

Seismic Safety Evaluation of Dams Against Large Earthquake Motions in Japan

On March 30, 2005, the Ministry of Land Infrastructure and Transport (MLIT) submitted "Draft of Guidelines for Seismic Safety Evaluation of Dams" (referred as "Guidelines") to all Regional Bureaus and their related organizations. The draft Guidelines systematically describes methods for evaluating seismic safety of dams subjected to large earthquakes. The Guidelines identify basic evaluation methods including earthquake motions used for seismic evaluation and safety and earthquake response analysis.

The Guidelines are organized as four chapters as shown in Figure 1. The Guidelines require seismic safety, setting of earthquake motions for seismic safety evaluation, and evaluation methods of seismic safety of dam bodies and their appurtenant structures.

Chapter 1 Basic matters

- 1.1 *Intent of the guidelines*
- 1.2 *Definitions of terms*
- 1.3 *Scope of application*
- 1.4 *Basics of seismic safety evaluation*
- 1.5 *Required seismic safety*
- 1.6 *Stored water levels to be considered in seismic safety evaluation*

Chapter 2 Earthquake motions used for seismic safety evaluation

- 2.1 *Selection of assumed earthquakes*
- 2.2 *Setting of level 2 earthquake motions used for seismic safety evaluation*

Chapter 3 Evaluation of seismic safety of dam bodies

- 3.1 *Policy for evaluation of seismic safety of dams*
- 3.2 *Seismic safety evaluation of concrete dams*
- 3.3 *Seismic safety evaluation of embankment dams*

Chapter 4 Evaluation of seismic safety of appurtenant structures

- 4.1 *Appurtenant structures to be subjected to seismic safety evaluation*
- 4.2 *Seismic safety evaluation of appurtenant structures*

Figure 1. Organization of "Draft Guidelines"

Earthquake motions used for the evaluation are level 2 earthquake motions generated by large earthquakes. When performing seismic safety evaluation of concrete gravity dams against large earthquake motions the Guidelines account for the damage process due to tensile crack generated in a dam body. In the case of seismic evaluation of rockfill dams, attention is given to earthquake-induced sliding deformation.

The "Guidelines" will be modified in the future to address verification with respect to existing dams. The Guidelines are considered to be "trial implementation" and studies will be performed toward formal application.

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Task Committee G: Transportation Systems

The Panel's Task Committee G: Transportation Systems was formally established at the 13th Annual Meeting of the UJNR Panel on Wind and Seismic Effects of UJNR, May 1981, Tsukuba, Japan. Surface transportation systems play a vital part of commerce and interaction between people, safety, and mobility. Among the surface transportation infrastructure, highway bridges are the most vulnerable to wind and earthquake hazards due to their open exposure to those natural hazard forces. The objectives of this Task Committee (one of seven comprising the Panel) are to plan, promote, and foster research on the behavior of highway bridges when subjected to wind and seismic forces and to disseminate research results as technical bases for developing or revising specifications and guidelines. This work is performed through conducting workshops, exchanging researchers, and performing cooperative research programs.

The most visible activity of Task Committee G is the annual US-Japan Bridge Engineering Workshop (see photographs 1 and 2). This workshop provides the venue to exchange recent research results and technologies among the Federal Highway Administration/National Institute of Land Infrastructure and Management/Public Works Research Institute (FHWA/NILIM/PWRI) researchers, government bridge engineers, and related academic and industrial researchers/practitioners. The first workshop was held at Tsukuba, Japan, in February 1984 and workshops have been held annually except 1986 alternating between the US and Japan. The latest 22nd workshop was held in Seattle, WA, 2006, see http://www.pwri.go.jp/eng/ujnr/newnl/enl_43.pdf. Approximately 800 technical papers were presented in previous TC G workshops. The workshop papers after the 19th Workshop are available by visiting http://www.pwri.go.jp/eng/ujnr/tc/g/tc_g.htm. Numerous researchers were exchanged between the FHWA, NILIM, PWRI and other research institutes.

This Task Committee has achieved many joint research projects, including:

- Coordinated experimental research study on the seismic performance of bridge pier and columns,
- Coordinated research study on aeroelastic, and aerodynamic response of cable-supported bridges with emphasis on cable inspection, vibration and corrosion protection, and
- Coordinated research study on use and performance of structural materials including new materials.

Furthermore, this Task Committee performed jointed post-earthquake investigations of transportation systems from the 1994 Northridge and the 1995 Hyogo-ken Nanbu (Kobe) Earthquakes. The Task Committee has been incrementally planning its future through its annual workshops, joint research, guest researcher exchanges, and its large number of publications.

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Photo 1. Bridge Engineering Workshop
(Saint Louis, 2002)



Photo 2. Study Tour (Kintai-kyo Bridge, 2003)