

I-580 / Galena Creek Arch Bridge

Arch Rib Evaluation, Finite Element Analysis

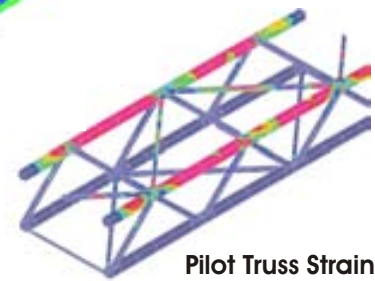
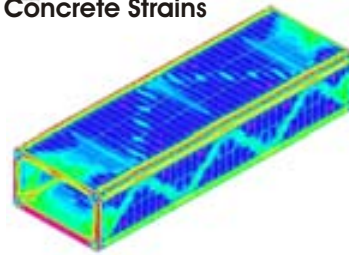
Location: Carson City, Nevada

Owner: Nevada DOT

Due to be completed in 2010, the I-580 and Galena Creek Arch Bridges are designed as parallel structures with a main arch span of 210 m, each able to carry three lanes of traffic. The western approach will have two spans (40m and 65m), and the eastern approach will have four spans (68m, 58m, 48m, and 36m). The main arch is integral with the prestressed concrete box girder superstructure in the middlemost 62 m of the span. Elsewhere the arch is free spanning. The arch rib is constructed by first erecting a steel pilot truss of rolled shapes, filling the cord tubes with grout, and encasing the pilot truss with reinforced concrete. Upon completion, the Galena Creek Bridge will be the largest concrete-arch bridge in the United States and the second-largest in the world. Its 1,722-foot length will be almost six football fields long. It is the largest of nine planned bridges of the I-580 Freeway Extension Project to complete a six-lane highway from the Mount Rose turnoff to Washoe Valley.



Concrete Strains

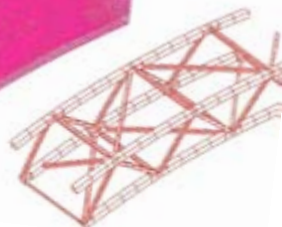


Pilot Truss Strains

Concrete Detail



Reinforcement Detail



Pilot Truss Detail

SC Solution's scope of work included finite element analysis of an 18m piece (segment 5) of the proposed I-580 and Galena Creek main arch, with the pilot truss option. Three issues were investigated:

1. Long-term creep and shrinkage effects, and the degree of composite interaction between the steel pilot truss and the surrounding concrete.
2. The shear loading on the studs between the pilot truss and the outer reinforced concrete.
3. Moment curvature properties of the arch rib segment.

After complete analysis of those three issues was performed, the task was extended to determine the moment curvature properties in a geometric configuration with additional stiffeners to prevent pilot truss buckling.