Dear reader,
We are pleased to be able to present the first issue of the TensiNet Newsletter called TensiNews. TensiNet was launched in March 2001 and will produce 5 more issues of TensiNews within the coming year.
The Newsletter will feature topics such as structural coated fabrics, tensile architecture projects, technological aspects, teaching and research topics. In particular TensiNews will provide information on books and magazines, conferences, seminars and workshops. Furthermore TensiNews will report on the Design Guide and Databases, which will be developed during the project.
The Working Group Coordinators are responsible for the content of TensiNews. Partners as well as external interested parties can propose contributions for the new issues. All the issues of TensiNews will be available on the TensiNet website at www.tensinet.com, which you are warmly invited to visit.

Marijke Mollaert, TensiNet Coordinator

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**TensiNet**

**The Aims**

TensiNet is an initiative of 22 partners from 9 European countries. The group consists of architects, engineers, material suppliers, contractors and producers. Through TensiNet they want to build up an information centre for tensile structures.

The **Aims of TensiNet** are to:

- Exchange and **share basic and multidisciplinary knowledge**
- Build up a reference **database** containing specific knowledge, detailed engineering data, example projects and more
- Set up the **basis for guidelines** and standards at European level
- **Initiate further research** in the field of tensile structures
- **Improve the awareness** of intrinsic properties of tensile structures

The Network activities are clustered around three dedicated **Working Groups**:

- **WG ENG**: Engineering and Construction
- **WG ARCH**: Architecture and Urban Planning
- **WG MAT**: Material, Measurement & Testing

**Forthcoming Events**

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<td>IFAI EXPO 2001</td>
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<td>Tennessee, USA</td>
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<td>TechTextil South America</td>
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<td>Textile Roofs 2002</td>
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In the Turkish metropolis Istanbul, the largest shopping centre in the country with an area of over 50000m² is currently being built.

In several building phases, three 100m high skyscrapers with offices, business and apartments - like a town within a town - is coming into being. As well as the shopping mall, several cinemas, a concert and theatre hall and several leisure amenities, the "Metrocity Millennium" offers direct access to the underground station Levent in the northeast of Istanbul.

Internal view of the Rotunda Dome © Ceno Tec

Metrocity Istanbul

Location: Istanbul, Turkey
Year of Construction: 2001
Planning period: 8 months
Handling period: 12 months (05/00 - 08/01)
Construction: IF Ingenieurgesellschaft Flachentragwerke, Reichenau (D)
Textile Roof: Ceno Tec GmbH, Greven (D)
Material: PTFE-coated glass fabric
Covered area: 3373 m²
(Rotunda 322m², Galleria 1034m², Tivoli 255m², swimming pool 1034m², tennis court 618m²)

This involved the realisation of a total of five different objects by Ceno Tec GmbH and IF Ingenieurgesellschaft Flachentragwerke: three roofs for the shopping mall -Rotunda, Galleria and Tivoli-and two further roofs for a tennis court and a swimming pool, resulting in a roofed ground surface of some 3400m².

The circular-shaped Rotunda Dome with a diameter of about 22m covers the three-storey atrium-like space in the middle of the shopping mall and has a height of about 22m.

The shops are placed along a kind of balcony on the three storeys. The Galleria consists of ten textile modules. Each module has a top-light. The roof spans an area of ca. 12m by almost 90m. The Tivoli Roof of the mall is supported by a 20m high Y support. All the structures are made of glass fibre fabric with a highly resistant PTFE coating, which is also known as Teflon. The building owner wanted to take advantage of the specific characteristics of textile buildings: the high durability with an expected life span of more than 25 years, the very good weather resistance, the high degree of transparency, the long-lasting attractive appearance due to the self-cleansing effect and the highest possible security as the material is non-inflammable. Several flexible joints were planned for the required earthquake protection according to the American ANSI standards. Therefore, the German textile engineers had to design several tricky details in order to allow shifts of at least five centimetres in all directions.

www.cenotec.de

The Trade Fair TECHTEXTIL 2001 in Frankfurt am Main, Germany

As in previous years the trade fair Techtextil in Frankfurt am Main, Germany, held from 24 to 26 April, attracted numerous of interest groups in the field of technical textiles and nonwovens. The trade fair was located on the site of Messe Frankfurt in halls 5 and 6, with 795 exhibitors from 43 countries.

The 16600 visitors came mainly from Germany, France, UK, Italy, Belgium, the Netherlands and Sweden. A special part of the exhibition was dedicated to the student competition ‘Textile Structures for New Building 2001’. All winning projects are shown in a special brochure.

Rasinger's winning design in the category "Macro Architecture", an airport using modular construction

The Techtextil symposium offered an excellent opportunity for the presentation of interesting lectures in the morning. The sector Buildtech predominantly dealt with tensile structures. All presentations are available on a CD-ROM. In summary the trade fair was a big success again, with more visitors and more exhibitors than in the previous year. The organization committee was even talking about an extension to 4 days... We are looking forward to visiting the fair next time.

Next Techtextil in Frankfurt: 8 to 10 April 2003.

www.techtextil.de
From 14 to 16 June 2001 the workshop Textile Roofs was organized in the Technical University of Berlin. This event, the sixth in the series, was sponsored by technet GmbH, Serge Ferrari S.A., the publisher Ernst & Sohn and TensinNet. TensinNet was represented by 6 speakers. Therefore we would like to thank for their interesting contributions: Rogier Houtman, Tentech (NL); Rainer Blum (D); Marijke Molhlaert, VUB (B); Lothar Grundig, TUB (D); Dieter Strobel, technet GmbH (D); Jürgen Haase, VUB (B). Textile Roofs 2002 and 03 will again be integrated with the network activities of TensinNet. The objective of these workshops is to provide teaching and guidance for the design, engineering and construction of textile architecture projects. The workshop offers specialized lectures in the morning sessions and hands-on (physical modeling and computer simulations) in the afternoon.

The participants can also give short presentations during the afternoon sessions, initiating more interactive discussions and a less formal exchange of knowledge. A special guest is invited for an evening lecture open to the public. Textile Roofs 2002 will be organized 30 May to 1 June.

www.textile-roofs.de

A flower from Venezuela for the world!

Name of the Project: Venezuelan Pavilion
Location: Expo 2000 Hannover
Name of client: Fundacion Expo 2000, Republica Bolivariana de Venezuela
Year of Construction: 2000

Architect: Arcitecto Fruto Vivas, Caracas, Venezuela

Design Roof Construction: Prof. Dr. Frei Otto, Dr. Ing. B. Rasch, Dipl. Ing. J. Bradatsch, Germany, Prof. Dr. Joseph Llorenz, Spain

Structural engineer: Buro Happold, Great Britain

Contractor for the membrane structure: ST-Rasch GmbH
Supplier of the membrane material: Ferrari SA

Material: PVC-coated polyester fabric
Covered surface: 1200 m²

The Venezuelan architect Fruto Vivas had the idea to create a pavilion as a symbol for the landscape of Venezuela. This includes the Andes Mountains, the rain forests and the coast. A spirally shaped arrangement is covered by a cupola which takes the shape of a flower when it is opened. This design, which can be opened and closed and which reflects the colors of the Venezuelan national flower, rests on a steel pillar.

This pillar contains the elevator of the building. The symmetrical flower consists of sixteen roof wings radiating outward from the center in two overlapping layers, which in closed position form a translucent, segmented cupola that offers protection from rain and wind. In cold weather conditions the wings are opened and form a shading roof for the naturally ventilated and lighted exhibition pavilion. The roof position is fixed according to the sun’s position to create the most favorable climatic conditions in the pavilion without any additional artificial ventilation measures becoming necessary during the summer exhibition.

The individual roof wings consist of biaxially curved, bending stiff trusses covered by a weather-resistant prestressed membrane. This double-curved, minimal-shaped membrane is supported by curved tubular sections cantilevering from the steel truss. All sixteen steel trusses are hinged to the centrally located mast top and each one is operated by an automatically controlled hydraulic cylinder. The position measurement and control of each individual cylinder guarantees the precise and synchronous operation of all sixteen roof wings.

The complete convertible roof structure of the Venezuelan Pavilion was designed, built and erected in five months only.

www.st-rasch.de

LITERATURE

Reviewed Books

Tensioned Fabric Structures
A practical Introduction
Editor: R.E. Shaeffer
English

This committee report describes the basic design principles, behaviour, materials, and construction process of tensioned fabric structures. Beginning with an overview of the history of the technology, the book examines the role of each participant in the project from inspection through completion. The advantages and disadvantages of various methods for shape determination and analysis are addressed.

Widespan Roof Structures
Editor: M.R. Barnes
English

This book presents current world thinking on the design and construction of large covered spaces. Drawing on contributions from internationally renowned projects and directly from the designers, architects, and engineers responsible, it offers insights into many of the most innovative construction design projects of recent years.
Buckingham Palace Ticket Office

Location: Green Park, London, facing Buckingham Palace
Client: Royal Collection Enterprises, London
Year of Construction: 1994
Architect: Michael Hopkins and Partners
Structural and fabric engineering consultants: Ove Arup and Partners
Analysis and cutting patterns: Tensys and David Wakefield
Fabric subcontractor: Landrell Fabric Engineering Ltd.
Material: "Velcro" fabric woven from Modacrylic
Covered surface: 138 m²
Cost of canopy at 1994 prices: £28000; cost/m² £203

Michael Hopkins and Partners were asked to design a temporary and demountable ticket office for the summer opening of Buckingham Palace which occurs in August and September. We proposed a prefabricated structure to be located adjacent to Canada Gate in Green Park and within site of the Palace. It responds to the location by taking its gently curving geometry from the radius of the nearby monument to Queen Victoria and its orientation ensures that visitors can look towards Buckingham Palace as they queue for tickets. The new ticket office is purposefully designed to exhibit a 'crafted quality' reminiscent of traditional boat building together with that of a tented summery image. A varnished red cedar sales office and decked area is provided beneath a white tented canopy which creates a new 'place' in the park.

(More information: <Soft Canopies> by Moritz Vandenberg, 1996, p48ff)

www.hopkins.co.uk

ACADEMIC INSTITUTIONS

TensNet will assemble a list of universities dealing with Textile Architecture in terms of research and/or education. They will be mentioned one by one in TensNet News.

UNIVERSITY OF BATH
DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING
PROF. M.R. BARNES

Lightweight structures design research was established in the Department of Architecture and Civil Engineering in the 1980's under a Wolfson research grant involving collaboration with industry and other universities in the UK and Germany. The group was responsible for the development of draft Codes of Practice for air-supported structures and design guides published by the Institution of Structural Engineers. Major activities of the research group have subsequently concerned the development of CAD systems for the design of lightweight structures, including prestressed minimum surface membranes, variable stress membranes, pneumatic and air-supported structures, cable networks and funicular grid-shells. Design techniques are currently being developed for battenened membranes, deployable tensile structures and analytically matched natural form structures. In all cases the procedures cover design spectrum from conceptual form finding to analysis and fabrication patternings. Aspects of research relating principally to behaviour under live loading concern the numerical simulation of wind/structure interaction in very wide span flexible surface structures, and material properties modeling for woven fabrics.

www.bath.ac.uk/departments/arch/csemwebpage/light.htm

A New Class of Biaxial Machines

When designing a new membrane roof, several properties of the material need to be determined experimentally: for the analysis the Young's moduli have to be known, and for the specification of the cutting patterns the compensation values have to be defined. These values can be measured in biaxial tests for representative variations in tension. We have developed a biaxial machine which has the following capabilities: it can test one homogeneous field of tension that is large enough for exact measurement. The overall dimension of our biaxial machine is: 2.44 m x 2.44 m, and the planar two-dimensional test sample is about 1.10 m x 1.10 m. The force is introduced into the sample via clamps and straps. On each side of the square sample 7 straps are fixed in clamps. These are attached via force measurement rings to low-friction ball screw spindles, the nuts of which are driven by a total of twenty eight independently controlled servomotors.

The servomotors are able to move perpendicularly to the force direction in such a way that the force is applied independently and uniaxially to every strap. To control the servomotors it is necessary to provide a control output variable for the force in the spindle. This must then be measured with a resolution better than 1%. Therefore the force measuring rings have been developed by ourselves. The biaxial measurement field has the dimension 0.70 m x 0.70 m, we can apply loads up to 200 kN/m. The strain measurement is performed with potentiometric sensors. Calibration of these sensors provides a nominal resolution of 1 μ. The external control circuit is set up digitally by means of a PC.

This machine has been developed in an EC-project in cooperation with IF (Constance), Ferrari (La Tour du Pin) and Audra (Friedberg).

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