

STABILITY OF ROCK FILL DAMS

Purpose(s): To predict rock-fill dam failure under static and dynamic loadings

Client: EDF-CIH

Date: 2002-2007

Location: Escoubous
(Pyrénées – France)

Partners: Ecole Centrale de Lyon

Project executive manager:
Fabian DEDECKER

Code(s) used: PFC^{2D}

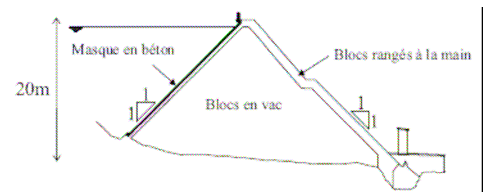
Rock fill dams are probably among the **oldest artifacts used in hydraulic engineering**. The technique was improved during the 20th Century, and many dams with a **width-to-height ratio smaller than 1** (current practice is 1.3) were built, mainly in France and Italy.

EDF-CIH has been working for many years on **anticipating the long-term behavior** of such structures, foreseeing that **internal defaults** may induce sudden failure. In this framework, EDF-CIH has developed several research programs that make use of the **discrete numerical approach, which is suited** perfectly to study structures composed of many blocks.

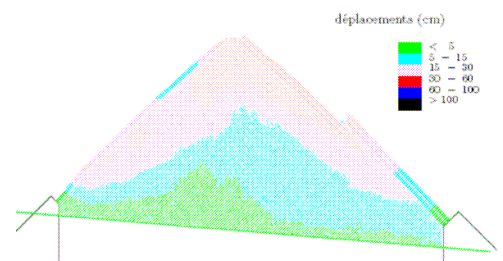
ITASCA has participated actively in all the studies done with the PFC^{2D} code. In particular, ITASCA has **developed efficient tools** dedicated to the construction of numerical models; these tools take into account all parts constituting the dam (individual rock blocks, upstream and downstream faces), and they include **rock blocks fractures and simulate creep behavior** (evolution of bond strength with time and **climatic factors**), as well as the mechanical response of the structure subjected to reservoir filling and emptying.



Escoubous dam (downstream view)



A numerical model scheme



Displacement field under gravity loading

KEYWORDS:

- Discrete modeling
- Rock fill dams
- Stability
- Vertical displacements
- Stone pitching

⇒ RESULTS:

- Stone pitching and upstream mask play important roles regarding the stability of the embankment.
- Long-term strains mainly are due to the coupling between cycles of reservoir filling/emptying and the time-dependent material behavior (creep).
- Climatic factors (rain, temperatures) strongly influence displacements in a rockfill dam.

REFERENCES:

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- Deluzarche, R., F. Dedecker and J. J. Fry. "Static and Dynamic Analysis of Stability of Rocky Slopes via Particle Methods," in Numerical Modeling in Micromechanics via Particle Methods (Proceedings of the 1st International PFC Symposium, Gelsenkirchen, Germany, November 2002), pp. 125-131. H. Konietzky, Ed. Lisse: Balkema, 2003.