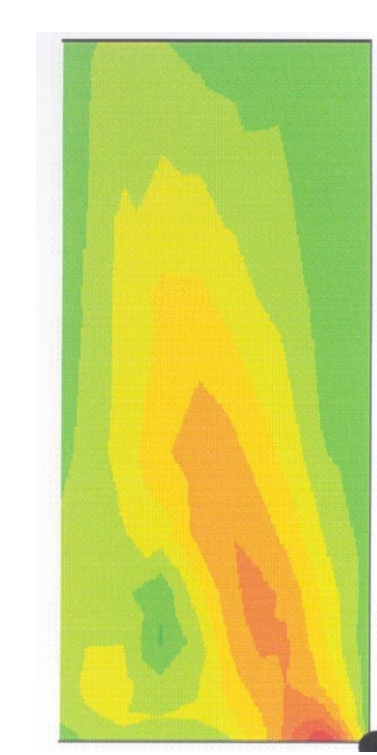
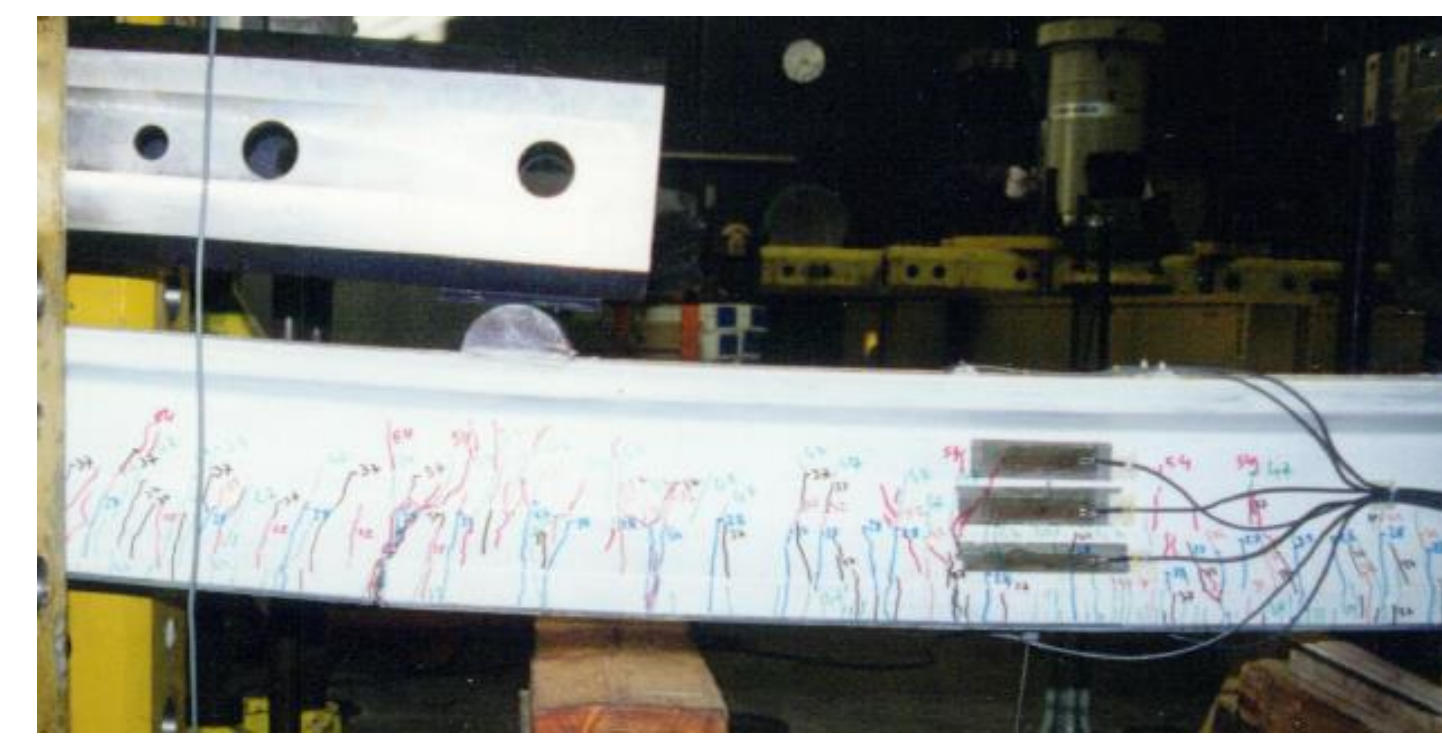
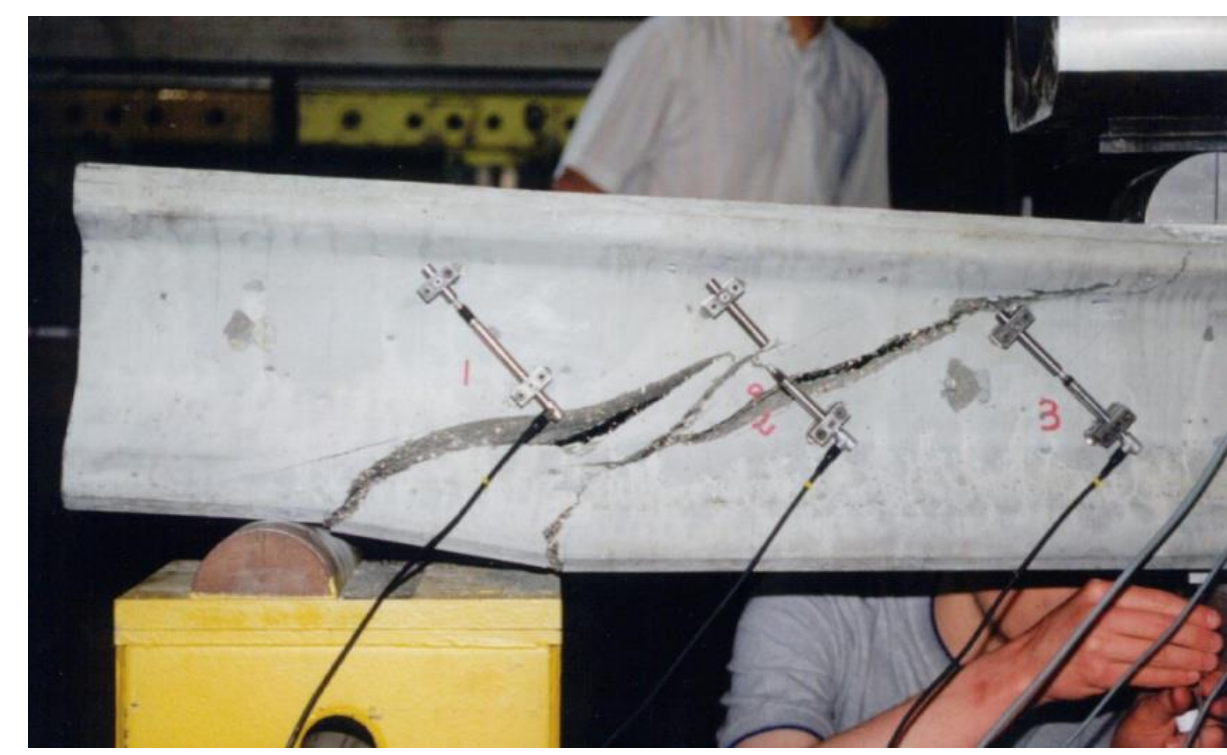




Ultra-High Performance Fiber-Reinforced Concrete (UHPFRC): Research and Standards Development in support of easy and safe Applications from 1997 to 2020

François TOUTLEMONDE, Pierre MARCHAND, Florent BABY, Pierre ROSSI, Nicolas ROUSSEL, Luca SORELLI, Thomas GUENET, Amaury HERRERA, Benjamin Terrade et al., Materials and Structures Department

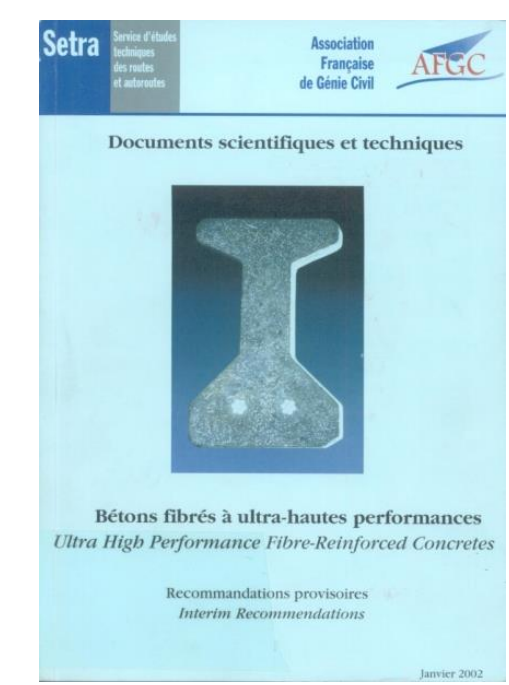
Qualification of first industrial applications



Tests of beams for Cattenom NPP cooling tower, 1997 – first design rules for EDF

Prototype design of high integrity containers, Sercombe 1997

Application to bridge engineering



First AFGC Recommendations 2002 revised 2013



UHPFRC - timber- CFRP
Prototype lightweight bridge
NR2C project, 2006



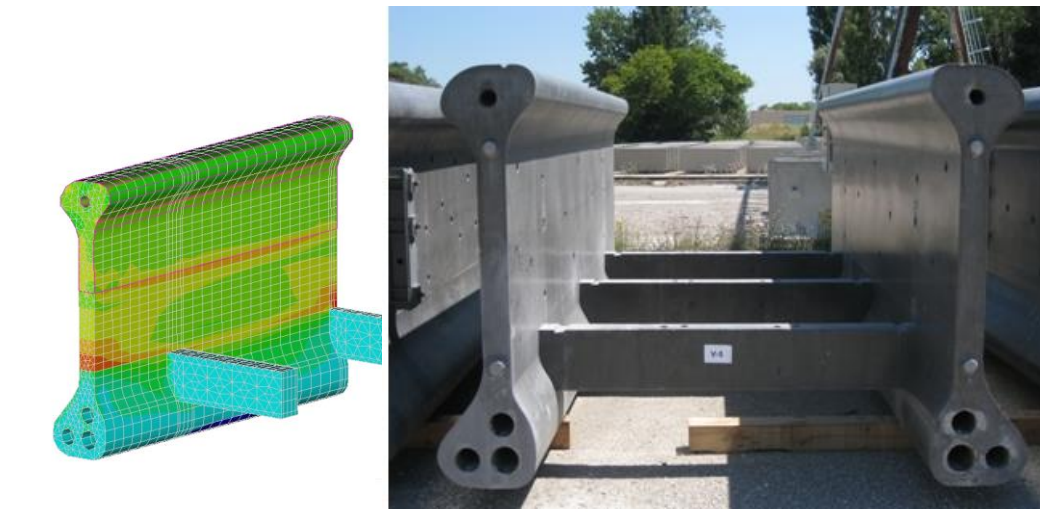
Transversally pretensioned
Waffle-slab bridge deck
segments
Assembled by post-tension
MIKTI project, 2003-2008



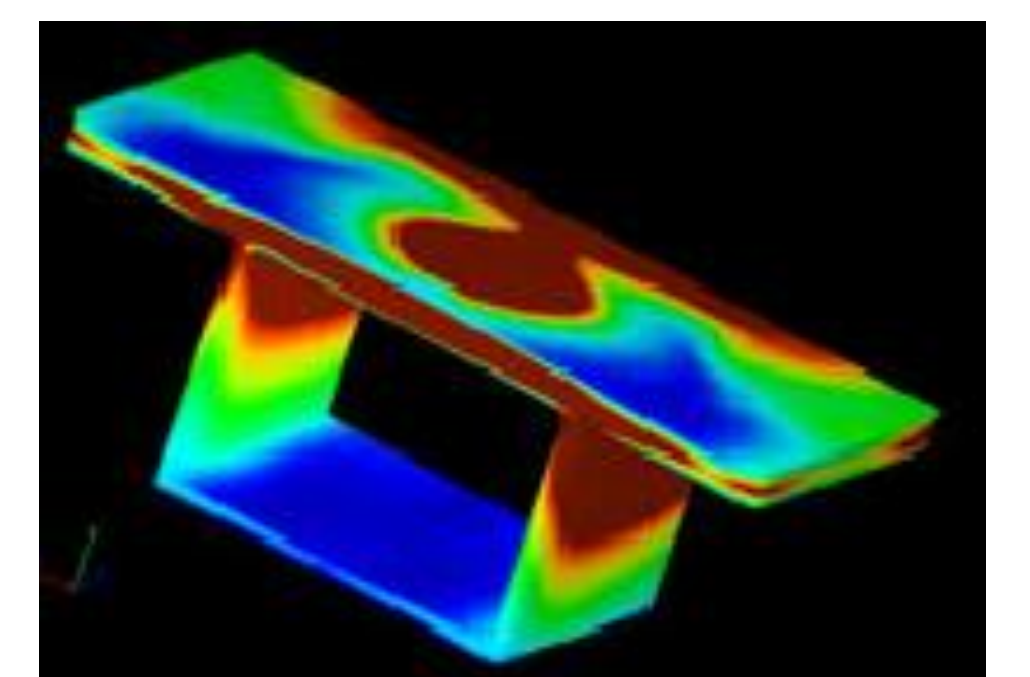
Concrete deck coating
using strain-hardening UHPFRC
ARCHES project, 2009

Advanced model for prevention of early age thermal cracking
segments of Passerelle des Anges footbridge, 2008

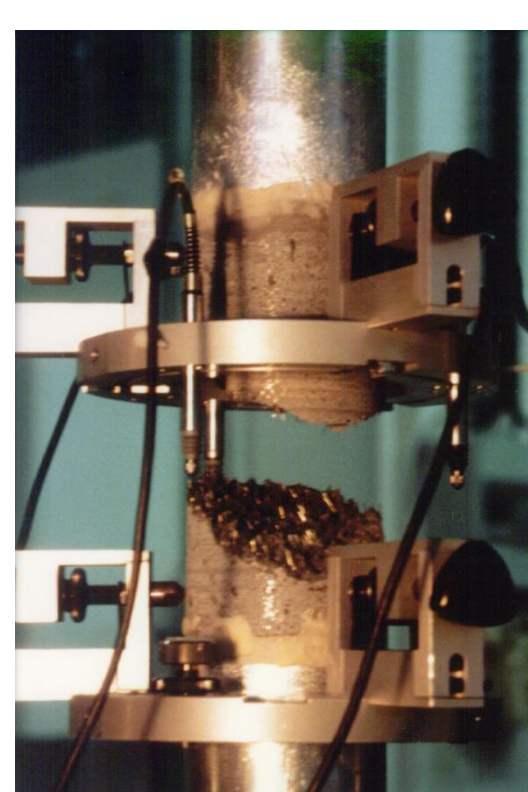
Strengthening of orthotropic
steel bridge decks
Orthoplus project, 2007-2012
Application on Illzach Bridge,
2011



Control of fiber orientation
due to casting, La Chabotte
segmental bridge, 2005



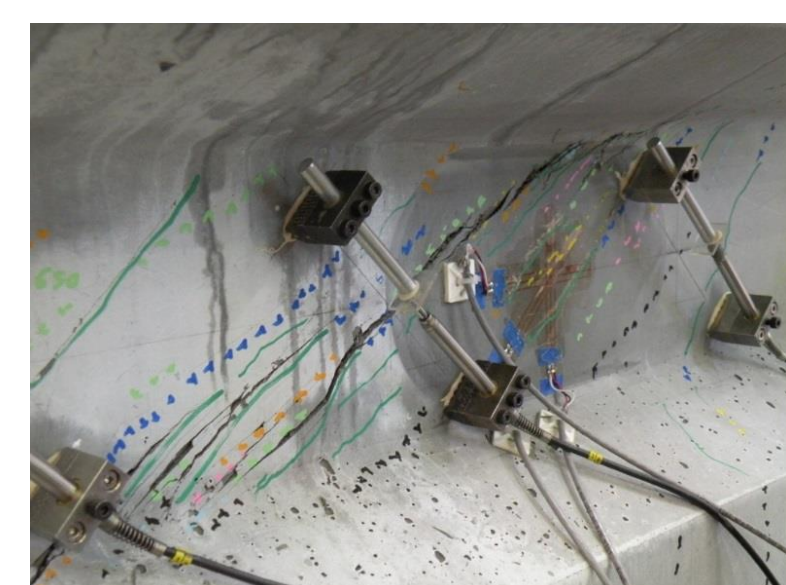
Application to bridge engineering



Characterization in direct tension
at different strain rates, 1996

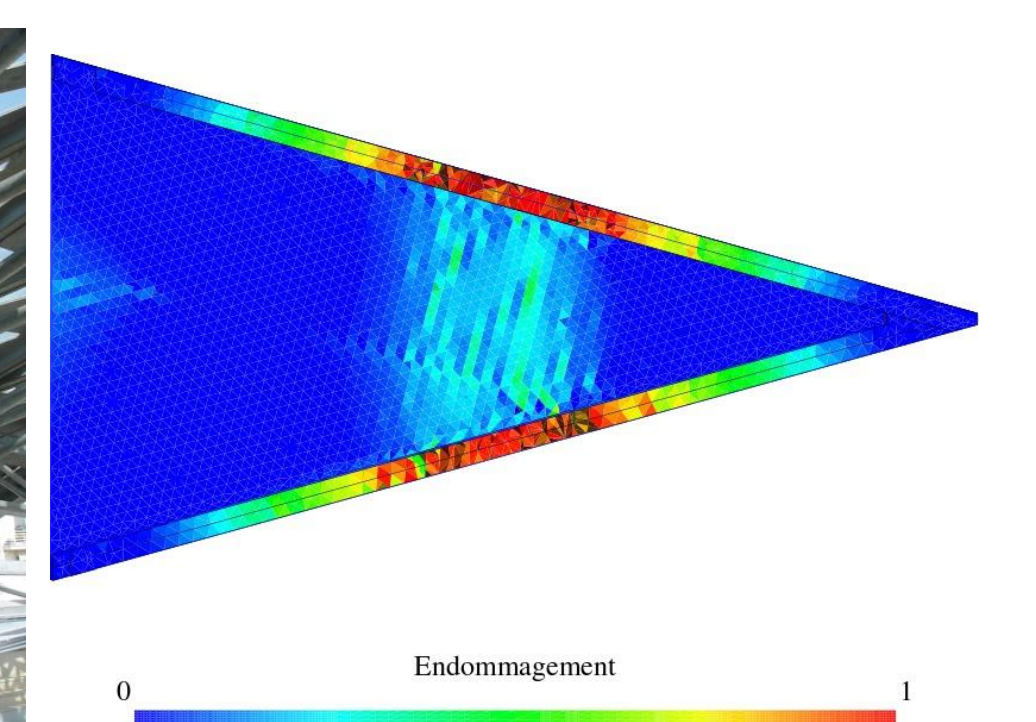
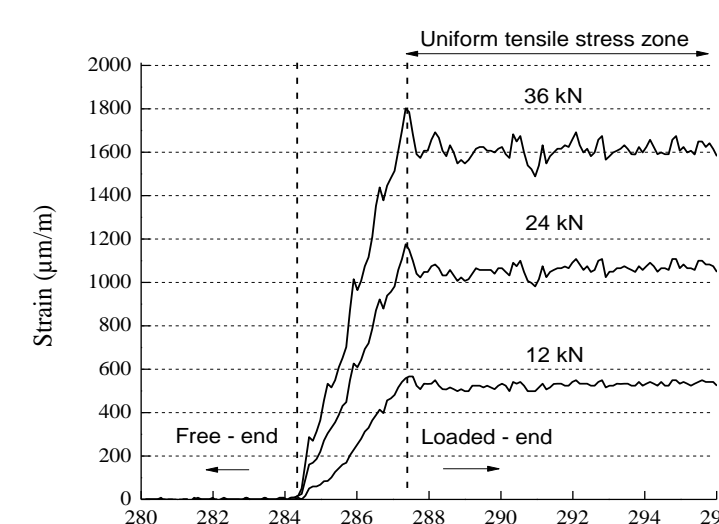


Shear tests on
prestressed / reinforced
beams for validating
shear design provisions,
2009 - 2017



Punching shear
MIKTI project, 2006

Direct anchor length identification
in a re-bar pull-out test
equipped with optic fiber
BADIFOPS project, 2012



Ductility analysis for a two-reinforced ribbed thin UHPFRC
triangle plate
(following implication in Jean Bouin project), Guénet 2016



Standards development in support of applications

NF P 18-470 and
NF P 18-710
published in 2016
NF P18-451 and
revised NF EN 13369
published in 2018

NF P 18-710: Design of
UHPFRC structures (UHPFRC
with steel fibres)
(National addition to EN 1992)

Design of non
structural
UHPFRC
elements

NF P 18-470: UHPFRC
(specification, performance,
production and conformity)
Type S UHPFRC for structures
Type A or Z UHPFRC for non
structural or architectonic elements

TEST
procedures in
normative
annexes
of NF P 18-470

NF P 18-451: Execution of
UHPFRC structures

Execution of non
structural or
architectonic
UHPFRC elements

Common rules for
precast products

Special rules for
precast products



ATEX committee
« La Marseillaise »

Qualification of
testing protocol
and data analysis:
Flexural prism test
vs. direct tensile
test
2010-2011

Transfer tests for qualification
of post-tension anchorage kits
adapted to UHPFRC
without passive reinforcement
2003-2007

UHPFRC 2009, 2013 and
2017: F. Toutlemonde
chair of the scientific
committees Promotion
through ACI awards
program



Expertise and promotion

Confirmation of UHPFRC durability on-site:

Investigations on Cattenom and Bourg-lès-Valence samples 2008, 2013, 2020