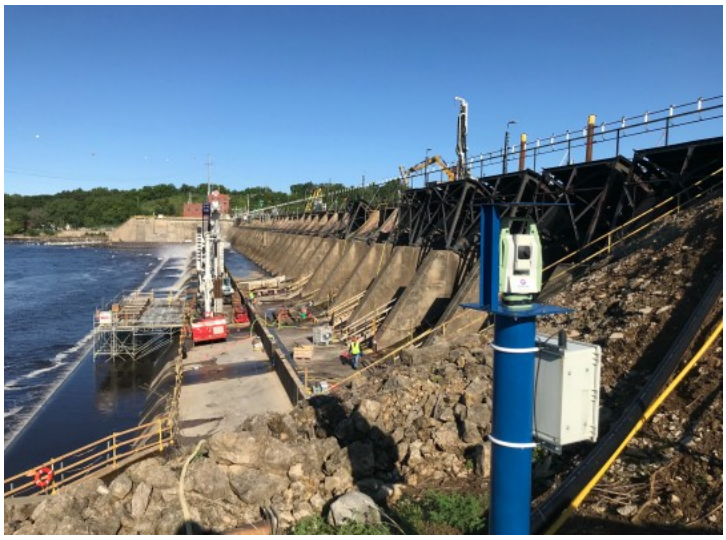
Prairie Du Sac Dam

Automated movement monitoring with grouped AMTS at an aging dam

Prairie du Sac Town - UNITED STATES



2018 - 2021

Wisconsin Power & Light (Alliant Energy Company)
Nicholson

3 AMTS (Cyclops)	**120** Monitoring Prisms
42 Spillway Piers	**10** Load Cells
7 Vibration Monitors	

PROJECT DESCRIPTION

The Prairie Du Sac Dam, built in 1914, is the last dam on the Wisconsin River. It contributes 31-MW of power to the dam's owner, Wisconsin Power & Light, and has a 1,010-feet-long concrete spillway structure bearing on sandy soil-founded timber piles. In 2018, a stability analysis indicated that the 4,200 aged timber piles were susceptible to continuing deterioration when the water level dropped and pilings were exposed to air. This change in ambient conditions was not originally designed for the spillway to withstand both vertical gravitational load and lateral load from the upstream to downstream hydraulic thrust. Therefore, the Spillway Foundation Remediation project was proposed to investigate the severity of the situation, and it primarily included the underpinning of the structure by installing micropiles and concrete transfer beams.

SIXENSE MONITORING SYSTEM

Due to the remediation project, a state-of-the-art automated movement monitoring system was needed to measure any potential dam structure movements prior to, during, and after the construction of the dam for risk control and construction effect evaluation. Sixense's system consisted of three automatic motorized total stations (AMTS), measuring over 120 monitoring prisms installed on the 42 spillway piers, providing near real-time data delivery. The highlight of the system was connecting three AMTS in a linear formation by measuring pairs of common prisms among individual AMTS. Through a flexible adjustment algorithm, the system allowed each AMTS in the group to share the reference (backsight) prisms placed outside the construction influence zone while limiting the measuring distance between the AMTS and the monitoring prisms to achieve the best measurement precision possible. The measurements were stored in an Integrating Data Management System (IDMS) called Geoscope that centralized all the data from the site, which allowed around-the-clock real-time access to the measurements through a dedicated website, trigger alarms in case measure points overrun the thresholds defined, and observing the dam behavior daily with minimum efforts on the field.

FINDINGS & CONCLUSIONS

The findings at the Prairie Du Sac Dam were informative. For example, after a continuous

monitoring period of over six months, numerous data sets were gathered, showing the behavior of the dam is subject to seasonal effects. Such behavior was unknown prior to the monitoring, and this became the key to determining and adapting monitoring alarm thresholds as the construction progressed. The AMTS group created a robust deformation monitoring system, delivering high-precision results in order to offer valuable information to the project designer and contractor to evaluate construction effects in a timely manner on the dam. Sixense's efforts on the Prairie Du Sac Dam also provided a cost-efficient solution and avoided intrusion on the site, which improved safety standards.