Dam rehabilitation and the perpetuation of human factors across time and space

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The perpetuation and effects of human factors across time and space in an era of federal dam building are explored in this paper by comparing and contrasting two embankment dams in Oregon: Clear Branch Dam and Cooper Creek Dam. Both structures were constructed by the Soil Conservation Service (SCS), now the Natural Resources Conservation Service (NRCS), in 1969 with concrete chute spillways founded on soil and/or rock. They are classified as high hazard potential structures. Clear Branch Dam was constructed to supply irrigation water; Cooper Creek Dam was constructed for flood protection and municipal water supply. The two dams have similar levels of complexity, and both experienced slope stability issues during construction; however, the two dams have different underlying geology and post-construction histories that heavily influence rehabilitation alternatives. Clear Branch Dam has been plagued by seepage and drainage issues since construction, culminating in a failure of the concrete auxiliary spillway in 2017 that required removal and replacement of a section of the spillway. The failure triggered an investigation by NRCS into its cause, which determined that design decisions to ignore recommendations from geologists for seepage and drainage measures led to excessive hydrostatic pressures acting on the spillway. A previous paper presented at the ASDSO conference in Orlando (Walter et al., 2019) explored the interaction of physical and human factors that led to the spillway failure. The human factors that contributed to the failure are understood through three primary drivers: 1) Human fallibility due to misperception, limited expertise, knowledge and information, and inaccuracy of models; 2) Pressure from non-safety goals; and 3) Complexity involving nonlinearities, feedback loops and network effects (Alvi, 2013). Complexity exacerbates the effects of human fallibility and limitation, as does time. In a new era of federal dam rehabilitation, rather than dam building, we are faced with a wicked and unique problem: the layering of human factors over time and across space on critical infrastructure projects. Today’s generation of engineers, geologists, and scientists working on dam rehabilitation projects navigate human factors amongst our respective design teams while simultaneously trying to unravel human factors that may have impacted the original design teams that came before us decades ago. In doing so, we often confront and grapple with the decisions of our predecessors from a perspective of privileged retrospect.