TRAINING AND RETRAINING OF EXPERTS IN EUROCODES AT MOSCOW STATE UNIVERSITY OF CIVIL ENGINEERING (MGSU)

M.E. LEYBMAN, VICE-RECTOR, MGSU

«Eurocodes – Training of Trainers» Workshop of EC and RF Experts
9-10 December 2010

Workshop of EC and RF experts **«Eurocodes – training of trainers»**
Moscow, 9-10 December 2010
Moscow State Construction University

Summary and recommendations

Experts, institutes and other stakeholders from EU and RF confirmed a need in progressing towards an effective convergence in technical regulations in the construction domain, in harmonization of the standards and compliance assessment procedures, in approaches to provision of integrated safety/security of the built environment, in provision of education and training on Eurocodes.

In view of these goals, the following recommendations have been developed:

1. Regulative Dialogue EU-RF in construction domain shall be extended in three new dimensions:
1) education, training and deepening of qualification of the experts in construction domains and in domain of integrated safety/security of the built environment with taking into account improvements of the national Russian norms and Eurocodes,
2) mutual monitoring of the changes of normative basis of technical regulation in EU and RF and exchange of the visits of experts,
3) cooperative work of experts on new (third) generation of the Eurocodes.

2. In order the experts can effectively work on harmonization of the Russian norms and the Eurocodes it is necessary to activate work along the educational dimension. It is proposed the following contact points for educational – from EU side – Torino Polytechnical University (Italy) and Delft Technical University (the Netherlands), from RF side – Moscow State Construction University (Telichenko V.I.). Extension of this cooperation to other Universities from EU and RF should be pursued. Appropriate framework for cooperation should be established by the contact point in cooperation with Joint Research Centre Ispra (A. Pinto), TC250 CEN (J.A. Calgaro), TC465 Construction (L.S. Barinova) and Russian Academy of Architecture and Construction (Travush V.I.).

3. It is proposed the following contact points for technical regulation monitoring dimension – from EU side – Joint Research Centre Ispra (A. Pinto), from RF side – Association of the Construction Universities of RF (Telichenko V.I.) and National Association of Designers (Kirillov I.A.). Appropriate actions and tools for cooperation should be established by the contact points within framework of ongoing bi-directional Regulative Dialogue Russia-EU.

Joint Research Centre Ispra	TC 250 CEN	Russian Academy of Archotecture and Construction Sciences	Moscow State Construction University
A. Pinto Act. Unit Head, ELSA, IPSC	J-A. Calgaro Chairman CEN/TC250-Structural Eurocodes	V.I. Travush Vice- President	V.I. Telichenko Rector

TRAINING OF EXPERTS IN EUROCODES: THE ROADMAP

- **Activity 1.** Incorporation of European construction standards (Eurocodes) into the RF system of education and their further development within its framework.

- **Activity 2.** Training of experts in Eurocodes by Russian and international specialists.

- **Activity 3.** Development of training manuals within the framework of the training course in “Fundamentals of the Russian and International Construction Legislation” for master students of civil engineering.

- **Activity 4.** Advanced training of civil engineers and designers at MGSU.

ACTIVITY 1

INCORPORATION OF EUROPEAN CONSTRUCTION STANDARDS (EUROCODES) INTO THE RF SYSTEM OF EDUCATION AND THEIR FURTHER DEVELOPMENT WITHIN ITS FRAMEWORK

MGSU team are engaged in the translation and publication of a series of designers' guides originally published by Thomas Telford Ltd. and the British Standards Institution (BSI):

2011
- Structural Eurocodes: Extracts from the Structural Eurocodes for Students of Structural Design EN 1990 – 1999 (licensed by the BSI Group)
- Designers' Guide to Eurocode EN 1990: Basis of Structural Design
- Designers' Guide to Eurocode EN 1991: Actions on Buildings

2012
- Designers' Guide to Eurocode EN 1992: Design of Reinforced Concrete Structures
- Designers' Guide to Eurocode EN 1993: Design of Steel Structures
- Designers' Guide to Eurocode EN 1994: Design of Composite Steel and Concrete Structures
- Designers' Guide to EN 1991-1-2, EN 1992-1-2, EN 1993-1-2, EN 1994 - 1-2 (Eurocode)

2013
- Designers' Guide to Eurocode EN 1995: Design of Timber Structures
- Designers' Guide to Eurocode EN 1996: Design of Masonry Structures
- Designers' Guide to Eurocode EN 1997: Geotechnical Design
- Designers' Guide to Eurocode EN 1998: Design of Earthquake Resistant Structures
- Designers' Guide to Eurocode EN 1999: Design of Aluminum Structures

«PUBLISHED BY MGSU»

ACTIVITY 2
TRAINING OF EXPERTS IN EUROCODES BY RUSSIAN AND INTERNATIONAL SPECIALISTS

A. Training sessions at the British Standards Institution (BSI)

delivered to 6 - 7 future experts a year

2011 • training session in Eurocodes EN 1990, 1991, 1992.

2012 • training session in Eurocodes EN 1993, 1994, 1999.

2013-14 • training session in Eurocodes EN 1995, 1996, 1997, 1998.

B. Delivery of Seminars and Master Classes by the Leading Experts of Technical Committee 250 of the European Committee for Standardization (CEN/TC 250)

On 19 – 21 October 2011, a seminar entitled "Eurocodes in Russia: Challenges and Opportunities" was delivered at MGSU

The seminar moderators :

Prof. Milan Holický,
Czech Technical University in Prague (the Czech Republic)
Prof. Venkatesh Kodur,
Michigan State University (the USA)

The seminar sessions were attended by over 60 MGSU professors and young researchers, specialists employed with design institutions and building companies.

The seminar video and audio signal was transmitted to 8 institutions of higher education.

On 21 – 25 November 2011, a master class in the practical implementation of Eurocodes was delivered at MGSU

EN 1990: Basis of Structural Design
Prof. Raman Narayanan, Imperial College London

EN 1991: General Loads and Effects
Prof. Pierre Spehl, SECO, Belgium

EN 1992: Design of Concrete and Reinforced Concrete Structures
Prof. Joost Walraven, Delft University of Technology

The master class was attended by over 80 lecturers of higher education institutions, specialists employed with design and construction companies based in Moscow and Russian regions.

On 28 May – 01 June 2012, a master class in the practical implementation of Eurocodes was delivered at MGSU

EN 1991-1-2, EN 1992-1-2, EN 1993-1-2, EN 1994-1-2:

Structural Fire Design

EN1993: Design of Steel Structures

EN1994: Design of Composite Steel and Concrete Structures

delivered by:

Prof. Pierre Spehl, SECO, Belgium

Prof. Joost Walraven, Delft University of Technology, the Netherlands

Professor Rik Debruyckere, Department of Metal and Composite Structures, SECO, Belgium

The master class was attended by over 100 lecturers of higher education institutions, specialists of design and construction companies based in Moscow and Russian regions.

In 2013-2014, master classes in Eurocodes EN1993, EN1999, EN1995, EN1996, EN1997, EN1998 are to be delivered at MGSU.

ACTIVITY 3
DEVELOPMENT OF TRAINING MANUALS WITHIN THE FRAMEWORK OF THE TRAINING COURSE IN "FUNDAMENTALS OF THE RUSSIAN AND INTERNATIONAL CONSTRUCTION LEGISLATION" FOR MASTER STUDENTS OF CIVIL ENGINEERING

2011. Comparative analysis of Russian and European construction regulations in:

- Cements. Specifications. Testing methods.
- Concretes, concrete mixtures. Specifications, testing methods.
- Methods of non-destructive control of concretes.

2012. Comparative analysis of Russian and European construction regulations in:

- Ceramic walling materials. Specifications, testing methods.
- Ceramic tiles. Specifications.
- Bitumen and bitumen mixtures. Specifications, testing methods.

2013. Comparative analysis of Russian and European construction regulations in:

- Waterproofing materials. Specifications, testing methods.
- Thermal insulation materials. Specifications, testing methods.
- Water supply and water disposal networks. Water supply facilities and networks.

ACTIVITY 4
"EUROCODES IN RUSSIA" ADVANCED TRAINING PROGRAM

In 2012, an advanced training program designated for design engineers, civil engineers, university lecturers and postgraduate students was developed to encompass:

- Dictionary of terms. Analysis of terms and definitions (Eurocodes EN1990 – 1999).
- Basis of design (Eurocode 0. EN 1990).
- Loads and effects (Eurocode 1. EN 1991).
- Design of reinforced concrete structures (Eurocode 2. EN 1992-1-1).
- Design of steel structures (Eurocode 3. EN 1993-1 -1).
- Design for accidental actions, including the fire design (EN 1991-1-2, EN 1992-1-2, EN 1993-1-2, EN 1992-1-2, EN 1991-1-7).
- Concretes and concrete mixtures (EN 206-1, EN 12390, EN 12350).
- Non-destructive concrete quality control methods (EN 12504-2:2001, EN 12504-3:2005, EN 12504-4:2004, EN 13791:2007).

Lectures and workshops will be delivered by the MGSU experts and specialists trained by the British Standards Institution (BSI), and by the attendees of the master classes delivered at MGSU. The on-line transmission of the vocational training program sessions will be available in 120 regions of Russia.

A vocational training program in Eurocodes will incorporate other courses

(Eurocodes EN 1994, EN 1995, EN 1996, EN 1997, EN 1998, EN 1999) upon the successful completion by the MGSU experts of new training courses in Eurocodes.

NEW ACTIVITY:

TRAINING OF SPECIALISTS IN CAST-IN-PLACE BRIDGE BUILDING

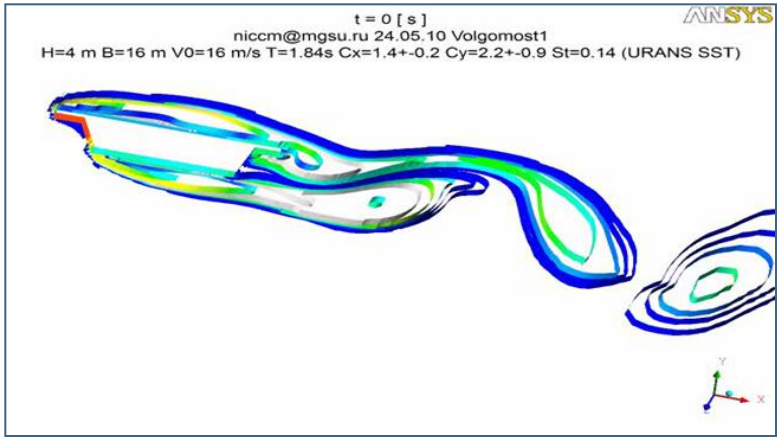
① Experimental and computational simulation of aerodynamic properties and strength of bridges on the basis of advanced information technologies

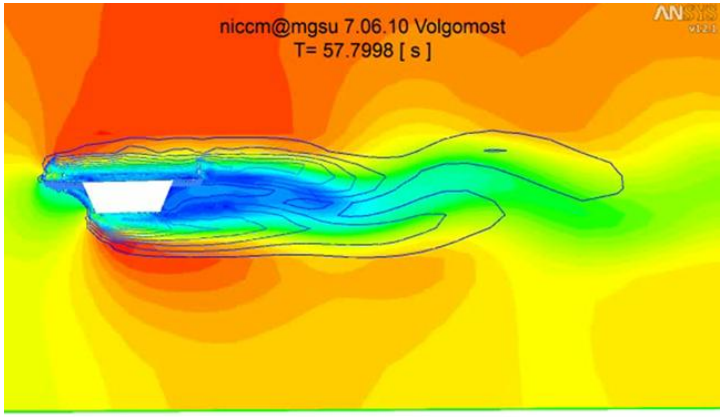
MGSU Research and Educational Center for Computerized Modeling

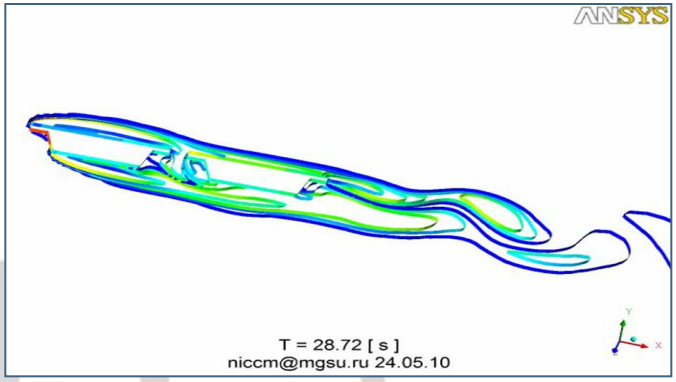
- The Center has accumulated a substantial expertise in mathematical and numerical modeling.
- The Center has a wide variety of the most efficient software available (ANSYS, NASTRAN, ABAQUS, LS-DYNA, PLAXIS, CFX, FLUENT, AUTODYN, ROBOT, STADIO, LIRA, SCAD, MICROFE, etc.), and advanced hardware (up to 7 teraflops).
- The Center specialists have developed and verified the most advanced methodologies of analysis of aerodynamic properties and strength of large-span structures and bridges.
- The Center has developed a methodology of integrated numerical modeling of bridges on the basis of advanced multi-processor technologies.
- The Center specialists are capable of performing a preliminary mathematical model of bridge wind channel tests to improve their efficiency.
- The Center specialists are capable of making calculations in respect of a complete 3D bridge model with account for the terrain and natural characteristics of the wind flow. The calculations will employ advanced multi-processor hardware.
- The Center proposes a methodology for the integrated monitoring of the bridge performance on the basis of advanced numerical modeling techniques.
- The Center proposes a methodology of the non-linear analysis of strength and service life of reinforced concrete structures with account for potential crack formation.
- The Center specialists have developed an original technology of 3D modeling of structural joints with account for the effects of plasticity and fatigue.

A. «Dancing Bridge» in Volgograd

Simplified rapid analysis of aerodynamic properties of the “Dancing Bridge”.



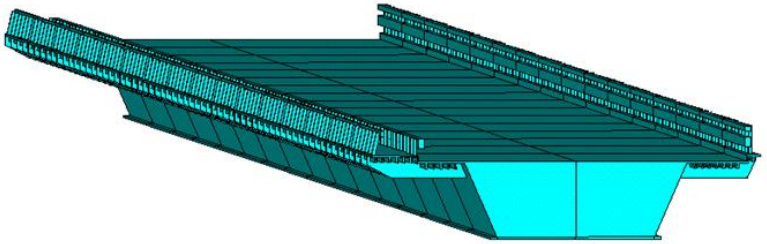


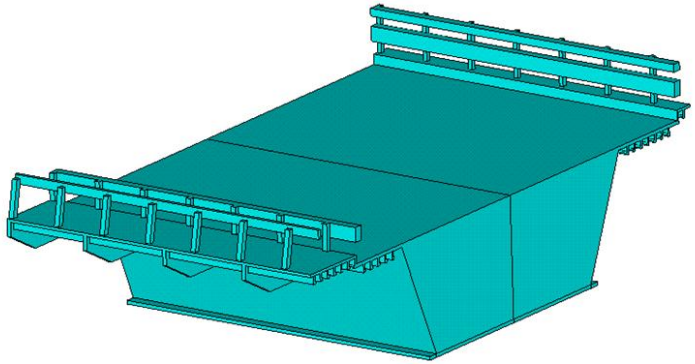


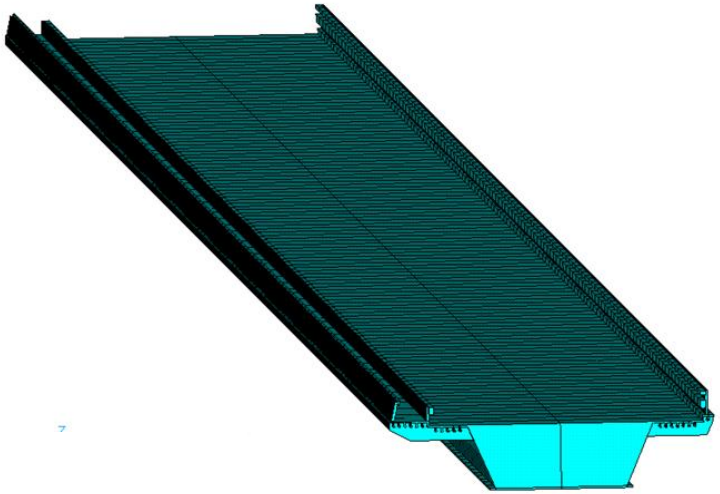
The frequency of forced vibrations of the bridge identified on the basis of the video report is equal to approx. 0.4 Hz; it is smaller than the one of similar bridges.

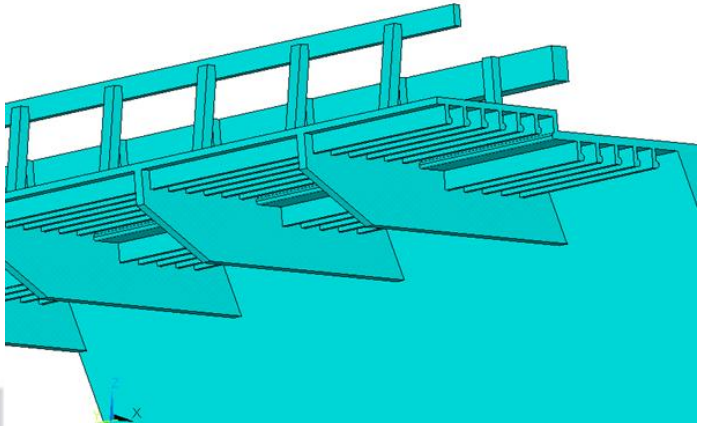
The vortex separation frequency varies from 0.3 to 0.5 Hz based on various methods of analysis. The presence of the two elements within the bridge structure (as it was originally planned) would prevent any resonance.

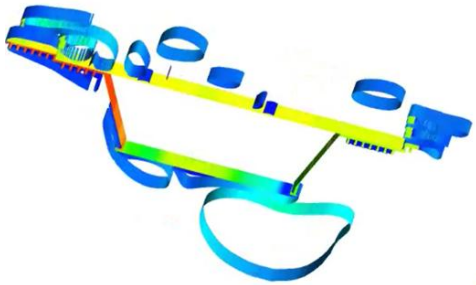
B. 3D Models of the “Dancing Bridge” in Volgograd and Its Structural Elements





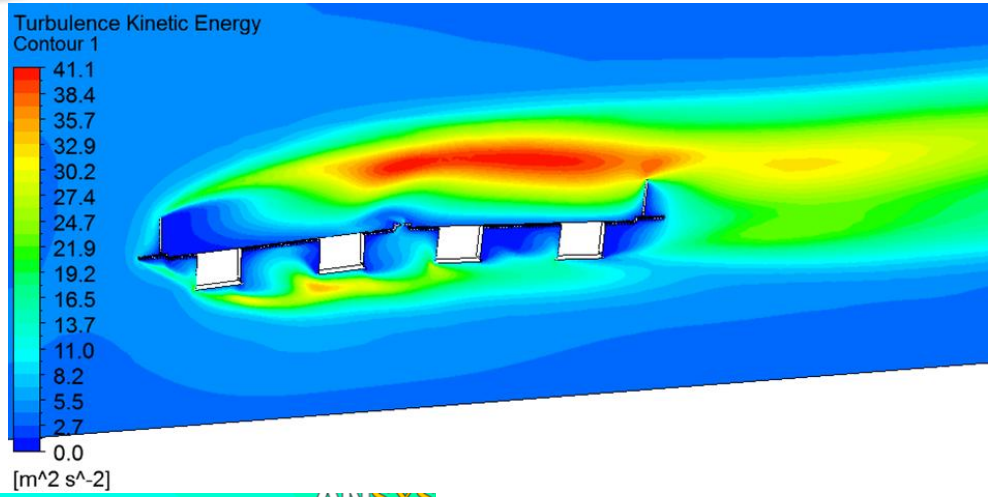


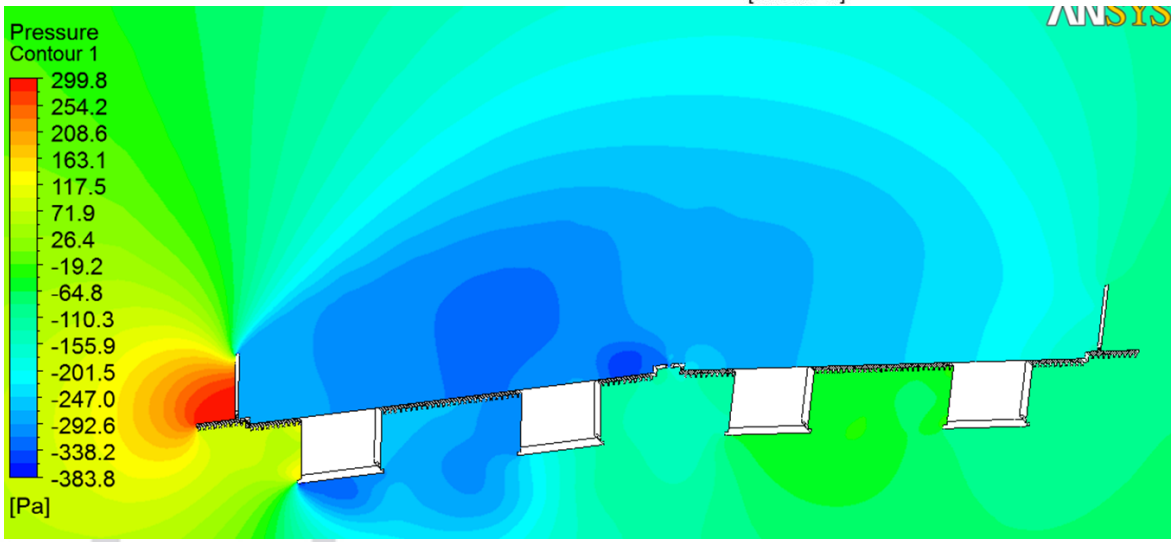




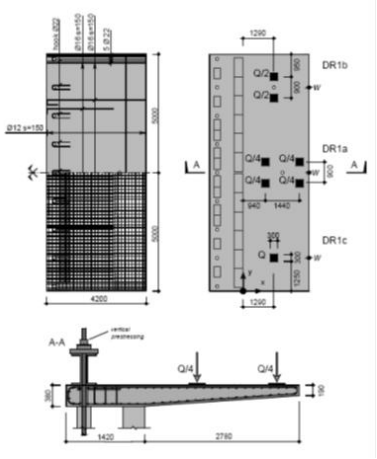
C. Digital Analysis of the Bridge Designed in Moscow

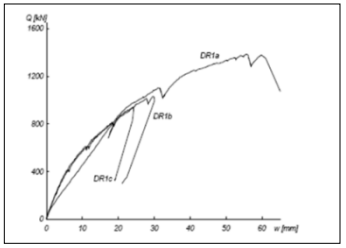
Average pressure values and the kinetic energy of turbulent pulsations



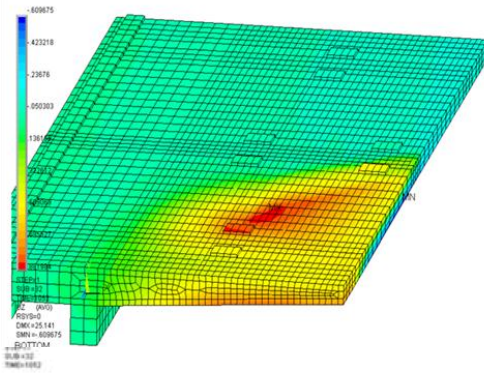


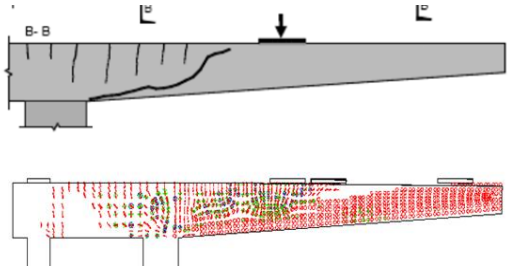
D. Stress-Strained State and Strength of a Reinforced Concrete Bridge Cantilever. Full-scale Experiment and Numerical Modeling

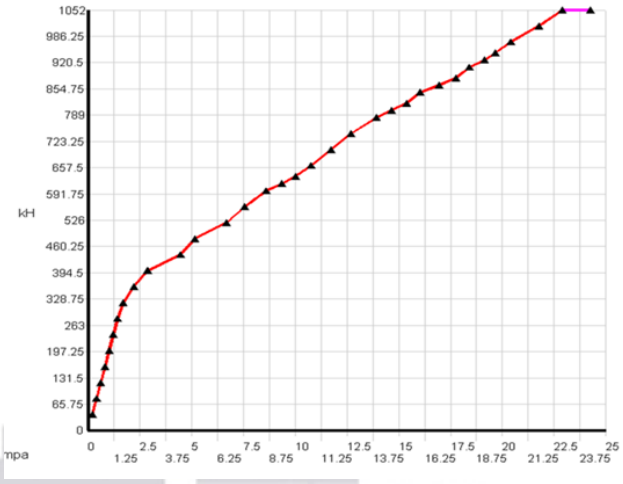


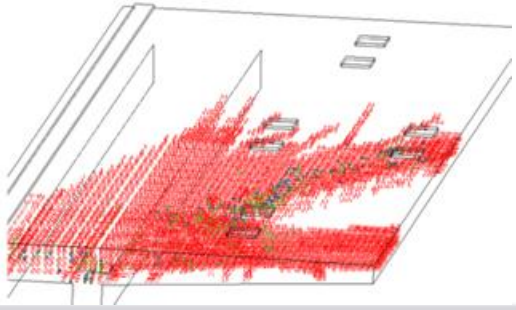


a) Bridge girder with cantilever



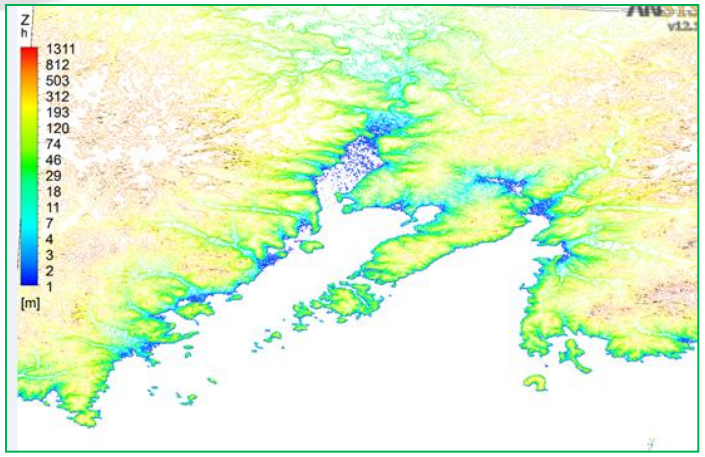


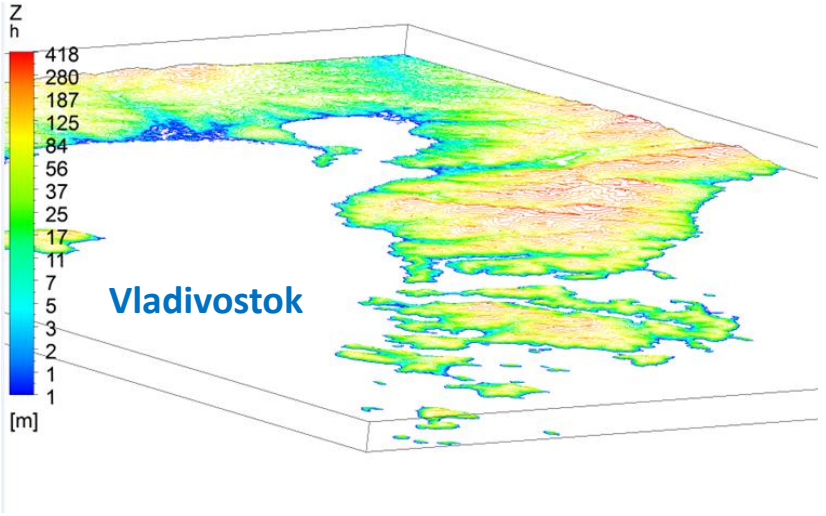


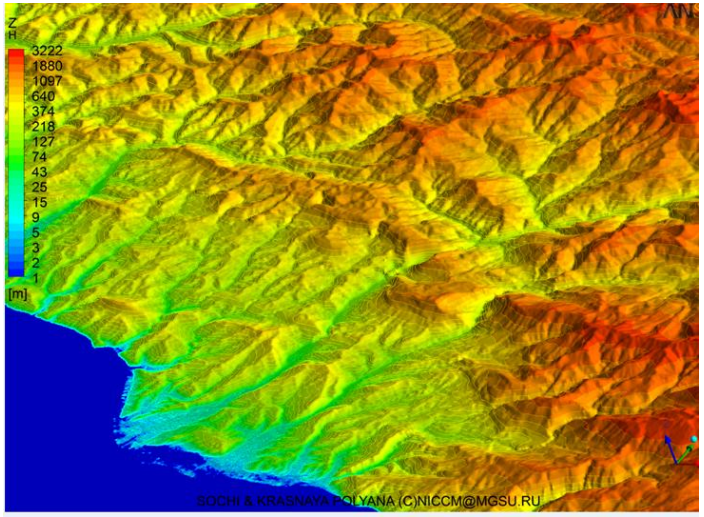


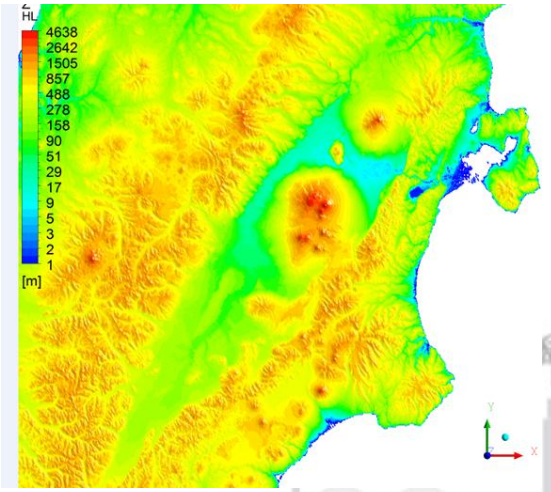
Cracking.
Calculation and Experiment.

E. Satellite Images (SRTM3,ETOPO1, SCANEX) in Terrain Modeling



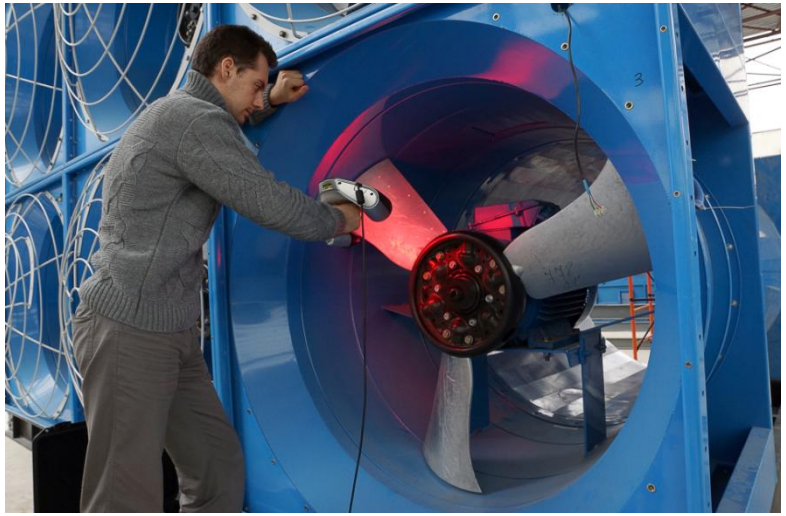


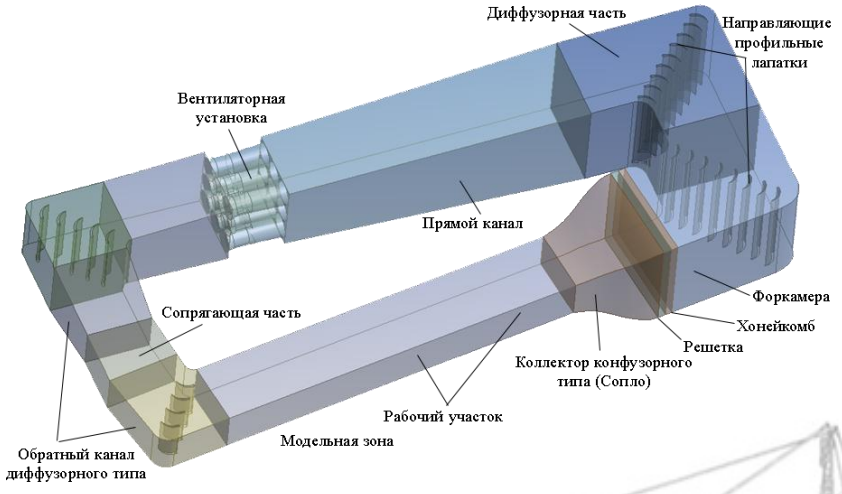




② Integrated Aerodynamic Testing of Bridge Models

MGSU has a laboratory responsible for the mathematical and physical modeling of aerodynamic loads in a wind tunnel suitable for the testing of models of bridges with the span length exceeding 100 meters.





In-situ Bridge Building and Testing of Bridge Models: Adopting the EU Experience

A. Incremental Launching backed by the Large-Area Formwork as a Bridge Building Technique

- For bridges with no mid-span support between the bridge piers
- For bridges that need over 12 pieces of formwork
- Span width up to 100 m
- Formwork length - 30 m per piece
- Equipment installation and labor intensity information (formwork length - 25 - 30 m per piece):

Installation time - approx. 3 - 4 weeks
Deinstallation time - 60 % of the installation time
Installation crew – 6 - 8 specialists
Crew of workers – 4 - 5 workers
Incremental launching intensity - 1 increment per week.

Incremental launching and the formwork, for example, DokaTop 50 formwork used for bearing structures

B. Cantilevering Bridge Building Technique

- For bridges with no mid-span support between the bridge piers
- For bridge radii over 150 m
- Span width of 100 to 250 m
- Length of formwork pieces (casting steps) up to 5 m
- Relocation of ready elements with the help of Doka CFT
- Equipment installation and labor intensity information (formwork piece length - 5 m):

Installation time - approx. 3 weeks
Deinstallation time - 60 % of the installation time
Installation crew – 7 - 10 specialists
Crew of workers - 7 - 10 workers
Launching intensity - 1 increment per week

Cantilevering a bearing structure with a Doka traveler

C. Composite Forming Carriage as a Safe Way to Build Composite Bridges

- Good for long bridges
- Excellent for narrow bearing structures
- Fits extensive radii bridges
- Formwork piece length up to 25 m
- Equipment installation and labor intensity

information (formwork piece length - 25 m):

Installation time - approx. 2 weeks

Deinstallation time - 60 % of the installation time

Installation crew – 6 -7 specialists

Crew of workers - 4 - 5 workers

Launching intensity - 1 increment per week

Bearing structure and a Doka forming carriage

D. Superstructure with Falsework Bridge Building Technique

- Needs a base for the falsework to rest on
- Any types of bearing structures are acceptable
- Any length of formwork pieces is acceptable
- Expedient falsework height shall not exceed 20 m

- Equipment installation and labor intensity information (formwork piece length - 25 m):

Installation time - approx. 0.1 - 0.15 hours/1 m of Staxo tower

Deinstallation time - 60 % of the installation time

Installation crew – at least, 2 specialists

Crew of workers – not needed

Launching intensity – a single-step effort

Bearing structure with a Doka Staxo 100 load-bearing tower

E. Bridge Pylons and Climbing Formwork

- Max. structural pylon height: 321 m (Vladivostok, Russia)
- Number of formwork pieces: 71
- Max. casting height: 4. 50 m
- Pylon installation and labor intensity information :

Installation time – approx. 8 weeks
Deinstallation time - 60 % of the installation time
Installation crew – 5 - 10 specialists per pylon bearing
Crew of workers – 5 - 6 workers per pylon bearing
Launching intensity – 1 piece per week

Pylon and Doka SKE100 climbing formwork

CONSTRUCTION OF A WIND TUNNEL AT MGSU

REGULATORY DOCUMENTS TO GOVERN THE WIND TUNNEL TESTING PROCEDURE

- Wind tunnel testing will be conducted in accordance with the Design Manual for Roads and Bridges BD 49/01 «Design rules for aerodynamic effects on bridges» (developed by the Roads Agency of the Department for Transport , England, Department for Regional Development , Northern Ireland and other departments of Great Britain).

Wind tunnel testing will also comply with the following regulations developed by the EU Road Agency:

- EN 14067-5:2005/ Railway applications – Aerodynamics. Part 5: Requirements and test procedures for aerodynamics in tunnels.
- EN 14067-6:2006/ Railway applications - Aerodynamics . Part 6: Cross wind effects on railway operation.
- EN 14067-4:2005/ Railway applications – Aerodynamics . Part 4: Requirements and test procedures for aerodynamics on open track.
- EN 1991-2:2003 Eurocode 1. Actions on structures. Part 2. Traffic loads on bridges. Section 6 -6.
- EN 1991-1-4:2005 Eurocode 1. Actions on structures, wind actions.

On 21-22 November, 2012, MGSU will host International Scientific Conference

"Up-to-date Issues of Application of Eurocodes and National Standards in the Russian Federation and EU States"

The Conference Program

The Plenary Session

Section 1. Building materials and technologies: codes and standards.

Section 2. Design of reinforced concrete and steel structures to the RF and EU standards.

The Conference speakers include the leading specialists employed with the educational institutions, research centers, design and construction companies of Russia and CIS states, as well as the experts of the Technical Committee 250 of the European Committee for Standardization (CEN TC 250):

prof. P. Spehl, prof. P. Debruyckere, prof. B. De Blaere, SECO, Belgium; Prof. M. Holický, Klokner Institute, Czech Technical University in Prague , the Czech Republic; prof. J. Walraven, Delft University of Technology, the Netherlands ; prof. J. Brouwers, Eindhoven University of Technology, the Netherlands.

The Conference Venue: Moscow State University of Civil Engineering (MGSU), 26 Yaroslavskoe shosse, Moscow, Russia.

THANK YOU FOR YOUR ATTENTION!

www.mgsu.ru