



# **Diana Users Association**

## **ANNUAL REPORT 2002**

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Secretary

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President

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## 1. Aim of the Association

The members of the Association are all users of the DIANA software package of TNO Building and Construction Research. In this capacity, they have a considerable interest in the gaining of knowledge of the Finite Element Method and (numerical) mechanics, as well as in the further development and extension of DIANA. To achieve this, the Association acts in a coordinating role by taking stock of the requirements of the members and by bundling these in the domains of knowledge need and system development. On this basis, the Association initiates new projects.

The Association is also a meeting place for the exchange of experiences with the software package. It is further utilized by TNO Building and Construction Research to inform the users on package development progress.

Finally, DIANA Analysis BV offers its members a view on the world beyond the Netherlands, where the information supply on the use of the package by foreign DIANA users is concerned.

## 2. Executive Committee 2002

During this reporting year, the Executive Committee consisted of:

President:	A. de Boer, Civil Engineering Division, Department of Transport, Public Works and Water Management, Utrecht
Secretary:	A. Borgart, Delft University of Technology, Faculty of Architecture, Delft
Treasurer:	P. Bierman, Royal Haskoning, Nijmegen

P. Bierman has succeeded J. P. Dunnes as treasurer starting December 3, 2002.

The Executive Committee has mainly dealt with the following issues:

1. Support of GUI in DIANA 8.
2. Support of 4D calculation research project through TNO Building and Construction Research.
3. Discussion on the start-up of possible new research projects.
4. Preparation of general and technical meetings.
5. Association finances.
6. Participation in Diana Foundation meetings.
7. Guiding concrete mechanics examples report in collaboration with CUR.
8. DIANA Users Asspciation website.
9. Sponsoring DIANA 2002 Tokyo congress.
10. Organizational member 2002 Tokyo congress.

### 3. Activities

#### 3.1 General

The Association holds a General Assembly twice a year, followed by a technical meeting (lectures).

The current set-up, with the meeting taking place in the afternoon and lectures during the evening, does have a positive effect on the attendance during the evening lectures. Attendance at the General Assembly, however, has remained low also in 2002.

Due to the launch of DIANA 8 in 2002 the General Assembly in the spring (June 5<sup>th</sup>) included the DIANA 8 presentation. This combined meeting was held at the Amersfoort Zoo. The fall Assembly again saw a normal General Assembly combined with an evening of lectures (December 3<sup>rd</sup>) at the Postiljon Hotel in Bunnik.

In 2002 the DIANA congress was held in Tokyo, being partly subsidized by the Diana Users Association. Several Association members participated. All Association members received a version of the bundled congress papers.

#### 3.2 Lectures technical meetings 2002

Lectures December 3, 2002:

- A. Rijswijk, PSE:  
Fire above the concrete bell type roof of an LNG tank
- F.Kwaaitaal, Civil Engineering Division, Department of Transport, Public Works and Water Management / Delft University of Technology:  
Numerical research of power exertion and crack formation in underwater concrete floors
- M. Hermans and J. Morrien, D3BN:  
Blob, special architecture, pragmatic construction
- A. Al-Rawe, Femsys Ltd:  
Import of CAD models into DIANA 8 and the interface CADFIX-FEMGV

#### 3.3 Summaries of lectures

##### **Fire above the concrete bell type roof of an LNG tank**

The storage of gases liquefied by cooling mainly takes place in vertical cylindrical tanks. And because the gas is cooled down to the boiling point, it is possible to keep it under atmospheric pressure. A usual structure for the tank in which the gas liquefied by cooling is stored is an isolated reservoir of 9% nickel steel. For tanks exceeding 4000 m<sup>3</sup> the government requires an extra safety tank made of concrete. This concrete safety tank protects the steel interior tank against

external influences, such as explosions, fire and components falling from the installation surrounding the tank.

The safety tank consists of the following components. A floor founded on the underground, on which stands the steel interior tank. On the outer edge of the floor there is a prestressed wall, enclosing the steel interior tank. On the wall, and above the steel interior tank, there is a bell type roof. The connections between the separate parts of the safety tank are generally monolith, to reduce the chance of leakage as much as possible. If the safety tank has been built up in this manner, it is called a 'full containment tank'.

Gases liquefied by cooling and stored at a temperature around the boiling point always show evaporation (boil-off). The evaporation causes an overpressure of the gas to occur inside the tank. The filling of the tank also causes overpressure. For reasons of safety, the tank is fitted with pressure relief valves. If the pressure relief valves start to operate the superfluous gas is burned at approximately 10 metres above the tank through an uptake.

The lecture addresses the effects of the temperature loads through a fire, as a result of the pressure relief valve starting to operate, on the concrete bell type roof of the safety tank.

The CUR report 134 [1] includes – for a similar structure – calculations in relation to the testing of the liquid density and the determination of the effects of a temperature load caused by an adjacent burning tank. The attention was aimed especially at the monolith connection of the wall with the floor.

[1] CUR report 134, Concrete Mechanics, examples of non-linear analysis with DIANA (Dutch), CUR, Gouda, The Netherlands, 1987

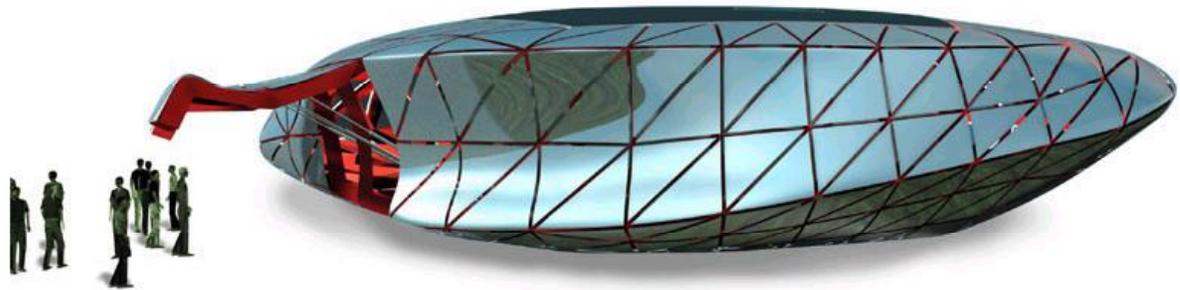
### **Numerical research of power exertion and crack formation in underwater concrete floors**

Establishing new design rules for unreinforced underwater concrete floors [CUR Recommendation 77] has led to the desire to further investigate a number of aspects in relation to power exertion and crack formation with the use of numerical models.

The numerical models are based on 2 'ultimate' states seen by the regulations commission as the upper and lower limits. The investigated crack formation image and the concomitant collapse mechanisms led to a surprising result. In one case, this has even led to supplementary research.

The presentation will address the build-up and the properties of the models and the research questions formulated by the CUR commission.

## **Blob, special architecture, pragmatic construction**



This will focus on the design process and also address the DIANA approach.

### **Import of CAD models into DIANA 8 and the interface CADFIX-FEMGV**

TranscenData has announced the launch of CADfix 5.0, the latest version of its industry leading CAD data interoperability tool. Version 5.0 delivers improvements in all aspects of the product with new and improved import and export interfaces, greatly enhanced processing times, support for a wider range of ancillary CAD data and assemblies and user configurable automatic model processing.

Version 5.0 introduces a number of new features and enhancements including up to 50 percent improvement in general processing times. The compatibility of CADfix with one of the world's leading high-end CAD systems is strengthened still further with updated CATIA import and export functionality.

CADfix now provides full support for STEP assemblies, which can be imported from CAD models and either processed as an assembly, or the components can be exploded and replicated as defined by the assembly structure. The new CADfix Assembly Manager tool allows the user to interrogate and manage their definitions, selecting individual components for display and processing, and editing the assembly definition as required.

A major requirement of many downstream analysis users of CAD data is the ability to defeature and simplify a model into a form more suited to their application. Typically, this means the removal of unwanted holes, small features and fillets. CADfix already offers an array of tools to facilitate this, and ongoing developments in this area have led to the release of some powerful new features. The CADfix user now has the ability to automatically detect and remove both through holes and blind holes, and to automatically detect and join edges and faces based upon criteria such as tangency of adjacent faces. These functions will help users realise further savings in downstream meshing applications where

the CAD-analysis link often breaks down with overwhelming model rework requirements.

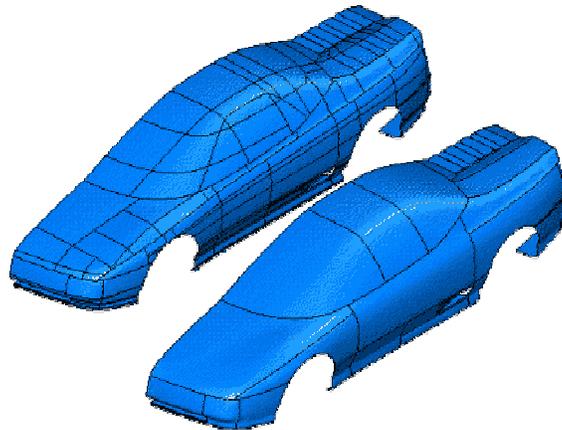
Furthermore, there is also a new 'binary' option for the current STL export. Tests demonstrate a major impact on downstream applications with vast improvements in file sizes. Greater control of the STL faceting provides smoother and more refined triangulation to suit some of the many different applications of the faceted representation.

Support for VDA-F5, the dominant neutral data exchange format in the German automotive industry, has improved with dramatic cuts in export times and file sizes. Interfaces to and from STEP, ACIS and Parasolid have all been enhanced, including links to Parasolid 12.1 and ACIS 6.3. A new native geometry export to the FEMGV Finite Element meshing system is also available.

CADfix is constantly under development, both at the request of the growing number of users who have welcomed the availability of a universal interoperability solution, and in response to developments in the industry.

### *CADfix In Action*

This surface model has been repaired and simplified using CADfix transformation tools.



Using CADfix, poorly defined surface/face models can be transformed to clean solid models in minutes.

During the General Assemblies TNO Building and Construction Research also reported on the progress of the 4D calculation stimulation project and the latest developments in release number 8.