



Historic Bridge Foundation Facebook Archives

Focus Bridge: Lion Bridge

May 2015

Carrying 7th Street over the Toulumne River in Modesto, California, this bridge is often called the “Lion Bridge” because of the concrete lion sculptures at each end of the bridge. One of the only bridges of its kind, the Lion Bridge is a large multiple span concrete cantilevered arch bridge. Examples of this type of bridge in California are usually associated with the firm of Leonard and Day, which is indeed the case with this bridge. Early proponents of concrete in bridge construction, Leonard and Day described this unusual variety of concrete bridge as a "canticrete" bridge.

Usually, a concrete arch bridge (or any type of true arch) does not act like a cantilever. However, with concrete cantilever arch bridges, engineers designed the bridges in a manner where each half of an arch span functions independently on its own, as a cantilever extending from the pier or abutment. Typically, this required an internal reinforcing system more advanced than a traditional system of rebar. In the case of the Lion Bridge, reinforcement took the form of riveted steel trusses arranged in a cantilever form. These trusses were then encased in concrete. In this sense, the bridge could be thought of as a concrete encased steel cantilever truss bridge. However in the case of the Leonard and Day "canticrete" bridges, traditional rebar reinforcing rods were also added alongside the trusses before the concrete was poured to give the bridge additional strength.

The Lion Bridge is a historically significant bridge. In addition to its high level of engineering significance, this bridge is also noteworthy for its aesthetic details. The bridge was designed with decorative balustrade railings, and piers that extend above the deck as ornate decorative pylons. The ends of the bridge have benches for pedestrians, and lion sculptures are placed at the ends of the bridge, on top of the railing.

The bridge retains good historic integrity, but the bridge has structurally deteriorated. The beautiful lion sculptures are cracked and crumbling. The northernmost arch span appears to have settled, and in doing so, it has clearly revealed its cantilever construction, since the two cantilevered halves of the bridge have separated and one is slightly higher than the other now. A special metal brace has been added under this span.

The county has proposed a project that is being described as a replacement project. However, as a bridge that is eligible for the National Register of Historic Places, this proposed project, which includes the use of federal funding, will require a Section 106 Review to consider alternatives such as rehabilitation as a way to improve this crossing.

Cantilevered concrete arch bridges are extremely rare nationwide. Perhaps the only other large, prominent example is the Belle Isle Bridge in Detroit, Michigan. The Belle Isle Bridge makes a nice comparison to the Lion Bridge as its design differs a bit. Unlike the Lion Bridge, the Belle Isle Bridge only has trussed reinforcing

in the arch ribs, with an unusual eyebar stay system above. This design eliminated any reinforcing trusses in the spandrel wall, which also enabled the Belle Isle Bridge to feature an open spandrel design, which would not have been possible with the Lion Bridge's reinforcing layout. Unlike the Lion Bridge, the Belle Isle Bridge also includes short concrete slab segments that span over the ends of each half of the arch span at the center of the span. These slabs rest on the arches a small distance back from the actual center of the bridge. Among the most prominent and iconic landmarks of Detroit, the Belle Isle Bridge has been rehabilitated and preserved.

Photos and Images



Lion Bridge, elevation view.



View beside the Lion Bridge



View showing two of the Lion sculptures on the bridge.



The Belle Isle Bridge in Detroit, Michigan is another large example of a concrete cantilever arch bridge, and its details make for a nice comparison to the Lion Bridge.



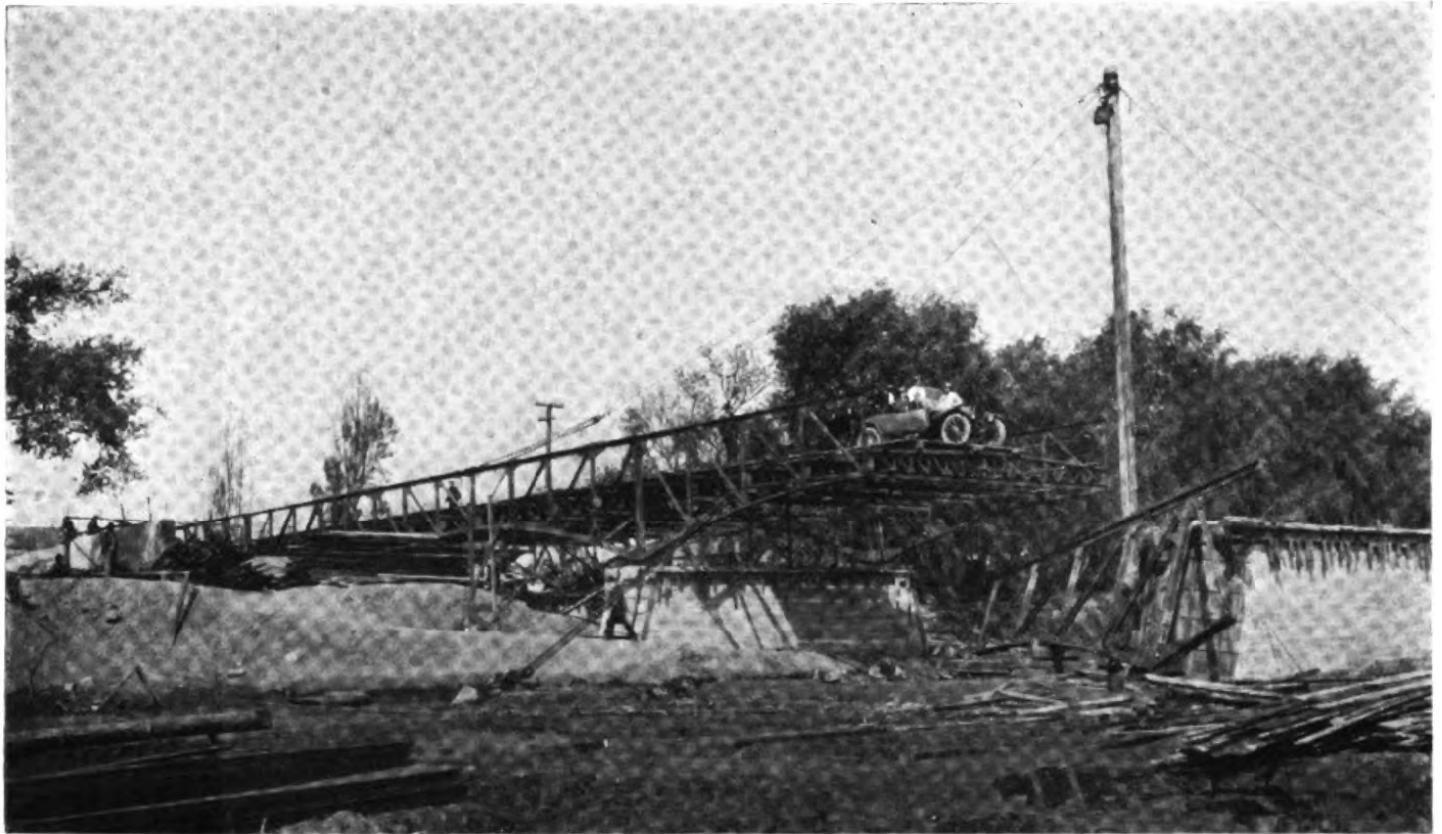
View showing the span of the Lion Bridge that has settled and been braced with steel beams.



View of a typical span on the Lion Bridge.

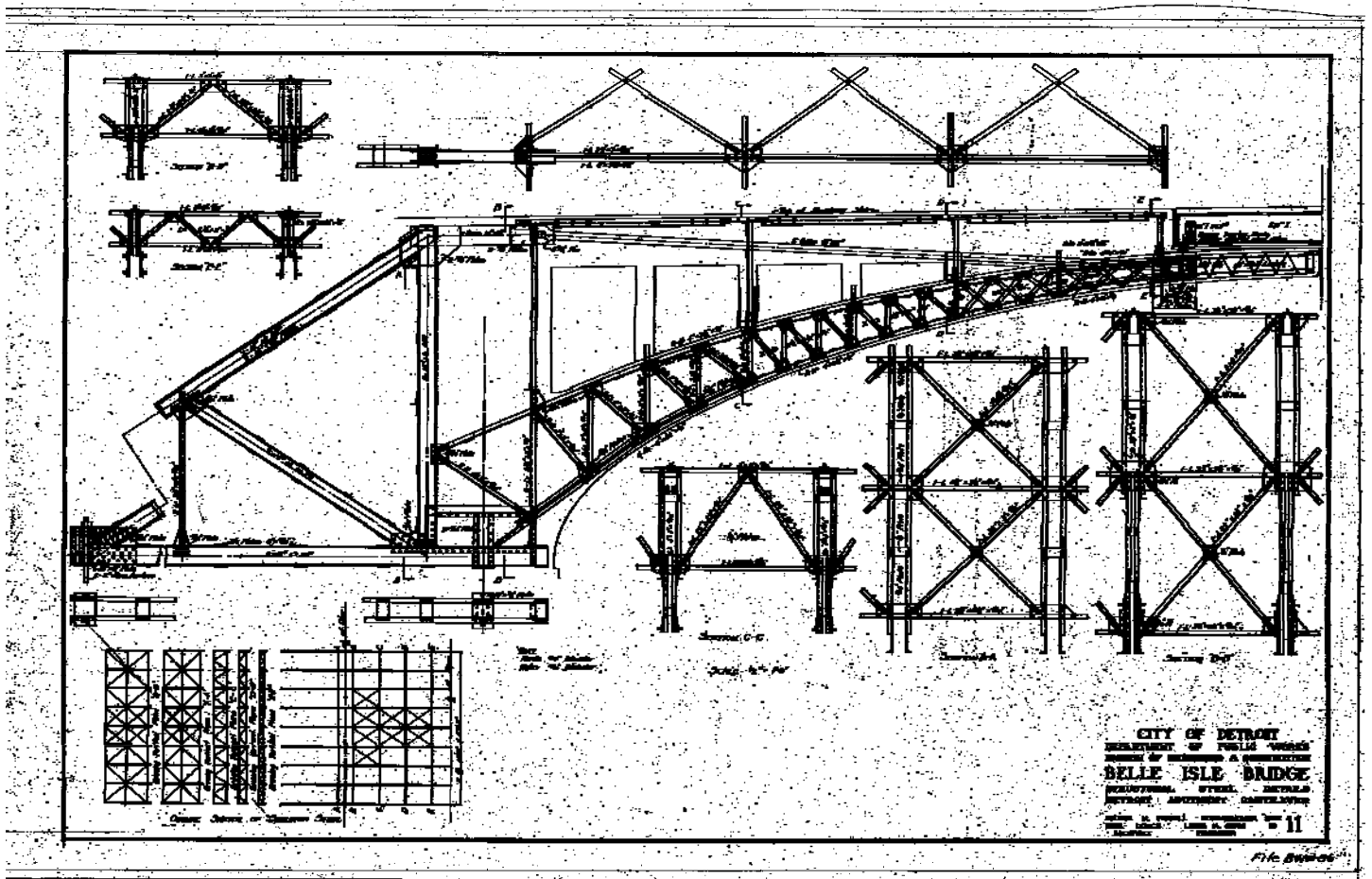


View under the deck at the center of a span on the Lion Bridge. Note the seam in the deck indicating where the two halves meet.



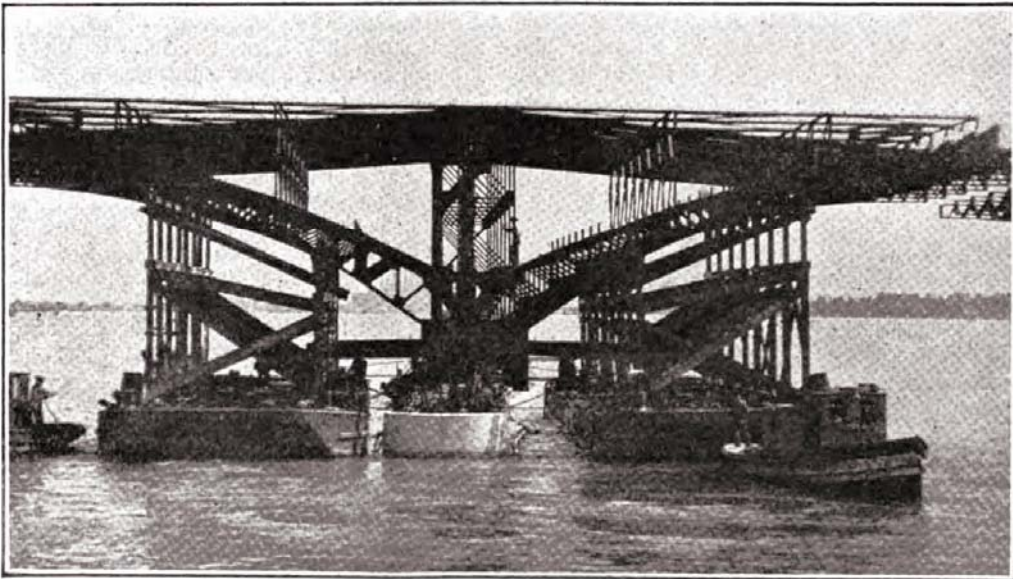
Construction Photo of Pajaro River Bridge: This Photo Shows A Canticrete Bridge With Its Trusses, Before Concrete Encasement
Source: The Architect and Engineer of California, 1919.
Digitized By Google.

This historical photo showing the construction of the Lion Bridge reveals the truss design of the internal steel reinforcing. Note how the trusses extend out from the pier and are able to support themselves without any additional aid, a demonstration of cantilever function.



From the original construction drawings, this shows the reinforcing layout of the Belle Isle Bridge. Unlike the Lion Bridge, the Belle Isle Bridge only has trussed reinforcing in the arch ribs, with only an eyebar stay above, which enabled this bridge to feature an open spandrel design.

Bridge Construction Showing Interior Reinforcing



**Source: Engineering News-Record Vol 87 1922,
Digitized By Google**

This photo shows the construction of the Belle Isle Bridge. Note the steel trussed ribs, which are supplemented by eyebars stays above.



This photo shows the crown of a Belle Isle Bridge span. Note the separation between the two halves of the bridge. Unlike the Lion Bridge, the Belle Isle Bridge includes short concrete slab segments that span between each half of the arch span. These can be seen resting on the arches a small distance back from the actual center of the bridge in this photo.