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AALBORG UNIVERSITY
DENMARK

Department of Civil Engineering

news and figures 2012

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Department of Civil Engineering

news and figures 2012

DEPARTMENT OF CIVIL ENGINEERING
AALBORG UNIVERSITY

Colophon
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Welcome to our department

2012 has been a year characterized by growth and where our department was able to deliver another sound financial result. This was especially due to our earnings from our many externally funded research projects, and in 2012 we were able to continue the tradition of securing additional funding. In particular, I would like to highlight our many young researchers who have carried on this practice and have been able to get individual post doc grants.

During the year 2012, we also worked a lot on how our department can improve and work with PBL (Problem Based Learning) on a daily basis, in terms of addressing specific tasks related to working and teaching practices. Another sizable, internal project has been the improvement of the security in our lab facilities along with the continued work on the proposal for our new building at the main AAU campus.

Our field of research has branched into many areas, which are one of the answers to our increasing development. This also goes for our increasing number of students where I would like to highlight our many cand.scient.tech degrees. Also, our number of PhD students is increasing, our firm financial situation is continuing and we are welcoming a growing number of new coworkers; specifically, we have boosted the area of sewer processing with a number of new colleagues. Overall, the research areas cover everything from types of foundations, building informatics, reliability and risk analysis and areas within food and design. This diversity within civil engineering is the key to the continued prosperity of our department.

Peter Frigaard
Head of department

Meet the management

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Introduction to our department

The Department of Civil Engineering focuses on research concentrated on developing and impacting the building sector in the future. Research and teaching are conducted in areas which centre on understanding environmental causality and planning people's physical environment.

Our department is divided into four divisions covering our main competence areas:
- Division of Architectural Engineering
- Division of Food+Design
- Division of Structures, Materials and Geotechnics
- Division of Water & Soil

We undertake contractual research projects for government institutions as well as private companies. Numerous experiments are carried out in our laboratories, which offer the best equipment along with a knowledgeable staff. While some equipment can be adjusted for an experiment, other equipment can be built specifically for a project or task.

Regarding both student and research projects, we are widely experienced in collaborating with external partners. We mainly collaborate with companies within the building and construction sector, and we have a profound knowledge of the demands and legislation within this area.

New projects and co-operations are always welcome, as new thoughts and ideas are best developed through dialogue!

Division of

Architectural Engineering

Associate Professor Kjeld Svidt
Head of division
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Research fields

We work with research and education in analysis, design, construction and operation of engineering systems for commercial, industrial and institutional facilities. Our main research areas are energy-efficient building design, indoor environment and building informatics.

Research groups

'Building Informatics', 'Indoor Environmental Engineering' and 'Strategic Research Centre on Zero Energy Buildings'.

2012 status

In 2012, we had special focus on two very interesting PhD projects. The first project was 'Energy Optimized Configuration of Concrete Element with PCM'. The PhD project is part of the Energy Efficient Concrete project. The concept presented and developed in the project focuses on the energy optimization and potential of the new product that could utilize the high thermal energy storage (TES) and thermally activated building system (TABS). The work investigates the potential of combining the micro-encapsulated phase change material (PCM) in the hollow core concrete deck element in order to increase the dynamic heat storage capacity of the internal envelope of the multi-storey buildings. Moreover, the study investigates the cooling capacity

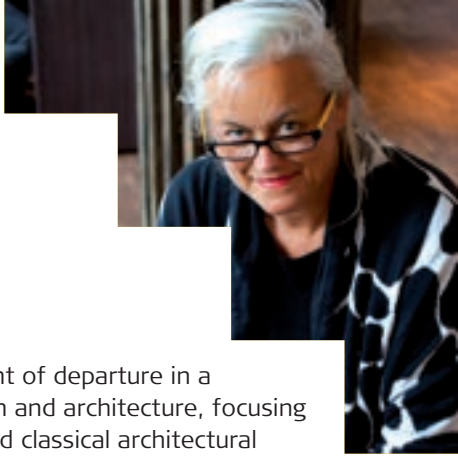
and performance of the concrete deck with PCM and integrated TABS, and highlights limitations and challenges of the new technology.

The second PhD project was 'Intelligent Glazed Facades: an experimental study'. Through the use of energy calculation software and thermal building simulation software, the initial analysis strives towards defining the potential of controlling the energy transport across the facade for a typical glazed office building located in Denmark and fulfilling the energy regulations from 2008. The results from the analysis show the potential of a dynamic façade, enabling variation of heat loss, solar energy transmittance, daylight transmittance, mass transport and thermal energy storage. The potential indicates that, compared to a static glass façade, a standard office building with a dynamic glass façade can reduce the building's energy requirements for operation with approx. 75%. The full-scale tests are used to demonstrate the performance of the individual technologies and also to validate the numerical models developed. The numerical analyses show that the dynamic façade provides energy saving potential for cooling, heating and lighting of between 50 to 80% compared to traditional facades.

In 2012, we also saw our first group of candidates graduate from our study programme, Master of Science and Technology in Building Informatics, which started in 2010. The programme focuses on topics like specification, design, and implementation and evaluation of information and communication technology (ICT) solutions in the building sector. These ICT solutions are, among other things, used for collaboration, communication and knowledge transfer in the building process. These candidates have started in jobs in various parts of the building sector, e.g. software development and implementation, architecture, engineering, construction and operation and management.

Introducing division of

Food+Design



Associate Professor Anna Marie Fisker
Head of division
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Research Field

At the Division for Food+Design we work with a point of departure in a holistic and multidisciplinary understanding of design and architecture, focusing specifically on food-related research and projects and classical architectural research. Our Food+Design research and development projects are primarily focused on core areas such as "experience" and "health", whereas the core research in architecture originate from architectural theory, history and praxis.

Research Groups

'Center for Food Science, Design and Experience' and 'Architecture & Interior'. Within this overall framework the research group "Center for Food Science, Design and Experience" focuses on e.g. how the physical surroundings influence the experience of the meal and the possibilities for gastronomic optimization of hospital meals. Additionally, we work with business oriented research and knowledge transfer within product innovation for SMBs, packaging development, communication etc. Add to this planning, development, teaching and conducting food-related tests, products and events that are carried out as research-based experiments aimed at collecting documented evidence.

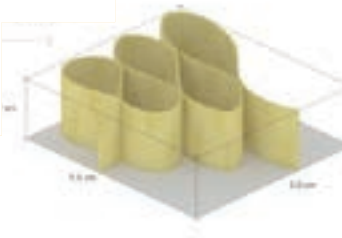
Our focal point is the holistic meal; and the projects are developed and optimized through a research-based approach in close co-operation with other key actors in the food sector.

Whilst consolidating this research field, we have paralleled expanded our curriculum to encompass the research group "Architecture & Interior", focusing more broadly on architecture in relation to an interdisciplinary approach to technical, societal and environmental changes. In 2012 the research group has initiated EU cultural program collaborations with universities in the UK, Italy, Greece and Norway.

Highlights in 2012

In 2012 the Division for Food+Design has partaken in the establishment of a new Master of Science Program, IFS, Integrated Food Studies, at Aalborg University Copenhagen. The Master is addressing today's national and global challenges in the food sector. The complexity of decision making processes in food production, distribution and consumption makes it necessary to see food related challenges from a holistic point of view. The master program offers an interdisciplinary i.e. a design orientated approach to understanding and developing public health, product design and food networks and policies.

In 2012 the Division of Food+Design was selected by curator David Chipperfield to be represented at the 13th Architecture Biennale in Venice with the student exhibition "BIRDHOUSES" from the 29 August to 25 November. Additionally the division organized a Biennale session in collaboration with partners from Politechnico di Milano, University of Fine Arts in Newcastle and NTU in Norway. We look forward to further nourishing architectural research based collaborations in 2013.



Division of

Structures, Materials and Geotechnics

Professor Lars Damkilde
Head of division
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Research field

The research field revolves around both theoretical and numerical modelling and experimental verification within the field of structural mechanics, structural materials and geotechnics.

Research groups

'Advanced Structural Engineering', 'Innovative Structures', 'Offshore Foundations', and 'RISK'.

The central research fields in the 'Advanced Structural Engineering' research group have been design of wind turbine towers and design of a floater and arm used in WaveStar (wave energy converter). Both designs are made in high strength concrete combined with posttensioned steel cables. In the 'Innovative Structures' research group, focus has been on kinetic structures including joints, but research has also been done in areas such as noise in buildings and influence of light on human behaviour. The 'Offshore Foundations' research group centres round the bucket concept used e.g. for foundation of offshore wind turbines. Based on many years of both experimental and theoretical/numerical research, we are now participating in installation of the first bucket foundations in the North Sea.

Besides the bucket foundations, research is also done in numerical modelling of geotechnical problems. The 'RISK' research group's area is fairly new, and the research will focus on simulations of emergency scenarios e.g. in life-saving operations at sea.

Working in laboratories

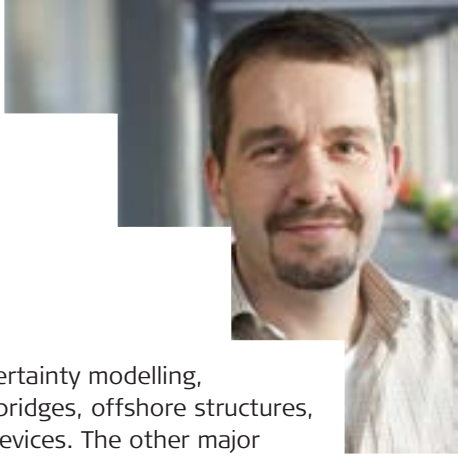
The laboratory facilities of the division are divided into three areas: geotechnical, materials and structures. The geotechnical laboratory is well-equipped and could be termed as leading in Denmark. There has been intense activity in the geotechnical laboratory and also in field experiments. The material laboratory has concentrated on behaviour of high strength concrete including long-term behaviour (creep), whereas the structural laboratory has concentrated on fatigue and application of posttensioning in high strength concrete members.

Plans for 2013

The reallocation to new buildings for both the Aalborg and Esbjerg facilities will probably require a lot of planning especially with the experimental facilities. We are confident that the new facilities will provide new opportunities, and we will strive to keep our high level of experimental activities in the transition period as well. For the 'Offshore Foundations' research group, 2013 will be a very important year where the bucket foundation concept may prove its great potential. The 'Innovative Structures' research group will continue to work on kinetic structures, and we aim to erect a real structure in combination with external partners. The 'Advanced Structural Engineering' research group will continue to use high strength concrete in design. We are also involved in a design of a new wave energy concept with very promising energy efficiency. The 'RISK' centre will concentrate on launching the new Cand. Tech. in Risk and Safety Management starting 1 February 2014.

Division of

Water & Soil



Associate Professor Morten Lauge Pedersen
Head of division
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Research field

The research focuses on several areas including uncertainty modelling, reliability assessment and risk analysis of buildings, bridges, offshore structures, coastal structures, wind turbines and wave energy devices. The other major research area is centred on modelling hydrological processes in urban areas and modelling chemical processes in sewage systems and drinking water supply systems along with hydraulics in aquatic ecosystems. Studies of anthropogenic use of natural resources such as rivers and groundwater are central issues of research.

Research groups

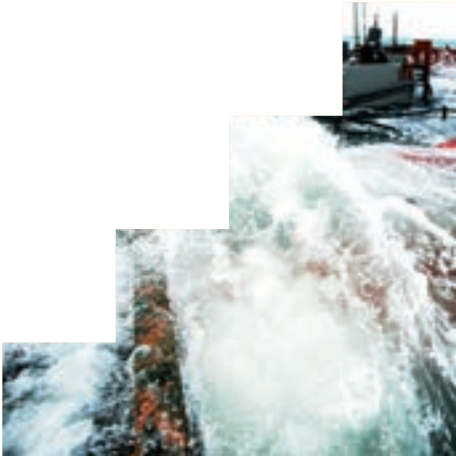
'Structural Dynamics, Reliability and Risk of Structures', 'Marine Structures' and 'Water, Environment and Landscape'.

Highlights in 2012

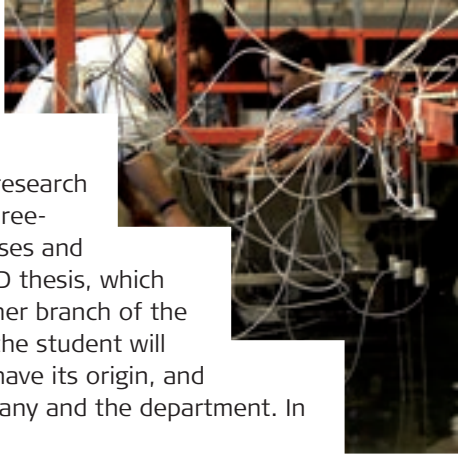
Our research group 'Structural Dynamics, Reliability and Risk of Structures' has found a solid research base and developed into a strong research unit over the past year.

In 2012, we also integrated two new researchers in chemical and biological process in water, Professor Jes Vollertsen and Associate Professor Asbjørn Haaning Nielsen. This has meant that we are now capable of focusing our research in all aspects of water in urban areas. Measurement and forecasting of precipitation using weather radar and predictions of storm water flow are key aspects. Flow and processes in both sewers and clean water systems can now be integrated in the urban water research, and focus can be put on effects of future climate changes on all aspects of water in the built environment as well as on effects in the receiving waters.

We will continue to work with renewable energy structures and effects of climate change on coastal structures in the future as the demand for renewable energy is increasing dramatically and coastal protection from rising sea levels will continue to be an important issue.



PhD programme



The PhD programme form an important part of the research done at the department. During the programme's three-year duration, the PhD student will take part in courses and teaching. The research project will culminate in a PhD thesis, which will be defended in public by the PhD student. Another branch of the programme is the Industrial PhD programme. Here, the student will be employed at a company where the research will have its origin, and so the working hours are divided between the company and the department. In 2012, the total of enrolled PhD students was 49.

PhD students, newly enrolled			PhD degrees awarded		
2010	**2011**	**2012**	**2010**	**2011**	**2012**
14	17	14	3	4	8

Finished PhD students in 2012

Anna Joanna Marszal, "Life Cycle Cost Optimization of a BOLIG+ Zero Energy Building

Jorge Robert Rodriguez Ramirez, "Wave Run-Up on Offshore Wind Turbines : numerical and experimental results"

Anne Kirkegaard Bejder, "Aesthetic Qualities of Cross Laminated Timber"

Ole Munch Johansen, "Eco-Hydrological Modelling of Stream Valleys"

Amin Barari, "Characteristic Behavior of Bucket Foundations"

Søren Peder Hyldal Sørensen, "Soil-Structure Interaction For Non-Slender, Large-Diameter Offshore Monopiles"

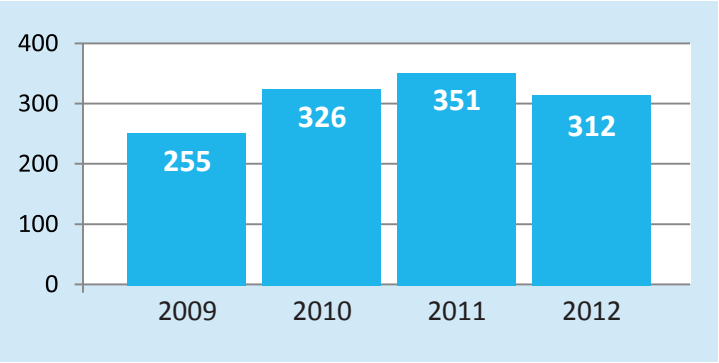
Inés Olmedo Cortés, "Indoor Airflow Patterns, Dispersion of Human Exhalation Flow and Risk of Airborne Cross-infection between People in a Room"

Arthur Pecher, "Performance Evaluation of Wave Energy Converters"

Research publications

The researchers at the Department of Civil Engineering are very productive and produce a large amount of research publications each year.

Number of research publications*



*The figures should be accepted with caution as they will typically increase as reporting is entered continuously, including previous years.

Find our research

All of the department's research is registered in VBN – Aalborg University's research database – which holds an impressive body of work from all of the university's research. To see full lists of publications, projects, activities and press clippings from our department, please go to vbn.aau.dk.

Teaching

Besides from our research staff of 106 employees, 15 % of the teaching is given by external partners. We emphasise that our students come into contact with the surrounding world via e.g. guest lectures or actual courses held by co-operation partners. This not only creates valuable bonds between our students and potential future employers; it also facilitates knowledge sharing at a high level between the academic universe and industry to the benefit of society.

Graduates from the Study Board of Civil Engineering				
	2009	**2010**	**2011**	**2012**
Bachelor degree	83	99	80	85
Master's degree	55	55	104	121
In total	138	154	184	206

Descriptions of study programmes and courses are available at studyguide.aau.dk.

2012 Highlights

A Greener Department
As a part of becoming a more green university, the department started taking steps towards a greener working environment. Some of the changes were as simple as changing printer settings to double-sided printing and others meant an investment in an electric bicycle.

University Award
PhD student Søren Heide Lambertsen was one of the recipients of the Esbjerg University Award. The award was presented by EU's climate commissioner Connie Hedegaard.

Lab testing
Our laboratory facilities are open to everyone who want to develop and test a product, and 2012 was yet another year where we had many domestic and foreign business partners renting our laboratory facilities to test their product.

Anniversary
We are happy to have celebrated Associate Professor Kjeld Svidt's 25th anniversary in 2012.

Royal Order of Chivalry
Professor Lars Damkilde received The Order of Dannebrog of The Royal Orders of Chivalry.

Teacher of the Year
The title as Teacher of the Year 2012 was given to Associate Professor Lars Vabbersgaard Andersen.

2012 Research Event presentations

The Research Event at the department has been a reoccurring event where we have presented the department's research and growing expertise in engineering. However, the event in 2012 will be the last one as of now.

DIVISION OF WATER & SOIL

- "Heavy rainfall in the USA" by Søren Thorndahl
- "Urban Polluted Waters" by Jes Vollertsen/Asbjørn Haaning Nielsen
- "Risk-based operation and maintenance for offshore wind turbines" by Jannie Jessen Nielsen
- "Herbicides in fen ecosystems – pathways and effects" by Morten Lauge Pedersen

DIVISION OF ARCHITECTURAL ENIGINEERING

- "Cost optimization of Net Zero Energy buildings" by Anna Marszal
- "Interpersonal transport of droplets and droplet nuclei" by Li Liu
- "Ventilation and air distribution in aircraft cabins" by Peter V. Nielsen

DIVISION OF FOOD+DESIGN

- "North Danish Fish and Experience" by Rene Langdahl Jørgensen
- "Frida - Children, Food and Design" by Hafdis Sunna Hermansdottir

DIVISION OF STRUCTURES, MATERIALS AND GEOTECHNICS

- "Numerical and experimental investigation of laterally loaded monopiles for offshore wind turbines" by Søren Peder Hyldal Sørensen
- "Bucket Foundations for Offshore Wind turbines—How to prevent buckling" by Søren Madsen
- "New forests and the built environment" by Andreas Falk and Eva Ritter

Find out more about

Research and researchers
vbn.aau.dk

Study programmes
studyguide.aau.dk

The department
byggeri.aau.dk (Danish site)
civil.aau.dk (English site)

The laboratories
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