Context International Contest

At an international workshop on shear force held in Rotterdam, the Netherlands, 2007,ULS predictions of three different concrete girder experiments were presented. The results prepared by six teams using six different nonlinear concrete software packages showed a large scatter. Also the prediction of the crack patterns at ULS and SLS load levels showed a large scatter. Research on the developing of a "Guideline for nonlinear analysis of concrete girders" was therefor started. The *fib* Model Code 1990 was the basic document when Peter Feenstra started the development of the guideline. From 2010 the draft version of the Model Code 2010 was used. Today the MC2010 and the Eurocode2 both allow to check the design capacity of concrete objects by nonlinear analysis with so-called safety formats. Validation of the guideline is done by simulations of old and new experiments. To verify human and software effects, several people were involved in this project and two commercially available software packages were used. Finally the guideline was published in May 2012 and used in out-sourcing engineering work for re-examinations of existing concrete structures in the Netherlands. To verify that this guideline is also acceptable for a larger group of international end-users and other software packages, a prediction contest of T-shaped prestressed girders is setup, based on the content of the guideline. The four almost similar precast prestressed girders have been manufactured in May of 2012 and used for other tests, which were not damaging the girders itself. The tests of the girders by Sebastiaan Ensink will take place from the second half of August until October 2014 in the Stevin Laboratory of Delft University of Technology.

The Shear Force Workshop, with contributions of the participants, is planned in the first week of November 2014 at the University of Parma. Beatrice Belletti and Cecilia Damoni, members of this university, were strongly involved in the validation of the guideline, in close cooperation with Jan Rots, Max Hendriks and Joop de Uijl from the Delft University of Technology. At the end of the workshop, there will be a winner!

Winner Contest: € 500,-

Participation Data

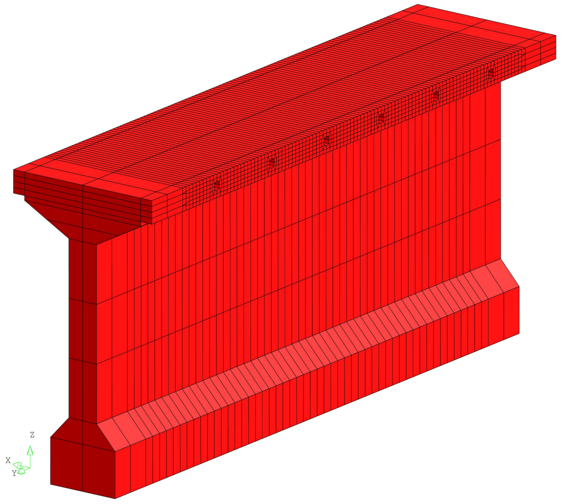
to be sent to the secretariat a.s.a.p.

First name ....
Last name ....
Company/University ....
Address ....
....
Country ....
Email ....
Software package ....

Final submission prediction: 15 August 2014

INTERNATIONAL CONTEST

SHEAR CAPACITY OF A LARGE T-SHAPED PRESTRESSED CONCRETE GIRDER



Workshop with predictions and experimental results

University of Parma, November 2014

Initiative

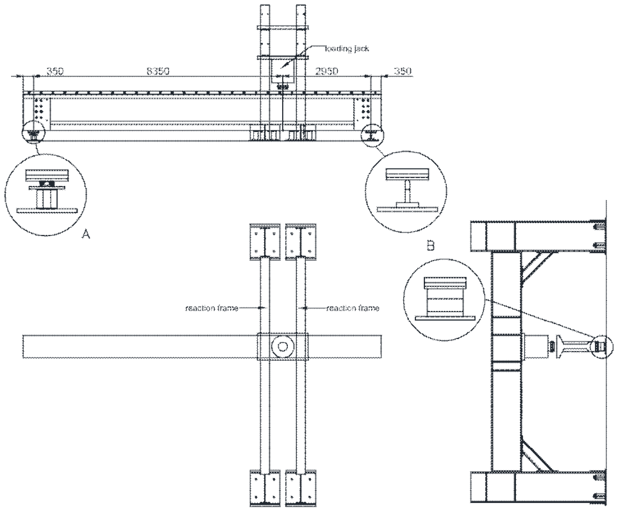
Cor van der Veen, Delft University of Technology, the Netherlands
Ane de Boer, Dutch Ministry of Infrastructure and the Environment, the Netherlands
Max Hendriks, Delft University of Technology, the Netherlands & NTNU, Norway
Beatrice Belletti, University of Parma, Italy

Secretariat

Email: info@dianausers.nl
Further Info Contest website: www.dianausers.nl

Test setup

The test setup is given in the figure below. The loading jack will be positioned at a distance of 2950 mm from the center of the support (support type B). The dimensions and material properties of the loading jack and the supports are given in appendix A (downloadable from the website).



QUESTIONS FOR INTERNATIONAL CONTEST
(BASED ON THE CONTENT OF THE GUIDELINE)

When participating the international contest, the following questions need to be answered:

1. Maximum (and minimum) load at failure.
2. Failure mechanism.
3. Cracking pattern at SLS (at 75% of failure load) and ULS.
4. Crack width at SLS (at 75% of failure load).
5. Load-displacement diagram at position of the load.

PRINCIPAL PROPERTIES

There are two types of T-shaped girders which differ only in width of the top flange (750 mm versus 875 mm).
All other properties such as concrete class, amount of prestressing and reinforcement are the same for each girder. The precast prestressed girders have been manufactured in May of 2012.
Note: all material properties are designated according to Eurocode 2.

Available drawings (see appendix A, downloadable from the website):

girder code	drawing numbers			
CODE101	100	S100	101	W100
CODE201	200	S200	201	
CODE301	300	S300	301	
CODE401	400	S400	401	

Note: the relevant parts of the drawings have been translated from Dutch to English.

Some basic data of T-shaped bridge girders:

girder code	type	height	width of top flange	length	concrete class	self-weight of girder
		[mm]	[mm]	[mm]		[kN]
CODE101	mid-beam	1300	750	12000	C53/65	110.75
CODE201	edge-beam	1300	875	12000	C53/65	114.55
CODE301	mid-beam	1300	750	12000	C53/65	110.80
CODE401	edge-beam	1300	875	12000	C53/65	114.65

In the top flange, in transverse direction, empty ducts are present (Ø45 mm c.t.c. 400 mm). At the ends of the girder in the thickened web also some empty ducts are present (8x Ø65 mm).

Prestressing

Each girder is pre-tensioned using 24 strands Ø15.7 mm (150 mm^2 per strand) with steel type FeP1860. The measured force per strand before casting of the concrete is 214 kN. However this force needs to be reduced (~8-9%) in order to take into account the elastic deformation of the cross-section to determine the actual prestressing force at t=0. The mean cubic concrete strength at time of prestressing was determined at $f_{cm,cube}$ = 54 N/mm^2.

Reinforcement

The shear reinforcement consist of stirrups (Ø10 mm) with a c.t.c. distance of 120 mm and 80 mm (except for thickened web at both ends) see appendix B (downloadable from the website), drawings 101, 201, 301, 401 and W100. For manufacturing of the reinforcement cage there is only some light longitudinal reinforcement present (10 x Ø8 mm). All reinforcement has steel type B500A (≤Ø6) and B500B (≥Ø8).

Concrete properties

The mean cubic concrete strength ($f_{cm,cube}$) is continuously monitored and checked by the manufacturer, see appendix C (green line for average, downloadable from the website) which includes the time of casting (May 2012). The mean cubic compressive strength after 28 days is $f_{cm,cube}$ = 83 N/mm^2 and the characteristic cubic compressive strength is $f_{ck,cube}$ = 77 N/mm^2. Moreover, the concrete mix is self-compacting concrete.

Also six 150x150x150 mm^3 cubes have been tested after about 9 months. Three cubes were tested in compression and three in splitting. The results are given in the table below. The testing of the girders will take place from the second half of August until October 2014.

number	test	$f_{cm,cube}$ [N/mm^2]	$f_{ctm,sp}$ [N/mm^2]	age [days]
1	compression	89.92		273
2	compression	91.62		273
3	compression	87.95		267
4	splitting		6.15	273
5	splitting		6.37	273
6	splitting		6.39	273