NATIONAL TECHNICAL UNIVERSITY OF ATHENS
SCHOOL OF CIVIL ENGINEERING
DEPARTMENT OF STRUCTURAL ENGINEERING
INSTITUTE OF STEEL STRUCTURES

NTUA INSTITUTE OF STEEL STRUCTURES

SHORT PRESENTATION

February 2020

School of Civil Engineering
Rankings

N.T.U.A.

INSTITUTE OF STEEL STRUCTURES

FEBRUARY 2020

- ❑ **No 11 in Europe**
- ❑ **No 39 in the world**

QS WORLD UNIVERSITY RANKINGS by subject

https://www.topuniversities.com/university-rankings/university-subject-rankings/2020/engineering-civil-structural

2020	University search		Europe
2	Delft University of Technology	More	Netherlands
3	University of Cambridge	More	United Kingdom
5	Imperial College London	More	United Kingdom
6	ETH Zurich - Swiss Federal Institute of Technology	More	Switzerland
7	Politecnico di Milano	More	Italy
8	EPFL	More	Switzerland
=15	University of Oxford	More	United Kingdom
23	Universitat Politècnica de Catalunya · BarcelonaTech (UPC)	More	Spain
25	Politecnico di Torino	More	Italy
38	Universidad Politécnica de Madrid	More	Spain
=39	National Technical University of Athens	More	Greece
=42	KTH Royal Institute of Technology	More	Sweden
=42	The University of Manchester	More	United Kingdom
45	University of Leeds	More	United Kingdom
=47	Technical University of Munich	More	Germany
=47	The University of Sheffield	More	United Kingdom
=47	UCL	More	United Kingdom

School of Civil Engineering Rankings

- No 3 in Europe
- No 7 in the world

ACADEMIC RANKING OF WORLD UNIVERSITIES SINCE 2003

http://www.shanghairanking.com/Shanghairanking-Subject-Rankings/civil-engineering.html

ShanghaiRanking's Global Ranking of Academic Subjects 2019 - Civil Engineering 2019

Field: Engineering Subject: Civil Engineering Methodology

World Rank	Institution*	Country/Region	Total Score	Score on PUB
1	Tongji University		354.1	100.0
2	Swiss Federal Institute of Technology Zurich		273.8	53.5
3	Tsinghua University		256.5	82.0
4	Lehigh University		255.1	33.4
5	The University of Texas at Austin		247.5	52.9
6	Polytechnic University of Madrid		246.4	52.6
7	National Technical University of Athens		237.1	47.7
8	University of Canterbury		232.9	31.8
9	The University of New South Wales		227.5	59.8
10	University of Illinois at Urbana-Champaign		222.4	58.3
11	University at Buffalo, the State University of New York		219.6	36.9
12	Nanyang Technological University		218.4	55.5
13	Western University		215.4	35.5
14	University of California, Berkeley		214.3	58.3
15	Southeast University		213.1	73.8

Institute of Steel Structures

http://labmetalstructures.civil.ntua.gr/cms/en/

Institute of Steel Structures
Staff

- 5 faculty members

Prof. Ioannis Vayas
Civil Eng. NTUA 1976, Dr. Ing. TU Braunschweig 1981

Prof. Charis Gantes
Civil Eng. NTUA 1985, PhD MIT 1991

Ass. Prof. Tassos Avraam
Civil Eng. NTUA 1979, Dr. NTUA 2004

Ass. Prof. Dimitrios Vamvatsikos
Civil Eng. NTUA 1997, Ph.D. Stanford University 2002

Dr. Pavlos Thanopoulos
Civil Eng. NTUA 1999, Dr. NTUA 2006

- 8 technical staff / 2 administrative staff
- 20 doctoral students

Institute of Steel Structures
Experimental Facilities

- 260m² strong floor with 24 anchor points of 1MN each
- Testing frames
- 16t crane
- Automatic hydraulic actuators up to 5MN
- Non-destructive testing equipment
- Salt spray (fog) corrosion testing chamber
- Central control system

Institute of Steel Structures
Experimental Equipment

TESTING FRAMEWORK

- Strong floor 14.45x18.00m with 40 lashings with a load capacity of ±500kN
- Testing framework 3.20x2.70x7.20m
- Testing framework 6.60x6.60x4.95m
- Testing framework 1.53x1.10x2.73m

INSTUMENTS FOR DESTRUCTIVE TESTING

- Tensile test machine
- Testing machine grabs for flat plate specimen 0-15mm
- Testing machine grabs for flat plate specimen 15-30mm
- Testing machine grabs for cylindrical specimen 15-30mm
- Testing machine grabs for cylindrical specimen 15-30mm

RECORDING INSTRUMENTS AND CONTROL

- PXI pc unit with processor 2 Ghz, RAM DDR2 1Gb and HD80Gb
- PXI-SCXI pc unit with processor Celeron 850 Hz and 512 sdram PXI-8184
- Terminal module analog inputs / outputs with BNC connectors BNC-2110
- Main frame for 4 pxi and 8 scxi cards PXI-1052
- Analog output card with 8 channels at 13bit PXI-6722
- Card with 24 digital input and 16 Analog 16bit PXI-6220
- Card with 24 digital input & 16 Analog 16bit and 2 analog out PXI-6221
- 8 channel card for LVDT with 1 or 3 Vrms at 2.5, 3.3, 5 or 10KHz SCXI-1540, 2 items
- 24 channel card for strain gauge of 120Ω for 1/4 bridge SCXI-1521B, 2 items

RECORDING INSTRUMENTS AND CONTROL

- 8 channel measuring card voltages 0-10V or Strain Gage of all the fastenings SCXI-1520, 3 items
- Terminal interface unit for the SCXI-1520 card, 3 items
- Terminal interface unit for the SCXI-1540 card, 2 items
- Terminal interface unit for the SCXI-1521B card, 2 items
- 8 channel data logger measurements
- Universal scanning
- Servo controller with adjustable actuator for recording
- Servo controller with adjustable actuator for recording
- Servo controller with adjustable actuator for recording
- Adjustable controller with temperature recorder
- PC for remote control of all the above units in labview

ACTUATORS - HYDRAULIC SYSTEMS - AUTOMATION

- Automatic ± 5MN actuator, active length ± 150mm.
- Automatic ± 2,5MN actuator, active length ± 250mm, with a digital gauge length (encoder) 500mm, servo valve BOSCH 40lit/min, oil filter and accumulator
- Automatic ± 600kN actuator, active length ± 250mm, with a digital gauge length (encoder) 500mm, servo valve BOSCH 4lit/min, oil filter and accumulator
- Automatic ± 300kN actuator, active length ± 150mm, with a digital gauge length (encoder) 300mm, accompanied by grabs for specimens
- Automatic 20kN actuator, active length ± 150mm, with a digital gauge length (encoder) 300mm
- Single acting hollow plunger for tension with active length 153mm and load capacity 600kN, 2 items
- Dual piston power, 156mm active length and load capacity of 498kN and 103kN pull pressure

ACTUATORS - HYDRAULIC SYSTEMS - AUTOMATION

- Single acting piston with an active length of 150mm and load capacity 539kN
- low profile single acting piston with an active length of 11mm and load capacity 201kN
- 320bar pressure hydraulic pump with 80lit/min oil supply fully automated and controlled by PC
- 250bar pressure hydraulic pump with 8lit/min oil supply and two outputs
- 160bar pressure hydraulic pump with 2lit/min oil supply, carrying servo valve BOSCH 4lit/min with oil filters and accumulator
- Hydraulic hand pump 2200cm3, double-acting with pressure gauge and switches
- Hydraulic hand pump 2200cm3, double-acting with pressure gauge and switches

Institute of Steel Structures
Experimental Equipment

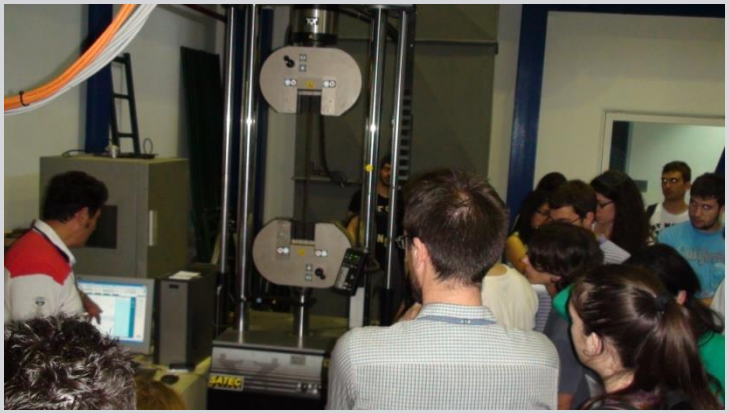
MEASURING INSTRUMENTS

- LVDT ±25mm, 2 items
- LVDT ±75mm, 5 items
- LVDT ±100mm
- LVDT ±150mm, 4 items
- LVDT ±300mm
- Extensometer 50mm
- Extensometer 10mm
- 500kN load cell
- 300kN load cell
- 20kN load cell
- Extensometer 100mm, 4 items
- PC interface for recording and measuring instruments

Institute of Steel Structures
Teaching

- 10 undergraduate courses
- 5 graduate courses

On steel and composite structures



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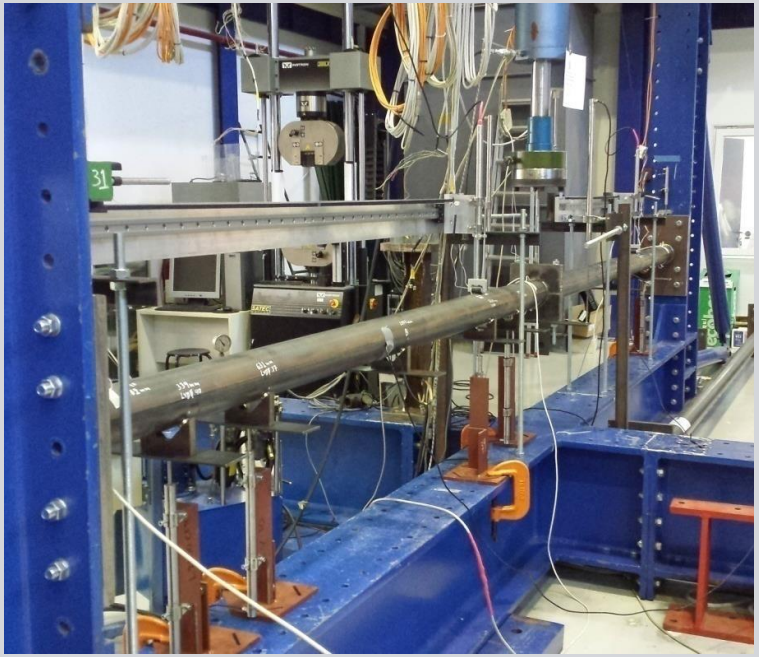
Experimental Research



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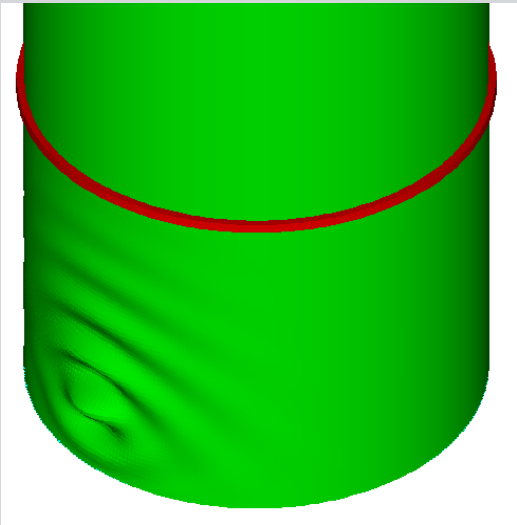
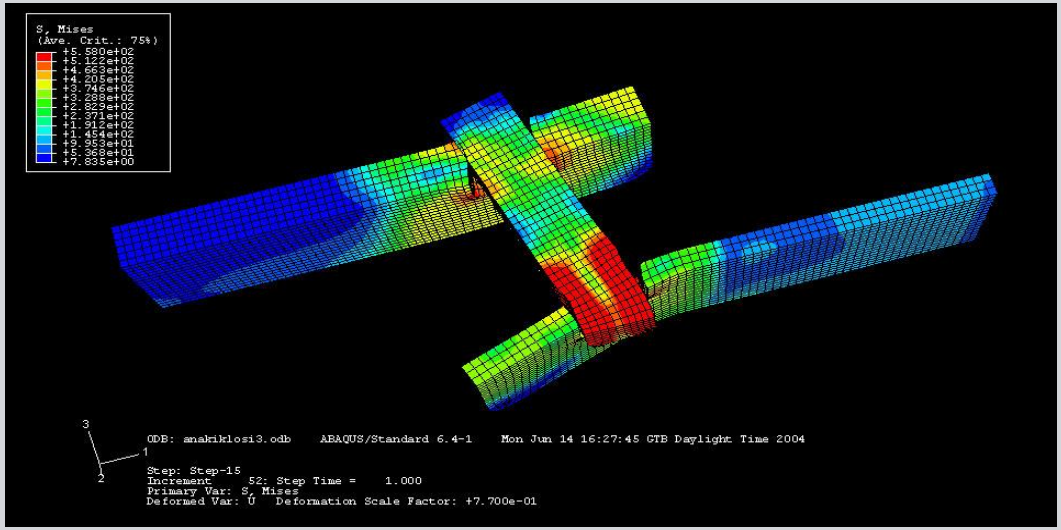
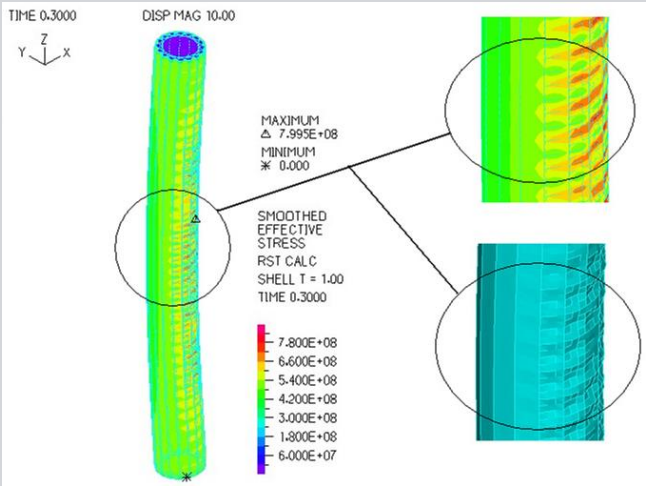
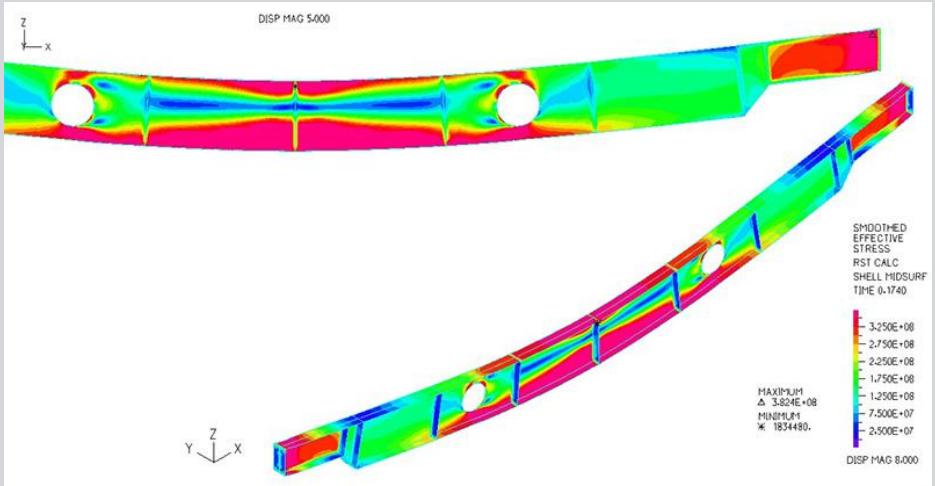
Numerical Research







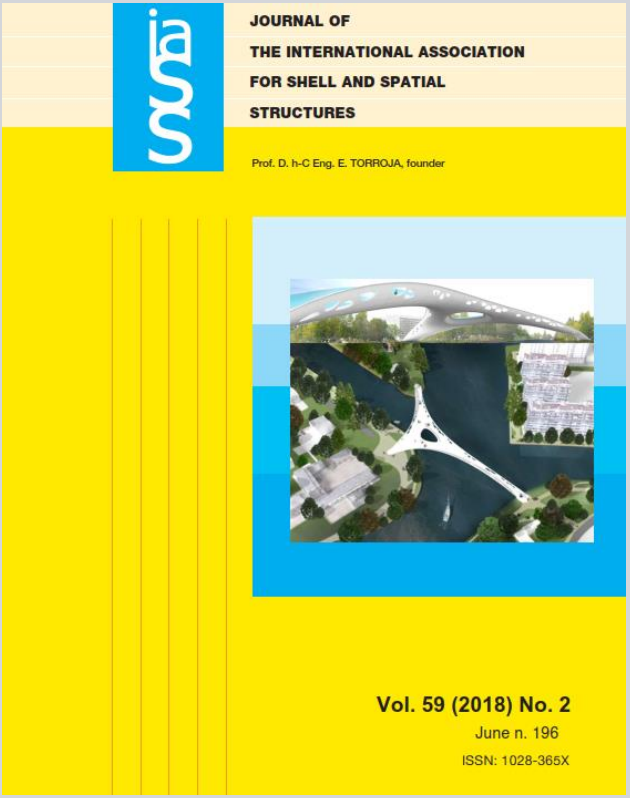


Institute of Steel Structures

Service to the community

Membership in CEN Project Teams for the development of the 2nd generation of Structural Eurocodes:

- **SC3/T1 (general and buildings) of Eurocode 3 (C. Gantes)**
- **SC3/T11 (towers, masts and chimneys) of Eurocode 3 (C. Gantes)**
- **SC8/T5 (silos, tanks and pipelines - towers, masts and chimneys) of Eurocode 8 (D. Vamvatsikos)**



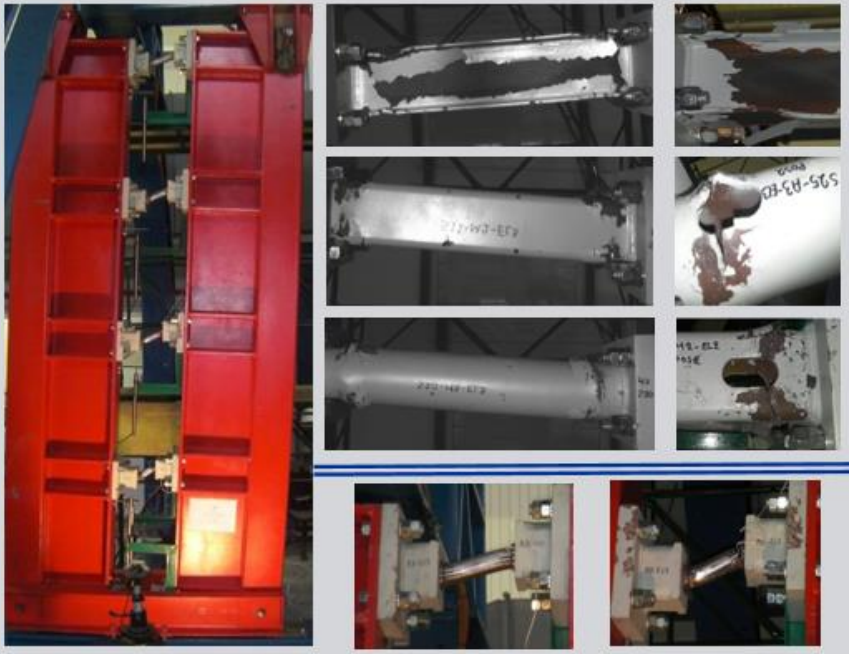
Editor-in-Chief, IASS Journal (C. Gantes)

FUSEIS – Innovative energy dissipation systems

Research Fund for Coal and Steel (European Community) - 2008 to 2011

NTUA, RWTH Aachen, POLITECNICO MILANO, IST Lisbon, SIDENOR

FUSEIS1

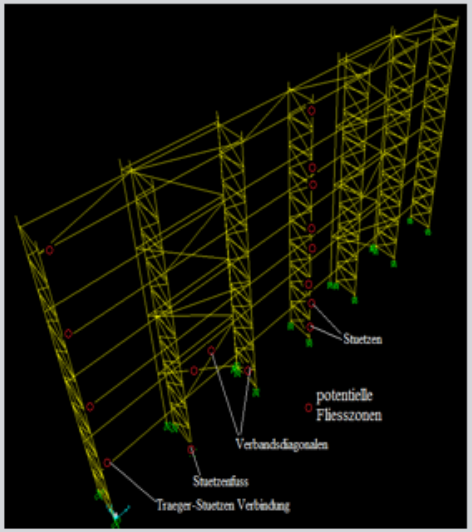


FUSEIS2

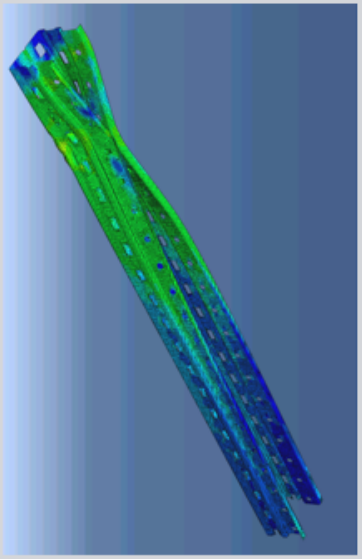
SEISRACKS2- SEISMIC BEHAVIOUR OF STEEL STORAGE PALLET RACKING SYSTEMS

Research Fund for Coal and Steel (European Community) – 2011 to 2014

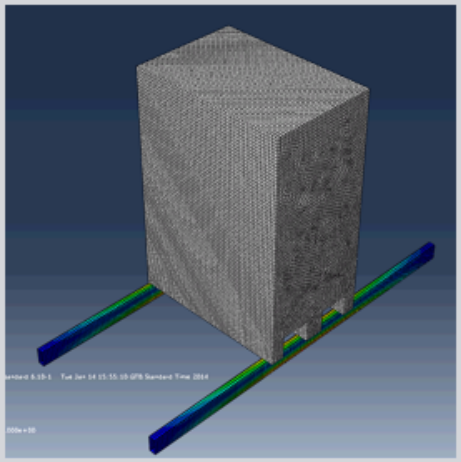
POLITECNICO MILANO, NTUA, RWTH Aachen, U. Liege, CCS, NEDCON, MODULBLOK, STOW, SCL



Non-linear analysis of overall system



Stability of perforated system columns

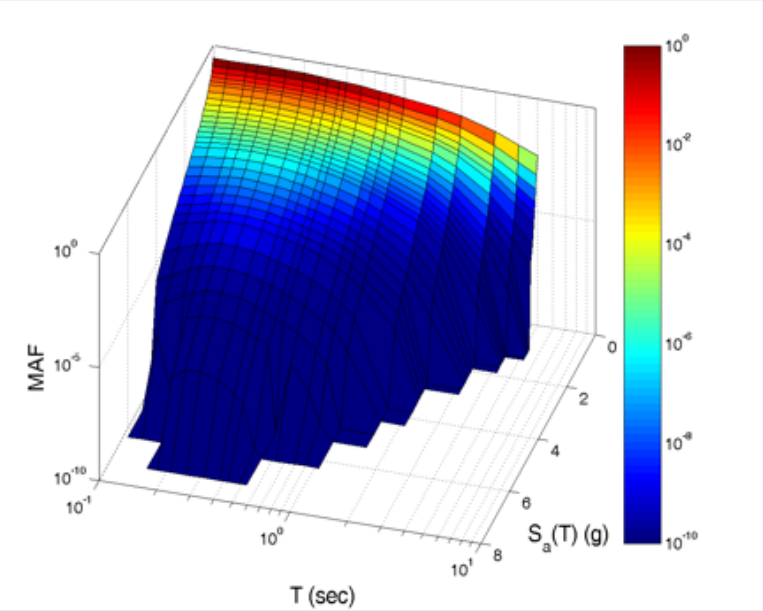


Sliding behavior of pallets

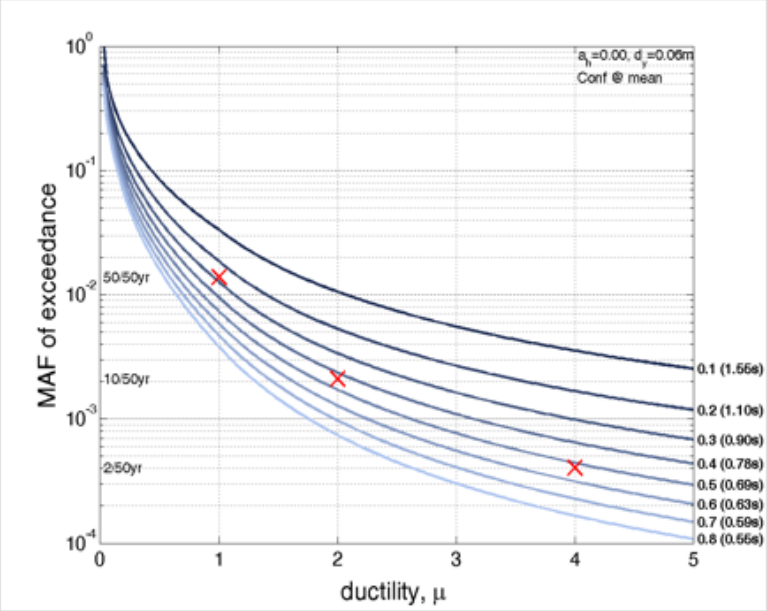
IDESIGN — Performance-based seismic design under uncertainties

Marie Curie Continuing Integration Grant – 2011 to 2015

Seismic fragility surface Sa(T)



Yielding frequency spectra and performance levels

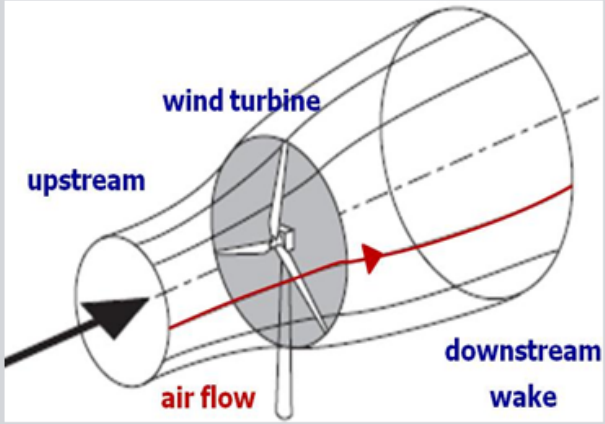


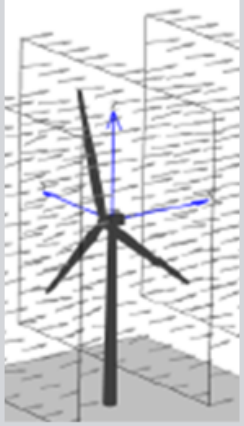
AIOLOS – Resolution of Complex Problems in the Analysis of "Next Generation" Wind Turbine Towers

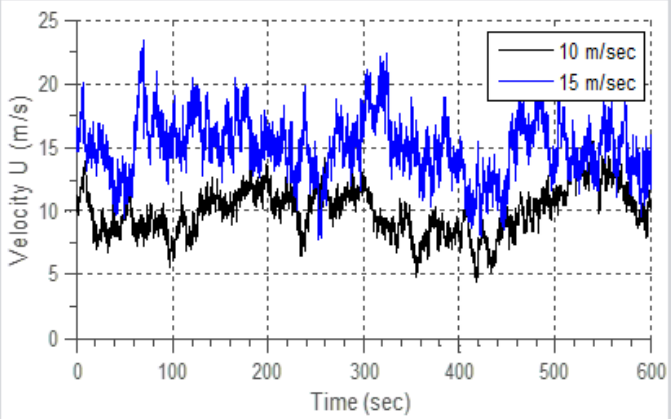
Thalis program – 2012 to 2015 NTUA, AUTh

- Development of wind time histories
- Strengthening of manhole openings
- Fatigue of connections

} of tubular wind turbine towers

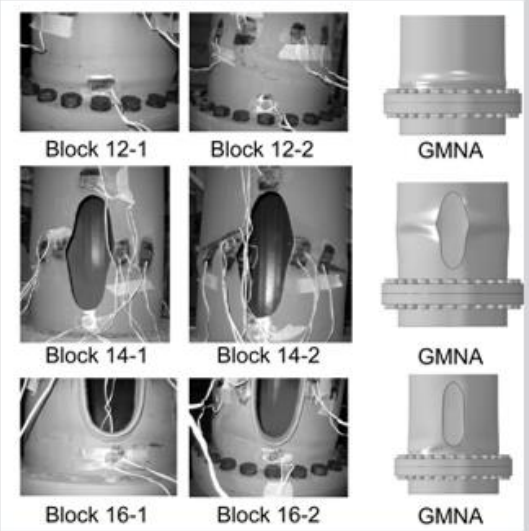




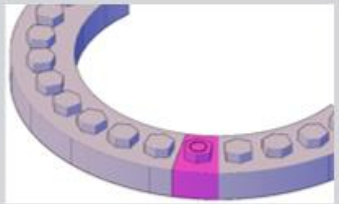


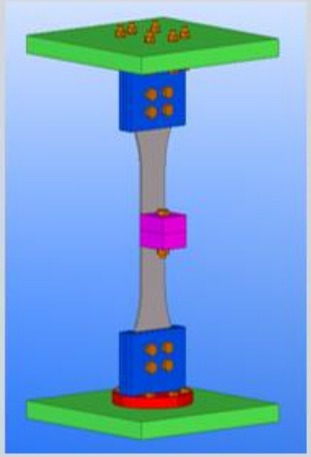
Institute of Steel Structures
Research Projects

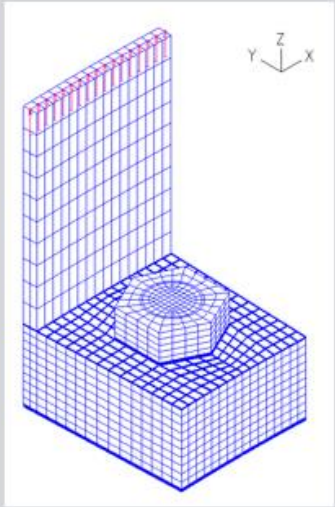
Strengthening of manhole openings



Fatigue of connections





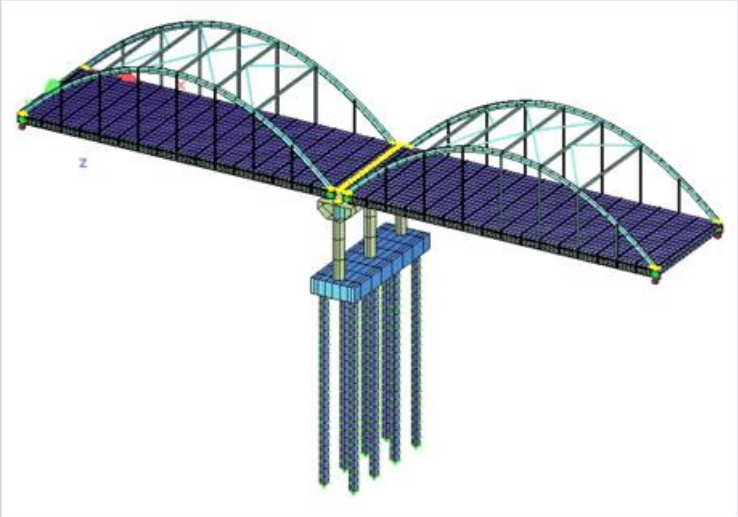


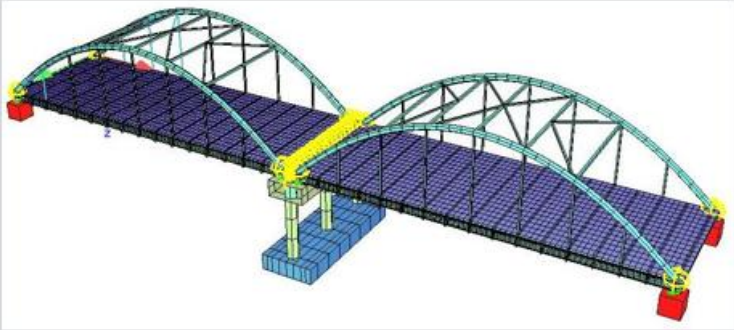
NAT-SEI-ISO – Innovative design of bridge piers in liquefiable soil using natural seismic isolation

Thalis program – 2012 to 2015

NTUA, AUTH, U. PATRAS, U. THESSALY, U. CYPRUS

2-span arch steel bridge with middle pier on liquefiable soil





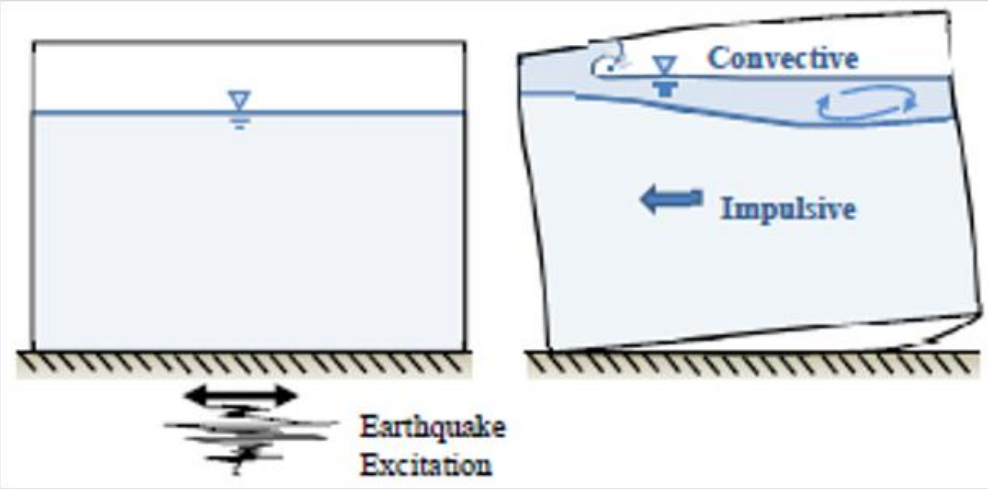
Investigation of feasibility of shallow foundation

RASOR — Vulnerability analysis and seismic risk evaluation for the protection of industrial facilities

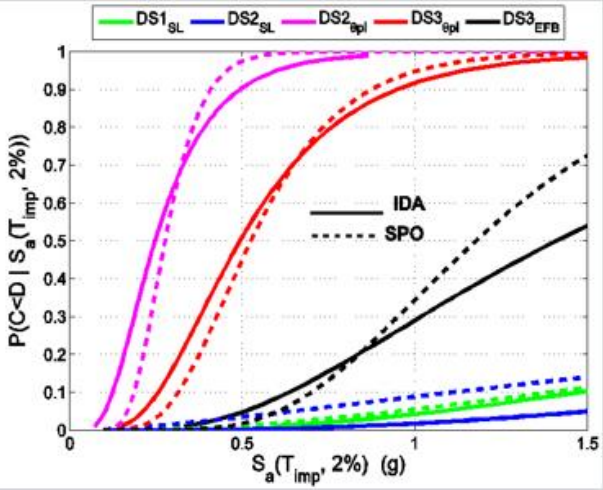
Thalis program – 2012 to 2015

U. THESSALY, ITSAK, NTUA, U. PATRAS

Simplified modeling of piping and tanks



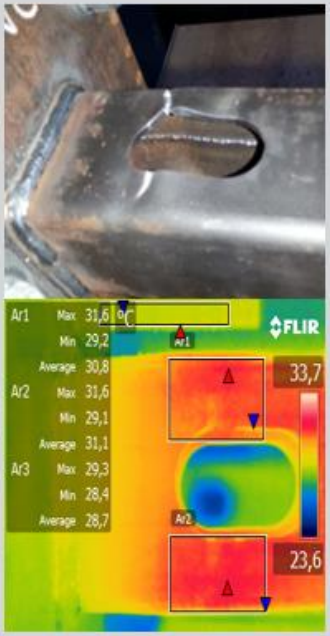
Fragility curves with static / dynamic analysis



MATCH- Material Choice for Seismic Resistant Structures

Research Fund for Coal and Steel (European Community) – 2013 to 2016

RWTH Aachen, NTUA, U. Thessaly, U. Pisa, RUUKKI-SSAB metals, ILVA Spa

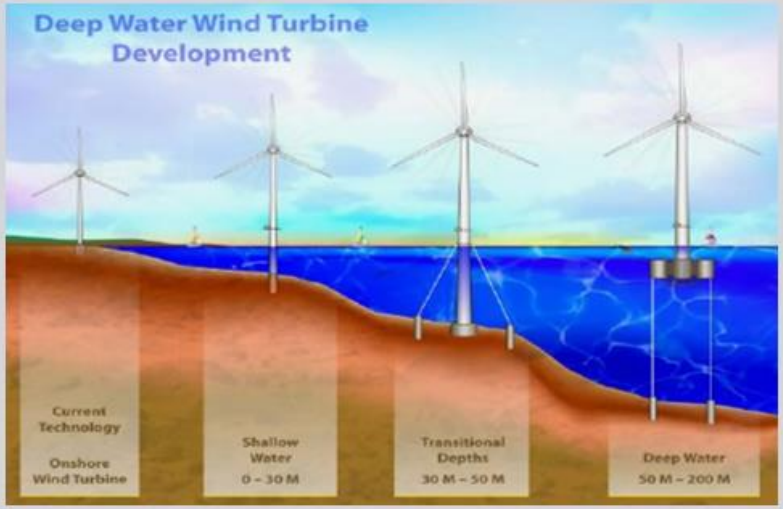


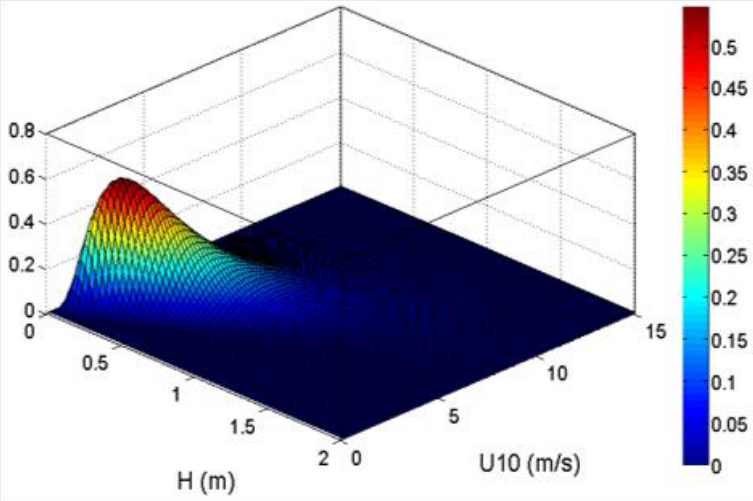
SEAWIND – Performance based design of offshore wind turbines

NTUA, U. PATRAS, DAE SA, TERNA ENERGY SA, HARBIN I.T., CEPPE

Greece – China Research Cooperation – 2013 to 2015

Investigation of technical / financial feasibility of offshore wind turbines in the Aegean Sea

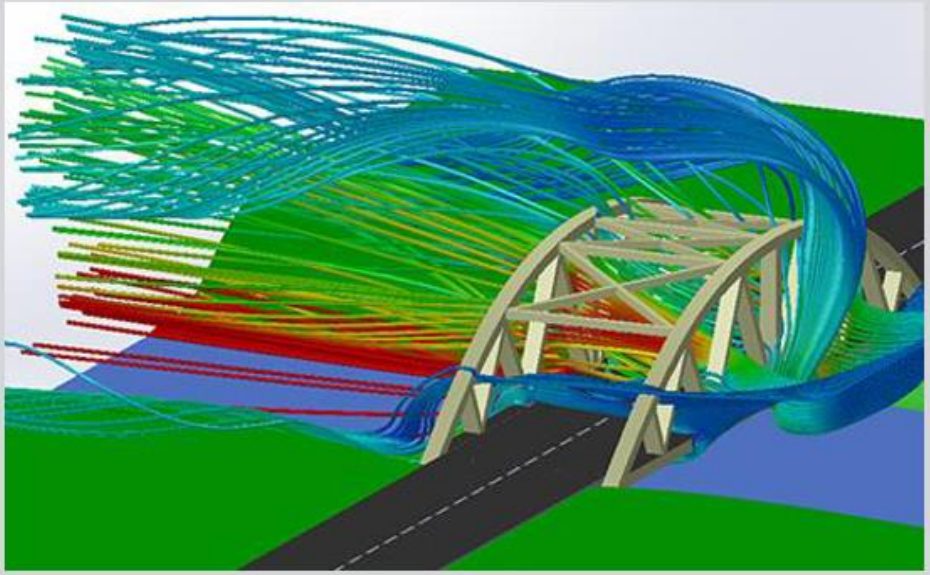




BRIDGECLOUD - Model-Based Aeroelastic Analysis of Long-Span Bridges on the HPC Cloud

EuroStars – 2013 to 2016

Numerical investigation of bridge – wind interaction

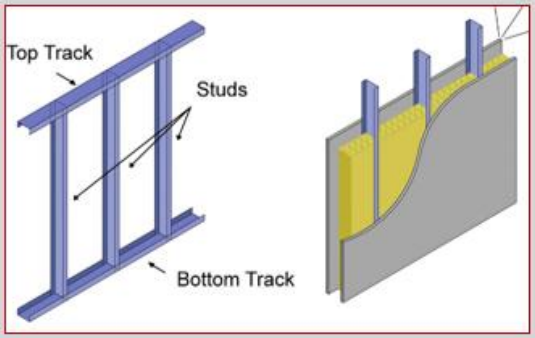


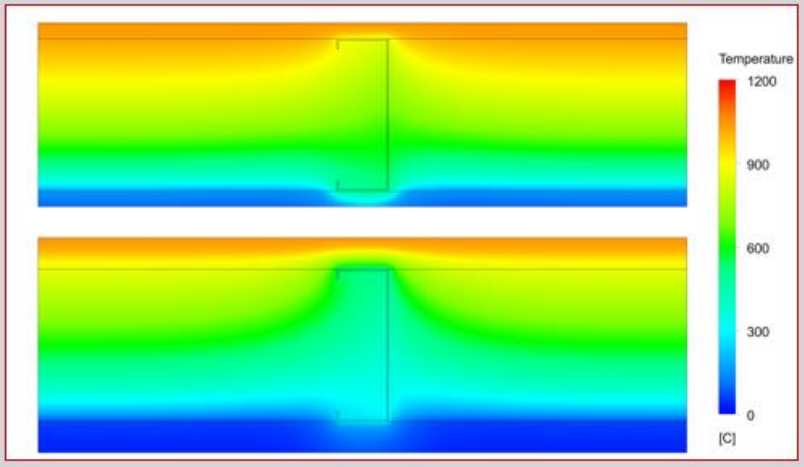
FIDES GMBH, WACKER GMBH, TU DRESDEN, POZNAN SNC, DENCO, NTUA, U. CRETE

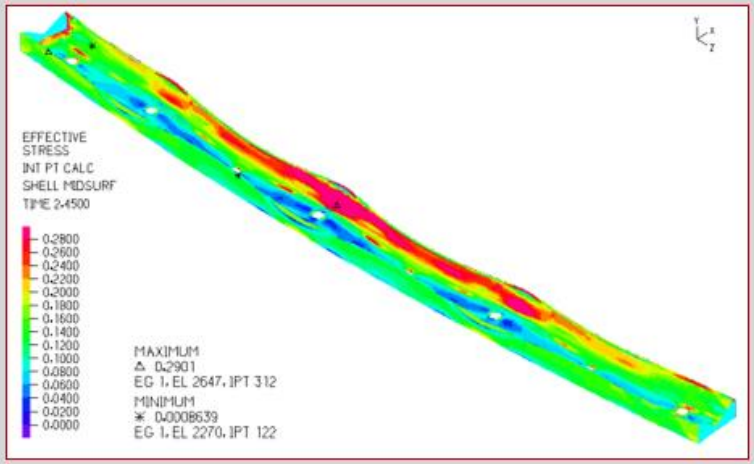
ELISSA — Energy Efficient Lightweight-Sustainable-Safe-Steel Construction

FP7 – 2013 to 2016

NTUA, STRESS, FARBE, WOELFEL GMBH, ZAE, KNAUF, U. ULSTER, COCOON, U. NAPOLI, VA-Q-TEC





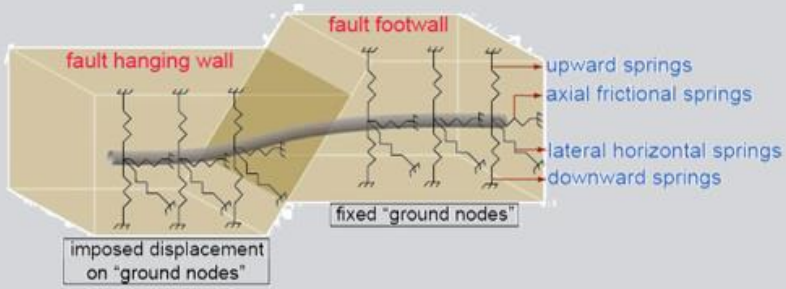


ENSSTRAM – Innovative design concepts of steel structures for the energy sector using advanced materials

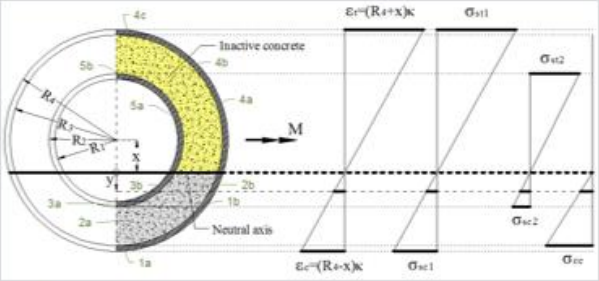
Aristeia II – 2014 to 2015

NTUA, U. PATRAS

Use of flexible joints in buried pipelines crossing seismic faults

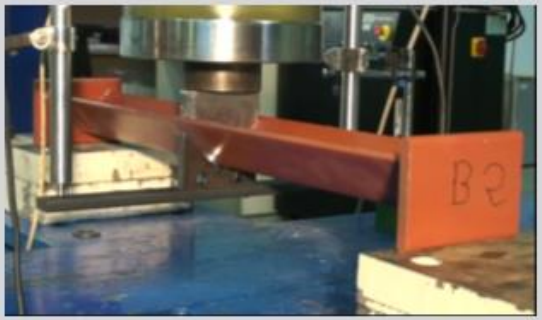


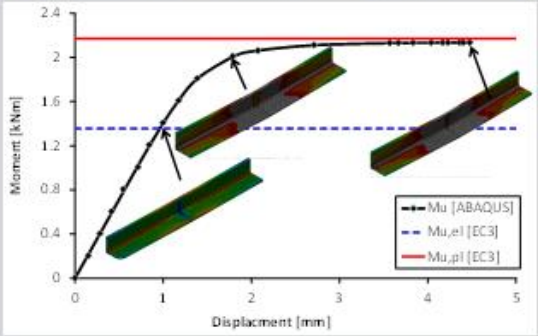
Sandwich-type wind turbine towers

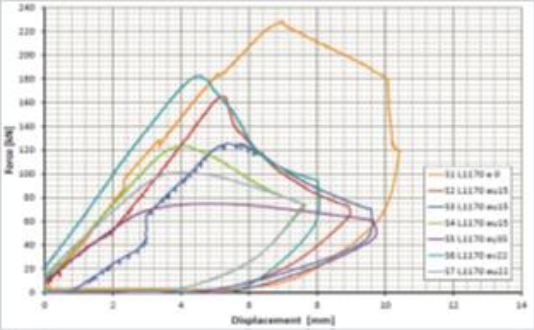


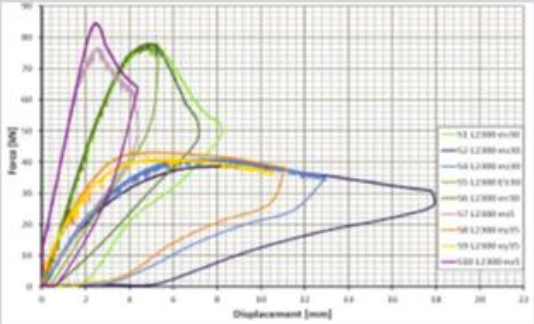
Plastic design of masts with L-section members

Cosmote/NTUA Research Cooperation
2014 to 2016





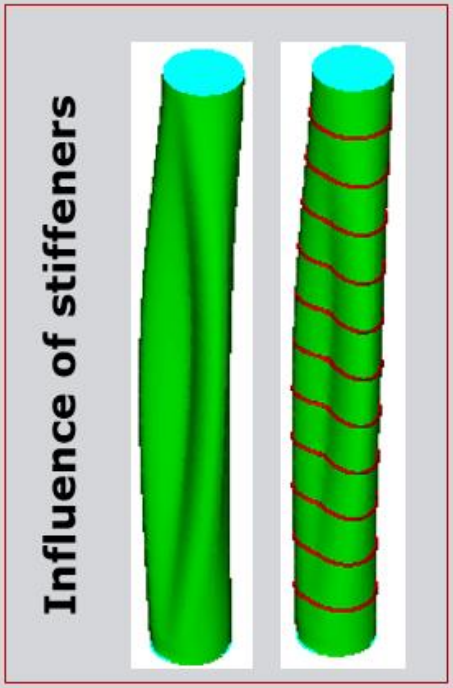


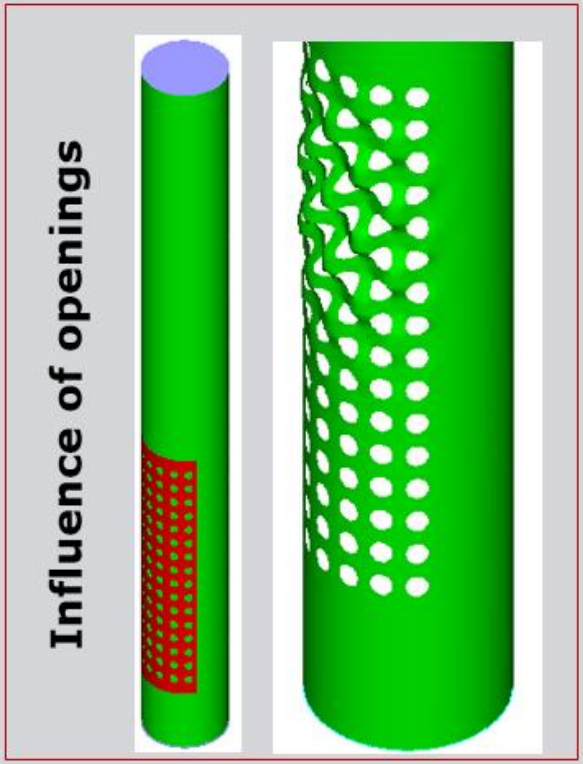


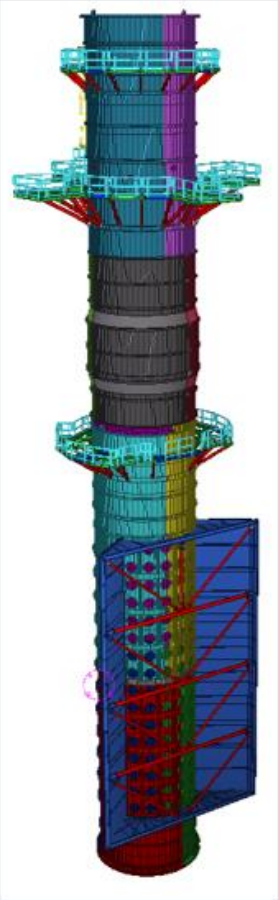
Buckling of Large Diameter Steel Chimneys

CICIND – 2015

NTUA, AMTE







INNOSEIS – VALORIZATION OF INNOVATIVE ANTI-SEISMIC DEVICES AND SYSTEMS

Research Fund for Coal and Steel (European Community) – 2016 to 2017

NTUA, ECCS, Universities of Milan, Pisa, Napoli, Timisoara, Aachen, Lisbon, Sofia, Hasselt and Maurer Söhne GmbH & Co. KG

Valorization actions for 12 innovative anti-seismic systems and devices were undertaken

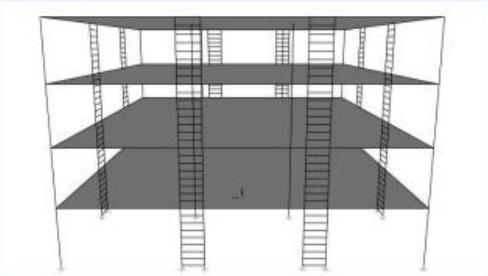


Fig. 2: Case studies with application examples on new steel buildings

- λ(LS) < 10%/50years → q-factor ✓
- λ(GC) < 1% - 2%/50years → q-factor ✓

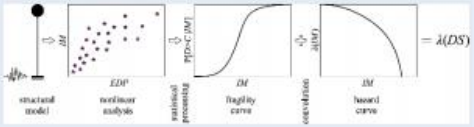
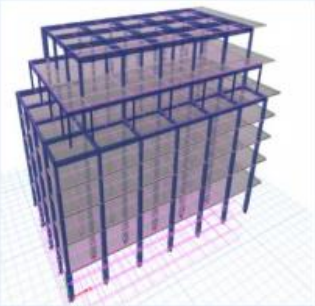


Fig. 3: INNOSEIS methodology to define values of behaviour factors



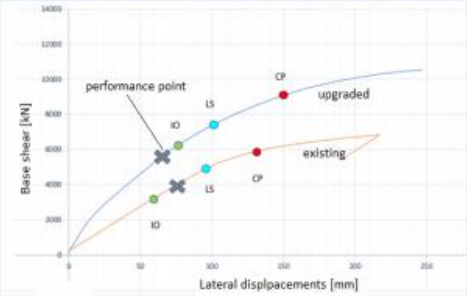
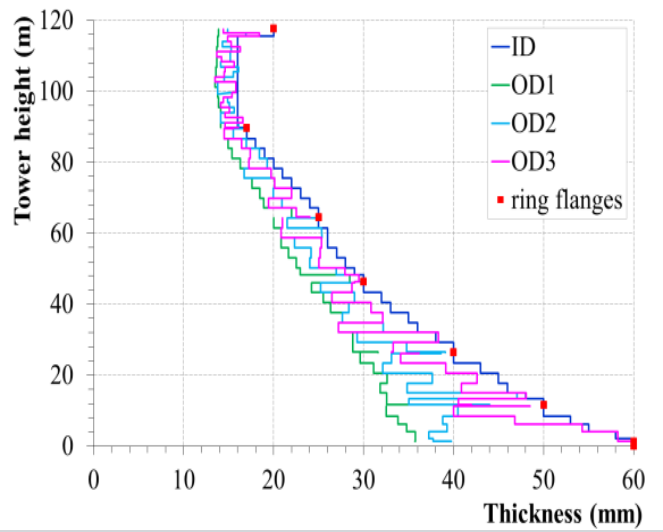


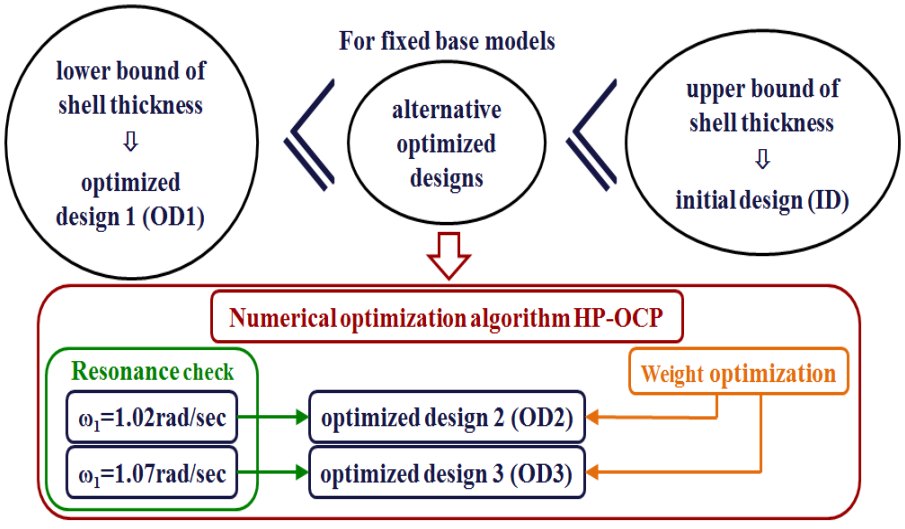
Fig. 4: Case studies with application examples on existing reinforced concrete buildings

"OptArch" – OPTIMIZATION DRIVEN ARCHITECTURAL DESIGN OF STRUCTURES

H2020-MSCA-RISE-2015 (European Community) – 2016 to 2020

NTUA, Centre de Mathématiques Appliquées de l'École Polytechnique, Univ. Joseph Fourier-SIMaP laboratory, EUPRAXIA, SHAPE, ACE Hellas, Univ. of Cyprus, Yasar Univ., Izmir Institute of Technology, McGill Univ., Cairo Univ., Jordan Univ. of Science & Technology,



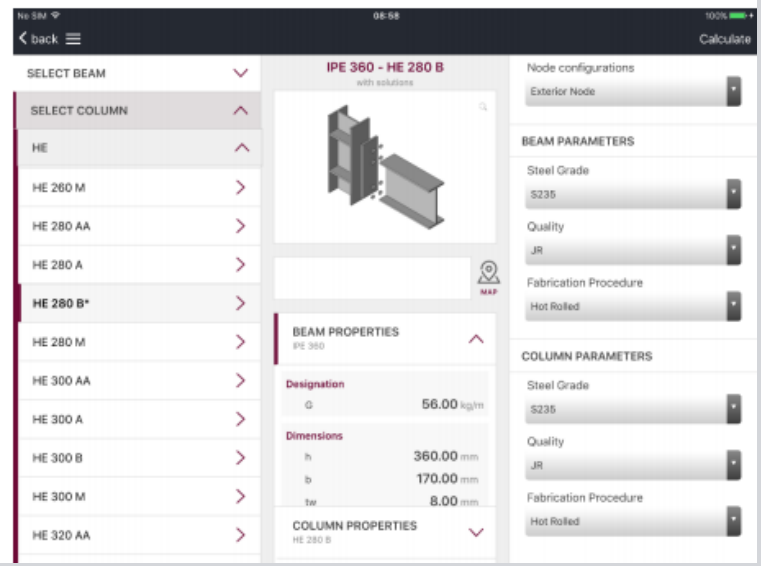


http://optarch.ntua.gr/

"EQUALJOINTS-PLUS" - Valorisation of knowledge for European prequalified steel JOINTS

Research Fund for Coal and Steel (European Community) – 2017 to 2019

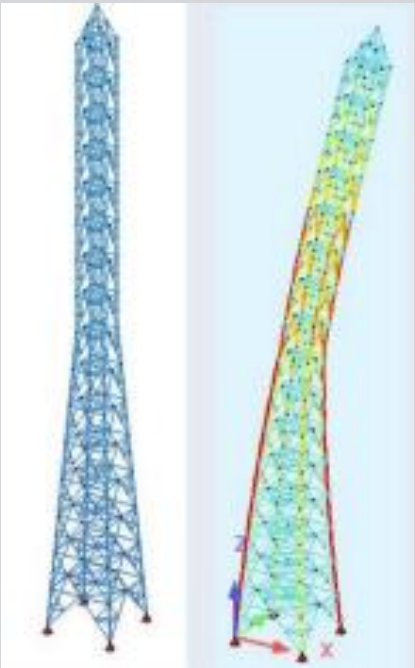
Univ. degli Studi di Napoli Federico II, Imperial College, Univ. de Coimbra, Univ. de Liège, Univ. Politehnica Timişoara, European Convention for Constructional Steelwork, ArcelorMittal, Univ. degli Studi di Salerno, České vysoké učení technické v Praze, NTUA, Reinisch Westfälische T.H. Aachen, Centre Technique Industriel de la Construction Métallique, T.U. Delft, Univ. V Ljubljani, Univ. Po Architektura Stroitelstvo I Geodezija, Univ. Politècnica de Catalunya, OneSource Consultoria Informática

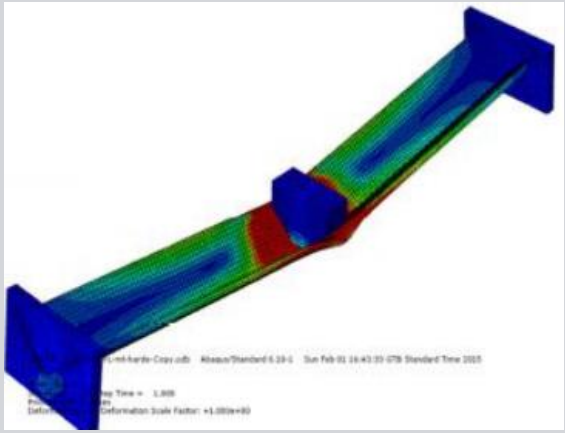


"ANGELHY" - Innovative solutions for design and strengthening of telecommunications and transmission lattice towers using large angles from high strength steel and hybrid techniques of angles with FRP strips

Research Fund for Coal and Steel (European Community) – 2017 to 2020

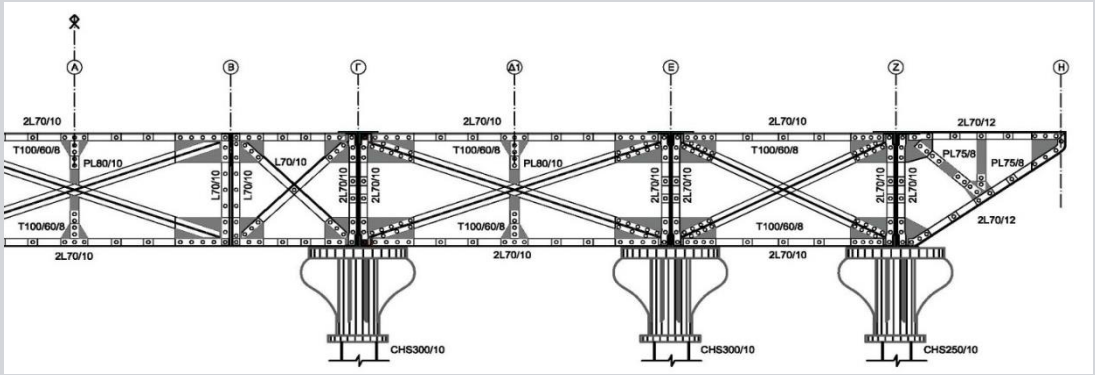
NTUA, ArcelorMittal, Univ. de Liège, COSMOTE, Centre Technique Industriel de la Construction Metallique, SIKA





"FRENCH DOCK" IN LAVRION HARBOUR

Evaluation of existing condition and design of strengthening measures for the loading dock, built in 1888 to serve the "Compagnie des Mines de Lavrion", which is now of monumental value for the city of Lavrion - 2018



"PANOPTIS" - Development of a Decision Support System for increasing the Resilience of Transportation Infrastructure based on combined use of terrestrial and airborne sensors and advanced modelling tools

H2020-MG-2016-2017/H2020-MG-2017 – 2018 to 2021

Airbus, NTUA, Acciona, Egnatia Odos, Future Intelligence, U. of Twente, IFSTTAR, FMI, AUTh, Sofistik, Corte, C4Controls

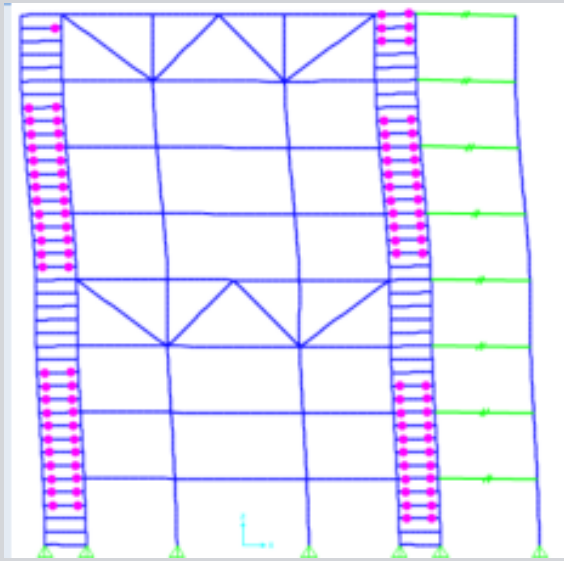
The purpose of the PANOPTIS project is to improve the resilience of the road infrastructures and ensuring reliable network availability under unfavorable conditions, such as extreme weather, landslides, and earthquakes by combining climate change scenarios with structural and geotechnical simulation tools, and with actual data from sensors.

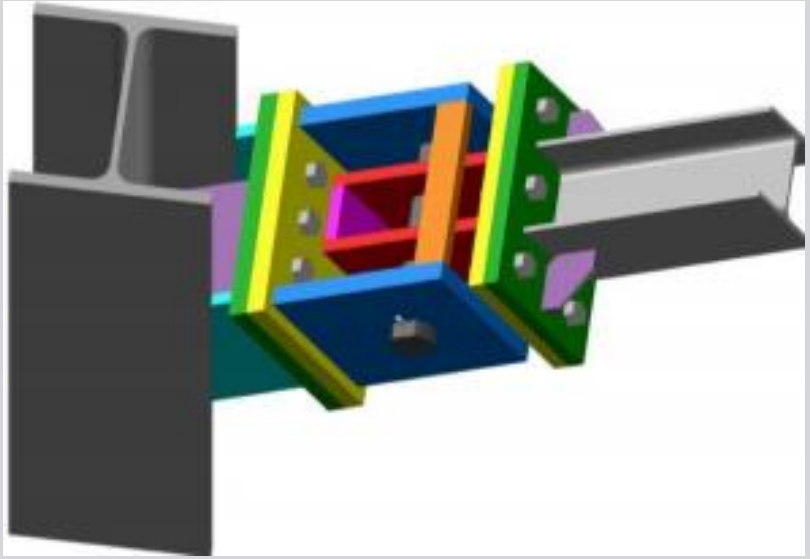
http://www.panoptis.eu/

"DISSIPABLE" – Fully dissipative and easily repairable devices for resilient buildings with composite steel-concrete structures

Research Fund for Coal and Steel (European Community) – 2018 to 2021

Politecnico di Milano, Instituto Superior Técnico, NTUA, SOFMAN SA, Universita degli studi di Trento, Rheinisch-Westfälische Technische Hochschule Aachen, Rina Consulting – Centro Sviluppo Materiali SPA, Universita di Pisa



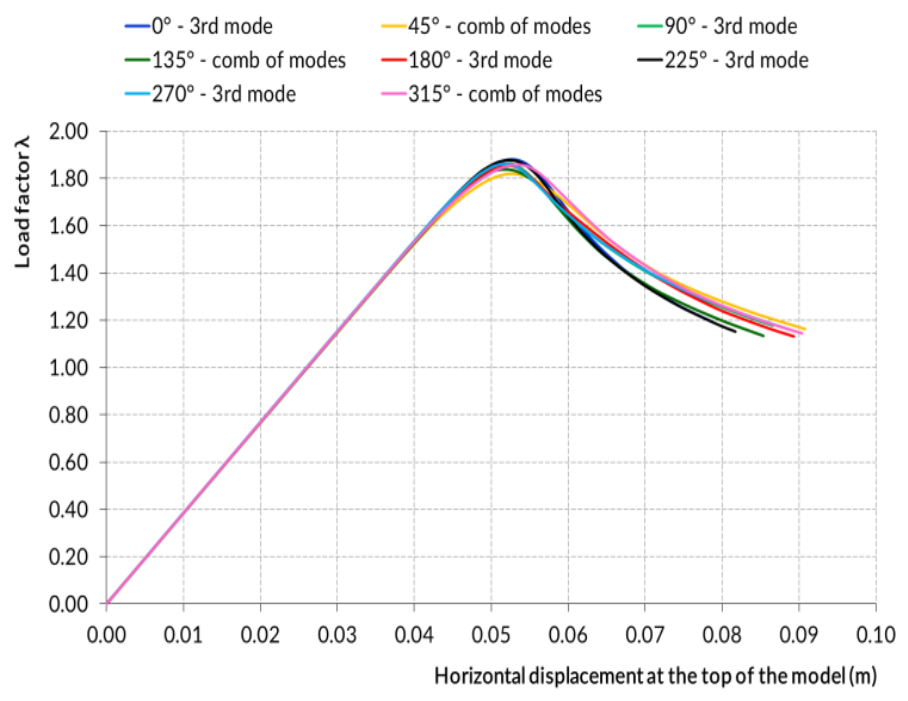


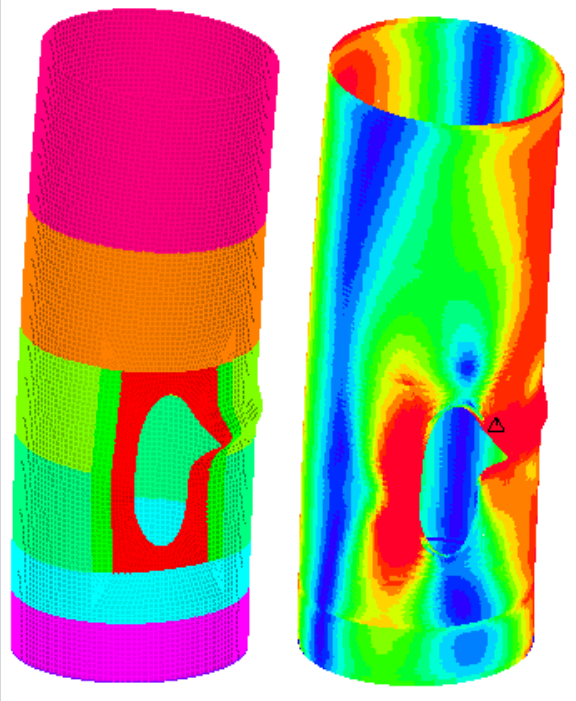
http://dissipable.ntua.gr/index.php

"HP-OCP" – High Performance Holistic Optimization Computational Platform

Research – Create - Innovate (GSRT) – 2018 to 2021

NTUA, ACE-Hellas, Diadikasia Business Consulting



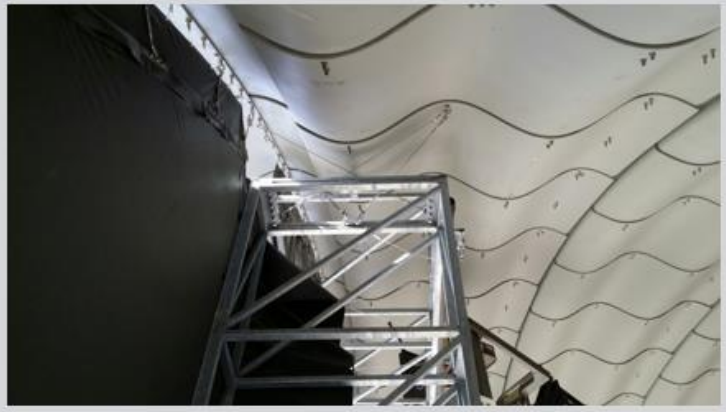


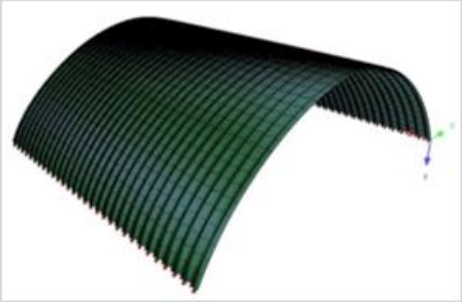
http://hp-ocp.ntua.gr/

Institute of Steel Structures
Tests for the industry

Experimental testing of members made of composite materials

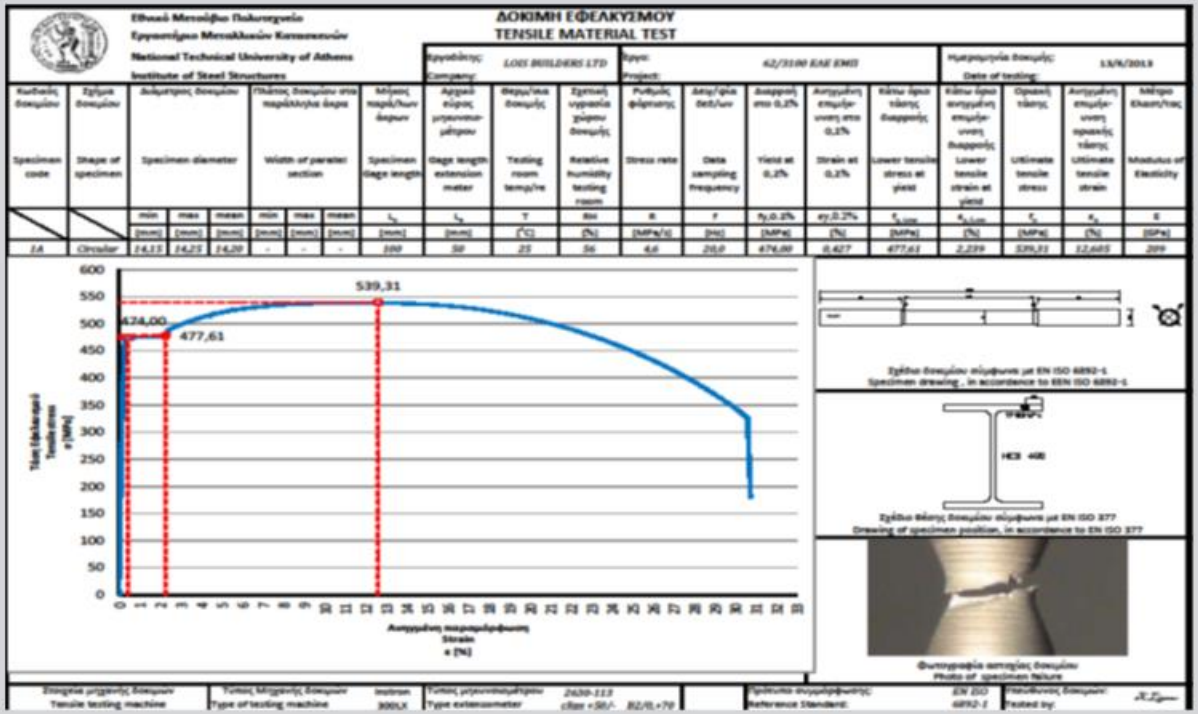
2011-13





Tension tests of pre-cambered beams

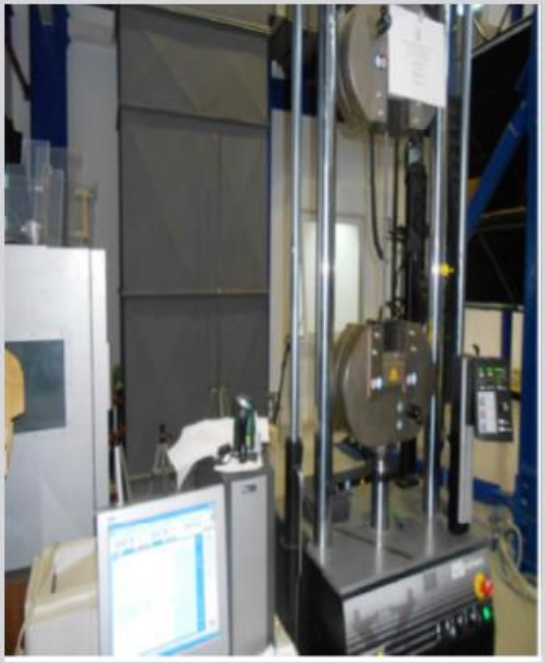
2013

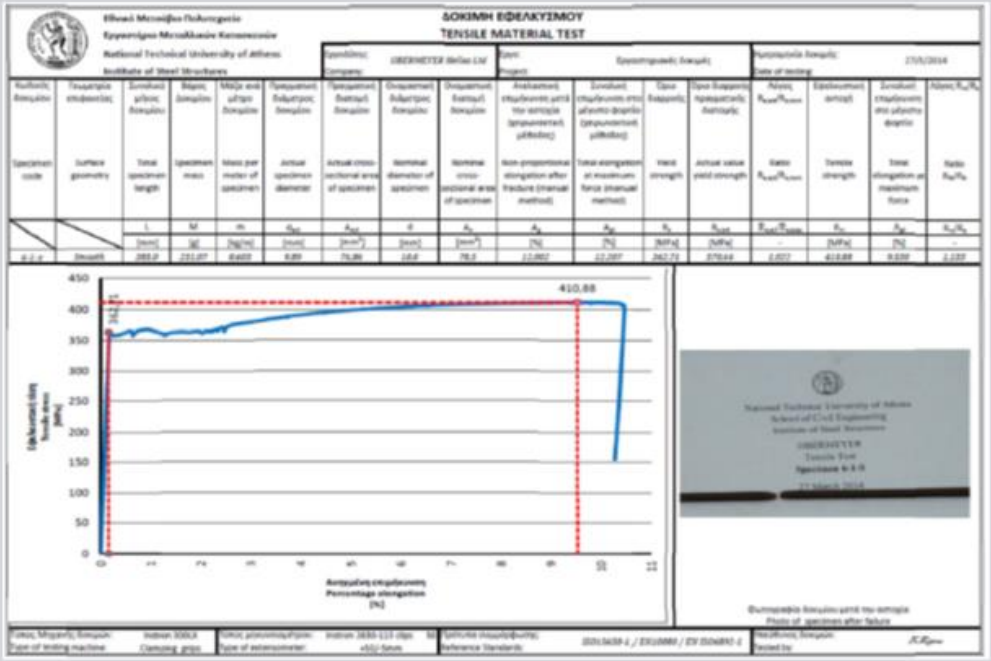


Lois Builders Ltd, Nicosia, Cyprus

Tension tests of reinforcement bars

2013





Obermeyer Hellas

Classification of safety doors in strength categories

2014

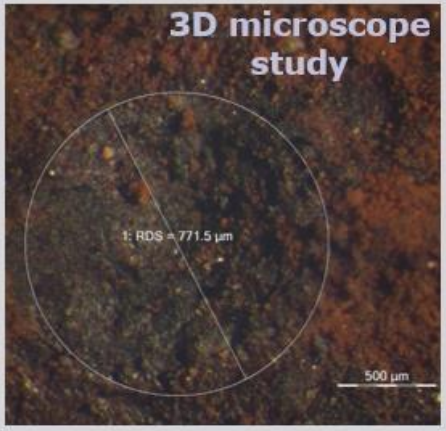
Porta Block, Athens

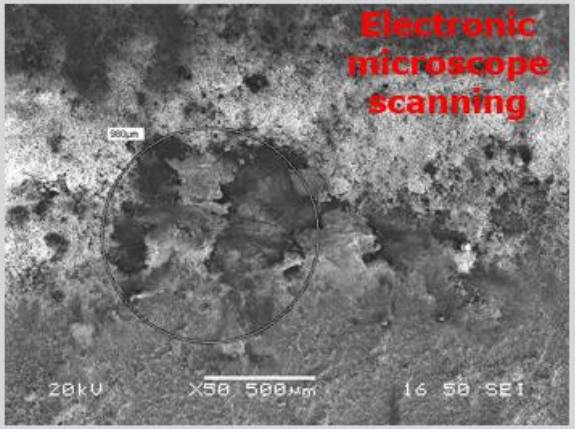
Institute of Steel Structures
Tests for the industry

Investigation of corrosion of tendons in pre-stressed railway bridge

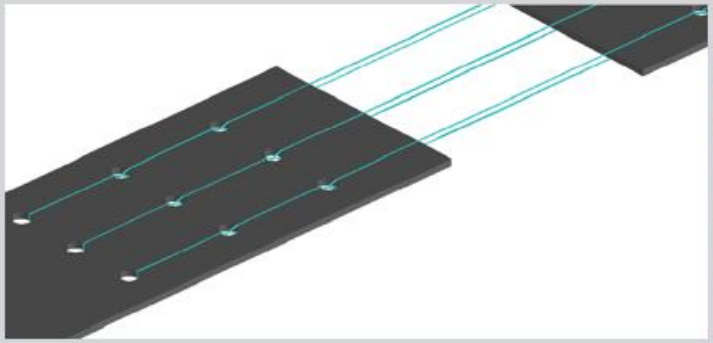
2014

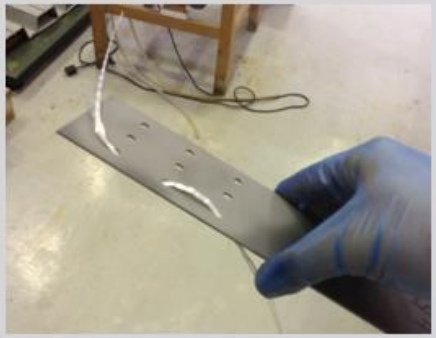
Collection of specimens

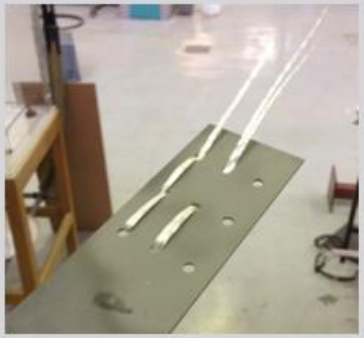


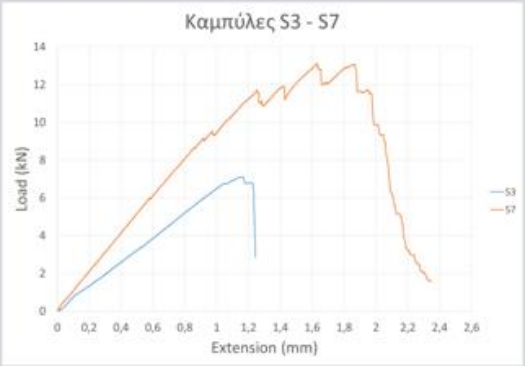


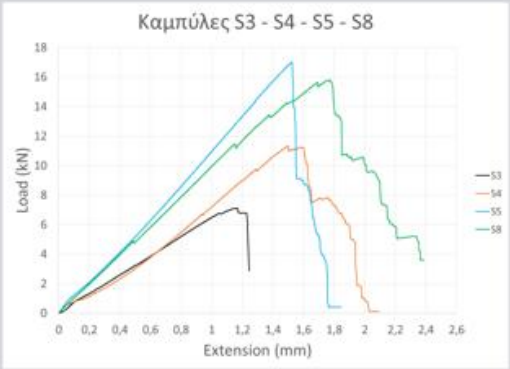
Splice connections of plates using FRPs

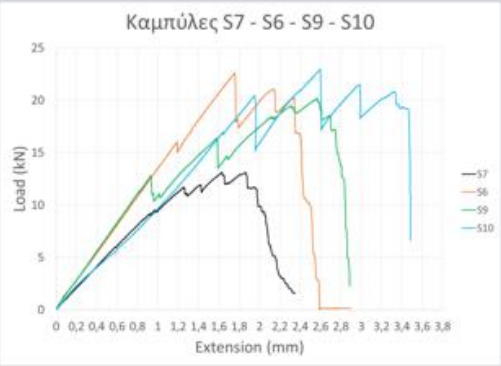












Increase of tension strength by 66% to 107% depending on the type of weave

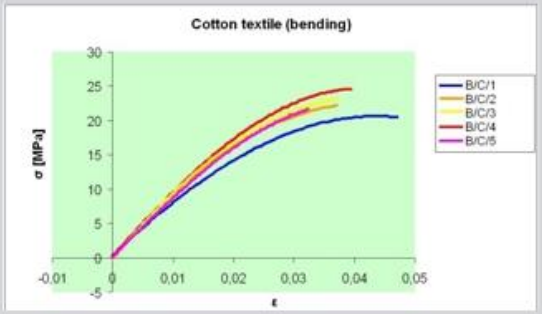
Institute of Steel Structures
Tests for the industry

Experimental investigation of mechanical properties of FRP with wool fibers

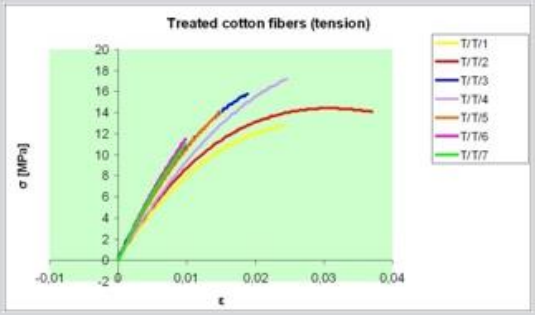
Unprocessed fibers

Processed fibers

Specimens



Tension



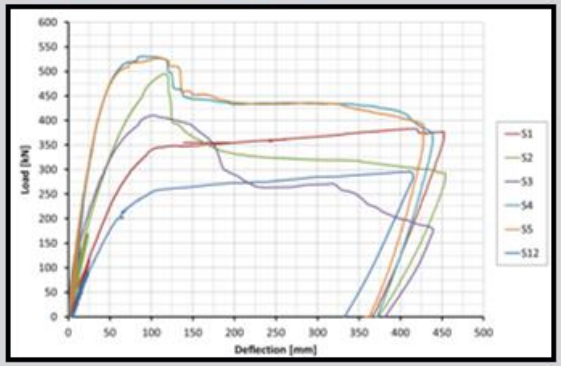
Bending

Imperfections

Tension tests & 3-point bending tests

Experimental investigation of Delta-Beams

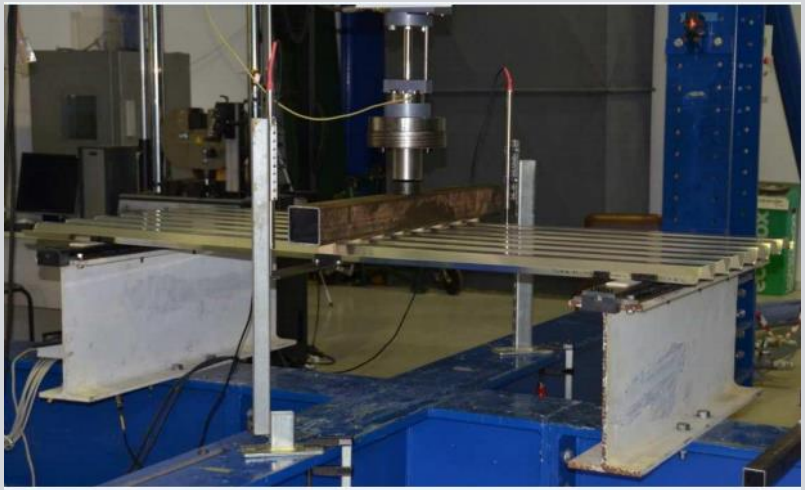
PEIKKO Group Corporation, 2015-2020



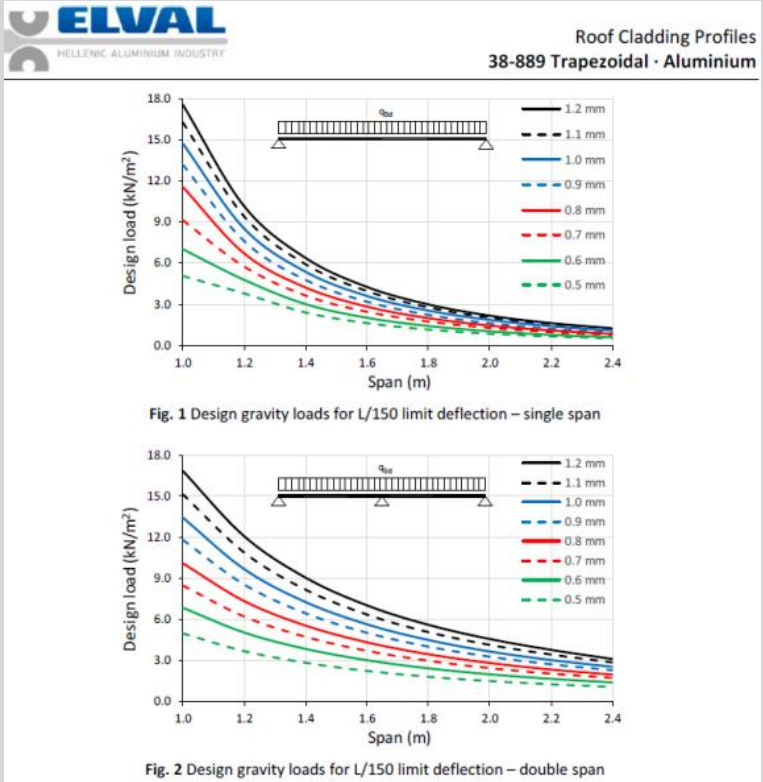
Certification of aluminum corrugated/trapezoidal panels

ElvalHalcor S.A., Athens, 2018

Experimental investigations have been carried out on three types of aluminum panels, of three different thicknesses and two alloys, according to EN 1999-1-4.



Experimental test with intermediate support

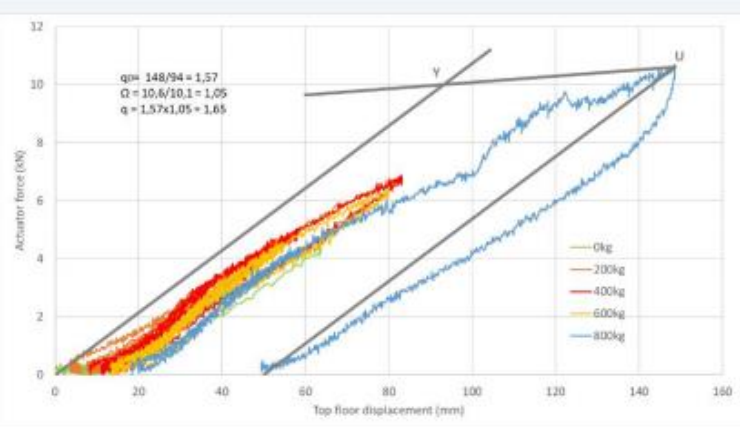


Carrying capacity diagrams

Full scale tests of racks under vertical and horizontal load

PAEGAE S.A, Athens, 2018

Experimental investigations have been carried out on industrial shelves of 7,70 m height, four levels and two openings, which consist of cold-rolled thin sections.

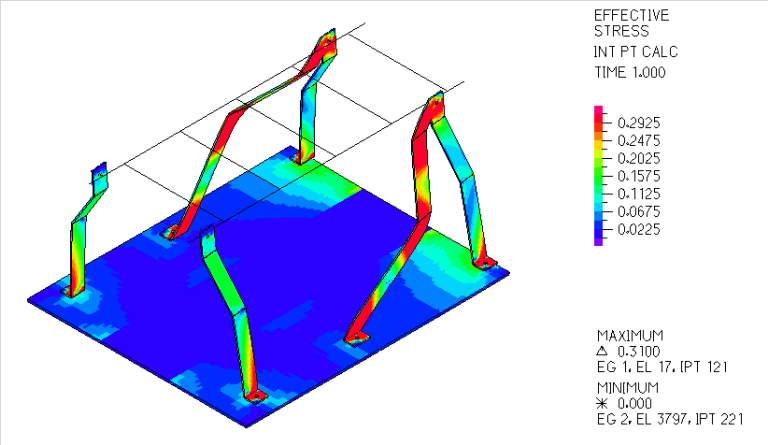


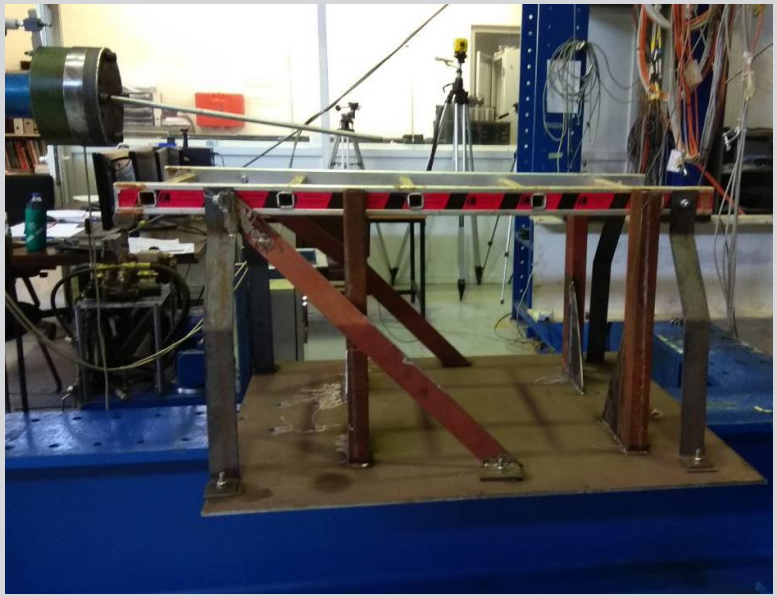
Determination of the Behavior Factor q from the tests

Supports of wind-turbine-tower ladder

Experimental and numerical investigations have been carried out to evaluate the structural performance of the supports of continuous, wind-turbine-tower ladders. The investigated support mechanism, proposed by Rokas Aioliki S.A., comprises a system of inclined and horizontal brackets, serving as load bearing and stabilizing components, respectively, which connect the ladder with the tower's shell

Rokas Aioliki S.A., Athens, 2018





Institute of Steel Structures
Indicative recent publications

Raftoyiannis, I.G., Avraam, T.P. and Michaltsos, G.T., "Analytical Models of Floating Bridges under Moving Loads", *Engineering Structures*, Vol. 68, pp. 144-154, 2014 (https://doi.org/10.1016/j.engstruct.2014.03.002).

Dimakogianni, D., Dougka, G. and Vayas, I., "Seismic Behavior of Frames with Innovative Energy Dissipation Systems (FUSEIS 1-2)", *Engineering Structures*, Vol. 90, pp. 83 – 95, 2015 (http://dx.doi.org/10.1016/j.engstruct.2015.01.054).

Dimopoulos, C.A. and Gantes, C.J., "Numerical Methods for the Design of Cylindrical Steel Shells with Unreinforced or Reinforced Cutouts", *Thin-Walled Structures*, Vol. 96, pp. 11-28, 2015 (http://dx.doi.org/10.1016/j.tws.2015.07.024).

Dimopoulos, C.A., Koulatsou, K., Petrini, F. and Gantes, C.J., "Assessment of Stiffening Type of the Cutout in Tubular Wind Turbine Towers under Artificial Dynamic Wind Actions", *Journal of Computational and Nonlinear Dynamics (ASME)*, Vol. 10, No. 4, 041004, 2015 (http://dx.doi.org/10.1115/1.4028074).

Iliopoulos, A., Smyrnaios, S. and Vayas, I., "Truss Models for Inelastic Stability Analysis and Design of Steel Plate Girders, *Engineering Structures,* Vol. 105, Issue 12, pp. 165-173, 2015 (http://dx.doi.org/10.1016/j.engstruct.2015.09.040).

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