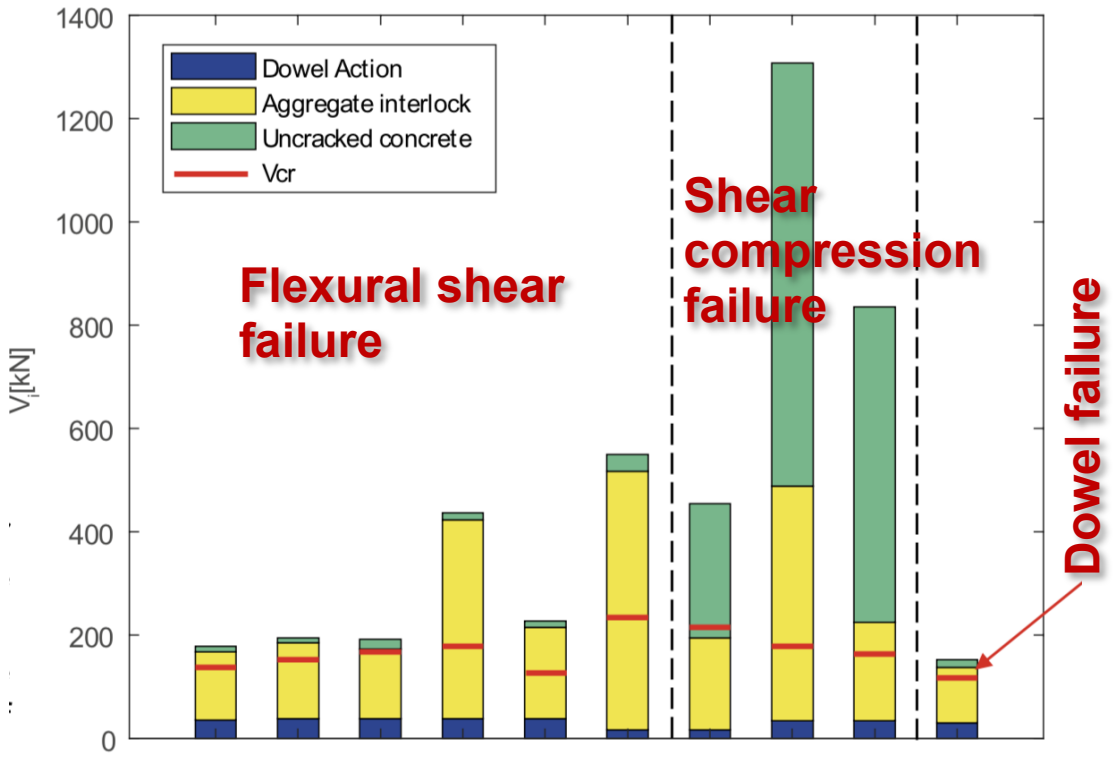
DIANA Users Association

Annual report 2019-2020-2021

20-01-2023



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

Annual Report 2019-2020-2021

Contents

1 Aim of the Association

The members of the Association are all users of the DIANA software package of DIANA FEA 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, DIANA FEA BV utilizes the Association to inform the Users on the DIANA package development progress.

2 Executive Committee

2.1 Executive Committee 2019

During this reporting year, the Executive Committee consisted of:

Chairman:	Dr.ir. A. de Boer, Ane de Boer Technisch Advies
Treasurer/ Secretary:	ir. C. v.d. Vliet, Arcadis Nederland BV
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 13th International DIANA Users Meeting in Trondheim, Norway.
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.

2.2 Executive Committee 2020

During this reporting year, the Executive Committee consisted of:

Chairman:	Dr.ir. A. de Boer, Ane de Boer Technisch Advies
Treasurer/ Secretary:	ir. C. v. d. Vliet, Arcadis Nederland BV
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 14th International DIANA Users Meeting in Valencia, Spain. Due to the Corona virus, in March 2020 we have decided to postpone the DIANA Users Meeting to a “safe” data.
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.

2.3 Executive Committee 2021

During this reporting year, the Executive Committee consisted of:

Chairman:	Dr.ir. A. de Boer, Ane de Boer Technisch Advies
Treasurer/ Secretary:	ir. C. v.d. Vliet, Arcadis Nederland BV
Committee member:	ir. H.G. Burggraaf, TNO Structural Reliability

The Executive Committee has in 2021, due to the Corona virus, only dealt with the following:

1. Discussion on continuing new research projects on the basis of a national and international user's wish list.
2. Continuing contributing to the set-up a database with publications related to DIANA or FEA.
3. Association finance.

3 Actitivities

3.1 General

The Association has the intention to organize a general meeting of members twice a year, followed if possible by a technical meeting (lectures). In 2019 there have been held two general meetings and two technical meetings (lecture evenings).
Due to the Corona virus, we have not been able to organize general meetings and technical meetings (lectures) in 2020 and 2021.

3.2 Technical lectures 2029

3.2.1 Technical lectures June 18th, 2019

Fire Safety Engineering with DIANA

Lex van der Meer, ABT

Fire Safety Engineering (FSE) gives a realistic representation of the behaviour of a fire and the effect on the environment, using physical models. It is a relatively new development. The method can be used to consider all aspects related to fire safety. The outcome can have a major impact on a design and can lead to the plan being simplified. This is cheaper and more sustainable, without compromising on safety. The presentation will discuss the possibilities of FSE, how DIANA FEA can be used for this, which points of attention are important here, and finally two examples from ABT projects will be discussed:
(1) instability of a steel façade column in the event of fire and
(2) integrity of a concrete layer to protect a steel column in case of fire.

Calculation of a segmented tunnel lining in a 3D continuum model

Yannick A.B.F. Liem, ARTHE

Where in earlier drilling tunnels the lining calculations were done using a decoupled model in which the soil acts as a load case and an elastic support on the tunnel, nowadays the preference is for a continuum calculation, in which both the soil mass and the tunnel lining are modeled. This has the advantage that the soil behaviour during all construction and operational phases is directly linked to the tunnel behaviour, where the soil layers and stress changes and stress distributions can be better described. The step to 3D modelling is essential when adjacent rings are joined by dowels, bolted connections, or friction behaviour between the mutual packers or segments.
In NEN9997 tunnels are explicitly classified as geotechnical structures, so Design Approach 3 must be applied for ULS calculations. Two possibilities are given for the application of partial factors. The designer is responsible for the choice and can lead to significant differences in the results!

Contest 2019 motivation and results

Yuguang Yang, TU Delft

The Contest of the 7th Lustrum of the DIANA Users Association is presented at the International User Meeting in Trondheim in May 2019. In total 4 FE software packages are used, 9 predictions were made and 20 people were involved in this competition. The results of the Contest shows some improvements for the Nonlinear Guideline, especially in the field of the design of the weak concrete structures. Weak in the sense of structures which are not belonging to the common type of concrete structures.

In this last Contest the two chosen simple beams were also not belonging to the common beams. Nevertheless there was enough discussion during the Contest session and afterwards during the pleasant dinner in the evening.
Results of the experiments and the motivation of the choice for the simple beam types will be shown. An inventory of the interpretation of the different beams input from the teams will be given.

Structural Analysis of Printed Concrete Structures

Freek Bos, TU Eindhoven

The use of 3D printing to create concrete structures, is rapidly gaining popularity. Several projects have already been realized in the Netherlands and around the world, and more are under preparation or construction. The ability to achieve free-form structures at no additional cost is the primary driver for this development. However, the efficient structural analysis of such structures is far from self-evident. Finite Element Analysis is an indispensable tool, but what modelling approach is suitable for small scale projects, without repetition, and with many geometrical and material properties still unknown? This lecture will discuss such issues, largely based on the experience developed during the structural design and engineering of the Cohesion pavilion, a project developed for the 350th anniversary of the University of Innsbruck, on which the presenter worked.

3.3 International DIANA Users Meeting 22-23 May 2019, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

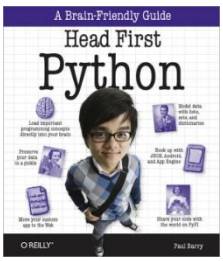
Wednesday, 22th May, 2019

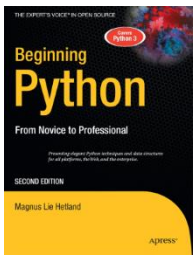
Workshop 'Parametric Modelling'

Introduction to Python and Parametric Modelling

DIANA GUI is very powerful for setting up all kinds of models in different ways. There are a lot of easy ways
of making parts of geometry in the GUI, modify them and so on. Importing from CAD files is another powerful method.

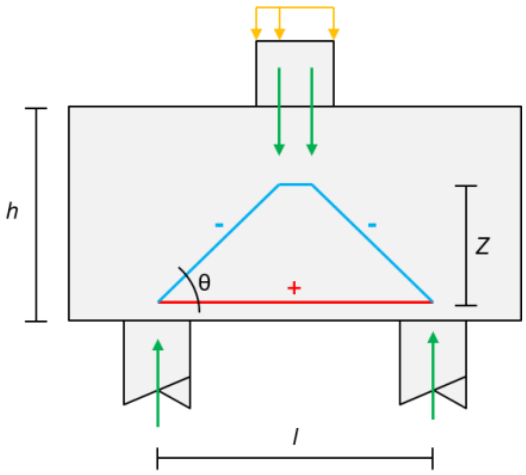
But what to do, if a certain geometry comes back again in several projects ?
Would it not be easy to be able to repeat a certain part of your model and automate the process of making the model ?
And if so, would it not be possible to also automate the analysis and output report process?
In DIANA it is made possible via an interface language Python. Python is an easy to understand, plug and play, discover on the internet language, that everybody can learn.
In the parametric modelling session we will give a quick overview of some basic commands and background outline of Python.





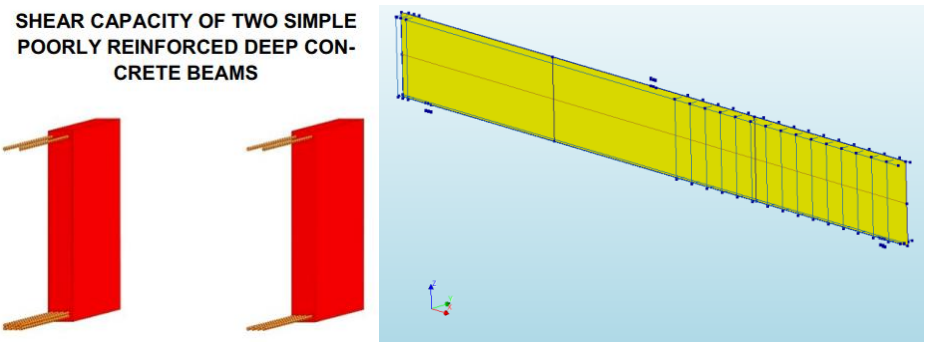
Example 1: Foundation

Next thing is to show a practical example of a project, where DIANA is at its best because of having a structure that is not in pure bending. Variation in dimensions will give together with the belonging reinforcement layout an optimized solution.



Example 2: Contest 2019

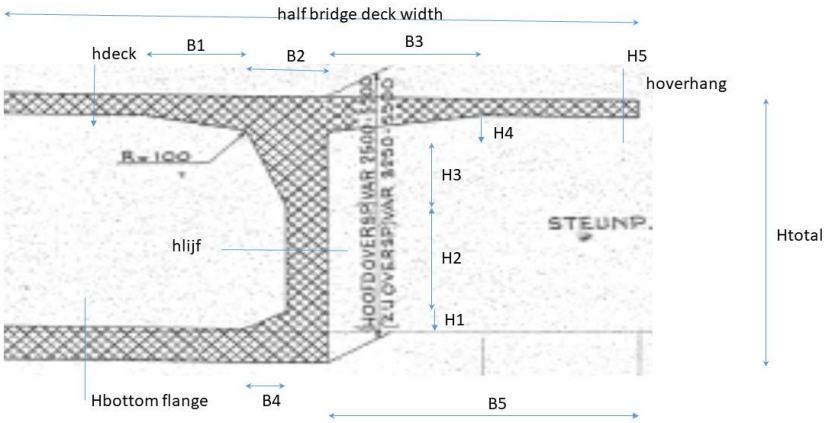
Another example project could be the beam of the contest. We will show how to make a parametric model for that. Information of the Contest beam is given in the flyer of the Users Meeting.



After that you can discover yourself some ways of parametric modelling in DIANA.

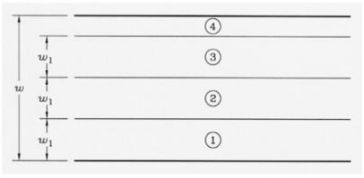
Example 3: Varying Geometry Structure

A nice practical example is a box-girder bridge and get acquainted with choosing the correct parameters for your structure. Variability in parameters about the width of a bridge deck is mostly fixed but can be also a variable one.
In longitudinal direction the H_{totaal} is varying parabolic over the length of the main and side spans. Also the thickness of the bottom flange is a varying parameter in the design process. H_{dek} is fixed, but the $h_{overhang}$ is again an variable parameter. All other B_i and H_i are variabel so parametric.



Example 4: Varying Mobile Loads

It is also possible to add the mobile loads and other combinations for a normative loading check on this kind of bridges. Variation in number of lanes, lane width and locations of the Eurocode axle load configuration for side span and main span can be variable parameters.



Key
w Carriageway width
w_i Notional lane width
1 Notional Lane Nr. 1
2 Notional Lane Nr. 2
3 Notional Lane Nr. 3
4 Remaining area

Figure 6: All lanes positioned all to the right side of the bridge

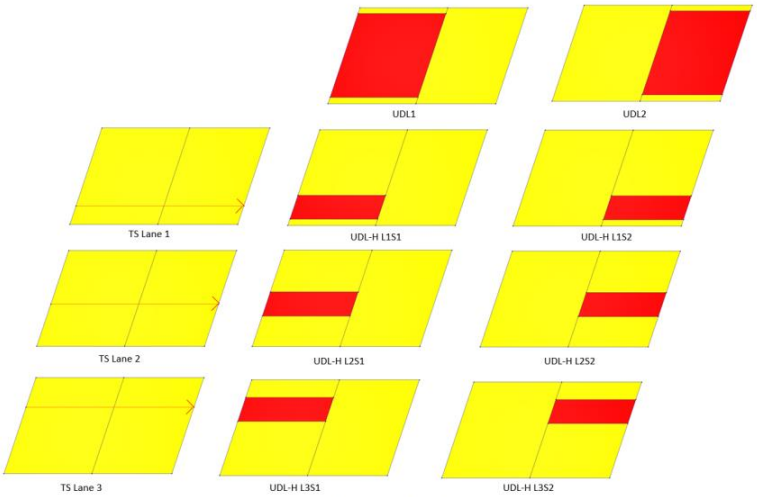


Figure 7: Traffic load, to define in Diana

Example 5: Your Own Example

Discussion examples on workshop

Lustrum Contest session

Yuguang Yang, Delft University of Technology, The Netherlands
Overview of the Lab experiments.

Pitch presentations of the received contributions.

Discussion

Yuguang Yang, Delft University of Technology, The Netherlands
Results of the Lab Experiments

Awarding Winner Contest

Thursday, 23th May 2019

Lectures:

Heated reinforced concrete slabs subjected to static load: Experimental results and numerical simulations

Assis Arano[1], Jiangpeng Shu[1], Jan Øverli[1], Max Hendriks[1,2], Terje Kanstad[1] and Matteo Colombo[3]
[1]Norwegian University of Science and Technology [Trondheim] (NTNU) - NO-7491 Trondheim, Norway
[2]Delft University of Technology (TU Delft) - Postbus 5, 2600 AA Delft, Netherlands
[3]Politecnico di Milano (PoliMi) – Via Gaetano Previati, 1/c. 23900 Lecco, Italy

Ferry-free coastal route E39 is a project by the Norwegian Public Roads Administration that aims to design a coastal highway route without ferry connections. Wide and deep fjords along the Norwegian coast make submerged floating tunnels (SFT) an alternative to conventional structures. In the unfortunate situation of accidental events, the SFT reinforced concrete (RC) structure may become damaged, affecting its load carrying capacity. Furthermore, fire condition has become an important issue in the design of tunnels.

A collaboration research project between NTNU and Politecnico di Milano has been started to study the behavior of RC elements when exposed to extreme conditions. This project is aimed at assessing the reliability of numerical approach in the prediction of RC 2D structural elements when exposed to the combination of fire and quasi-static loading. An ad hoc experimental campaign has been defined to provide a reliable benchmark. Three different fire load cases have been studied: 0 (reference case), 60 or 120 min fire exposure time. Afterwards, bending tests with a simply supported condition on a circular support have been performed, with a linear circular load applied on a steel ring. Two identical tests have been performed for each load case.

Numerical results have been obtained by reproducing the experiments using Diana FE. Nonlinear heat and structural analyses were performed to study the thermal and mechanical behavior of the slabs. Moreover, material tests were performed to provide accurate temperature-dependent material properties in the simulations. Load-deflection curve, crack pattern and temperature distribution along the slab thickness, were the main variables used to compare the results.

This study aims to develop a better-calibrated model, which will be able to assess the risk analysis of SFT and its feasibility in the E39 project.

Keywords: fire tests, quasi-static tests, reinforced concrete slabs, nonlinear analyses

Punching shear failure due to impact loading

Wouter Meijers, Royal HaskoningDHV, The Netherlands

The Dutch Safety Requirements specifies that newly build nuclear reactors shall provide suitable protection measures in the event of an accidental aircraft crash. Usually this is done with a so-called aircraft protection shell (APS) made from reinforced concrete which protects vital safety systems inside the reactor.
An aircraft impact causes an extreme load in a short time period, which depends mostly on the speed and the mass of the projectile (the aircraft). The response of the target (APS) is highly non-linear and difficult to predict. Therefore analysis for impact loading is usually done with explicit FEM packages.
Several experiments have been carried out to study the behaviour of concrete walls under impact loading. The interaction between the projectile and the target defines the load as either "hard impact" or "soft impact", both with their own failure mechanisms. For hard impact, the

dominant failure mechanism is punching shear failure, where the kinectic energy impacted by the projectile is entirely absorbed by the deformation of the target.
A hard impact experiment is modelled in DIANA to verify the analysis of aircraft impact on the APS. Two methods are used, one with a force-time load and one with an explicit projectile with a predefined speed. In both cases the target is modelled with solid elements. The exact behaviour of the experiment is hard to reproduce, but an indication of punching shear failure is noticeable.

Finite element modelling of UHPFRC flexural-reinforced elements

Eduardo J. Mezquida-Alcaraz, Juan Navarro-Gregori, Pedro Serna Ros
Institute of Science and Concrete Technology, ICITECH, Universitat Politècnica de València, Spain

A simplified closed-form non-linear hinge model to derive the tensile material properties of Ultra-High Performance Fibre-Reinforced Concrete (UHPFRC) from load-deflection response obtained from Third Point Bending experimental Tests (TPBT), and its numerical validation using a Finite Element Model (FEM) developed in Diana software was presented in The 12th International DIANA Users Meeting hold in Porto. The numerical model developed is based on the discrete cracking model as interface behavior on the central beam section where the macrocrack position is forced to take place, and a smeared cracking approach where a fixed total strain crack model, expressed as function of a crack opening fibre-reinforced concrete fib curve, in the rest of the beam. As it was demonstrated, this model showed good accuracy in a set of TPBT specimens made of UHPFRC with strain-hardening constitutive behaviour.
Now, the numerical model has been used in order to validate the closed-form non-linear hinge model when UHPFRC shows both soft-hardening and soft-softening constitutive behaviour. It seems that running the FEM using the parameters obtained from the non-linear hinge model in a TPBT as a UHPFRC's constitutive behaviour in these cases shows a slight conservative response in tension.
Moreover, soft-hardening and soft-softening UHPFRC TPBT's specimens reinforced with longitudinal steel bars have been tested experimentally and modelled using the FEM developed. The tensile parameters of UHPFRC obtained using the simplified closed-form non-linear hinge model have been used to define the constitutive behaviour of the FEM. High accurate results for this new type of specimens and a very stable response of the model due to the presence of the reinforcement have been obtained, despite the slight conservative response previously observed in non-reinforced specimens.

Collision protection Oosterweel link tunnels

Zhekang Huang and Willem Nobel, Witteveen+Bos, The Netherlands

For the new infrastructure of the Oosterweel link (Belgium) a sacrificial structure is designed to protect the tunnel. Due to the location at the edge of the port of Antwerp this structure is designed to withstand the impact of a sea vessel. It's energy on impact, about 250 MN, is partly dissipated by plowing through the soil where the remaining energy has to be absorbed by a reinforced concrete bumper. This is achieved by a combination of cofferdam-, beam- and cable action. The energy dissipation through the plowing action is analyzed with Abacus, while the energy absorption of the structure is calculated with DIANA.
The top of the structure is situated about 12 meters below the water table and has a total length of nearly 600 meters consisting of a concrete bumper of 475 meters and an anchor length of 95 meters. The bumper is a cofferdam filled with reinforced concrete, where horizontal sheet piles are used as reinforcement instead of ordinary reinforcement bars. During impact of a ship on the bumper the energy is party absorbed by the cofferdam action and bending of the bumper in the horizontal plane. However, the largest part of the impact energy is absorbed by cable action in the horizontally placed sheet piles and is achieved by utilizing the plastic strain of the steel. Recently the anchorage of the cable force in the quay wall is analyzed in detail with the latest version of DIANA X. The existing quay wall is reinforced with railway tracks to properly transfer the cable force from the horizontal sheet piles in order to assure proper

anchoring. Special attention is given to model and evaluating the interfaces, stress concentrations and the observed results.

Finite element analysis of an arch dam, emphasizing on the modelling of boundary conditions and connections

Mathias Berg Rønning and Lorents Flygansvær, NTNU, Norway

The goal for this thesis is to assess the importance of realistic modelling of boundary conditions and connections, when performing a nonlinear finite element analysis of a concrete dam. This is done by making four FE-models of the dam, where the models have an increasing compliance with the physical problem. The boundary conditions and connections effect on displacement-, crack-, and stress response are then studied. The displacement response were increased about 17 % from the most simplified to the most realistic model. The stress field and crack pattern varied locally near the connections, globally the effect were damped due to redistribution of forces allowed when using a nonlinear material model. The results showed that the most important modelling aspect is avoidance of all cohesion between dam and bedrock. Thus, a connected interface simulating no-slip-contact, or a real contact formulation, is preferred. Further, it is recommended that a list of criteria for realistic modelling are made based on the problem at hand, and the FE-model are checked for compliance with these.

Follow-up on Bubbledeck floor investigation with DIANA

Kris Riemens, ABT, The Netherlands

A Bubbledeck floor is a concrete floor structure that consists of a prefab bottom shell where plastic hollow spheres are placed on for weight reduction with in-situ concrete casted on top of it. Following the collapse of a parking garage at Eindhoven Airport in May 2017 where this type of floors has been applied, questions have arisen whether existing buildings with the same type of floors are sufficiently safe. The Dutch Ministry of Internal Affairs has subsequently published the information document: “Onderzoek constructieve veiligheid breedplaatvloeren in bestaande bouwwerken opgeleverd na 1999” (“Research structural safety precast concrete planks in existing buildings completed after 1999”). It has been established that several Bubbledeck floors in existing buildings in the Netherlands do not have the capacity to take up the occurring loads for which they have originally been designed. To gain insight into the structural behaviour of Bubbledeck floors and the risks they might impose, advanced non-linear calculations have been performed by ABT with the program DIANA using 2D and 3D models. It was shown that certain configurations of the floor system indeed lead to significant lower capacity than the originally calculated capacity. Strengthening measures have subsequently been sought, among these is the application of CFRP (Carbon Fibre Reinforced Polymer) strips. DIANA models were also made to check these strengthening measures with promising results. More recently, new experimental tests have been performed on specimens with CFRP strengthening measures, so that now also the DIANA models with CFRP strengthening measures can be checked and validated.

Cracking of restrained RC elements: validation of constitutive models and applications

Ferreira C.[1], Sousa C.[1], Azenha M.[2], Pimentel M [1], Faria, R.[1]
[1] CONSTRUCT, University of Porto, Faculty of engineering, Portugal
[2] ISISE, University of Minho, School of Engineering, Portugal

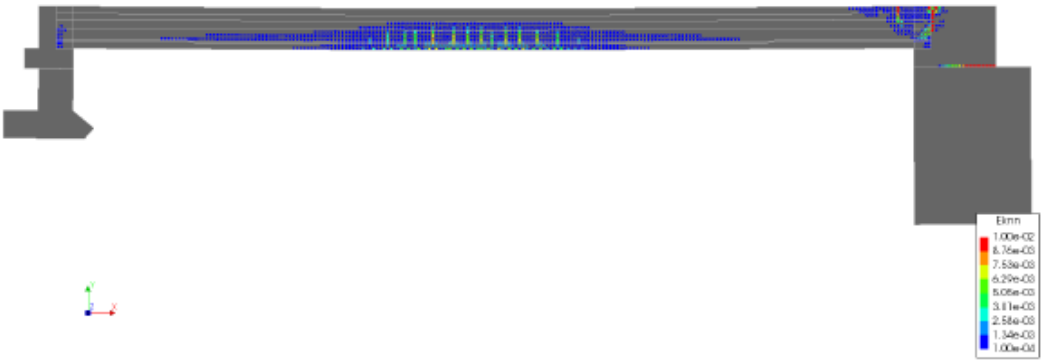
Concrete experiences important volume changes, due to cement hydration and autogenous shrinkage in the early ages and due to drying in the long-term. In massive structures, such as thick walls, dam spillways or nuclear vessels, the volume changes can lead to cracking, which might impair the structure function and service life. For a proper assessment of the structure behaviour, the calculation of the developed stresses is paramount. This is a complex

calculation process, because not only the volume changes have to be realistically quantified, but also the mechanical concrete properties, which vary rapidly in the early ages and keep evolving until the long-term, have to be truthfully simulated. Recently, new test setups have been developed for measuring the concrete stresses developed in the early ages. New approaches have also been proposed for the constitutive modelling of basic and drying creep effects.
This work presents a thermo-hygro-mechanical analysis methodology for calculation of the serviceability behaviour of restrained reinforced concrete structures, since the early ages until the long-term. Validation tasks, based on experimental results reported in the literature, are also discussed. The analysis framework is then applied to the study of the crack formation in a thick, restrained, slab-like structure.

Strength assessment of a concrete bridge: From 3D linear to 2D non-linear

Niels Kostense, Arcadis B.V. , The Netherlands

For the structural assessment of concrete bridges the typical approach is to adopt some simplifications regarding modelling the actual geometry. Common practice is to use a combination of beam, plate or shell elements to describe the structural behavior and only in rare cases solid elements are used. This modelling approach is established throughout the years due to the lack of computational power. Nowadays this problem has been tackled when it comes to linear-elastic analysis. The reason can more be found in the conventional methods for the capacity checks, which are based on internal forces of structural members rather than checking the capacity on element stress level.
In this project a prestressed girder viaduct with a compression layer cast on-site is analyzed with respect to bending moment capacity. An integral model with the bridge piers is used to adequately describe the rotational spring stiffness of the substructure. Geometry of the bridge is imported in DIANA IE. For the linear analysis a full 3D model with solid elements is adopted. From these internal forces the first capacity checks are performed. This indicated that redistribution of the bending moment between the mid-span and support was necessary to comply with the required load bearing capacity. The ability to do so is verified by a non-linear analysis. The practical approach that enabled reuse of the 3D results for the 2D physical non-linear analysis is discussed. Phased analysis combined with a so called double mesh model is adopted for the prefabricated girder and compression layer. The load bearing capacity is verified after several refinements by the GRF-safety format.

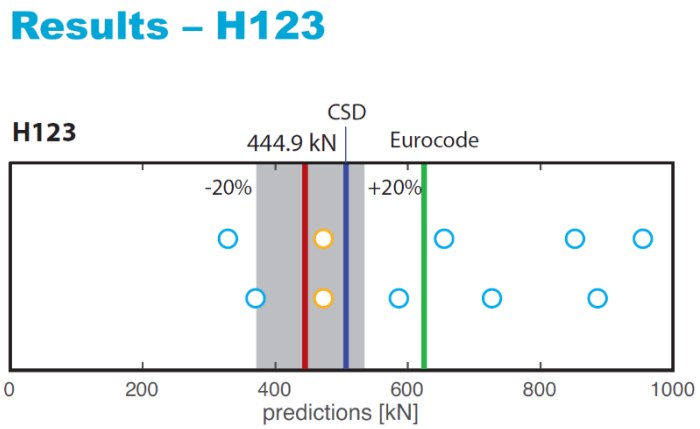


Other International User Meeting issues:

- **DIANA Users Wishes,**
- **DIANA New Features &**
- **Case Study Award**

3.4 Technical lecture evening December 10th, 2019

This evening was dedicated to the Contest 2019 H123 girder.



The results of the prediction of the Contest H123 girder showed a lot of variation in predicting the correct failure load, based on the NLFEA Guideline 2017, version 2.1. The reason of the different variations could be:
1) the setup of the contest around the H123 beam, or
1) the interpretation of the input data, or
2) the prediction of the FEA user/teams
The discussion will hopefully become clear at the end of the evening.
First an overview has been given with possible options compared to a basic model of the H123 girder, which are related to user choices with regard to nonlinear calculation, material properties, type of crack model, etc. Teams are classified according to the type of the choosen crack model, the options “Fixed” and “Rotated”. These two options are discussed in any case!
After the summer period, 9 teams (different companies and software) registered for a postdiction of the H123 girder failure. Since each team makes its own choice which options are further elaborated, it is not yet possible to indicate that in detail.
Each team has had the opportunity to give a short presentation on this evening on their own findings. After these presentations, a discussion about the results and possible follow-up actions has been held.

4. Financial aspects

Financial aspects 2019-2021

The annual reports for 2019-2021 were jointly submitted to the cash audit committee and approved. No activities took place in 2020 and 2021 and relatively few costs were incurred. It has therefore been decided not to collect any contribution in these years.

Before 2019, there was already a desire to reduce the equity capital to a minimum amount needed to guarantee the organization of an international User Meeting, in practical terms, this means that we want a minimum of approximately € 10.000,-- in the savings account.
In 2020 and 2021, costs were incurred for adjustments to and hosting of the website and for bank costs and general administration. By failing to collect a contribution, shareholders' equity has fallen to the level we wanted to achieve in these years. The aim is to maintain shareholders' equity at this level from 2022.

An International Users Meeting took place in 2019. The Users Meeting had its own budget, based on a contribution of € 2.775,-- from the association's treasury. Based on subsequent calculation, the contribution from the association has been adjusted to more than € 1.400,--. From next year it is the intention that the Users Meeting has a balanced budget, without a contribution from the association treasury. The annual contribution then covers the costs of administration, hosting and lecture evenings, while the costs of the Users Meeting are fully covered by the contribution of the participants.

Special yearly aspects

2019 Besides the aforementioned Users Meeting, there are a few details to report. Apart from the Users Meeting, the costs mainly consisted of administration (€ 1.500,--) and lecture evenings (€ 2.200,--).

2020 In 2020, the remainder of the conversion of the website will be invoiced and paid (€ 1.280,--). At the beginning of 2020, administration costs had already been incurred for a Lecture Evening and an Users Meeting, which were ultimately canceled due to the pandemic (€ 300,-- respectively (€ 750,--). General administration costs (€ 1.300,--) and hosting (€ 400,--) were also the largest cost items.

2021 In 2021, the costs consisted almost entirely of general administration costs (€ 765,--) and hosting (€ 385,--).

4.1 Financial aspects 2019

SAMENVATTING BIJ FINANCIEEL JAARVERSLAG 2019 / SUMMARY 2019

Balans / Balance sheet	31 december 2019	1 januari 2019
ACTIVA / ASSETS		
Vaste activa / Fixed assets	€ -	
	€ -	
Vlottende activa / Current assets		
Vorderingen / Outstanding debts	€ 1 615	€ 2 297
Liquide middelen / Liquid Assets	€ 18 958	€ 20 836
	€ 20 773	€ 23 133
Totaal activa / Total assets	€ 20 773	€ 23 133
PASSIVA / LIABILITIES AND EQUITY		
Eigen vermogen / Equity capital	€ 20 773	€ 22 341
	€ 20 773	€ 22 341
Kortlopende schulden / Current liabilities	€ 0	€ 791
	€ 0	€ 791
Reserveringen en voorzieningen / Reservations and provisions	€ -	
	€ -	
Totaal passiva / Total liabilities	€ 20 773	€ 23 133

Winst- en verliesrekening 2019 / profit and loss account 2019	debet / debit	credit
Netto omzet / net revenue	€ -	€ 11 950
Kostprijs van de omzet / cost of sales	€ 8 103	€ -
Bruto omzetresultaat / gross margin	€ -	€ 3 847
Personeelskosten / staff costs	€ 4 955	€ -
Algemene beheerskosten / general mangnt costs	€ 462	€ -
Financiële baten / financiell benefits	€ -	€ -
Financiële lasten / financiell charges		
Resultaat uit gewone bedrijfsvoering / result on ordinary operations	€ 5 417	€ -
Buitengewone baten en lasten / extr. income and expenses	€ -	€ 0
Resultaat (verlies) / loss	€ 1 569	€ -

Penningmeester DOV: / Treasurer DIANA Users Association	Accordering kascommissie: / Approval audit committee	
datum: 3 augustus 2022	datum:	datum: 25 augustus 2022
	Johan de Boon	Nynke Vollema

4.2 Financial aspects 2020

SAMENVATTING BIJ FINANCIEEL JAARVERSLAG 2020 / SUMMARY 2020

Balans / Balance sheet	31 december 2020		1 januari 2020	
ACTIVA / ASSETS				
Vaste activa / Fixed assets	€ -			
		€ -		
Vlottende activa / Current assets				
Vorderingen / Outstanding debts	€ 240		€ 1 815	
Liquide middelen / Liquid Assets	€ 16 344		€ 18 958	
		€ 16 584		€ 20 773
Totaal activa / Total assets		**€ 16 584**		**€ 20 773**
PASSIVA / LIABILITIES AND EQUITY				
Eigen vermogen / Equity capital	€ 16 584		€ 20 773	
		€ 16 584		€ 20 773
Kortlopende schulden / Current liabilities	€ -		€ -	
		€ -		€ -
Reserveringen en voorzieningen / Reservations and provisions	€ -			
		€ -		
Totaal passiva / Total liabilities		**€ 16 584**		**€ 20 773**

Winst- en verliesrekening 2020 / profit and loss account 2020	debet	credit
Netto omzet / net revenue	€ -	€ -
Kostprijs van de omzet / cost of sales	€ 0	€ -
Bruto omzetresultaat / gross margin	**€ 0**	**€ -**
Personeelskosten / staff costs	€ 2 360	€ -
Algemene beheerskosten / general mangnt costs	€ 1 834	€ -
Financiële baten / financial benefits	€ -	€ 6
Financiële lasten / financial charges		
Resultaat uit gewone bedrijfsvoering / result on ordinary operations	**€ 4 188**	**€ -**
Buitengewone baten en lasten / extr. income and expenses	€ -	€ -
Resultaat (verlies) / loss	**€ 4 188**	**€ -**

Penningmeester DOV: / Treasurer DIANA Users Association	Accordering kascommissie: / Approval audit committee	
datum: 3 augustus 2022	datum:	datum: 25 augustus 2022
	Johan de Boon	Nynke Vollema

4.3 Financial aspects 2021

SAMENVATTING BIJ FINANCIEEL JAARVERSLAG 2021 / SUMMARY 2021

Balans	31 december 2021	1 januari 2021
ACTIVA / ASSETS		
Vaste activa / Fixed assets	€ -	
	€ -	
Vlottende activa / Current assets		
Vorderingen / Outstanding debts	€ 64	€ 240
Liquide middelen / Liquid Assets	€ 15 214	€ 16 344
	€ 15 279	€ 16 584
Totaal activa / Total assets	**€ 15 279**	**€ 16 584**
PASSIVA		
Eigen vermogen / Equity capital	€ 15 279	€ 16 584
	€ 15 279	€ 16 584
Kortlopende schulden / Current liabilities	€ -	€ -
	€ -	€ -
Reserveringen en voorzieningen / Reservations and provisions	€ -	
	€ -	
Totaal passiva / Total liabilities	**€ 15 279**	**€ 16 584**

Winst- en verliesrekening 2021 / profit and loss account 2021	debet	credit
Netto omzet / net revenue	€ -	€ -
Kostprijs van de omzet / cost of sales	€ -	€ -
Bruto omzetresultaat / gross margin	**€ -**	**€ -**
Personeelskosten / staff costs	€ 765	€ -
Algemene beheerskosten / general mangnt costs	€ 541	€ -
Financiële baten / financial benefits	€ -	€ 0
Financiële lasten / financial charges		
Resultaat uit gewone bedrijfsvoering / result on ordinary operations	**€ 1 306**	**€ -**
Buitengewone baten en lasten / extr. income and expenses	€ -	€ 0
Resultaat (verlies) / loss	**€ 1 306**	**€ -**

Penningmeester DOV: / Treasurer DIANA Users Association	Accordering kascommissie: / Approval audit committee	
datum: 3 augustus 2022	datum:	datum: 25 augustus 2022
	Johan de Boon	Nynke Vollema

5. Publication lists

5.1 Publication list 2019

Aalto University, Maebashi Institute of Technology and Waseda University

Weiwei Lin[1], Nozomu Taniguchi[2], Teruhiko YodaA[3]:
[1] Aalto University, Espoo, Finland,
[2] Maebashi Institute of Technology, Gunma, Japan,
[3] Waseda University, Tokyo, Japan
A Long-life Maintenance Strategy for Existing Steel Railway Structures in Japan,
20th CONGRESS OF IABSE New York City 2019 *The Evolving Metropolis*, PG 1784-1790

Ane de Boer Consultancy, Delft University of Technology, Norwegian University of Science and Technology and Politécnico, Universidad San Francisco de Quito

Ane de Boer[1], Max A.N. Hendriks[2,3], Eva O.L. Lantsoght[2,4]:
[1] Ane de Boer Consultancy, Arnhem, the Netherlands
[2] Delft University of Technology, Delft, the Netherlands,
[3] NTNU, Trondheim, Norway
[4] Politécnico, Universidad San Francisco de Quito, Quito, Ecuador
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Dimitrios F. KARYPIDIS[1], Mats GRANATH[1], Carlos G. BERROCAL[1], Peter SIMONSSON[2], Rasmus REMPLING[1]:
[1] Chalmers University of Technology, Gothenburg, Sweden and
[2] Swedish Transport Administration, Luleå, Sweden
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[1] Faculty of Civil Engineering, Cracow University of Technology, Krakow, Poland
[2] non-associated
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F. Lo Monte[1], R. Felicetti[1], A. Meda[2], A. Bortolussi[3]:
[1] Politecnico di Milano
[2] Univ. degli studi di Roma Tor Vergata
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[1] TNO
[2] Utrecht University
[3] Shell Global Solutions
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[2] Univ. Colorado
[3] Sharif Univ. of Technology:
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[1] ISISE, University of Minho, Guimarães, Portugal
[2] CEris, ICIST and FCEE, University of Madeira, Funchal, Portugal,
Behaviour of RC structures strengthened with prestressed CFRP laminates: a numerical study. Association for Bridge and Structural Engineering Symposium Guimarães, Portugal, March 27-29, 2019 Towards a Resilient Built Environment Risk and Asset Management, pp. 276-283

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Dimitrios Dermentzoglou 1 , Myrta Castellino 2 , Paolo De Girolamo 2 , Maziar Partovi 3 , Gerd-Jan Schreppers 3 and Alessandro Antonini 1,*
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Department of Civil Engineering, Katholieke Universiteit Leuven (KU Leuven), Kasteelpark Arenberg 40, Heverlee, 3001 Belgium
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M.J. Osmolska[1,2], T. Kanstad[2], M.A.N. Hendriks[2,4], G. Markeset[1]
[1] Department of Civil Engineering and Energy Technology, Oslo Metropolitan University (OsloMet—Storbyuniversitetet), 0166 Oslo, Norway
[2] Department of Structural Engineering, Norwegian University of Sciences and Technology (NTNU), 7491 Trondheim, Norway
[3] Norwegian Public Roads Administration (NPRA), Directorate of Public Roads, 7030 Trondheim, Norway
[4] Faculty of Civil Engineering and Geosciences, Delft University of Technology (TU Delft), 2628 CN Delft, The Netherlands
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[1] ISISE & IB-S, Department of Civil Engineering, University of Minho, Azurém, Guimarães, Portugal.
[2] Division of Structural Engineering and Bridges, KTH Royal Institute of Technology, Stockholm, Sweden.
[3] Department of Materials Engineering, Applied Mechanics and Construction, University of Vigo, Vigo, Spain.
[4] Faculty of Engineering and Technologies, University Lusiada – Norte, Famalicão, Portugal.
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A contest on modelling shear behaviour of deep concrete slab strips using nonlinear FEM
Yuguang YANG[1], Ane DE BOER[2], Max A.N. HENDRIKS[3]
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