



Technical Committee P on CMD WORKSHOP

Cemented Soil Dams *Introduction to the CMD Workshop*

Michel LINO, ISL Ingénierie

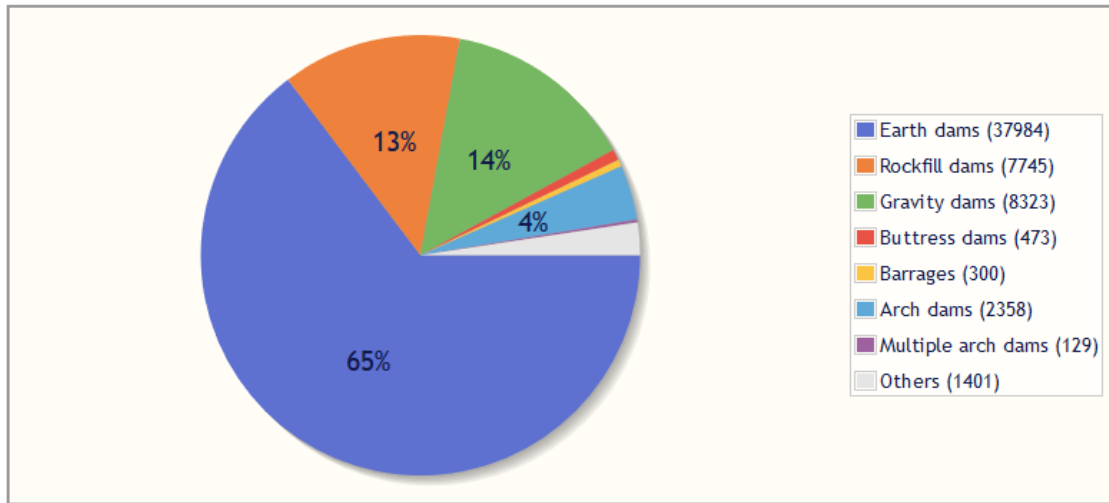


May 28th, 2022



Introduction to CMD

Earth dams predominate for some 65 % of all reported dams.



From ICOLD Database (2021)

- 78% of existing dams are embankment dams (Earth and Rockfill) (ICOLD Database)
- 65% are earth dams
- this proportion is even higher in China
- Only 14% are concrete gravity dams

Why?

- ✓ Concrete is an expensive material
- ✓ Good rock foundation is needed for a concrete dam
- ✓ Earth dams are simple to design and build (at least apparently...)

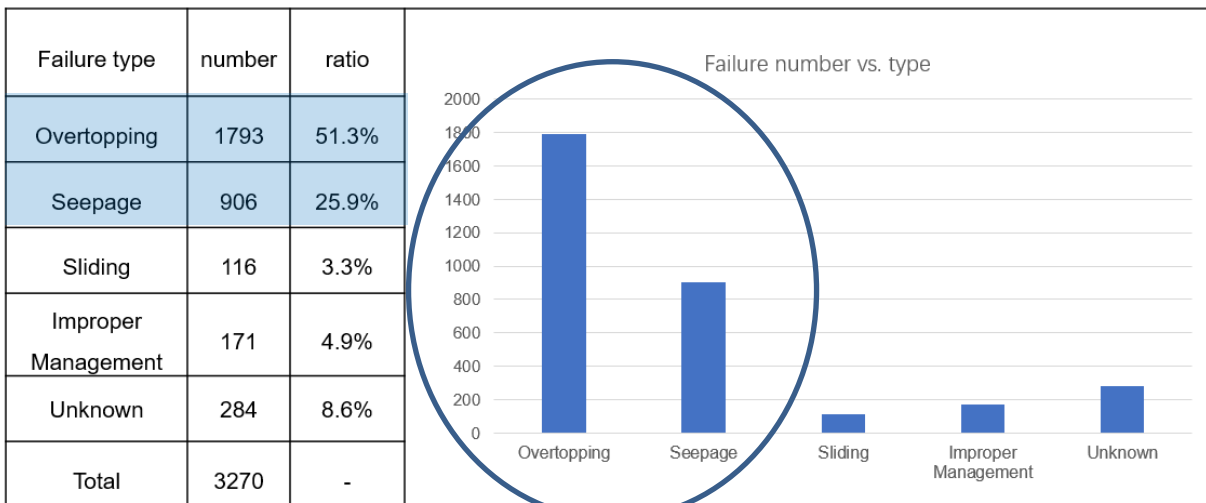


Introduction to CMD

Statistics of different failure types of embankment dam in China (CHINCOLD, 2014)

| Dam type | Existing dams ¹ | Failed ¹ | Ratio |
|------------------|----------------------------|---------------------|-------|
| Concrete | 2047 | 11 | 0.54% |
| Earth & rockfill | 88072 | 3270 | 3.71% |
| Masonry | 5633 | 50 | 0.89% |
| Others | 527 | 166 | - |
| Total | 96279 | 3497 | 3.63% |

Earth & rockfill dams have a high failure ratio.



Overtopping and internal erosion account for 77% of the failures of earth dam

How to improve overtopping and internal erosion resistance of earth dams?

This one of the main drivers of CMD development.



Introduction to CMD and CSD

The basic principles of CMD

- A **new construction material** different from earth, alluvium, rockfill or concrete/RCC.
- **Environmental friendly** : use the material available in the vicinity and preferably in the reservoir.
- **High degree of safety** : CMD is a cohesive material
 - Resistant to internal erosion
 - Can withstand overtopping
 - High degree of internal and external stability
- Can be adapted to **poor foundation** or even non rock foundation
- The material strength can be fitted to what is really needed, on the contrary of concrete which is generally oversized.



Introduction to CMD and CSD

2012 ICOLD Committee P on CMD is launched :

- Dr. Jia President (China), Michel Lino Vice-President (France)
- China, France, USA, Spain, South Africa, Japan, Iran, UK, Greece, Turkey, Austria are the main contributors.
- Objective : 3 bulletins on CMD
 - ✓ **RFC bulletin approved in November 2021** : main author is Dr. Jin Feng, with a large international contribution.
 - ✓ **CSD Bulletin to be approved in Marseille 2022**, drafted by French engineers, great implication of China who adopted this new idea and contribution of USA, Iran and Spain, Malaysia
 - ✓ **Hardfill/CSG/CBGR bulletin(s)** on going: a mature technology with 3 different approaches from France and Europe, Japan and China



Overview of the CMD technologies



Program of the Workshop

13:50 – 14:10: Presentation (video) of the RFCDB Bulletin: F. Jing, China

14:10 – 14:50: Presentation of the CSD Bulletin

- Introduction: M. Lino, France
- From transport infrastructures to hydraulic works: D. Puiatti, France
- Properties of treated soils: P. Cochet, France
- Design: M. Lino, France
- Perspectives and conclusions: M. Lino, France

14 :50 – 16 :10: Invited presentations on Cemented Soil uses (about 10 min/presentation)

1. The French Seine North Europe Canal: B. Deleu, France
2. CSD: Engineering and design advances: P. Agresti, France
3. Example of application: China
4. Field tests on overtopping resistance of CS: P. Peeters, Belgium
5. Field tests on overtopping resistance of CS: T. Mallet, France
6. Protection CS dike with high stakes: P. Agresti, France
7. CS and small dams: M. Kaboré, Burkina Faso
8. Soil preparation before treatment: D. Puiatti, France

16:10 – 16:15: Conclusion: M. Lino

