



June 3, 2012

Mayor Bill Bogaard and Members of the City Council  
City of Pasadena  
100 North Garfield Avenue  
Pasadena, CA 91109

Re: La Loma Bridge

Dear Mayor Bogaard and Council Members,

I gave limited structural engineering input to Pasadena Heritage as part of their participation with the La Loma Bridge Advisory Group (LLBAG) back in August 2010. My preliminary computations provided to Public Works staff at that time suggested to me that much of the anticipated future seismic demand was delivered to the approaches at the ends of the bridge rather than to the main columns and arches in the Arroyo. The design team considered the concept, but informed me of the Eagle Rock fault system under Bent #4 on the east side of the drainage channel reported by their geologic consultant. The design team had to address the effects to the existing bridge from the potential for uplift of the ground on the north side of the bridge and shaking from future seismic activity, which led them to their current proposal. The LLBAG gave concurrence to their overall concept. I am not a member of the LLBAG, but I have had and continue to have concerns about the excessive loss of historic fabric that results from the current proposal. The entire top of the bridge including the deck slab, girders, upper façade arches and approach abutments at each end of the bridge are slated to be removed and replaced. This is a potential adverse effect that is contrary to the Earlier Finding of Effect that was part of the Section 106 process submitted to the State Historic Preservation Officer (SHPO) in 2006. That report concluded there was no adverse effect with the earlier retrofit scheme.

Another retrofit option that was mentioned in the couple of meetings with the design team that I attended was base isolation, but it had not been considered in the 2009 Bridge Type Selection Report of 2009 by the designers. I have recently reviewed the seismic uplift problem with a very well-known consultant for base isolation systems with the goal of proposing an alternative approach to preserve much more of the existing fabric. Pasadena City Hall has a base isolation system installed, which is designed to absorb a large portion of postulated future earthquake shaking and displacements at the isolator level in the basement. The base isolation system reduced the amount of intervention that was needed in the building above the isolators and preserved more of the historic fabric.

It is feasible, according to this consultant to install similar devices in the bridge foundations that will address the current geologic findings of the postulated future

seismic uplift and shaking. A schematic description of an earthquake hazard reduction program that incorporates base isolation follows:

- Remove and replace only the existing deck slab as it is obviously deteriorated.
- Maintain in place all of the existing transverse girders directly under the slab. The ribbed appearance from underneath created by the girders is a character defining feature of the original construction.
- Maintain in place the main arches and the smaller spandrel arches at the top of the bridge.
- Maintain in place the existing end abutments and foundations by adding additional reinforced concrete inside the 3 sides of each end abutment. This is accessible because the existing road deck will have been removed. Once the road deck is re-built, there will be no visible evidence of the new concrete.
- Maintain in place all the columns and arches that support the road deck.
- Shore the existing bridge and install the base isolation dampers inside the foundations under the columns. The manufacturer explained that the dampers would have to be replaced only after an earthquake sufficiently strong to trigger them. The annual probability of this occurrence is small. Provisions would have to be made in the design to be able to access them. An opinion of cost per damper was offered by the supplier of \$ 175,000 per unit with a delivery time of one year. These unit costs are a small percentage of the overall construction budget, and are only included for information. Some temporary shoring and down-time may be required to repair the bridge after any stronger earthquake no matter what type of system is ultimately built.
- Repair all deteriorated existing concrete surfaces to eliminate falling hazards as is presently proposed.
- Install the new wider road, sidewalks and balustrade over the existing structure as is presently proposed.

This is a very schematic description, but I am convinced that it can be successfully implemented and it requires less demolition and potentially less new construction than is presently proposed. Portions of the column strengthening scheme proposed by the design team that the LLBAG has already endorsed might remain. The base isolation consultant has expressed a desire to give more detailed input to the design team and Public Works to explain how crushable compression dampers can accommodate both future uplift and horizontal shaking. The inclusion of this proposed alternative in the updated report to SHPO for Section 106 compliance is reasonable.

Very truly yours,



Michael Krakower, Structural Engineer  
Pasadena Heritage Board Member