

## Product News

### ATENA

#### ATENA Update 4.2.7g

we are continuously improving and developing our software ATENA, the leading solution for the simulation of real behavior of reinforced concrete structures. Our users can always download the latest ATENA Version 4.2.7g directly from our web site: <http://www.cervenka.cz/downloads>.

ATENA 4.2.7g has been released in May 2011. All users with the valid maintenance agreement can upgrade to the latest ATENA version from the Downloads section of our web, or request an installation CD.

Main changes since 4.2.7b:

- Added bond material model for cyclic loads (CCBarWithMemoryBond)
- Newer version of the T3D mesh generator
- Fixed a bug with monitors in construction process in ATENA 3D
- Czech texts which slipped into the English version of ATENA 2D changed to English
- Fixed displaying crack width in AtenaWin
- Fixed in binding reinforcement to volume elements
- Fixed of unnecessary Floating Point Exception in Interface material
- Fixed a bug in Fire Boundary condition
- Other small fixes and changes in the kernel (monitors on reinforcement, fatigue, boundary load, lumped masses in dynamics, ...)
- Updated ATENA-GiD scripts
- Updated Manuals

We apologize for not releasing the planned version 4.2.8. We have decided to make more features, above all the 64bit analysis kernel, available to our users as soon as possible, and we are now testing ATENA 4.3.0 pre-release versions. The release is planned in the autumn. The main improvements and fixes are:

- First 64bit version of the ATENA kernel, AtenaConsole, and AtenaWin (x64). This allows ATENA to use more than 2GB of RAM during analysis
- Completely new graph component in AtenaWin
- Added option to apply initial opening on contacts (LOAD INITIAL GAP)
- Improved implementation of hydration heat and general heat sources/sinks (material CCTransportMaterialLevel7; not yet supported in any GUE)
- Improved connecting of beam elements (CCBeamNLConnection)
- Updated ATENA-GiD scripts
- Automatic check if an update is available for download

Furthermore, we are working on applying multithreading in the most computationally intensive parts of the kernel, which lets a single analysis make use of nowadays common multi-core processors. New versions of our stochastic package SARA and the randomization of ATENA Science (RLACS project) are also being developed.

### AmQuake

The AMQUAKE program allows European engineers to design safe masonry buildings in seismic regions in accordance with the latest European standards and modern seismic assessment methods. The introduction of Eurocode 6 and 8 in March 2010 in the European community requires to verify almost all new masonry buildings for seismic safety.

In a few days, a campaign will be started to promote the French and Romanian versions. New version of our software for seismic design of masonry building AmQuake 1.22 was released. There are many changes and new features

- new option for reinforcement visualization in concrete elements
- improved automatic generation of Reinforced Masonry model from Confined Masonry
- improvements in DXF import
- improvements in protocol generation
- optimization for faster analysis times
- improvements in calculation of horizontal seismic force distribution

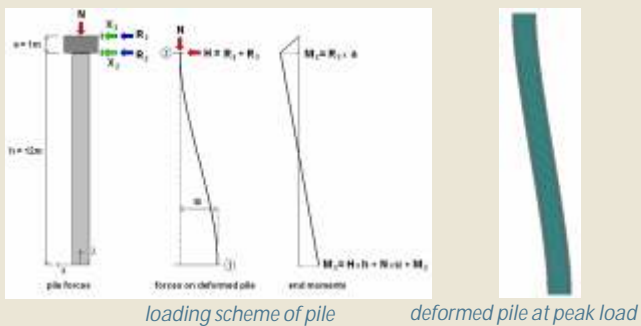


Try this new program for seismic design of masonry buildings based on pushover analysis according to Eurocode 8 with Wienerberger products. More at: [www.amquake.eu](http://www.amquake.eu)

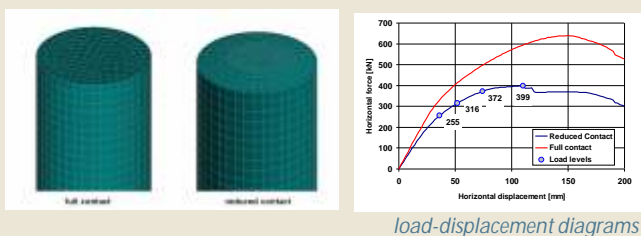
Only for 390€

## Our Current Projects

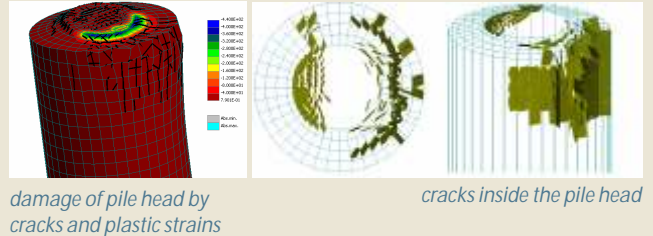
**Rotation Capacity of Piles Subjected to Horizontal Loading**  
Large RC piles were investigated with the aim to simulate the pile response due to the shear force under imposed vertical loading. Two cases of pile head geometry are considered, one with a full section, the other with 50% reduction of diameter of the contact surface. The behavior during the loading and the failure modes were evaluated. The analysis was made for company ESTEYCO, Spain (Esteyco works in a research project regarding integral railway viaducts which includes the study of its behavior in a global sense and the behavior of each of its parts. For this type of viaducts, the pile being designed is a clamped pile in both ends that tolerates considerable transverse displacements on the top while maintaining the necessary load transfer capability. Therefore, there was a special interest in modeling this element with FE and in studying its behavior in two different definitions. One of them is defined with full section and the other with a section with 50% reduction of diameter of the contact surface)



The FE model was made in ATENA 3D and included all longitudinal and transverse reinforcement. The top and bottom ends were fixed. The loading was applied by means of artificial loading plate, with free horizontal and vertical movements, but with constrained rotation. The horizontal force and top moments was applied by a pair of prescribed displacement. The detail of FE model in case of reduced contact area in the top pile head is shown.

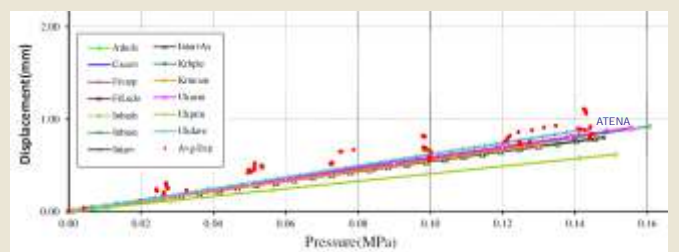
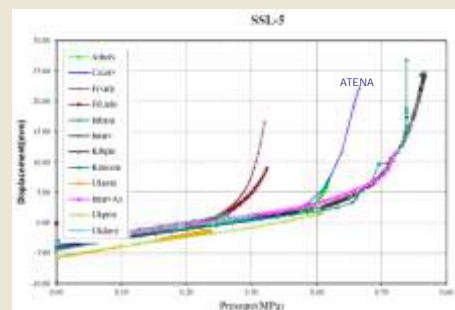
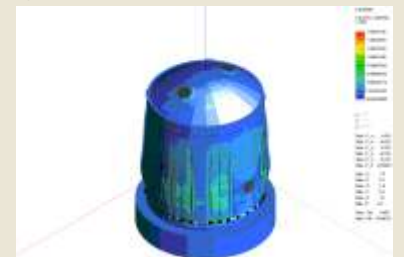


The numerical simulation provides data, which closely resemble a physical testing. The diagrams showing relation between the horizontal shear force and displacement revealed the effect of pile head geometry on the global resistance. The analysis provided sufficient data about damage of concrete due to cracks and plastic deformation in the critical region of pile near the ends. The failure near the pile end in case of reduced loading contact area was effected by concrete splitting, which caused a decreased resistance with respect to the case of original geometry.



### BARC

Bhabha Atomic Research Centre in India, BARC, has launched an interesting and demanding project on testing a 1:4 scaled model of 540 MW pressurized heavy water reactor containment made of prestressed concrete. ATENA is one of the 16 participants in this project. The aim is to simulate the test and to predict the failure. In January 2009 a pre-test meeting was organized in Bombay where the participants presented and compared their first results. In February 2011 six experimental tests have already been performed at BARC. Tests #1 to #4 were up to 100% of design pressure. Test #5 and #6 were up to 156% of the design pressure. Fig. 2 shows a graphs of LD diagrams of all participants on these experiments. ATENA results are indicated by a small label approximately in the middle of all results. Fig. 3 shows the displacements at dome crown from these tests. Next tests (increase loading up to failure) should take place in 2011 in the laboratories of BARC, and therefore the results of the experiments are not yet available.





## Our Current Projects

### VALIDATION OF POST-TENSIONING ANCHORAGE ZONE

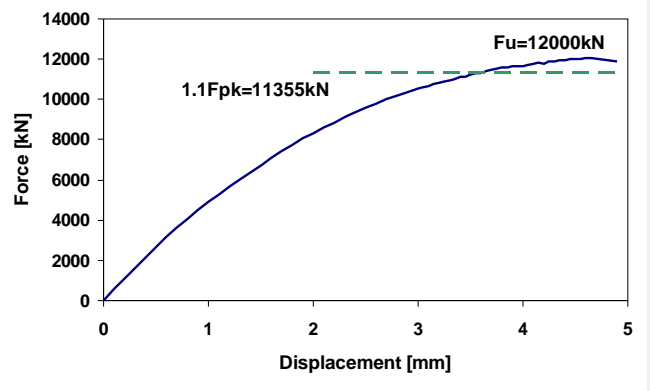
Anchorage regions for post-tensioned concrete structures are designed to transfer high forces from prestressing tendons to concrete. In the current practise, the safety of such systems is ensured by certification process, which is based on experimental verification. Such physical tests can be supplemented by numerical simulations, which offer a rational explanation of the observed behaviour and reveal the sensitivity to design parameters. The combination of experimental and numerical methods increases the economy of the development process and improves the product safety.

In this R&D project by VSL International Ltd, a specialist contractor for post-tensioning works, a combination of experiments and numerical analysis for the validation of a new anchorage system. It was done in cooperation with Cervenka Consulting from Prague, which provided the numerical analysis. The physical tests were performed at the laboratories of the Technical University in Munich and Stuttgart.

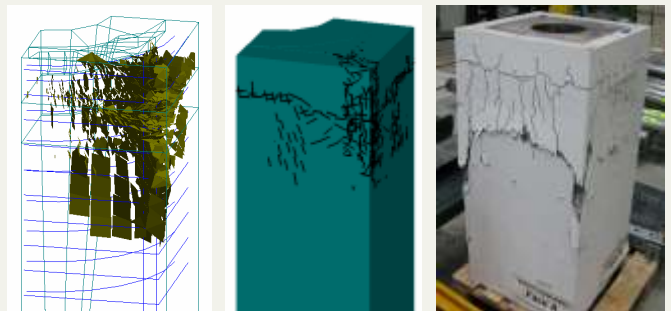
The shape of the load-displacement curve reflects the damage progress and ductility related to a failure type. The cracks on the surface as well as inside of the specimen can be predicted. A good agreement with the cracks observed in the experiment is found.

The stress state of concrete at the maximum load documents that a confinement effect by the spiral and stirrup reinforcement increases the uniaxial concrete strength of 50 MPa into the range of 100-200 MPa. This is the main source of the load carrying capacity of anchorage regions.

The experimentally validated numerical model was used as a tool for optimisation of the anchorage and design. It can be utilized for design of future optimization of reinforcement detailing. The model can also be used to assess other effects such as the size of the test specimen (e.g. larger than the minimum size tested) or other shapes of the anchorage zone (rectangular anchorage zone rather than square shape) on the load capacity and cracking behaviour of the local anchorage zone.



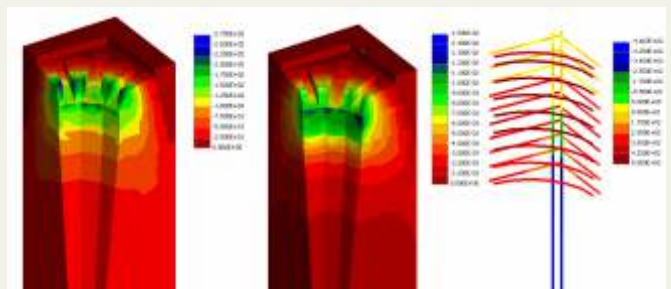
Load-displacement diagram from test simulation



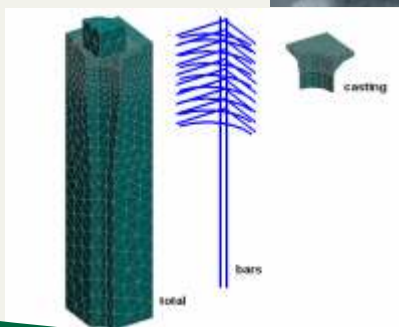
Crack pattern on surface at failure: simulation and experiment



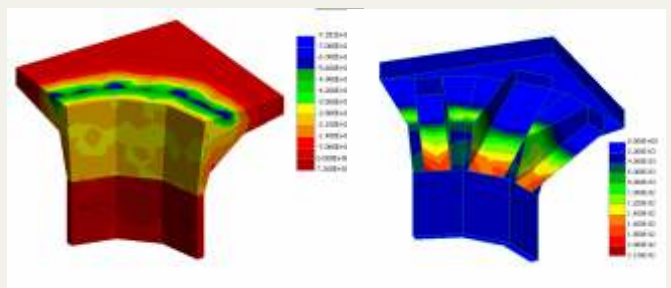
set-up for laboratory testing



Stress and plastic strain in confined concrete and in confining reinforcement



FE model of the anchoring specimen (1/4 symmetrical model)



Stresses and plastic strains in casting

## *fib* Medal of Merit awarded to Vladimír Ěervenka

President of Ěervenka Consulting company, Dr. Vladimír Ěervenka, celebrated in June 2011 his 70th birthday. On this occasion he received the 2011 *fib* Medal of Merit in recognition of his outstanding contributions to the field of structural concrete and to *fib*. The medal was presented to Dr. Ěervenka by *fib* president György L. Balázs, during the opening ceremony of the recent *fib* symposium held in Prague. Vladimír Ěervenka was born in 1941 in Zlín, Moravia. In 1962 he received a degree in engineering from the Czech University in Prague. In 1970 he earned his Ph.D. at the University of Colorado, Boulder, USA, with a dissertation on inelastic finite element analysis of reinforced concrete panels under in-plane loads, which was world-wide pioneering work in the field of computer modeling of concrete structures. Dr. Ěervenka's distinguished career has been devoted to the development of nonlinear finite element models of reinforced concrete. He worked as a researcher in the United States, Germany and the Czech Republic, and, after founding Ěervenka Consulting in 1992, has brought his expertise and analysis software ATENA to many countries around the world, including, among others, Japan, India, Germany and USA, for applications such as nuclear containments, bridges, historical buildings, tunnels, anchoring and pre-stressing technique etc.



His invaluable contributions to CEB and *fib* include work on CEB Bulletin 230 "RC elements under cyclic loading", *fib* Bulletin 45 "Practitioners' guide to finite element modeling of reinforced concrete structures" and the 2010 *fib* Model Code, as well as involvement in *fib* Commission 2 "Safety and performance concepts", Task Group 4.1 "Serviceability models", and Special Activity Group 7 "Assessment and interventions upon existing structures". Ěervenka Consulting has been a corporate member of *fib* since 1998.

## Where You Can Meet Us ATENA Seminar 2011

CZECH REPUBLIC - Prague, June 7-9, 2011

We look forward to advanced ATENA users, who want to learn more about the theoretical background of the new ATENA and its advanced application areas as ATENA 3D, GiD-pre/postprocessing, dynamic, eigenvalue, creep, thermal or fire analyses. For more information and on-line registration watch our website: <http://www.cervenka.cz/news/atena-advanced-user-seminar-2011>. You can book a place through on-line registration till July 31 for cheaper fee.

## 6th International Conference Fibre Concrete 2011

CZECH REPUBLIC - Prague, September 8-9, 2011

The conference focused on fibre reinforced concretes traditionally held biennially. We will present our papers and you are also welcome to visit our exhibition stand. More info: <http://concrete.fsv.cvut.cz/fc2011>

## 18th Concrete Days

CZECH REPUBLIC - Hradec Kralove, November 23-24, 2011

We will present us at the Exhibition CONCRETE 2011 in the ALDIS Congress Centre in Hradec Kralove. ATENA software will take part in the traditional professional exhibition in the conference.

## IALCCE 2012 - 3rd Symposium on Life-Cycle Civil Engineering

AUSTRIA - Vienna, October 3-6, 2012

IALCCE is a young Association founded in October 2006. Its activities encompass all aspects of Life-Cycle assessment, design, maintenance, rehabilitation, and monitoring of civil engineering systems. The mission of IALCCE 2012 is to bring together all cutting edge research in the field of Life-Cycle Civil Engineering and so to advance both the state-of-the-art and state-of-practice in the field. More details you can find on: <https://ialcce2012.boku.ac.at>