



Agenda Item No. 1

To: Building and Operating Committee/Committee of the Whole
Meeting of April 26, 2007

From: Ewa Z. Bauer, Deputy District Engineer
Denis J. Mulligan, District Engineer
Celia G. Kupersmith, General Manager

Subject: **APPROVE ACTIONS RELATIVE TO THE AMENDMENTS TO THE INTERAGENCY AGREEMENT WITH THE STATE OF CALIFORNIA, DIVISION OF MINES AND GEOLOGY TO INSTALL A SEISMIC INSTRUMENTATION SYSTEM ON THE GOLDEN GATE BRIDGE RELATIVE TO CONTRACT NO. 99-B-5, GOLDEN GATE BRIDGE SEISMIC RETROFIT (PHASE II), SOUTH APPROACH STRUCTURES; AND, TO INSTALL A WIND MONITORING SYSTEM ON THE GOLDEN GATE BRIDGE**

Recommendation

The Building and Operating Committee recommends that the Board of Directors approve the following actions relative to the Interagency Agreement with the State of California, Division of Mines and Geology - *Strong Motion Instrumentation Program (SMIP)*:

1. Authorize an amendment to the Agreement in the amount of \$35,000 for the increase in cost of the installation of Phase II seismic instrumentation system by SMIP with the understanding that these SMIP services are part of the Golden Gate Bridge Seismic Retrofit (Phase II), South Approach Structures Project; and,
2. Authorize a budget increase in the amount of \$35,000 in the FY 06/07 Bridge Division Capital Budget for the Golden Gate Bridge Seismic Retrofit (Phase II), South Approach Structures Project with the understanding that sufficient federal funds have been allocated to finance this increase, subject to the concurrence of the Finance-Auditing Committee; and,
3. Authorize an amendment to the Agreement with the SMIP in the amount of \$20,000 for the installation of a recorder and an anemometer for wind monitoring of the Golden Gate Bridge; and,
4. Authorize a budget transfer of \$20,000 from the FY 06/07 District Division's Engineering Department Operating Budget to the FY 06/07 Bridge Division Capital Budget, subject to the concurrence of the Finance-Auditing Committee.

This matter will be presented to the Finance-Auditing Committee at its April 26, 2007, meeting for concurrence and to the Board of Directors at its April 27, 2007, meeting for appropriate action.

Summary

The Golden Gate Bridge Seismic Instrumentation System is part of the Golden Gate Bridge Seismic Response Plan. In addition to the structural inspection, the information provided by the instrumentation system will be utilized to analyze the integrity of the Bridge structures after a major earthquake and to aid in the determination of repair measures. The wind data will be similarly used after extreme wind events. Instrumentation systems on all major Bay Area bridges, including the Golden Gate Bridge, are connected to a monitoring computer in the Sacramento office of the State of California Division of Mines and Geology – Strong Motion Instrumentation Program (SMIP) for processing and notification.

The Board, by Resolution No. 2001-121, authorized an Agreement with SMIP for the services to be performed for Phase II seismic instrumentation system in coordination with the construction work under *Contract 99-B-5, Golden Gate Bridge Seismic Retrofit (Phase II), South Approach Structures*. The Contractor for Contract 99-B-5 has furnished the seismic sensors and recorders, and has installed seismic cables and construction access. Under the SMIP Agreement, the installation and testing of these sensors and recorders is to be performed by SMIP personnel, with expertise and experience in the seismic instrumentation in conjunction with the construction progress.

Due to the extension of the Contract 99-B-5 construction time associated with added steel repairs and painting, the cost of the originally scheduled installation services by SMIP has increased as a result of wage increases and inflation. Furthermore, a recent assessment of the instrumentation system resulted in determination that additional free field sensors and rehabilitation of the downhole sensors shall be added to the scope of work to be performed by SMIP in connection with the Phase II Seismic Retrofit construction. Hence, SMIP requested a budget adjustment in the amount of \$35,000 to complete the Phase II instrumentation system and perform added work described above within the South Approach Structures. Staff has determined that the proposed cost increase is commensurate with the increased scope of services and construction time, and recommends its acceptance.

The Seismic Instrumentation Advisory Panel, at its meeting on October 25, 2006, recommended installing a wind monitoring system on the Golden Gate Bridge to monitor the Bridge response during wind storms and to provide a warning system to assist in implementing traffic control measures during high wind periods and Bridge inspection subsequent to wind storms. The wind monitoring system will consist of a new high resolution recorder and a new compatible anemometer, which will be triggered at a predetermined wind speed to track and measure movement of selected locations along the suspension span and the displacement sensors at towers and pylons. This wind instrumentation will be connected to the seismic instrumentation transmission cables and the high resolution recorder will capture data from the sensors that were previously installed as part of the seismic instrumentation project. SMIP submitted a cost proposal of \$20,000 to install the wind monitoring recorder and anemometer. Staff has determined the proposed cost to be commensurate with the scope of work and recommends its acceptance.

Fiscal Impact

If approved, the increase in the cost of \$35,000 for the SMIP services associated with installation of the seismic instrumentation system at the Bridge south approach structures requires an increase in

the FY 06/07 Bridge Capital Budget for the Golden Gate Bridge Seismic Retrofit (Phase II), South Approach Structures Project in the same amount. Sufficient federal funds have been allocated for Phase II and are available to finance this increase.

The \$20,000 cost of the wind instrumentation will be financed by a budget transfer from the FY 06/07 District Division's Engineering Department Operating Budget to the FY 06/07 Bridge Division Capital Budget. Sufficient funds are available in the FY 06/07 District Division's Engineering Department Operating Budget to finance this increase.

Background

The Governor's Board of Inquiry on the Loma Prieta Earthquake recommended the installation of seismic instrumentation on the Golden Gate Bridge. The Bay Conservation and Development Commission reinforced this recommendation during its hearings on the seismic analysis of the Bridge.

The Board, by Resolution No. 91-263, authorized negotiation with the State of California, Division of Mines and Geology – *Strong Motion Instrumentation Program* (SMIP), for the procurement and installation of a seismic instrumentation system, and authorized forming a Seismic Instrumentation Advisory Panel to assist the District to plan and design the Seismic Instrumentation System. With the help and recommendation of Dr. George W. Housner, Chairman of the Governor's Board of Inquiry on the Loma Prieta Earthquake, the Board appointed the original Seismic Instrumentation Advisory Panel, composed of the following eminently renowned experts on seismic instrumentation: Dr. Alexander C. Scordelis, Dr. A. M. Abdel-Ghaffar, Dr. Bruce Bolt, Dr. Ray W. Clough, and Charles Seim, P.E. Subsequently, the Board approved the appointment of Dr. Gregory L. Fenves and Dr. Wen S. Tseng to replace retiring Drs. Scordelis and Abdel-Ghaffar, and Dr. Douglas S. Dreger to replace passing Dr. Bruce Bolt. Dr. Ray W. Clough has recently resigned from the Panel. The Panel has approved the scope of the Phases I and II Seismic Instrumentation.

The Board, by Resolution No. 92-194, authorized execution of an Interagency Agreement with the State of California, Division of Mines and Geology – *Strong Motion Instrumentation Program*, for the procurement and installation of the Phase I Seismic Instrumentation System for the Golden Gate Bridge. This system, consisting of 76 sensors and 2 recording stations, was completed in July 1995. The 72 acceleration sensors and 4 displacement sensors are distributed over the entire Bridge and vicinity.

The Phase II Seismic Instrumentation System, consisting of 25 sensors for South Approach Structures and 24 sensors for the North Viaduct and the North Anchorage Housing, and 2 recording stations at Pylons S1 and North Anchorage, will be installed in stages as part of the Bridge Seismic Retrofit Project.

The seismic sensors on the Bridge are linked by telephone to SMIP office in Sacramento, California. When peak accelerations and velocities are detected that exceed a pre-established minimum threshold, the data recorded at the Bridge is transmitted to SMIP. There, a computer algorithm automatically analyzes the data and classifies the event as weak, light, moderate, severe or extreme according to the Modified Mercalli Intensity (MMI) Scale. This classification, along with the measured values of several key parameters, is then transmitted back to the District by special alphanumeric pagers. This entire process is automatic and is completed within seconds of the event.

Depending on the intensity of the earthquake, the Bridge's Earthquake Response Plan will initiate a series of sequential inspection tasks, beginning with an immediate visual inspection of the roadway for obvious damage, followed by an initial damage assessment made by teams of specially trained maintenance personnel. Then, if necessary, a detailed engineering analysis of the Bridge computer model and the seismic instrumentation data will be conducted to estimate the capacity of structural members for consideration of repairs.