ABSTRACT: The failure of a large dam is a significant hazard to both the general population and the environment. This is particularly true for earthquake-induced failures where there may be little or no warning time. Due to the high consequences of failure, dams are often designed for large earthquake events with return periods in excess of 2,500 to 10,000 years. The past 30 years has seen a dramatic development in the sophistication and complexity of the tools and methods used to perform these analyses. Modern evaluations of embankment dams include probabilistic seismic hazard analysis for developing the earthquake loading and advanced numerical analysis for estimating the corresponding dam response, primarily in terms of likely deformations. This lecture presents one such analysis approach using the finite difference program FLAC. Key factors are discussed, including the importance of the input ground motions, selection of material models, soil degradation through liquefaction or cyclic softening, and the use of numerical analysis results in risk assessment. The methods and lessons learned are demonstrated through two analysis case histories: a) Tuttle Creek Dam near Manhattan, Kansas (a 137-foot-high embankment that was recently remediated for seismic loading) and b) Success Dam near Porterville, California (a 145-foot-high dam that is the focus of a detailed risk assessment study).

BIOGRAPHY: Michael Beaty has 25 years of engineering experience with a particular focus on seismic evaluations. This work includes exploration, analysis, and/or design for a variety of facilities including embankment dams, concrete arch and gravity dams, slopes, foundations, towers, bridges, and pipelines. His analytical experience includes non-linear finite difference analysis for geotechnical works and soil-structure interaction, dynamic site response analysis, seismic hazard, slope stability, and seepage. Dr. Beaty is recognized for his work in seismic deformation analysis including the effects of liquefiable soils. He has worked for the CA Department of Water Resources (Division of Safety of Dams and Division of Engineering) and as a private consultant. He received his BS degree in civil engineering from UC Berkeley, his MS in structural and solid mechanics from UC Davis, and his PhD in geotechnical engineering from the University of British Columbia in Vancouver, Canada. Michael is a registered Civil Engineer in Oregon, California, and Washington and a registered Geotechnical Engineer in Oregon. He currently operates Beaty Engineering LLC in Beaverton, Oregon.