SSNV214 - Law of behavior BETON_RAG : cyclic loading of a concrete test-tube

Summary:

This document presents a test making it possible to validate the capacities of the model of behavior BETON_RAG, used to consider the behavior long-term of the structures affected by the reaction alkali-aggregate. One simulates the behavior of a test-tube under cyclic loading in simple traction.

1 Problem of reference

The loading consists of the application of two cycles of loading in traction then of two cycles of loading in compression.

1.1 Geometry

The test is pressed on a unit cubic finite element.

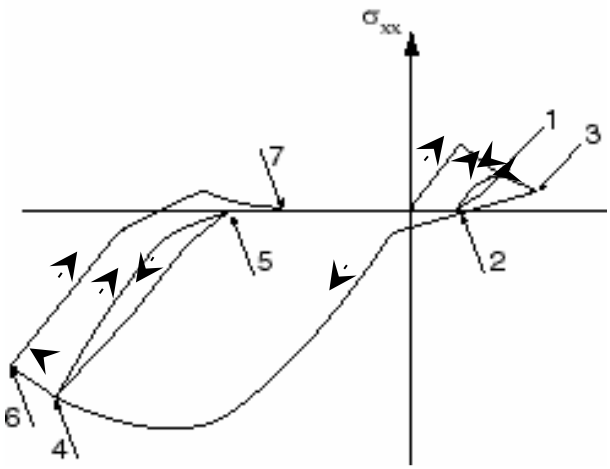
1.2 Property of materials

Young modulus: $E=32000\ MPa$
Poisson's ratio: $\nu=0.2$
Tensile strength: $\sigma_{ft}=3.0\ MPa$
Compressive strength: $\sigma_{fc}=38.3\ MPa$
Deformation with the peak of compression: $\varepsilon_{fc}=2,0.10^{-3}$
Deformation with the peak of traction: $\varepsilon_{ft}=1,8.10^{-4}$

1.3 Boundary conditions and loadings

Control in displacement

1. traction $\epsilon_{xx}=1,4.10^{-4}$
2. relaxation (with $\sigma_{xx}=0$)
3. traction $\epsilon_{xx}=1,0.10^{-3}$
4. compression $\epsilon_{xx}=-4,0.10^{-3}$
5. relaxation (with $\sigma_{xx}=0$)
6. compression $\epsilon_{xx}=-5,0.10^{-3}$
7. traction $\epsilon_{xx}=0$



The answer of the model is given Figure 2-1.

2 Reference solution

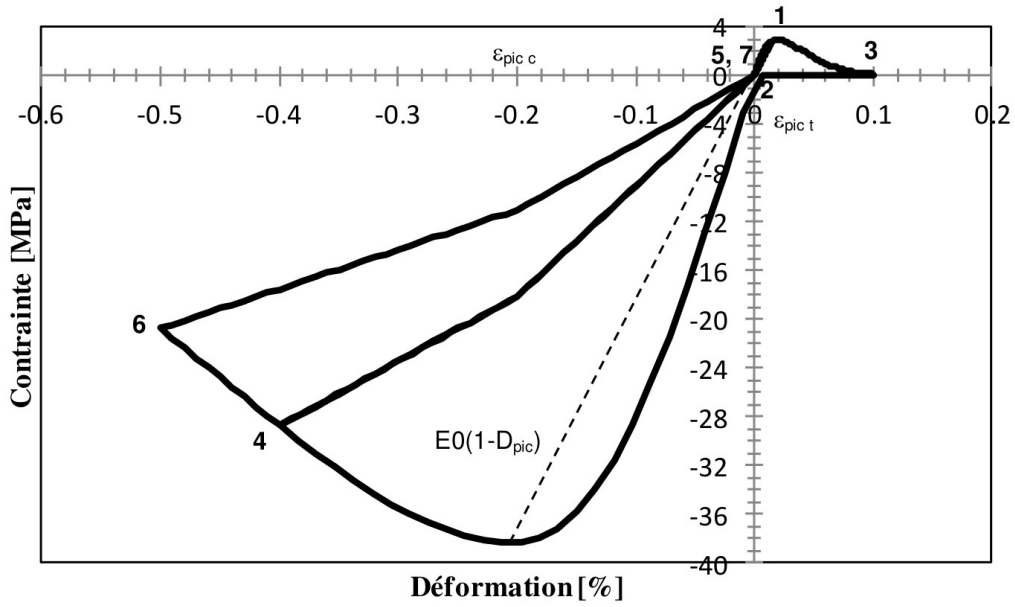


Figure 2-1 : Simulation of the behavior of the concrete under uniaxial cyclic loading

This test makes it possible to validate the capacity of the model to reproduce a uniaxial cyclic loading. Piloting in imposed deformation makes it possible to traverse the totality of the curve, including the lenitive part. D_{pic} corresponds to the damage with the peak of compression. The classification from 1 to 7 corresponds at the various stages of loading quoted with the §1.1.3. No unrecoverable deformation is visible since the part of the model tested is elastic endommageable.

3 Modeling A

3.1 Characteristic of modeling

The problem is modelled in 3D.

3.2 Characteristic of the grid

1 mesh HEXA8

3.3 Sizes tested and results

Identification	Moments	Type	Reference	Tolerance
$SIXX(N6)$	1.0	external source	3.0	7.0%
$SIXX(N6)$	3.0	external source	0.0E+00	0.20
$SIXX(N6)$	7.0	external source	0.0E+00	1.0E-05

4 Summary of the results

Results calculated by *Code_Aster* check the not-regression.