

Projet National :
COMPORTEMENT ET EVALUATION DES OUVRAGES SPECIAUX
vis-à-vis de la fissuration et du retrait (www.ceosfr.org)
Behaviour and Assessment of special construction works
concerning cracking and shrinkage

ConCrack international benchmark
“Control of Cracking in R.C. Structures”
www.concrack.org contact@concrack.org

Context

Cracking is an inherent phenomenon to concrete structures. However, its control is essential in order to ensure serviceability of structures throughout time and therefore it is a major concern for durability and sustainability.

The French national programme CEOS.fr (whose name can be translated as : “Behaviour and assessment of special construction works concerning cracking and shrinkage”) aims at dealing with this issue, particularly for special works (specific use, specific shape and size, specific requirements for loading or durability ...), coupling numerical modelling and experimental approaches and those elaborated by engineers/practitioners.

This programme is the framework set up by French professionals involved in Building and Civil Engineering works to make a decisive step in the predictive capacity of models to describe the states of cracking, with the final objective to develop tools for designers and to give grounds to the evolution of standards.

Based on the experiment driven from CEOS.fr, an international benchmark is organised dealing with the modelling of the behaviour of the tested mock-ups (monotonic and cyclic loading – prevented or free shrinkage).

Base of the study

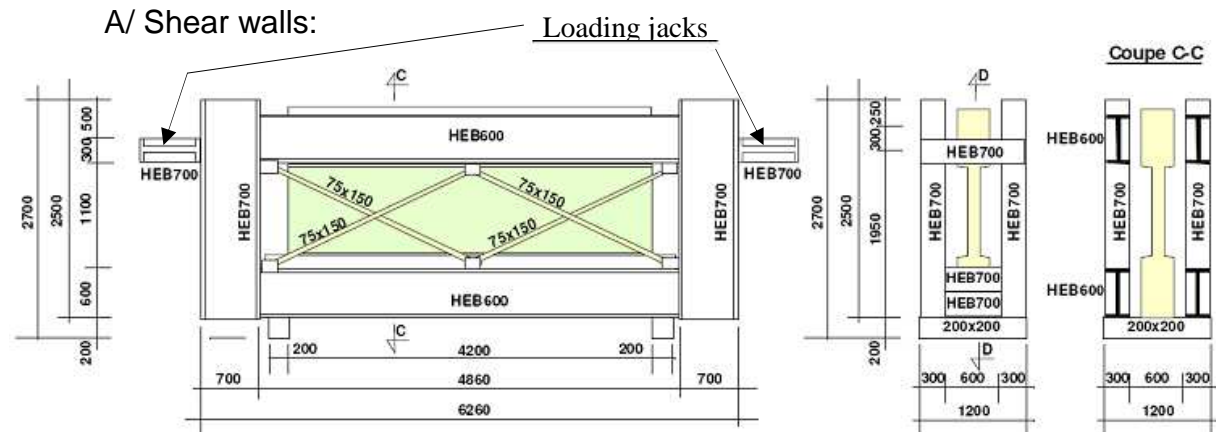


Figure 1: Shear wall specimens – left: wall on its testing bench - right: sectional elevation of the wall

The aim of this sub-program is to get data on cracking mechanism and pattern when a wall is submitted to monotonic or alternate loading applied within its symmetry plane (figure 1). The overall dimensions selected for the testing samples are 4.20 m long by 1.50 m high and 0.15m thick (general scale is 1/3rd). Other specifications are:

- concrete category: C40, with one variant of C25
- reinforcement ratio: 0.5% to 1% in two layers
- limited reinforcement resistance to accommodate with the bench loading capacity (4 MN)
- fully instrumented (external optical extensometers, internal temperature and displacement optical sensors, strain gauges on reinforcement bars and kinematic field measures will be performed by means of image correlation during the test)

Two loading configurations are selected for the purpose of this benchmark (same geometry, same reinforcement scheme):

- 1/ specimen under *monotonic* shear loading
- 2/ specimen under *cyclic* shear loading

B/ Large Beam specimens:

Large-scale specimens (L=6.10 m, l=1.60 m, h=0.80 m) have been designed to explore the influence of different "second order" parameters. Once cast, these are let to harden freely, slightly protected from major weather conditions, for about four weeks. Then they are placed on a bending bench (figure 2), tightened to it by prestressing bars and brought to bending limit stage by two rows of four 100 T jacks.

Two types of specimens are considered (both are selected for the benchmark):

- 3/ large beam specimens *loaded in bending after free shrinkage* (figure 2 & 3)
- 4/ large beam specimens with *restrained shrinkage* (figure 4)

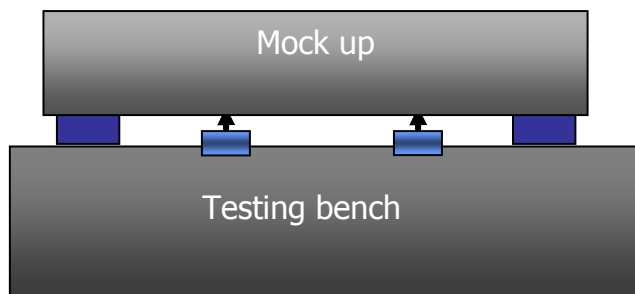


Figure 2: Large beam, scheme of the test

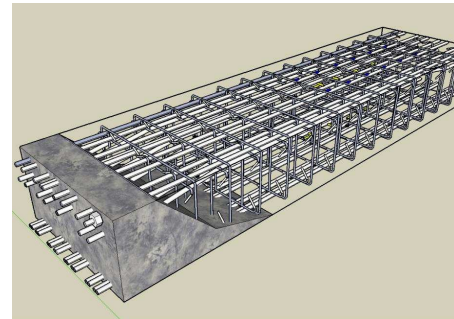


Figure 3: geometry and reinforcement scheme for the free shrinkage specimens

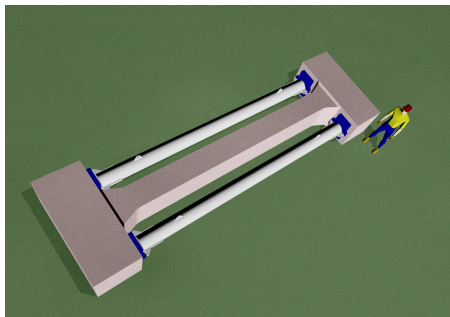


Figure 4: I shape geometry for the restrained shrinkage specimens and restrained system

Specimens are fully instrumented, externally and internally:

- During the hardening stage: temperature sensors, vibrating cord sensors for local internal and external deformation, internal and external optical fibre sensor, electrical strain gauges placed on reinforcement bars.
- During the loading phase: load and displacement sensors, acoustic sensors and an image correlation technique on a lateral face.

For each specimen, all materials parameters will be provided (elasticity, strength, thermal parameters, etc) and any available data will be given on loading conditions (boundary conditions, loading programme, etc).

Rules of participation for the benchmark

A complete file will be delivered next June detailing the different experiments and giving the data for each specimen (geometries, materials parameters, experimental specifications, loading programmes...). This file will be sent (and/or available on the secure web site www.concrack.org) to research groups who have applied for the benchmark (see the form bellow). Candidates are asked to choose between 1, 2 or more of the cases proposed (2 is strongly suggested). Afterwards the program is organised in three stages.

1- Blind stage (15 June- 15 December 2010)

Simulation of the behaviour of the loaded specimens will be required 6 months after the input data files are given to participants.

2- Feed-back stage (January – April 2011)

In order to better calibrate the blind calculations all recorded and processed experimental data are provided to competitors (upon reception of analysis reports). At the same time, organizers will prepare a synthesis of the results issued from the blind stage (only anonymous comparisons will be included in the synthesis report).

3- Restitution workshop (May - June 2011)

In order to present the whole results (synthesis of the blind simulations and comments issued from the feed-back stage) a “restitution ConCrack workshop” will be organised (planned May-June 2011 in Paris). The benchmark participants will be invited to present and comment their works.

Participation

Participation is open to research or engineering groups excluding people involved in the CEOS.fr programme. *To apply, all you need to do is to fill in and return the form below.*

International benchmark participation form

Control of cracking in R.C. Structures (www.concrack.org)

Surname & First name :

University / Company :

Address :

.....

E-mail :

Phone and Fax numbers :

I apply for the international CEOS.fr benchmark as presented above : YES - NO

If yes, my interest is related to (cross the boxes) :

1/ shear wall under *monotonic* shear loading

2/ shear wall under *cyclic* shear loading

3/ large beam specimen *loaded in flexion (monotonic loading after free shrinkage)*

4/ large beam specimen with *restrained shrinkage*

I am interested to attend the “restitution workshop”: YES - NO

Please return this form as soon as possible (before 13 June 2010) to:

Prof. Jacky Mazars, Lab. 3S-R, BP 53, 38041 Grenoble cedex 9 – France

Fax : +33 4 76 82 70 43 - E-mail : contact@concrack.org