The National Institutes of Health | Division of Technical Resources | Office of Research Facilities

Design Requirements Manual **News to Use**

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Seismic Design Parameters

Earthquakes are an unpredictable natural hazard and can result in loss of critical facilities and infrastructure. While strong earthquakes are unusual in the state of Maryland, perceptible seismic events still occasionally occur. In the fall of 2011, a 5.8 magnitude earthquake occurred in Mineral VA and effects were felt on the National Institutes of Health (NIH) campus in Bethesda. The Division of Technical Resources (DTR) subsequently undertook a Seismic Risk Assessment Study. The study reviewed available NIH geotechnical investigation reports, performed probabilistic seismic hazard analysis, performed structural analyses, and evaluated soil amplification effects in a simplified manner. As a result, section 5.2.1.G was introduced to the 2016 version of the Design Requirements Manual (DRM) to provide updated seismic design parameters that would be applied to critical facilities.

Seismic Risk Assessment and Categories

The Seismic Risk Assessment Study involved a structural and nonstructural assessment of representative components of the NIH campus in order to come up with a campus-wide risk assessment. The campus has more than 50 structures, including a hospital, animal facilities, research laboratories, and the Central Utility Plant. The study's assessment of these buildings classified them into risk categories, from I (lowest risk) to IV (highest risk) based on potential loss of life, research, and property in the event of a significant seismic event. Based on a building's assigned risk category, the DRM may require seismic parameters more conservative than those in the International Building Code (IBC) for critical facilities.

Basic IBC Seismic Requirements

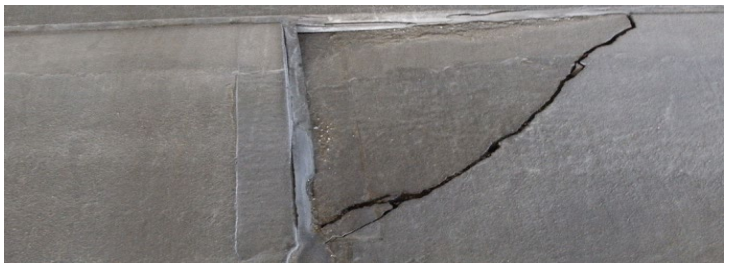
Seismic loads shall be determined using the provisions of the IBC. Seismic acceleration values may be developed using the contour maps in the IBC, or by developing a site-specific acceleration study. The site-specific seismic acceleration study shall be performed by a qualified geotechnical engineer. The engineer shall classify the site in accordance with the IBC based upon shear wave velocity using boring logs and other appropriate investigation techniques.

DRM Requirements

Following the release of the executive order 13717-Establishing a Federal Earthquake Risk Management Standard (dated February 5, 2016), DTR introduced a new section to its DRM. Section 5.2.1.G: Seismic Loads may require NIH-specific seismic design parameters for certain structures. Designers are advised to contact DTR at the initial stage of the design process to determine whether these parameters are applicable to the project. NIH-specific seismic design parameters may be required for the following cases:

- New buildings
- Existing buildings being proposed for renovation, including entire buildings or wings renovated between expansion joints.
- All buildings or sections of buildings classified as risk category IV by risk assessment using the IBC Risk Category Table.

If additional parameters are required, they may result in further structural and non-structural lateral restraint or increased lateral force-resisting structural capacity.



Example of damage caused by earthquake

Additional Recommendations

DTR also has several design recommendations based on experience and best practices, as follows:

Structural:

- Expansion joints should have sufficient clear distance to accommodate seismic movement.
- Buildings should comply with detailing requirements for ductility and deflection compatibility.

Non-Structural:

- All overhead lighting and emergency exit lights should have proper bracing to prevent swinging and negative interactions with other components.
- Pipe system and cable trays should be laterally braced.
- Telecommunication room racks shall be bolted together and secured to the floor.
- Large components, including generators, pumps, air handlers, and storage tanks, should be on isolation dampers with proper stoppers.
- Heavy items should not be stored on high shelves and each shelf shall clearly indicate weight restrictions.
- Glass and other breakable items should not be stored on open shelves and racks without lips or restraints.
- Doors on storage cabinets and industrial shelving units should latch or lock securely.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'. **Please address questions or comments to:** shawm@nih.gov

Further details on this month's topic are available on the DRM website Chapter 5 Section 5.2.1.G
https://www.orf.od.nih.gov/TechnicalResources/Pages/DesignRequirementsManual2016.aspx