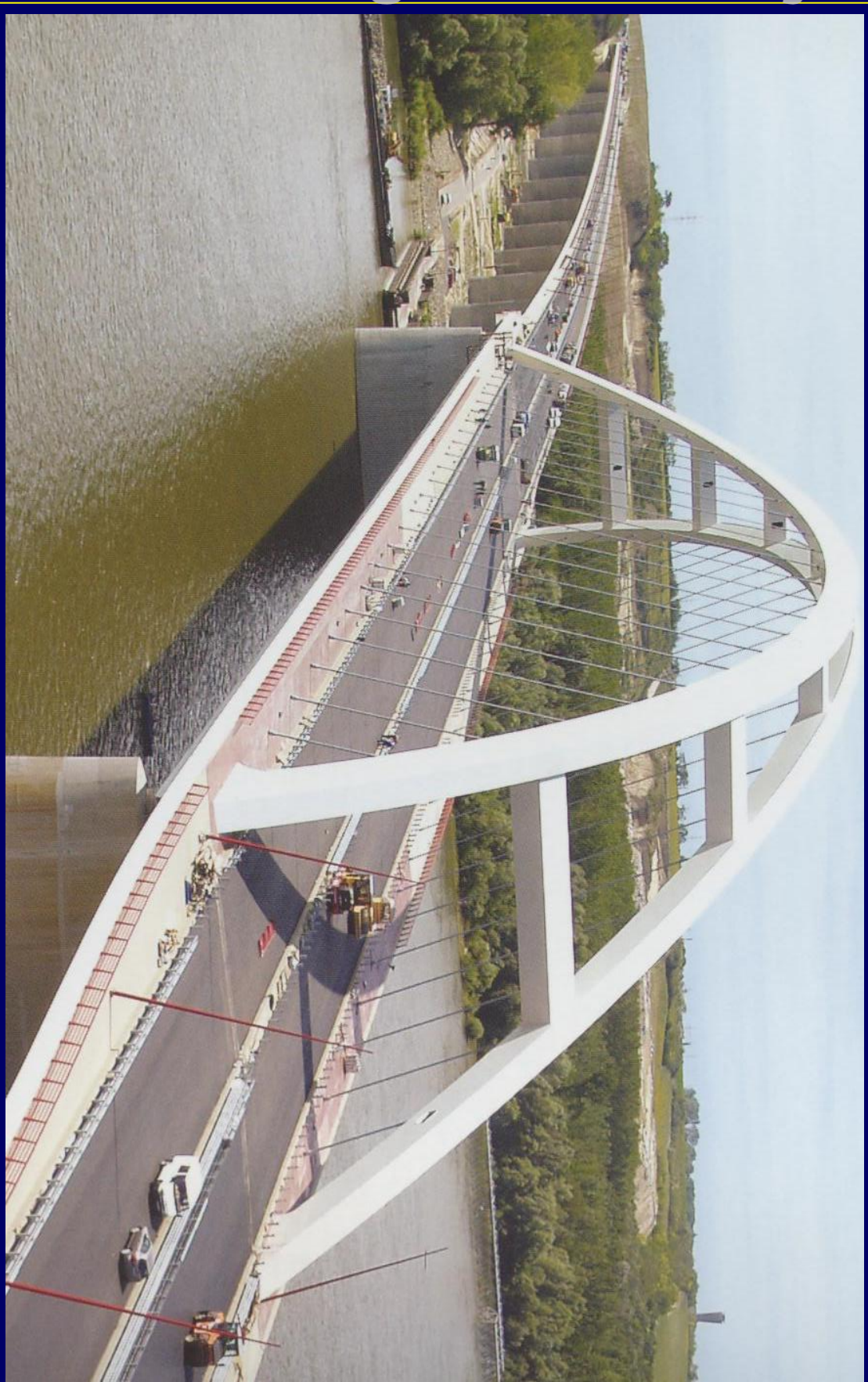
- Total length ~1680 m.

- Two flood bays – continuous steel box girders.

- River-bed bridge 307,9 m span.
  (the longest of this type)

- Simply supported basket ear shape steel arch
  With cable supported stiffening girder.

Pentele bridge at Dunaújváros



Pentele bridge at Dunaújváros

- Contribution of the department

  - determination of the optimal shape of the arch and suspension system

  - independent control of results of static and dynamic calculation

  - verification of the stability using a 1:33 scale model

  - static and dynamic load test

Pentele bridge at Dunaújváros

Pentele bridge at Dunaújváros

Northern M0 bridge

- In construction
- Will be completed in 2008.
- Five individual bridges, total length 1862 m.
- Three post-tensioned, erected by incremental launching
- Szentendre Danube Branch: three bay composite structure
- Main Danube Branch : cable stayed bridge
- Contribution of the department
    - independent control
    - permanent consultation of the design work

Northern M0 bridge

M7 motorway viaduct at Kőröshegy

- Opened to traffic in August 2007.

- Double cell post tensioned box girder

60 +95 + 13 *120 + 95 + 60 m

-The largest viaduct in Central Europe

- Free cantilever method with cast in situ and precast elements

- Static and dynamic load tests

M7 motorway viaduct at Kőröshegy

M7 motorway viaduct at Kőröshegy

Education

Previous state

- Until 1960: Four years education system

- After 1960: Five years education system

- Main basic subjects:
  Mechanics, Theory of structures,
  Steel Structures, R. C. and Timber Structures
  Soil Mechanics, Foundations,
  Bridge Engineering

- Specialization in Bridges and Constructions (25kr.)
  Steel and Composite Bridges (8 kr.)
  R. C. Bridges and Other Structures (8 kr.)

Education

- Drawing works:
  R. C. monolithic highway girder bridge
  Steel railroad bridge (sketch level)

- General plans with a few details
  Steel and composite bridge
  R. C. box girder highway
  EUROCODES

- Diploma work

Education

Changes due to the Bologna

- Four years (240kr.) BSc program from 2005.

- Specialization in Bridges and other structures

  - Steel Bridges (2+2, 4 kr.)
  - Reinforced Concrete Bridges (2+2, 4 kr.)
  - Composite R.C. Steel Bridges (2+2, 4 kr.)
  - Wooden Bridges (1+1, 2kr.)

- Diploma work

Education

Expectation

- Needs according to the development of the infrastructure in Hungary:
  - Increasing of the knowledge in bridge engineering
  - designing
  - constructing
  - knowledge of new technologies

- Involvement to the international job market

Education

Education

Education

Education

Education

Education


Thank you for your attention!