



The 1864 Failure of Dale Dike Dam (Sheffield, UK) - A Victorian Disaster DFIC Decade Dam Failure Series

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ABSTRACT

Dale Dike Dam was located eight miles northwest of the City of Sheffield, South Yorkshire, England, and was built from 1861 to 1863 in order to supply clean water to the rapidly growing community and industry. Unfortunately, as first filling was nearly complete in 1864, the dam suddenly failed and the resulting breach flood swept more than 12 miles downstream, causing an estimated 250 fatalities and damaging or destroying more than 600 houses, factories, mills, and shops. In his "A Complete History of the Great Flood at Sheffield," Harrison (1864) describes the losses as well as survival outcomes; for example, in one remarkable story, a man trapped on the upper floor of his row house chose to batter his way through the partition wall shared with a neighboring house, and he continued on through four units, collecting (and saving) thirty-four people as he worked towards safety. To this day, the Dale Dike failure remains, by far, the most consequential dam failure in the history of Great Britain and the country's worst civil engineering disaster.

The dam had a height of 95 feet and a crest length of 1,254 feet, and would have provided a reservoir storage of more than 2,600 acre-ft. As was typical in that era of British dam building, the dam was configured as an embankment with a narrow puddle clay core and foundation cutoff trench, with the core flanked by relatively permeable shells consisting of shale, rubble, and rockfill. Several failure investigations were conducted immediately after the failure, and no consensus was reached regarding the failure mode and mechanism. More than a century after the failure, the failure was re-investigated and it was concluded that the mechanism of the failure was most likely cracking of the puddle clay core due to differential settlement along the axis of the dam, subsequent hydraulic fracture of the core, and then internal erosion upstream of the core which progressed to result in collapse of the crest of the dam.

This presentation and paper will place this disaster in historical context and will describe the design and construction of the dam, a warning sign of the failure which was discovered but acted up too late to prevent the failure, the various hypotheses regarding the failure mode and mechanism, the flood path and destruction, and lessons learned for modern-day safety consequences estimation and risk management.