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Session 7: Concluding Remarks

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CONCLUDING REMARKS
by Dr. Panos Dakoulas, Co-Chairman

First, I would like to congratulate and thank Dr. Von Thun for an excellent report and presentation. As shown by the state-of-the-art papers this morning, and by the presented papers in this session, there has been significant progress in this field during the last 10 years, and along with this progress, there has been also a continuous shifting of our goals to more ambitious ones.

I wish to make few comments with respect to seismic response of earth and rockfill dams.

With respect to the seismic response of earth dams and earth-structures to weak excitations (where inelastic deformations are not a problem) a variety of both simplified and sophisticated models has been developed recently, that allows us to have a reasonably good assessment of the relative importance of various factors affecting the response. The most important of these factors are

3-D canyon geometry
material inhomogeneity
canyon flexibility, and
spatial variation of the ground motion.

As professor Gazetas discussed this morning, the first two tend to increase the acceleration response, while the last two tend to reduce it. No doubt, there is substantial room for improvement of our understanding of their relative importance by further refining and expanding our models. As mentioned by Prof. Veletsos, Prof. Novak and Prof. Gazetas, the effect of ground motion incoherence on the response of earth and rockfill dams may be an area where we need to improve our understanding.

However, the most challenging task is the understanding and prediction of seismic response of earth dams and earth-structures experiencing strong inelastic action. The relative importance of the previous factors may be quite different during such inelastic behavior.

Strong nonlinearity will tend to be the predominant factor, which through increased hysteretic dissipation of wave energy, as well as destruction of potential resonances, may lead to much smaller amplification (about 1) or even deamplification of the motion at the dam crest, as well as substantial filtering of the high frequency acceleration response. This has been demonstrated on numerous occasions in the past and in this conference, through both rigorous inelastic analyses and actual field measurements, indicating in certain cases crest amplifications about or less than one.

I would like to emphasize the need to continue this research by using models which range from the simpler ones (as for example, the Layered Inelastic Shear Beam), which are very efficient and can model inelasticity quite well, to the more rigorous coupled elastoplastic finite-element formulations with appropriate constitutive models and adaptive meshes (that can be refined refined locally), as, for example, the one presented by Prof. Zienkiewicz. The latter models, at their final stage of development, will offer us the advantage of a unified approach to solve from the inelastic deformation problems up to liquefaction failure problems; that is, of course, if we can afford such analyses. In the meantime the use of simplified models which are more custom-made to our urgent needs is very appropriate and desirable, and, as Dr. Von Thun discussed earlier, this trend is apparent in this conference.

Finally, I would like to conclude by stressing once more the need to verify our models with high quality field measurements, as well as centrifuge measurements, to gain confidence in their validity.

I would like to thank you very much for your contributions and your presence.