A 352-ton trailer truck transferring a cooling unit had to pass over three steel stringer bridges in Toledo, Ohio. The Ohio Department of Transportation permitted the passage of the super-load on condition that the state be paid for any resulting damages.

The Three Reinforced Concrete Deck-on-Steel Girder Bridges Located in Toledo, Ohio

Figure 1: First Bridge Had A Single Span Over Swan Creek (LUC-2-1658)

Figure 2: Second Bridge Had Four Continuous Spans Over I-475 (LUC-2-1026)

Figure 3: Third Bridge Was The Largest With Five Spans Over The Ohio Turnpike (LUC-2-0463)
The potential damage was determined by instrumented bridge monitoring techniques, as well as pre- and post-super-load diagnostic tests. The instrumented global bridge monitoring techniques consisted of intermittent geometry monitor, diagnostic load testing comprised of both static and dynamic tests, local NDE techniques to observe material properties, and continuous slow and high speed monitoring.
Figure 6: Strain gage location plan
The analytical model represents both the geometric and mechanical properties of a bridge. The use of FE analysis in conjunction with Unit influence line decomposition (UILD) aids in determining pre-diagnostic truck load tests used to predict the response of the super-load.

**Correlations Between The Pre-Super-Load Diagnostic Test Results And The Simulations Obtained From FE Analyses**

Figure 7: Color coded force and stress contours allow engineers to see distribution and pinpoint the maximum response of the structure in terms of stress, force, rotation, and deflections.

Figure 8: A field test calibrated 3D FE model can be used to simulate the global and local responses of a bridge under any loading combination.
Figure 9: Views of loaded truck

Figure 10: Views of wheels under super-load
The FE analyses and the results from UILD based on diagnostic tests indicated that the super-load would pass over the bridge safely. There were no additional visible cracks probably because the opening of existing cracks prevented new crack formations, and/or because the concrete tensile strength was higher than expected.

The research revealed that even with the most capable analytical and experimental tools, it is not easy to predict whether a super-load crossing may cause damage or impact the life-cycle performance of a bridge.