DISCUSSION ON FAIL-SAFE LARGE DAMS IN EARTHQUAKE PRONE HIMALAYAN REGION

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The paper provides an excellent overview on the future dam projects in the Himalayas; many of them are very challenging projects in view of the high seismicity in the Himalayas. The basic (defensive) seismic design aspects of large embankment dams given by the author such as liberal free-board, increase of crest width and flattening of slopes etc. are very effective and practical. The author favours embankment dams over concrete dams in highly seismic areas. At this time, there is no proof or evidence, which shows that the very high embankment dams (rockfill dams with clay core with a height of over 200 m) are seismically safer than concrete dams of similar height.

As a matter of fact, despite the advances in structural analysis and constitutive laws for soils, it is still very difficult to predict the seismic (deformation) behaviour of large rockfill dams (including concrete-face rockfill dams) accurately. Benchmark problems (Ozanam and La Barbera, 1994) analysed by different teams have shown that due to the non-linear behaviour of embankment dams, the scattering in the results is very significant, much more than in the case of concrete dams. Therefore, I feel that it is premature to classify one dam type as safe as another one.

Furthermore, I believe that the author is aware that the 335 m high Rogun dam in Tajikistan is still under construction (and may not be completed in the near future; the coffer dam was washed away by a flood a few years ago).

I would like to add that the seismic design criteria for large dams have changed. For most of the dams designed against earthquakes 20 or 30 years ago, seismic design criteria and methods were used, which are considered as outdated today; therefore, it is time to look also into the seismic safety of the existing large dams. Most of them may still be safe but nobody really knows.

Dam engineers, who are very much focussed on the value of the peak ground acceleration, should be aware that already moderate earthquakes such as the Napa earthquake in California of September 3, 2000 with a magnitude of 5.2 caused a maximum peak ground acceleration near the fault of 0.49 g (EERI, 2000). A magnitude 8.0 earthquake may not cause higher accelerations than a magnitude 6.5 earthquake; however, the duration of strong ground shaking of a larger earthquake will be longer.

REFERENCES

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