RILEM 2011

RILEM

International Union of Laboratories and Experts in Construction Materials, Systems and Structures,

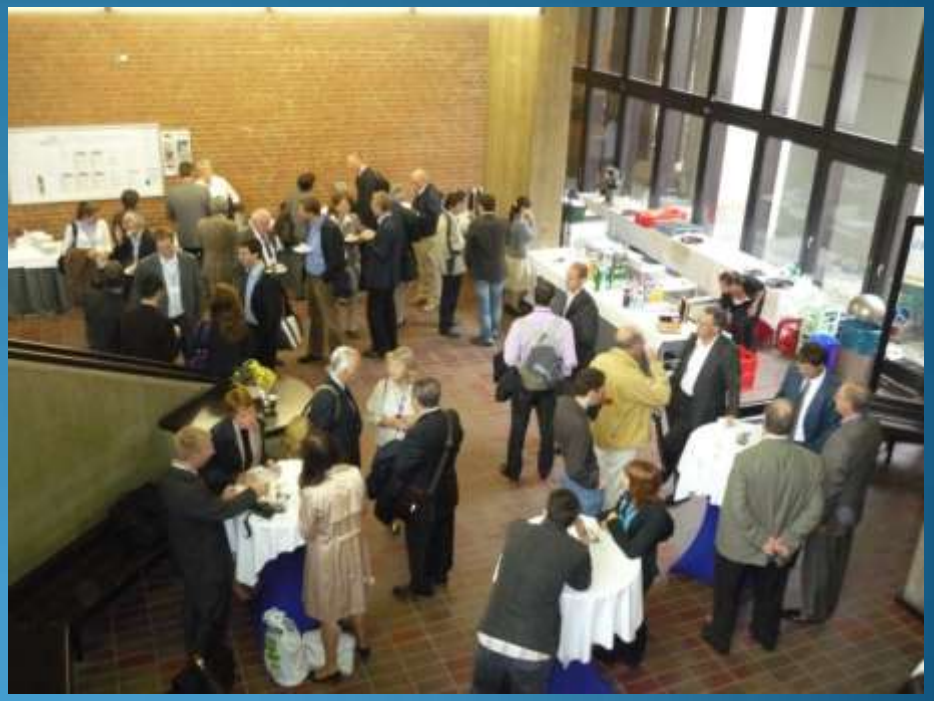
Réunion **I**nternationale des **L**aboratoires et **E**xperts des **M**atériaux, systèmes de construction et ouvrages

Foundation: June 1947

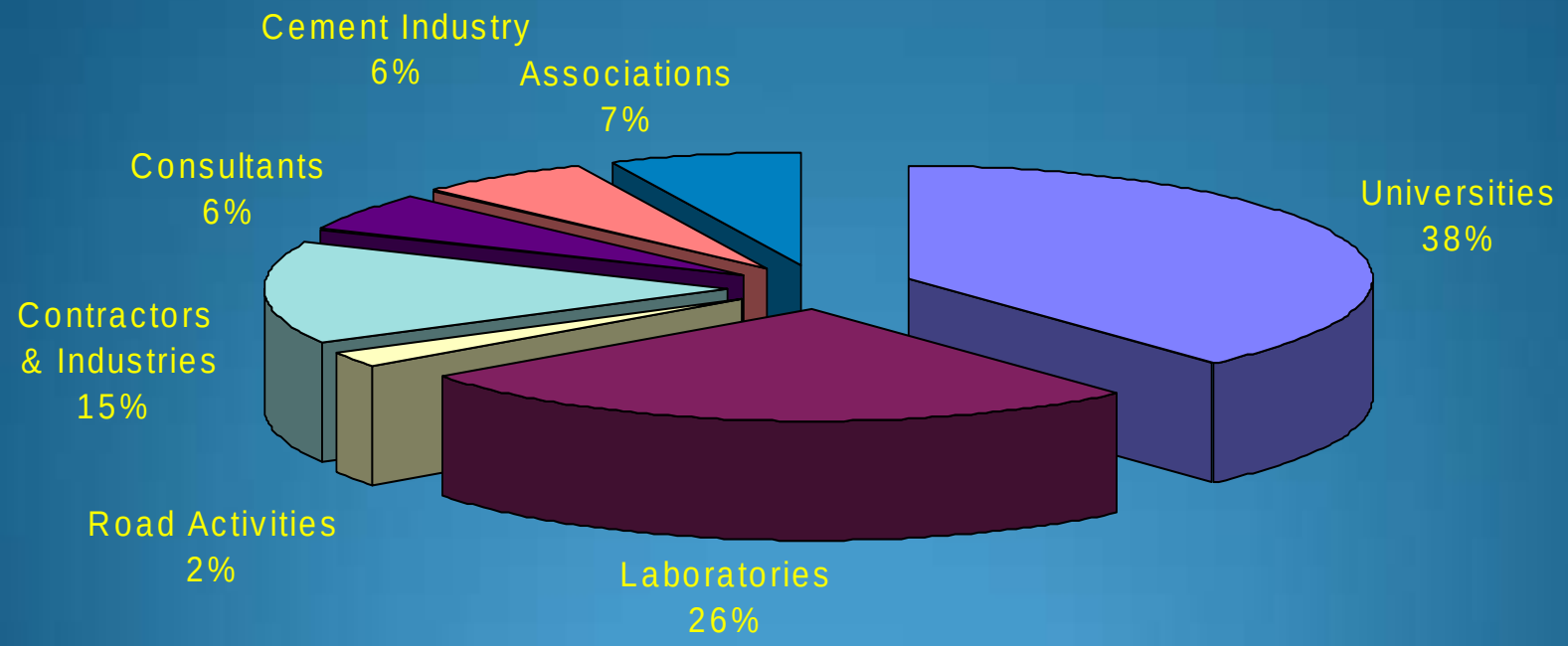
Objective: to promote the scientific exchange of information between experts world- wide

An international network of technical experts advancing the knowledge in materials and structures

- More than1350 experts involved
- More than 800 members active in our Technical Committees (TC)



RILEM Membership



Professional Affiliation

Meetings and Technical Exchanges

- RILEM Annual Week
  - 2011 Hong Kong
  - 2012 Cape Town
  - 2013 Paris
  - **2014 Sao Paulo (in combination with 13 DBMC)**

Meetings and Technical Exchanges

- RILEM Annual Week
- International RILEM events: workshops, seminars, conferences
- Technical Committees (TC) meetings
- PhD’s workshops

Producing the know-how

Technical Committees work typically results in:

- Recommendations on test methods
- State-of-the-art report on the subject treated by the TC

Scope of Technical Committees

- Mechanical Performance and Fracture
- Test Methods, Materials Characterization and Processing
- Service Life and Design
- Durability and Deterioration Mechanisms
- Bitumen, Masonry and Timber

More than 35 Technical Committees

- These committees are organized in 5 Clusters:
  - Cluster A (Convener: Prof. Wolfgang Brameshuber): Mechanical Performance and Fracture
  - Cluster B (Convener: Dr. Nicolas Roussel): Test Methods, Materials Characterization and Processing
  - Cluster C (Convener: Prof. Lars-Olof Nilsson): Service Life and Design
  - Cluster D (Convener: Prof. Nele de Belie): Durability and Deterioration Mechanisms
  - Cluster E (Convener: Prof. Manfred N. Partl): Bitumen, Masonry and Timber

- 6 new TCs approved in 2011

  - TC MCD (Cluster E): Mechanisms of cracking and debonding in asphalt and composite pavements
    Chair: Prof. William G. Buttlar

  - TC NUM (Cluster B): Numerical modeling of cement-based materials
    Chair: Prof. Klaas van Breugel

  - TC SCM (Cluster B): Hydration and microstructure of concrete with supplementary cementitious materials
    Chair: Prof. Nele De Belie

- 6 new TCs approved in 2011

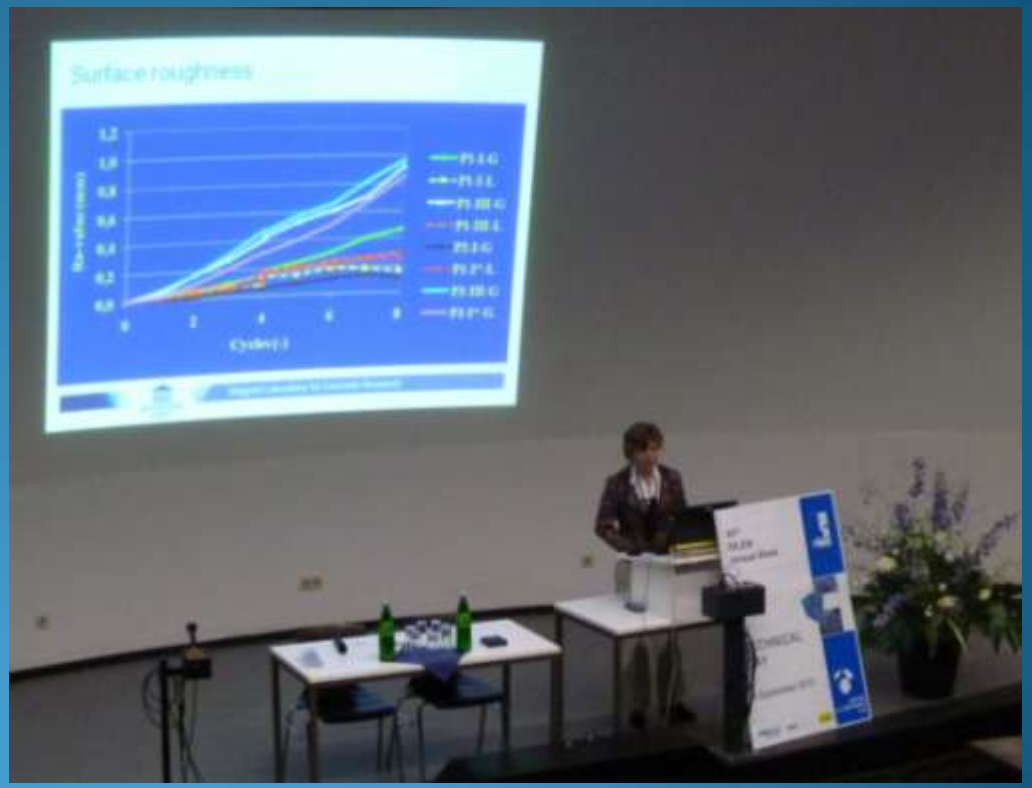
  - TC RTE (Cluster E): Reinforcement of timber elements in existing structures
    Chair: Dr. Th. Tannert

  - TDC (Cluster D): Test methods to determine durability of concrete under combined environmental actions and mechanical load
    Chair: Prof. Y. Yao

  - TDK (Cluster A): Testing methods for determination of double-K criterion for crack propagation in concrete
    Chair: Prof. S. Xu

Dissemination of information

- Publications
- Meetings
- PhD-courses
- Books
- Website



Educational Activity Committee (EAC)

The Standing Committee EAC promotes RILEM educational activities worldwide. This may involve:

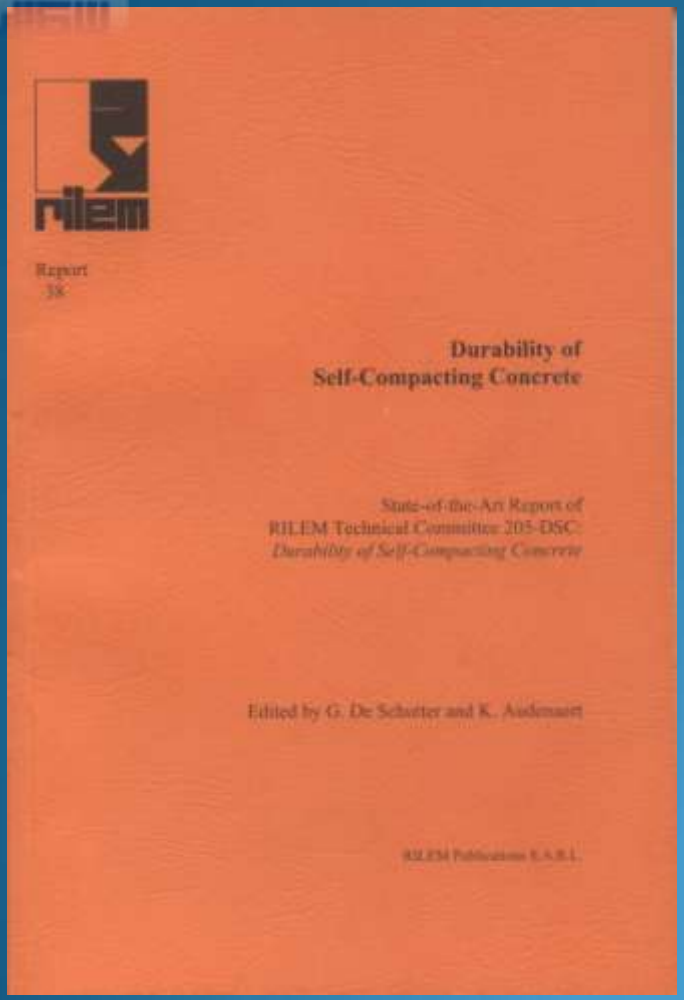
- Educational courses such as Doctoral courses, Short Seminars for the profession (e.g. practicing engineers) and Training Courses for university teachers;
- Educational publications such as Text Books and other teaching material.

EAC Activities 2011

German-Russian Forum on concrete	31 Jan – 4 Feb	Dresden, D
CMC Concrete Microscopy Course	16-20 May	Delft, NL
Infrared and Raman Spectroscopy	1 July	Madrid, E
Cementitious material hydration	1 July	Madrid, E
Alkali activated binders	2 July	Madrid, E
Multi scale modelling	3 July	Madrid, E
NIST computer modelling workshop	20-22 July	Washington, USA
Cement and Concrete	25 Aug – 1 Sept	Nanjing, CN
Modelling localized inelastic deformation	12-16 Sep	Prague, CZ
Mechanics of Tire-Pavement Interaction	26-28 Sep	Delft, NL
Textile and Fibre reinforced concrete	6 Oct	Buenos Aires, AR
1º Simpósio Internacional IBRACON/RILEM	3 Nov	Florianopolis, BR

…

RILEM Publications



- Technical reports
- State-of-the-Art reports
- Proceedings of workshops and conferences
- Scientific Journal *Materials & Structures*

RILEM Awards

- Robert L'Hermite Award

2007 N. Roussel
LCPC
Rheology of fresh concrete

2008 J. Weiss
Purdue University, USA
Volume stability of concrete

2009 P. Lura
Empa, Switzerland
Early age properties

2010 N. de Belie
Ghent University, Belgium
Biocatalytic processes and self healing of concrete

2011 L. de Lorenzis
University of Salento, Italy
Interface modelling

RILEM Awards

- Robert L'Hermite Award

- RILEM Fellow
- Honorary Member

RILEM Web server functions

- Services dedicated to RILEM members and activities
- Provide free access to most of RILEM publications and promote technical activities to enhance dissemination of knowledge and world-wide visibility

RILEM Website www.rilem.net

RILEM General Secretariat

sg@rilem.org

- Mrs. Pascale Ducornet, General Secretary
- Mrs. Gilberte Combes
- Mr. Grégory Censier

- The General Secretariat is available for the registrations, the publications and the technical activities.

LAT-Rilem

Goal Establish connections to Universities Research Centers, Scientists and Engineers in Latin America

Established Fall 2010 in Buenos Aires

Chairman Prof. Luis Lima

Rilem Membership fees: 40% discount for all countries in Latin America

Summary of benefits and values

- Become part of a world-wide network
- Participate in active technical committees
- State of the art activities
- Interact with leading scientists and technologists

Visit us at

www.rilem.net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Topics and Results of TC's

- **TC-221** Self healing phenomena in cement-based materials (TC Chair E. Schlangen)
- **TC-223** Masonry strengthening with composite materials (TC Chair M. R. Valluzzi)
- **TC-222** Simulations of concrete flow (TC Chair N. Roussel)

TC-221 Self healing phenomena in cement-based materials

Report by

Erik Schlangen

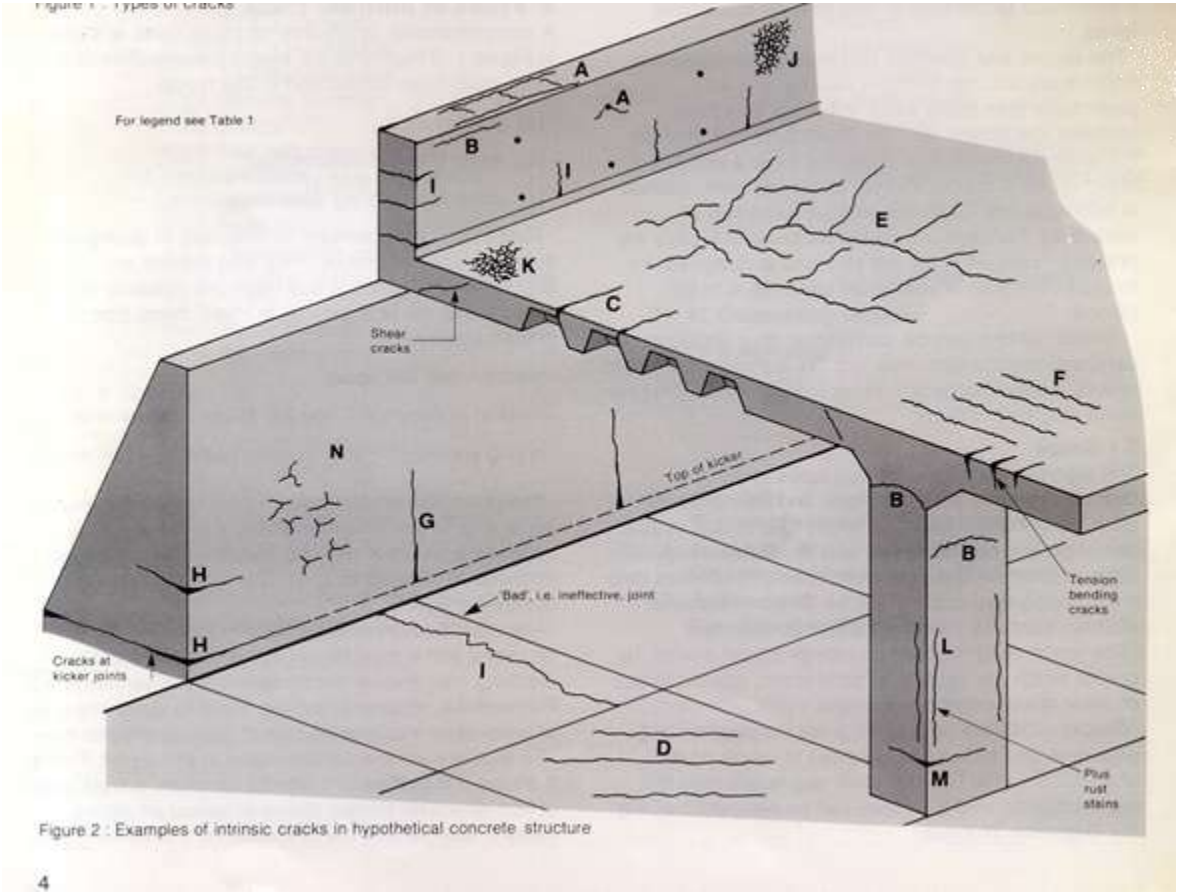

Figure 2 : Examples of intrinsic cracks in hypothetical concrete structure

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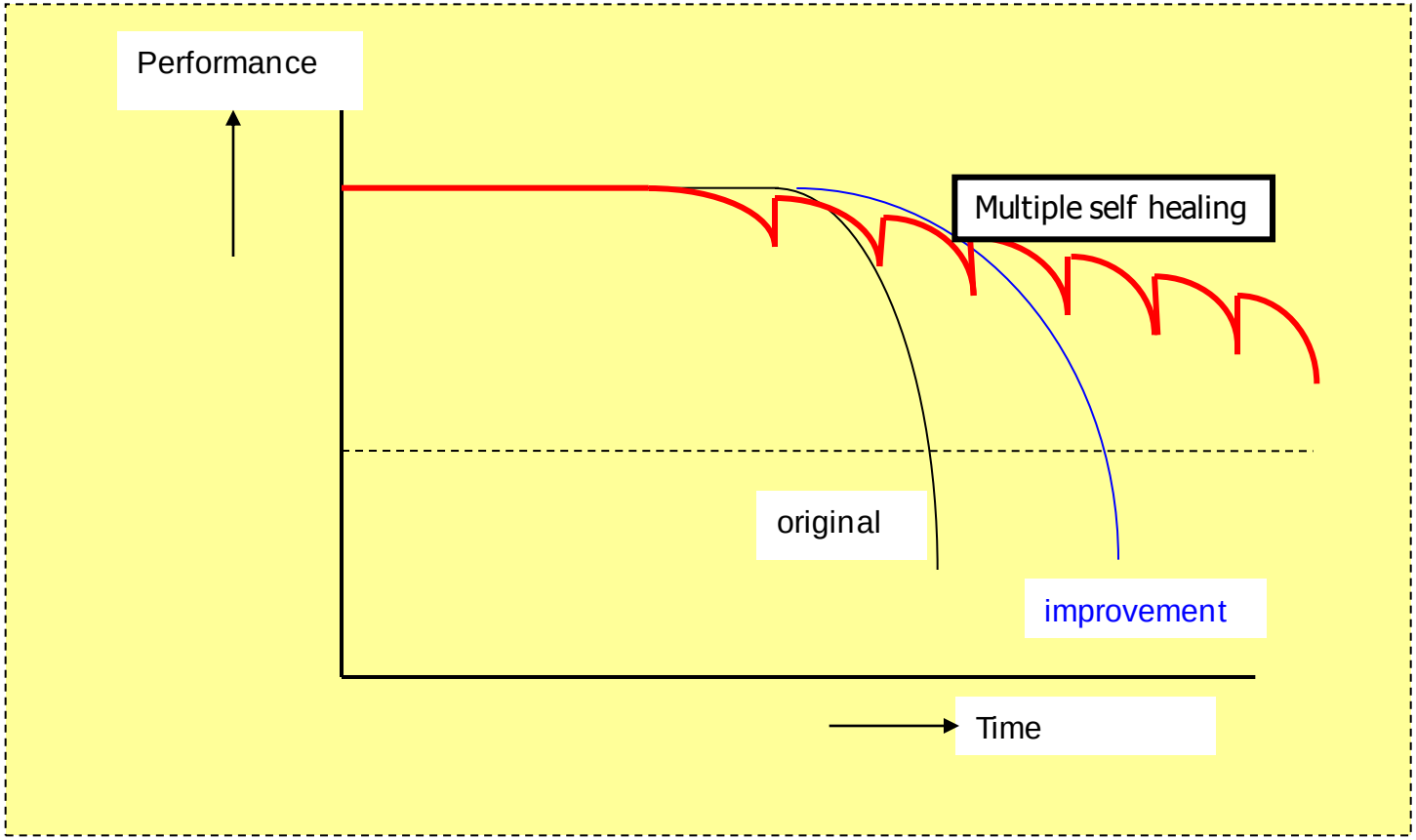
Self healing ambitions (multiple healing)



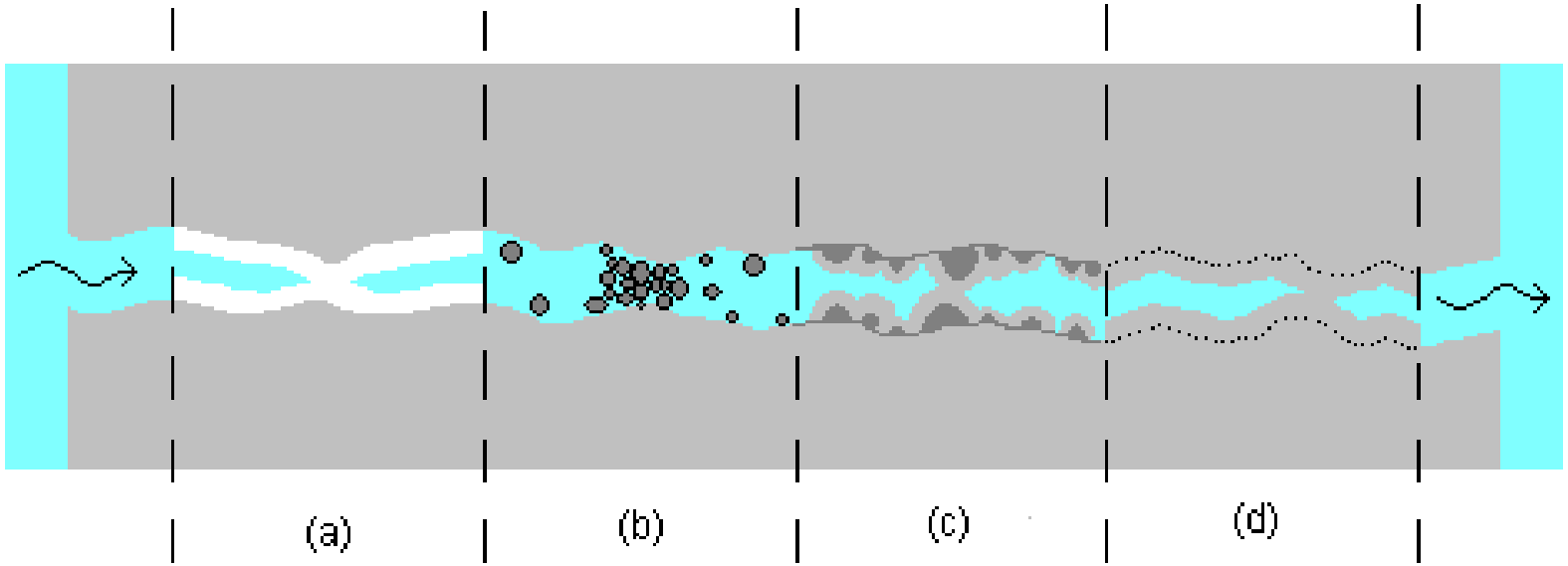
Is self healing always a solution?

RILEM TC 221 Self Healing Concrete

- Dr. Oguzhan COPUROGLU
- Prof. Nele DE BELIE
- **Dr. Mario DE ROOIJ** ***(Secr.)***
- Dr. Carola EDVARDSEN
- Prof. Mette GEIKER
- Prof. Dr Ningxu HAN
- Mr Chengwei HAO
- Prof. R. Doug HOOTON
- Mr. Haoliang HUANG
- Dr. Antony D. JEFFERSON
- Prof. Konstantin KOVLER
- Dr. Jianzhong LAI
- Prof. Robert LARK
- Prof. Victor C. LI
- Dr. Ahmed LOUKILI
- Prof. Dr.-Ing. Viktor MECHTCHERINE
- Prof. Hirozo MIHASHI
- Prof. Lars-olof NILSSON
- Mr. Tomoya NISHIWAKI
- Shunzhi QIAN
- Prof. Dr.-Ing. Hans W. REINHARDT
- **Dr Erik SCHLANGEN** ***(Chair)***
- Mr. Yeqing SHEN
- Mr Luguang SONG
- Dr Pavel TRTIK
- Prof. Dr. Ir. Klaas VAN BREUGEL
- Mrs Kim VAN TITTELBOOM
- Prof. Jason WEISS
- Dr. Guang YE
- Mrs Xiongzhou YUAN

Some Possible Mechanisms for Self-Healing:

a) Formation of $CaCO_3$ of $Ca(OH)_2$ in crack
b) Loose parts blocking the crack path
c) Ongoing hydration in the crack
d) Swelling of cement matrix



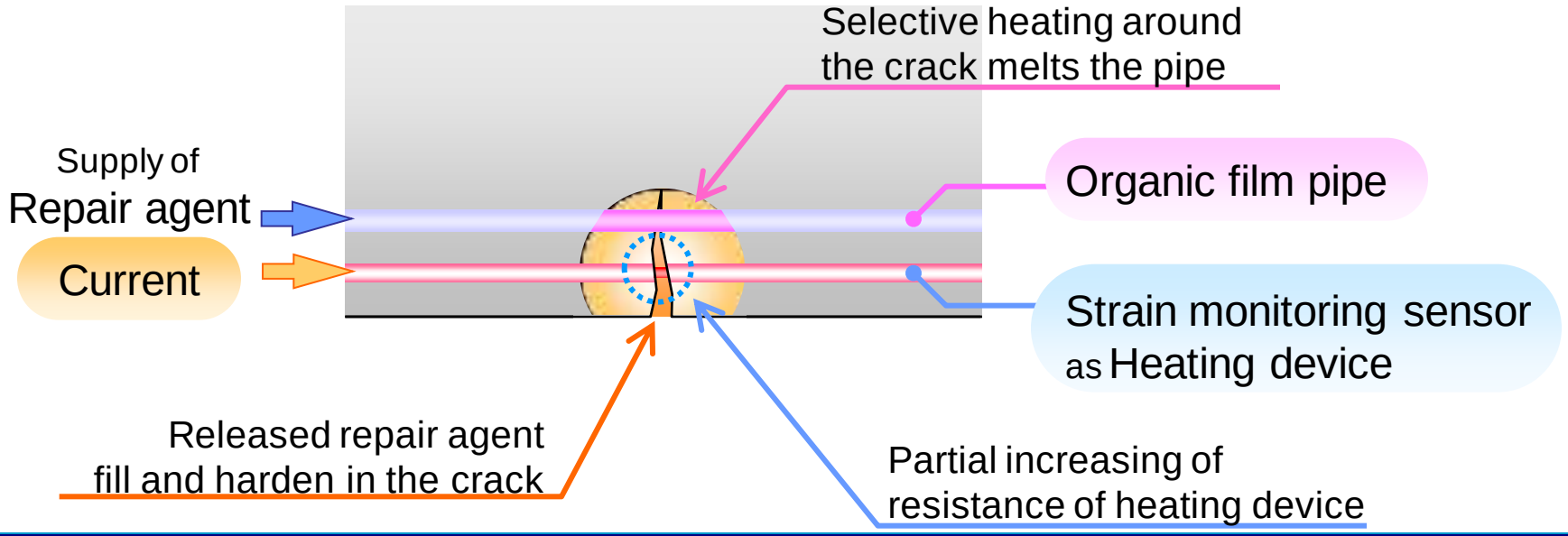
‘Active’ Self-Healing System

Self-healing using selective heating around generated crack

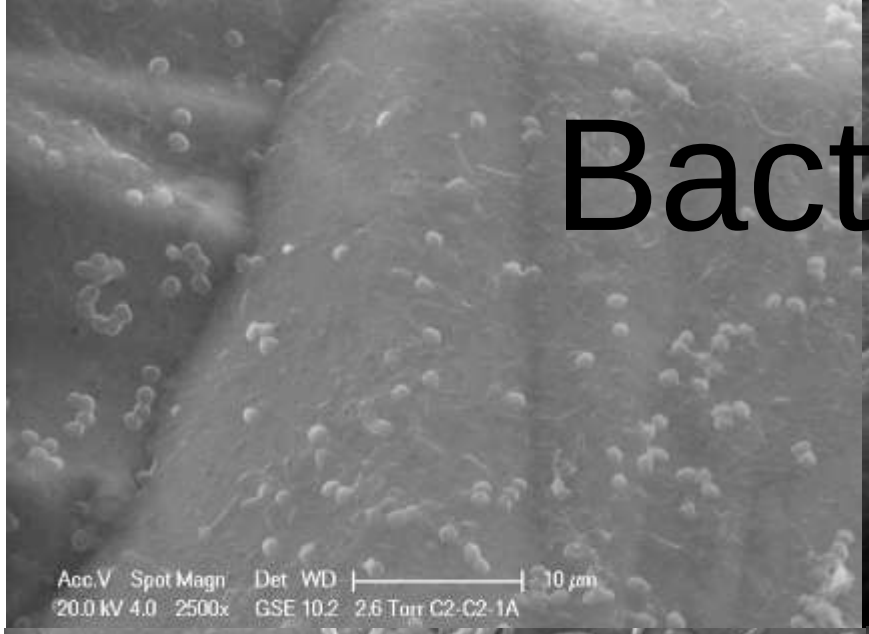
Sensing function

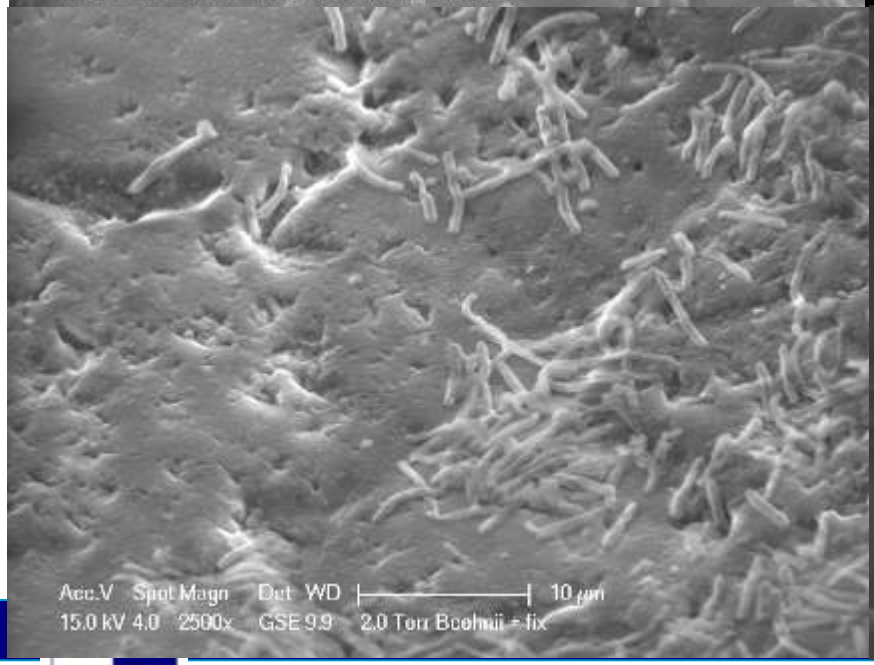
Processing function

Actuating function



Bacteria





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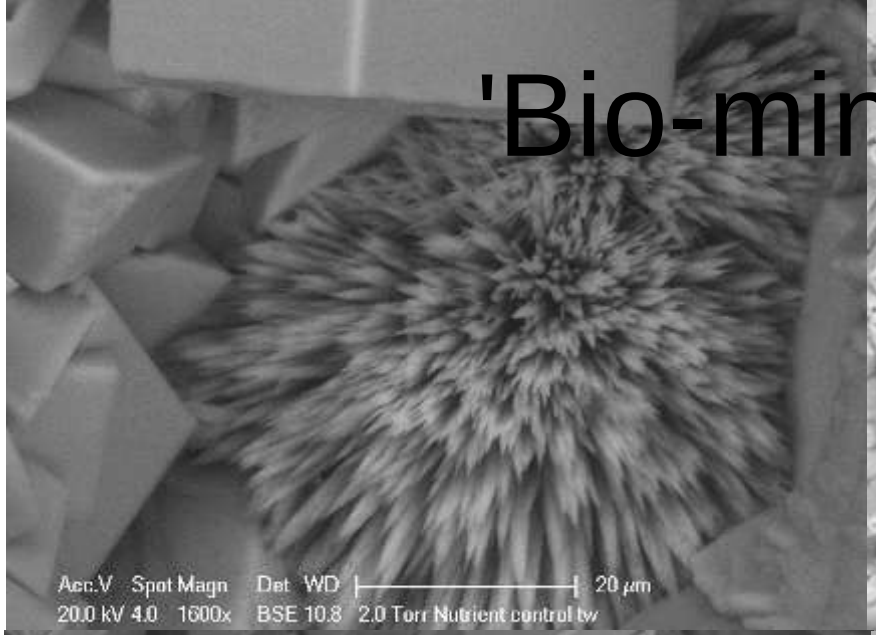
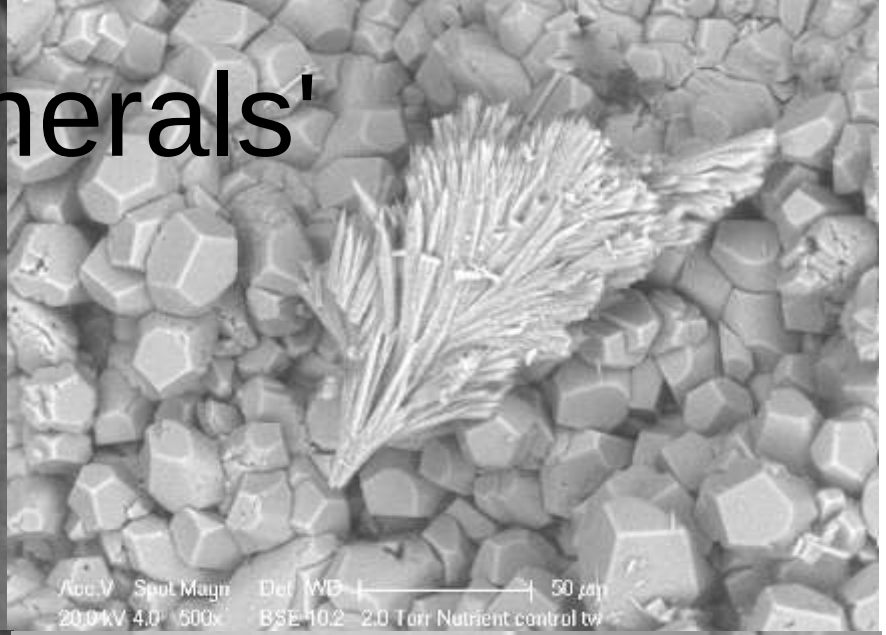
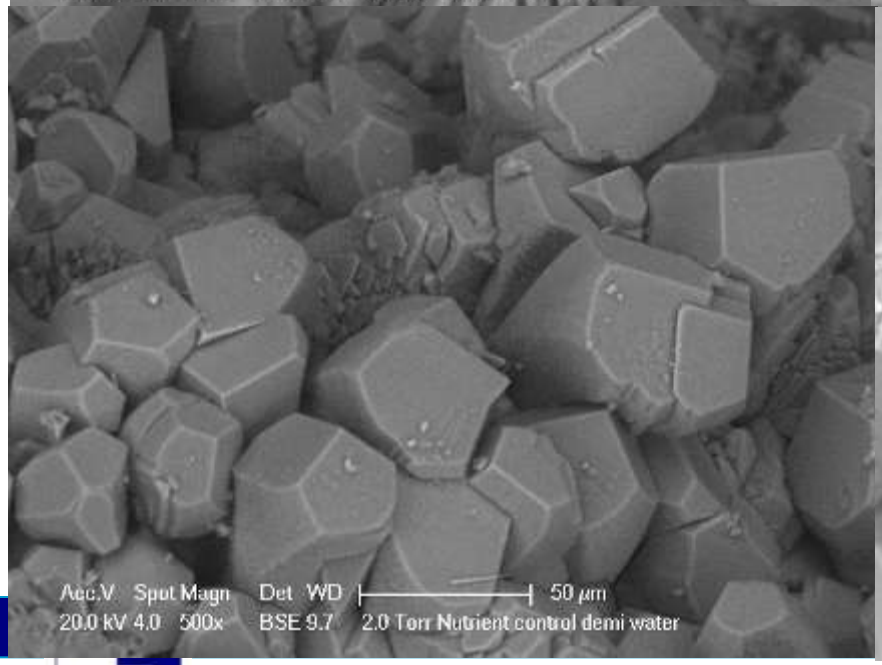
TC 221 Self healing

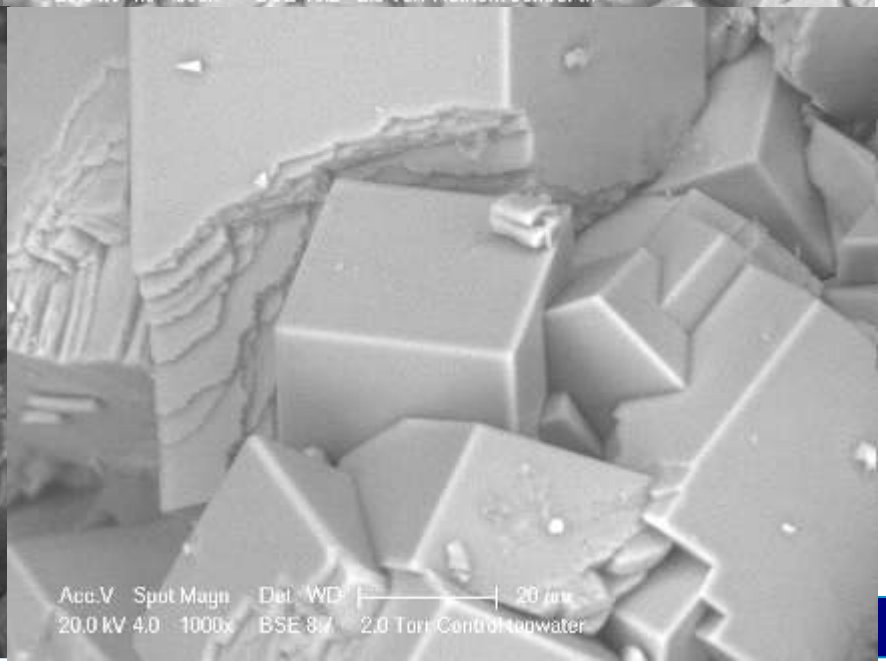
Jonkers & Schlangen, Netherlands

'Bio-minerals'









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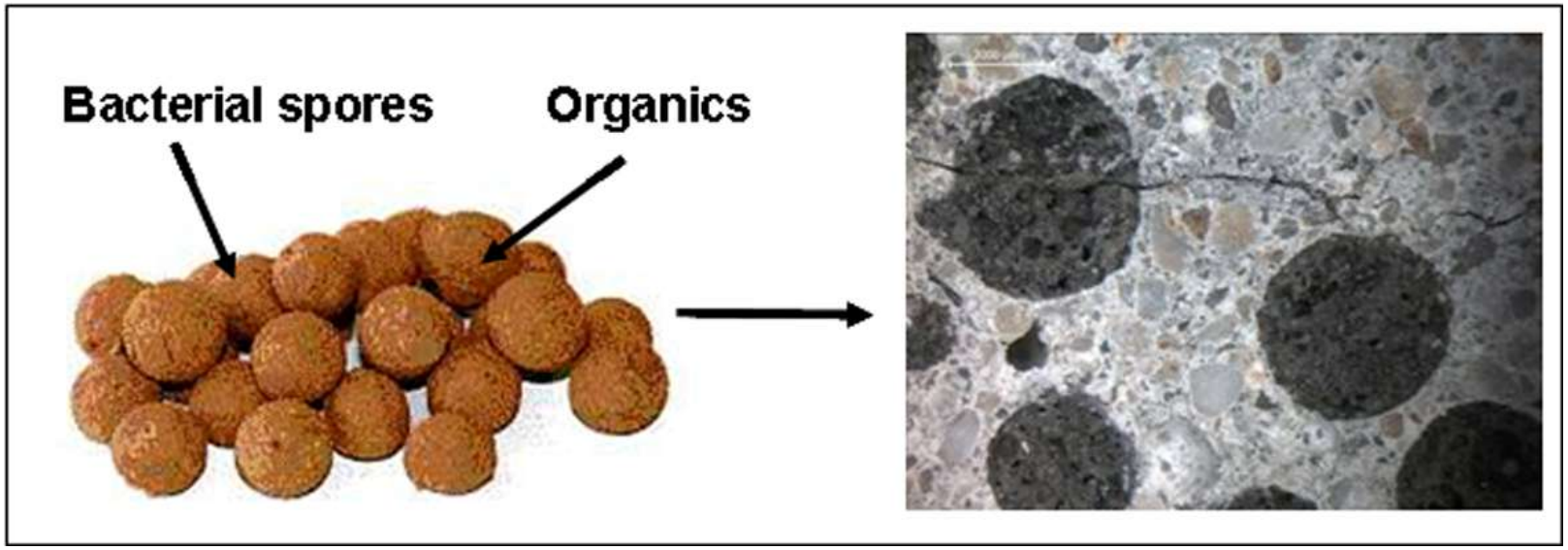
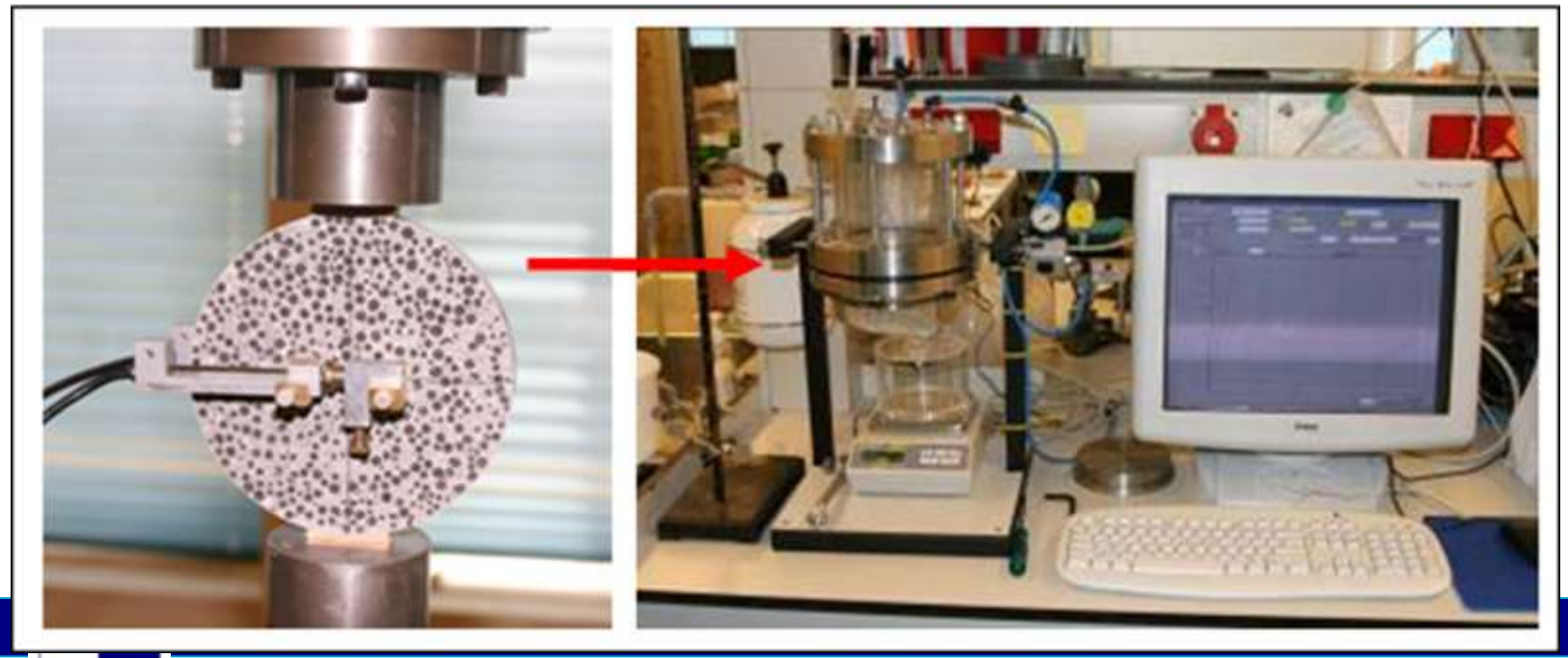
TC 221 Self healing

Jonkers & Schlangen, Netherlands





TC 221 Self healing

Jonkers & Schlangen, Netherlands

TC 221 Self healing

Jonkers & Schlangen,
Netherlands

Conclusions and future research

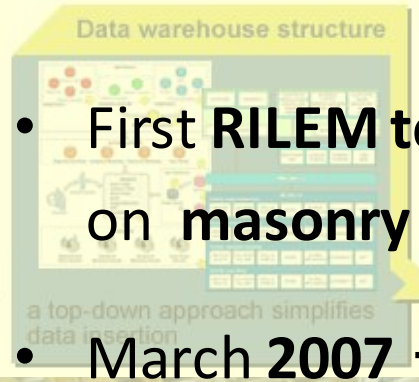
- Self Healing is not just a Hype!
- It really works!
- It needs input from different disciplines
- It can save a lot of money
  - Less repair work
  - Less material use
  - Less traffic jams
  - Good for the environment
- RILEM TC-221 gives insight!

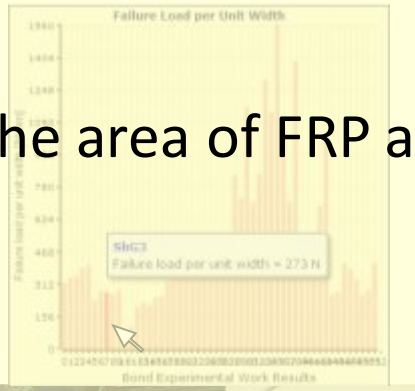
RILEM Technical Committee

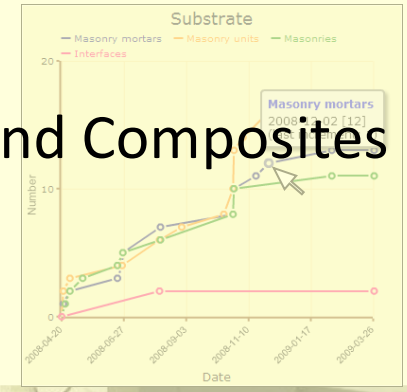
223-MSC

MASONRY STRENGTHENING WITH COMPOSITE MATERIALS

Chairperson: ***Maria Rosa Valluzzi***, University of Padova, Padova, Italy
Secretary: ***Daniel Oliveira***, University of Minho, Guimaraes, Portugal





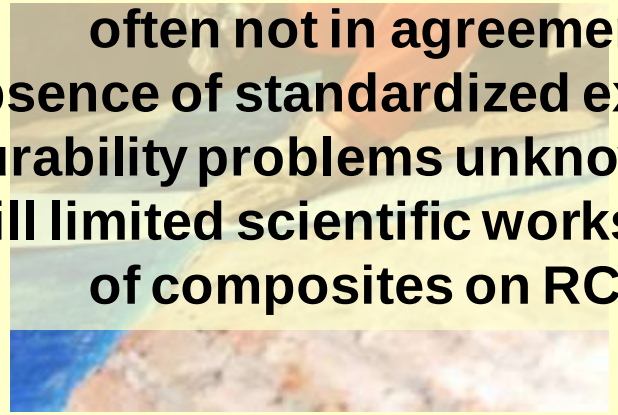
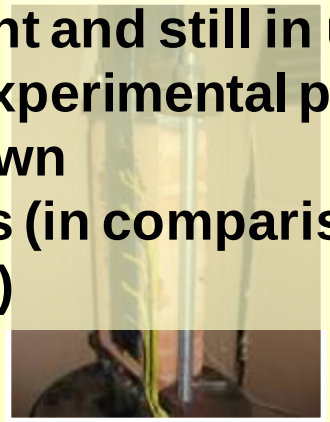


- First **RILEM technical committee** in the area of FRP and Composites on **masonry** structures
- March **2007** → end **2012**
- **21** promoting members + **25** new affiliated members from **26 Institutions** and **12 countries**

RILEM TC 223-MSC
Motivation

Large diffusion of applications even in historical field, in a contest of:

- **lack of standardization: only CNR (IT) and ACI (US) available, often not in agreement and still in upgrading**
- **absence of standardized experimental procedures**
- **durability problems unknown**
- **still limited scientific works (in comparison with application of composites on RC)**






RILEM TC 223-MSC
Objectives

Masonry **S**trengthening with **C**omposite materials

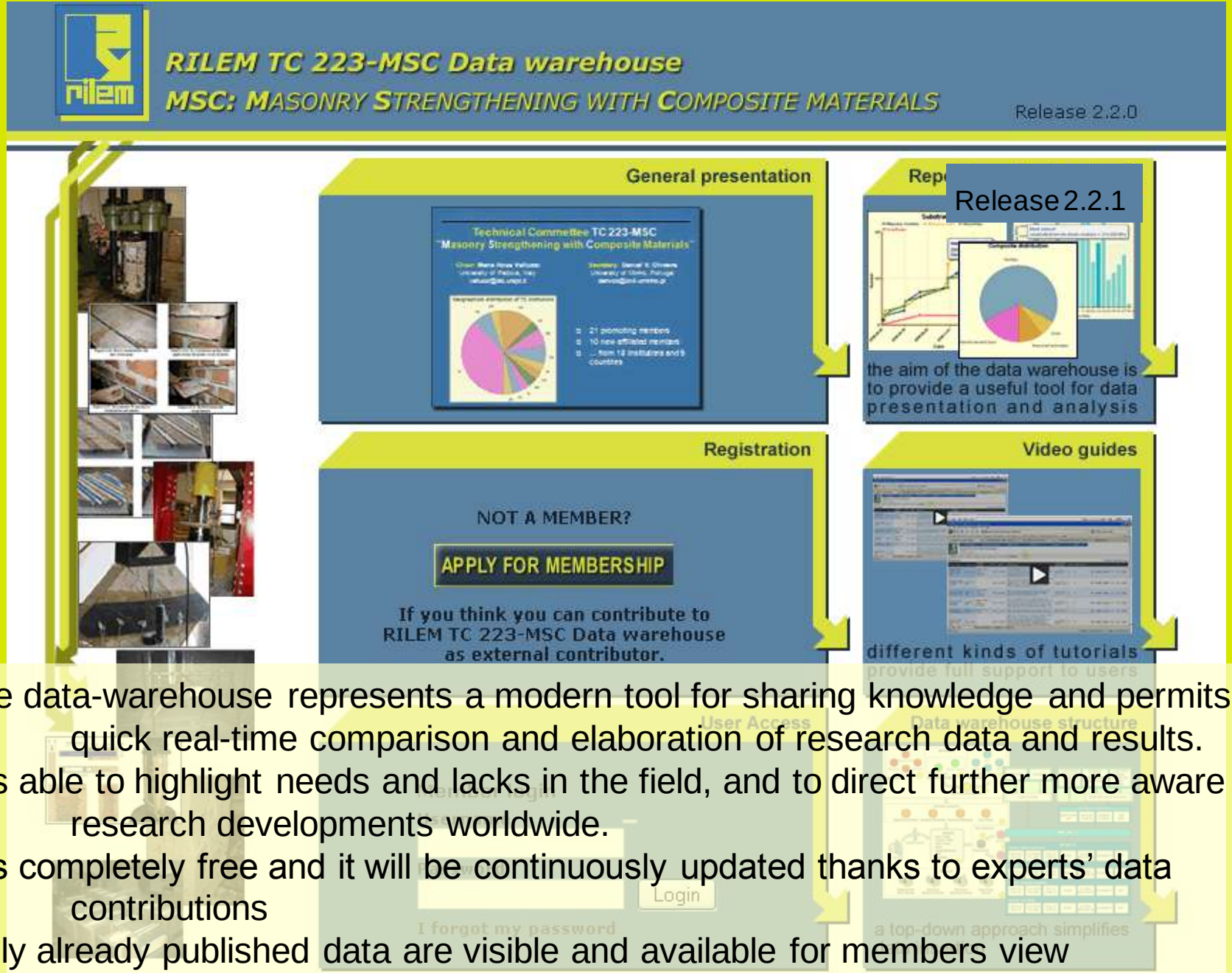
- **Systematization of current knowledge** on the structural behaviour of masonry strengthened with composites
- **Specification of limits and capability** of various systems in different contexts (modern, historical,..)
- **Identification of procedures for design and control** (limitation parameters of efficiency, simple test procedures, in-situ effectiveness)
- **Guidelines** for use of composite materials in existing masonry constructions

RILEM TC 223-MSC
Products

Masonry **S**trengthening with **C**omposite materials

- **Data WareHouse** (DWH) of the results obtained for various composite materials and types, masonry typologies, structural components and assemblages, local behaviour, case studies

  https://rilem223dwh.isqweb.it (www.rilem.net)
- **State-of-the-Art Report** (STAR) on the current knowledge (experimental and analytical works, case studies, standards and codes, NDT and durability)
- **Round Robin Test** (RRT) on bond of EBR FRP textiles and SRP: double leap (DLST) and single leap shear tests (SLST), 12 laboratories, more than 280 tests → **Rilem Reccomendations**
- **Durability tests** (crystallization problems, temperature and humidity influence on applications), 5 Labs → **Rilem Guidelines**
- **Workshop** in Wroclaw (SAHC 2012)



- The data-warehouse represents a modern tool for sharing knowledge and permits a quick real-time comparison and elaboration of research data and results.
- It is able to highlight needs and lacks in the field, and to direct further more aware research developments worldwide.
- It is completely free and it will be continuously updated thanks to experts' data contributions
- Only already published data are visible and available for members view

https://rilem223dhw.isqweb.it

RILEM TC 223-MSC Data warehouse

MSC: MASONRY STRENGTHENING WITH COMPOSITE MATERIALS

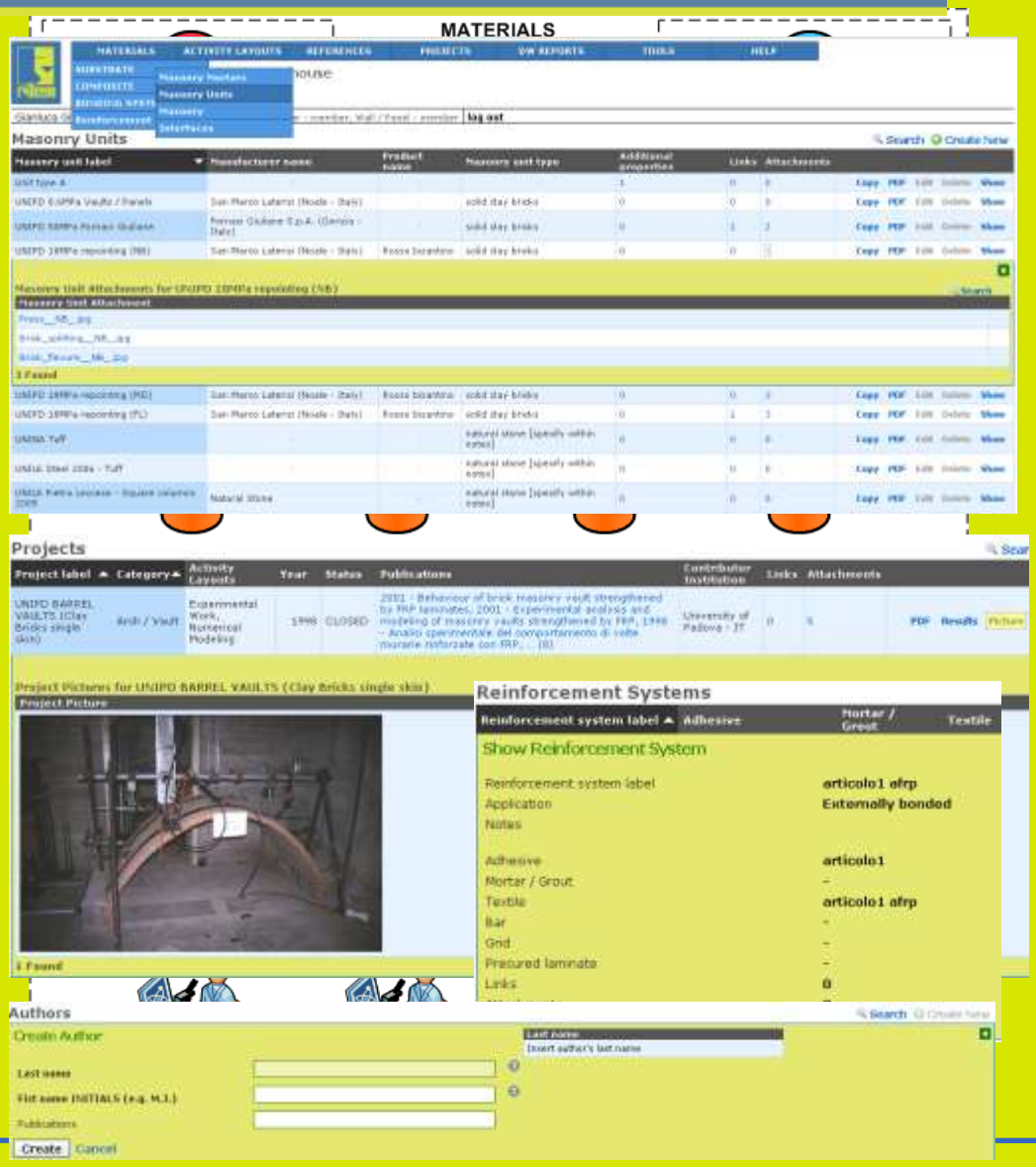
Release 2.2.1

It is possible to organize data on:

- **Materials**: substrates and reinforcements
- **Activity Layouts**: test set-ups and other specific information
- **References**: authors, sources and publications
- **Projects**: connections among all parts
- **Results**: elaboration and comparison

by using:

- a user-friendly approach to simplify data insertion and records modification and view, sort and search the existing ones
- functions of duplication of records (useful for references, materials, ..) and live-search
- different kinds of tutorials (including video-guides)



RILEM TC 223-MSC Data warehouse

MSC: MASONRY STRENGTHENING WITH COMPOSITE MATERIALS

Release 2.2.1

This tool is able to generate data output as:

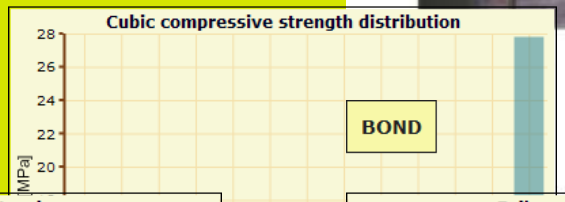
- reports (projects and materials) in Adobe® pdf format
- tables in MS Excel® format

and compare data and results by:

- charts and diagrams grouped as

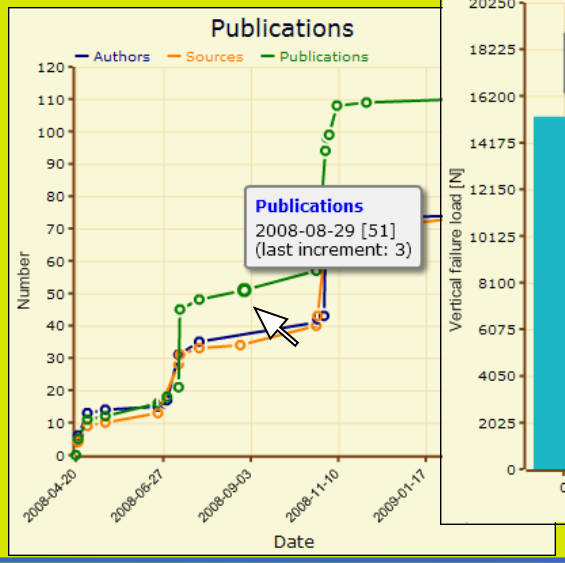
- General Charts
- Data Charts
- Results Charts

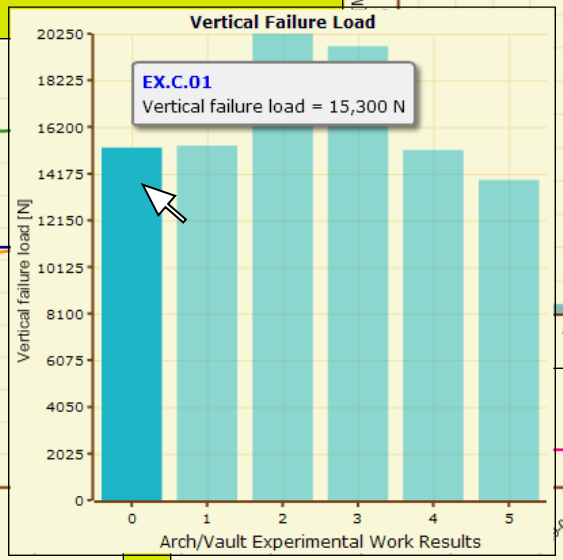
MASONRY MORTARS

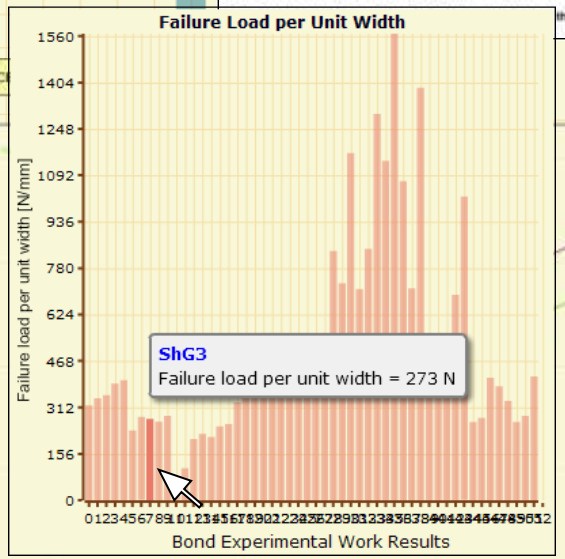


ARCH/VAULT

BOND





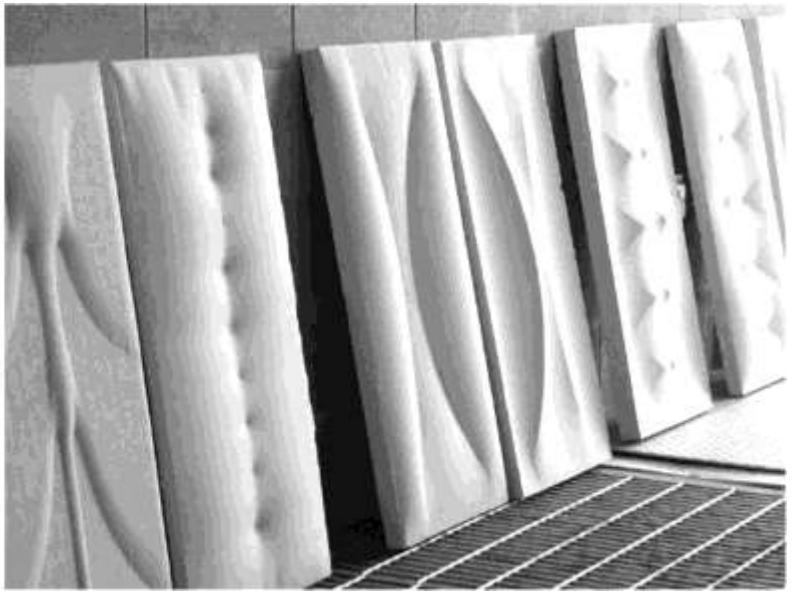


Technical Committee Report :

SIMULATIONS OF CONCRETE FLOW

TC 222-SCF

Chairman : Nicolas Roussel
Secretary : Annika Gram



R. Schmitz, M. West
Fabric formed concrete

ANALOGY WITH CONCRETE STRUCTURAL ENGINEERING

HARDENED CONCRETE

MIX DESIGN

HARDENED STATE
MECHANICAL PROPERTIES

PREDICTION TOOLS FOR
STRUCTURAL ENGINEERS

FRESH CONCRETE

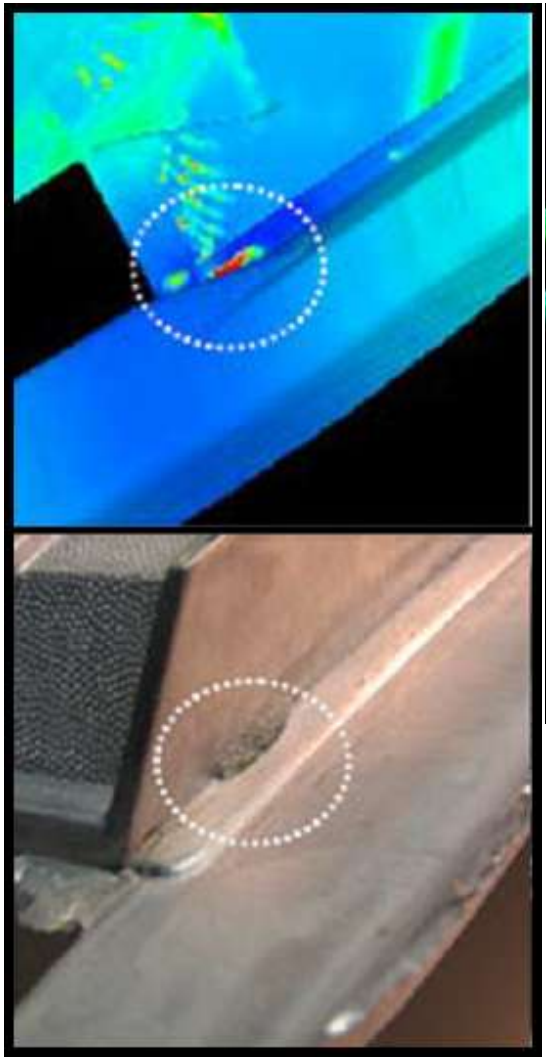
MIX DESIGN

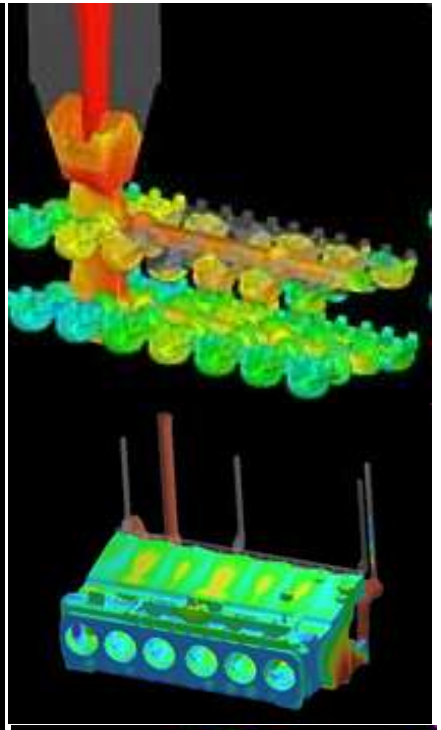
FRESH STATE
RHEOLOGICAL PROPERTIES

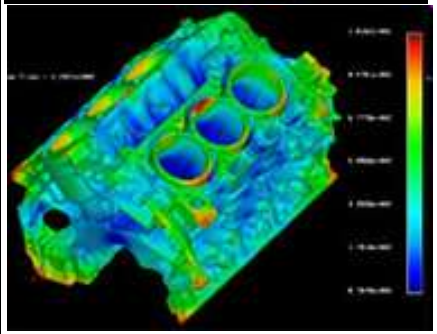
PREDICTION TOOLS FOR
PROCESS ENGINEERS

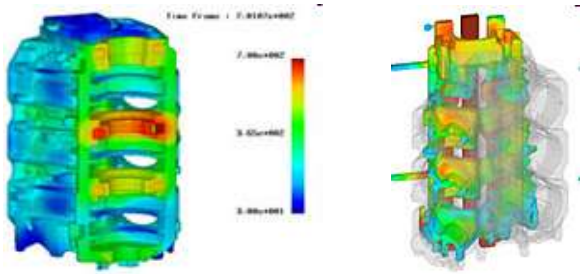
WHAT ABOUT OTHER INDUSTRIES ?

Steel, aluminium and plastic industries



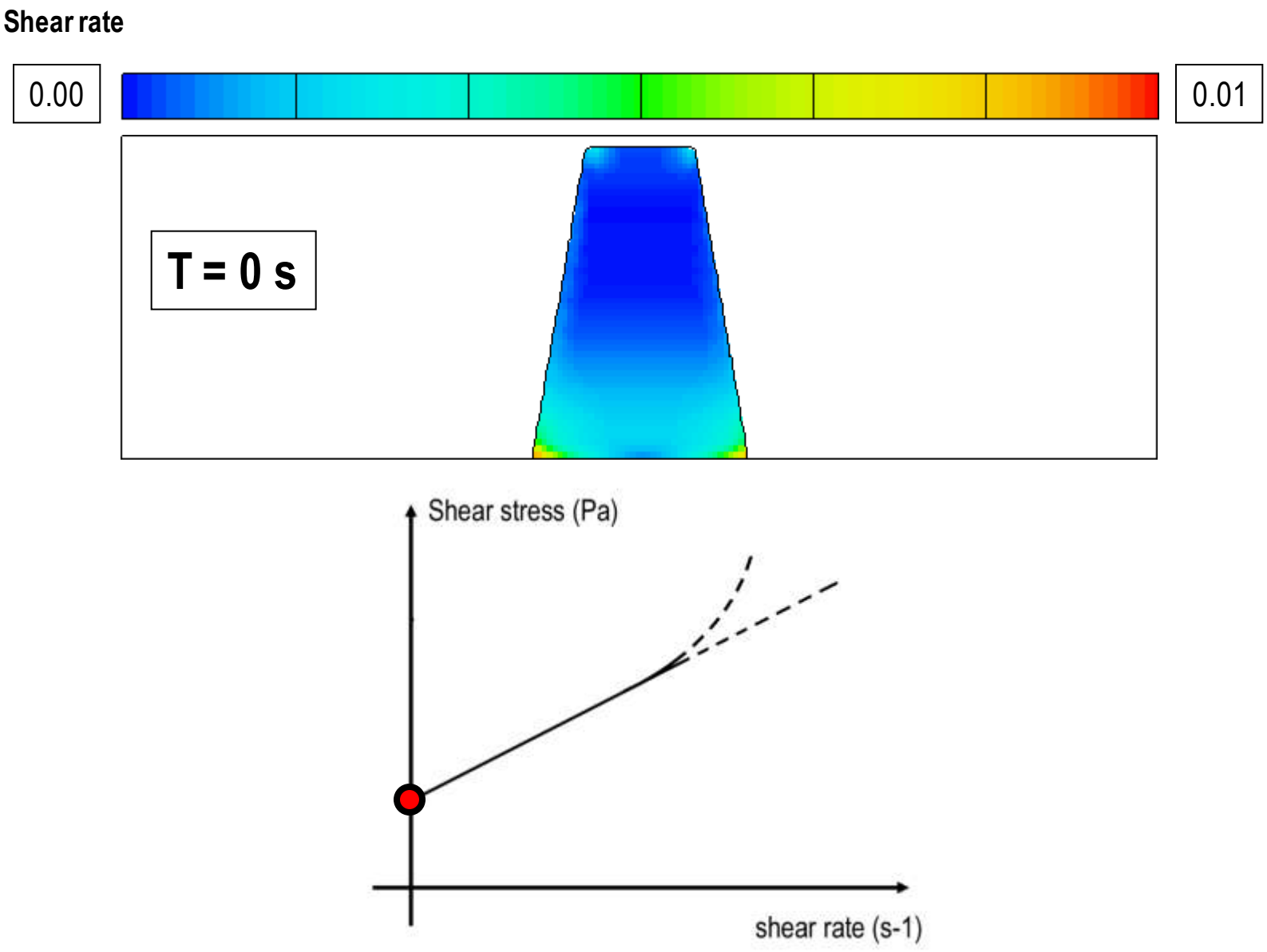




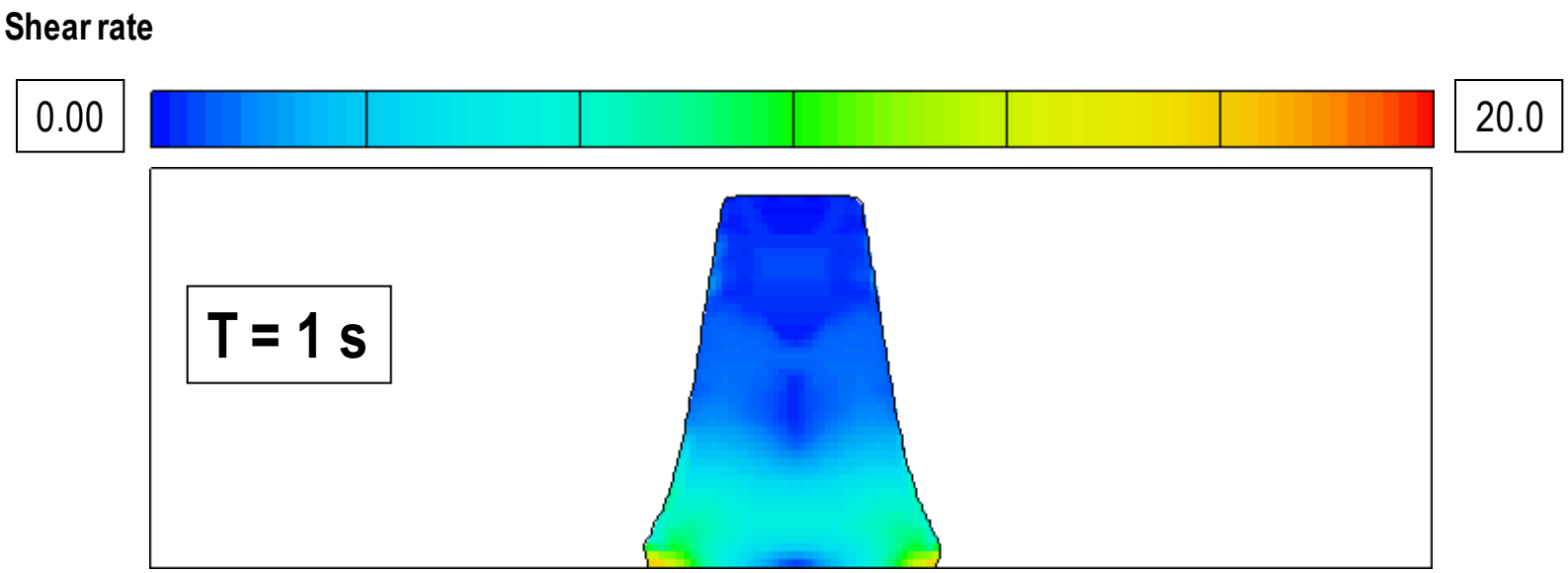


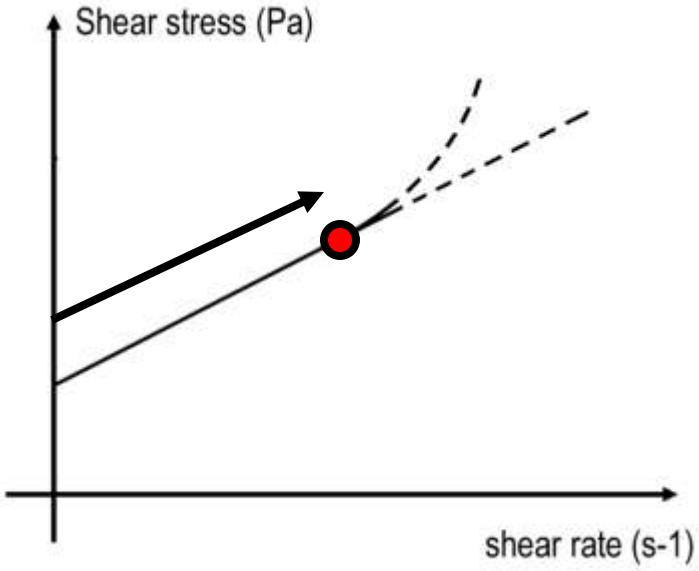
Industrial context

SLUMP AND SLUMP FLOW

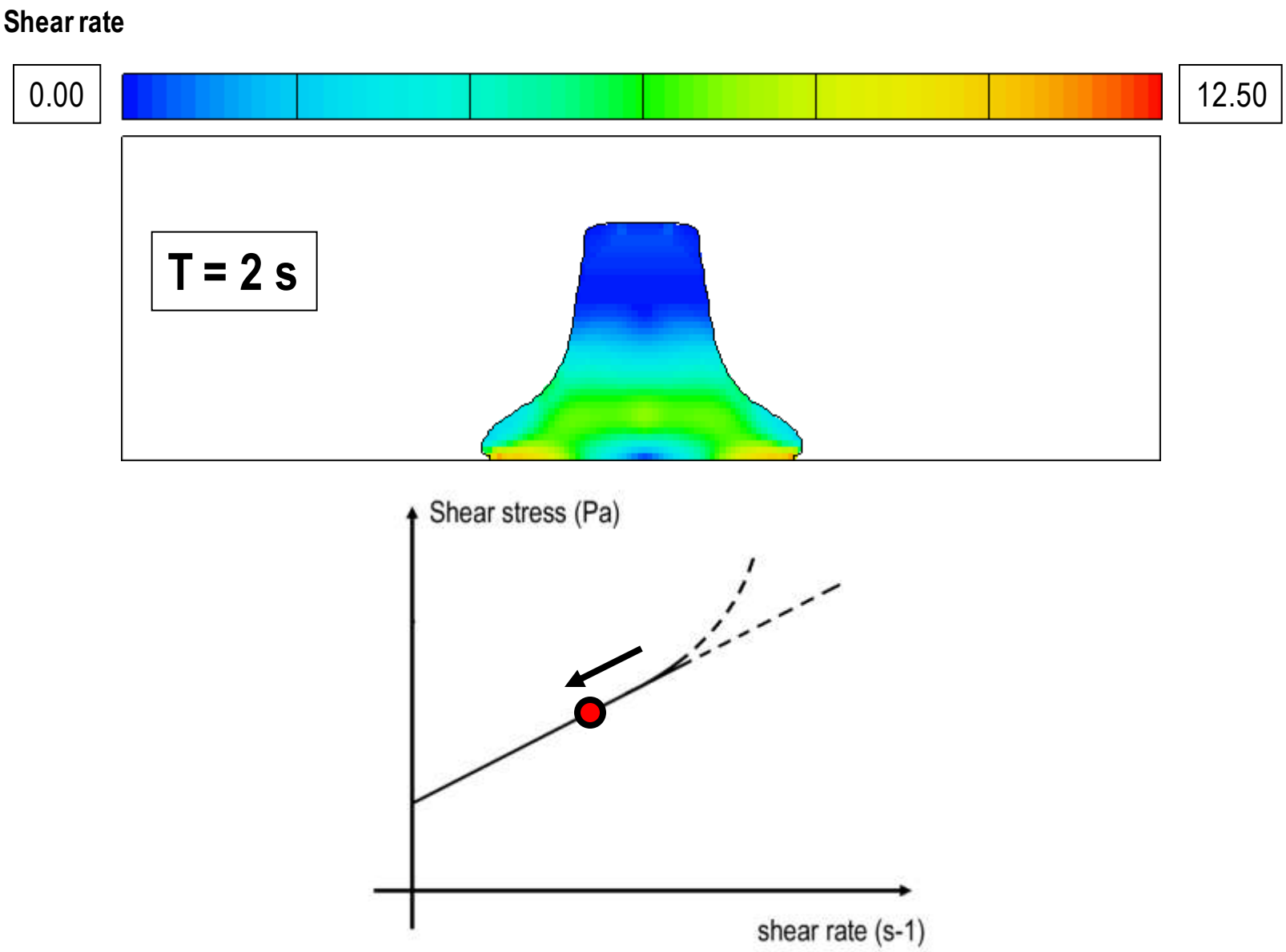


SLUMP AND SLUMP FLOW

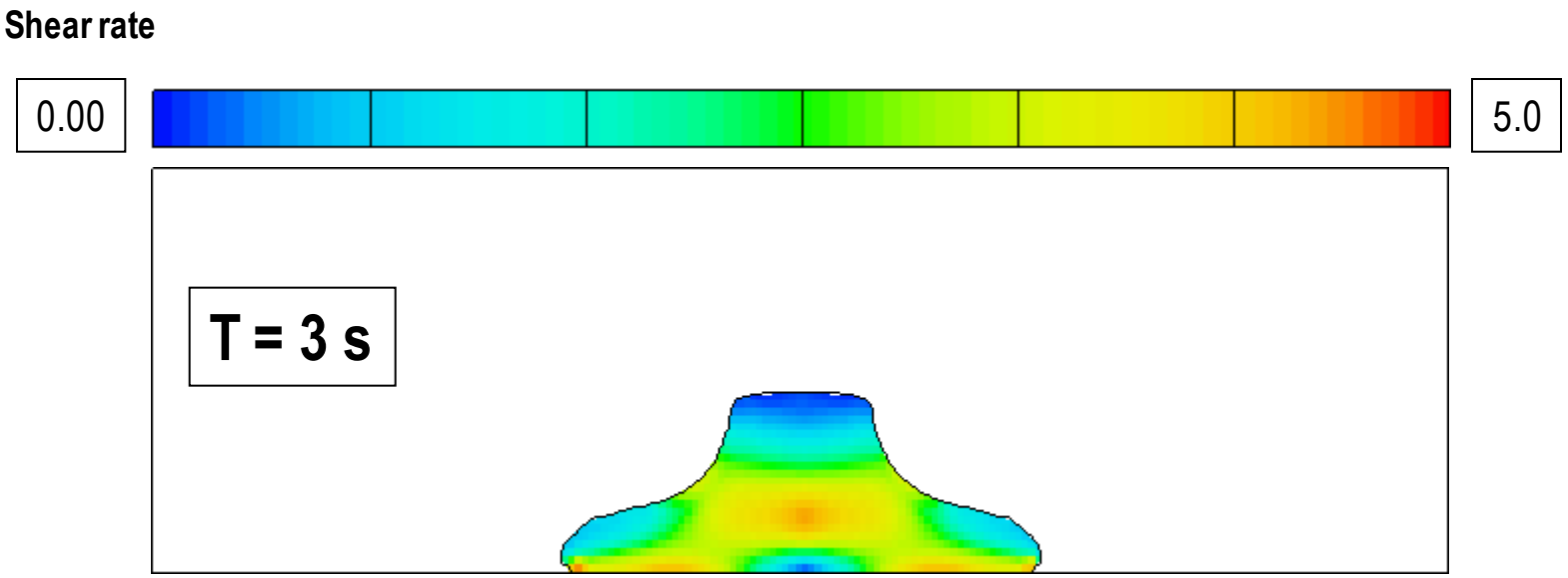


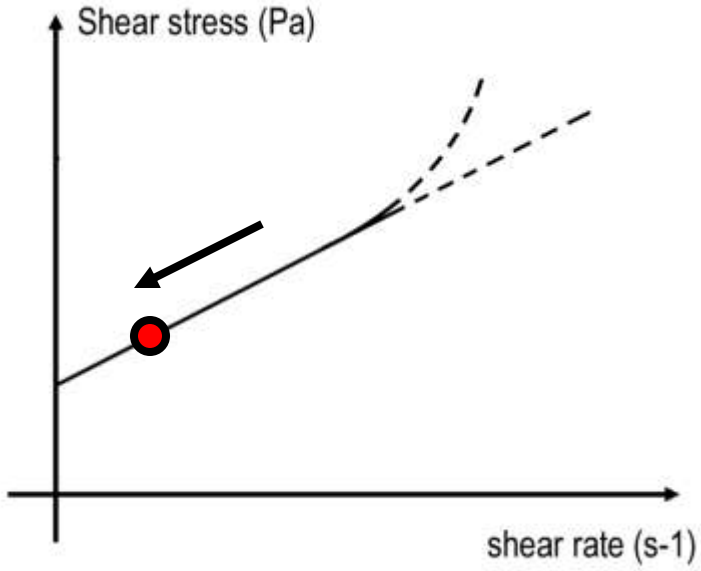


SLUMP AND SLUMP FLOW

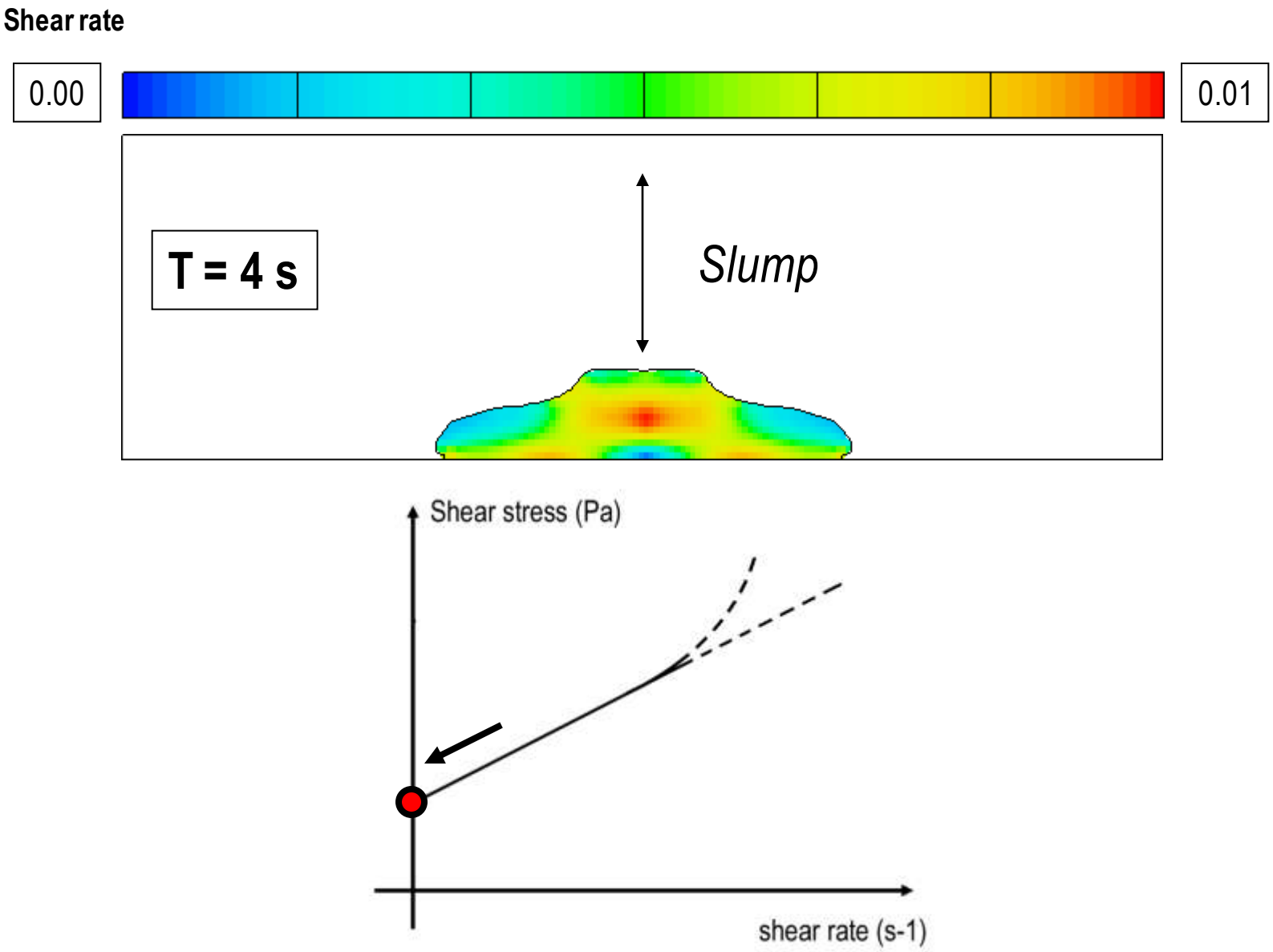


SLUMP AND SLUMP FLOW

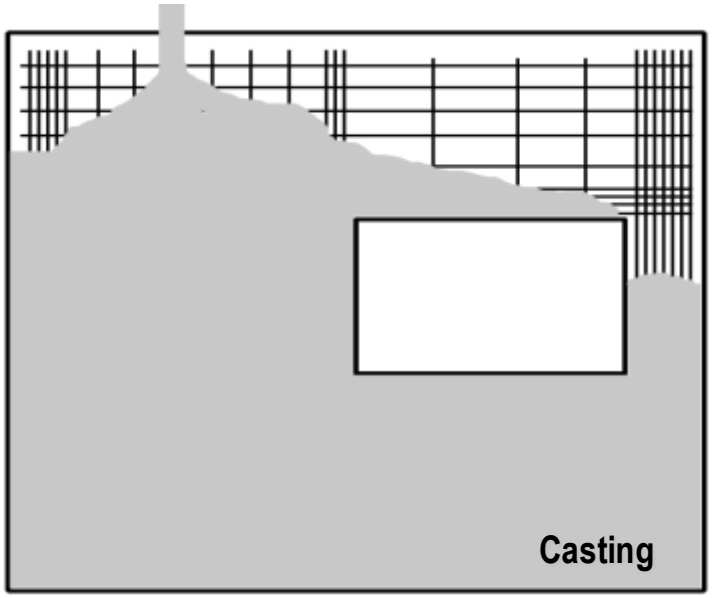


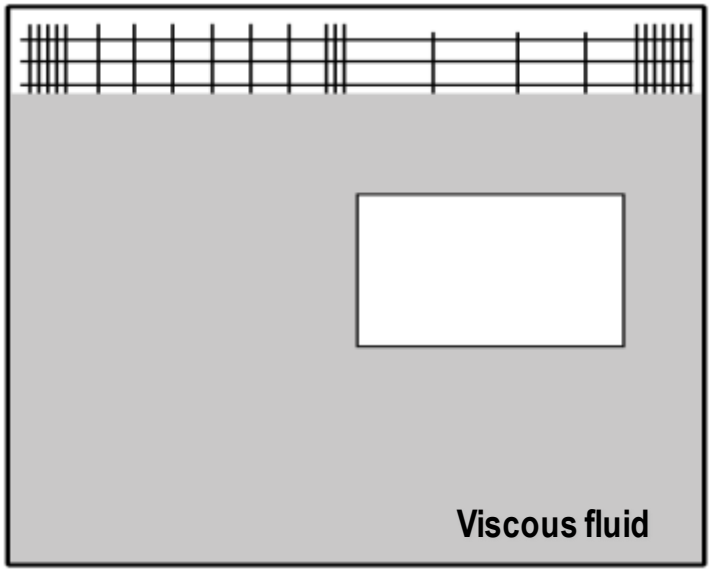


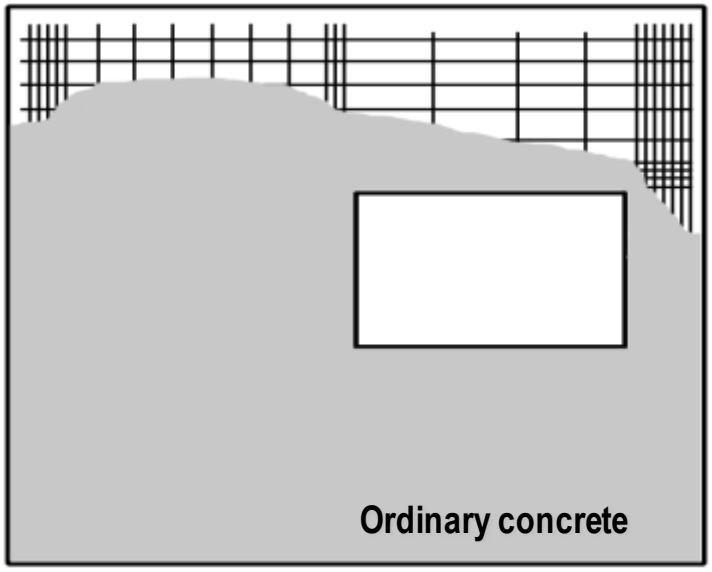
SLUMP AND SLUMP FLOW

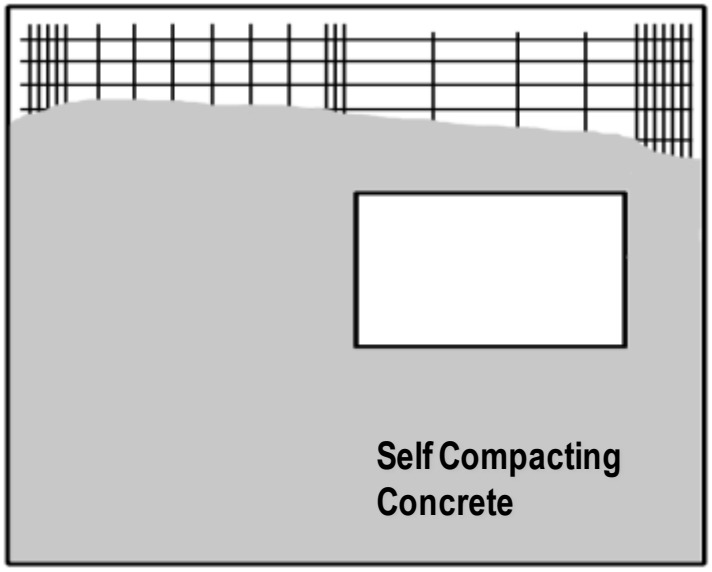


CASTING PROCESSES

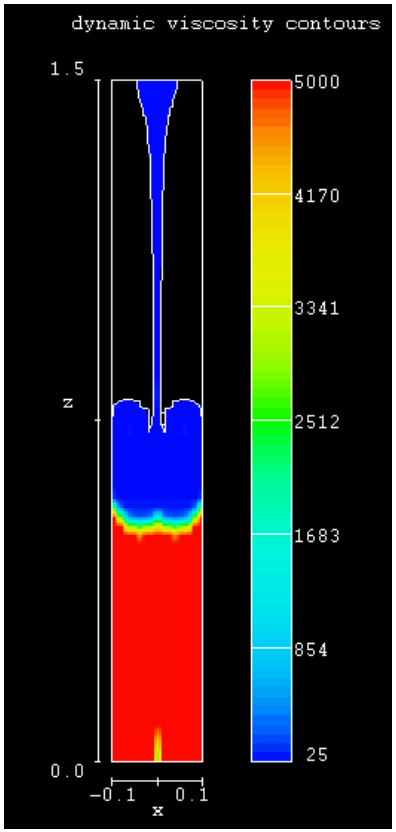




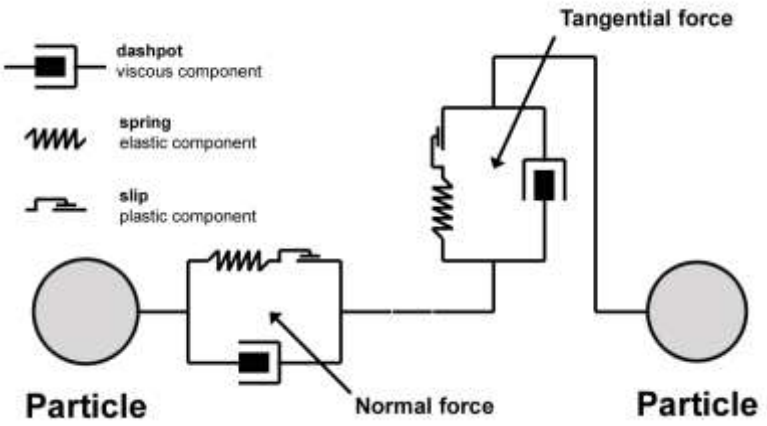


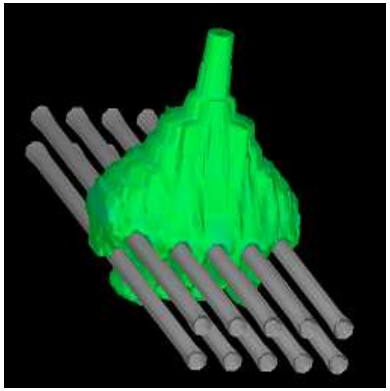


NUMERICAL TECHNIQUES

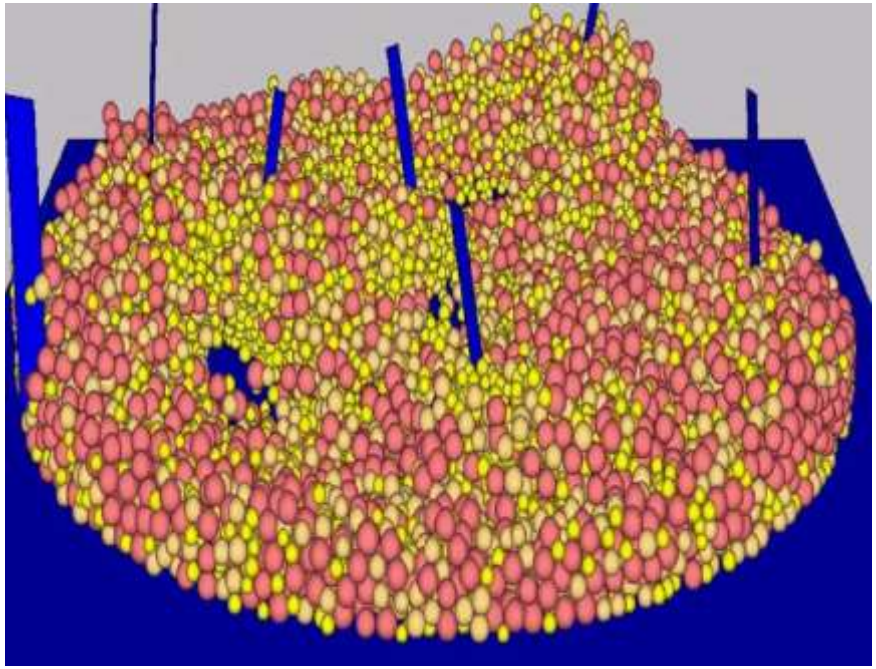


Computational fluid mechanics



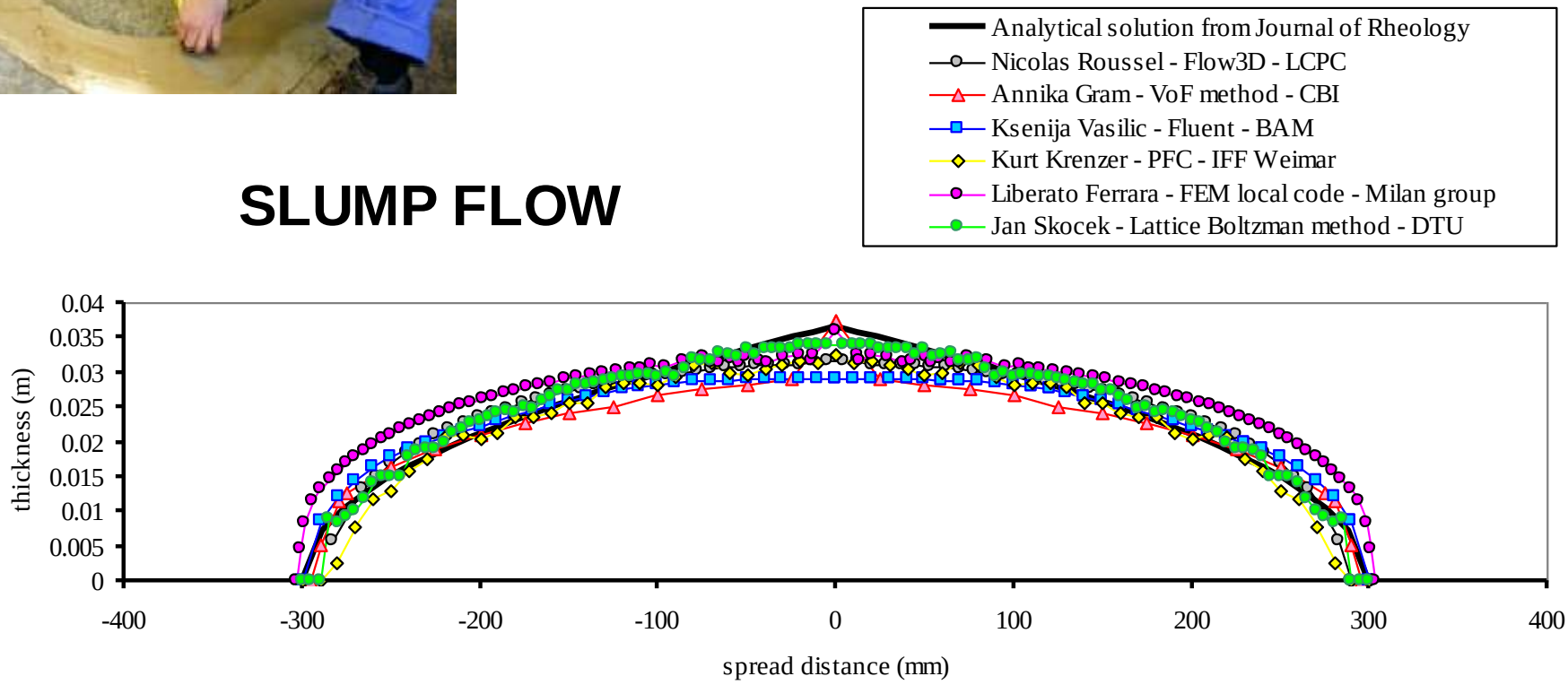


Distinct element methods



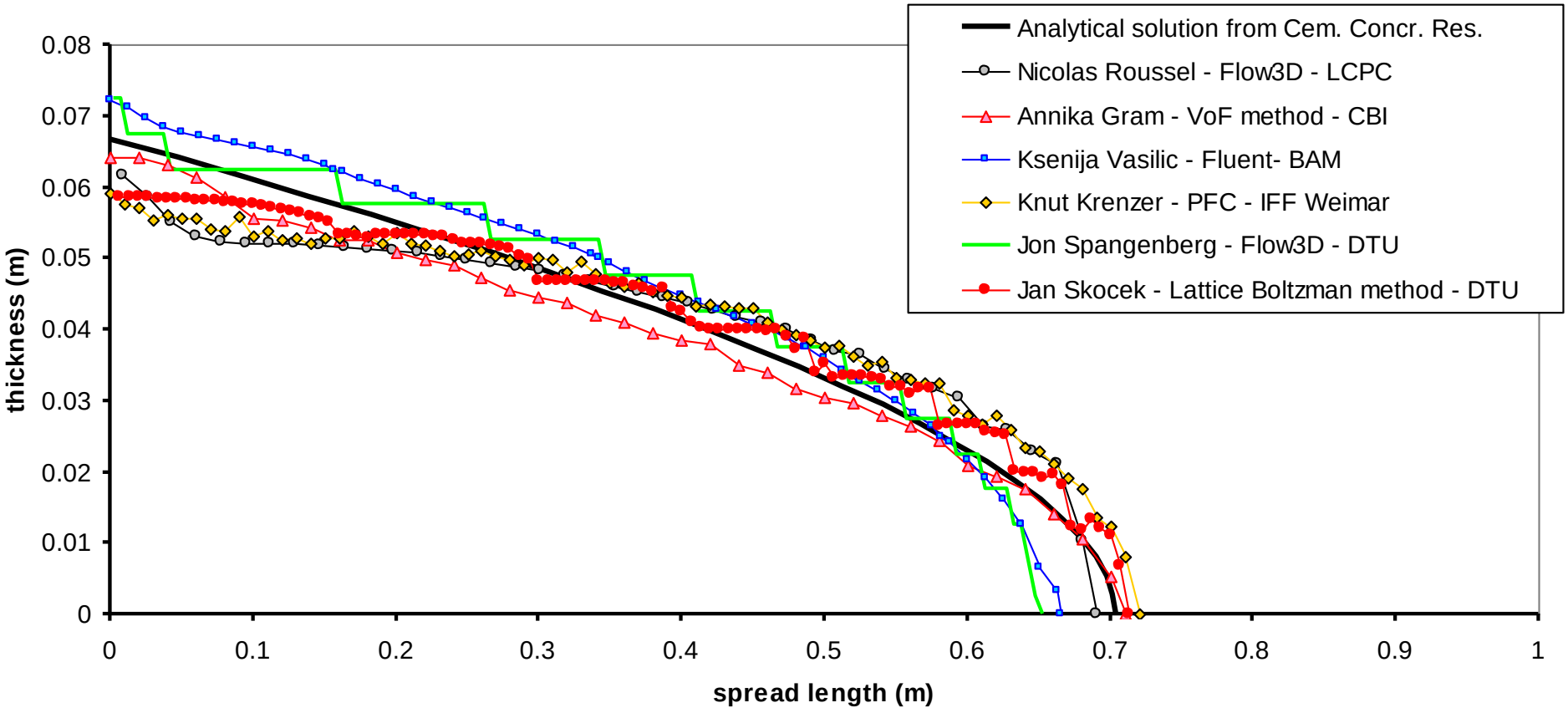
COMPARISON OF THE NUMERICAL TECHNIQUES

SLUMP FLOW

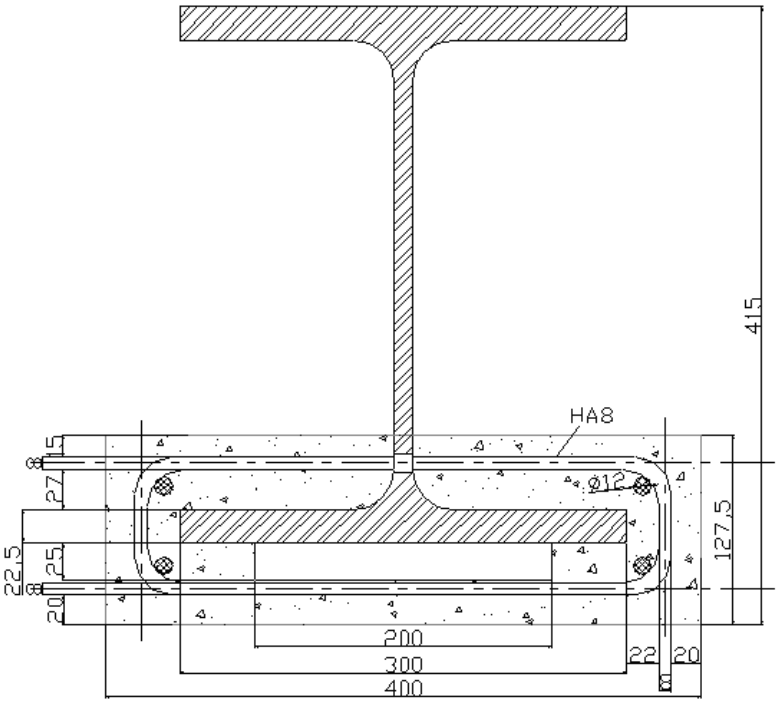


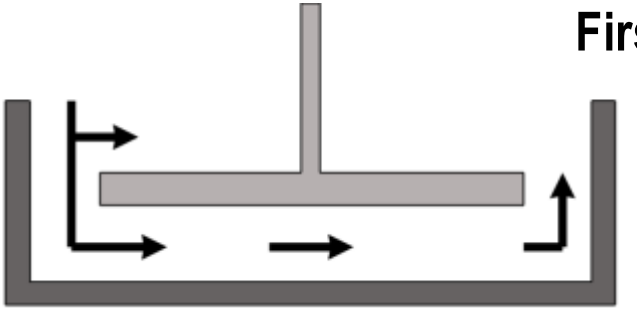
COMPARISON OF THE NUMERICAL TECHNIQUES

LCPC BOX

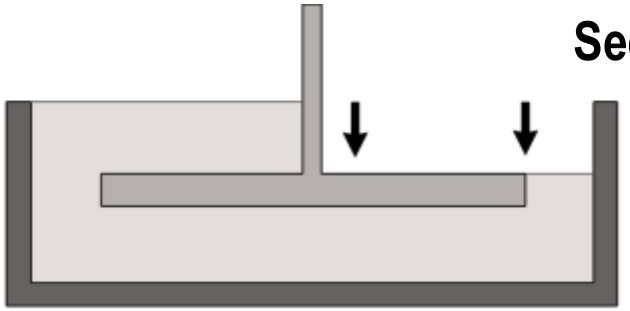


Example 1 : Rheological requirements





First phase



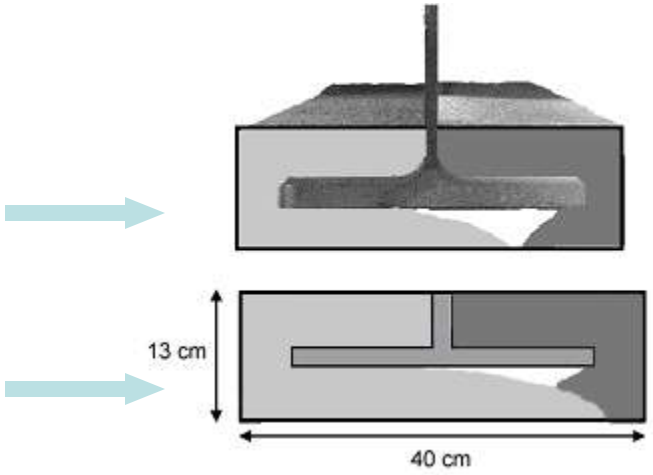
Second phase

INDUSTRIAL APPLICATION

SCC with 120 Pa yield stress (SF 620mm)

Shape of the concrete in the formwork (experimental)

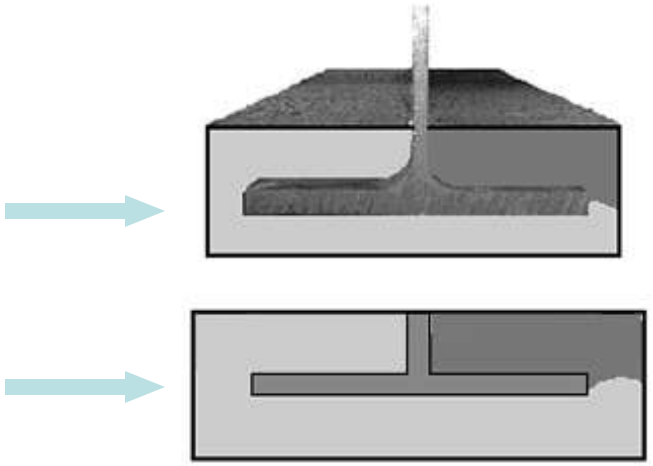
Shape of the concrete in the formwork (simulation)



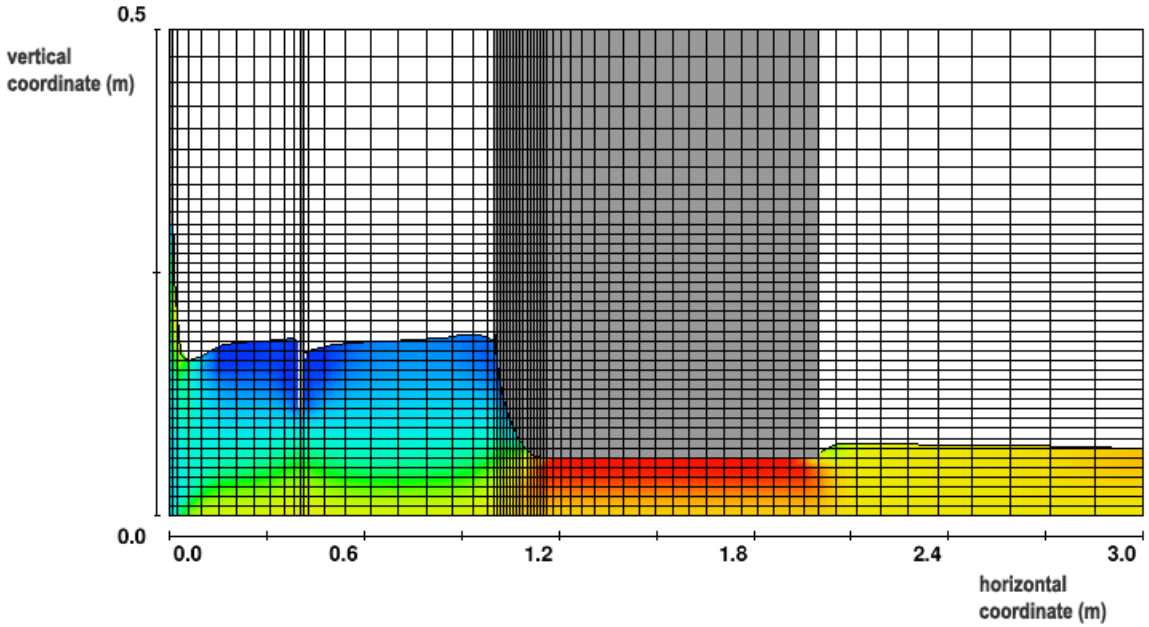
SCC with 60 Pa yield stress (SF 700mm)

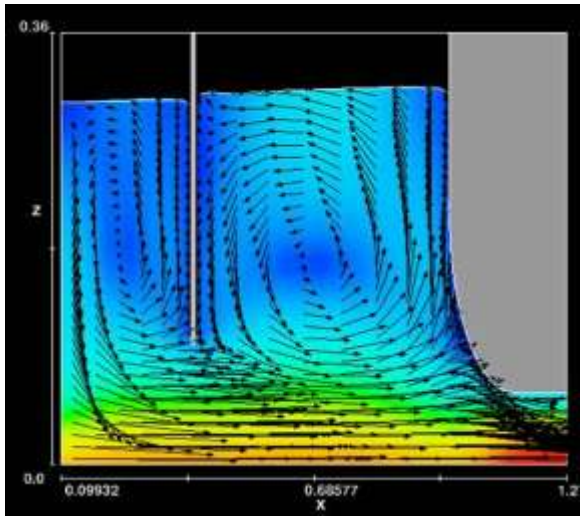
Shape of the concrete in the formwork (experimental)

Shape of the concrete in the formwork (simulation)



Example 3 : machine and process development





F. de Larrard, N. Roussel, International Journal of Road Materials and Pavement Design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