(over the) HANGING ^ 10

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Images courtesy of Caltrans

The widening of Interstate 10 in suburban Los Angeles provided the opportunity to build a new pedestrian overcrossing with an attractive through-truss as the centerpiece.

HIGHWAY WIDENING is nothing new in southern California.

The recent addition of high-occupancy vehicle (HOV) lanes to a roughly 12-mile stretch of Interstate 10 east of Los Angeles illustrates this. Of course, as a highway expands, surrounding infrastructure must also be altered. As a result of the I-10 expansion, the concrete Bess Avenue Pedestrian Overcrossing—which opened in 1956 and crosses I-10 in Baldwin Park, Calif., roughly 20 miles east of downtown Los Angeles—had to be demolished and rebuilt in order to span the newly widened freeway.

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The replacement bridge, one of several being replaced or expanded for the project, was designed to span 80 ft over the I-10 westbound lanes and 157 ft over the eastbound lanes and HOV lanes, for a total bridge length of 654 ft, including approach ramps. While these approaches employ concrete box girders, a steel through-truss serves as the main span over the freeway. The new bridge, which doubles as a structural landmark and gateway for the town, provides an expanded 10-ft wide walkway, which meets current ADA requirements, and convenient pedestrian access over the freeway to Baldwin Park's downtown.

Pedestrian and Seismic Vibration

It is now well known that, under pedestrian excitation, footbridges can exhibit large-amplitude vibrations that can impact serviceability. This is especially true for a footbridge with a relatively longer span, which can become a line-like structure with low natural frequency—e.g., close to or less than 1 hertz (Hz). If not adequately designed or mitigated, such a bridge can exhibit vibrations of significant amplitude when subjected to pedestrian loading within the designed static capacities of the bridges. The AASHTO LRFD *Specification for Pedestrian Bridge Design* requires that the fundamental frequency in a

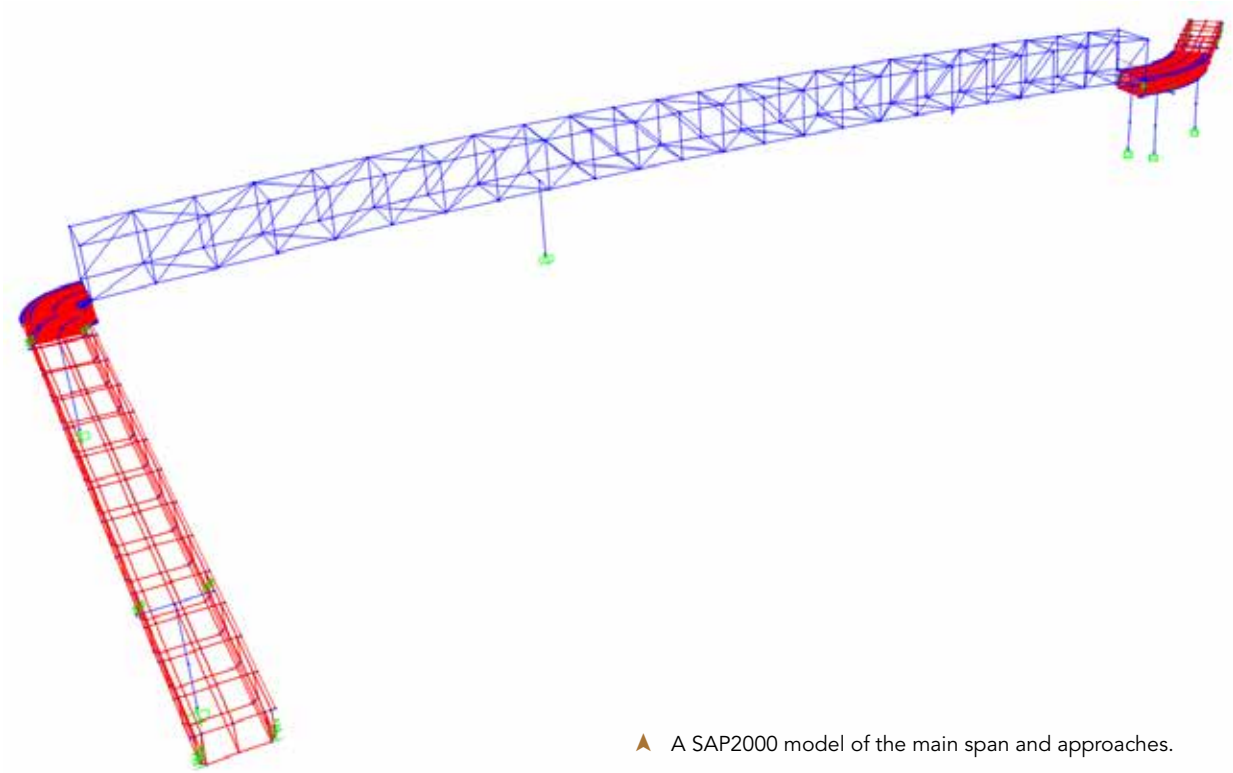
▲ The bridge's total length is 654 ft, including approaches.

➤ A special 247.5-ft-long through-truss is used as the main bridge element.

vertical mode of the pedestrian bridge without live load shall be greater than 3.0 Hz to avoid the first harmonic. In the lateral direction, the fundamental frequency of the pedestrian bridge shall be greater than 1.3 Hz to prevent the users from the discomfort or concern caused by structural vibration.

Since the Bess Avenue POC is certainly a long-span pedestrian bridge, 3D structural analysis was conducted with SAP2000 to ensure that it provides sufficient stiffness against unwanted vibrations. A special through-truss—247.5 ft long, 11.5 ft high and 11 ft wide—was used as the main bridge element (with spans of 80 ft and 157 ft, divided by a concrete pier between the westbound and eastbound/HOV lanes) and a 5.2-ft-deep concrete box girder superstructure was used for the two approach ramp structures. Members include HSS12×12×⅝ for the top and bottom chords, HSS8×6×½ and HSS8×8×½ for the vertical struts, HSS5×5×½ for the top strut and HSS6×4×½ for the bottom strut.

Due to the bridge's location in a high-seismic zone (M=7.5), plus the irregular geometry of the bridge's layout, the complex nonlinear response may dominate the structural dynamic behavior in an earthquake event, which cannot be accurately predicted by elastic modeling. Based on the



A SAP2000 model of the main span and approaches.

Caltrans Seismic Design Criteria (SDC), a balanced design strategy was employed for the seismic design. The structure was divided into three portions, isolated by expansion joints and designed to act independently to accommodate out-of-phase movements between them: the concrete box girder superstructure for two approach ramp structures and the steel truss for the main portion spanning over I-10. The steel truss was supported by a spherical fixed bearing on Bent 5 and steel-reinforced elastomeric bearing pads with anchor bolts on both ends; these supports provide extra stiffness.

The truss was built via the accelerated bridge construction (ABC) method, which eliminates falsework and minimizes the impact on traffic during construction. It was erected in two phases; the first segment was erected over Bent 5 in a six-hour window and the remaining portion was erected in a second six-hour window and spliced with the first segment.

Using approximately 100 tons of steel, the bridge now serves as a welcoming gateway for Baldwin Park and provides better access to the town center from the residential areas on the opposite side of the highway. ■

Owner and Structural Engineer
California Department of Transportation

General Contractor
Flatiron West, Inc., San Marcos, Calif.

The bridge accommodates a widened I-10.