Agenda Item No. 5

To: Building & Operating Committee/Committee of the Whole
Meeting of May 24, 2007

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

Subject: **APPROVE APPOINTMENT TO THE GOLDEN GATE BRIDGE SEISMIC INSTRUMENTATION ADVISORY PANEL**

Recommendation

The Building & Operating Committee recommends that the Board of Directors approve the appointment of Dr. Edward L. Wilson, Professor Emeritus of Structural Engineering, University of California at Berkeley, as a member to fill a vacancy on the District's Seismic Instrumentation Advisory Panel, with the understanding that panel members will serve at no fee but will be reimbursed for out-of-pocket expenses.

Summary

The Board, by Resolution 92-26, appointed the following Seismic Instrumentation Advisory Panel to plan and design the seismic instrumentation system, with the understanding that panel members would serve at no fee:

- Dr. A.M. Abdel-Ghaffar
- Dr. Bruce A. Bolt
- Dr. Ray W. Clough
- Dr. Alexander C. Scordelis (chair person)
- Charles Seim, P.E.

The panel approved the design of the Phase I Seismic Instrumentation System, consisting of 76 sensors and 2 recording stations, which were installed in 1995. The panel also approved the design of the Phase II Seismic Instrumentation System for the North Approach Structures with 24 sensors and one recording station, which was installed in 2003, except some sensors within the North Anchorage Housing to be installed after completion of seismic retrofit work.

The Board, by Resolution 99-218, appointed Dr. Bruce Bolt to be the new chairperson and Dr. Gregory Fenves and Dr. Wen Tseng as new panel members to replace retiring Dr. Alexander Scordelis and Dr. A. M. Abdel-Ghaffar. The panel approved the design of the Phase II Seismic Instrumentation System for the South Approach Structures with 25 sensors and one recording station, which are being installed in conjunction with the Phase II Seismic Retrofit of South Approach Structures.

The Board, by Resolution 2005-094, appointed Dr. Gregory L. Fenves to be the new chairperson and Dr. Douglas S. Dreger as new panel member to replace passing Dr. Bruce Bolt. The panel recommended installing a wind monitoring system for the suspension span of Golden Gate Bridge. The District is entering an agreement with SMIP to implement this system.

Due to the recent resignation of retiring Dr. Ray W. Clough, it is necessary to appoint a new panel member. After consultation with the panel chairperson, the District Engineer would like to recommend Dr. Edward L. Wilson (resume attached) as a new panel member.

Fiscal Impact

The reimbursable expenses for the panel are estimated to be less than $1,000 annually, which are included in the FY 06/07 Engineering Department's Operating Budget.

Background

The Governor's Board of Inquiry on the Loma Prieta Earthquake stressed the importance of installing seismic instrumentation on the Golden Gate Bridge. The Bay Conservation and Development Commission reinforced this importance during its hearings on the seismic analysis of the Bridge. 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 eminently renowned experts of seismic instrumentation listed above.

The panel established a two-phase scope of work for seismic instrumentation to comply with the recommendation of the Governor's Board of Inquiry as follows:

> Phase I: Installation of basic seismic instrumentation, at the earliest time, to obtain information in an earthquake about the ground motion and the structural response of the existing Bridge. This phase was designed by the Advisory Panel and installed by the State of California, Division of Mines and Geology – Strong Motion Instrumentation Program (SMIP). This system has been in good working condition under a maintenance agreement with SMIP, and data from several earthquakes have been recorded.
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> Phase II: Installation of additional seismic instrumentation after the seismic retrofit of the Bridge to obtain detailed information in an earthquake on ground motion, structural response of the retrofitted Bridge, over-stresses of structural elements, and verification of the computer model prepared for the seismic retrofit design. The Phase II Instrumentation for the

North Viaduct Structures was designed by staff and approved by the Advisory Panel, and was installed in year 2003, except some sensors within the North Anchorage Housing. The Phase II Instrumentation for the South Approach Structures was also designed by staff and approved by the Advisory Panel, and is being installed in conjunction with the Phase II Seismic Retrofit Project.

The wind monitoring of the suspension span of the Bridge was recommended by the Panel. The District is in the process of entering into an agreement with SMIP to implement this system. Details of this system will submitted to the Panel for approval in its next meeting.

The District has also converted the computer analytical models of the Suspension Bridge and South Approach Structures into an ADINA program based on seismic retrofit designers' computer models. This program will be used to analyze earthquake data subsequent to a strong earthquake corresponding to Level 3 or higher response level, in accordance with the District's Earthquake Response Plan. Conversion of computer program for the North Approach is near completion.

There remains a substantial amount of work for the Seismic Instrumentation Program, as described above. In order to set up and maintain a first-class seismic instrumentation system, the Seismic Instrumentation Advisory Panel should remain in place to provide expert advice and approval for this important system, which will monitor Bridge behavior and provide valuable information to safeguard the safety of the Bridge.

Attachment

ATTACHMENT

BIOGRAPHICAL SUMMARY

Edward L. Wilson is a Professor Emeritus of Structural Engineering at the University of California at Berkeley, where he was a faculty member from 1965 to 1991. From 1973 to 1976 he served as Chairman of the Division of Structural Engineering and Structural Mechanics. From 1987 to 1990 he was Vice Chairman of the Department of Civil Engineering. At the present time he is a consultant on the structural analysis of complex structures and is engaged in the development of new methods of analysis and computer programs in the general area of structural engineering. He is currently a member of the Seismic Review Committee for the Berkeley Campus.

At the University he taught courses and conducted research on structural analysis, computer analysis, dynamics and finite element methods. He has published over 180 technical papers and reports. During his 30 years of teaching at the University, 29 doctoral students completed their dissertations under his supervision.

He received his D. Eng. Degree from the University of California in 1963. From 1963 to 1965 he was a senior research engineer at Aerojet General Corporation, Sacramento, California. At Aerojet he developed numerical methods and computer programs for the thermal and stress analysis of the MINUTEMAN missile and the APOLLO space capsule. He has been responsible for the development of several computer programs which are extensively used by professionals in the Civil, Mechanical and Aerospace engineering. The general three-dimensional finite element analysis program SAP and the TABS series of programs for the static and dynamic analysis of three-dimensional building systems are examples of programs initially developed by Professor Wilson.

He was the first to develop computational methods and practical computer programs for the analysis of tall buildings and hydroelectric structures. These special purpose programs include heat transfer analysis and the effects of creep, incremental construction, soil-structure-fluid interaction, and flow in porous media. Since these programs have been extensively adopted by a large number of firms throughout the world he has been involved directly and indirectly as a consultant on a very large number of engineering projects.

In 1985 he was elected to the National Academy of Engineering. He was appointed as the T. Y. and Margaret Lin Professor in Engineering in 1990. He received the Berkeley Citation at the time of his retirement from teaching in 1991 for his contributions to the profession he received the Huber (1974) and the Howard (1995) medals by ASCE. In 1998 he received the Lifetime Achievement Award from the Los Angeles Tall Building Design Council. In 2003 he received Von Neumann Medal from the United States Association of Computational Mechanics for the development of the SAP series of programs.

Professor Emeritus Edward L. Wilson

Edward L. Wilson
Structural Consultant

Education

D. Eng. University of California, Berkeley, 1963

M.S. University of California, Berkeley, 1959

B.S. University of California, Berkeley, 1955

Professional Societies

Member, ASCE, American Society of Civil Engineers

Member, EERI, Earthquake Engineering Research Institute

Member, USCOLD, United States Committee on Large Dams

Member, SEAONC, Structural Engineers Association of Northern California

Biographic Details

Over forty five years of professional experience in Civil, Mechanical and Aerospace Engineering.

Former Professor and Vice Chairman of the Civil Engineering Department at University of California at Berkeley (1965-1991).

Published over 180 papers, reports and books. Supervised 29 Doctor's Degree Students

Appointed as the T.Y. and Margaret Lin Professor in Engineering, 1990.

Received Berkeley Citation, 1991

Elected to the National Academy of Engineering, 1985

Received the Huber, 1974, and Howard, 1995 awards by ASCE for his contributions to the Structural Engineering Profession.

Currently Member, Engineering Criteria Review Board for BCDC and Seismic Review Committee for the UC Berkeley Campus

Selected Projects

Field Engineer Ten Mile River Bridge, 1953

Project Engineer for the Model Analysis and Material Studies of Oroville Dam, 1958-60

Wrote the first automated finite element analysis computer program and analyzed Norfork Dam, 1960-62

Developed numerical methods and computer programs for the stress analysis of the Minuteman missile and the APOLLO space capsule 1963-65

Developed the original three-dimensional earthquake analysis programs SAP, 1969, ETABS, 1973, SAP80 1980 and SAP90 1990.

Developed the computer programs SMIS, 1963, and CAL, 1976, for the Computer Assisted Learning of static and earthquake analysis of structural systems. These programs have been used worldwide at over 100 Universities.

Consultant on the new Bay Bridge, retrofit of the Richmond-San Rafael and Golden Gate Bridges