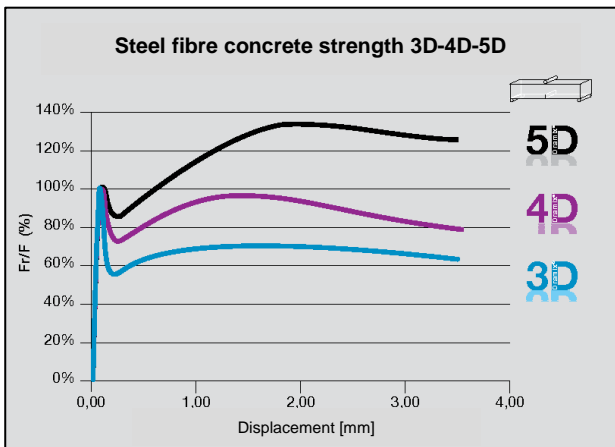


## Steel fibre reinforced concrete structures

Steel Fibre Reinforced Concrete (SFRC) is well known in several areas of civil engineering as a structural application - underground structures probably represent one of the most important fields of application for SFRC (tunnels, caverns, shafts, etc), as well as slope stabilization works.

The development of the new Dramix® 4D and 5D steel fibres, released in 2012 with enhanced mechanical properties ( $f_{ym}$  up to 2300 MPa), allowed for a remarkable expansion of the fields of application for SFRC structures. In fact, with these fibres it became possible to improve structural performance to levels that were previously unattainable.



The referred improvement of performance is extraordinary in serviceability limit state verifications (namely for crack control), being also very important in ultimate limit state verifications. Especially for SFRC solutions combined with traditional rebar reinforcement.

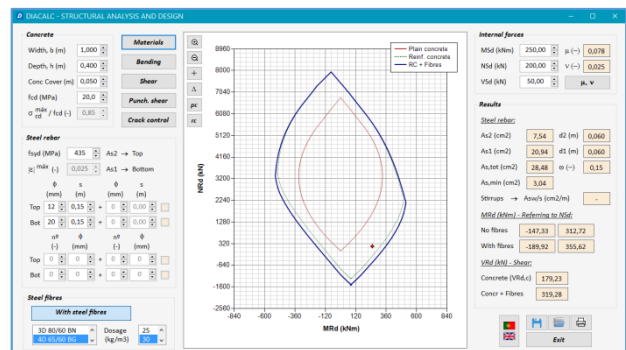
After four years of investigation, an integrated software that includes the contribution of steel fibres was developed for structural analysis and design (DIACalc®) in accordance with

European standards, namely Eurocode 2 and the German standard DAfStb Stahlfaserbeton (extension of DIN EN 1992-1-1 for SFRC).

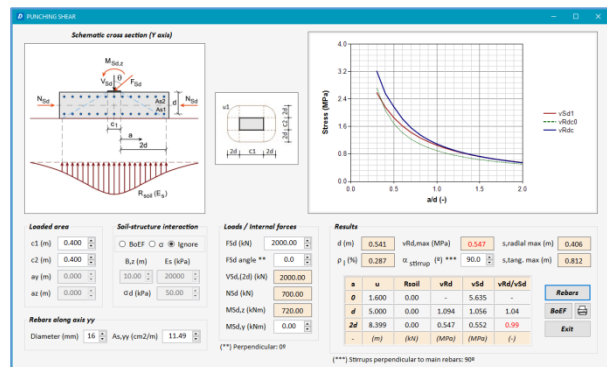
## Analysis and design of SFRC structures

Complete structural analysis can be performed with DIACalc®, regarding the following Ultimate Limit State (ULS) and Serviceability Limit State (SLS) verifications:

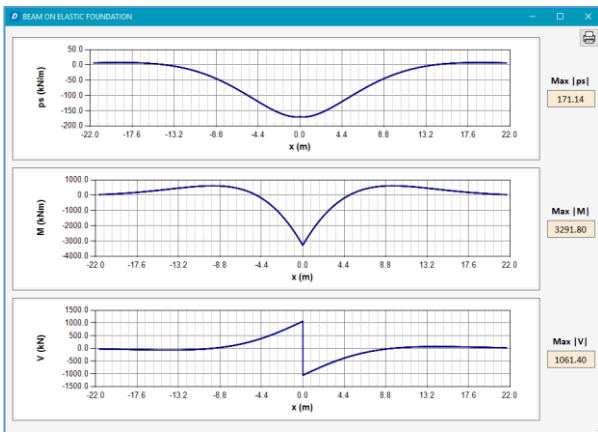
- **ULS** → Structural resistance
  - > Bending (with or without axial force)
  - > Shear
  - > Punching shear
- **SLS** → Durability
  - > Crack control



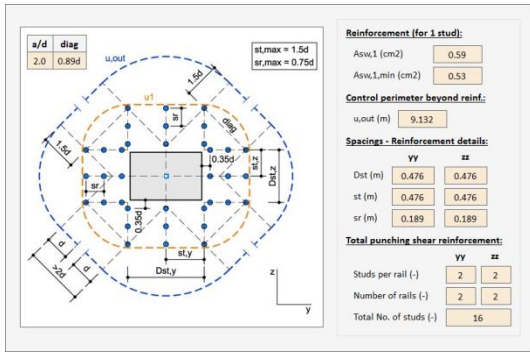
Bending and Shear



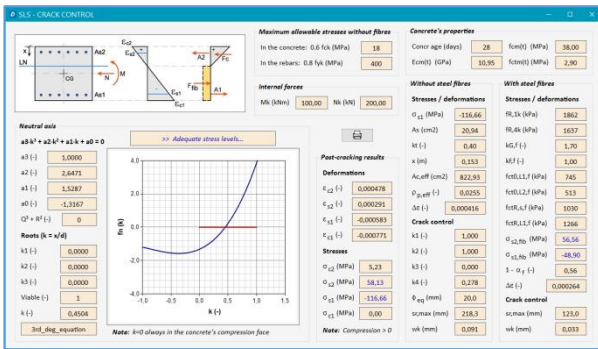
Punching shear



Beam on elastic foundation



Punching shear reinforcement



Crack control

DIACalc® automatically produces complete output results, in five languages, allowing the creation of technical reports almost instantly.

## Fields of application for SFRC

The new 4D and 5D fibres allow for the design of more competitive SFRC structures in several areas of civil engineering:

- Underground structures (caverns, tunnels, shafts, etc.);



- Hydraulic structures (dams, power plants, water channels, etc.);
- Earth retaining structures (including diaphragm walls);
- Foundations (including piles);
- Slope stabilization works;



- Pavements (industrial, harbour, 'Clad racks', rafts, etc.);



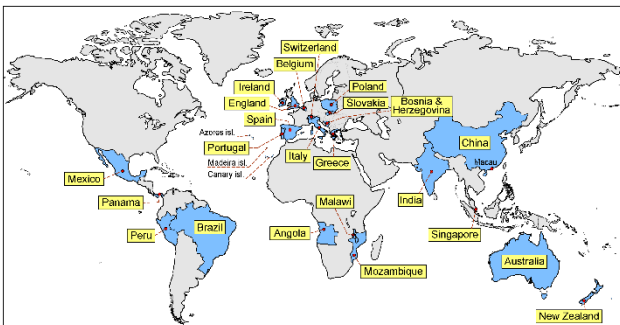
- Prefabricated structures (tunnel linings, tubular structures).

## DIACLASE, Consultores de Engenharia, Geologia e Ambiente

**Diaclase** was founded in 2006 for the purpose of developing projects and studies in the areas of Civil Engineering, Geology / Geotechnics, Hydrogeology and Environment, and also to provide technical assistance to the execution of works.

The company counts with the participation of a specialised staff, with vast experience in the referred areas of interest for SFRC structures, in order to provide high quality services, with competence and the required versatility to keep up with the growing technical challenges of the present time.

The geographical distribution of the company activity has been extended in the past years to several countries in Europe, Africa, Latin America and Asia, in a gradual and consistent manner, as a response to the recent trends of the global engineering services market.



**Diaclase** takes into account the most important technical areas that contribute in a decisive manner for the design of SFRC solutions, from the definition of the concrete composition, the choice of the most adequate steel fibre, the structural analysis and design of the solutions, and finally the laboratory tests.

## Price list of DIACalc®

The purchase of **DIACalc®** licenses shall be in accordance with the following price list:

- **1 license:** 3.250 euros
- **2 licenses:** 2.750 euros / license
- **3 licenses:** 2.500 euros / license
- **4 licenses:** 2.250 euros / license
- **≥ 5 licenses:** 1.950 euros / license  
(+ VAT, if applicable)

Each license of **DIACalc®** is perpetual, valid for one single computer, and the software must be installed on a hard disk.

A fully comprehensive User Manual is provided with the software.

**Diaclase** may, at its discretion, offer program upgrades, at no cost, if released within 90 days of the purchase of a new Software License.

Technical support will also be available, at no cost, for the period of 90 days from the date of purchase of a new Software License.