EL COMITE DE ASPECTOS COMPUTACIONALES DE ICOLD

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Universidad Politécnica de Valencia
iPresas

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UNIVERSIDAD POLITECNICA DE VALENCIA

iPresas Risk Analysis

II JORNADA ANUAL DE INNOVACIÓN Y TECNOLOGÍA INTERNACIONAL EN PRESAS Y BALSAS
La Ingeniería de Presas y Balsas en el Siglo XXI

CIGB ICOLD
COMMISSION INTERNATIONALE DES GRANDS BARRAGES
INTERNATIONAL COMMISSION ON LARGE DAMS
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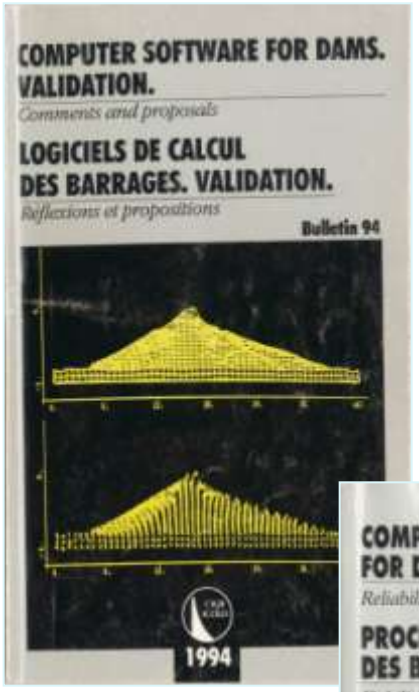
Technical Committees
Presently, ICOLD has 26 Technic
management of water resources.
Bulletins have been published and
List of Committees:
A COMPUTATIONAL ASPECTS
B SEISMIC ASPECTS OF DAM
C HYDRAULICS FOR DAMS
D CONCRETE DAMS
E EMBANKMENT DAMS
F ENGINEERING ACTIVITIES WITH THE PLANNING PROCESS FOR WATER
T.O.R
Share Space
COMPUTATIONAL ASPECTS OF ANALYSIS AND DESIGN OF DAMS
Chaired by I. ESCUDER
Prepare recommendations on the part numerical models have to play in the design activity of a new dam project, and on prerequisites needed for their use.
Prepare recommendations on the part numerical models have to play in evaluation of the behaviour of existing dams, and on prerequisites needed for their use.
Organise Benchmark Workshops to compare numerical models between one another and/or with reference solutions.
Organise the dissemination and publication of problems and solutions prepared during previous Benchmark Workshops, so as to provide engineers, software editors and researchers with reference solutions.
Propose lines of research aiming at establishing valid numerical models for the solution of dam problems presently not amenable to reliable numerical treatment.
ATIONS
Bulletin 138
Our Last Publication
General approach to Dam Surveillance
Bulletin 141
Our Last Publication
Concrete face Rockfill Dams - Concepts for design and construction
Bulletin 144

Contenido

- Boletines
- ICOLD Benchmark Workshops 1991-2012
- Mandato y términos de referencia
- Retos



The focus of the Bulletin N. 94 was mainly addressed on general concepts of the numerical modelling process.

Bulletin N. 122 made reference to the critical review of the reliability level of presently available mathematical models adopted for the design and safety assessment of dams.

GUIDELINES FOR USE OF NUMERICAL MODELS IN DAM ENGINEERING

CONTENTS - SOMMAIRE

FOREWORD	AVANT-PROPOS
1 INTRODUCTION	1 INTRODUCTION
2 NUMERICAL MODELS FOR NEW DAMS	2 MODELES NUMERIQUES POUR LES PROJETS DE BARRAGES NEUFS
3 PARTICULAR ISSUES ON EXISTING DAM MODELING	3 PARTICULARITES DES MODELES POUR LES BARRAGES EXISTANTS
4 LESSONS FROM PAST EXPERIENCE – CASE HISTORIES	4 LEÇONS DE L'EXPERIENCE – CAS D'ECOLE
5 INTEGRATION OF NUMERICAL MODELS INTO THE GLOBAL ENGINEERING APPROACH	5 ROLE DES MODELES NUMERIQUES DANS L'APPROCHE GLOBALE DE L'INGENIERIE DES BARRAGES
6 CONCLUSIONS	6 CONCLUSIONS

Benchmark-Workshops

Venue	Year	Themes
Bergamo	1991	1. The linear-elastic computation of a double curvature arch dam with its foundation under self weight, hydrostatic load, thermal load. 2. The seismic response of an embankment dam under conditions of both low and medium levels of seismic loadings.
Bergamo	1992	1. Seismic analysis of the Talvacchia dam. 2. Static analysis and dynamic response of El Infiernillo embankment dam.
Paris	1994	1. Non-linear analysis of joint behaviour under thermal and hydrostatic loads for an arch dam. 2. Evaluation of critical uniform temperature decrease for a cracked buttress dam (2Danalysis). 3. Evaluation of pore pressure and settlements of an embankment dam under static loadings. 4. Dynamic analysis of an embankment dam under a strong earthquake.
Madrid	1996	1. Earthquake response of an arch dam including the non-linear effects of contraction joint opening. 2. Evaluation of stress intensity factor K1 along the tip of the crack in a buttress dam under thermal gradient effects (3D analysis). 3. Steady-state and transient 2D unconfined seepage analysis for different types of earth dams. 4. Effect of large foundation settlement on an embankment dam.
Denver	1999	1. Uplift pressure and stress analysis of an arch dam and foundation. 2. Imminent failure flood level evaluation for a gravity dam with interface crack (rock/concrete) and varying uplift pressures. 3. Evaluation of the global factor of safety against failure of an embankment dam. 4. First filling of a rockfill dam: a case study.

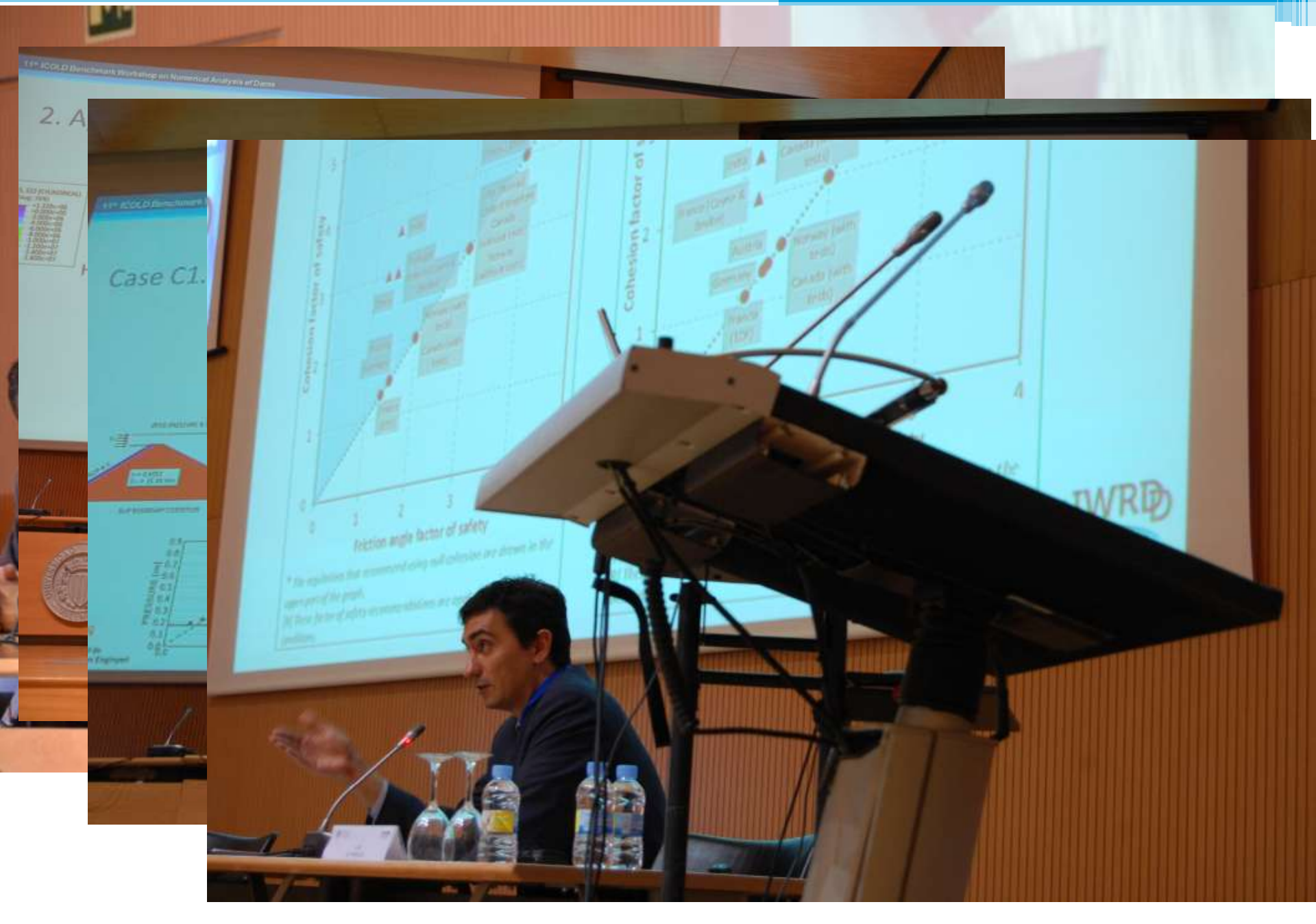
Venue	Year	Themes
Salzburg	2001	1. Evaluation of AAR (alkali-aggregate reaction) effects on the structural behaviour of an arch dam: interpretation of the measured behaviour and forecasting of the future trend. 2. Prediction of upstream face deflection of a CFRD (concrete faced rockfill dam) during its first impounding. 3. Interpretation of measurement results for the radial crest displacements of Schlegeis dam.
Bucarest	2003	1. Evaluation of ultimate strength of gravity dams with curved shape against sliding. 2. Thermal analysis of RCC (rolled compacted concrete) gravity dam. 3. Seepage through an earthfill dam-foundation system and piezometric level variation.
Wuhan (China)	2005	1. Evaluation of AAR reaction effects on the behaviour of an Italian hollow gravity dam. 2. Temperature field simulation and crack analysis of a RCC arch dam. 3. Evaluation of the behaviour and safety (static and dynamic) of a rockfill dam.
S. Petersburg	2007	1. Analysis of the elastic behavior of an arch-gravity dam. 2. Stress-strain state of high rock-fill dam with a central earth core at large amplitude of operation water level changes in the upstream. 3. Advanced numerical modelling for dams.
Paris	2009	1. Initial strain and stress development in a thin arch dam considering realistic construction sequence. 2. Analysis of a concrete faced rockfill dam including concrete face loading and deformation. 3. Stability of a dam abutment including seismic loading.

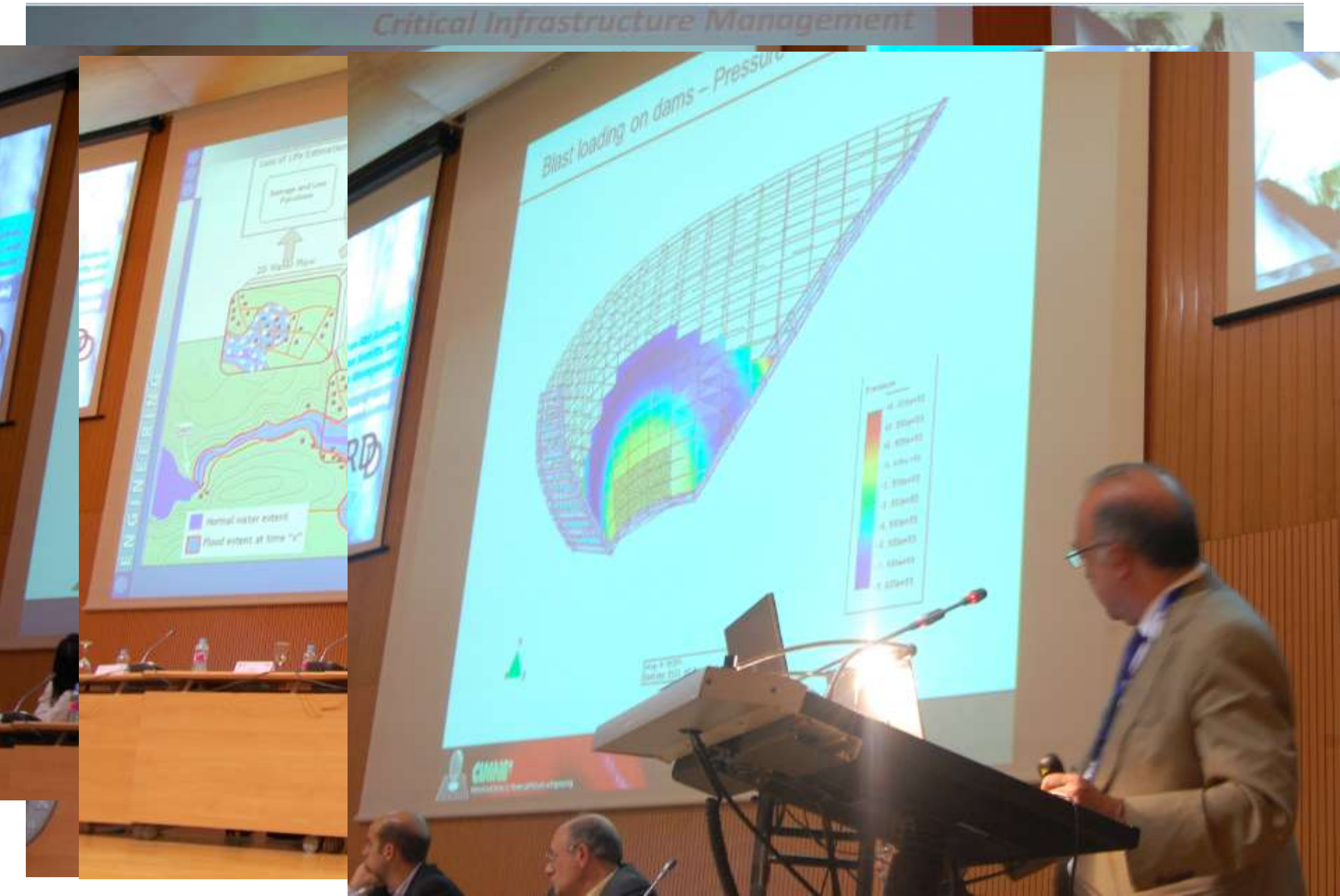
THIRD IWRDD, VALENCIA, 2011

THIRD IWRDD, VALENCIA, 2011

	TOTAL
FORUM	219
TECH. VISIT	89
COURSE	48
11th ICOLD BW	137

TOTAL INDIVIDUAL* 272


Case C1.
Cohesion factor of safety
Friction angle factor of safety
IWRDD


Critical Infrastructure Management
Blast loading on dams – Pressure
Normal water extent
Flood extent at time "x"

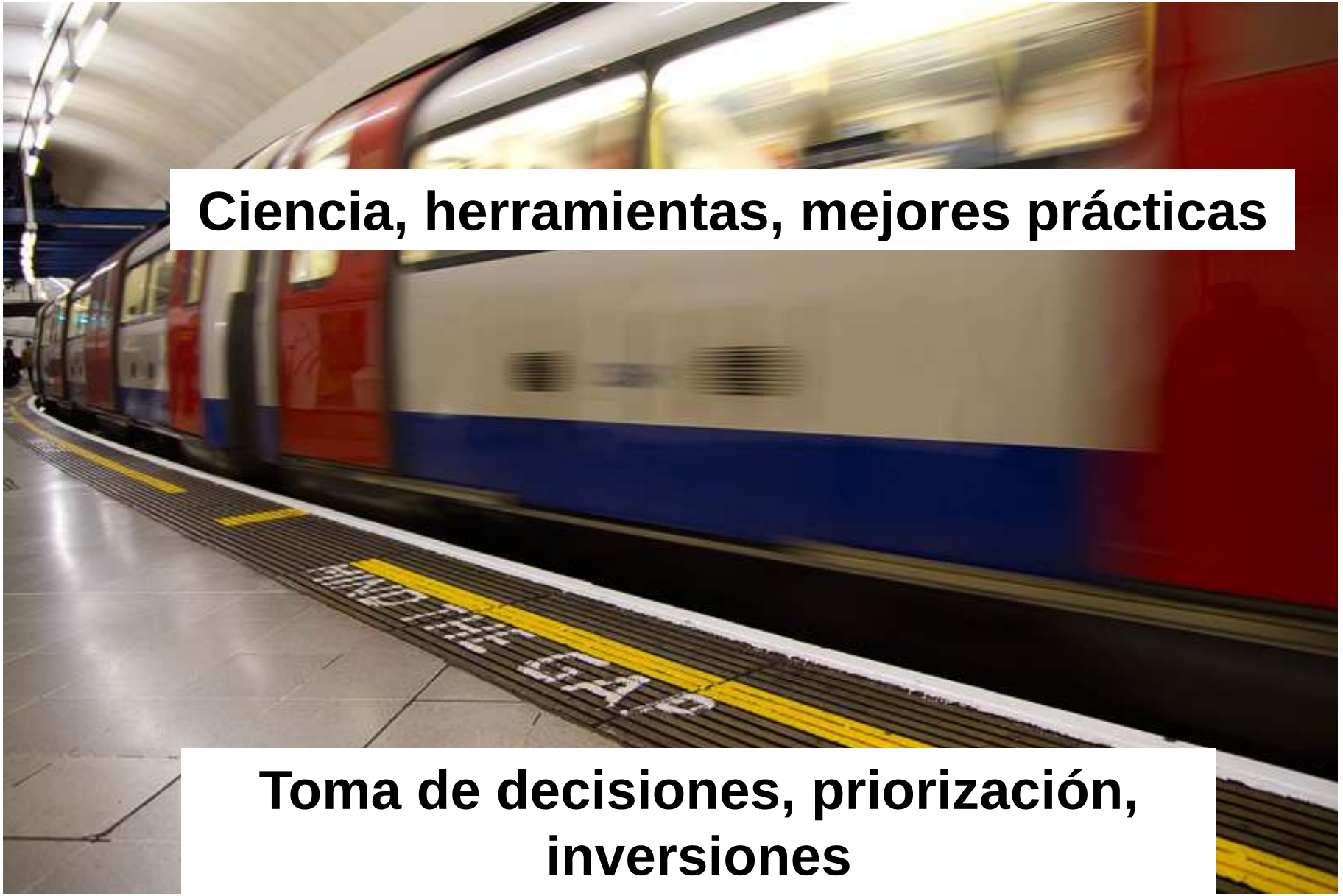
- 1. **Prepare recommendations** on the role and capabilities of numerical models to deal with problems relevant to dams throughout their life cycle (design, construction, operation, maintenance, rehabilitation, etc.)

- 2. **Organize Benchmark Workshops** to compare numerical models between one another and/or with reference solution, including the dissemination and publication of results

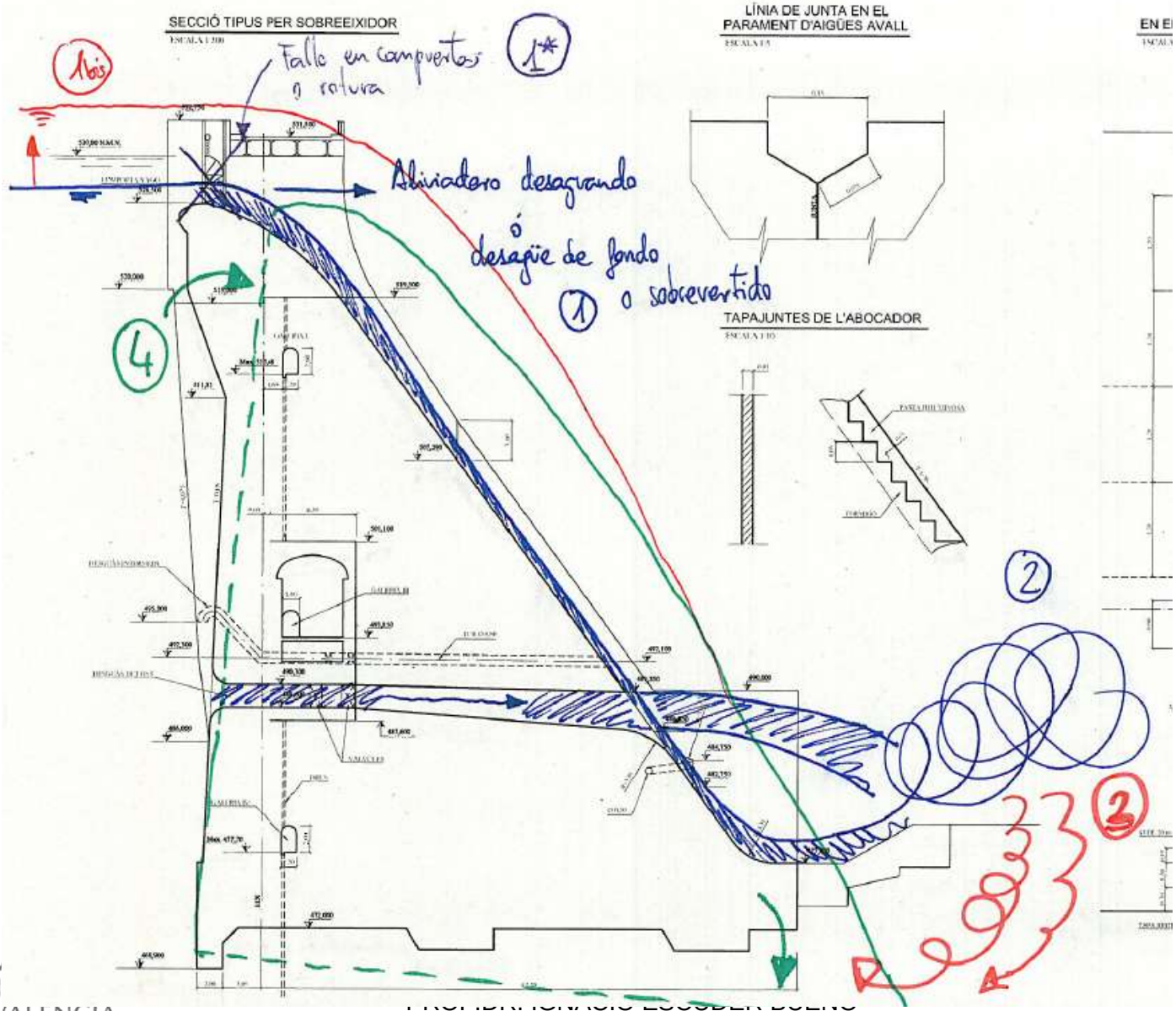
- 3. Prepare recommendations on how computational methods can be used to **estimate risks and account for uncertainties** inherent to dams

- 4. Review and consolidate the “state of the art” on **new probabilistic approaches** to traditionally deterministic inputs and outcomes of numerical modeling

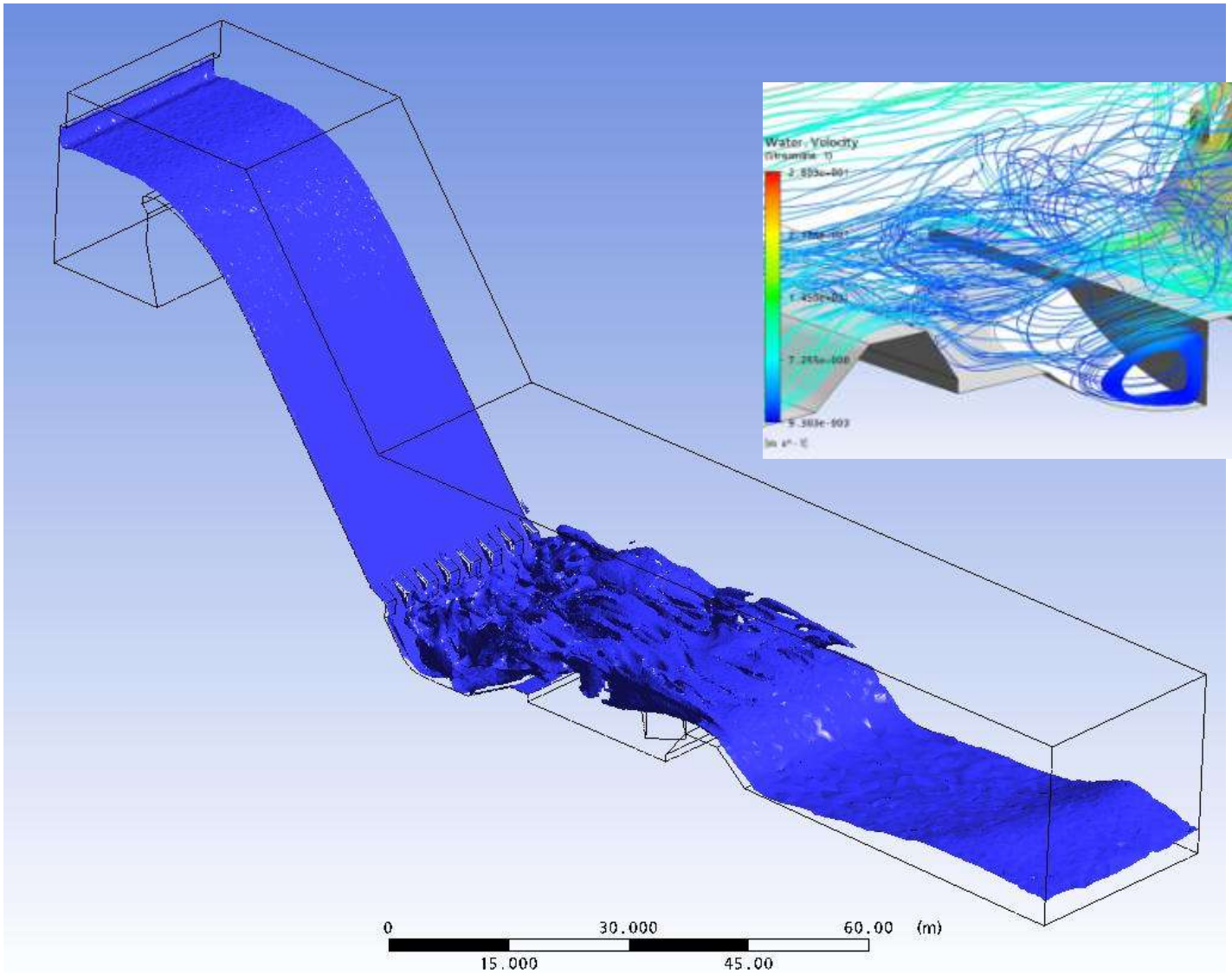
- 5. Propose lines of **research aiming at establishing valid numerical models** for the solution of dam problems presently not amenable to reliable numerical treatment

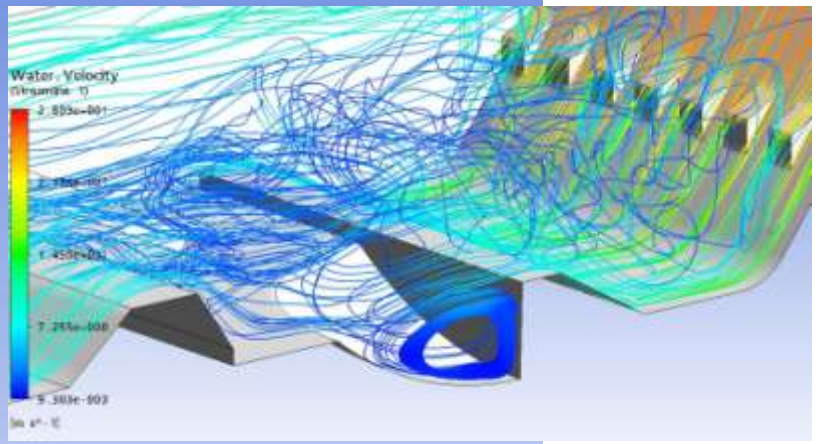

Ciencia, herramientas, mejores prácticas
Toma de decisiones, priorización, inversiones

IDENTIFICACIÓN MODOS DE FALLO

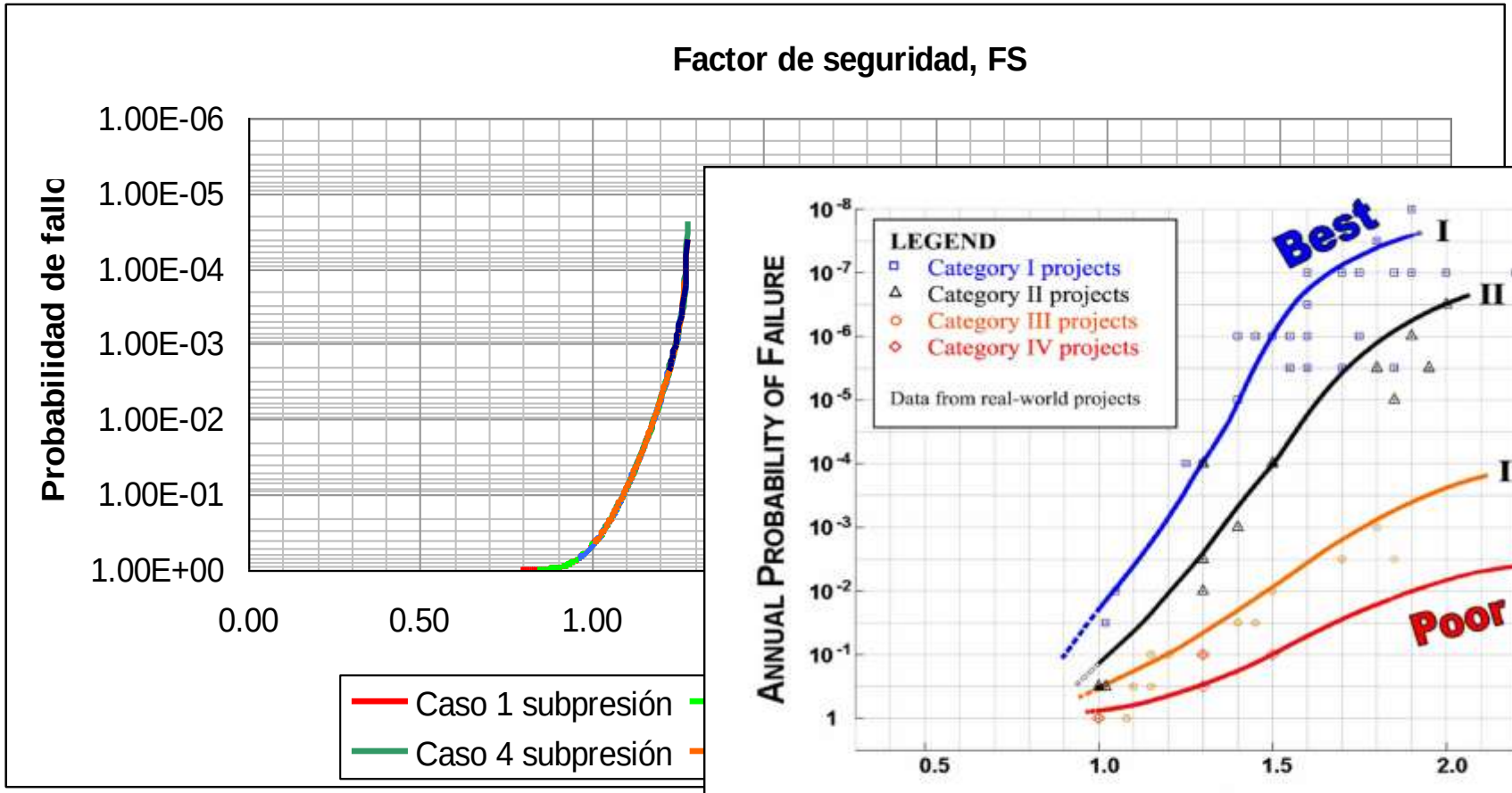


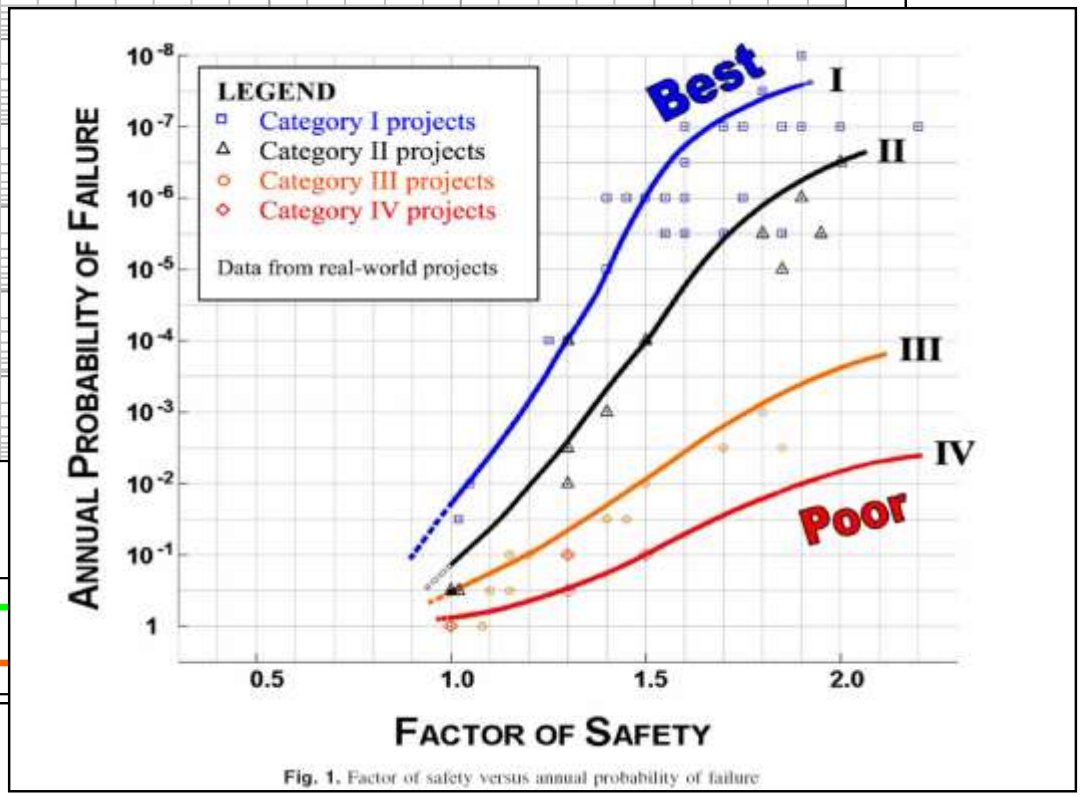
RESPUESTA HIDRAULICA-ESTRUTURAL



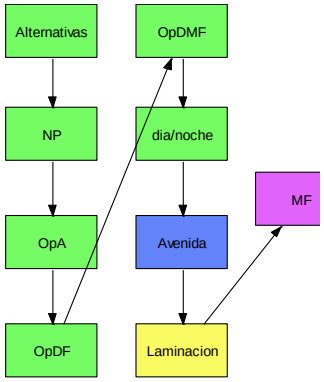


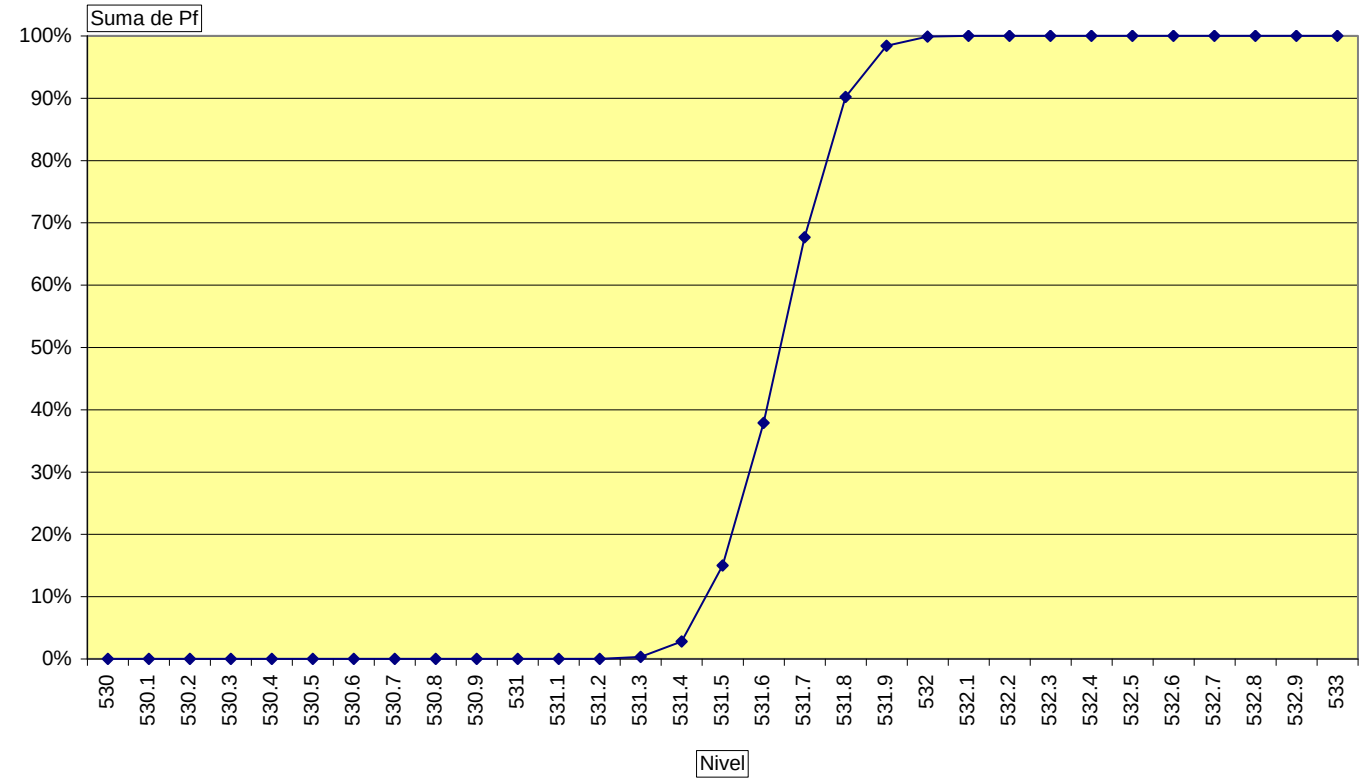
COEFICIENTES DE SEGURIDAD-PROB. FALLO





MODELOS DE RIESGO





CÁLCULO-COMPUTACIONAL RIESGO

Results

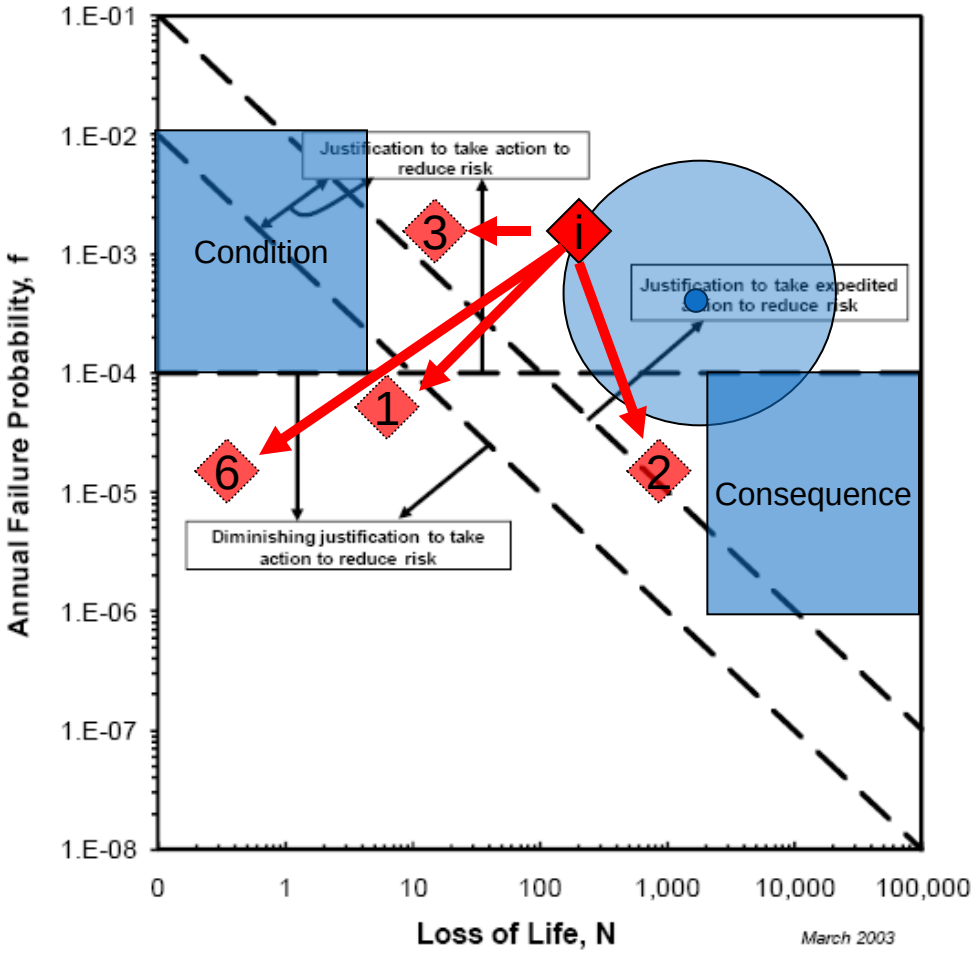
	SlidingDr	Undermining	Total
Probability	1.69374439167e-006	8.395685835e-006	1.00894302267e-005
Risk (euros)	197.486076794	938.719336525	1136.20541332
Risk (lives)	0.00301963902844	0.0142992637428	0.0173189027713

Results

	prob	AEP	Failure mode	Hov	MaxWL	Moment	PL	QBr	QRou	SOp	Tov	Under
1	0.0	0.0750593616814	Undermining	0.0	1195.41328446	day	1186.5	29342.6315891	0.0	2	0.0	1
2	0.0	0.0750593616814	Undermining	0.0	1195.41328446	night	1186.5	29342.6315891	0.0	2	0.0	1
3	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	day	1186.5	38422.2034652	0.0	2	0.0	0
4	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	night	1186.5	38422.2034652	0.0	2	0.0	0
5	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	day	1186.5	38422.2034652	0.0	2	0.0	0
6	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	night	1186.5	38422.2034652	0.0	2	0.0	0
7	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	day	1186.5	38422.2034652	0.0	2	0.0	0
8	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	night	1186.5	38422.2034652	0.0	2	0.0	0
9	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	day	1186.5	38422.2034652	0.0	2	0.0	0
10	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	night	1186.5	38422.2034652	0.0	2	0.0	0
11	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	day	1186.5	38422.2034652	0.0	2	0.0	0
12	0.0	0.0750593616814	SlidingDr	0.0	1195.41328446	night	1186.5	38422.2034652	0.0	2	0.0	0
13	0.0	0.0376187938389	Undermining	0.0	1196.84952461	day	1186.5	31940.790012	0.0	2	0.0	1
14	0.0	0.0376187938389	Undermining	0.0	1196.84952461	night	1186.5	31940.790012	0.0	2	0.0	1
15	0.0	0.0376187938389	SlidingDr	0.0	1196.84952461	day	1186.5	40671.3555328	0.0	2	0.0	0
16	0.0	0.0376187938389	SlidingDr	0.0	1196.84952461	night	1186.5	40671.3555328	0.0	2	0.0	0

Tolerable Risk Guidelines

"Making Better Decisions" (ERIC.H.)



INCERTIDUMBRE

- Más que un número
- Toma de decisiones con incertidumbre
- Priorizar acciones estructurales y no estructurales
- Entendimiento de las responsabilidades compartidas

Muchas Gracias