IEEE/PES Transformers Committee
Spring 2004 Meeting, March 7-11, 2004
San Diego, California, USA

# Seismic Design Considerations for Transformers

**-- Technical Presentation, Tuesday, March 9, 4:45 p.m. --**

**by Howard Matt, Dennis Ostrom, and Craig Riker**

## 1. Abstract

Recent moderate and strong earthquakes have demonstrated that parts of electrical power systems are very vulnerable to damage. A short history of past earthquakes and their affect on the electric utilities with particular attention to transformers will be presented. An overview of how the electric utilities have responded to the earthquake hazard by the development of a standard for industry use. Requirements of IEEE 693 Standard "Recommend Practice for Seismic Design of Substations" and current research efforts through the PEER Lifeline Program will be investigated.

## 2. Learning Objectives

Attendees of the presentation will learn about the following items:

- Review how earthquakes affect power system facilities and equipment.
- Raise the awareness and understanding of the vulnerabilities of power transformers
- Review design details for transformers that contributes to both good performance and failure during earthquakes.
- Suggest approaches for new construction that have shown to reduce earthquake damages to transformers.
- PEER (Pacific Earthquake Engineering Research) Lifelines Program is providing data, models, and methods needed to improve the earthquake reliability and safety of lifelines systems.

## 3. Learning Outcomes

Attendees will learn methods to improve the earthquake response of electric power transformers. Document where the most transformer damages are concentrated. Address issues pertaining to a transformer's earthquake performance, mitigation, retrofit and recommended installation practices.

Following the presentation, there will be responses from a couple of OEM's representatives.

## 4. Presenter's Biographies

**Howard Matt:** Mr. Matt is a Graduate Student Researcher for the Department of Structural Engineering at the University of California at San Diego. Mr. Matt is working toward his PhD in Structural Engineering. Mr. Matt received his BSCE at the University of Washington. He has currently working on a project for the PEER Lifeline Program titled "Seismic Qualification Requirements for Transformer Bushings".

**Dennis Ostrom:** Dr. Ostrom is a RE in the state of California and received his PhD from the University of California at Los Angeles in 1973. He has been an independent consultant since 1996 specializing in the field of earthquake engineering as it relates to electric utilities. Before that, the Southern California Edison Company employed him for over 25 years working as their in-house Earthquake Engineering consultant. He is the author of many technical papers and served on the IEE344 Standard that dealt with the seismic qualification of nuclear power plant equipment. He is also past Co-Vice Chairman of the Subcommittee of the Seismic Design of Substation Working Group, which developed the first IEEE 693 Standard. He is currently working on a PEER project titled "Database of Seismic Parameters of Equipment in Substations".

**Craig Riker:** Mr. Riker has been employed with San Diego Gas & Electric Company for 26 years. Currently, he is a Principal Engineer in the Civil/Structural Engineering Group. He is a member of the IEEE Standard 693 Committee. Mr. Riker received his BSCE from San Diego State University and is a Registered Professional Engineer. He is currently a member of the PEER Lifelines Advisory Panel on Electrical System Seismic Safety and Reliability.

Following the presentation, there will be responses from a couple of OEM's representatives.