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Experimental mechanics study of a dam Tainter gate

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The primary objective of this instrumentation project is to determine the performance of the Tainter gate's trunnion bearings at the Carlyle Lake Dam in Illinois. The Tainter gate is a type of radial arm floodgate used in dams and canal locks to control water flow. The trunnion bearings are the critical component of the structure. Friction in the bearing can cause excessive forces in the structural arms of the Tainter gate and can result in a structural failure of the gate. Experimental determination of the stresses in the structural arms facilitates computation of friction encountered in the trunnion bearing when raising or lowering the gate. Specially designed transducers which could be readily attached to the structural arm were fabricated and installed to measure the strains present in the gate during routine operation. The transducer consisted of four strain gauges mounted on the flexural transducer and wired in a Wheatstone bridge configuration. The change in resistance of the Wheatstone bridge is linearly related to the strain imposed on the transducer. By measuring the voltage history of the transducer it is possible to determine strain in the structural arms during operations of the Tainter gate. The strains were recorded by using a LabView program custom written for this purpose. Simple mechanics based analysis of the resulting strains is expected to facilitate analysis of forces on the bearing. Preliminary results from the field investigation will be presented and discussed.