



TIP 354: Substation Seismic Performance with Supplemental Damping Devices

Context

BPA has performed research and development on two types of supplemental damping devices in the past. Damper pads and dual-action axial friction-type ring spring dampers have been studied and tested. The damper pads have not proved significantly beneficial. The ring spring dampers have not been fully characterized for different voltage class equipment and 3-D tested. In FY2015, BPA is performing research and development to identify and characterize, for different voltage class equipment, the ring spring damper or some other type of damping device.

Description

The purpose of this project is to investigate and improve upon the seismic performance of existing BPA substations, as a system. This project is a continuation of a previous research and development project, TIP 291: Substation Seismic Performance, FY2013 to FY2014, in which a detailed numerical model was developed and used to assess the seismic vulnerability of existing substation designs on a system basis. The numerical model will be utilized and built upon for this project. New design policies, standards and supplemental damping devices for electrical equipment installations will be evaluated as a mitigation method.

The work plan will consist of performing a review of the previous “Substation Seismic Performance” project and the previous damping device research. The IEEE 693 and IEEE 1527 standards are being updated. The co-investigators are both actively working on these committees and are aware of industry concerns in this area. This project will provide another opportunity to review our current seismic standards and substation construction standards. Significant analytical modeling will be performed using the previous research models and adding supplemental damping devices. Significant modeling work will need to be performed to verify the damping device performance.

Why It Matters

This project is significant for evaluating available supplemental damping devices mitigation options to reduce the seismic vulnerability of BPA’s transmission system. The dependable performance of the BPA power grid is important to maintain a reliable supply of energy.

The results of this project will allow BPA to successfully address the seismic vulnerability of existing and new transmission system substations.

Goals and Objectives

BPA is performing research and development to identify and characterize, for different voltage class equipment, the ring spring damper or some other type of damping device. The results of the damper characterization will be incorporated into the system evaluation proposed in this project. This research will focus on how one or two different types of damping devices will affect the seismic performance of the substation system.

The major project objectives are:

- Perform a review of the “Substation Seismic Performance”, FY2013 to FY2014 Research Project
 - Verify the Seismic Qualification Report data.
 - Verify the analytical models.
- Review the latest industry developments regarding supplemental damping devices of IEEE 693, IEEE 1527 and EPRI Seismic Studies Group.
- Review the latest BPA seismic standards and substation construction standards.
- Analytically model stand-alone components and the system, of all three voltage classes, without and with supplemental damping devices.

Deliverables

The main deliverable for this is a final report detailing the literature review; verification of Seismic Qualification Report data and analytical models; development of numerical model; and applicability of results.

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Project Start Date: October 1, 2015

Project End Date: September 30, 2016

Funding

Total Project Cost: \$70,000

BPA FY2016 Budget: \$70,000

Reports & References

Related Technology Innovation Projects:

TIP 291: Substation Seismic Performance

Links

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