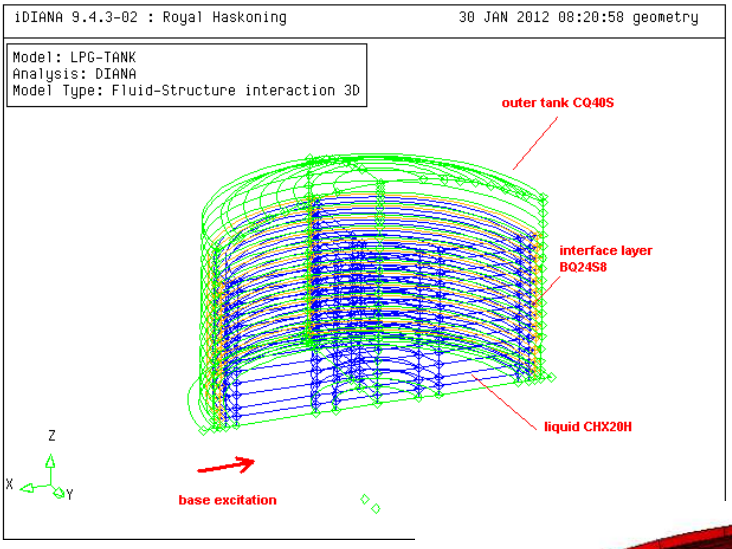
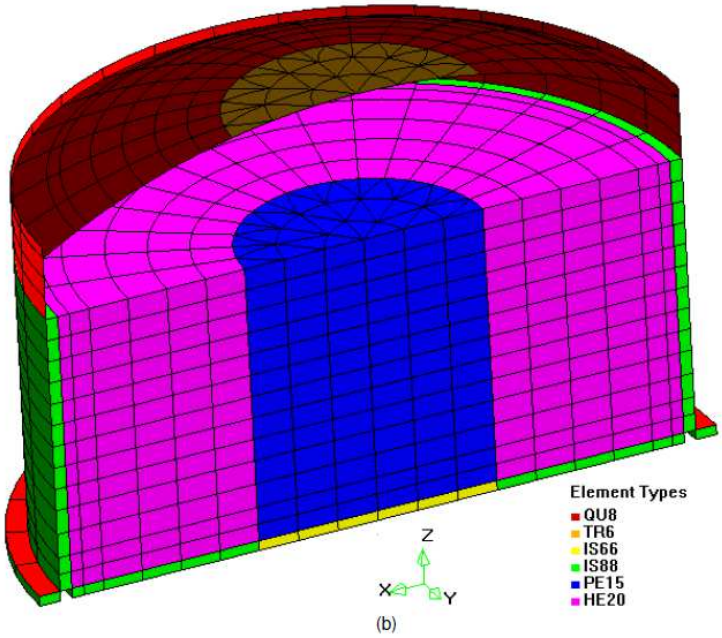
DIANA Users Association

Annual report 2013

02-06-2014





Dr.ir. A. de Boer
Chairman DIANA User's Association

Annual Report 2013

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 2013

During this reporting year, the Executive Committee consisted of:

Chairman:	dr.ir. A. de Boer, Centre for Infrastructures, Ministry of Infrastructures and the Environment, Utrecht
Secretary/ Treasurer:	ir. N. Vollema, Royal HaskoningDHV, Nijmegen
Committee member:	ir. H.G. Burggraaf, TNO Structural Reliability

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. Organizing of the 8th International DIANA Users Meeting in Gothenburg, Sweden.
3. Continuing contributing to the set-up a database with publications related to DIANA or FEA.
4. Extending the existing e-mail database with foreign users in the fields of concrete, concrete mechanics, bridges and tunnels.
5. Preparation of general and technical meetings.
6. Association finance.
7. Progress in an international response/discussion forum around developments now and in the future related to Users Wishes.

3 Actitivities

3.1 General

The Association holds a general meeting of members twice a year, followed if possible by a technical meeting (lectures). In 2012 there have been held two technical meetings, lecture evenings.

3.2 Technical lectures June 20th, 2013

Slabs containing weak spots, experiments and FE analysis
Yuguang Yang, TU Delft

Part of the project renovation concrete bridges and viaducts, a feasibility study has been executed around slabs with different concrete strengths. This research consisted of both a numeric and an experimental part, by which the numeric part mostly concerned the predictions of the structural safety. The comparison of the results of the experiments with the numeric analysis will be further discussed.

Expansion joint analysis Katerveer bridge
Gerco-Kees Bloemsma, Arcadis

In this lecture, the analysis of the expansion joint of a bridge will be further discussed. This expansion joint is known to have a few execution problems and through the analysis it was shown that the negative effects of this are numerical acceptable. In other words: How it can go wrong within a project and, how we can be saved by applying FEM and how it can be better in the future (through improvements during the whole project).

T-giders and intermediate panels; experiments and setup FE model
Sana Amir, TU Delft

Part of the project renovation concrete bridges and viaducts experiments are executed around the behaviour of the intermediate panels, that are located in the bridge deck between the T-girders. Using the application of a wheel print load at different locations at the panels, the failure behaviour of the panels will be analysed. Besides the variation in locations of the wheel print, also the ratio of prestressing in transversal direction of the panels is varying to show the membrane action in the intermediate panels.. The experiments and the setup of the FE model for the simulation of the FE model will be further discussed.

3.3 International DIANA Users Meeting, 25-26 April 2013, Gothenburg, Sweden

Lectures

User-supplied subroutines developed for use in DIANA
Karin Lundgren and Kamyab Zandi Hanjari, Chalmers University, Sweden

Fibre reinforced concrete in dapped-end beams
Elena V. Sarmiento, NTNU, Norway

Fatigue Analysis of Bascule Bridge Detail
Coen van der Vliet and Peter Konijnenbelt, Arcadis, The Netherlands

Study of the behaviour of reinforced concrete slabs subjected to concentrated loads near supports
Beatrice Belletti, Cecilia Damoni, Max A.N. Hendriks*, University of Parma, Italy
*Delft University of Technology, The Netherlands & NTNU, Norway

Modelling of Bond Behaviour of Naturally corroded Reinforcement in concrete structural Members
Mohammad Tahershamsi, Eyrún Gestsdóttir, Tómas Guðmundsson and Karin Lundgren
Chalmers University, Sweden

The use of DIANA for non-linear finite element analysis in the advanced concrete structures course at Chalmers
Mario Plos,Chalmers University, Sweden

FEM analysis of reinforced concrete decks with compressive membrane action
Cornelis van der Veen and Gert Jan Bakker, Delft University of Technology, The Netherlands

Non-linear finite element analysis of steel fibre reinforced concrete in combination with conventional reinforcement
David Fall and Karin Lundgren, Chalmers University, Sweden

Structural appraisal of existing box girders
Henco Burggraaf, TNO, The Netherlands

Numerical Modelling of Textile Reinforced Concrete
Natalie Williams Portal, Chalmers University, Sweden

Crack assessment of hardening concrete structures: Comparisons between DIANA and two alternative programs and experimental results
Anja B.E.Klausen, Øyvind Bjøntegaard, Terje Kanstad, NTNU, Norway

Finite element modeling of a two-way slab with different approaches
Jiangpeng Shu, Mario Plos, Kamyab Zandi Hanjari, Karin Lundgren,
Chalmers University, Sweden

Modelling of tensile membrane action at very large displacements by use of DIANA
Dirk Gouverneur , Robby Caspeele , Luc Taerwe, Ghent University, Magnel Laboratory, Belgium

Keeping track of the crack
Max A.N. Hendriks, Arthur T. Slobbe, Delft University of Technology, The Netherlands & NTNU, Norway

Anchorage of corroded bars: from cover cracking to cover spalling
Kamyab Zandi Hanjari, CBI and Chalmers University, Sweden

DIANA Release 9.4.5
Gerd-Jan Schreppers, TNO DIANA BV, The Netherlands

3.4 Technical lectures November 28th, 2013

Stochastic Finite Element Method (SFEM) - Intrusive Formulations
Rein de Vries, TU-Delft / TNO / Arup

Normally, the structures will be checked by deterministic based analysis, for example by the Eurocode recommendation. However, one can also achieve this by stochastic based methods. With these methods, the uncertainty in the structure and loads will explicitly be taken into account. A distinction can be made between intrusive and unintrusive methods, whereby the last one is the most doable. Hereby, a Monte Carlo stimulation will be executed in which the parameters will be carefully variated. However, this method is mostly time consuming and that is why alternatives are being sought. The intrusive methods take the underlying uncertainty of the system directly into account in the mathematical formulation, so a stimulation is not necessary. This lecture further explains the available methods and gives an example in a – which is already a time consuming application in dynamic analysis, so the effectiveness can also be tested.

Design of prestressed concrete structures subject to severe thermal loading
Sander J.H. Meijers, Johan J. Van Sloten, Jaap H.A. Strik, John G. Kraus

Protected Storage Engineers, a brand of Royal HaskoningDHV. Prestressed concrete structures, such as storage tanks for liquefied gases, may be exposed to severe thermal loading. Inner tank leakage in case of LNG storage implies exposure of the inner face of the concrete wall to a temperature of -165 ºC. In another situation surface temperatures up to 600 ºC can be reached on the dome roof in case of fire. Thermal loading differs from mechanical loading in that thermal loading not necessarily leads to stress build-up in the structure. The eventual stress build-up due to thermal loading corresponds to the local amount of thermal restraint. In the present paper it is shown for the case of a liquefied ethylene storage tank that superposition of these stress inducing thermal strains onto the strains due to mechanical loading leads to safe and

economic design. The mechanical cross-sectional forces as well as the thermal restraint have been determined separately with linear-elastic FEM, while the mechanical strains have been determined from the FEM results using non-linear elastic cross-section analysis according to EN 1992-1-1:2011.
In an automated process, final cross-sectional stresses follow directly from the superposed strains, taking plasticity into account. The results are compared to those resulting from staggered heat flow and non-linear elastic FEM analysis with smeared cracking.

T-girders and intermediate panels, experiments and results FE models
Sana Amir, TU Delft

Within the project renovation concrete bridges and viaducts of Rijkswaterstaat, experiments have been executed around the behaviour of the intermediate panels, that are located in the bridge deck between the T-girders. Using the application of a wheel print loads at different locations of the panels, the failure behaviour of the panels will be calculated. Besides the variation in locations of the wheel print load, the prestressing ratio in transversal direction of the complete bridge deck will be varied to discover the membrane action in the panels. The experiments and the setup of the FE models for the simulation with the FE models will be further discussed.

Modelling a skew slab with high wide edge beams
Shen Ma, ABT-Velp

Judging a skew slab, build in the past, in which the reinforcement has been determined based on the reinforcement moments and forces in the non-orthogonal directions, is mostly difficult. An extra dimension is the behaviour of this structure, where high wide edge beams are added in longitudinal direction to the skew slab. The modelling of the slab and supporting the applicable assumptions, along with the results will be further discussed.

4. Financial aspects 2013

DIANA Users Association

DIANA Ontwikkelingsvereniging

Balans behorend bij financiëel jaarverslag 2013

	31 december 2013		31 december 2012	
ACTIVA				
VASTE ACTIVA	€ 0		€ 0	
		€ 0		€ 0
VLOTTENDE ACTIVA				
Vorderingen (debiteuren)	€ 550		€ 0	
Liquide middelen	€ 34,962		€ 38,080	
Transitoria	€ 0		€ 0	
		€ 35,512		€ 38,080
TOTAAL ACTIVA		€ 35,512		€ 38,080
PASSIVA				
EIGEN VERMOGEN	€ 34,288		€ 37,716	
		€ 34,288		€ 37,716
KORTLOPENDE SCHULDEN				
Transitoria (crediteuren)	€ 1,224		€ 364	
		€ 1,224		€ 364
TOTAAL PASSIVA		€ 35,512		€ 38,080

Winst- en verliesrekening behorend bij financiëel jaarverslag 2013

	2013	
Netto omzet	€ 7,734 +	
Kostprijs van de omzet	€ 7,719 -	
BRUTO OMZETRESULTAAT		€ 16
Personeelskosten	€ 2,349 -	
Algemene beheerskosten	€ 1,460 -	
Financiële baten	€ 364 +	
Financiële lasten	€ 0 -	
RESULTAAT UIT GEWONE BEDRIJFSVOERING		-€ 3,430
Buitengewone baten en lasten	€ 0 +	
RESULTAAT		-€ 3,430

Penningmeester DOV:	Accordering kascommissie:	
	handtekening:	handtekening:
19 jan 2018		
	naam: Sander Meijers	naam: Kris Riemens
Nynke Vollema / Coen van der Vliet opgemaakt 5 februari 2014 gecorrigeerd ivm boekhoudmethode m.i.v. 2014)	datum: 19 jan. 2018	datum: 20-12-2017

5. Publication list 2013

ABT

Joostensz Bsc., Ostar, Hulst PMSe, Matthijs van der, “Detailleren met DIANA”, Bouwen met Staal, December 2013.

ARCADIS

Vliet, C. van der, A. de Boer, G. Wolsink. 2013. Dwarskrachtscheuren in het Gouwe Aquaduct? Cement 2013-4 p. 42-47. Uitgeverij Aeneas, Boxtel.

Vliet, C. van der, R. Lensen, F. Deurinck, G. Jonkheijm. 2013. Ontworpen op extremen (1) en (2). Cement 2013-4 p. 80-86 resp. Cement 2013-5 p. 58-63. Uitgeverij Aeneas, Boxtel.

Vliet, C. van der, R.W.M.G. Heijmans, F. Deurinck. 2013. The 2nd Coentunnel Project - Challenges for design and construction. Proceedings of the Arabian Tunnelling Conference 'Sustainable Tunnelling in the GCC - Challenges and Opportunities', Dubai, 11-13 Dec 2013

Chalmers University

Coronelli, D. ; Zandi Hanjari, K. ; Lundgren, K. (2013). Severely Corroded RC with Cover Cracking. Journal of Structural Engineering-Asce. 139 (2) s. 221-232.

Fall, D. ; Rempling, R. ; Jansson, A. et al. (2013). Modelling cracking and bending failure of SFRC beams with conventional reinforcement, 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures. s. 1276-1285. ISBN/ISSN: 978-849410041-3

Flansbjer, M. ; Lindqvist, J-E. ; Zandi Hanjari, K. et al. (2013). Mechanical behaviour of concrete piles affected by sulphate attack, Proceeding of the International IABSE Conference: Assessment, Upgrading and Refurbishment of Infrastructures, May 6-8, 2013, Rotterdam, The Netherlands. s. 556-557.

Williams Portal, N. ; Lundgren, K. ; Walter, A. M. et al. (2013). Numerical modeling of textile reinforced concrete, In 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures, FramCoS-8, Toledo, Spain.

Zandi Hanjari, K. ; Kettil, P. ; Lundgren, K. (2013). Modelling the structural behaviour of frost-damaged reinforced concrete structures. Structure and Infrastructure Engineering. 9 (5) s. 416-431.

Zandi Hanjari, K. ; Lundgren, K. ; Plos, M. et al. (2013). Three-dimensional modelling of structural effects of corroding steel reinforcement in concrete. Structure and Infrastructure Engineering. 9 (7) s. 702-718.

Delft University of Technology

ISI Journal Papers 2013

Max A.N. Hendriks, Jan G. Rots, "Sequentially linear versus nonlinear analysis of RC structures", *Engineering Computations*, 30 (issue 6), 2013, 792-801.

Giorgia Giardina, Anne V. van de Graaf, Max A.N. Hendriks, Jan G. Rots, Alessandra Marini, "Numerical analysis of a masonry facade subject to tunnelling-induced settlements", *Engineering Structures*, 54, 2013, 234-247.

A.T. Slobbe, M.A.N. Hendriks, J.G. Rots, "Systematic assessment of directional mesh bias with periodic boundary conditions: applied to the crack band model" submitted to journal *Engineering Fracture Mechanics*, 109, 2013, 186-208.

B. Belletti, C. Damoni, J.A. den Uijl, M.A.N. Hendriks, J.C. Walraven, "Shear Resistance Evaluation of Prestressed Concrete Bridge Beams: fib Model Code Guidelines for Level IV Approximations", *Structural Concrete*, 14 (No. 3), 2013, 242-249.

Non-ISI Journal Papers 2013

Giorgia Giardina, Max Hendriks, Jan Rots, "Nieuw model geeft betere inschatting schade aan gebouwen", *de Onderbouwing*, 6(15), 2013, 12-13.

Books, chapters 2013

Beatrice Belletti, Cecilia Damoni, Max Hendriks, "Evaluation of the carrying capacity of reinforced concrete slabs subjected to concentrated loads near supports", Studies and Researches (annual review of structural concrete, Graduate School in Concrete Structures, Fratelli Pesenti, Politecnico di Milano, Italy), 32, 2013, 131-154. ISBN 978-88-904292-6-2.

A.T. Slobbe, M.A.N. Hendriks, J.G. Rots, "A testing procedure for the evaluation of directional mesh bias", VIII International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS-8), J.G.M. Van Mier, G. Ruiz, C. Andrade, R.C. Yu and X.X. Zhang (Eds), 2013

B. Belletti, C. Damoni, M.A.N. Hendriks and J.A. den Uijl, "Nonlinear finite element analyses of reinforced concrete slabs: comparison of safety formats", VIII International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS-8), J.G.M. Van Mier, G. Ruiz, C. Andrade, R.C. Yu and X.X. Zhang (Eds), 2013.

R. Esposito and M.A.N. Hendriks, "Multiscale Material Model for ASR-affected Concrete Structures", XII International Conference on Computational Plasticity. Fundamentals and Applications, Complas XII, E. Onate, D.R.J. Owen, D. Peric and B. Suarez (Eds), 2013

A.T. Slobbe, M.A.N. Hendriks and J.G. Rots, "C1 – continuous crack propagation across quadratic elements", XII International Conference on Computational Plasticity. Fundamentals and Applications, Complas XII, E. Onate, D.R.J. Owen, D. Peric and B. Suarez (Eds), 2013

Jori Kappen, Giorgia Giardina, Max A.N. Hendriks and Jan G. Rots, "3D numerical analysis of tunnelling induced damage: the influence of the alignment of a masonry building with the tunnel axis", Eurotun:2013, Proceedings of the third International Conference on Computational Methods in Tunneling and Subsurface Engineering, 2013.

H. Mortier, J.H. Jonker, J.G. Rots, G.J. Hobbelman, G. Giardina, M.A.N. Hendriks, "Increasing allowable deformation criteria through application of level II LTSM approach" in World Tunnel Congress 2013 Geneva, Underground – the way to the future! G. Anagnostou & H. Ehrbar (eds), 2013.

B. Belletti, C. Damoni, M.A.N. Hendriks , "Non-Linear Finite Element Analyses of Existing Reinforced Concrete Bridge Beams", IABSE Symposium Report, IABSE Symposium, Rotterdam 2013: Assessment, Upgrading and Refurbishment of Infrastructures , pp. 1631-1638(8).

V. Mariani, A.T. Slobbe, M.A.N. Hendriks, J.G. Rots, "Application of sequentially linear analysis to the seismic assessment of slender masonry towers", in "Research and Applications in Structural Engineering, Mechanics & Computation: Proceedings of the Fifth International Conference on Structural Engineering, Mechanics & Computation" (ISBN 978-1-138-00061-2).

J.G. Rots, M.A.N. Hendriks, A.T. Slobbe, A.V. van de Graaf, "Circumventing Bifurcations", *Abstract only*, 3rd international conference on computational modeling of fracture and failure of materials and structures, CFRAC 2013, M. Jirásek, O. Allix, N. Moës, X. Oliver (Eds), Prague, June 5-7, 2013.

A.T. Slobbe, M.A.N. Hendriks, J.G. Rots, "C^1 - continuous crack propagation across quadratic elements", *Abstract only*, 3rd international conference on computational modeling of fracture and failure of materials and structures, CFRAC 2013, M. Jirásek, O. Allix, N. Moës, X. Oliver (Eds), Prague, June 5-7, 2013.

R. Esposito, M.A.N. Hendriks, "Multiscale Material Model for ASR-affected Concrete Structures", *Abstract only*, 3rd international conference on computational modeling of fracture and failure of materials and structures, CFRAC 2013, M. Jirásek, O. Allix, N. Moës, X. Oliver (Eds), Prague, June 5-7, 2013.

Ministry of Infrastructure and the Environment & Delft University of Technology

dr.ir.drs. René Braam, dr.ir. Cor van der Veen dr.ir. Ane de Boer "Trekelementen in onderwaterbetonvloeren", Cement 2013/3

E.O.L. Lantsoght, C. van der Veen & J.C. Walraven, A. de Boer, "Peak shear stress distribution in finite element models of concrete slabs", SEMC 2013: The fifth international conference on structural engineering, mechanics and computation, 2-4 September 2013 Cape Town, South Africa

Eva O.L. Lantsoght, Cor van der Veen, Joost Walraven, Ane de Boer, “Applying Experimental Results to the Shear Assessment Method for Solid Slab Bridges”, **C**oncrete 2013, Conference being held on the Gold Coast, Queensland, 16 – 18 October 2013

Eva O.L. LANTSOGHT Cor VAN DER VEEN Joost C. WALRAVEN Ane DE BOER, « Shear Assessment of Reinforced Concrete Slab Bridges”, Rotterdam IABSE May 2013

EVA O.L. LANTSOGHT, COR VAN DER VEEN, JOOST C. WALRAVEN, ANE DE BOER “Shear Assessment Practice for Reinforced Concrete Slab Bridges in the Netherlands”, IBC 2013 on June 2-6, 2013, in Pittsburgh, Pennsylvania

E.O.L. Lantsoght, C. van der Veen, A. de Boer, J.C. Walraven, “Transverse Load Redistribution and Effective Shear Width in Reinforced Concrete Slabs”, Heron 201?(in press)

Eva Olivia Leontien Lantsoght, Cor van der Veen, Joost Walraven, Ane de Boer, `Recommendations for the shear assessment of reinforced concrete slab bridges from experiments`, IABSE, SEI 4-2013

S. Amir, C. van der Veen, J. C. Walraven, A. de Boer, ‘Numerical investigation of the bearing capacity of transversely
prestressed concrete deck slabs’, Euro-C, St. Anton Austria

Ministry of Infrastructure and the Environment & TNO DIANA BV

Frissen, ir. C., Schreppers, Dr. ir. G.J., Boer, Dr. ir. A. de, Nieuwe aanpak bepaling wapening en scheurwijdten met brug bij Heteren, Cement, 2013/4.

Chantal Frissen, Ane de Boer Gerd-Jan Schreppers, “Design checks and nonlinear response of a full 3D model of a box girder bridge”, Rotterdam IABSE May 2013

Ministry of Infrastructure and the Environment & Delft University of Technology & TNO DIANA BV

Boer, Dr. ir. A. de, Frissen, ir. C., Veen, Dr. ir. C. van der, Schreppers, Dr. ir. G.J., Improving the quality of structurual concrete design, IABSE Workshop, Helsinki, Finland, February 14-15, 2013.

Dr.ir. A. de Boer, Dr.ir. C. van der Veen, Ir. C. Frissen, Dr.ir. G.J. Schreppers, “Full control of structural concrete design by NLFEA”, NAFEMS World Congress June 2013 Salzburg Austria

Ministry of Infrastructure and the Environment & RHDHV

Rob VERGOOSSEN Marius NAAKTGEBOREN Marcel ‘T HART Ane DE BOER Evert VAN VUGT, “Quick Scan on Shear in Existing Slab Type Viaducts”, Rotterdam IABSE May 2013

Ministry of Infrastructure and the Environment & Arcadis

Ane DE BOER, Nico BOOIJ, Paul COPIER, CRIAM: “Structural Risk Index Weighing Model”, Rotterdam IABSE May 2013

Coen VAN DER VLIET Ane DE BOER Gerrit WOLSINK, “Shear failure of 30-year-old aqueduct wall?”, Rotterdam IABSE May 2013

Ministry of Infrastructure and the Environment

Ane de Boer “Modelling and quality improvements in 3D concrete design”, NAFEMS, London, Concrete Seminar May 2013

TNO Earth, Environmental and Life Sciences

Conference papers:
Orlic, B., Wasssing B.B.T., Geel, C.R. (2013). Field scale geomechanical modeling for prediction of fault stability during underground gas storage operations in a depleted gas field in the Netherlands. Proc. of the 47th US Rock Mechanics / Geomechanics Symposium (ARMA), San Francisco. Paper no ARMA 13-300.

Orlic, B. (2013). Site-specific geomechanical modeling for predicting stress changes around depleted gas reservoirs considered for CO2 storage in the Netherlands. Proc. of the 47th US Rock Mechanics / Geomechanics Symposium (ARMA), San Francisco. Paper no ARMA 13-446.

Orlic B., Mazurowski M., Papiernik B., Nagy S. (2013). Assessing the geomechanical effects of CO2 injection in a depleted gas field in Poland by field scale modelling. In M. Kwaśniewski, Łydżba, D. (Eds.), Proc. of EUROCK 2013 - The 2013 ISRM International Symposium. Wrocław, 21-26 September 2013, 969-975. Taylor & Francis Group: London. ISBN:978-1-138-00080-3.

Report:
Wassing, B.B.T., Orlic, B., Leeuwenburgh, O., Geel, C.R. (2014). 3D Geomechanical Modelling of Fault Stability in the Lacq Field. TNO2014 R10378 (confidential report).

TNO DIANA BV

Schreppers, G.J., Elkadi, A., Numerical simulation of large dams. NAFEMS NORDIC Seminar: Numerical Simulation in Energy Applications, 5-6 February 2013.

6. Memberslist

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