Submitted to: Metropolitan Transportation Commission: James P. Spering (Chair), James T. Beall, Jr. (Vice Chair), Keith Axtell, Jane Baker, Sharon J. Brown, Mark DeSaunier, Dorene M. Giacopini, Mary Griffin, Elihu Harris, Tom Hsieh, Mary V. King, Jean McCown, Charlotte B. Powers, Jon Rubin, Angelo J. Siracusa, Stephen Kinsey, Kathryn Winter, Sharon Wright, Harry Yahata, and;  
cc: The Honorable Governor Wilson  

Date: June 24, 1998  

Subject: Concerns on Seismic Safety of the New East Bay Bridge Design  

The Honorable Commissioners:  

I had faxed the attached letter (Attachment 1) to the MTC-Bay Bridge Design Task Force (Mary King, Chair) on June 21, 1998 and attended the June 22 meeting of the Task Force. In the letter, I had expressed my concerns about seismic safety of the proposed "self-anchored, single tower" suspension bridge. I took my 2 minutes of public comment time to reiterate my concerns at the meeting hoping that the Task Force will consider them in their deliberations.  

During the discussion time of the Task Force before the vote was taken, Commissioner Hsieh asked MTC staff, Mr. Steve Heminger, to respond to my assertion that "There are no major bridges built using this system and there is no experience and data on seismic performance of such a system." Mr. Heminger had provided the Task Force members with a list of 22 self-anchored suspension bridges with a photo of the Konohana bridge in Japan [Attachment 2]. Mr. Heminger then responded to Commissioner Hsieh that:  

"... One thing I'd like to point out, and I've had the opportunity to review Professor Astaneh's letter, there is a sentence that says there are no major bridges built using this system, and there is no experience and data on seismic performance in such a system. Well, it seems to me this list refutes the first part of that statement, and, as I indicated, and as was indicated by another speaker, the photograph that is attached to your list is of the bridge in Japan that survived the Kobe earthquake. So there is experience, and there is data on the survivability of these structures, the Konohana bridge in Japan is in Kobe and survived the 1995 Kobe earthquake..."  

[Excerpts from the transcript of the meeting proceedings, full text on this item is in Attachment 3]  

The above response was not based on facts. In the aftermath of Kobe earthquake, I went to Kobe and for 12 days investigated damage to bridges. The Konohana bridge is not in Kobe and is in Osaka, a nearby city not affected by the Kobe earthquake with almost no damage to any facility. I have provided photos and information on this bridge in Attachment 4. There are no similarities between the Konohana bridge and the new East Bay bridge. The bridge is not a major bridge on highways. It only connects a highway to a man-made island, has only four lanes and very light traffic. I am very familiar with this bridge. I have studied documents explaining design, especially seismic design of this bridge.
The only other bridge in Mr. Heminger’s list that is located in seismic area, is Kiyosu bridge (circa 1928) with a main span of 300 feet and double tower which for single tower the main span is only 150 feet [See attachment 4]. This bridge has no relevance whatsoever the New East Bay bridge.

Other than Konohana bridge, the only other modern bridge in the list provided to you by MTC staff is Young-Jong bridge in Seoul, Korea. Seoul is not a serious seismic zone and until recently they were not even designing their bridges there for seismic effects. I have attached information on this bridge as well. The bridge is not a major bridge similar to the East Bay bridge. The Korean bridge connects a highway to the new Airport.

Since, you may have base your vote on the inaccurate information provided by MTC Staff at June 20, 98 meeting, which was also reflected in the press (Oakland Tribune, 6/23/98), I felt compelled to provide you with factual information.

The process of approving this design, from safety point of view, as I see it, is very similar to the case of design of Tacoma-Narrows bridge [Attachment 5]. The bridge, a 2800 feet main span suspension bridge, was designed by one of the most eminent bridge engineers of all times; Leon Moisseiff (who also had led the design of SFOBB). However, during the review process, a lone voice of Theodore L. Condron persistently expressed his concern about wind safety of the bridge. But, his concerns were ignored. The bridge was completed and opened in July 1940 and in November of the same year, during a windy day the main span collapsed (info from: Engineers of Dream, by Henry Petroski, Alfred A. Knopf, Publishers, N.Y.).

There is no experience on actual seismic performance of this bridge and based on my recent evaluation of seismic safety of this bridge, I am of the opinion that this system has many inherent flaws that may not be possible to remove during the final phase and make it a seismically safe bridge as one have led to believe.

I plead with you and the Honorable Governor Wilson, to consider questionable seismic safety of this bridge in your decision making and do not approve this design.

Sincerely yours,

[Signature]

Abolhassan Astaneh-Asl

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1. A. Astaneh-Asl is a professor of structural engineering at the University of California, Berkeley. His area of specialty is seismic behavior and design of buildings and bridges. Since the 1989 Loma Prieta earthquake, he has been heavily involved in seismic studies and research as well as seismic design and retrofit of major bridges in California, Japan, New Zealand and Thailand. He has conducted several studies and testing of the East Spans of the Bay Bridge and the Golden Gate Bridge. He has been on the seismic retrofit design team of the Carquinez bridges and was a seismic advisor to retrofit design of Hayward San Mateo and Richmond San Rafael bridges. He, along with architecture Professor Gary Black designed a replacement for the East Spans of Bay Bridge. The opinions expressed here are solely those of the author and do not necessarily reflect the views of the University of California or agencies and individuals whose names appear here.
To: Mary King (Chair), Sharon Brown, Mark DeSaulnier, Elihu Harris, Tom Hsieh, Jon Rubin, Angelo Siracusa, (Bay Bridge Design Task Force)

Date: June 20, 1998

Subject: Concerns on Seismic Safety of the New East Bay Bridge Design

The Chair and Members of the Task Force:

I have just completed an independent and careful study of the seismic safety of the "self-anchored" suspension bridge, the design that you are currently considering for replacement of the East Span of the Bay Bridge. Several major items about seismic safety of the proposed bridge gravely concern me. I am convinced that if the proposed self-anchored bridge is constructed and the Hayward Fault ruptures, there is a high probability that the resulting earthquake can severely damage this bridge and possibly cause partial or catastrophic failure of the main span (during construction and/or after completion). Even the design report: "30% Selection Report, May 98" prepared by the design team for Caltrans indicates that there will be structural damage to the main tower and possibly a permanent bend in the tower. Also, the design report raises the possibility of various failures under or around the foundations of main tower, which is supported on the steep slopes of the fractured Yerba Buena Island.

The SFOBB is perhaps the most important bridge in the U.S. with more than 285,000 cars crossing it daily. It is however, located between two major active faults. Given the fact that we know little about what kind of earthquakes can hit this bridge in the future, the damage it would sustain could be far more serious than anticipated. In my opinion, there is no rational in spending $1.5 billion to build a bridge of this importance using a highly questionable system that will very likely be unstable during a major seismic event.

Unlike regular suspension bridges, where main cables are connected to very large concrete anchor blocks, which are firmly embedded in the solid ground, in the proposed "self-anchored" suspension bridge, there are no anchor blocks. The main cables are connected to the deck of the bridge. There are no major bridges built using this system and there is no experience and data on seismic performance of such a system. In the literature, there is almost no information about this so-called self-anchored suspension bridge system. Only Niels J. Gimsing, one of the most prominent bridge engineers of the world and Professor at Technical University of Denmark, has a short paragraph on self-anchored suspension bridges in his book: "Cable Supported Bridges". He considers this system inferior to other bridge systems.
In addition to the possible overall instability of the proposed bridge, I am also concerned about the following:

- Supporting the main towers on piles instead of firm rock,
- connection of main span to skyway (which in current design may not survive large earthquakes and may result in collapse of the span)
- The performance of two decks separated from each other with more than 50 ft
- The joints connecting the main span to the rest of the bridge.

If at any of these weak points, the performance is not as the designers assumed, partial collapse can occur.

Knowing your commitment to public seismic safety, I hope you will give serious consideration to the issues raised. I plead with you to discuss the seismic safety of the existing East Bay spans at your next meeting. As you may know, Caltrans is spending more than $50 million to strengthen the existing East Bay structure. This prudent move on the part of Caltrans can ensure that if during the next 5-6 years a major earthquake occurs, people will not get killed or seriously injured on the existing East Bay spans. In addition, in seeing how fast Caltrans rebuilt the collapsed freeways in Los Angeles after the Northridge earthquake, it should be possible for Caltrans to expedite strengthening of the East Bay span and make it safe by this Christmas. Having done that, your task force has fulfilled its responsibility for seismic safety.

After the existing bridge is made safe, the current panic and rush to get a new bridge - any bridge, safe or unsafe - will subside. Without the prevailing anxiety, a proper process (perhaps including an open international competition) would lead to a selection of a seismically safe and aesthetically pleasing bridge designed to serve the people of The Bay Area for the next century and beyond.

Sincerely yours,

Abolhassan Astaneh-Asl


1. A. Astaneh-Asl is a professor of structural engineering at the University of California, Berkeley. His area of specialty is seismic behavior and design of buildings and bridges. Since the 1989 Loma Prieta earthquake, he has been heavily involved in seismic studies and research as well as seismic design and retrofit of major bridges in California, Japan, New Zealand and Thailand. He has conducted several studies and testing of the East Spans of the Bay Bridge and the Golden Gate Bridge. He has been on the seismic retrofit design team of the Carquinez bridges and was a seismic advisor to retrofit design of Hayward San Mateo and Richmond San Rafael bridges. The opinions expressed here are solely those of the author and do not necessarily reflect the views of the University of California or agencies and individuals whose names appear here.
### SELF-ANCHORED SUSPENSION BRIDGES

<table>
<thead>
<tr>
<th>NAME (LOCATION)</th>
<th>YEAR</th>
<th>MAIN SPAN (M)</th>
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</thead>
<tbody>
<tr>
<td><strong>EUROPEAN</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrsonwicr Bridge (Germany)</td>
<td>1870</td>
<td>22.8</td>
</tr>
<tr>
<td>Muhlenhorr (Germany)</td>
<td>1899</td>
<td>42.0</td>
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<tr>
<td>Napageld (Austria)</td>
<td>1910</td>
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<td>Cologne-Deutz (Germany)</td>
<td>1915</td>
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<td>Lippstadt (Germany)</td>
<td>1917</td>
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<td>Admiral Scheer (Germany)</td>
<td>1927</td>
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<td>Forst (Germany)</td>
<td>1927</td>
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<td>Cologne-Mulheim (Germany)</td>
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<td>315.0</td>
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<tr>
<td>King Alexander I (Yugoslavia)</td>
<td>1934</td>
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</tr>
<tr>
<td>Krefeld Bridge (Germany)</td>
<td>1935</td>
<td>250.0</td>
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<td>Chelsea Bridge (England)</td>
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<td>107.3</td>
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<td>St. Germain (France)</td>
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<td>Duisburg-Rurhont (Germany)</td>
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<td>Merelbeke (Belgium)</td>
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<td>Ninth Street (Pittsburgh)</td>
<td>1927</td>
<td>131.1</td>
</tr>
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<td>Sixth Street (Pittsburgh)</td>
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<td>Little Niangua (Missouri)</td>
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<td>Hutsonville (Indiana)</td>
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<tr>
<td><strong>ASIAN</strong></td>
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</tr>
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<td>Kiyosu (Japan)</td>
<td>1928</td>
<td>91.5</td>
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<tr>
<td>Konohana (Japan)</td>
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<td>300.0</td>
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<tr>
<td>Young-Jong (Korea)</td>
<td>1999</td>
<td>300.0</td>
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*This table and the following photo of Konohana bridge was provided to members of Bay Bridge Design Task force by MTC staff at their June 22, 1998 Meeting.*
Transcription of Question asked by Commissioner Hsieh on questions raised by Professor Astanet at the June 22, 1998 meeting of MTC Bay Bridge Task Force and the answers received from the MTC staff.
(Not an official transcript. Transcribed from voice recorder by Rick Feher)

[Tom Hsieh:] Steve, first I want to thank you for preparing this green sheet, which I was concerned about this particular design, the self-anchored suspension Bridges, which has not been a traditional way of design; I asked Mr. Heminger to compare this so we have a chance to understand this design is not a first time. On the other hand, as Professor Astaneh testified today—and he did identify one question which is kind of interesting. He said that the other twenty-two bridges, I think most of them, are from 1929 through 60s, and only two bridges were designed for 1990, and another one [to be] completed in 1999. The question is, Does that raise some question about this particular design, may be so it's so new, and is our design, somewhat meet the level of standard of safety as we have been talking about?

[Steve Heminger:] Commissioner, I asked the same question myself when I received the list from Mr. Rothman who provided it to me, and I'd like to invite him to give one answer. One thing I'd like to point out, and I had the opportunity to review Professor Astaneh's letter, there is a sentence that says there are no major bridges built using this system, and there is no experience and data on seismic performance in such a system. Well, it seems to me this list refutes the first part of that statement, and, as I indicated, and as was indicated by another speaker, the photograph that is attached to your list is of the bridge in Japan that survived the Kobe earthquake. So there is experience, and there is data on the survivability of these structures. But I believe the other question you are raising is, these bridges had sort of a heyday in the twenties and thirties, and then there weren't a lot built and now there are a couple of big ones being built, and that here it would be a third. And maybe Mr. Rothman can respond as to why that is the case.

[Herb Rothman:] Actually, there is not a big difference between a suspension bridge which is self-anchored and a cable-stayed bridge. They're both really using the superstructure of the bridge the same way, and the basic behavior is quite similar. Self-anchored suspension bridges are being used now in Japan and Korea—two of the few countries that are building new bridges. We haven't had many in this country because there's really not that much demand for new bridges of those lengths. I believe that, the technology required—you know, we've been criticized because we're using nineteenth-century technology and because we're using brand-new bridges that haven't been tested. Actually, I'd say that the technology of cable-stayed bridges really applies to this as well. And, on suspension bridge work, as most of the details and loads that we've used on conventional suspension bridges; I really don't have an answer otherwise; I have no doubt that we're using standard technology almost every place we can.

[Tom Hsieh continues with question about Willie Brown's alignment concern.]
Konohana-Ohashi Bridge (Osaka)

Konohana-ohashi Bridge, built in 1990, connects Hokko to Maishima where Osaka City hopes to have the 2008 Olympic Games. This is a mono-cable style bridge, only one cable in the middle. When night closes in, this cable is lit with scarlet illumination and two white poles shine bathed in lights. When walking along the pavement of the Nanko Cosmo Square toward Yachoen (bird sanctuary), strollers can get a fine view of the whole bridge 3 kilometers away in the north.
Fig. 1 Location of Konohana Bridge

Fig. 2 General view of Konohana Bridge

Fig. 3 Side view of Konohana Bridge

Konohana Bridge
Osaka, Japan
PLATE 31 Kiyosu Bridge, Tokyo, Japan.  
(From: Bridge Aesthetics Around the World) 
(TRB, NRC, 1991,)
Young-Jong Bridge

(Korea)

http://www.freeway.co.kr
The Young-Jong Bridge (Korea)
The Young-Jong Bridge (Korea)
YOUNG-JONG Br. (Seoul)
The Kiyosu-Bashi Bridge
(Osaka – Japan)
Chelsea Bridge over the River Thames. (London, England)
Self-anchored steel suspension bridge with spans off 164 ft., 332 ft., and 163 ft.
Built in 1937 it replaces an older suspension bridge that was opened for traffic in 1858.
In spite of subsequent strengthening, the older bridge was closed in 1935.

(Source: NISEE - University of California, Berkeley)

Detail of Chelsea Bridge showing tower unsupported transversely, and the anchorage between cable and girder. The cables consist of 37 wire ropes, each 1 7/8 in. diameter, grouped into a hexagonal section.
Note the stability problem of the tower, and compare the boundary conditions at the top and normal to the span.

(NISEE - University of California - Berkeley).
Seventh, Ninth and Sixth Street Bridges (Pittsburgh-Philadelphia)
Top : View of the 7th Street Bridge. Middle : 7th Street Bridge under Construction
Bottom : View of the 7th, 9th and 6th Street Bridges in Pittsburgh

ROSENSTEIN BRIDGE AT STUTTGART
(1976-1977)

Unsymmetric self-anchored suspension bridge with spans of 27.0 and 51.1 meters, built for the Federal Garden Exhibition. Bridge deck of concrete, with width varying from 3.5 to 5.7 meters and depth of only 35cm. Steel tower with monocell cross section, height 21 meters above bridge deck.
Main cable converging at tower, locked coil ropes 75 millimeters in diameter, inclined hangers with twin-strands 15 millimeters in diameter.
Box 7, Folder 6

Item 12

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