How to Avoid Structural, Corrosion, and Deterioration Disasters in Water Dams

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Situation

Dams are considered systems with potentially destructive water forces due to the volume and weight of the water behind the dam. This means that any failure has the potential to cause destruction of lives, property, and the environment. Even though dam failures are rare, they can cause substantial damage and loss of life.

History of Dam Failures

Koshi Barrage, in India, collapsed in 2008 and affected approximately 4.8 million people and devastated 100,000 houses [1].

Atomic Bombs or Dam Failures

Banqiao Reservoir, in China, collapsed in 1975 with its aftermath compared with Hiroshima bombing.

Table 1: Atomic Bombs and Dam Failure comparison

	Banqiao failure	Hiroshima bombing
Death toll	171,000	135,000
Time taken	20 days	15 hours
Houses	11,000,000	60,000

Problems

- **Structural Weakening and Destabilization:** types of materials used are not appropriate to the dam surroundings.
- **Corrosion:** steel reinforcement corrosion and concrete cracking occur because of high humidity.
- **Environmental Deterioration:** rapid changes in water level and pressure can cause habitat frag mentation and reservoir-induced seismicity respectively. Landslides are a result of both water level and pressure.

Problems – Continued

With reference to Figure 1:
Structural Weakening and Destabilization: shown in concrete failure cracking and at the base of a dam where stability failure occurs.
Corrosion: seen at the end of the piping where erosion has resulted in a scour hole.
Environmental Deterioration: can be caused by a mini landslide that can cause a slump. Rodent activity is a sign of habitat fragmentation.

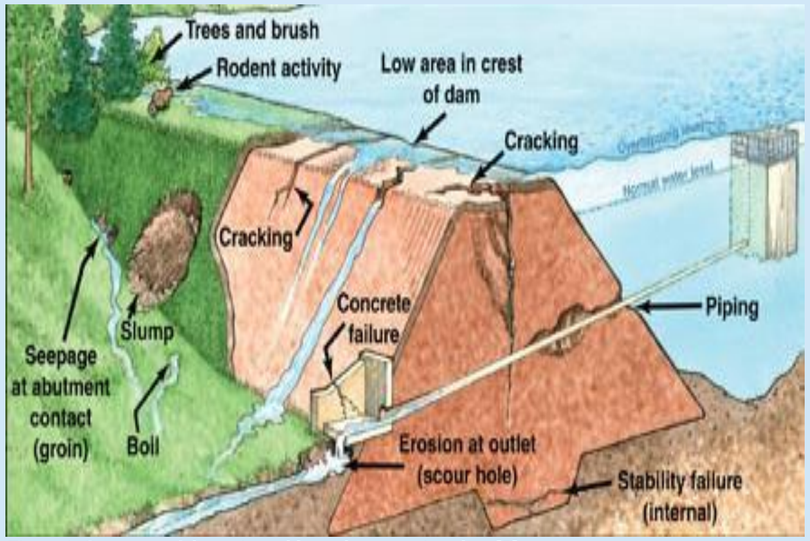

Figure 1: Summary of the main problems that occur in a dam [2]

References:
[1] "UNDMT response to Bihar Floods 2008". United Nations in India. [Online]. Available: http://www.un.org.in/_ layouts/CMS/ undmt_biharfloods2008 .aspx [Accessed: Nov. 15, 2013].
[2] J. Wu, J. Huang, X. Han, Z. Xie and X. Gao. Three-gorges dam--experiment in habitat fragmentation? Science 300(5623), pp. 1239-40. 2003. Available: http://ezproxy.aus.edu/login?url=http://search.proquest.com /docview/ 213596143?accountid=16946. [Accessed: Nov. 20, 2013].
Other references are available upon request

Solutions

- **Structural weakening and destabilization** can be avoided by strengthening the foundations and patching any spills; in addition to scheduled maintenance especially for outlet pipes. New effective alarm systems will help with prompt notification for any cracks or leaks.
- **Corrosion** can be avoided by choosing suitable materials for concrete. For example, the critical corrosion amount (CCA) can be determined to identify which materials are compatible with each other.
- **Environmental deterioration** can be avoided by studying and understanding the geological surroundings of the dam site. However, the water level and pressure should be maintained consistently.

Evaluation of Solutions

The evaluation for the 3 solutions is based on:

- Cost of the process
- Efficiency of materials
- Quality of materials

Evaluation of corrosion's solutions

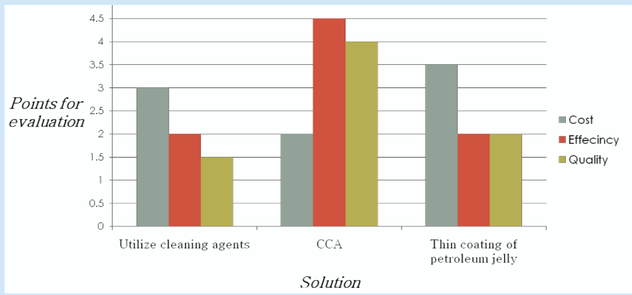

Figure 2: Comparison of corrosion solutions