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ABF-CAL-LTR-000331

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PROJECT: **San Francisco Oakland Bay SAS Bridge Superstructure**
Caltrans Contract No. 04-0120F4
ABF Job No. 660110

SUBJECT: **Conflict between Free Cable and Box Girder**

Gentlemen:

American Bridge / Fluor Enterprises Inc., A Joint Venture (ABFJV) and the Engineer's have been discussing the conflict between Free Cable and Box Girder since August 21, 2007 in the Working Drawing Campus (WDC). These discussions have resulted in the development of the "Freehanging Cable Interference Solutions 10-9-07" Matrix (see attached) that lists possible solutions to the problem.

As developed, solutions have been jointly studied and eliminated as appropriate. On October 9, 2007, at the WDC, TYLin informed ABFJV that solution #1 combined with solution #8 will resolve the conflict between the Main Cable and the box girder near Pier E2. When ABFJV questioned solution details, TYLin would not elaborate why they believed the solution was going to work or the basis upon which they arrived at their conclusion.

ABFJV is concerned that the combination of solutions #1 and #8 is not going to work because proposed solution #8 restrains the Main Cable from hanging freely between saddles during construction. One of the fundamental concepts of suspension bridge construction is that the Main Cable must be free-hanging between saddles during construction, in order to ensure equal tension in all Main Cable Wires. From ABFJV's past internal experience with suspension bridges plus our knowledge of these, ABFJV is not aware of any suspension bridge cable in the world that was erected without a free-hanging Main Cable between saddles.

ABFJV believes that Solution #6 is the best option available to resolve the free hanging cable interference problem, and Solution #6 will not delay completion of the project. However, as ABFJV advised in the WDC, solution #6 does not eliminate or exclude other possible solutions. ABFJV is interested in investigating other viable options to mitigate cost impact without delaying the contract completion date. However, it is imperative that the Engineer/TYLin share with ABFJV the details in support of TYLin's determination that combining solution #1 and solution #8 will rectify the problem. Without this supporting data, ABFJV can not evaluate the proposed solution and without a proper evaluation, ABFJV is hesitant to accept TYLin's suggestions that combining solution #1 and solution #8 is a viable option. As such we respectfully request the Department provide the requested supporting data to ABFJV as soon as possible.

Since solution #1 and #8 will take several months to develop and gain a full understanding of all the implications of using this method, time is of the essence for the Engineer to provide the requested information.

The intent of the above is, as with other matters such as these in the past, to work together with the Department and its consultants in an effort to obtain a solution that is the most beneficial for the Project.

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Sincerely,

AMERICAN BRIDGE/FLUOR ENTERPRISES, INC. A JOINT VENTURE

Michael Flowers
Project Director

cc:

File: 02.01

Freehanging Cable Interference with OBG at the East End

	Proposed Solution	Pros	Cons	Forced Cable	Free Cable	Technically Feasible	Exclusive Solution	Suspender Bracket Redesign Required	Permanent Design Change	Temporary Design Change	Parties Affected	Est. Time Required to Resolve Conflict	Estimated Schedule Impact	Action Items
1	Rotate the OBG about Pier E2 to lower the OBG in the area of the interference. The girder needs to be lowered approximately 600mm near PP116. This can be accomplished by raising the girder at Hinge A, lowering the temporary truss in the main span, or a combination of the two.	Will allow erection of a freehanging cable without interference from saddle to saddle. No modifications are required to the OBG.	Will affect the design elevation of the temporary truss near E2 and at Hinge A. The OBG at Hinge A will have to be raised significantly higher to obtain any appreciable movement near PP116. (3:1 ratio) Cable wrapping will still be difficult. Falsework Removal will be difficult.	No	Yes	?	?	Yes	No	No	ABF, KCB, AWC, FNP	3 months	Delay to KCB. Additional time to jack the deck up.	ABF determined that the OBG at Hinge A needs to be raised 2m to achieve a .6m clearance at PP116. The OBG cradle adjustment is +/-0.3m. TYLin is studying this solution. TYLin are calculating the stresses in the OBG with this option. Analysis is ongoing. TYLin stated that a combination of options 1 and 8 are valid. ABF requested but TYLin would not provide any detailed information.
2	Permanently relocate the East Saddles about 500mm away from the bridge.	Will allow erection of a freehanging cable without interference from saddle to saddle. Will provide additional clearance between the main cable and the OBG for compacting and wrapping. Moving the East Saddle laterally will eliminate the strand interference with the anchorage floorbeams.	Changes the East Saddle PI and will affect analysis performed by AWC, FNP and TYL. Requires redetailing of the East Anchorage and East Saddle Grillage, which is already underway. Strands Interfere with the deck above the East Anchorage. Moving the East Saddle laterally will require the saddle to be moved more to achieve the same clearance and will create an interference between the east saddle support beams and the u/s of the OBG.	No	Yes	?	Yes	Yes	Yes	No	ZPMC, CTLLC, AWC, FNP, KIS, GCC	6 months	Additional detailing by CTLLC.	ABF to provide sketches of resulting strand interference with the OBG. TYLin to evaluate loading in crossbeam and anchorage. CT suggested moving the east saddle laterally, not in the plane of cable. No longer being considered due to complexity.
3	Temporarily relocate the East Saddle away from the bridge and jack back into place after load transfer.	Will allow erection of a freehanging cable without interference from saddle to saddle. Will provide additional clearance between the main cable and the OBG for compacting.	Changes the East Saddle PI and will affect analysis performed by AWC, FNP and TYL. Requires the design of temporary attachments to the East Saddle Grillage which will permit saddle jacking. The length of the strands in the anchorage will be changed when the jacking occurs which will affect the final tension in the strands. Cable wrapping will still be difficult.	No	Yes	?	Yes	Yes	No	Yes	ZPMC, CTLLC, AWC, FNP	8 months	Additional detailing by CTLLC. Additional time to jack the saddle.	
4	Construct the main cable on top of the bridge deck and coordinate load transfer to prevent any scrapping of the wires on the deck.	Will not impact the OBG fabrication except for local OBG reinforcement. Will not impact the Temporary Truss design except for the additional loading of the main cable on the deck.	The lift off point of the strands from the deck must be accurately determined to set the correct sag in the strands. Large softeners must be used to prevent kinking and damage of the strands. Box Girder may require localized reinforcement. The load transfer sequence must enable the cable to be lifted off the deck. This option will require an extension of the divider plates to keep the strands organized. Cable wrapping will still be difficult.	Yes	No	?	No	Yes	No	No	ABF, AWC, FNP	6 months	Additional time to arrange strands.	No longer being considered due to a resulting critical path delay during PWS erection.
5	Lower the OBG at Pier E2 during construction of the main cable, Erect the Cable, Swing the Cable, Raise the Box Girder, Install the Bearings at Pier E2 and Perform Load Transfer.	Will allow erection of a freehanging cable without interference from saddle to saddle. No modifications are required to the OBG.	Will interfere with the bearing and shear key installation. Will not be very effective since the saddle moves with the girder. Cable wrapping will still be difficult.	No	Yes	?	?	Yes	No	No	ABF, KCB, AWC, FNP	3 months	Additional time to jack the deck and install the Pier E2 bearings and shear keys.	
6	Remove the interfering section of the OBG, construct the main cable, swing the cables outward, repair the OBG and perform load transfer.	Will allow erection of a freehanging cable without interference from saddle to saddle. Will provide clearance between the main cable and the OBG for compacting.	Cable wrapping will still be difficult. Additional work is required to repair the bridge deck. Requires the design of temporary works to swing the cable prior to load transfer. Potential FCM Welding	No	Yes	Yes	Yes	No	No	Yes	ABF, ZPMC, AWC, FNP	1 month	None	ABF presented a solution, where the corner assembly from PP111 to PP118 is field installed. This solution presents a minimal impact to the structural steel detailing and fabrication since we are using existing shop splice for field splices. ABF submitted RFI No. 944. ABF stated that they are proceeding with this option; however, if any of the other options are determined to be more acceptable at a later date, the corner assemblies can be shop welded at that point. TYLin will recheck SPCM requirements.
7	Install a temporary saddle to deflect the main cable away from the OBG during cable erection.	Eliminated the need to swing the cable after erection since it is built in a swung position.	Cable kinking must be evaluated. Requires the design of a temporary saddle and any additional box girder reinforcement. Cost and schedule impacts to install strands into additional saddles. Setting the strand sag must consider the affect of the temporary saddles. The sag in the short span can not be checked. Cable wrapping will still be difficult.	Yes	No	?	?	No	No	No	ABF, AWC, FNP	9 months	Additional time to form the strands and adjust. (Approx. 1 month)	
8	Install several temporary saddles to gradually deflect the main cable away from the OBG during cable erection.	Eliminated the need to swing the cable after erection since it is built in a swung position.	Requires the design of several temporary saddles and any additional box girder reinforcement. Cost and schedule impacts to install strands into additional saddles. Setting the strand sag must consider the affect of the temporary saddles. The sag in the short spans can not be checked.	Yes	No	?	?	No	No	No	ABF, AWC, FNP	9 months	Additional time to form the strands and adjust. (Approx. 1 month per saddle)	TYLin are evaluating this solution. TYLin stated that they are looking at four temporary saddles to hold the strands laterally. These saddles are located near the east anchorage. Analysis is ongoing. TYLin stated that a combination of options 1 and 8 are valid. ABF requested but TYLin would not provide any detailed information.

9	Investigate the changes to the freehanging cable profile using the anticipated suspended weight and Hinge reactions.	When the final weights and hinge reactions are considered, the final cable profile may not interfere with the deck. Will allow erection of a freehanging cable without interference from saddle to saddle.	We will not know the final cable profile for several months. The heavier box girder weights will likely result in the freehanging and final cable profiles being lower. Cable wrapping will still be difficult.	No	Yes	?	?	Yes	No	No	ABF, AWC, FNP	6 months	None	
10	Increase the design tension in the main cable to raise the freehanging cable profile.	Increasing the main cable tension will raise the main cable and eliminate the anticipated interferences. Will allow erection of a freehanging cable without interference from saddle to saddle.	We will not know the final cable profile for several months. The increased cable tension will affect the box girder moments Cable wrapping will still be difficult.	No	Yes	?	?	Yes	Yes	No	ABF, AWC, FNP	6 months	None	TYLin to calculate the tension required to raise the freehanging cable above the deck. This is not a valid option.
11	Build Pier E2 Shorter, Construct the Box Girder lower with bearings, Erect the Cable, Swing the Cable, Raise the Box Girder and Perform Load Transfer.	Will allow erection of a freehanging cable without interference from saddle to saddle. No modifications are required to the OBG.	Will interfere with the bearing and shear key installation. Will not be very effective since the saddle moves with the girder. Cable wrapping will still be difficult.	No	Yes	?	?	Yes	Yes	No	KFM, HaChang, ABF, KCB, AWC, FNP	6 months	Additional time to jack the deck and place second stage concrete.	
12	Build the Tower taller (temporary or permanent)	Will allow erection of a freehanging cable without interference from saddle to saddle.	A Tower extension will not be very effective since it is so far away from the interference. Cable wrapping will still be difficult.	No	Yes	?	?	Yes	Yes	No	ABF, AWC, FNP, ZPMC, CTLLC	3 months	Additional time to build the taller tower.	TYLin will evaluate.
13	Pull the tower to the West (or offset the saddle) an additional amount to raise the cable in the main span.	Will allow erection of a freehanging cable without interference from saddle to saddle.	There will be differntial load in the strands during construction. The strands must be restrained by friction within the saddle for this option to work. Cable wrapping will still be difficult. The stresses in the Tower must be considered.	No	Yes	?	No	Yes	No	No	ABF, AWC, FNP	6 months	None	TYLin analysis indicates that a 500mm displacement of the tower saddle will result in a 250mm rise in the freehanging cable at PP116. ABF inquired about the differential forces at the tower saddle. TYLin to review and provide next week. TYLin have determined that this option will require a combination of pulling the tower and sliding the saddle to the West. TYLin will check the differntial tension in the freehanging cable. ABF stated that sliding the tower saddle would severely impact our tower grillage/saddle erection procedure. TYLin stated that this solution is not effective unless the tower is pulled and the saddle is translated. TYLin have not investigated the differntial cable tensions resulting from this solution and are no longer considering this option.
14	Erect the cable in a geometry closer the the final location by forcing the cable out with temporary suspenders or struts attached to cable formers.	Eliminated the need to swing the cable after erection since it is built in a swung position.	Requires the design of several temporary struts/suspenders. Cost and schedule impacts to install strands into additional cable formers/ struts. Setting the strand sag must consider the affect of the temporary struts. The sag in the short spans can not be checked. Cable wrapping will still be difficult.	Yes	No	?	?	Yes	No	No	ABF, AWC, FNP	9 months	Additional time to form the strands and adjust. (Approx. 1 month per strut)	
15	Install non-conflicting strands first.	Will more accurately determine the correct sag in each strand.	Does not resolve the interference of the other strands. Strand locations within the saddle will limit when the strands can be erected.	No	Yes	?	No	Yes	No	No	ABF, AWC, FNP	3 months	Additional time due to inefficient erection of strands.	This solution is not valid.
16	Swing the cable with weights suspended near the mid-span which will raise the cable near the supports. Used after cable erection.	The box girder and temporary truss is not affected.	Setting the strand sag must consider the affect of the weights. Cable wrapping will still be difficult. The weights must be large to raise the strand at PP116. Strand kinking limits must not be exceeded.	Yes	No	?	?	Yes	No	No	ABF, AWC, FNP	6 months	Additional time to install/remove weights.	This does not provide a solution for the freehanging cable interference. This option may be beneficial once the cable is constructed.

Due to technical complications or significant schedule impacts, these solutions are no longer being considered.