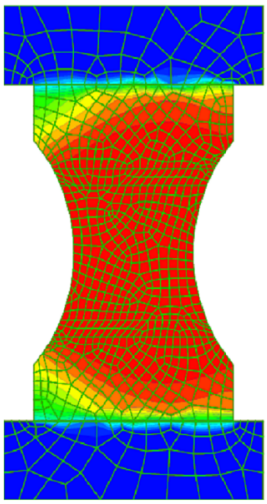
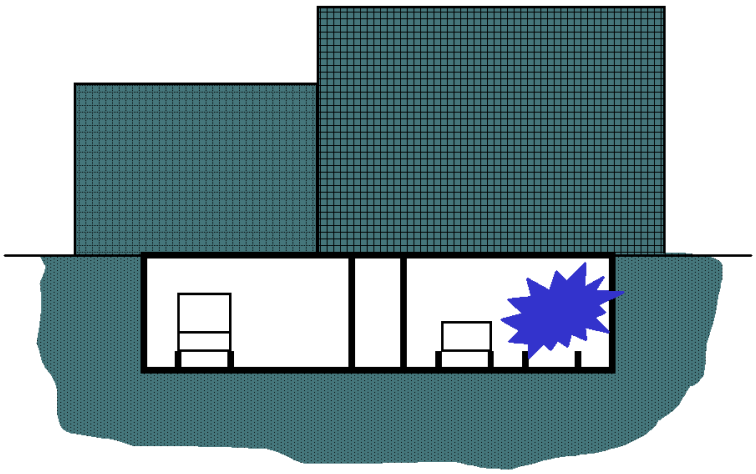
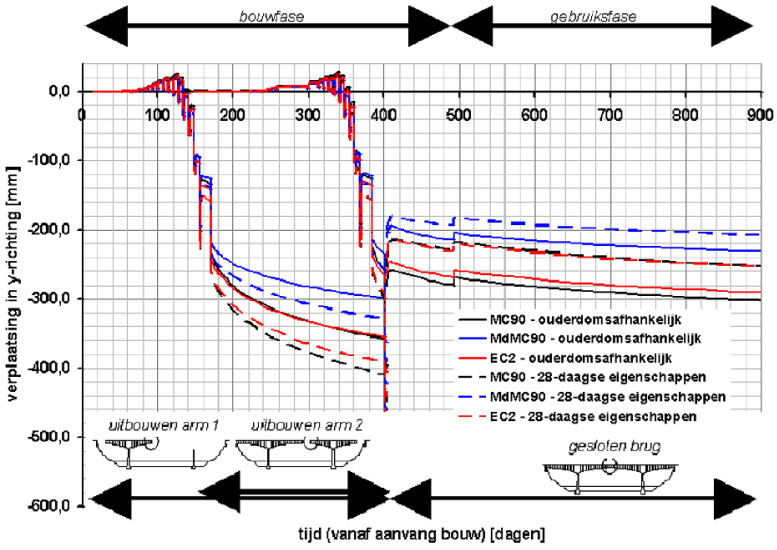
DIANA Users Association

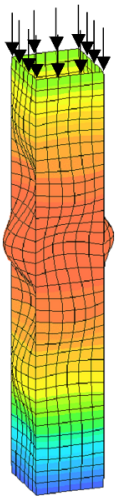
Annual Report 2005

01-07-2006









ir. A. de Boer
Chairman DIANA Users Association

Annual Report 2005

Contents

1. Aim of the Association

The members of the Association are all users of the DIANA software package of TNO-DIANA BV.
In this capacity, they have a considerable interest in gaining knowledge in the Finite Element Method and (numerical) mechanics, as well as in the further development and extension of DIANA.
To achieve this, the Association fulfils a coordinating role by taking stock of the members' needs in terms of research and development, and initiating new projects.
The Association is also a meeting place for the exchange of experiences with the software package.
Furthermore, TNO-DIANA BV utilizes the Association to inform the Users on the DIANA package development progress.

2. Executive Committee 2005

During this reporting year, the Executive Committee consisted of:

Chairman:	ir. A. de Boer, Bouwdienst RWS
Secretary/Treasurer:	ing. P. Bierman, Royal Haskoning, in November succeeded by ir. N. Vollema, Royal Haskoning
Committee member:	Dr. ir. A. Vervuurt, TNO Built Environment and Geosciences

The Executive Committee has mainly dealt with the following:

1. Discussion on continuing new research projects on the basis of a national and international user's wish list.
2. Formulate further form of internationalization within the DIANA Users Association
3. Organizing of the 2nd International DIANA Users Meeting in Nijmegen, The Netherlands
4. Preparartion of general and technical meetings.
5. Association finance.
6. Set up new sample reports in association with the CUR, resulting in a CUR report 200x-x, advanced calculation for civil constructions. It should now be a wider report, set up with examples, using multiple packages and being carried by more user associations. Other packages are: Plaxis, M-serie, Esa-Prima-Win, Intron etc.

3. Activities

3.1 General

The Association holds a general meeting of members twice a year, followed if possible by a technical meeting (lectures). Since the 2nd International User Meeting was held in the Netherlands in April 2005, it is decided not to organize a technical lecture evening in spring 2005.

3.2 Technical lectures November 2005

3.2.1 Estimation of model parameters in nonlocal damage theories by inverse analysis techniques

C. Iacono[1], L. J. Sluys[1], J. G. M. van Mier[2]
[1]) Delft University of Technology, Faculty of Civil Engineering and Geosciences, Delft
[2]) ETH Zurich, Department of Civil Engineering, Materials Research Center, Zürich, Switzerland

The solution of the model parameters identification problem allows to establish important links between the experimental and the numerical world, with the final purpose of obtaining a reliable computational model that can properly describe the examined phenomena. The identification problem of the gradient-enhanced continuum damage model is addressed as an inverse problem. The final model parameters estimate is the solution of a minimization procedure of the discrepancy between experimental and corresponding numerical data. Particularly, the inverse procedure focuses on the identification of the length scale parameter and the slope of the softening branch of the local constitutive law for quasi-brittle materials, such as concrete and rock.
Different related aspects are investigated, such as:

(i) the uniqueness of the inverse solution (well-posedness of the inverse problem),
(ii) factors that may influence the final parameters estimate (e.g. the uncertainty associated with the experimental data or the initial guess of the model parameters as a starting point of the searching process),
(iii) qualitative and quantitative choice of the experimental data to be involved in the problem,
(iv) choice of the best identification strategy,
(v) limitations of applicability, reliability and predictive capabilities of the calibrated numerical model, in terms of size effects and for different loading conditions,
(vi) the problem of objectively extracting intrinsic material properties from structural experimental responses (i.e. the possible dependency of the model parameters from structural factors).

For this purpose, two experimental data sets are taken into account:

(i) tensile size effect tests on dog-bone shaped specimens with *global* data (force vs. deformation curves) and
(ii) a series of double-edge notched uniaxial tensile tests and single-edge notched bending tests on specimens made of the same concrete with global and *local*

data (width of the fracture process zone vs. deformation curves). The effects of involving the different types of experimental data in the solution of the inverse problem are investigated.

Two inverse techniques are used, in cascade, in order to optimize *effectiveness*, *efficiency* and *robustness* of the inverse method: the K-Nearest Neighbors (KNN) method and the Kalman filter (KF) method [3] [4]. The different features of the two inverse techniques result in.

3.2.2 Buckling of aluminium structure components in fire conditions

J. Maljaars – TNO Built Environment and Geosciences / Eindhoven University of Technology, Eindhoven

The carrying capacity of aluminium structures, such as fast ships or components of offshore platforms must be designed with fire resistance. However, the mechanical behaviour of aluminium structures in fire conditions is still insufficient.
One important failure mechanism at aluminium components is buckling, where thin plates in compression state are getting instable. When the buckling mechanism occurs, the carrying capacity of the component is reduced even below the plasticity limit.
The buckling behaviour at room temperature of simple cross-sections is well known, but not for high temperatures. Within a thesis research this knowledge should be extended. A mechanical response model for buckling aluminium components in fire conditions will be established.
The buckling behaviour will be studied by experiments to thin walled box cross sections loaded in compression. At this stage ultimate limit state experiments are fulfilled at different temperature levels:

1) temperature load at 20ºC
2) constant higher temperature with increasing compression load
3) constant compression load with increasing temperature

The experiments are simulated by FE models (shell-models), with the use of DIANA release 9.1. Uni-axial tension experiments are used to set-up the uni-axial material model, in which the VonMises yield condition is leading.
The following results have been found:

- a good comparison was found between the experiments and the FE results for experiments with a temperature load at 20ºC; the difference in load bearing capacity was almost 5%
- To validate the FE model for the experiments with a constant higher temperature with increasing compression load, more experiments are needed
- For the constant compression load with increasing temperature, the FE results are similar to that of the experiments (mean difference is 6% at failure temperatures between 250 till 310º C).

Both experiments and FE simulations show that thin walled structures under higher temperature loads have lower buckling resistant then structures at a level of temperature 20ºC.
The next step in this research project is the long-term behaviour of aluminium structures. The creep component of aluminium will be added to the material model.

3.2.3 BLEVE-resistance of covering-over highways structures – a feasibility study of a BLEVE resistant design

C. van der Vliet, Civil Engineering Division, Ministry of Transport, Public Works and Water Management, Utrecht

In this study the Civil Engineering Division of the Ministry of Transport, Public Works and Water Management cooperates with TNO Built Environment and Geosciences and Defence, Security and Safety. The feasibility of a design of the covering-over of highways loaded by a BLEVE loading will be researched. The framework of this research is:

- the covering-over structure should not collapse and
- the structural reliability of the above structure is sufficient to a BLEVE loading.

For this study a covering-over structure has been used in a common highway in the Netherlands, it's not related to any specific highway.
For the BLEVE explosion load a volume of 50 m3 propane (peak pressure ± 17 bar) is used as a realistic scenario.
With FE analyses, a lot of different examples are calculated. Variations in the geometry of the structure and the amount of reinforcement are made.
By strengthening the structure with more main longitudinal reinforcements, extending the thickness of walls and using shear reinforcements, the resistance of the structure can be achieved to the effects of the BLEVE explosion load case.

3.2.4 Realistic simulation of the deformation of cantilever bridges – Comparison of the Eurocode and ModelCode1990 with new design recommendations.

G. Louman, Delft University of Technology / Civil Engineering Division, Ministry of Transport, Public Works and Water Management, Utrecht

During the lifetime of cantilever bridges, the material properties of the concrete change a lot. The effect of time dependency of some material properties should be taken more realistic in account in the design. In this study the time dependency of concrete will not related to the 28-days strength, but related to specific time steps of the construction period. The common input of the 28-days strength should be subdivided to time related development input of the concrete strength. It's obvious that with more time input steps the simulation gets more realistic. To keep the simulation realistic, the material input time steps are related to specific moments, like casting concrete, removing the formwork and the load time steps of the different concrete parts.
To get a realistic description of the deformations during the construction of the cantilever bridge and after the completition of the bridge a phased non-linear time dependent analyse is needed.
Within this study creep and shrinkage material models, based on the ModelCode1990, the Eurocode and a modified ModelCode1990 are used.
The simulation is the first cantilever bridge in high strength concrete "Stichtse Brug", completed in 1997.

The visco-elastic creep behaviour of high strength concrete will be modelled in DIANA, using the rheological Kelvin chain model and the shrinkage behaviour by discrete stress-strain diagrams.
Results and measurements are compared, not only during construction of the bridge but also after completition of the bridge.
First conclusion is the difference in deformations between the calculations based on the 28-days strength of concrete and the full time dependent strength input of the concrete.
A strong advise can be given that in the future the bridges should be analysed on the full time dependent strength input of concrete.
Secondly, the deformation results, related to the checking code Eurocode are less then the deformation results related to the ModelCode1990. The modified ModelCode1990 deformation results are less then the Eurocode deformation results.
The measured deformations of the bridge lay between the Eurocode results and the modified ModelCode1990 results.
It's recommended to use the Eurocode as checking medium, even for high strength concrete, so far there isn't published another ModelCode version.

3.3 International DIANA Users Meeting 2005, Nijmegen, The Netherlands

Lectures:

Repeated linear analyses as an alternative to nonlinear analysis
J.G. Rots, S. Invernizzi, Delft University of Technology, The Netherlands

FE model for concrete half-slab floor shear failure
H. Hofmeyer, M. Verbaten, H. Monster, ABT consulting engineers, The Netherlands

Modeling the thermal expansion of the refractory lining of a RH-degasser taking into consideration the influence of joints
D. Gruber, Montan University of Leoben, Austria

Finite element calculations of brittle joint behavior in clamped block revetments in the Netherlands
D.J. Peters, Royal Haskoning, The Netherlands

Three-dimensional finite element calculations of biaxial hollow slabs
M. Schnellenbach-Held, M. Aldejohann, University of Duisburg-Essen, Germany

3D Advance Modeling to Support Design of Concrete Treatment Shaft in the United States
W. Dekelbab, M. Hendriks, O. Ramadan, TNO DIANA North America, TNO DIANA BV, NTH Consultants, Ltd.
Probabilistic analysis of structures sensible to creep, shrinkage and cracking of concrete

C. Sousa and A. Serra Neves, University of Oporto, Portugal

Reassessment of concrete platforms
K.V. Hoiseth, NTNU-Trondheim, Norway

Strengthening of concrete structures with Externally Bonded CFRP
D.A. Hordijk, Adviesbureau ir. J.G. Hageman B.V. and Eindhoven University of Technology, The Netherlands

Nonlinear analysis of concrete structures with DIANA: examples and possibilities.
M. Pimentel, P. Cachim and J. Figueiras, University of Porto, Portugal

Structural Fire Safety engineering solutions using computer modeling techniques
A. Allam, Halcrow Group Ltd and University of Ulster, United Kingdom

DIANA nonlinear simulation and damage assessment of an historical masonry tower
A.Carpinteri, S. Invernizzi, G. Lacidogna, Politecnico di Torino, Italy

Experimental investigations and numerical simulations using DIANA of concrete on the mesoscale
C. Rieger and T.Wilhelm, Darmstadt University of Technology, Germany

Numerical simulation of a fracture test for refractories
T. Auer, Montan University of Leoben, Austria

4D analysis of a shield driven tunnel
N. van Empel, Witteveen & Bos, The Netherlands

A CD with the presentation can be asked by the secretary of the DIANA Users Association, info@dianausers.nl

4. Financial aspects 2005

DIANA Ontwikkelingsvereniging
Financiëel jaarverslag 2005

Rekening Courant 2005

Inkomsten			Uitgaven	
beginsaldo op 1 januari		16.295.07	bankkosten	137.62
contributie	12 * 324	3.888.00	afgedragen BTW	-152.00
bijdrage deelnemers Int. Users Meeting april 2005		7.136.55	kamer van koophandel	22.76
rente		36.79	ALV en lezingenavond	626.80
			secretariaatswerkzaamheden	3.171.37
			website	355.81
			kosten t.b.v. International Users Meeting april 2005	7.174.90
			overige uitgaven	433.68
van spaarrekening		0.00	naar spaarrekening	0.00
			eindsaldo op 31 december	15.585.47
totaal		27.356.41	totaal	27.356.41

Spaarrekening 2005

Inkomsten		Uitgaven	
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rente	264.69		
van rekening courant	0.00	naar rekening courant	0.00
		eindsaldo op 31 december	14.222.32
totaal	14.222.32	totaal	14.222.32

Vermogen 2005

1 januari			31 december	
saldo rekening courant		16.295.07	saldo rekening courant	15.585.47
saldo spaarrekening		13.957.63	saldo spaarrekening	14.222.32
openstaande vorderingen (1 x contributie 2002)		272.25	openstaande vorderingen (1 x contributie 2002)	272.25
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openstaande vorderingen (2 x contributie 2004)		544.50	openstaande vorderingen (1 x contributie 2004)	272.25
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voorraad papier + porti	PM	0.00	creditrente bank 4e kwartaal 2005	8.68
kosten hosting website (1 maand)		-23.00	voorraad papier + porti	PM 0.00
betalingsverplichtingen (BTW)		152.00	betalingsverplichtingen (BTW)	-172.00
kosten JRI Communication 1-10-2004 t/m 31-12-2004		-167.50	kosten notuleren ALV november 2005	-306.45
kosten binnenlands betalingsverkeer bank 4e kwart 2004		-21.44	kosten JRI Communication 1-10-2005 t/m 31-12-2005	-401.25
verzendkosten bank 4e kwartaal 2004		-11.71	kosten binnenlands betalingsverkeer bank 4e kwart 2005	-29.52
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Penningmeester DOV:	Accordering kascommissie:	
	handtekening:	handtekening:
ir. N.M. Vollema	naam: S. Truijens	naam: Abdellaoui
opgemaakt 22 mei 2006	datum: 13 juni 2006	datum: 13 juni 2006

5. Publication list 2005

Technical University Eindhoven
A.T. Vermeltfoort, Brick-mortar interaction in masonry under compression, Technical University Eindhoven, Delft University Press, Delft, 2005

Technical University Eindhoven & Bouwdienst Rijkswaterstaat
A. de Boer and E.L.Klamer, External FRP reinforcement and uncertainties in standards, Cobrae bridge engineering conference, 30 mrt.-1 apr. 2005, Cobrae, Zurich/Dubendorf, Switserland

TNO Built Environment and Geosciences
Orlic, B., Schroot, B. (2005).
Predicting mechanical impact of CO2injection. 67rd EAGE Conference and Technical Exhibition. Paper A 019.Madrid.

Pruiksma, J.P., Teunissen, J.A.M., Barends, F.B.J., Orlic, B., Cassiani,G. (2005).
Sensitivity analysis and model type evaluation for subsidenceabove offshore gas reservoirs. In Barends, F.B.J., Carbognin, L.,Gambolati, G., Steedman, R.S. (Eds.), Proc. of the 7th InternationalSymposium on Land Subsidence (SISOLS 2005). Land Subsidence - SpecialVolume: Multi-disciplinary Assessment of Subsidence Phenomena in theRavenna Area. Shangai, China, pp. 65-78

Brecht Wassing, Hans Veldkamp
Geboorde tunnels, Nauwkeuriger voorspelling maaiveldbeweging
TNO-NITG – Informatie mei 2005-05-30

Wouter Zijl, Max Hendriks, Marcel ’t Hart
A Velocity-Based Approach to Visco-Elastic Flow of Rock
Mathematical Geology, Vol. 37, no. 2, February 2005

TNO Built Environment and Geosciences & Bouwdienst Rijkswaterstaat
A. de Boer and P.H. Waarts, Comparison of various structural safety tunnel calculations in soft soil, 15-17 juni 2005, 5th International Symposium Geotechnical Aspects of Underground Construction in Soft Ground, TC28, Amsterdam, The Netherlands

Bouwdienst Rijkswaterstaat
Ane de Boer, Li Hua Lu
The renewing single joint of flyovers
Nafems World Congress 2005, Malta 17 – 20 May 2005, engineering simulation: best practices and visions of the future

A. de Boer and A. Zeilmaker, Punching shear in deep unreinforced underwater concrete floors, Computational Plasticity VIII, Fundamentals and Applications, Complas 2005, Barcelona, 5-8 september 2005, Spain

L.H. Lu and A. de Boer, Remaining life of orthotropic steel bridge decks, Fourth int. conference on current and future trends in bridge engineering and maintenance, 10-11 october, ICE, Kuala Lumpur, Malaysia

TNO DIANA BV

Gerd Jan Schreppers, Geir Horrigmoe, A review of FEA technology issues confronting the civil engineering industry Nafems World Congress 2005, Malta 17 – 20 May 2005, engineering simulation: best practices and visions of the future

Olivier Gastebled, Salt modelling with DIANA and Geomec
Rapport 2005-DIANA-R001

Richard Witasse, Non-linear 3D finite element analysis of a riser support base plate – Influence of a broken bolt
Rapport 2005-DIANA-R002

Boris van Luipen, Inceptie IN50
Rapport 2005-DIANA-R003

Ahmed Elkadi, 3D Nonlinear Geomechanical Modelling of the Yibal Field with Main Faults using GEOMEC
Rapport 2005-DIANA-R004

Ahmed Elkadi, Nonlinear calculation of a lock
Rapport 2005-DIANA-R005

Giovanna Lilliu, Early Age Behaviour of a Wall
Rapport 2005-DIANA-R006

6. Memberslist

Ingenieursburo Zonneveld BV
t.a.v. J.P. van der Windt
Max Euwelaan 23
3062 MA Rotterdam
windt@zonneveld-rotterdam.nl

Gemeentewerken Rotterdam
t.a.v. P. Jongbloed
Postbus 6633
3002 AP Rotterdam
p.jongbloed@gw.rotterdam.nl

GeoDelft
t.a.v. J.A.M. Teunissen
Postbus 69
2600 AB Delft
j.a.m.teunissen@geodelft.nl

Bouwdienst Rijkswaterstaat
t.a.v. A. de Boer
Postbus 20000
3502 LA Utrecht
a.dboer@bwd.rws.minvenw.nl

TU Delft
Faculteit CITG
t.a.v. W. Peperkamp
Postbus 5048
2600 GA Delft
w.peperkamp@citg.tudelft.nl

TU Eindhoven
Faculteit Bouwkunde
t.a.v. E. Klamer
Postbus 513
5600 MB Eindhoven
e.l.klamer@bwk.tue.nl

Adviesburo D3BN/DHV Zaandam
t.a.v. J.J. Morrien
Postbus 2081
1500 GB Zaandam
c.morrien@d3bn.nl

Shell Int. Exp. and Prod. B.V.
Finance Department EPT-CS
(mbt Res and Technology Service)
t.a.v. M. Molenaar
Postbus 60
2280 AB Rijswijk
mathieu.molenaar@shell.com

ABT
t.a.v. ing. A.A. van den Bos
Postbus 82
6800 AB Arnhem
a.vd.bos@abt-consult.nl

HASKONING
t.a.v. D.J. Peters
Postbus 151
6500 AD Nijmegen
dj.peters@royalhaskoning.com

Witteveen+Bos
t.a.v. F. Kaalberg
Postbus 233
7400 AE Deventer
frank.kaalberg@nzlijn.nl

TNO Bouw
Afdeling Constructies
t.a.v. F. Galanti
Postbus 49
2600 AA Delft
f.galanti@bouw.tno.nl

NITG-TNO
t.a.v. B. Orlic
Postbus 80015
3508 TA Utrecht
b.orlic@nitg.tno.nl

TU Delft
Faculteit Bouwkunde
t.a.v. A. Borgart
Berlageweg 1
2628 CR Delft
a.borgart@bk.tudelft.nl

Montan University Leoben
Attn. Prof. H. Harmuth
Franz-Josef Strasse 18
A-8700 Leoben, Austria
Harald.harmuth@unileoben.ac.at

Corresponderende leden:

TNO DIANA BV
t.a.v. G.J. Schreppers
Postbus 49
2600 AA Delft

TNO DIANA BV
t.a.v. G. Lilliu
Postbus 49
2600 AA Delft

TNO DIANA BV
t.a.v. R. van der Meer
Postbus 49
2600 AA Delft

TNO DIANA BV
t.a.v. M. Hendriks
Postbus 49
2600 AA Delft

TNO-Bouw
t.a.v. G. Kusters
Postbus 49
2600 AA Delft