



Monitoring For The Kentucky Lock Addition Project



- **Objectives:** Monitor temporary dam during construction
- **Solution:** Jewell Instruments Little Dipper
- **Benefits:** High-precision and exceptional repeatability
- **Results:** Reliable and precise measurements

Overview

Due to delays experienced and projected at the existing Kentucky Lock (110 ft x 600ft), a 1992 Feasibility Study recommended the addition of the new, larger lock (110ft x 1200ft). The Water Resources Development Act of 1996 authorized The Kentucky Lock Addition project, located at Tennessee River Mile 22.4 in western Kentucky at the location of the dam at the Tennessee River – forming Kentucky Lake. During the adjacent excavation for the new lock that started in 2010, Jewell Instruments was contracted to monitor the performance of the existing Lock wall and temporary Cofferdam to control excavation sequencing and assure continued operation of the existing Lock and safety throughout construction.

Background

The Kentucky Lock Addition project is a new 110ft wide by 1,200ft long navigation lock that will be located landward and adjacent to the existing 110 x 600ft lock. Most of the tows using the 600 ft long existing lock are longer than 600ft. Therefore, they have to perform a time-consuming double lockage, a procedure that takes about three hours. These double lockages, along with the high traffic volumes experienced at Kentucky Lock, result in significant and costly delay for commercial vessels. From 1996–1998, the average delay time for a vessel at Kentucky Lock was about six hours. A new 1,200ft lock will virtually eliminate these delays in the near future and significantly reduce them in the out years.

The total project cost is estimated at \$532 million. Based on this \$532 million cost and the savings due to a reduction in delay times, the project has a benefit to cost ratio of 2.5. The reductions in transportation costs provided by this new lock will be realized by the consumers in the 20 states that ship products through Kentucky Lock.

The U.S. Army Corps of Engineers, Nashville District, has the primary responsibility for designing and constructing the project and will operate the lock once it is complete. However, the Tennessee Valley Authority (TVA) is an active partner in the new lock since it will be an integral component of TVA's Kentucky Dam.



Jewell Instruments Little Dipper Inclinometer



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Project

Prior to construction of the new Lock, a cofferdam had to be built to act as a temporary dam to hold back upstream water (Kentucky Lake). Once the cofferdam was constructed, excavation began to remove soil material downstream from the cofferdam and immediately adjacent to the existing land-side lock wall. This leaves the cofferdam and existing lock wall unrestrained on the land side which could result in movements or instability that could cause closure of the existing lock.

Having both the water loads on only one side of both the cofferdam and existing Lock wall required installation of an autonomous sensor array to continuously monitor horizontal soil displacement (in-place inclinometers), water levels (piezometers) and Lock wall movement (tilt meters and joint meters). The tiltmeters selected were the [Jewell Instruments Model 906 Little Dipper In-Place Inclinometers](#).

The [Little Dipper](#) is an in-place inclinometer system for monitoring slopes, embankments, deep excavations, tunnels, tank foundations, retaining walls, and other types of ground movement.

Installed as a string of vertical or horizontal sensors inside inclinometer casing, or by direct burial, this instrument provides a continuous record of ground displacement. Fiberglass rods connect the sensors inside the casing, and fins or universal pivots couple the sensors to the casing walls. [Little Dipper's](#) on-board electronics accept a wide input voltage range and drive long cables without signal loss. The waterproof and non-corrodible ABS sensor housing also makes the [Little Dipper](#) a popular tool for underwater tilt measurements in shallow marine applications.

Thalle Construction, the Contractor for the project retained the services of Jewell Instruments to assure a reliable sensor array can provide continuous real-time information to assure ongoing use of the lock and safety during construction. The various sensors were hardwired to remotely powered and remotely accessed data loggers that continuously monitor sensor response and post data onto Jewell Instruments' Atlas web-based server. Data can be reviewed in real-time through simple password-protected internet access.



Results

Each sensor has limit values assigned that when exceeded, trip email messages to staff that allow for remote access and review of data for decisions related to changes in construction sequencing or implementation of contingency plans.

This type of monitoring system not only provides a measure of risk mitigation for construction activity and assurance of continued operation of an essential part of our waterway transportation system, but can be left in place for long-term maintenance of the new and improved structure.

About Jewell Instruments

Jewell Instruments is a world leader in the design, manufacture, and distribution of high-precision products. Our expertise includes acceleration and tilt sensors, electronic compasses, avionics components, solenoids, and panel meters. The extensive application knowledge we have obtained through decades of experience allows us to provide custom solutions for a diverse group of industries. In fact, customers from all over the globe contact us for solutions to aerospace, medical, industrial, and telecommunications applications - to name a few.

To find out more, visit our website!



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