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September 4, 2006

California Coastal Commission
North Coast District Office
710 E Street, Suite 200
Eureka, CA 95502-4908

App. 1-06-022-A1
September 7, 2007 ;
Item 10a. Ten Mile Bridge Railing

Dear Commissioners:

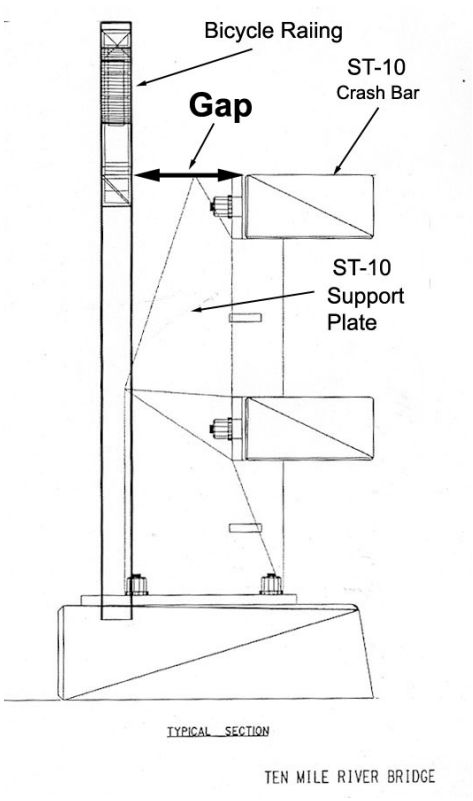
I support the proposed amendment to CDP 1-06-022, with the following condition:

Condition: The design of the railing proposed for the inland side of Ten Mile Bridge shall be modified 1) to eliminate the horizontal gap between the back of the automobile crash bar and the lower bar of the bicycle railing and 2) to integrate the bicycle railing and the ST-10.

Discussion

Caltrans and the Commission are to be congratulated for their work to develop attractive, visually transparent railings for the Ten Mile Bridge. The railing initially proposed, the ST-20, would have been 54" high and closer to a cattle guard gate than a scenic railing.

The railings proposed in this amendment are vastly better. The height of the railings on both sides of the bridge is 42", good for both safety and aesthetics. The design of the bicycle rail, with its curved elements and graceful posts, is a commendable advance over previous designs.



Unfortunately, the good aspects of the new railings are overshadowed by a fundamental design flaw – placement of a separate bicycle railing well in back of the automobile barrier. Both safety and aesthetics are compromised by the separation and setback of the bicycle railing.

Safety

The Caltrans design for the combination automobile/bicycle railing creates a significant hazard for cyclists. An entirely separate bicycle railing is placed at the **back** of the supporting plates for the automobile barrier (the ST-10). In consequence the bicycle railing is 15" behind the front of the ST-10 crash bar, and there is a horizontal gap of about 7 inches between the back of the crash bar and the bicycle railing.

The gap is unnoticeable in the photo simulations provided to the Commission in Exhibit 1 of the amendment application. However, the gap shows clearly in the cross section of the railing in Exhibit 2

of the amendment (reproduced here). I myself was unaware of the significant setback of the bicycle railing until I saw the permit application and its Exhibit 2.

A cyclist who went over the lower, 32-inch high automobile barrier could easily have an arm, shoulder, leg, knee, or shoe go into the gap between the automobile crash bar and the bicycle rail. If he or she had the misfortune of then colliding with one of the sharply angled support plates of the ST-10, a serious injury could well occur.

Aesthetics

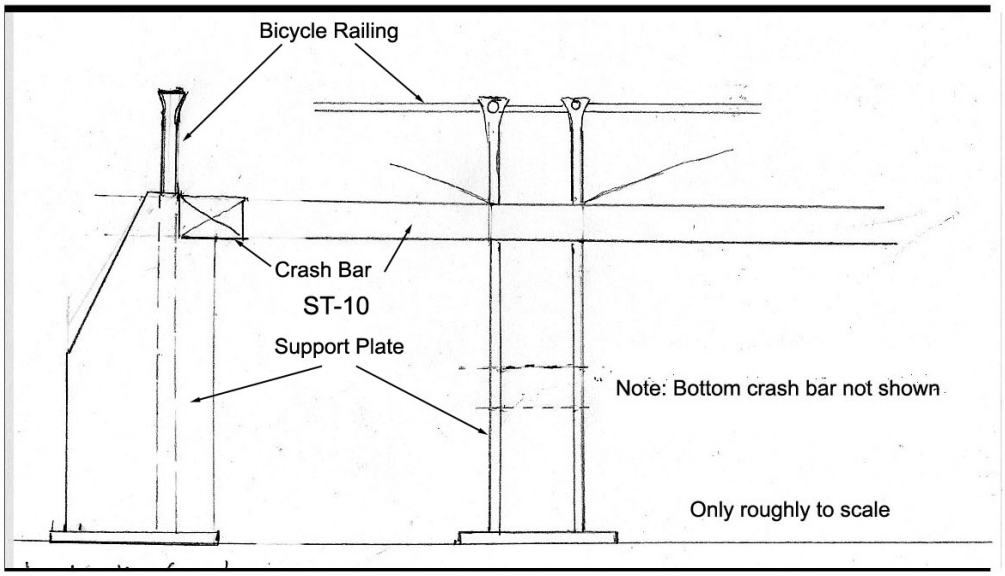
The bicycle railing is 15” behind the front of the ST-10 crash bar, which will look peculiar to motorists and, especially, cyclists. Both will see the gap between the back of the ST-10 and the bicycle barrier. Because of its placement, the bicycle rail will look like an add-on rather than an integrated part of the overall rail design. This defeats one of the design goals for the railing system.

Placing the bicycle railing behind the ST-10 support plates also creates another problem. The pedestrian and bicycle railings have graceful, fairly wide twin support posts. These are quite elegant on their own, but placing them behind the ST-10 support plates brings them into conflict with the design of the ST-10.

One of the aesthetic strengths of the ST-10 is the use of the paired "thin" vertical supports instead of thick "posts." The posts of the bicycle rail are thick rather than thin. When placed behind the ST-10, these posts essentially fill the opening between the paired thin supports of the ST-1

Recommendations

The obvious solution to all of the problems with the present design is to integrate the bicycle railing into the ST-10. This could be done by joining the bottom bar of the bicycle railing to the back of the top crash bar of the ST-10 and modifying the railing posts so that they don’t fill the space between the two support plates. A rough sketch of this concept is below.



With the alternative design, there would no longer be a gap, nor would the bicycle support posts fill up the space between the support plates of the ST-10.

Caltrans Objections and Response

When I pointed out the difficulties of the present design and proposed the above alternative to Roberto Lacalle, Chief, Office of Design & Technical Services Division of Engineering Services, he responded:

> **To work around the lengthy and expensive crash test process**, the Division of Research and Innovation Crash Test Unit [*a unit of Caltrans]* **requires that any attachments to rails be a minimum of 15 inches behind the face of the railing to reduce the snag potential.** In a nut shell if a rail has openings, it has the potential for snagging the vehicle which could result in a failed test. … any penetration of the hood into the cab constitutes a failed crash test per NCHRP Report 350. This is particularly a problem for the Pickup test where the hood tends to ride up and over the railing. **Vertical elements required to support the bike rail could snag the hood and likely fail the test.**[1] [Emphasis added]

As happened with the railing for the Noyo Bridge, Caltrans has asserted "safety requirements" and "standards" to justify its design as "necessary. But there is nothing necessary about its design other than Caltrans' arbitrary internal decisions:

- First, to refuse to consider a design that might require a crash test, and
- Second, to accept as an immutable given the 15" setback requirement of its own internal engineering unit.

The potential snagging problem could be solved in my alternative design by engineering the vertical bicycle railing supports to "breakaway" under the force of a car impact, but to stay in place under the impact of a cyclist. The difference in impacts in the two cases is so great that this could be done with a great safety factor.[2]

Engineering analysis could likely show that the breakaway supports would not create a snagging problem. If not, Caltrans could and should perform the required crash test. The railing placed on the Ten Mile Bridge will set a precedent for bridges to come.

There is certainly time available to perform a crash test on the railing without holding up construction. The basic structural engineering for the bridge will be independent of the placement of the bicycle railing, and the railing will be the last item to go on the bridge. The cost of the crash test is small in relation to the cost of this and future bridges

Conclusion

A safer and more aesthetic railing should be required for the Ten Mile Bridge. Caltrans has again, as so often in the past, cited "safety reasons" and "standards" for its design. But, safety reasons, as well as aesthetics, strongly argue for the alternative design. The cited "standard" (15" setback) is Caltrans own standard. It can provide an

[1] Roberto Lacalle email to Vince Taylor, August 27, 2007

[2] Not only are the magnitudes different, but the impact of a vehicle skidding into along the rail will be parallel to the rail, whereas the cyclist impact will be primarily perpendicular to the rail.

exception to the standard, or it can perform a crash test to validate the safety of the alternative design.

The Commission should require Caltrans to modify its railing design to integrate the bicycle railing with the ST-10 in order to eliminate the proposed gap between the two and to retain the open space between the ST-10 support plates.

Sincerely,

Vince Taylor, Ph.D.
Executive Director