Corvallis Van Buren Bridge Replacement

Challenge:

The Corvallis Van Buren Bridge, originally constructed in 1913, underwent a replacement initiative to create an earthquake-ready bridge over the Willamette River on eastbound OR-34. Although the area near the bridge was used as a community dump site in the early 20th century, today this stretch of the Willamette River is a critical habitat for fish and other wildlife. It's also an environmentally attractive area with local recreational activities such as rowing and golf. To prepare for the new bridge, a comprehensive understanding of the soil and foundation was pertinent. GRL Engineers were hired to analyze the foundation's capacity, along with the construction quality of the project's drilled shafts.

Method:

Two 98.4-inch diameter test shafts were constructed, and Bi-Directional Static Load Testing was utilized to assess end bearing and side shear data of the drilled shafts. The Load Test Assembly (LTA) consisted of three hydraulic jacks positioned between a top and bottom 2-inch-thick steel bearing plate. The LTAs were incorporated at predetermined locations (approximately 70-80 feet above the base) in the shafts with total lengths of approximately 220 and 235 feet. GRL conducted the tests in two cycles as per the loading schedule.

Thermal Wire® cables were installed on the reinforcing cage of the test shafts to help locate potential anomalies along the shaft length. The thermal data was analyzed approximately 2-3 days after concrete placement with Thermal Integrity Profiling (TIP).

Crosshole Sonic Logging (CSL) was implemented on the project's 8 drilled shafts. The CSL testing was performed more than 3 or 4 days after concrete placement. Each tested shaft was approximately 8-feet in diameter with 8 steel access tubes of 1.5-inch diameter. A total of 28 CSL profiles were collected for each shaft.

Shaft verticality was assessed with a SHAPE® device lowered into the shaft while eight ultra-sonic signals scanned the shaft's sidewalls simultaneously as the unit ascended and descended the length of the excavation. The device used sonic pulse arrival time to estimate verticality, depth vs diameter, and volume.

Results:

During the Bi-Directional Static Load Test in Bent 3, the LTA applied an average maximum downward gross load of 2,805 kips and simultaneously an upward net load of 1,983 kips (less the shaft self-weight of 822 kips). At this loading, the top of LTA displaced 0.29 inches, and the base of LTA displaced 0.19 inches (see Figure 1 and Figure 2).

Project Details

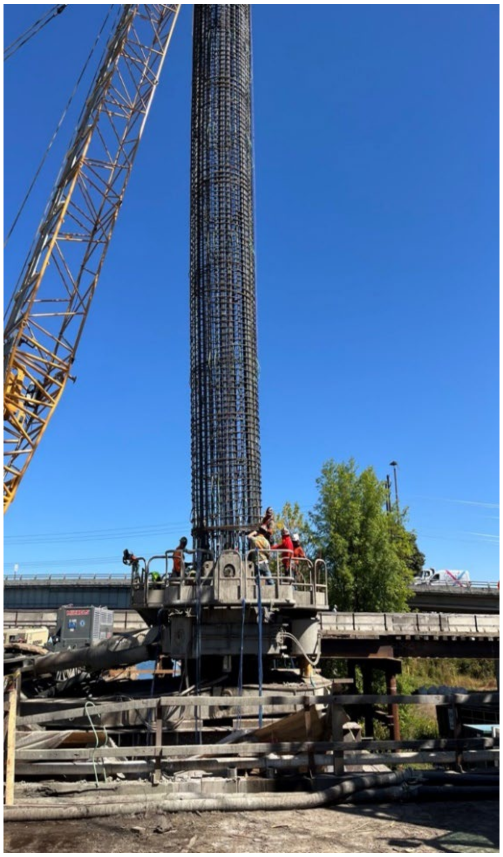
Client: Michels Construction

Location: Corvallis, OR

GRL Office: Washington

GRL Services

- Thermal Integrity Profiling
- Crosshole Sonic Logging
- Drilled Shaft Verticality Assessments
- Bi-Directional Static Load Testing



Based on the TIP results, the Effective Radius was generally consistent with the reported as-built shaft radii. The reported volume of concrete was 102 percent of the theoretical volume. Some of the wires in the cage did not function at all temperature nodes for the full duration of curing which made a complete interpretation of data difficult (Figure 3), thus the complementary value of the CSL testing was proven. The areas that were able to be assessed were rated as “Satisfactory”.

CSL results for the assessment of the relative concrete and shaft construction quality were considered within an acceptable range. (Figure 4) It was noted in the report that the Engineer of Record and Design Team would consider further assessment of an anomaly localized near one of the access tubes.

Following drilled shaft verticality testing with the SHAPE device, the offset verticality was reported as 0.25 feet over a vertical height of 232.9 feet, or a verticality percentage of 0.11%. (Figure 5)

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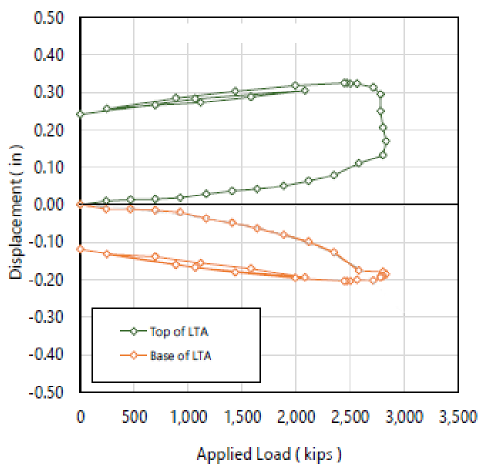

Figure 1 *Load Movement Curves*

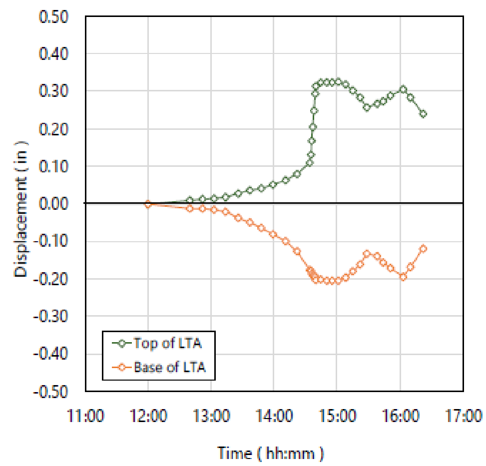

Figure 2 *Displacement vs Time Curves*

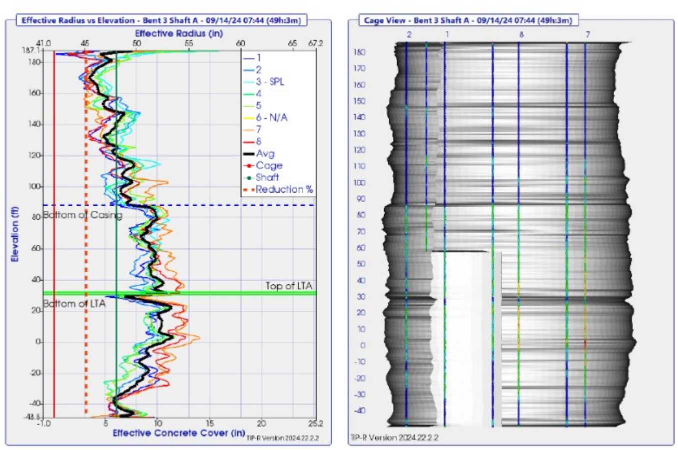

Figure 3 *Estimated Effective Radius vs Depth Cage View*

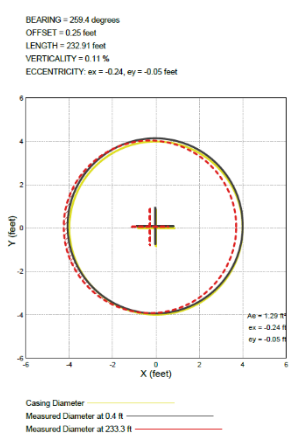

Figure 5 *Offset Verticality*

Figure 4 *Sample of CSL Test Results*