Bridge Load Testing

- **Objectives:** Measure bridge's loadbearing capacity
- **Solution:** Jewell Instruments **Series 700 Tiltmeter**
- **Benefits:** High-precision and exceptional repeatability
- **Results:** Achieved a more accurate assessment of capacity

Overview

Tiltmeters installed on a scenic, but sagging, concrete bridge in California's historic 49er Gold Country measured structural response to a series of load tests. Project engineers rated the tiltmeter results "more accurate" than theodolite measurements that were also performed.

Jewell Instruments 700 Series Tuff-Tilt sensor

Project

Parrotts Ferry Bridge, part of the New Melones Dam Project completed by the Sacramento District of the U.S. Army Corps of Engineers, spans the Stanislaus River near Vallecito, California. Howard, Needles, Tammen & Bergendoff (HNTB) designed the bridge as a three-span, cast-in-place, post-tensioned single cell box girder structure with a center span of 640 ft and two end spans of 325 ft. T.Y. Lin performed the design review. In 1979 S.J. Groves and Sons completed the structure after a construction period lasting two years.

The deck elevation is 350 ft above the former streambed (inundated by New Melones Lake as a result of the dam project). The two bridge piers are about 225 ft high. The superstructure, of lightweight concrete, was erected using the segmental balanced cantilever construction method. It was post-tensioned longitudinally, vertically and transversely by high-strength bar and strand tendons.

Creep deflection during the five months after construction resulted in midspan sag of about 11 inches. Over the next 10 years, inspections and surveys disclosed an additional 11 inch deflection of the middle span. Concerned about the nearly 2 ft of displacement that had occurred, and the fact that the midspan deflection was growing larger, the Corps decided

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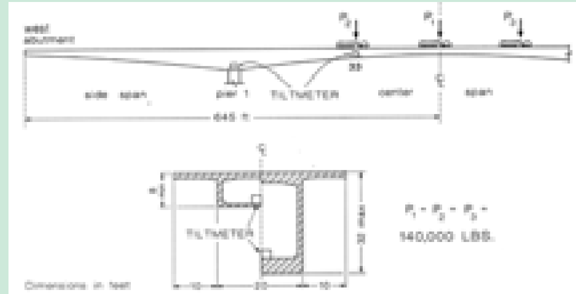
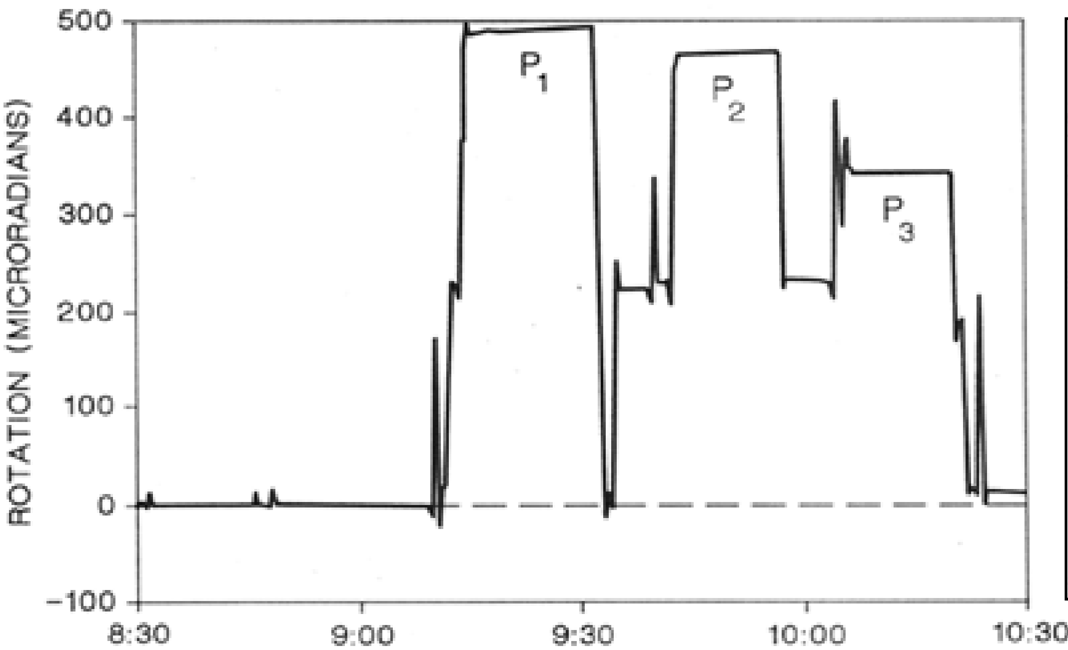
to investigate these phenomena.

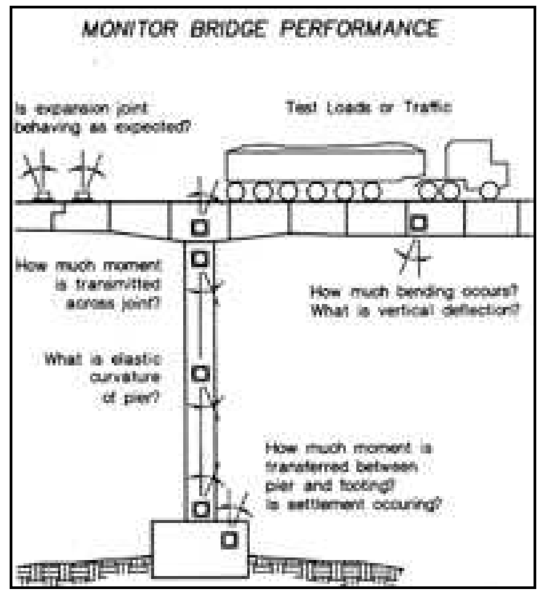
T.Y. Lin led the study team. A critical aspect of the 1989 field investigation was load testing. The objectives of the load testing program were 1) to determine the stiffness of the concrete and 2) to evaluate whether the overall stiffness of the bridge has deteriorated beyond safe limits.

Two gravel trucks, each with a double trailer, provided a static test load of 140 kips (about 70 kips or 70,000 pounds each). Care was taken to ensure that the loads were symmetrical with respect to the longitudinal centerline of the bridge. All three spans were load tested.

Structural response to the imposed loads was measured in two ways: 1) deflections were measured with a theodolite and an electronic distance measurement device, and 2) rotations were measured using [700 Series Ultra Precision tiltmeters] supplied by Jewell Instruments. One of the problems with the deflection data, according to T.Y. Lin, was their degradation by temperature effects.







Parrott's Ferry Bridge, Tiltmeter on Joint 33

Results

"Though the deflection measurements were corrected for temperature effects as far as possible, it was felt that the rotation (tiltmeter) measurements were more accurate," said T.Y. Lin.

The study disclosed another important advantage of the rotation measurement approach: tiltmeters can record continuously, revealing the complete history of flexure during the loading/unloading cycle.

The overall investigation, which also involved laboratory testing and computer modeling, established that the bridge superstructure's unusual profile is mainly due to creep of the lightweight concrete. T.Y. Lin developed recommendations for controlling sag over the life of the bridge including annual surveys and inspection.

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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